CY HEALTH PHYSICS
TECHNICAL SUPPORT DOCUMENT

Connecticut Yankee Decommissioning

Health Physics Department Technical Support Document

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Subject: Assessment of Existing Groundwater Dose for Phase II Release Areas of the Final Status Survey Report

Date: 2/15/05

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Assessment of Existing Groundwater Dose for the Phase II Release Areas of the Final Status Survey Report

1.0 PURPOSE

The Haddam Neck Plant (HNP), License Termination Plan (hereafter called LTP) requires that the potential dose to a hypothetical future resident of the Haddam Neck Plant (HNP) site be determined for each survey area at the time that the request is made to the Nuclear Regulatory Commission (NRC) to remove the survey unit from the HNP license. This document provides the determination of existing groundwater dose for the survey areas/units within the Final Status Survey (FSS) Phase II Release Area. The FSS Phase II Release Area includes Survey Areas 9523, 9524, 9525, 9526, 9528 (Units 0000, 0003, 0004), 9535, 9536, 9537, 9538, and 9806 (See Table 1 for a complete list of survey areas and units). It should be noted that this assessment considers only radiological contamination. Groundwater sample results for other contaminants are addressed in other documents.

2.0 BACKGROUND

2.1 Groundwater Monitoring Program

The Groundwater Monitoring Program is described in Reference 5-1, "Groundwater Monitoring Program". The program is intended to integrate all aspects of groundwater characterization, monitoring and remediation required to support HNP closure decisions. The program scope includes groundwater related requirements defined by multiple regulatory standards and includes specification, maintenance, and operation of specific infrastructure and monitoring systems. The program is responsible for the construction, maintenance, operation and ultimate decommissioning of the facilities and instrumentation that comprise the physical systems required to support groundwater monitoring data collection and decision management. The program is controlled through Reference 5-2, the "Groundwater Monitoring Program Quality Assurance Plan" (GWMP QAP) and applicable implementing procedures.

Reporting results of a groundwater monitoring sampling event procedurally includes:

- Data Quality Assessments (DQAs) of field parameters
- Off-site laboratory quality assurance results
- Data reduction
- Assessment of conclusions and recommendations
- Internal HNP review prior to publication for distribution.

The installation of new groundwater wells procedurally requires identification of specific Data Quality Objectives (DQOs) to optimize the location, configuration, and intended use of the well(s).

3.0 Discussion and Dose Calculation

3.1 Discussion and Evaluations

Certain survey units in the Haddam Neck site need to be evaluated for potential dose to a hypothetical future resident of the site due to existing groundwater. Table 1 below shows the survey units included in the FSS Phase II release area for the HNP site that have been identified for an existing groundwater assessment (See Attachment 1).

Table 1
FSS Phase II Release Area – Survey Units with Potential for Existing Groundwater Impact

Survey Area	Survey Unit	Class	General Description of the Survey Unit (Per LTP)	General Site Location	Potentially Affected by Groundwater
9523	0000	3	*Southeast Wetland Area*	Lower Discharge Canal	No
9524	0000	3	*South Site Grounds*	Southeast Landfill	No
9525	0000	3	*Southeast Site Road*	Southeast Mountain Side	No
9526	0000	3	*Northeast Mountain Side*	Northeast Mountain Side	No
9526	0001	2	*Northeast Mountain Side*	Northeast Mountain Side	No
9526	0002	2	*Northeast Mountain Side*	Northeast Mountain Side	No
9528	0000	3	*Southeast Mountain Side*	Middle Discharge Canal	Yes
9528	0003	2	*Southeast Mountain Side*	Middle Discharge Canal	Yes
9528	0004	2	*Southeast Mountain Side*	Southeast Mountain Side	No
9535	0001	1	*Southeast Landfill Area*	Southeast Landfill	No
9535	0002	2	*Southeast Landfill Area*	Southeast Landfill	No
9536	0000	2	*Construction Piles Near Rifle Range*	Southeast Landfill	No
9537	0000	2	*Permitted Landfill Area*	Southeast Landfill	No
9538	0000	2	*Material Storage Area*	Southeast Landfill	No
9806	0000	A	*Southeast Landfill*	Southeast Landfill	No

It can be seen from Table 1 that there are two site survey units which are part of the FSS Phase II release area that require an evaluation of existing groundwater dose. These will be discussed in the following, along with a discussion of groundwater monitoring results in the area of the Southeast Landfill.

3.1.1 Middle Discharge Canal Area

Attachment 3 provides an evaluation of the information collected to date on the nature and extent of possible groundwater contamination on the peninsula area of the site. The conclusion of Attachment 3 is that the source of the low level detections on the lower peninsula (Middle Discharge Canal Area is a part of the lower peninsula) is known, and based on this information, the concentrations in groundwater monitoring wells are not expected to be higher than already measured in these wells. Based on this conclusion, the groundwater monitoring data collected to date for the Middle Discharge Canal Area can be used to perform a final "existing" groundwater dose calculation for the affected survey units.

It can be seen from Figure 1 of Attachment 1, survey units in the vicinity of the middle discharge canal are within the capture zone of groundwater monitoring wells exhibiting detectable levels of radioactivity. "Detected Groundwater Contamination" is defined in the CY LTP Section 5.4.7.1 as the presence of:

- Plant-related radionuclides, which are also present in background, at a concentration greater than two standard deviations over background, or

- Plant-related radionuclides, not present in background, at a concentration greater than the Minimum Detectable Concentration (MDC) and greater than two times the standard deviation in the net concentration.

The use of the MDC as the criteria for "Detectable Groundwater Contamination" is acceptable due to the very low level sensitivity that the analytical laboratory is required to achieve. While other measures, such as the two sigma error of the analysis or the 95% critical level are often used as a metric of detection (i.e., is the sample different from background?), these are often subject to higher than expected false positive error rates. The MDC states the actual measurement capabilities, which can be measured reliably, given the actual sample counting conditions. Stated another way, the MDC is the radionuclide concentration level required to give a specified high probability that the sample level is greater than the two sigma error or critical level. Table 2 lists the contractually Required MDCs that the off-site laboratory is required to achieve for CY groundwater samples. As can be seen in Table 2, the required MDC for each radionuclide is set at a value that is less than five percent (5%) of the corresponding 25 mrem/yr Groundwater DCGL. It can be seen that in most cases the required MDC is significantly lower.

A review of analytical results indicates reveals laboratories consistently achieve analytical MDCs that are fifty percent (50%) or less of the required MDC. The conclusion is when a sample result is less than the analytical MDC it can be confidently stated that the potential groundwater dose for that radionuclide is less than fifty percent (5%) of the 25 mrem/yr groundwater DCGLs, and is not required to be included with the dose assessment consistent with LTP section 5.4.7.2, Gross Activity DCGL.

Table 2
Groundwater Monitoring Well Sample Analysis Sensitivities

Radionuclide	25 mrem/yr Groundwater DCGL (pCi/L)	Required Analysis Minimum Detectable Concentration (MDC) (pCi/L)	Required Analysis MDC as a Percentage of the 25 mrem/yr DCGL (%)
H-3	652,000	400	0.06
C-14	9,010	200	2.2
Mn-54	24,200	50	0.21
Fe-55	65,400	25	0.04
Co-60	1,140	25	2.2
Ag-108m	4,240	50	1.2
Ni-63	31,500	15	0.05
Sr-90	251	2	0.80
Nb-94	6,750	50	0.74
Tc-99	26,400	15	0.06
Cs-134	342	14	4.1
Cs-137	431	15	3.5
Eu-152	7,330	50	0.68
Eu-154	5,050	50	0.99
Eu-155	32,500	50	0.15
Pu-238	15.1	0.5	3.3
Pu-239	13.6	0.5	3.7
Pu-241	460	15	3.3
Am-241	13.2	0.5	3.8
Cm-243	19.4	0.5	2.6

Of the FSS Phase II survey areas adjacent to the middle portion of the Discharge Canal, only Survey Units 9528-0000 and 9528-0003 are within the capture zone of a monitoring well exhibiting detectable groundwater contamination. As seen in Attachment 2, Survey Unit 9528-0002 is within the 100 meter capture zone of the Upper Peninsula area where limited decommissioning activities are ongoing (9520-0003 is the nearest survey unit). Therefore, potential groundwater impacts to of Survey Unit 9528-0002 will be reevaluated in the future.

As shown in Attachment 1, groundwater monitoring wells within the capture zone radius of Survey Unit 9528-0003 that have shown detectable plant related contamination are MW-2 and Supply Well B. Additional, Attachment 1 shows the only groundwater monitoring well within the capture zone distance of 100 meters of Survey Unit 9528-0000 that has shown detectable plant related contamination is MW-2.

Sampling results for MW-2 and Supply Well B were reviewed for potential existing groundwater dose impact. Results of that review are shown in the following.

Table 3
Middle Discharge Canal Area Groundwater Sample Results

Monitoring Well Number	Number of Sample Rounds	Most Recent Sample Round	Detected Groundwater Contamination	Comments
MW-2	5	Dec 04	Dec 02: Pu-241 Sept 04: H-3	Pu-241 Detection is a False Positive (See Table 4)
Supply Well B	2	Dec 04	Jan 02: Sr-90	None

As indicated in Table 3, few sample results qualify as detectable contamination per the LTP. Table 4 provides additional details on the sample results that qualified as detectable contamination.

Table 4
Detailed Sample Results & False Positive Determination
Middle Discharge Canal Monitoring Wells

MW Well #	Sample Date	Radio-nuclide	Sample Result (pCi/L)	2 Sigma Uncer-tainty (pCi/L)	Minimum Detectable Concentra-tion (pCi/L)	Positive Results of Total Results for the Sample Round	Limiting Mean for the Sample Round (pCi/L)	Bias Adjusted MDC (pCi/L)
MW-2	Dec 02	Pu-241	11.2	3.62	6.34	21 of 21	10.45	16.79
MW-2	Sept 04	H-3	439	193	300	N/A	N/A	N/A
SW-B	Feb 02	Sr-90	1.02	0.35	0.45	N/A	N/A	N/A

The Tritium (H-3) sample result is slightly above the MDC, meets the LTP criteria for detectable groundwater contamination and will be included in the dose assessment.

When all the Pu-241 sample results for the December 2002 sampling round are considered together (as is done in Table 4), there is a significant positive bias in the laboratory analysis for this sampling round. A positive bias is indicated when the results for a sampling round show some or all of the following trends:

- For a radionuclide not expected to be present, a high percentage of the results are positive (i.e. greater than zero). If no analytical bias is present, and a normal distribution is assumed, it is expected there will be a relatively even split of negative (i.e. results less than zero) and positive results for a given radionuclide. In the case of Pu-241 (Table 4), all 21 sample results for the December 2002 sampling round are positive.

- For a radionuclide expected to be present in some of the samples for a sampling round (i.e. Sr-90), a parametric statistical evaluation of the sample results can be determine the magnitude of the bias. The parametric statistical test determines the underlying background distribution or limiting mean for a certain radionuclide for a sample round. The limiting means have been determined for much of the groundwater characterization data and have been reported in the periodic CY Groundwater Monitoring Reports.

- For a radionuclide not expected to be present, the average concentration of all groundwater samples for that radionuclide in a sample round is positive and a significant percentage of the analytical MDC. A limiting mean can also be determined for these data sets using parametric statistics.

With two of the above three trends shown (the only two that are applicable), a positive bias is indicated for December 2002 Pu-241 sample result. In cases such as this, the analysis MDC must be adjusted to include the analytical bias and the results re-evaluated against the detection criteria. This adjustment has been done in Table 4 by adding the Pu-241 limiting mean for the December 2002 sample round to the analysis MDC. It was also checked that the Bias Adjusted MDC was less than 5% of the DCGL for Pu-241. Based on this reevaluation, the December 2002, Pu-241 result is determined to be a false positive.

The Sr-90 result for February of 2002 (Supply Well B) was not taken as part of a sampling round and therefore there are not a sufficient number of samples taken at the same time to evaluate analytical bias. The Sr-90 result will therefore be presented as detectable groundwater contamination even though a follow-up sample collected in December of 2004 did not show "detectable groundwater contamination".

For Survey Unit 9528-0003, the highest existing groundwater dose, within the zone of influence of these survey units, is associated with the January 2002 Sr-90 sample result for Supply Well B (1.02 pCi/L). H-3 was not detected in that sample of Supply Well B and therefore no H-3 dose need be included. Using the CY

LTP 25 mrem/yr Groundwater Derived Concentration Guideline Level (DCGL) for Sr-90 of 251 pCi/L for Sr-90, the calculated dose would be 0.102 mrem/yr. As this is approximately 0.4 percent of the 25 mrem DCGL, consistent with the CY LTP, this dose is not required to be included in showing compliance with site unrestricted release criteria.

For Survey Unit 9528-0000, the only sample result qualifying as detectable groundwater contamination is the September 2004 H-3 result for MW-2(439 pCi/L). Using the CY LTP 25 mrem/yr Groundwater Derived Concentration Guideline Level (DCGL) for H-3 of 652,000 pCi/L, the calculated dose would be 6.73 E-4 mrem/yr. As this is approximately 0.003 percent of the 25 mrem DCGL, consistent with the CY LTP, this dose is not required to be included in showing compliance with site unrestricted release criteria.

In conclusion, the dose from existing groundwater contamination present in the monitoring wells within the capture zone of Survey Units 9528-0000 and 9528-0003 is insignificant and need not be included in showing compliance with site unrestricted release criteria per the protocol defined in the CY LTP Section 5.4.7.2, Gross Activity DCGLs.

3.1.2 Southeast Landfill Area

There are a number of monitoring wells located near the Southeast Landfill Area. Table 7 below summarizes the groundwater monitoring results for these wells.

Table 5
Southeast Landfill Area Groundwater Sample Results

Monitoring Well Number	Number of Sample Rounds	Most Recent Sample Round	Detectable Groundwater Contamination	Comments
MW-200	5	Dec 04	No	None
MW-201	4	Jun 02	No	*Water Level too Low to Sample After Jun 02*
MW-202	6	Dec 04	No	None
MW-203	8	Dec 04	Dec 01 : Ni-63, Mar 02 : Tc-99	False Positives (See Table 6)
MW-204	6	Dec 04	No	None
MW-205	7	Dec 04	No	None
MW-206	6	Dec 04	No	None
MW-207	8	Dec 04	Dec 01 : Pu-238, Sept 03 : Sr-90	False Positives (See Table 6)
MW-208	4	Dec 04	Dec 03 : Sr-90 Filter/Unfiltered	False Positives (See Table 6)

As indicated in Table 5, there are a few samples qualify as detectable contamination per the LTP. Table 6 provides more details on the sample results that qualified as detectable groundwater contamination.

Table 6
Detailed Sample Results & False Positive Determination
Landfill Monitoring Wells

MW Well #	Sample Date	Radio-nuclide	Sample Result (pCi/L)	2 Sigma Uncer-tainty (pCi/L)	Minimum Detectable Concentra-tion (pCi/L)	Positive Results of Total Results for the Sample Round	Limiting Mean for the Sample Round (pCi/L)	Bias Adjusted MDC (pCi/L)
203	Dec 01	Ni-63	7.43	3.8	6.1	14 of 14	4.31	10.41
203	Dec 01	Pu-238	0.136	0.1	0.11	24 of 26	0.284	0.394
203	Dec 01	Am-241	0.199	0.15	0.18	12 of 14	0.102	0.282
203	Mar 02	Tc-99	13.9	8.07	11.3	23 of 23	5.78	17.1
207	Dec 01	Pu-238	0.379	0.19	0.071	24 of 26	0.284	0.355
207	Dec 01 Recount	Pu-238	0.16 (< MDC)	0.14	0.22	24 of 26	0.284	0.504
207	Sept 03	Sr-90	0.437	0.239	0.415	34 of 34	0.30	0.715
208	Dec 03	Sr-90	0.891 (Un-filtered)	0.32	0.478	66 of 67	0.45	0.928
208	Dec 03	Sr-90	0.52 (filtered)	0.266	0.448	66 of 67	0.45	0.898

When all the sample results for a particular radionuclide during the corresponding sampling round are considered together (See Table 6), it can be seen that there is a significant positive bias in the laboratory analysis for all of the radionuclides that exhibited detectable groundwater contamination. Using the same evaluation techniques as discussed in Section 3.1.1 for Pu-241, the following was determined:

- In all the cases in Table 6, even though none of the radionuclides were expected to be present, essentially all of the results are positive.

- Although detection of Sr-90 is expected in some monitoring wells on the CY site, as can be seen in Table 6, the limiting mean of the Sr-90 data for the applicable sample rounds is positive and nearly the same magnitude as the analysis MDC.
- For all radionuclides that exhibited detectable groundwater contamination in the landfill area monitoring wells that were not expected to be present, the average concentration of all groundwater samples for the radionuclide

for a sample round was positive and a significant percentage of the analysis MDC. A limiting mean was also determined for these data sets.

For all of the sample results listed in Table 6, two of the above three trends are shown (all that are appropriate for the radionuclide being reviewed), therefore, a positive bias is indicated. In cases such as this, the analytical MDC can be adjusted for the positive bias and the results re-evaluated against the detection criteria. This adjustment has been done in Table 6 by adding the limiting mean for the appropriate sample rounds to the analysis MDC.

A review of the last column of Table 6 (Bias Adjusted MDC) shows that none of the sample results are considered detectable groundwater contamination per the definition in the CY LTP. For the December 2001 sample round the initial result for Pu-238 was slightly above the adjusted MDC. A sample recount yielded a value well below both the unadjusted and adjusted MDC. Therefore, there was no detectable groundwater contamination in that sample.

In summary, there is no existing groundwater contamination in the monitoring wells within the capture zone of Southeast Landfill Area survey units; i.e., no wells need be included in showing compliance with site unrestricted release criteria per the protocol defined in the CY LTP section 5.4.7.2, Gross Activity DCGLs.

4.0 Conclusions

The preceding analyses show that for all the survey units in the FSS Phase II release area of the Haddam Neck Plant site, there is no "existing groundwater contamination" dose that needs to be included in showing compliance with site unrestricted release criteria per the protocol defined in the CY LTP.

5.0 References;

5.1 Ground Water Monitoring Program, RPM 5.3-0 Rev. CY-001 Major

5.2 Groundwater Monitoring Program Quality Assurance Plan, GWMP QAP, current revision

5.3 Connecticut Yankee Haddam Neck Plant License Termination Plan, Rev. 2

CY-HP-0193

Attachment 1

Haddam Neck Plant

License Termination Plan
Supplemental Information – Survey Areas Potentially Affected by Groundwater Contamination and Capture Zone Analysis

CONNECTICUT YANKEE ATOMIC POWER COMPANY

HADDAM NECK PLANT
362 INJUN HOLLOW ROAD • EAST HAMPTON, CT 06424-3099

January 31, 2005
Docket No. 50-213
CY-05-022

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D. C. 20555

Haddam Neck Plant
License Termination Plan
Supplemental Information - Survey Areas Potentially Affected by Groundwater Contamination and Capture Zone Analysis

The Haddam Neck Plant (HNP) License Termination Plan (LTP) Section 5.4.7 requires a notification to the NRC for any changes to the survey areas to which the "existing groundwater" dose term of the compliance equation (Equation 5-1 of the LTP) is to be applied. The HNP LTP also requires preparing and making available for NRC inspection, a capture zone analysis. As a result of additional groundwater characterization activities and the completion of the capture zone analysis, changes have resulted in the list of survey areas to which the "existing groundwater" term needs to be considered. The purpose of this letter is to submit these changes.

Connecticut Yankee Atomic Power Company (CYAPCO) hereby provides the attached report (Attachment 1) which presents the results of the capture zone analysis for the Haddam Neck Plant site. Using the largest capture zone determined by the analysis, the zone of influence was confirmed to be no more than the 100 meters currently used in the HNP LTP. A difference was determined concerning the directions in which the capture zone is to be applied from a groundwater monitoring well. The attached report calls for the capture zone to be conservatively applied in all directions from the monitoring well and not just on the flanks of the plume as currently specified in the HNP LTP. The effect of this change is discussed below.

Additional groundwater characterization has been conducted since the determination of which survey areas needed to consider the "existing

groundwater" dose term included in the HNP LTP. Sample results have shown some low levels of detectable ground water contamination, as defined in the HNP LTP Section 5.4.7.1 (Hereafter called detections), in additional wells along the flanks of the industrial area plume and in certain wells on the peninsula between the discharge canal and the Connecticut River. Although the calculated dose to a hypothetical future resident due to these additional detections is very low (i.e., < 0.6 mrem/yr), the affected survey areas will be included in Table 5-3 of the HNP LTP to ensure that the potential for dose is considered.

Discussion

The groundwater monitoring characterization results have shown low level (in some cases intermittent) detections of radiological contaminants in the following additional wells compared to those currently described in the HNP LTP:

Monitoring Well	Location
MW-1	Central Peninsula
MW-2	Central Peninsula
MW-104S	Northern Industrial Area
MW-108S	Southern Industrial Area
MW-113S	Upper Peninsula
MW-117S	Central Peninsula
MW-122S (Installed after LTP Rev 1)	Southern Industrial Area
MW-123 (Installed after LTP Rev 1)	Northern Industrial Area
MW-124 (Installed after LTP Rev 1)	Northern Industrial Area
Supply Well B	Central Peninsula

The attached Figure 5-3 illustrates the capture zones for those monitoring wells listed above located in the industrial area and vicinity along with other monitoring wells in the eastern industrial area that have shown detections of radiological contamination (MW-101S/D, MW-103S/D and MW-102S/D). Although there are other monitoring wells more toward the center of the plume in this area that have shown detections, the monitoring wells illustrated in Figure 5-3 define the perimeter of the zone of influence for the industrial area and the upper peninsula. By reviewing these capture zones, the affected survey areas were determined for this portion of the site and are shown in Table 1 of this submittal.

The attached Figure 5-3.1 illustrates the capture zones for the monitoring wells listed above that are located in the central peninsula area. As with Figure 5-3, these zones have been used to determine the survey areas for which groundwater dose impact needs to be considered. These survey areas are also listed in Table 1 of this submittal.

For the remaining monitoring wells outside the industrial area capture zone perimeter or not listed for the peninsula area, there have been no validated detections. Additional detail on groundwater monitoring results has been, and will continue to be, provided in the semi-annual groundwater monitoring reports submitted to the State of Connecticut DEP in support of the Phase 2

Hydrogeologic Work Plan. Copies of these reports will be provided to the NRC and EPA. As described in the HNP LTP, when CYAPCO requests release of a survey area from the NRC license, an evaluation will be included as to whether there is any groundwater dose impact. CYAPCO will continue to review the list of affected survey areas listed in Table 1 and provide updates to the NRC based on new groundwater characterization information as they occur.

It should be noted that the following survey areas are currently listed in HNP LTP Table 5-3 as being affected by groundwater contamination but are not included in Table 1: 9104, 9108, 9110, 9112, 9114, 9116, 9118, 9120, 9126, 9128, and 9307. These survey areas were deleted during the recent update of the HNP LTP (August 2004 Update of the HNP LTP) but were left inadvertently in Table 5-3. The HNP LTP has been revised to reflect the above described changes and the revised pages of the HNP LTP will be distributed to the controlled copy holders of the HNP LTP in the near future.

If you should have any questions regarding this information, please contact Mr. G. P. van Noordennen at (860) 267-3938.

Sincerely,

Signed by G. Bouchard *1/31/05*

G. H. Bouchard Date
Director Nuclear Safety/Regulatory Affairs

Attachment 1: Estimated Zone of Influence/Capture Zone for Hypothetical Water Supply Well in Post-Closure Dose Modeling

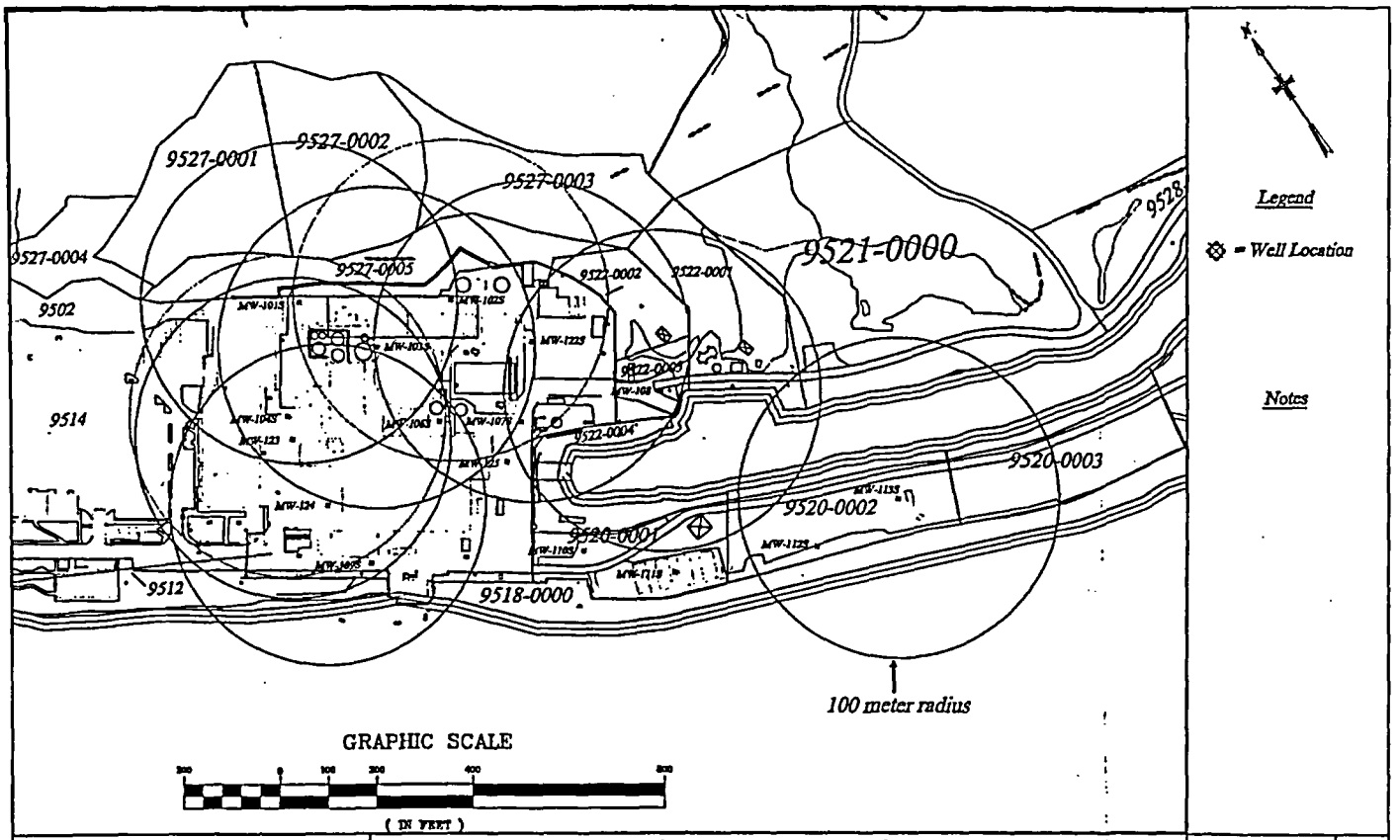
cc: S. J. Collins, NRC Region 1 Administrator
T. B. Smith, NRC Project Manager, Haddam Neck Plant
R. R. Bellamy, Chief, Decommissioning and Laboratory Branch, NRC Region1

E. L. Wilds, Jr., Director, CT DEP Monitoring and Radiation Division
P. Hill, CT DEP
M. Rosenstein, US EPA, Region 1

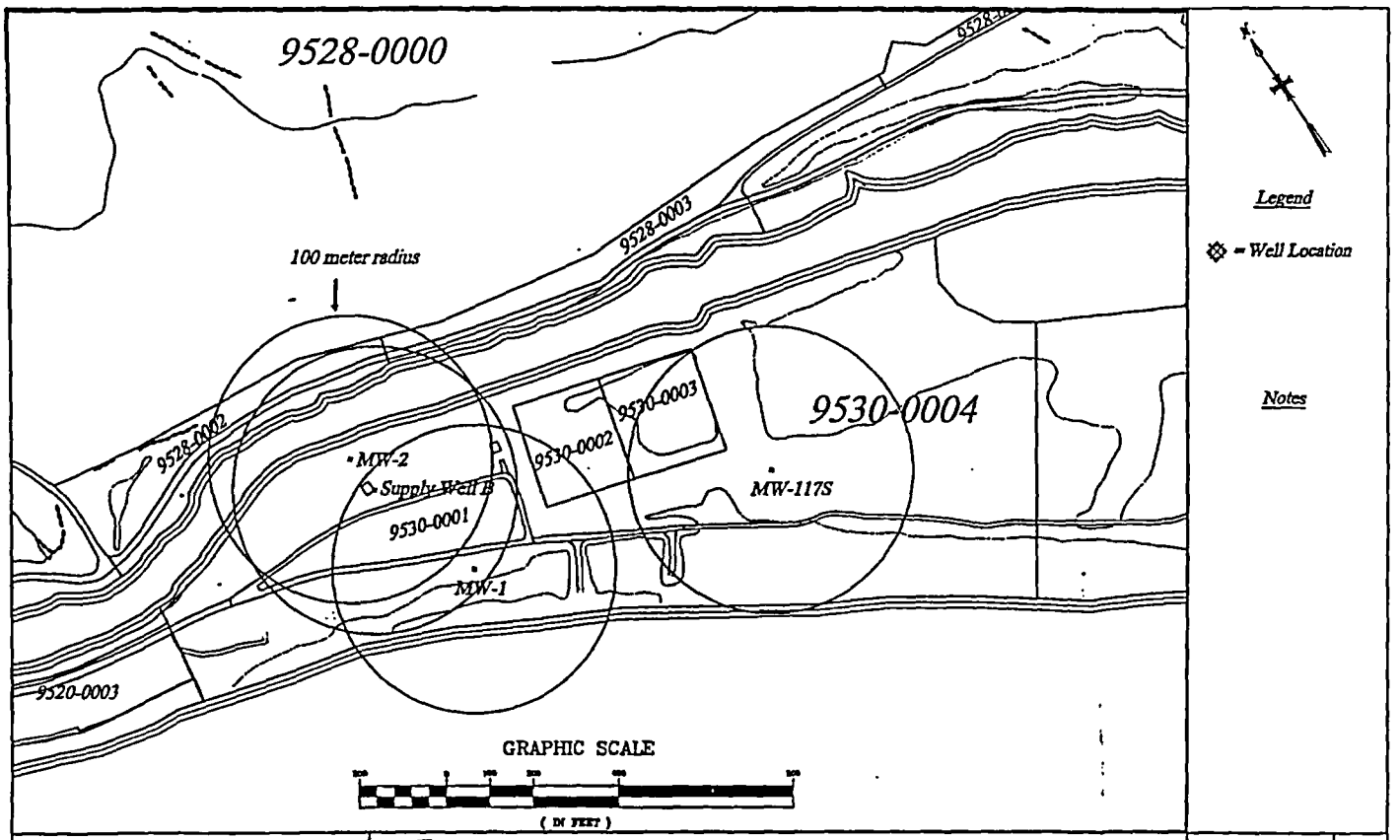
Table 1

Survey Areas Affected by Groundwater Contamination
(All Survey Units Unless Otherwise Noted)

Survey Area		
1000	9306	9522
2000	9308	9527
3000	9310	9528(Units 0,2 &3)
4000	9312	9530 (Units 1,2,3 &
5000	9313	4)
6000	9502	9801
9102	9512	9802
9106	9514	9803
9226	9518	9804
9302	9520	9805
9304	9521	



January 2005	Connecticut Yankee Atomic Power Company Capture Zone Perimeter for Affected Monitoring Wells in the Industrial Area and Upper Peninsula	Figure Number	Rev
		Figure 5-3	0



January 2005	Connecticut Yankee Atomic Power Company Capture Zone Perimeter for Affected Monitoring Wells in the Central Peninsula	Figure Number	Rev
		Figure 5-3.1	0

Docket No. 50-213
CY-05-022

Attachment 1

Haddam Neck Plant
License Termination Plan
Supplemental Information – Survey Areas Potentially Affected by Groundwater Contamination and Capture Zone Analysis
Estimated Zone of Influence/Capture Zone for Hypothetical Water Supply Wells in Post-Closure Dose modeling

January 2005

TECHNICAL MEMORANDUM

Estimated Zone of Influence/Capture Zone for Hypothetical Water Supply Wells in Post-Closure Dose Modeling

PREPARED FOR: Mr. Terry Peacock, Connecticut Yankee Atomic Power Company

PREPARED BY: Chuck Miller, CH2M HILL Chuck Miller

COPIES: Mr. Rich McGrath, CYAPCO

CH2M HILL Project File

DATE: January 11, 2005

Introduction

This technical memorandum describes the analysis of site groundwater characteristics at Connecticut Yankee Atomic Power Company's (CYAPCO) Haddam Neck Plant (HNP) nuclear power station to develop estimated zones of influence, or capture zones, for hypothetical water supply wells at the plant. The hypothetical water supply wells are part of the post-closure dose estimate modeling for the resident farmer scenario performed to determine compliance with Nuclear Regulatory Commission (NRC) license termination criteria.

The capture zone assessment was performed after obtaining results from on-site hydrogeologic testing and studies. These studies include stratigraphic analyses based on geologic logs generated during soil borings for foundation studies and during water supply well and groundwater monitoring well drilling at the facility. Hydrogeologic testing at the site includes long-term water level monitoring in 29 wells on-site and the Connecticut River; performing a pumping test in the unconfined aquifer; and performing packer test pumping in discrete intervals and open-borehole pumping in deep bedrock boreholes.

Groundwater at the HNP is found in both a shallow unconfined and possible semi-confined aquifer within the unconsolidated alluvium and in confined and semi-confined aquifer units within the underlying fractured crystalline bedrock. The unconfined aquifer is expected to exhibit a generally-isotropic capture zone, except where affected by boundary effects, with a radius that is directly proportional to the pumping rate applied to a water supply well. The aquifer pumping test results indicate a capture zone radius for the unconfined aquifer ranging from less than 30 feet at a pumping rate of 0.5 gallons per minute, to approximately 200 feet at a pumping rate of 29 gallons per minute.

The fractured bedrock aquifer exhibits highly variable and directional (i.e., anisotropic) capture zone effects that are dependent on both pumping rates and interception of

transmissive fractures by the borehole. Open borehole pumping tests at HNP revealed hydaulic connectivity ranging from 185 to 462 feet in transmissive near-horizontal fracture sets at open-borehole pumping rates of 1.9 and 6.7 gallons per minute, respectively.

Hydrogeologic Measurements

The capture zone analysis is supported by two sets of hydrologic measurements collected as part of hydrogeologic characterization of the HNP site. These measurement sets are pumping operations supporting bedrock characterization activities and a shallow unconfined aquifer pumping test. Results of these tests are discussed in the following subsections.

Bedrock Pumping Activities

Characterization of the fractured bedrock aquifer was performed through packer testing in one open bedrock borehole (borehole BH-121A) and Hydrophysical™ logging performed in four open bedrock boreholes (boreholes BH-118A, BH-119, BH-120, and B H-121A). Groundwater elevation hydrographs for 29 monitoring wells were evaluated during the bedrock pumping activities to identify pressure transients related to pumping events. Results of the open borehole pumping are used in this capture zone analysis because open borehole construction is considered to be representative of the hypothetical water supply well.

Details of the bedrock pumping activities are described in the *Connecticut Yankee Atomic Power Company Haddam Neck Plant Task 2 Supplemental Characterization Report* (CH2M HILL, 2004a). These tests include both discrete-interval pumping using an instrumented straddle packer assembly and open-borehole pumping performed as part of Hydrophysical™ logging of four boreholes. Locations of the bedrock boreholes and the surrounding transducer/data logger-equipped monitoring wells are shown in Figure 1. The anisotropic nature of distant hydraulic responses in the fractured bedrock system is illustrated in Figure 2 (observed responses to open-borehole pumping). The magnitudes of the distant responses to the bedrock pumping events are shown in Table 1. The bedrock pumping activities were short duration activities (e.g., generally more than 8 hours, but less than 12 hours duration) and the hydrographs for distant well responses indicated non-equilibrium conditions (i.e., drawdown curves were not asymptotic).

Unconfined Aquifer Pumping Tests

Characterization of the shallow unconfined aquifer was performed through a variable-rate step-drawdown test followed by a seventy-two hour constant-rate pumping test performed in a test well (well AT-1) located in the northwestern portion of the HNP industrial area. The test well was screened across the saturated thickness of the unconfined aquifer in the test study area and completely within the unconsolidated materials. Groundwater elevation hydrographs for surrounding wells were evaluated for test-related pressure responses.

Details of the unconfined aqufier pumping tests are described in the *Connecticut Yankee Atomic Power Company Haddam Neck Plant Task 2 Supplemental Characterization Report* (CH2M HILL, 2004a) and *Technical Memorandum – Results of the Unconfined Aquifer Pumping Test Conducted in the Industrial Area of the Haddam Neck Plant, East Hampton, Connecticut* (CH2M HILL, 2004b). The test, or production, well and surrounding observation wells that indicated hydraulic responses are shown in Figure 3. Drawdown responses observed in monitoring wells during the step-drawdown test and the constant-rate pumping test are shown in Figures 4 and 5, respectively. The magnitudes of distance drawdown responses to the unconfined aquifer pumping are shown in Table 2.

Extrapolation of Test Measurements and Observations to the HNP Site

The pumping test measurements from the unconfined, confined and semi-confined units are considered sufficiently-representative of hydrogeologic conditions to allow their application for a broader assessment of the apparent capture zones. Pumping test activities have included distance-drawdown responses to groundwater pumping at nearly the rate used for post-closure dose modeling (i.e., 0.45 gallons per minute).

Measurement results expanded to areas beyond those actually tested, however, requires defining assumptions and identifying the apparent range of uncertainty applicable to the extrapolation. The following discussion summarizes the HNP hydrogeologic conceptual site model, describes dividing the HNP site into areas of similar hydrogeologic properties, and explains the applicability of the capture zones to those areas.

HNP Hydrogeologic Conceptual Site Model

The groundwater aquifer system at HNP includes the following features:

- A shallow unconfined aquifer system found in generally-sandy unconsolidated alluvial deposits of varying thickness and engineered fill surrounding plant structures. The shallow unconfined aquifer may be hydraulically connected t othe shallow bedrock in some areas.
- Confined and semi-confined (i.e., "leaky") aquifer systems in fractured bedrock underlying the unconsolidated deposits. The fractured bedrock is encountered at varying depths below ground surface and the bedrock aquifer exhibits varying degrees of confinement. Bedrock aquifer tranmissivity is largely controlled by fracture sets oriented in a generally north-south direction.
- The Connecticut River is adjacent to the site and serves as a groundwater discharge boundary for the aquifer system (confined, semi-confined and unconfined aquifers).
- Groundwater beneath HNP is recharged by local infiltration of precipitation and surface water percolation and by infiltration of precipitation in the upland areas to the north of the power station area, inland of the river.

Additional discussion of the HNP hydrogeologic conceptual site model is found in the *Connecticut Yankee Atomic Power Company Haddam Neck Plant Phase 2 Hydrogeologic Characterization Work Plan Task 1 Summary Report* (CH2M HILL, 2004c).

HNP Capture Zone Functional Areas

The HNP site was divided into three similar functional areas for the capture zone assessment, as shown in Figure 6. The following areas of the HNP site have been identified as comparable to the hydrogeologic test areas based on structural similarity and hydrostratigraphic features:

- The HNP central industrial area. This area includes all of the primary power station structures (e.g., reactor containment, primary auxiliary building, fuel building, service and control buildings, and turbine building) and hydrogeologically consists of a relatively thin layer of alluvial deposits and construction fill overlying a thick fractured crystalline bedrock formation that is encountered relatively shallow below ground surface. Groundwater in this area exhibits varying degrees of plant-related contamination. This area is part of the river terrace of the HNP adjacent to the Connecticut River. The unconsolidated formation generally lies in direct contact with the bedrock in this area and appears to be in communication with semi-confined bedrock sytems. Based on observations during dewatering activities to support structure demolition, it is likely that the unconfined aquifer overlying the bedrock in the central portion of this area will not sustain long-term pumping and may become dewatered. Seasonal variations in local recharge will result in variable amounts of available groundwater in this area.
- The HNP parking lot and peninsula area. This area includes the administration buildng, parking lot, warehouse areas and the EOF on the northern portion (relative to plant north) of the river terrace area. It also includes the discharge canal peninsula to the south of the industrial area, the discharge canal itself, and the river terrace inland of the discharge canal extending to the southern property boundary near the Salmon River. This area consists of a relatively thick layer of unconsolidated alluvial and overbank deposits overlying crystalline bedrock. The unconsolidated formation is separated from the bedrock by a dense layer of sand, silt, and gravel that is interpreted as glacial till and exhibits low transmisivity. Although the shallow unconsolidated aquifer in these areas is in communication with the aquifer underlying the industrial area, the predominant groundwater flow (i.e., northeast to southwest) tends to minimize the distribution of contaminants from the industrial area laterally into these areas. The upper pensinsula (i.e., the area immediately adjacent to the industrial area) exhibits some groundwater contamination that appears continuous with that underlying the industrial area. The lower peninsula (i.e., the southern portion of the peninsula extending from the current waste storage area to the southern terminus of the peninsula at the mouth of the discharge canal) is in hydraulic communication with both the discharge canal and the Connecticut River. There are no defineable contaminant plumes present in the lower peninsula and observed contaminant concentrations do not exceed closure criteria.
- The HNP upland area. This is the largest part of the HNP and consists of steeply-sloping upland area to the east (relative to plant north) of the river terrace. It includes the Independent Spent Fuel Storage Installation (ISFSI) and the former HNP landfill

area. The upland area consists primarily of discontinuous veneers of soil overlying crystalline bedrock. The landfill area near the southern end of the upland area exhibits a relatively thick sandy surface deposit. No groundwater contamination is found in this area. The groundwater in the upland area is in hydraulic communication with the industrial area and the parking lot area via local recharge into the unconsolidated aquifer and through flow of groundwater within the underlying fractured bedrock.

The capture zone dimensions applicable to these functional areas are shown in Table 3. The estimated water supply well capture zones for these areas depend on the following site-specific conditions:

- The aquifer being pumped (i.e., shallow unconfined or bedrock);
- The pumping rate applied to the well;
- The total depth of the well; and
- Interception of specific transmissive fracture sets in the bedrock aquifer.
- Degree of communication between semi-confined units and overlying unconfined units.

Variability of site-specific conditions within each functional area leads to uncertainty in the exact radius of well capture zones. The assumptions used to identify the capture zone radii and apparent uncertainties are also described in Table 3.

Application of Capture Zone Assessment to HNP Post-Closure Dose Modeling for the Resident Farmer Scenario

The HNP license termination plan (LTP) establishes a plume influence boundary at a distance of one-hundred meters from the groundwater contamination plume within the industrial area. The contamination plume is defined as the 1,000 pCi/L plume contour of tritium in groundwater. Post-closure dose estimate modeling assumes the hypothetical water supply well would not capture site-related groundwater contaminants if installed along that boundary. The LTP states that if the capture zone is determined to be greater than one hundred meters, then NRC will be notified. The empirical test measurements used to support determination of the well capture zone are described below.

Unconfined Aquifer Pumping Test Results

For wells completed in the shallow unconfined aquifer, the capture zone of a well pumped at 0.5 gpm was less than 30 feet (<10 meters). This determination is based on the 0.5 gpm portion of the step-drawdown test performed prior to the constant-rate aquifer pumping test conducted in the unconfined aquifer. The test was conducted in a five-inch diameter well that was screened over the entire thickness of the unconfnined aquifer. A near-field monitoring well located 29 feet from the pumping well was equipped with a data-logging pressure transducer to record near-field effects. No response was observed in the near-field monitoring well during the 0.5 gpm pumping activity.

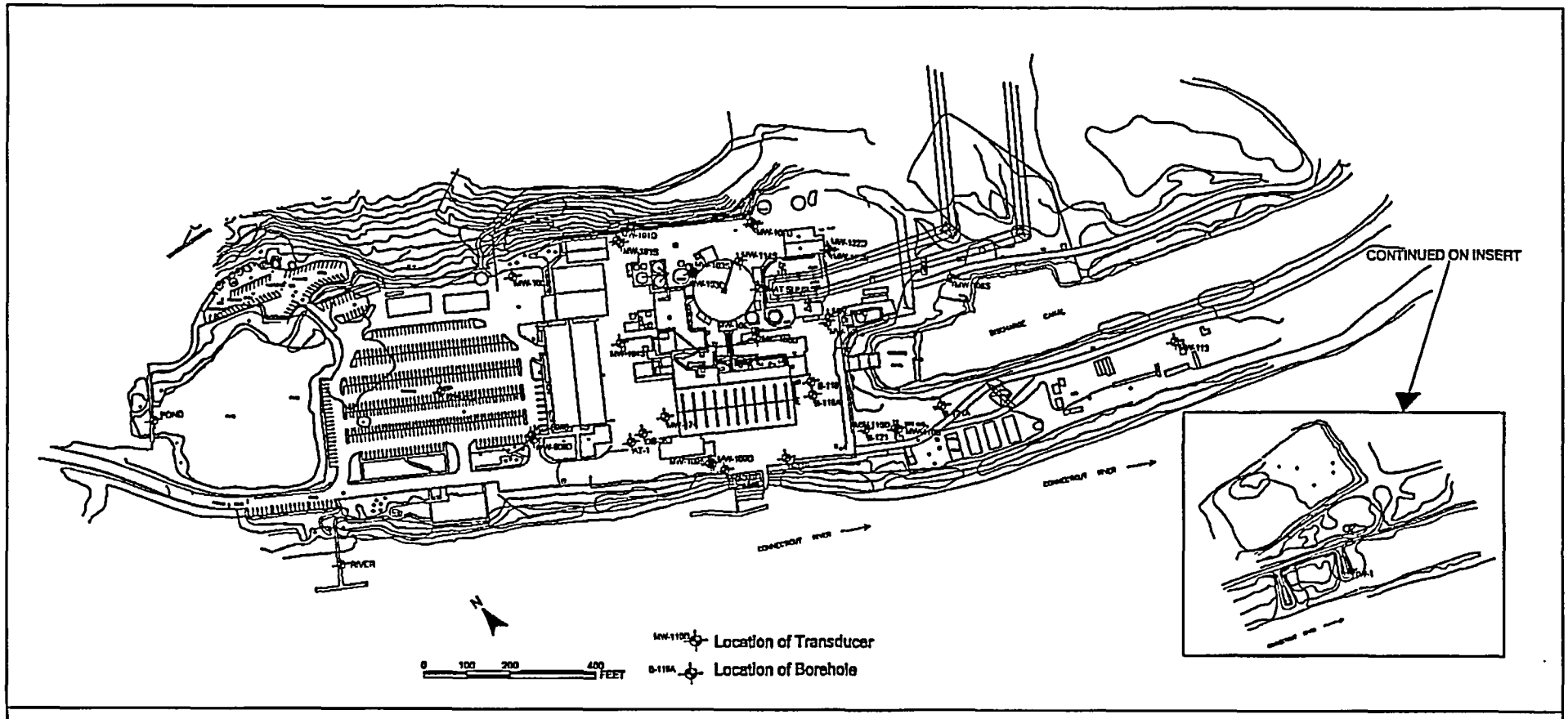
The results of the seventy-two hour constant rate pumping test provide a good upper-level bounding estimate of capture zone in the unconsolidated formation. The test well was pumped at 29 gpm, and at the end of the test period a drawdown response was observed in the near-field monitoring well at 29 feet (8.6 m) from the pumping well and in the next nearest monitoring well at a distance of 100 feet (30 m). A possible hydraulic response (i.e., a downward inflection in the distant well hydrographs late in the pumping test period) attributable to the pumping test was observed in two wells 190 feet (58 m) from the pumping well, delineating a probable maximum capture zone of approximately 200 feet (61 meters) at a pumping rate of 29 gallons per minute in the unconsolidated materials of the shallow unconfined aquifer.

Based on these observations, the capture zone of a hypothetical water supply well completed in the unconfined aquifer is less than the 100 meters stipulated in the post-closure dose model. Based on the similarity of the unconsolidated materials across the site, the capture zone for a hypothetical water supply well under the modeled conditions (i.e., 0.46 gpm) can be assumed to be less than ten meters. The capture zone should be assumedto extend uniformly in all directions around the hypothetical water supply well.

Confined Aquifer/Fractured Bedrock Pumping Test Results

For wells completed in bedrock boreholes that intersect transmissive fractures, pumping from an open borehole is identified as the most representative test measurement for this assessment. Open borehole pumping was conducted during characterization of bedrock hydraulic properties at the site during 2004. Pumping was conducted at various rates in four boreholes. Hydraulic responses were observed in distant wells equipped with data-logging pressure transducers and were evaluated to confirm that the responses were related to the pumping activities. The open borehole capture zone was observed to range from 185 feet (56 meters) at a pumping rate of 1.9 gpm to 462 feet (141 meters) at a pumping rate of 6.7 gpm.

Based on these observations, the capture zone for a hypothetical water supply well completed in fractured bedrock and pumped at the modeled conditions (i.e., 0.46 gpm) is less than the 100 meters evaluated in the post-closure dose model. This estimate is based on the observation that pumping an open bedrock borehole at a rate approximately four times the modeled rate (e.g., 1.9 gpm vs. 0.46 gpm) produced an observed maximum capture zone of only 56 meters. The open boreholes used for the borehole pumping tests were cased from the ground surface to the top of bedrock and are consistent with the expected design of a bedrock water supply well as typically constructed near the site. The containment foundation mat sump and other dewatering activities were active during the bedrock pumping. Although this distant extraction may have reduced the observed magnitude of distant drawdown responses, it is not expected to have substantially reduced the observed radius of influence.



Notes: (1) Transducer locations are approximate locations
(2) Base map obtained from Malcolm Pirnie, April 2002

FIGURE 1

LOCATION OF WATER LEVEL TRANSDUCERS AND BOREHOLES
HADDAM NECK PLANT (HNP)

CH2MHILL

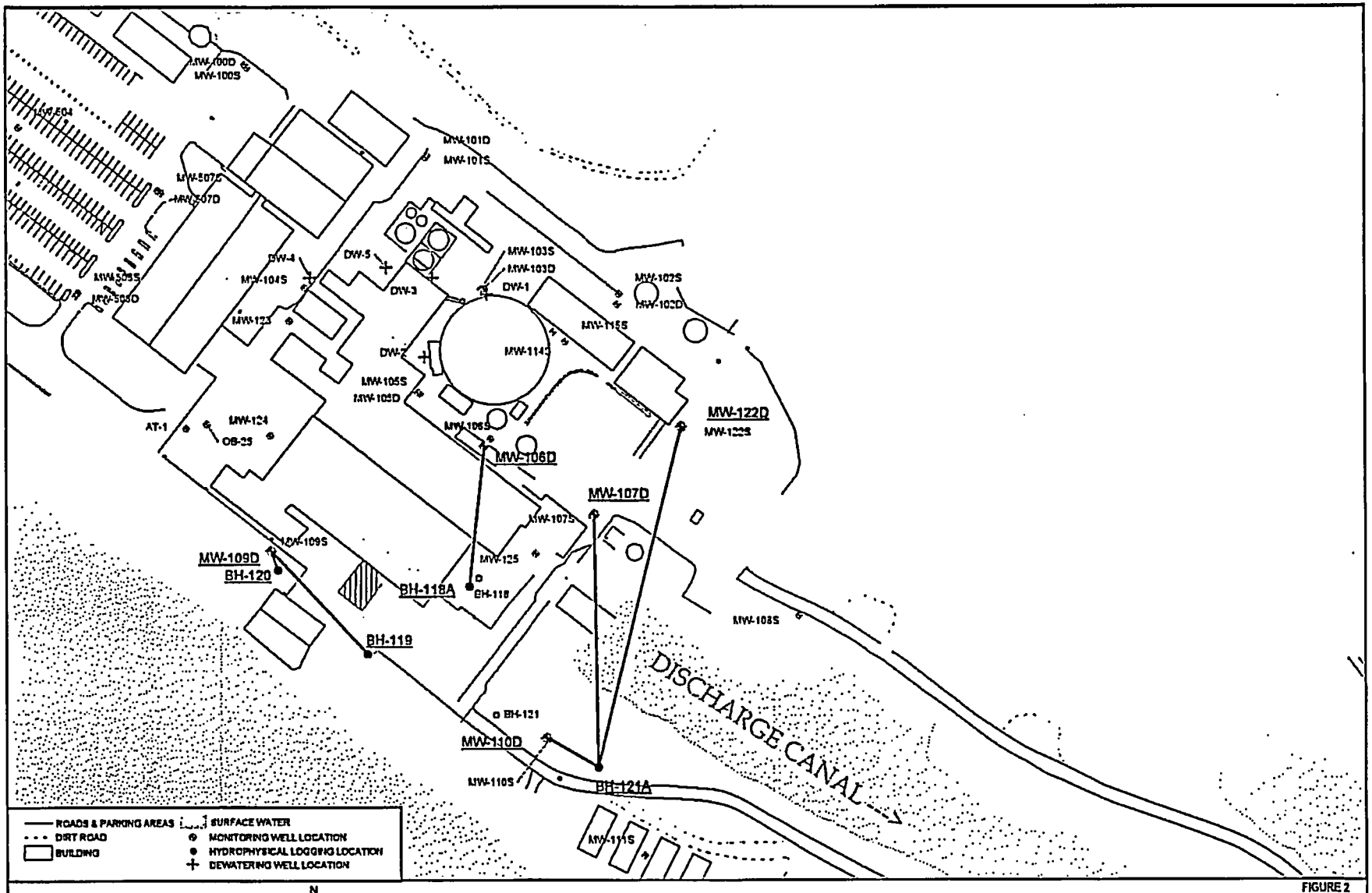


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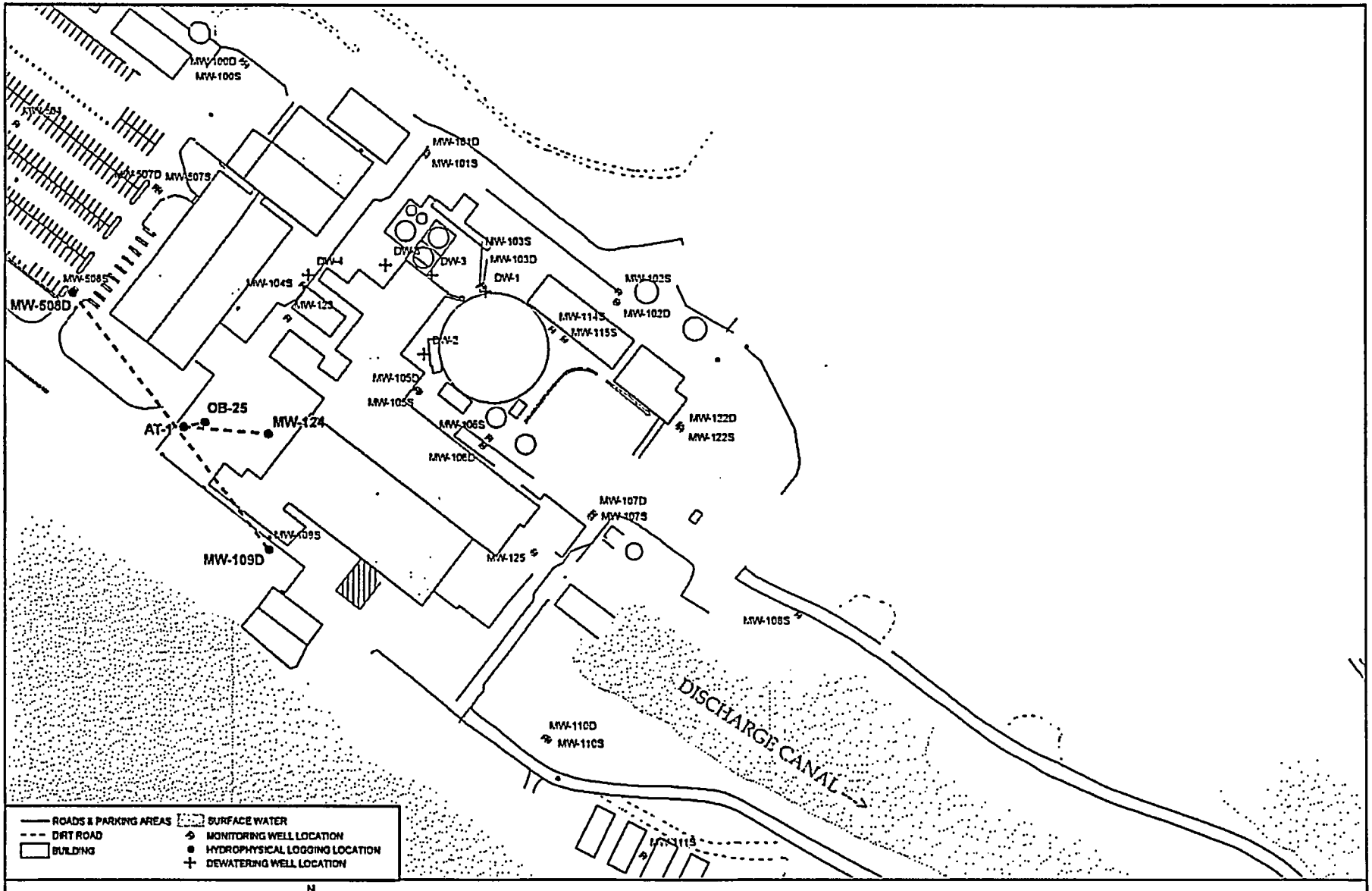
FIGURE 2
MONITORING WELLS SHOWING RESPONSE TO PUMPING IN BEDROCK BOREHOLES DURING HYDROPHYSICAL LOGGING
CONNECTICUT YANKEE (HNP)
HADDAM NECK, CT

Table 1. Location and Magnitude of Responses to Bedrock Pumping Events in Open Boreholes.

Pumping Location	Pumping Rate	Drawdown in Pumping Well	Well Exhibiting Response	Distance from Pumping Well	Drawdown Observed
BH-118A	5 gpm	4.8 ft	MW-106D	185 ft	0.45
BH-118A	31 gpm	78 ft	MW-106D	185 ft	1.10 ft
BH-119	1.4 gpm	21 ft	MW-109D	185 ft	0.1 ft
BH-120	1.9 gpm	16 ft	MW-109D	28 ft	1.4 ft
BH-121A	6.7 gpm	37 ft	MW-110D	74 ft	1.1 ft
			MW-107D	333 ft	0.1 ft
			MW-122D	462 ft	0.6 ft



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CONNECTICUT YANKEE (HNP)
HADDAM NECK, CT

Figure 4
Step Drawdown Test Response in AT-1 and OB-25
September 2004

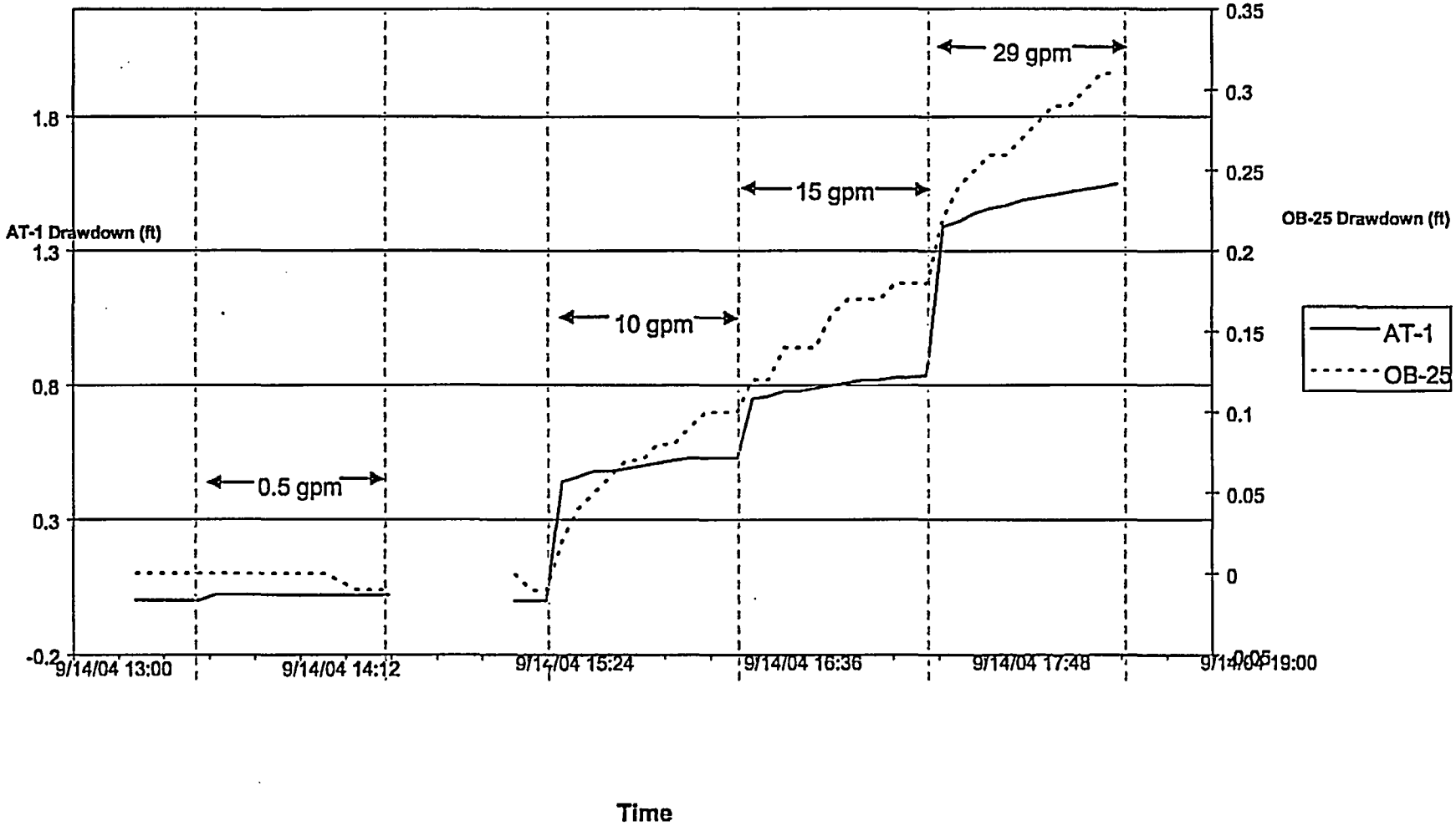
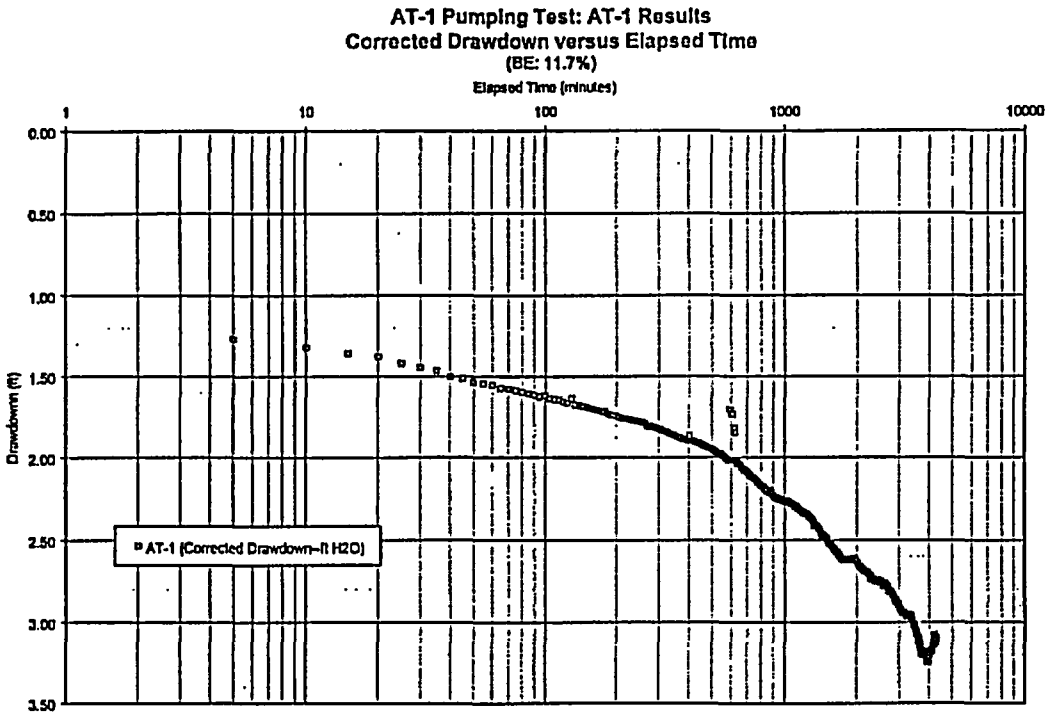
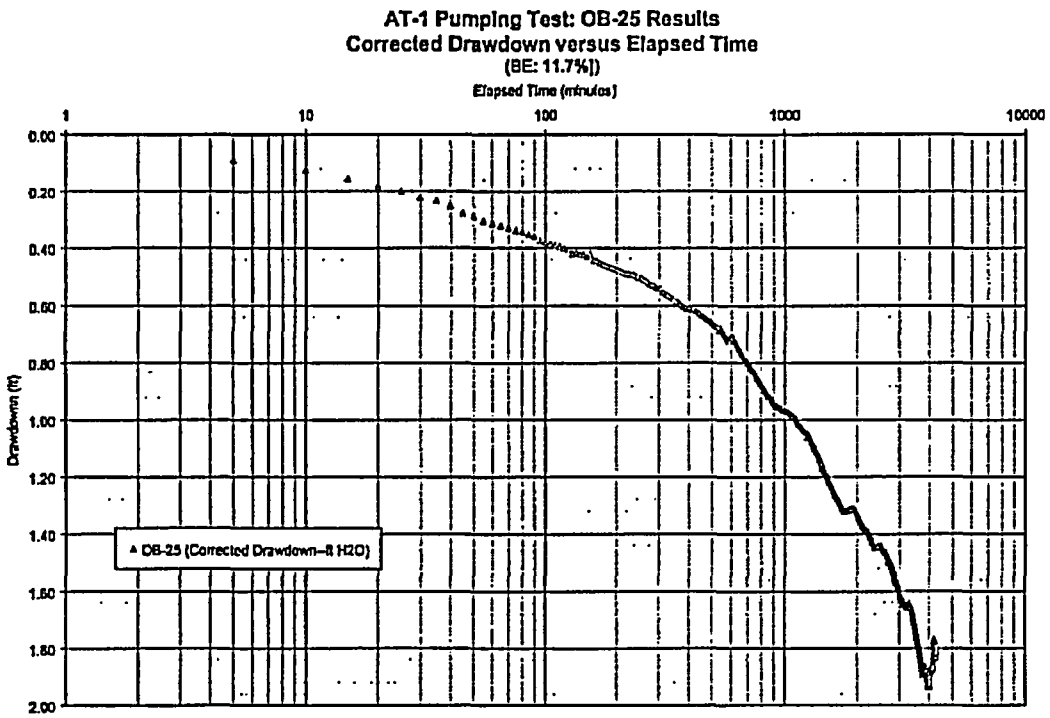


Figure 5. Drawdown Responses During Constant Rate Pumping Test.





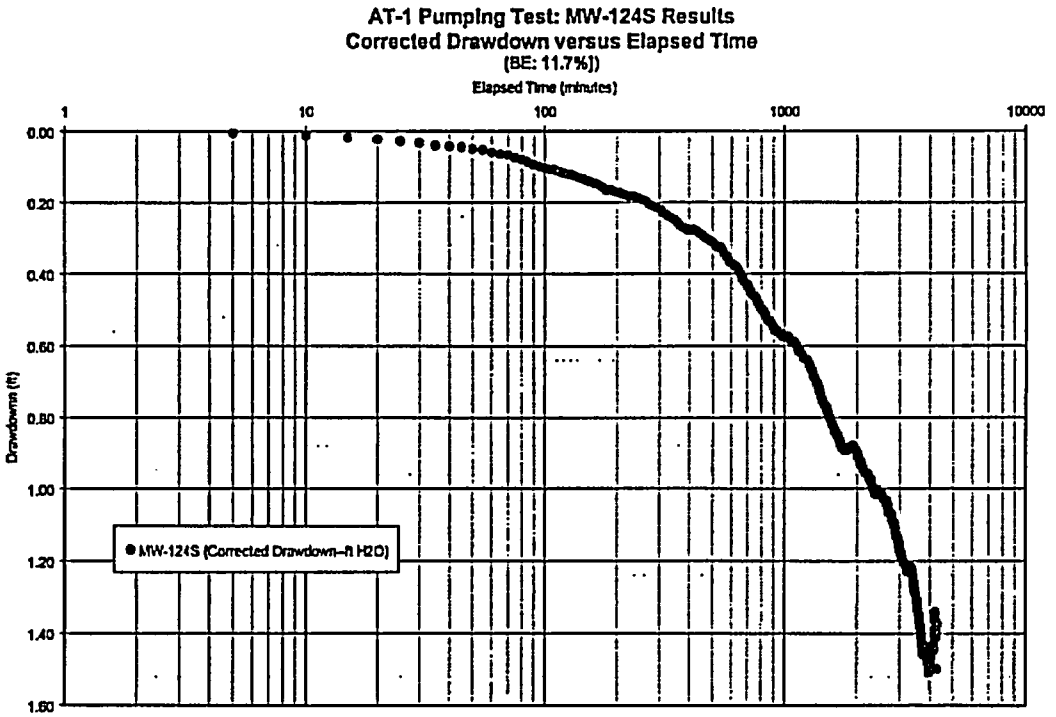
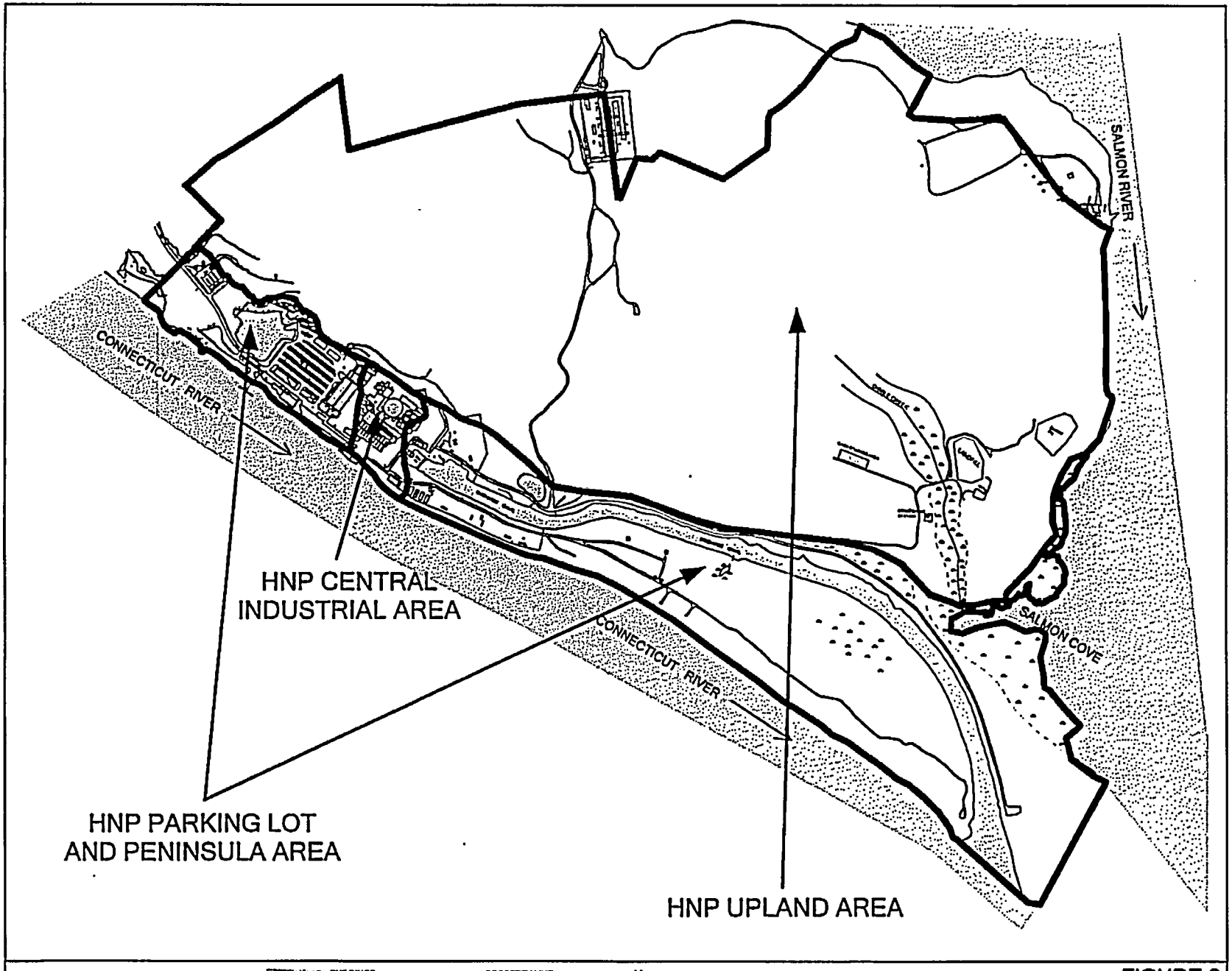

AT-1 Pumping Test: MW-124S Results
Corrected Drawdown versus Elapsed Time
(BE: 11.7%])
Elapsed Time (minutes)
1
10
100
1000
10000
Drawdown (ft)
0.00
0.20
0.40
0.60
0.80
1.00
1.20
1.40
1.60
MW-124S (Corrected Drawdown–ft H2O)

Table 2. Location and Magnitude of Responses to Unconfined Aquifer Pumping Events.

Pumping Location	Pumping Rate (gpm)	Drawdown in Pumping Well (feet)	Well Exhibiting Response	Distance from Pumping Well (feet)	Drawdown Observed (feet)
AT-1 (Step-drawdown test observations at the end of each 1-hour duration step)	0.5	0.05	OB-25	29	0
	10	0.5	OB-25	29	0.1
	15	0.85	OB-25	29	0.18
	29	1.5	OB-25	29	0.32
AT-1 (Final drawdown at end of 72-hour constant rate pumping test)	29	3.25	OB-25	29	1.95
			MW-124	100	1.5
			MW-109D	190	Inflection response only*
			MW-508D	190	Inflection response only*

*Note: No measureable drawdown response was observed in hydrographs for these two wells, however, a downward inflection the hydrograph of each wells was observed late in the constant rate pumping test period.



BUILDINGS
SWAMP
SURFACE WATER
PROPERTY LINE
N

CH2MHILL

FIGURE 6
HNP CAPTURE ZONE FUNCTIONAL AREAS
HADDAM NECK, CT

27feb04_CY Site Map of HNP

Table 3. Capture Zone Dimensions Applied to Functional Areas.

Functional Area	Unconsolidated Formation Capture Zone Radius (feet/meters)	Pumping Rate (gpm)	Bedrock Formation Capture Zone Radius (feet/meters)	Pumping Rate (gpm)	Applicable Assumptions	Uncertainties and Comments
HNP Industrial Area	<30 ft/<10 m	0.5	<200 ft/<62 m	0.5	a. Unconfined aquifer well(s) are completed above the bedrock interface. b. Bedrock wells are cased from surface to bedrock and open hole below. c. The pumping rate is applied on a continuous basis.	a. The unconfined aquifer in the central portion of this area may not sustain this pumping rate over time and may become dewatered. b. The magnitude of observed hydraulic responses in distant bedrock wells may be affected by operation of the containment mat sump.
River Terrace (Parking Lot and Peninsula)	<30 ft/<10 m	0.5	<200 ft/<62 m	0.5	a. Unconfined aquifer well(s) are completed above the bedrock interface. b. Bedrock wells are cased from surface to bedrock and open hole below. c. The pumping rate is applied on a continuous basis.	
Upland Area (Including ISFSI and landfill)	<30 ft/<10 m	0.5	<200 ft/<62 m	0.5	a. Unconfined aquifer well(s) are completed above the bedrock interface. b. Bedrock wells are cased from surface to bedrock and open hole below. c. The pumping rate is applied on a continuous basis.	a. With the exception of the landfill vicinity, most of the upland area exhibits only a very thin veneer of unconsolidated material over bedrock, thus precluding construction of shallow wells in the unconfined aquifer.

Notes:

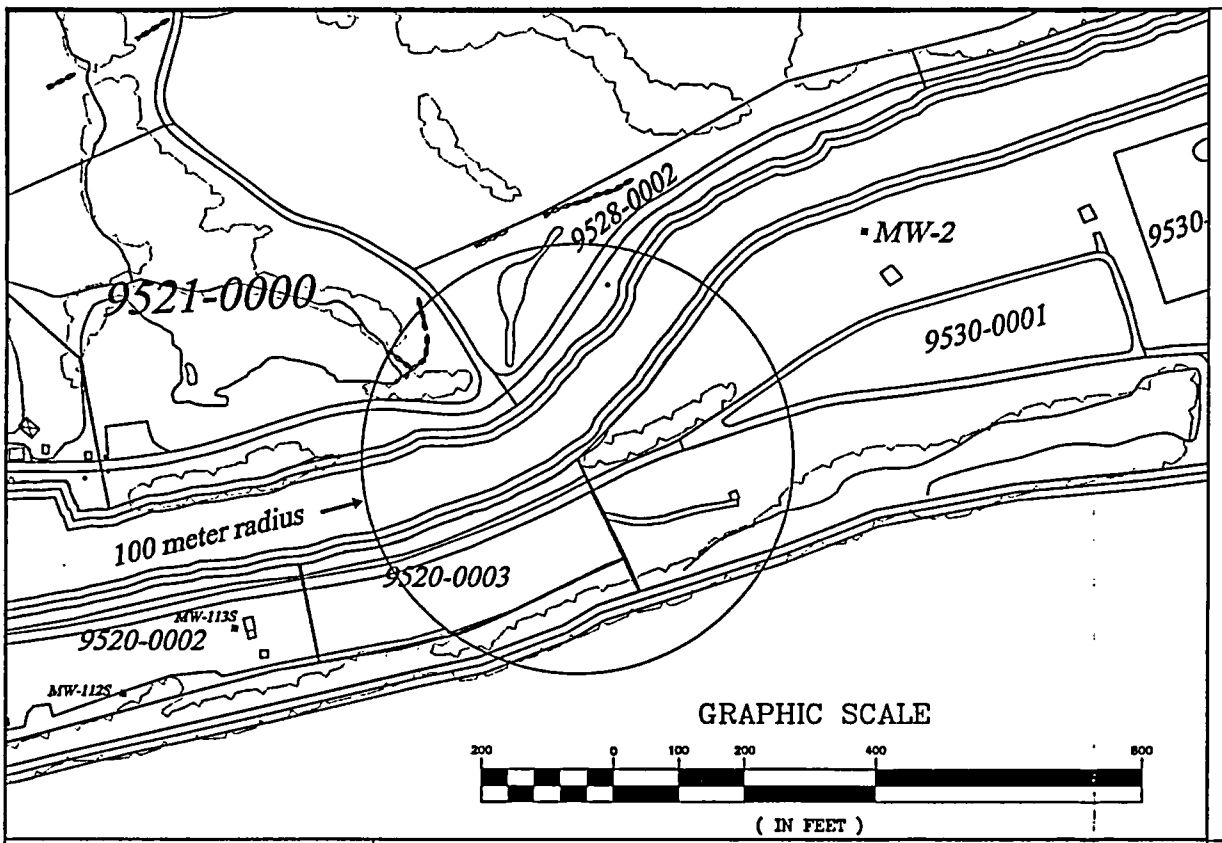
"<" = Less Than

gpm = gallons per minute

Attachment 2

Haddam Neck Plant

Survey Units in the Capture Zone Radius of Survey Area 9520-003



Legend

= Well Location

Notes

Capture Zone Radius is measured from the corner of Survey Area 9520-0003 closest to the Phase II Release Area

Attachment 2	Connecticut Yankee Atomic Power Company Survey Units in the Capture Zone Radius of Survey Area 9520-0003	Date	Rev
		February 2005	0

Attachment 3

Haddam Neck Plant

Connecticut Yankee Haddam Neck Plant Peninsula Groundwater Assessment

Connecticut Yankee Haddam Neck Plant Peninsula Groundwater Assessment

PREPARED FOR: Mr. Terry Peacock, Connecticut Yankee Atomic Power Company

PREPARED BY: Chuck Miller, CH2M HILL

COPIES: Mr. Rich McGrath, CYAPCO

CH2M HILL Project File

DATE: February 8, 2005

1 Introduction

This document is a compilation and interpretation of the information collected to date on the nature and extent of radiological groundwater contamination on the discharge canal peninsula at the Connecticut Yankee Atomic Power Company (CYAPCO) Haddam Neck Plant (HNP) and potential sources for that contamination.

Strontium 90 (Sr-90) has been detected at low concentrations in monitoring well MW-117 during three of the last nine sampling rounds. No specific source of the observed Sr-90 has previously been identified and the detections in MW-117 do not appear to be part of a larger contaminant plume. The purpose of this study is to evaluate the nature and extent of groundwater contamination on the peninsula, including the Sr-90 detected in MW-117, and determine if there is an apparent source. There have been periodic detections of other radionuclides in groundwater samples collected from monitoring wells on the peninsula. With a few exceptions (as discussed in the following sections of this report) historic concentrations of radionuclides detected in groundwater in the peninsula area are very low. The locations of detection of radionuclides are, for the most part, isolated spatially and temporally.

This document summarizes the available groundwater and soil data, and evaluates apparent sources of the radionuclides observed in groundwater. The following conclusions are based on the assessment described in this document:

- The activity concentrations of radionuclides and radioactive indicators (e.g., gross alpha and gross beta activity) detected in groundwater on the upper and lower peninsula do not exceed the most stringent water quality standards selected for assessment of plant closure (i.e., Maximum Contaminant Levels established as drinking water standards).
- Radionuclides detected in groundwater in the upper peninsula (i.e., the "boneyard" area) appear to be related to downgradient migration of plant-related contaminants from historical activities in the central industrial area (i.e., nuclides detected in MW-110S and MW-110D) and local activities in the boneyard (i.e., waste water discharges to the

plant sanitary septic system) that may have historically affected wells MW-111S, MW-112S, and MW-113S.

- Concentrations of plant-related contaminants in groundwater in the upper peninsula wells, particularly in the area of wells MW-110S, MW-110D, and the new bedrock well MW-121A are expected to vary in the near future as the plume of contaminants originating in the central industrial area continues to migrate toward this area.
- Radionuclides detected in groundwater in the lower peninsula area are present at low concentrations and do not appear to represent a "plume" of contamination related to a single source. The most likely sources of the observed radionuclides in groundwater in the lower peninsula are 1) episodic migration of low activity concentration process water historically discharged to the canal and drawn into the peninsula formation by either hydraulic head difference between the canal and the Connecticut River or the hydraulic capture of water by operation of the plant sanitary water supply wells; and 2) leaching of nuclides from low-activity concentration dredge spoils that were historically removed from the discharge canal and placed on the lower peninsula.
- Contaminant concentrations are expected to continue to diminish in the lower peninsula area and detections to become less frequent. No mechanisms have been identified that would cause the concentration of plant-related contaminants in groundwater to increase beyond their present levels in the lower peninsula. The sanitary water supply wells will be removed from service within the next 24 months and all plant-related water discharges to the canal will also be discontinued in the same time frame. The residual radioisotopes present in soil on the lower peninsula are not expected to contribute to either an increase in groundwater concentrations or increased frequency of detection of radionuclides. No additional characterization of groundwater or potential sources in the lower peninsula is indicated based on the results of this assessment.

2 Background

The area that now forms the peninsula was part of the property developed for use as a private airport in the 1940s. The runway ran approximately parallel to the current orientation of the peninsula, extending from the current location of the industrial area to near the position of the dredge spoil coffer-dam area on the peninsula (Figure 1). The CYAPCO nuclear power station was constructed, and the cooling water discharge canal was excavated between 1964 and 1967, separating the peninsula from the mainland. The canal is approximately 5,550 feet long. The elevation of the bottom of the canal is approximately minus six feet mean sea level (msl) (Mactec, June 2004). The peninsula ground level elevation varies from 8 to10 feet msl, with higher elevations near the tip where material appears to have been piled, along the edge adjacent to the canal, at water supply wells TPW-1 and TPW-2, and around the dredge spoil coffer-dam area (Figure 1).

2.1 Peninsula Wells

Numerous groundwater wells are located on the peninsula. These include the following types of wells:

- supply wells providing sanitary and process water to HNP;

- test wells installed as part of a previous water supply exploration; and
- groundwater monitoring wells that are part of the groundwater monitoring system.

The wells on the peninsula are discussed below.

Water Supply Wells

Water supply wells A and B were installed on the peninsula in 1963 (Figure 1) to supply sanitary water and process water for HNP. By 1984, the water supply wells were exhibiting elevated temperature, which dramatically reduced the utility of the water for process cooling functions. The elevated temperature was caused by capture of the heated water from the discharge canal due to the close proximity of the water supply wells to the canal and the high hydraulic conductivity of the aquifer.

An investigation was undertaken to identify alternative water supply well locations (Leggette, Brashears & Graham, Inc., 1985). During the second half of 1984 and early 1985, 15 monitoring wells were installed on the peninsula in a water supply investigation. Following the exploration stage, two additional observation wells and two water supply wells (Wells C and D) were installed on the side of the peninsula nearest the Connecticut River. The replacement wells, however, exhibited elevated total dissolved solids and other water quality issues. The new water supply wells were removed from service and supply wells A and B were returned to service. The discharge canal water pulled into the peninsula by the operation of wells A and B is a potential source of groundwater contamination.

Test Wells

The wells identified as test wells are all located in the lower peninsula area and were installed as part of historical water supply investigations. Some were constructed at the time of initial plant construction, and others were constructed during the 1985 water supply exploration.

Production wells A and B and a test well identified as Well 10-2 were part of the initial sanitary supply investigation. Monitoring wells MW-1 through MW-18, along with production wells TPW-1 and TPW-2 and Test Wells TW-1 through TW-4 were constructed during the 1985 water supply investigation. The "test wells" and monitoring wells MW-1 through MW-18 were inspected and found to be substandard and unacceptable for inclusion in the HNP groundwater monitoring system, although they apparently met the needs of the water supply investigations.

Monitoring wells MW-5, -6, -7, -9, -10, -11, -12, -14, -15, -16, -17, and -18 were located on the most distal end of the peninsula and were abandoned in 2004. The remaining test wells and historical monitoring wells are also not acceptable for use in groundwater quality monitoring and will be abandoned. The four production wells will remain until the end of plant decommissioning.

Groundwater Monitoring Wells

Seven wells on the peninsula are part of the current HNP groundwater quality monitoring system. Monitoring wells MW-110S and -110D, MW-111S, MW-112S, and MW-113S are all located in the upper peninsula area. Well MW-111S was located in the midst of the four

sanitary sand filter structures and was abandoned in 2004 prior to demolition of the filter structures. Wells MW-112S and -113S are located adjacent to the sanitary leaching field. Wells MW-110S, and -110D are part of the industrial area monitoring system. Shallow bedrock monitoring well MW-110D has historically exhibited plant-related contamination that is attributed to downgradient migration of contaminants from the central HNP industrial area. MW-110D is not included in this assessment.

Two deep bedrock boreholes (BH-121 and BH-121A) are also located on the upper peninsula. Borehole 121A has been configured with a multi-level sampling device, however, the system is not yet in service and no historical monitoring data are available. Borehole 121 is not part of the monitoring system. The bedrock boreholes are not included in this assessment.

One well, MW-117, is located in the lower peninsula area, approximately midway along the length of the peninsula and approximately midway across the width.

2.2 Historic Land Use Activities

The peninsula area of HNP is divided into the following two general areas of historical activities:

- The *upper peninsula*, which extends approximately 1,300 feet from the industrial area south gate (relative to plant north). This area was used as a lay-down area for various materials during and after plant construction. The upper peninsula is also the site of the plant sewerage disposal facility, which includes septic tanks and lift stations, a series of four sand filters, and a septic leaching field. This area is commonly referred to as the "bone yard" and is currently used for staging of empty and filled waste containers. The following final status survey units comprise the upper peninsula: 9518-00, 9520-01, 9520-02, and 9520-03.

- The *lower peninsula* incorporates the remainder of the peninsula and includes the location of the four sanitary water production wells, the numerous test wells associated with historical water supply explorations, and dredge spoil deposit areas. Construction debris of uncertain origin has also been deposited on the ground surface in some areas of the lower peninsula. Soil and sediment excavated during original construction of the HNP discharge canal were placed on the peninsula. In 1979, 1500 cubic yards (yd^3) of spoil was dredged from the discharge canal and 29,000 yd^3 of dredge material was removed from in front of the intake structure. Both spoils were allowed to settle out in the coffer-dam area on the peninsula (Figure 1). In 1984, the area on the river side of the intake structure was again dredged, and the material placed on the peninsula near the meteorological station. In 1987, additional sandy material was dredged from the canal and placed in the coffer-dam structure. At about the same time, some of the dredge material was removed from inside the coffer-dam settling area and placed on the outside edge of the structure widening the eastern coffer-dam of the settling basin (FSS, historical records). These dredged materials appear to extend across the location of monitoring well MW-117S. The dredged materials on the peninsula are potential sources for groundwater contamination. Over the operating life of the plant, additional construction debris was placed at various locations on the peninsula. On the north side of the peninsula, and adjacent to the canal, is a large wetland area that has been flooded

by the canal during some high tides while the plant was still operating. Characterization of this wetland is discussed in Section 5. Sediment from the discharge canal washed into this wetland area, and the soils underneath are potential sources of groundwater contamination. The following final status survey units comprise the lower peninsula area: 9530-01, 9530-02, 9530-03, 9530-04, 9530-05, and 9531-00.

3 Geology and Hydrogeology of the Peninsula

A hydrogeologic cross-section constructed across the lower peninsula area shows a heterogeneous sequence of clastic materials (fine-grained sand, silt, and clay) that do not correlate with the fluvial and glacial deposits defined in the industrial area (Figures 2 and 3). These materials are present near the confluence of the Salmon River and the Connecticut River and thicken away from the site. The unconsolidated deposits likely represent deltaic deposits associated with the Salmon River. Previously constructed cross-sections through the peninsula identify similar deposits (CH2M HILL, April 2004).

Peninsula monitoring wells are constructed in the unconsolidated deposits overlying bedrock. The bedrock surface of the peninsula generally dips to the southeast. Pre-construction borings in the vicinity of MW-4 encountered bedrock at 68 feet below mean sea level (bmsl). Closer to the river, at TW-2, bedrock was encountered at 96 feet bmsl, but was not encountered in TW-1 as deep as 124 feet bmsl.

Groundwater elevations in the shallow unconsolidated deposits on the peninsula are tidally influenced, generally a few feet above mean sea level (msl) at high tide, and less than 1 foot msl at low tide. Transmissivities in formations in which TPW-1 and TPW-2 are screened have been measured at 25,000 to 57,000 gallons per day per foot (Leggette, Brashears & Graham, 1985). Water supply wells A and B are screened in sand and gravel deposits which are highly transmissive and hydraulically connected to the discharge canal. As a result, during plant operations, both of these water supply wells exhibited elevated temperature due to thermal contamination from capture of plant discharge water in the canal. This suggests that discharge water from the canal was moving into the aquifer formation of the peninsula, and with sufficient head differences in the canal and groundwater in the peninsula, may have been migrating through the peninsula in other locations as well.

4 Groundwater Analytical Data

The results of groundwater sampling and analysis have been generated and documented under the HNP groundwater monitoring program. Historical published quarterly groundwater monitoring results at HNP from 1992 through 2004 were evaluated to determine the current conditions in both areas of the peninsula (i.e., upper and lower peninsula). Most reported detections of radionuclides in groundwater in peninsula area wells are very low, only slightly exceeding the reported minimum detectable concentrations (MDC). The methodology for evaluating the groundwater analytical data is described below.

4.1 Groundwater Assessment Methodology

For the purposes of this assessment, a detectable concentration of a constituent of interest in groundwater is defined as a measured concentration exceeding the MDC for the analyte in the individual sample. This definition of detected constituents is consistent with the HNP License Termination Plan and is appropriate due to the MDCs being established at a relatively small fraction of the applicable MCL or MCL equivalent concentrations for constituents of interest. The average of the actual laboratory-reported MDCs for individual beta- and photon-emitting radionuclides are compared to the nuclide MCL equivalent concentrations in Table 4-1. The average MDCs for selected non-specific radioactivity measurements (i.e., gross alpha and gross beta) and mass-based total uranium measurements are compared to the applicable MCLs in Table 4-2.

Table 4-1. Comparison of Required MDCs to MCL Equivalent Concentrations for HNP Beta- and Photon-Emitting Radionulicdes of Interest Subject to Dose-Based MCL.

Radionulicde	MCL Equivalent Concentration (pCi/L)	Average Actual Analyitcal MDC[1] (pCi/L)	Average Actual MDC as a Fraction of the MCL Equivalent Concentration
Tritium	20,000	275	0.01
Carbon-14	2,000	7.8	0.004
Manganese-54	300	4.1	0.001
Iron-55	2,000	8.3	0.004
Cobalt-60	100	3.8	0.04
Nickel-63	50	3.5	0.07
Strontium-90	8	0.87	0.11
Technetium-99	900	11.3	0.01
Cesium-134	80	3.7	0.05
Cesium-137	200	2.5	0.01
Europium-152	200	9.8	0.05
Europium-154	60	12	0.2
Europium-155	600	10.6	0.02
Plutonium-241	300	7.0	0.02

[1] – Average of the actual MDCs for samples in the peninsula groundwater analysis data set.

As shown in Table 4-1, the average analytical MDCs for the beta- and photon-emitting nuclides in the peninsula groundwater data set are generally less than 5 percent of the MCL equivalent concentration, with the exception of Nickel-63 (7%), Strontium-90 (11%) and Europium-155 (20%). This indicates that excluding nuclide concentrations that do not exceed the MCL does not substantially affect the cumulative MCL estimate for these

nuclides. The one exception is Europium-154, for which the MDC is a larger fraction of the MCL equivalent concentration (i.e., 20 percent). This nuclide, however, is infrequently detected at HNP and has never been detected in groundwater samples collected from the peninsula area.

Table 4-2. Comparison of Average MDCs to MCL Concentrations for Selected Non-Dose Based and Mass-Based MCLs.

Measurement	MCL Concentration	Average Actual Analytical MDC[1]	Average Actual MDC as a Fraction of the MCL Concentration
Gross Alpha	15 pCi/L	1.3 pCi/L	0.09
Gross Beta	50 pCi/L	2.6 pCi/L	0.05
Total Uranium	30 ug/L	0.01 ug/L	0.0003

[1] – Average of the actual MDCs for samples in the peninsula groundwater analysis data set.

The historical data set used in this analysis is presented in Appendix A. The observed concentrations of the detected radionuclides were compared to the maximum contaminant level (MCL) promulgated under the Federal Safe Drinking Water Act and subsequently implemented by the State of Connecticut as the state's drinking water standards. Two types of MCLs are applicable to the radioactive constituents detected in HNP groundwater; a dose-based MCL applies to beta- and photon-emitting radionuclides and individual numerical limits apply to gross alpha and gross beta measurements as well as total uranium.

The comparison to the dose-based MCLs for the individual beta- and photon-emitting nuclides was performed by dividing the observed concentration of regulated nuclides in each groundwater sample by the equivalent concentration for each nuclide (i.e., the nuclide activity concentration that would result in exceeding the MCL if only that nuclide were present) and summing the individual fractions for each nuclide present in a sample. This "sum of fractions" was compared to a limit of 1.0, or unity, to determine whether or not the MCL was exceeded

For the gross alpha and gross beta measurements, the measured concentrations were divided by the MCLs of 15 pCi/L and 50 pCi/L, respectively. The observed total uranium concentrations were divided by the total uranium MCL of 30 ug/L. In all three cases, the results were reported as a fraction of the MCL.

4.2 Groundwater Assessment Results

The historical record of groundwater monitoring on the peninsula for 2003 through June 2004 contains a total of 78 detections of specific radionuclides and/or non-specific measurements (i.e., gross beta and gross alpha) in groundwater samples from the upper and lower peninsula areas. No radionuclide concentrations on the peninsula exceed MCLs. The data set used for the assessment presented in the technical memorandum has not been evaluated for the presence of positive bias in the laboratory analysis. As a result, some of the detections discussed herein may be identified as "false positives". Analysis of beta-

emitting radionuclides (e.g., strontium-90, plutonium-241) by liquid scintillation counting is particularly sensitive to positive bias.

Upper Peninsula ("boneyard") Assessment

Sampling and analysis data were assessed for the following monitoring wells located in the upper peninsula or "boneyard" area:

- MW-110S
- MW-111 (well abandoned in 2004)
- MW-112
- MW-113

The radioactive constituents detected in groundwater samples from the upper peninsula wells are summarized and compared to MCLs in Tables 4-3 and 4-3 for beta/photon emitters and for other regulated radioactive constituents, respectively. The assessment indicates that radioactive constituents, including constituents attributed to plant-related sources have been detected in groundwater in the upper peninsula area. Previous assessment of groundwater in the upper peninsula indicates that contaminants observed in wells MW-110S and MW-111 are most likely part of a groundwater contaminant plume extending from the HNP central industrial area downgradient toward the Connecticut River. Historical operation of the sanitary septic system and septic sand filters in the upper peninsula may have also contributed to conditions observed in MW-111. Wells MW-112 and MW-113 are likely impacted by historical waste water discharges to the existing sanitary waste leach field adjacent to the wells.

Table 4-3. Summary of Regulated Beta- and Photon-Emitting Radionuclides Detected in Upper Peninsula Monitoring Wells.

Well	Beta/Photon-Emitting Nuclides Detected	Activity Concentration Range (pCi/L)	Maximum MCL Sum-of-Fractions for Observed Detections[1]
MW-110S	Tritium	1,010 to 3,270 pCi/L (twelve detections)	0.17
	Plutonium-241	6.9 to 13.2 pCi/L (two detections)	
MW-111	Nickel-63	4.14 pCi/L (single detection)	0.08
MW-112	Strontium-90	5.49 pCi/L (single detection)	0.69
MW-113	Strontium-90	0.58 to 0.84 pCi/L (two detections)	0.10

[1] – If the sum-of-fractions is equal to, or greater than, 1.0, then the MCL is exceeded.

Table 4-4. Summary of Other Regulated Radioactive Constituents Detected in Upper Peninsula Monitoring Wells.

Well	Radioactive Constituents Detected	Activity Concentration Range (pCi/L)	MCL Fraction at Maximum Concentration[1]
MW-110S	Gross Alpha	Not Detected	Not Detected
	Gross Beta	1.88 to 7.47 pCi/L (twelve detections)	0.15
	Total Uranium	0.012 ug/L (one detection)	Less than 0.01
MW-111S	Gross Alpha	0.68 to 1.0 pCi/L (three detections)	0.07
	Gross Beta	3.24 to 7.39 pCi/L (nine detections)	0.15
	Total Uranium	0.04 ug/L (one detection)	Less than 0.01
MW-112S	Gross Alpha	Not Detected	Not Detected
	Gross Beta	2.62 to 3.61 pCi/L (two detections)	0.07
	Total Uranium	0.016 ug/L (single detection)	Less than 0.01
MW-113S	Gross Alpha	1.82 to 2.95 pCi/L (two detections)	0.20
	Gross Beta	8.3 to 31.4 pCi/L (nine detections)	0.63
	Total Uranium	0.072 ug/L (one detection)	Less than 0.01

[1] – If MCL fraction is equal to, or greater than, 1.0, then the MCL is exceeded.

Lower Peninsula Area Assessment

Historical groundwater sampling and analysis has been conducted for the following wells in the lower peninsula area:

- MW-1
- MW-2
- MW-3
- MW-13
- Supply Well B
- TW-1
- MW-117S

The radioactive constituents detected in groundwater samples for the lower peninsula wells are summarized and compared to MCLs in Tables 4-5 and 4-6 for beta/photon emitters and for other regulated radioactive constituents, respectively. The assessment indicates that radioactive constituents, including constituents attributed to plant-related sources have been detected in groundwater in the lower peninsula area, but the observed concentrations do not appear to represent an organized contaminant plume and do not exceed drinking water standards. The observed groundwater gradient and flow direction in the vicinity of the HNP central industrial area does not support migration of groundwater from the industrial area to the lower peninsula.

The operational history of the lower peninsula presents some possible sources for the groundwater contamination observed. These potential sources are:

- Episodic migration of low activity-concentration process water historically discharged to the canal and drawn into the peninsula formation by either hydraulic head difference between the canal and the Connecticut River or the hydraulic capture of water by operation of the plant sanitary water supply wells
- Leaching of nuclides from low-activity concentration dredge spoils that were historically removed from the discharge canal and placed on the lower peninsula.

Migration of water from the discharge canal and capture of water by the water supply wells appears to be the most likely source of groundwater contamination observed in the lower peninsula. Historic discharges contained variable concentrations of radioactive constituents and discharge water would be expected to readily migrate into the peninsula. The sanitary water supply wells were completed in a coarse, gravelly, formation in hydraulic connection with the canal and operated at substantial pumping rates. Direct capture of canal water was previously documented by the development of a thermal plume that reduced the utility of the supply wells for supplementary cooling water.

The potential for contaminants leaching from dredge spoils to impact groundwater in the lower peninsula is discussed in Section 5 of this document.

Table 4-5. Summary of Regulated Beta- and Photon-Emitting Radionuclides Detected in Lower Peninsula Monitoring Wells.

Well	Beta/Photon-Emitting Nuclides Detected	Activity Concentration Range (pCi/L)	Maximum MCL Sum-of-Fractions for Observed Detections[1]
MW-1	None Detected	None Detected	None Detected
MW-2	Tritium	439 pCi/L (single detection)	0.04
	Plutonium-241	11.2 pCi/L (single detection)	
MW-3	None Detected	None Detected	None Detected
MW-13	None Detected	None Detected	None Detected
Supply Well B	Strontium-90	1.02 pCi/L (single detection)	0.13
TW-1	None Detected	None Detected	None Detected
MW-117S	Strontium-90	0.76 to 1.42 pCi/L (three detections)	0.18

[1] – If the sum-of-fractions is equal to, or greater than, 1.0, then the MCL is exceeded.

Table 4-6. Summary of Other Regulated Radioactive Constituents Detected in Lower Peninsula Monitoring Wells.

Well	Radioactive Constituents Detected	Activity Concentration Range (pCi/L)	MCL Fraction at Maximum Concentration[1]
MW-1	Gross Alpha	Not Detected	Not Detected
	Gross Beta	Not Detected	Not Detected
	Total Uranium	Not Analyzed	Not Analyzed
MW-2	Gross Alpha	Not Detected	Not Detected
	Gross Beta	2.75 to 4.43 pCi/L (three detections)	0.09
	Total Uranium	Not Analyzed	Not Analyzed
MW-3	Gross Alpha	Not Detected	Not Applicable
	Gross Beta	Not Detected	Not Detected
	Total Uranium	Not Analyzed	Not Analyzed
Mw-13	None Detected	None Detected	None Detected
Supply Well B	None Detected	None Detected	None Detected
TW-1	None Detected	None Detected	None Detected
MW-117S	Gross Alpha	1.59 to 3.8 pCi/L (two detections)	0.25
	Gross Beta	5.41 to 11.66 pCi/L (nine detections)	0.23
	Total Uranium	Not Detected	Not Detected

[1] – If MCL fraction is equal to, or greater than, 1.0, then the MCL is exceeded.

5 Soil and Sediment Analytical Data

Soil and sediment analytical data generated during characterization of the lower peninsula were evaluated to assess the potential for soil and historically-deposited dredge spoils to act as sources of groundwater contamination. The methodology applied in the assessment and the results are presented in the following subsections.

5.1 Soil Assessment Methodology

As part of site characterization and final status survey activities, soil samples have been collected at a number of locations on the peninsula, and sediment samples in the discharge canal. Sediment samples were collected at 77 locations in the discharge canal and analyzed for Sr-90 (a beta emitter), and gamma spectroscopy. Soil sampling locations on the peninsula are segregated into 5 final status survey units (Figure 4). FSS unit 9530-01 is a roughly triangular-shaped area bounded by roads in the western portion of the peninsula. FSS unit 9530-02 is the western half of the dredge spoil coffer dam area. FSS unit 9530-03 is the eastern half of the dredge spoil coffer dam area. FSS unit 9530-04 is the remainder of the middle portion of the peninsula with the exception of units 01, 02, 03, and 05. Area 5 is a 600 foot diameter partial circle on the canal edge of the large wetlands area in the northern central area of the peninsula. The southernmost portion of the lower peninsula is included in FSS unit 9531-00.

To evaluate residual soil and dredge spoils on the peninsula as potential sources of groundwater contamination, it is necessary to quantify the potential for leaching of contaminants from the contaminated soil. For this assessment, an approach was developed that uses distribution coefficients (K_ds) generated by Brookhaven National Laboratory (BNL) to support design of backfill material for HNP closure activities. Specimens of local fill soil were collected from a commercial sand pit near the HNP and sent to BNL for determination of the K_ds for selected nuclides. This material consists of locally-mined, well-graded, alluvial sand, also known as "bank run" sand. The material was tested to determine its capacity to sorb four nuclides of interest at HNP:

- Cobalt-60;
- Cesium-137;
- Strontium-90; and
- Iron-55.

The data generated from the backfill study was selected for use in this assessment because it was based on testing of soil from a similar depositional environment to that of the peninsula. The soil samples collected for the BNL K_d study are assumed to be sufficiently representative of the soil in the peninsula to allow approximation of the K_ds of the peninsula soil. The distribution coefficients observed for the test soil (Brookhaven National Laboratory, 2004) were then applied to the soil samples collected from the HNP peninsula area to estimate the potential equilibrium water concentration resulting from contact of water with the soil.

Distribution coefficients were determined for two soils (one slightly more coarse than the other) and for a mixture of the two soil types. This resulted in a high, low, and medium K_d for the selected nuclides. The distribution coefficient of a constituent of interest is defined as the concentration of the constituent sorbed onto the soil matrix divided by the concentration of the constituent remaining in solution at equilibrium conditions as described in the following equation:

$$K_d = \frac{C_{soil}}{C_{soln}}$$

Where: K_d = the distribution coefficient
C_{soil} = the equilibrium concentration of the constituent of interest on soil
C_{soln} = the equilibrium concentration of the constituent of interest in solution.

For this assessment, an arbitrary soil screening concentration was developed using the K_ds for selected nuclides generated by the BNL study and using the MCL equivalent concentration for the selected nuclides as the equilibrium solution concentration and solving the distribution coefficient equation for the equilibrium soil concentration. The equilibrium soil concentration was then used as a screening concentration to determine if the observed soil concentrations could result in equilibrium groundwater concentration that would meet the MCL. The soil screening concentration was determined as follows:

$$C_{screen} = K_d \times C_{MCL} \times 0.001$$

Where: K_d = the distribution coefficient in units of mL/g
C_{screen} = the soil screening concentration of the nuclide of interest in soil in units of pCi/g
C_{MCL} = the MCL equivalent concentration of the nuclide of interest in water in units of pCi/L

The analytical results for soil samples collected from the peninsula were then compared to the soil screening concentrations to evaluate the potential for the existing soil to cause exceedence of the MCL in groundwater. The following simplifying assumptions are applied to the analysis:

- The distribution coefficients developed for the backfill material are representative of the soil in the peninsula.
- The contaminated soil would actually reach an equilibrium condition with water in a saturated state.

The soil screening concentrations derived from this exercise are shown in Table 5-1. The measured radionuclide concentrations in soil samples from the peninsula were subsequently compared to the soil screening concentrations to estimate whether or not the observed soil could be expected to cause exceedence of the MCL. As previously described

for the groundwater analytical results, soil analyses were assumed to be detections if the reported result exceeds the reported laboratory MDC for the sample.

Table 5-1. Soil Screening Concentrations for Peninsula Groundwater Assessment.

Radionuclide	K_d Value[1] Soil A (mL/g)	K_d Value[1] Soil B (mL/g)	K_d Value[1] Mixed Soil (mL/g)	Radionuclide MCL Equivalent Concentration[2] (pCi/L)	Estimated Soil Screening Concentration -High (pCi/g)	Estimated Soil Screening Concentration -Low (pCi/g)
Cobalt-60	2	220	22	100	22	0.2
Cesium-137	23	149	45	200	29.8	4.6
Strontium-90	15	10	44	8	0.35	0.08
Iron-55	160	1200	1200	2000	2400	320

[1] – K_d Values determined experimentally by Brookhaven National Laboratory on local vendor bank-run sand.

[2] – MCL Equivalent Concentration is the concentration of a single nuclide which, if present in water, would meet the MCL.

The comparison of observed soil concentrations to the calculated soil screening concentrations provides a basis for evaluating the potential for residual soil to cause groundwater to exceed the MCL. A second calculation was also performed to estimate the equilibrium groundwater concentration using the measured soil nuclide concentrations and the distribution coefficients established in the BNL backfill study using the following equation:

$$C_{GW} = \frac{C_{soil}}{K_d} \times 1000$$

Where: K_d = the distribution coefficient of the nuclide of interest in units of mL/g

C_{soil} = the measured concentration of the nuclide of interest in soil in units of pCi/g

C_{GW} = the estimated equilibrium concentration of the nuclide of interest in water in units of pCi/L

The results of the estimated groundwater concentration calculation were then compared to the actual measured groundwater concentrations.

5.2 Soil Assessment Results

Soil analytical results for the four nuclides for which K_ds were established (i.e., Co-60, Cs-137, Sr-90, and Fe-55) were evaluated and compared to the soil screening concentrations. The soil analytical data used in this assessment are presented in Appendix A of this

technical memorandum. The results of the assessment of soil concentrations in the individual FSS units of the peninsula, as well as discharge canal sediments, are discussed below and are summarized in Table 5-2.

Table 5-2. Comparison of Summary Peninsula Final Status Survey Unit Soil Concentrations to Calculated Soil Screening Concentrations.

Radionuclide	Unit 9530-01 Maximum Detected Soil Concentration Exceeds Soil Screening Concentration?	Unit 9530-02 Maximum Detected Soil Concentration Exceeds Soil Screening Concentration?	Unit 9530-03 Maximum Detected Soil Concentration Exceeds Soil Screening Concentration?	Unit 9530-04 Maximum Detected Soil Concentration Exceeds Soil Screening Concentration?	Unit 9530-05 Maximum Detected Soil Concentration Exceeds Soil Screening Concentration?	Unit 9610 Maximum Detected Sediment Concentration Exceeds Soil Screening Concentration?
Cobalt-60	Low – No High – No	Low – No High – No	Low – No High – No	Low – No High – No	Low[2] – Yes High – No	Low[2] – Yes High – No
Strontium-90	Low – No High – No	Low – No High – No	Low – No High – No	Low – No High – No	Low[2] – Yes High – No	Low[2] – Yes High – No
Iron-55	Low – No High – No	Low – No High – No	Low – No High – No	Low – No High – No	Low[2] – No High – No	Low[2] – No High – No
Cesium-137	Low – No High – No	Low – No High – No	Low – No High – No	Low – No High – No	Low[2] – No High – No	Low[2] – Yes High – No

[1] "High K_d" and "Low K_d" soil screening concentrations for these four nuclides are defined in Table 5-1.

[2] The "Low K_d" soil screening concentration is not expected to be representative of the fine-textured canal sediments or organic wetland soils.

In summary, the observed soil and sediment concentrations of nuclides detected in soil samples collected from the lower peninsula could account for the low concentrations of strontium-90 historically detected in wells on the peninsula. The soil and sediment concentrations, in-turn, are relatively low and would not be expected to cause groundwater concentrations to exceed the MCLs for the nuclides evaluated. The distribution coefficients derived for fill soil at HNP appear to be reasonably representative of most of the soil material on the peninsula. The following exceptions were identified for application of the distribution coefficients:

- The fine-textured bottom sediments of the discharge canal, which are expected to exhibit substantially higher distribution coefficient than the sandy fill material; and

- The finer-textured and higher organic-content wetland soil in Unit 9530-05, also expected to exhibit substantially higher distribution coefficient that the sandy fill material tested.

In both cases where the distribution coefficients may not be fully representative of the samples evaluated, use of the distribution coefficients established for this assessment is conservative and in no instance was the high K_d soil screening concentration exceeded

Survey Unit 9106 – Discharge Canal Sediment Assessment

Ten radionuclides were detected in sediment samples from the canal. The nuclides detected are described in detail in Appendix A, Table A-3 and A-4. Cobalt-60, cesium-137, and stontium-90 are widely distributed in the canal bottom. Cobalt-60 was detected in 71 samples, cesium-137 was detected in 64 samples and strontium-90 was detected in 43 samples. The soil screening concentrations derived from the distribution coefficient study were conservatively applied to the canal sediments. The maximum observed concentrations of cobalt-60, strontium-90, and cesium-137 exceeded the low K_d screening concentration, but not the high-K_d screening concentration. The K_ds for nuclides of interest in the fine-grained canal bottom sediments are expected to be substantially higher than those of the sandy backfill soil samples. With the higher Kds associated with fine grained sediments, the in-situ canal sediments are not believed to be a current source of groundwater contamination to the peninsula. Historically-dredged discharge canal sediments mixed with sand could be a possible source for Sr-90 detections in groundwater samples on the peninsula, depending on the concentration and K_d of the final mixture.

Survey Unit 9530-01 Soil Assessment

Radionuclides detected in soil samples collected in Survey Unit 9530-01 are detailed in Appendix A, Table A-5. Four nuclides were detected in samples collected from Unit 9530-01; cesium-137 was detected in 26 samples, cesium-134 in 1 sample, carbon-14 in 1 sample and technetium-99 in one sample. The observed soil nuclide concentrations in this unit do not exceed the soil screening concentrations based on the lowest K_ds of the nuclides for which the screening concentrations were established (i.e., Cs-137 and Cs-134 – assumed to behave like Cs-137). Estimated equilibrium groundwater concentrations of those nuclides calculated using the backfill K_d and Unit 1 soil samples are consistent with nuclide

detections in groundwater. Soil in Unit 9530-01 is not expected to contribute to future elevation of radionuclide concentrations in groundwater.

Survey Unit 9530-02 Soil Assessment

Radionuclides detected in soil samples collected in Survey Unit 9530-02 are detailed in Appendix A, Table A-6. Only two nuclides were detected in samples from this unit; cesium-137 in 16 samples and carbon-14 in one sample. The observed soil nuclide concentrations in this unit do not exceed the soil screening concentrations based on the lowest K_ds of the nuclide for which the screening concentrations were established (i.e., Cs-137). Estimated equilibrium groundwater concentrations of those nuclides calculated using the backfill K_d and Unit 2 soil samples are consistent with nuclide detections in groundwater. Soil in Unit 9530-02 is not expected to contribute to future elevation of radionuclide concentrations in groundwater.

Survey Unit 9530-03 Soil Assessment

Radionuclides detected in soil samples collected in Survey Unit 9530-03 are detailed in Appendix A, Table A-7. Five nuclides were detected in soil samples from this unit; cesium-137 in 16 samples, strontium-90 in 1 sample, manganese-54 in 1 sample, carbon-14 in 1 sample, and iron-55 in two samples. The observed soil nuclide concentrations in this unit do not exceed the soil screening concentrations based on the lowest K_ds of the nuclides for which the screening concentrations were established (i.e., Cs-137, Sr-90, and Fe-55). Estimated equilibrium groundwater concentrations of those nuclides calculated using the backfill K_d and Unit 3 soil samples are consistent with nuclide detections in groundwater. Soil in Unit 9530-03 is not expected to contribute to future elevation of radionuclide concentrations in groundwater.

Survey Unit 9530-04 Soil Assessment

Radionuclides detected in soil samples collected in Survey Unit 9530-04 are detailed in Appendix A, Table A-8. Four nuclides were detected in soil samples from this unit; cesium-137 in 23 samples, plutonium-239 in 1 sample, strontium-90 in 1 sample, and carbon-14 in 1 sample. The observed soil nuclide concentrations in this unit do not exceed the soil screening concentrations based on the lowest K_ds of the nuclides for which the screening concentrations were established (i.e., Cs-137 and Sr-90). Estimated equilibrium groundwater concentrations of those nuclides calculated using the backfill K_d and Unit 4 soil samples are consistent with nuclide detections in groundwater. Soil in Unit 9530-04 is not expected to contribute to future elevation of radionuclide concentrations in groundwater.

Survey Unit 9530-05 Soil Assessment

Radionuclides detected in soil samples collected in Survey Unit 9530-05 are detailed in Appendix A, Table A-9. Five nuclides were detected in soil samples from this unit; cesium-137 in 14 samples, cobalt-60 in 11 samples, strontium-90 in 3 samples, technetium-99 in 1 sample, and carbon-14 in 1 sample. The observed soil cobalt-60 concentrations in 7 samples from this unit exceed the soil screening concentration based on the lowest K_d of the nuclide, although the actual magnitude of exceedence is small. The observed soil strontium-90 concentration in 1 sample equaled, but did not exceed the soil screening concentration based on the lowest K_d of the nuclide. None of the observed soil nuclide concentrations in this unit exceed the soil screening concentration based on the highest K_ds of nuclides for which the screening concentrations were established (i.e., Cs-137, Sr-90, and Co-60). Unit 5

includes a relatively large area of wetland that exhibits substantial plant growth. This area is subject to inundation by water from the discharge canal during high tide. The soil in this unit is expected to contain a larger content of natural organic matter than the neighboring areas of the peninsula and may, therefore, be expected to exhibit substantially-higher distribution coefficients for nuclides of interest than the sandy fill soil used to develop the K_ds. Estimated equilibrium groundwater concentrations of those nuclides calculated using the backfill K_d and Unit 5 soil samples are consistent with nuclide detections in groundwater. Soil in Unit 9530-05 is not expected to contribute to future elevation of radionuclide concentrations in groundwater.

Survey Unit 9531-00 Soil Assessment

Survey Unit 9531-00, which encompasses the southern-most portion of the lower peninsula was evaluated during final status survey and determined to be un-impacted by plant operations. No additional characterization (e.g., soil sampling and analysis) has been performed in this survey unit and no contamination sources have been identified. No potential contribution to observed groundwater contamination in the lower peninsula is attributed to Survey Unit 9531-00.

6 Conclusions and Recommendations

The intermittent historical detection of Sr-90 in groundwater from well MW-117S and other locations in the lower peninsula area of HNP is consistent with low-level contamination resulting from either historical migration of water from the discharge canal into the aquifer underlying the peninsula, or leaching of very low levels of radionuclides from dredge spoils historically placed on the peninsula surface. Well MW-117S should be kept as part of the HNP groundwater monitoring system and sampled during regularly-scheduled sampling events. Groundwater contaminant concentrations in the lower peninsula are expected to decrease and detection of radionuclides in groundwater to become less frequent.

Radionuclides detected in wells located in the upper peninsula (i.e., the "boneyard") area are consistent with identified sources in the boneyard (i.e., the sanitary sewage system/leach field) and with migration of contaminants from the central industrial area of the plant. Groundwater contaminant concentrations in the upper peninsula wells are expected to continue to vary as plant decommissioning activities continue in that area and as identified plant-related contaminant plumes continue to migrate in the direction of the upper peninsula. The upper peninsula groundwater should be addressed in concert with the remainder of the industrial area.

7 References

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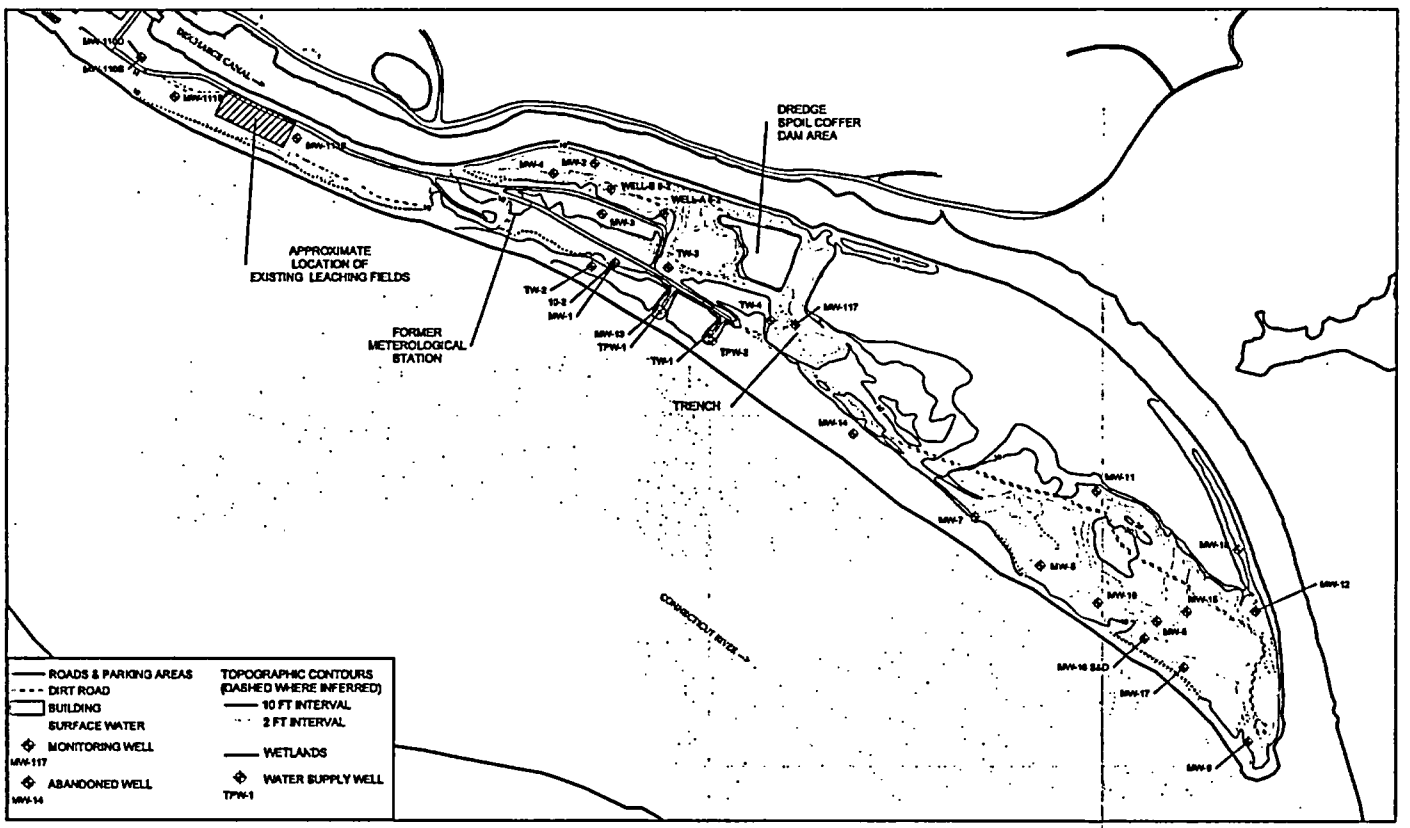

N

0 200 400 Feet

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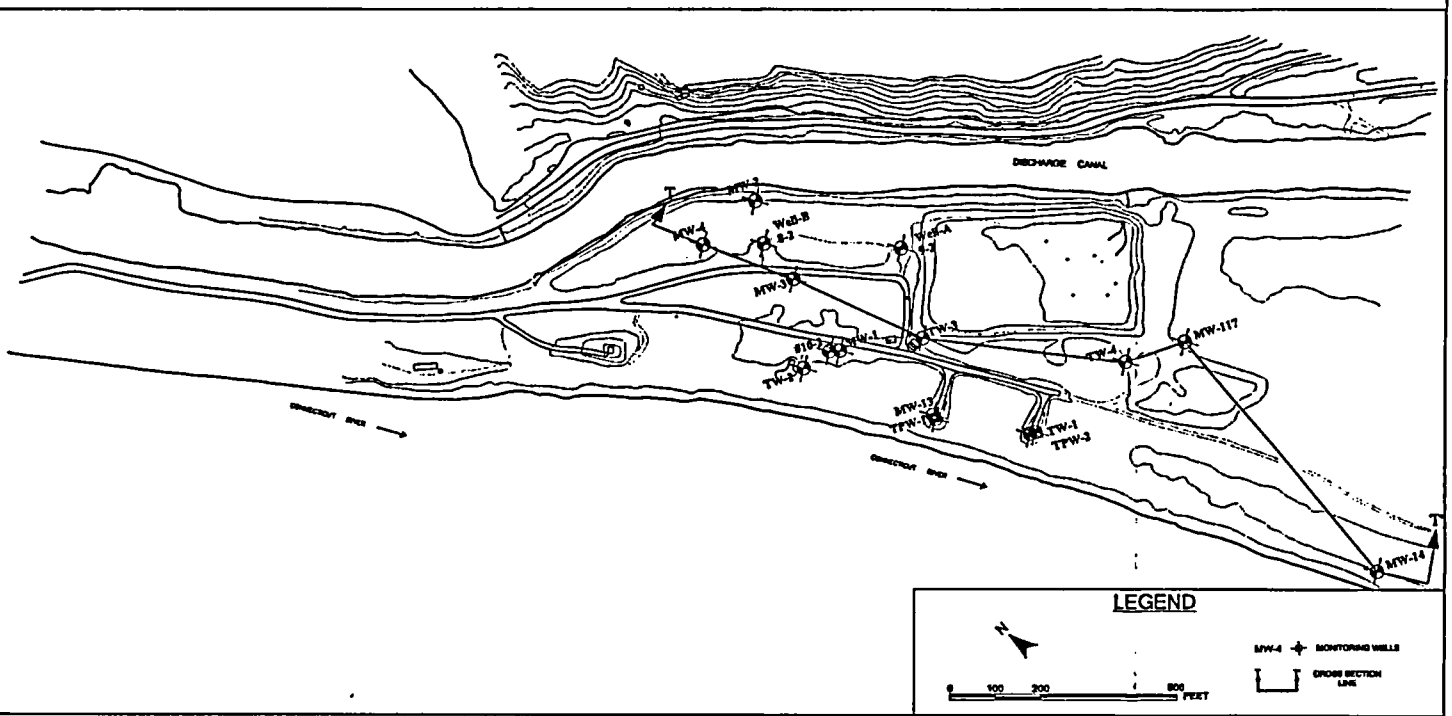
FIGURE 1
PENINSULA AREA, HADDAM NECK PLANT
HADDAM NECK, CT



NOTES: (1) CROSS SECTIONS COMPILED FROM BORINGS COMPLETED DURING SEVERAL SITE INVESTIGATIONS (1983, 1996, AND 2003)

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FIGURE 2
GEOLOGIC CROSS SECTION ORIENTATION
PENINSULA AREA
CONNECTICUT YANKEE HNP
HADDAM NECK, CT

D:\jen04_Peninsula area XS orientations created by CH2M HILL.jpw

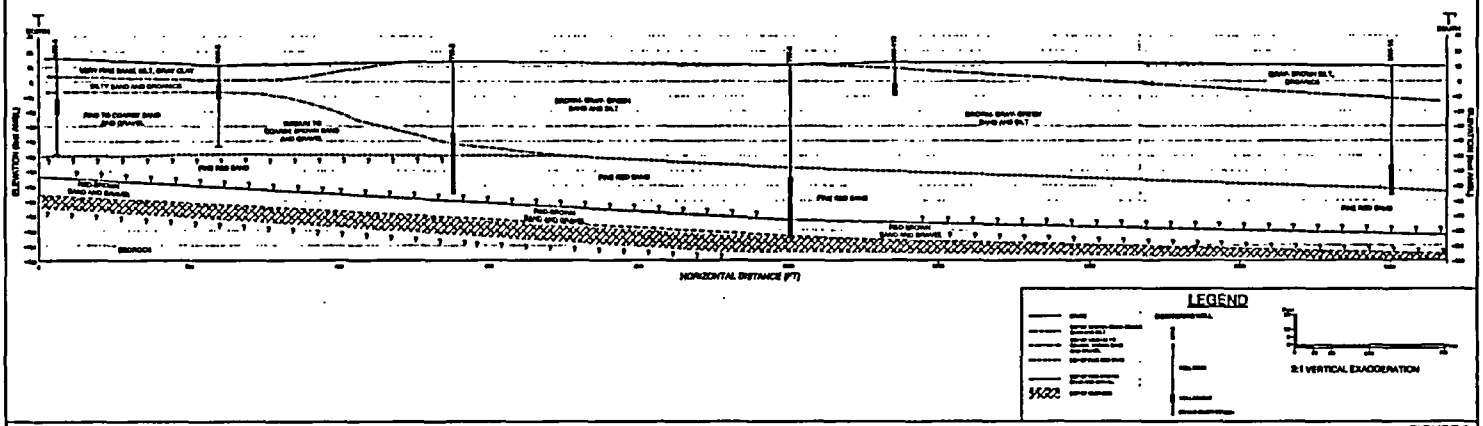
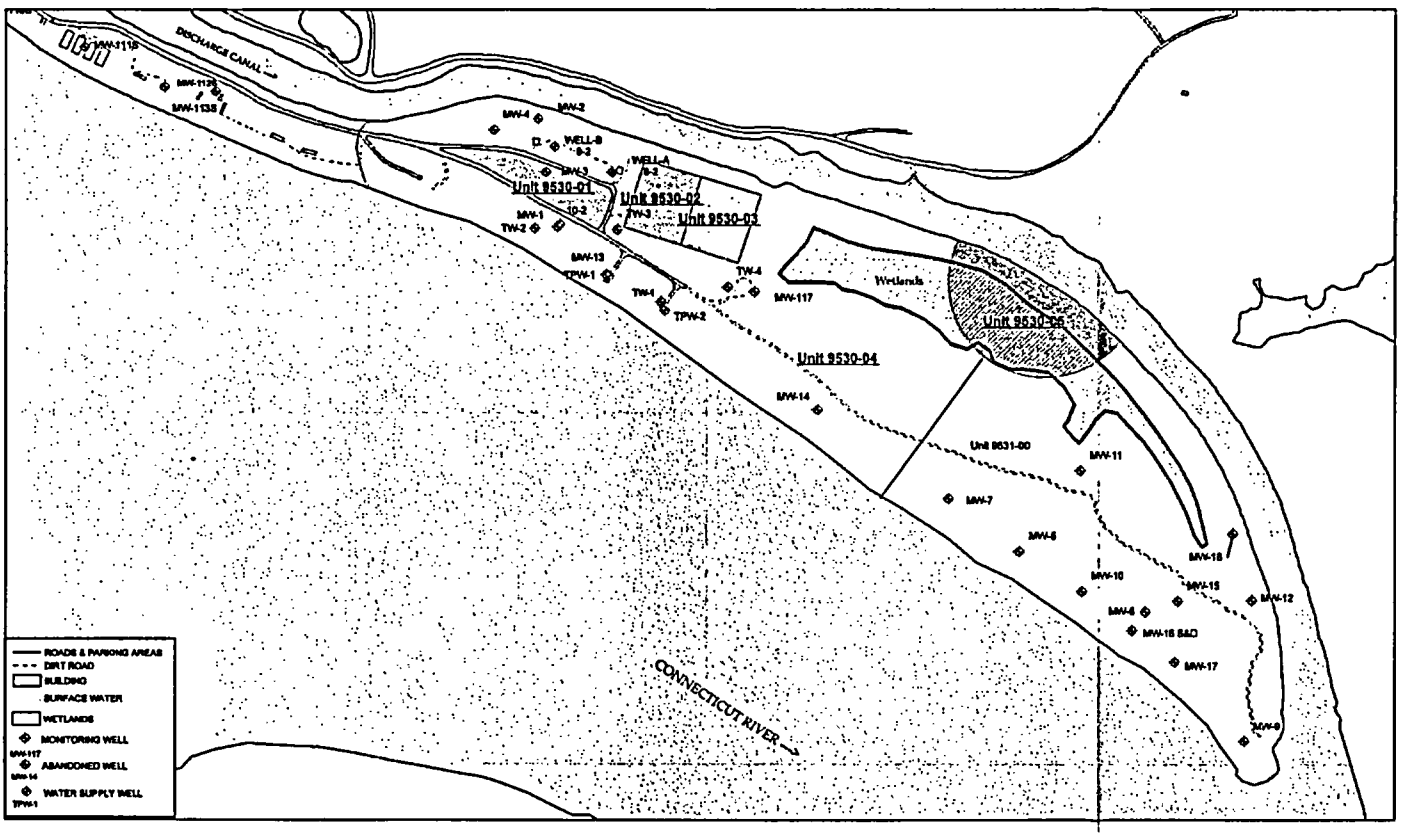


FIGURE 3
CROSS SECTION T-T'
PENINSULA AREA
CONNECTICUT YANKEE NMP
HADDAM NECK, CT



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0 200 400 Feet

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FIGURE 4

PENINSULA FINAL STATUS SURVEY UNITS, HADDAM NECK PLANT

HADDAM NECK, CT

Appendix A

Table A-1
Peninsula Evaluation
Laboratory Analytical Data Reported for Groundwater From HNP Peninsula Wells
Connecticut Yankee Haddam Neck Plant
Haddam Neck, CT

Well ID	Nuclide/Analyte (unit)	Net Concentration	2-Sigma TPU	Actual MDC	Analysis Date
MW-1	Ag-108m(pCi/L)	0.784	1.2	2.15	19-Jul-04
MW-1	Ag-108m(pCi/L)	-0.826	2.72	4.51	18-Oct-04
MW-1	Am-241(pCi/L)	-1.81	2.35	4	19-Jul-04
MW-1	Am-241-gamma(pCi/L)	-22.2	18.1	27.6	18-Oct-04
MW-1	Boron(ug/L)	5.08	-	0.54	26-Jul-04
MW-1	Boron(ug/L)	5.2	-	0.54	22-Oct-04
MW-1	Co-60(pCi/L)	0.75	1.58	2.95	19-Jul-04
MW-1	Co-60(pCi/L)	0.174	2.9	5.58	18-Oct-04
MW-1	Cs-134(pCi/L)	1.02	1.47	2.73	19-Jul-04
MW-1	Cs-134(pCi/L)	-2.38	2.83	4.55	18-Oct-04
MW-1	Cs-137(pCi/L)	-0.248	1.38	2.41	19-Jul-04
MW-1	Cs-137(pCi/L)	1.01	2.7	5.15	18-Oct-04
MW-1	Eu-152(pCi/L)	1.5	3.57	6.33	19-Jul-04
MW-1	Eu-152(pCi/L)	3.48	8.39	15	18-Oct-04
MW-1	Eu-154(pCi/L)	-1.42	4.1	7.13	19-Jul-04
MW-1	Eu-154(pCi/L)	-0.992	6.34	12.2	18-Oct-04
MW-1	Eu-155(pCi/L)	3.94	3.94	6.94	19-Jul-04
MW-1	Eu-155(pCi/L)	-4.5	9.71	17	18-Oct-04
MW-1	Gross Alpha(pCi/L)	0.302	0.939	2	26-Jul-04
MW-1	Gross Alpha(pCi/L)	-0.254	0.552	1.35	16-Oct-04
MW-1	Gross Beta(pCi/L)	0.234	0.875	1.84	26-Jul-04
MW-1	Gross Beta(pCi/L)	1.33	1.16	2.24	16-Oct-04
MW-1	H-3(pCi/L)	223	172	274	20-Jul-04
MW-1	H-3(pCi/L)	51.9	183	305	7-Oct-04
MW-1	Mn-54(pCi/L)	1.41	1.43	2.69	19-Jul-04
MW-1	Mn-54(pCi/L)	-1.74	2.46	4.04	18-Oct-04
MW-1	Nb-94(pCi/L)	-0.174	1.29	2.26	19-Jul-04
MW-1	Nb-94(pCi/L)	-1.52	2.19	3.66	18-Oct-04
MW-1	Sr-90(pCi/L)	0.944	0.726	1.47	15-Jul-04
MW-110S	AcTh-228(pCi/L)	-7.9	9.4	21	25-Jun-03
MW-110S	Ag-108m(pCi/L)	0.243	1.22	2.23	21-Nov-02
MW-110S	Ag-108m(pCi/L)	-0.445	1.12	1.9	22-Jan-03
MW-110S	Ag-108m(pCi/L)	1.13	2.26	4.22	30-Apr-03
MW-110S	Ag-108m(pCi/L)	1.1	2.4	4.3	25-Jun-03
MW-110S	Ag-108m(pCi/L)	0.646	1.47	2.85	22-Nov-03
MW-110S	Ag-108m(pCi/L)	-0.689	2.56	4.55	21-Jan-04
MW-110S	Ag-108m(pCi/L)	0.273	1.69	3.12	1-Apr-04
MW-110S	Ag-108m(pCi/L)	-1.55	1.4	2.2	19-Jul-04
MW-110S	Ag-110m(pCi/L)	0	3.4	6.5	25-Jun-03
MW-110S	Am-241 (gamma)(pCi/L)	4.09	26	47	1-Feb-02
MW-110S	Am-241 (gamma)(pCi/L)	-2.9	5.22	8.57	31-Jul-02
MW-110S	Am-241 (gamma)(pCi/L)	-0.499	1.76	2.54	28-Aug-02
MW-110S	Am-241 (gamma)(pCi/L)	-2.99	3.81	6.32	21-Nov-02
MW-110S	Am-241 (gamma)(pCi/L)	-1.83	1.57	2.45	22-Jan-03
MW-110S	Am-241 (gamma)(pCi/L)	-16	22.7	36.9	30-Apr-03
MW-110S	Am-241 (gamma)(pCi/L)	1.71	2.38	4.41	22-Nov-03
MW-110S	Am-241 (gamma)(pCi/L)	4.88	10.1	17.3	1-Apr-04
MW-110S	Am-241 (gamma)(pCi/L)	0.753	2.45	4.22	19-Jul-04
MW-110S	Am-241(pCi/L)	-0.00335	0.00673	0.169	31-Jul-02

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Laboratory Analytical Data Reported for Groundwater From HNP Peninsula Wells
Connecticut Yankee Haddam Neck Plant
Haddam Neck, CT

Well ID	Nuclide/Analyte (unit)	Net Concentration	2-Sigma TPU	Actual MDC	Analysis Date
MW-110S	Am-241(pCi/L)	0.0451	0.0906	0.122	25-Aug-02
MW-110S	Am-241(pCi/L)	0.0481	0.0966	0.13	18-Dec-02
MW-110S	Am-241(pCi/L)	0.0768	0.109	0.104	30-Jan-03
MW-110S	Am-241(pCi/L)	0	0.105	0.116	7-May-03
MW-110S	Am-241(pCi/L)	-0.0429	0.104	0.354	5-Apr-04
MW-110S	Ba-140(pCi/L)	-7	15.6	35	25-Jun-03
MW-110S	Be-7(pCi/L)	3	34	64	25-Jun-03
MW-110S	Boron(ug/L)	238	-	0.54	15-Apr-04
MW-110S	Boron(ug/L)	191	-	4.88	15-Apr-04
MW-110S	Boron(ug/L)	291	-	0.54	26-Jul-04
MW-110S	C-14(pCi/L)	1.46	5.06	11	5-Aug-02
MW-110S	C-14(pCi/L)	4.19	3.72	7.85	10-Aug-02
MW-110S	C-14(pCi/L)	-3.5	3.8	8.57	8-Nov-02
MW-110S	C-14(pCi/L)	0.923	3.61	7.88	15-Jan-03
MW-110S	Ce-141(pCi/L)	3	9.4	16	25-Jun-03
MW-110S	Ce-144(pCi/L)	3.6	18.4	32	25-Jun-03
MW-110S	Cm-242(pCi/L)	0	0.18	0.199	31-Jul-02
MW-110S	Cm-242(pCi/L)	-0.0116	0.0233	0.278	25-Aug-02
MW-110S	Cm-242(pCi/L)	-0.0139	0.0279	0.332	18-Dec-02
MW-110S	Cm-242(pCi/L)	0	0.114	0.126	30-Jan-03
MW-110S	Cm-242(pCi/L)	0	0.123	0.136	7-May-03
MW-110S	Cm-243,244(pCi/L)	-0.0034	0.00682	0.171	31-Jul-02
MW-110S	Cm-243,244(pCi/L)	0	0.111	0.123	25-Aug-02
MW-110S	Cm-243,244(pCi/L)	0	0.119	0.131	18-Dec-02
MW-110S	Cm-243,244(pCi/L)	0	0.0945	0.105	30-Jan-03
MW-110S	Cm-243,244(pCi/L)	0.0431	0.0866	0.117	7-May-03
MW-110S	Co-57(pCi/L)	-10	24	42	25-Jun-03
MW-110S	Co-58(pCi/L)	1.7	3	5.2	25-Jun-03
MW-110S	Co-60(pCi/L)	-4.87	5.5	11	1-Feb-02
MW-110S	Co-60(pCi/L)	2.13	2.2	4.37	31-Jul-02
MW-110S	Co-60(pCi/L)	0.398	1.43	2.83	28-Aug-02
MW-110S	Co-60(pCi/L)	1.09	2.05	3.98	21-Nov-02
MW-110S	Co-60(pCi/L)	-0.367	1.3	2.34	22-Jan-03
MW-110S	Co-60(pCi/L)	0.565	2.49	5.07	30-Apr-03
MW-110S	Co-60(pCi/L)	0.8	2.2	3.9	25-Jun-03
MW-110S	Co-60(pCi/L)	-0.958	1.87	3.25	22-Nov-03
MW-110S	Co-60(pCi/L)	-1.52	3.51	6.43	21-Jan-04
MW-110S	Co-60(pCi/L)	0.291	2.02	3.86	1-Apr-04
MW-110S	Co-60(pCi/L)	0.194	1.86	3.42	19-Jul-04
MW-110S	Cr-51(pCi/L)	-13	50	93	25-Jun-03
MW-110S	Cs-134(pCi/L)	-3.33	4.9	8	1-Feb-02
MW-110S	Cs-134(pCi/L)	-0.97	1.95	3.33	31-Jul-02
MW-110S	Cs-134(pCi/L)	0.432	1.35	2.61	28-Aug-02
MW-110S	Cs-134(pCi/L)	-0.929	1.86	3.14	21-Nov-02
MW-110S	Cs-134(pCi/L)	0.0694	1.44	2.64	22-Jan-03
MW-110S	Cs-134(pCi/L)	-0.498	2.76	5.01	30-Apr-03
MW-110S	Cs-134(pCi/L)	-1.7	3	6.2	25-Jun-03
MW-110S	Cs-134(pCi/L)	1.1	2.16	4.44	22-Nov-03
MW-110S	Cs-134(pCi/L)	-0.477	4.22	7.79	21-Jan-04

Table A-1
Peninsula Evaluation
Laboratory Analytical Data Reported for Groundwater From HNP Peninsula Wells
Connecticut Yankee Haddam Neck Plant
Haddam Neck, CT

Well ID	Nuclide/Analyte (unit)	Net Concentration	2-Sigma TPU	Actual MDC	Analysis Date
MW-110S	Cs-134(pCi/L)	0.739	2.01	3.75	1-Apr-04
MW-110S	Cs-134(pCi/L)	-0.753	1.87	3.21	19-Jul-04
MW-110S	Cs-137(pCi/L)	0.738	5	9	1-Feb-02
MW-110S	Cs-137(pCi/L)	-0.325	1.75	3.05	31-Jul-02
MW-110S	Cs-137(pCi/L)	0.629	1.34	2.57	28-Aug-02
MW-110S	Cs-137(pCi/L)	0.353	1.45	2.72	21-Nov-02
MW-110S	Cs-137(pCi/L)	-0.0573	1.27	2.31	22-Jan-03
MW-110S	Cs-137(pCi/L)	0.844	2.65	4.97	30-Apr-03
MW-110S	Cs-137(pCi/L)	1.2	2.6	4.6	25-Jun-03
MW-110S	Cs-137(pCi/L)	-0.31	1.87	3.45	22-Nov-03
MW-110S	Cs-137(pCi/L)	-0.185	3.24	6.15	21-Jan-04
MW-110S	Cs-137(pCi/L)	0.128	1.88	3.41	1-Apr-04
MW-110S	Cs-137(pCi/L)	1.45	1.86	3.05	19-Jul-04
MW-110S	Eu-152(pCi/L)	1.73	12	22	1-Feb-02
MW-110S	Eu-152(pCi/L)	-2.91	4.06	6.74	31-Jul-02
MW-110S	Eu-152(pCi/L)	2.46	3.05	5.83	28-Aug-02
MW-110S	Eu-152(pCi/L)	-1.14	3.65	6.24	21-Nov-02
MW-110S	Eu-152(pCi/L)	-0.969	3.26	5.64	22-Jan-03
MW-110S	Eu-152(pCi/L)	2.12	6.68	12.2	30-Apr-03
MW-110S	Eu-152(pCi/L)	-2.8	6.6	12	25-Jun-03
MW-110S	Eu-152(pCi/L)	1.59	5.07	9.46	22-Nov-03
MW-110S	Eu-152(pCi/L)	3.18	8.76	16.7	21-Jan-04
MW-110S	Eu-152(pCi/L)	4.28	5.5	9.96	1-Apr-04
MW-110S	Eu-152(pCi/L)	0.288	3.89	6.77	19-Jul-04
MW-110S	Eu-154(pCi/L)	-3.29	17	30	1-Feb-02
MW-110S	Eu-154(pCi/L)	-3.62	5.18	8.56	31-Jul-02
MW-110S	Eu-154(pCi/L)	-0.685	3.61	6.7	28-Aug-02
MW-110S	Eu-154(pCi/L)	-3.53	4.41	7.14	21-Nov-02
MW-110S	Eu-154(pCi/L)	1.6	3.83	7.73	22-Jan-03
MW-110S	Eu-154(pCi/L)	6.82	7.24	16.1	30-Apr-03
MW-110S	Eu-154(pCi/L)	5.9	8.6	14	25-Jun-03
MW-110S	Eu-154(pCi/L)	5.47	4.61	12	22-Nov-03
MW-110S	Eu-154(pCi/L)	4.95	10.4	23.2	21-Jan-04
MW-110S	Eu-154(pCi/L)	0.463	4.23	8.39	1-Apr-04
MW-110S	Eu-154(pCi/L)	2.66	4.74	9.18	19-Jul-04
MW-110S	Eu-155(pCi/L)	-11.4	16	26	1-Feb-02
MW-110S	Eu-155(pCi/L)	0.537	3.74	6.49	31-Jul-02
MW-110S	Eu-155(pCi/L)	-1.89	2.4	3.84	28-Aug-02
MW-110S	Eu-155(pCi/L)	0.519	3.16	5.48	21-Nov-02
MW-110S	Eu-155(pCi/L)	1.04	2.32	4.22	22-Jan-03
MW-110S	Eu-155(pCi/L)	0.77	7.61	13.5	30-Apr-03
MW-110S	Eu-155(pCi/L)	4.1	10.8	18	25-Jun-03
MW-110S	Eu-155(pCi/L)	2.61	3.16	6.17	22-Nov-03
MW-110S	Eu-155(pCi/L)	-4.82	6.68	11.2	21-Jan-04
MW-110S	Eu-155(pCi/L)	5.24	6.81	12.5	1-Apr-04
MW-110S	Eu-155(pCi/L)	-1.15	4.2	6.86	19-Jul-04
MW-110S	Fe-55(pCi/L)	4.05	2.44	6.32	25-Jul-02
MW-110S	Fe-55(pCi/L)	10.6	3.58	11.7	30-Aug-02
MW-110S	Fe-55(pCi/L)	-5.54	5.19	10.6	8-Dec-02

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Well ID	Nuclide/Analyte (unit)	Net Concentration	2-Sigma TPU	Actual MDC	Analysis Date
MW-110S	Fe-55(pCi/L)	-8.85	3.83	6.23	1-Feb-03
MW-110S	Fe-59(pCi/L)	-6.1	9	19	25-Jun-03
MW-110S	Gross Alpha(pCi/L)	0.379	1.2	0.94	13-Feb-02
MW-110S	Gross Alpha(pCi/L)	0.402	0.51	0.965	16-Jul-02
MW-110S	Gross Alpha(pCi/L)	0.0576	0.359	0.952	21-Aug-02
MW-110S	Gross Alpha(pCi/L)	-0.0147	0.281	0.813	5-Dec-02
MW-110S	Gross Alpha(pCi/L)	-0.0348	0.274	0.863	21-Jan-03
MW-110S	Gross Alpha(pCi/L)	0.138	0.368	0.858	7-May-03
MW-110S	Gross Alpha(pCi/L)	0.91	1.56	2.7	25-Jun-03
MW-110S	Gross Alpha(pCi/L)	-0.022	0.764	1.93	22-Nov-03
MW-110S	Gross Alpha(pCi/L)	0.0386	0.469	1.22	22-Jan-04
MW-110S	Gross Alpha(pCi/L)	-0.164	0.562	1.33	13-Apr-04
MW-110S	Gross Alpha(pCi/L)	-0.0535	0.988	2.44	22-Jul-04
MW-110S	Gross Beta(pCi/L)	**2.79**	1.4	0.88	13-Feb-02
MW-110S	Gross Beta(pCi/L)	**4.07**	1.66	2.81	16-Jul-02
MW-110S	Gross Beta(pCi/L)	**6.51**	1.89	2.66	21-Aug-02
MW-110S	Gross Beta(pCi/L)	**4.39**	1.63	2.62	5-Dec-02
MW-110S	Gross Beta(pCi/L)	**4.28**	1.61	2.59	20-Jan-03
MW-110S	Gross Beta(pCi/L)	**7.47**	2.03	2.74	7-May-03
MW-110S	Gross Beta(pCi/L)	**7.3**	2.4	2.7	25-Jun-03
MW-110S	Gross Beta(pCi/L)	**3.99**	1.61	2.73	22-Nov-03
MW-110S	Gross Beta(pCi/L)	**4.7**	1.63	2.58	20-Jan-04
MW-110S	Gross Beta(pCi/L)	**1.88**	0.765	1.27	13-Apr-04
MW-110S	Gross Beta(pCi/L)	**4.35**	1.33	2.05	22-Jul-04
MW-110S	H-3(pCi/L)	**3270**	440	240	11-Feb-02
MW-110S	H-3(pCi/L)	**2980**	366	268	27-Jul-02
MW-110S	H-3(pCi/L)	**1470**	268	259	18-Aug-02
MW-110S	H-3(pCi/L)	**2390**	242	278	14-Nov-02
MW-110S	H-3(pCi/L)	**2050**	221	289	25-Jan-03
MW-110S	H-3(pCi/L)	**1430**	183	256	8-May-03
MW-110S	H-3(pCi/L)	**1370**	240	330	25-Jun-03
MW-110S	H-3(pCi/L)	**1420**	203	297	9-Nov-03
MW-110S	H-3(pCi/L)	**1290**	178	255	14-Jan-04
MW-110S	H-3(pCi/L)	**2050**	287	282	3-Apr-04
MW-110S	H-3(pCi/L)	**1010**	220	310	19-Jul-04
MW-110S	I-131(pCi/L)	-25	52	99	25-Jun-03
MW-110S	K-40(pCi/L)	10	32	58	25-Jun-03
MW-110S	La-140(pCi/L)	-8.1	17.8	41	25-Jun-03
MW-110S	Mn-54(pCi/L)	0.0197	4.7	8.6	1-Feb-02
MW-110S	Mn-54(pCi/L)	-2.52	2.36	3.73	31-Jul-02
MW-110S	Mn-54(pCi/L)	0.0538	1.33	2.46	28-Aug-02
MW-110S	Mn-54(pCi/L)	-0.595	1.61	2.76	21-Nov-02
MW-110S	Mn-54(pCi/L)	0.0934	1.24	2.3	22-Jan-03
MW-110S	Mn-54(pCi/L)	-2.24	2.99	4.92	30-Apr-03
MW-110S	Mn-54(pCi/L)	0.8	2.8	5.1	25-Jun-03
MW-110S	Mn-54(pCi/L)	0.65	2.16	4.26	22-Nov-03
MW-110S	Mn-54(pCi/L)	-2.59	3.05	4.91	21-Jan-04
MW-110S	Mn-54(pCi/L)	0.726	2.11	3.87	1-Apr-04
MW-110S	Mn-54(pCi/L)	0.368	1.7	3.06	19-Jul-04

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Well ID	Nuclide/Analyte (unit)	Net Concentration	2-Sigma TPU	Actual MDC	Analysis Date
MW-110S	Nb-94(pCi/L)	3.08	4.1	8.4	1-Feb-02
MW-110S	Nb-94(pCi/L)	-0.739	1.81	3.08	31-Jul-02
MW-110S	Nb-94(pCi/L)	0.169	1.23	2.31	28-Aug-02
MW-110S	Nb-94(pCi/L)	0.76	1.35	2.68	21-Nov-02
MW-110S	Nb-94(pCi/L)	-0.0717	1.13	2.08	22-Jan-03
MW-110S	Nb-94(pCi/L)	-1.46	2.47	4.19	30-Apr-03
MW-110S	Nb-94(pCi/L)	-2.4	2.4	5.3	25-Jun-03
MW-110S	Nb-94(pCi/L)	-1.28	1.72	2.76	22-Nov-03
MW-110S	Nb-94(pCi/L)	-1.54	3.58	6.39	21-Jan-04
MW-110S	Nb-94(pCi/L)	0.432	1.64	3.04	1-Apr-04
MW-110S	Nb-94(pCi/L)	0.0195	1.7	2.68	19-Jul-04
MW-110S	Nb-95(pCi/L)	2.3	4.2	7.4	25-Jun-03
MW-110S	Ni-63(pCi/L)	3.1	2.75	3.96	25-Jul-02
MW-110S	Ni-63(pCi/L)	0.0155	1.9	3.07	30-Aug-02
MW-110S	Ni-63(pCi/L)	3.12	4.12	5.32	8-Dec-02
MW-110S	Ni-63(pCi/L)	1.16	2.71	3.79	31-Jan-03
MW-110S	Pu-238(pCi/L)	0	0.108	0.12	8-Aug-02
MW-110S	Pu-238(pCi/L)	0.0328	0.0837	0.196	23-Aug-02
MW-110S	Pu-238(pCi/L)	0	0.121	0.134	4-Dec-02
MW-110S	Pu-238(pCi/L)	0	0.117	0.129	23-Jan-03
MW-110S	Pu-238(pCi/L)	0	0.218	0.242	1-May-03
MW-110S	Pu-239,240(pCi/L)	0.044	0.0883	0.119	8-Aug-02
MW-110S	Pu-239,240(pCi/L)	0.0654	0.118	0.231	23-Aug-02
MW-110S	Pu-239,240(pCi/L)	-0.00989	0.0198	0.237	4-Dec-02
MW-110S	Pu-239,240(pCi/L)	-0.00954	0.0192	0.228	23-Jan-03
MW-110S	Pu-239,240(pCi/L)	0	0.218	0.241	1-May-03
MW-110S	Pu-241(pCi/L)	6.91	3.46	6.84	14-Aug-02
MW-110S	Pu-241(pCi/L)	-10.3	3.23	7.57	1-Sep-02
MW-110S	Pu-241(pCi/L)	4.12	3.94	8.04	27-Dec-02
MW-110S	Pu-241(pCi/L)	13.2	4.58	8.16	31-Jan-03
MW-110S	Pu-241(pCi/L)	2.63	8.3	15.1	12-May-03
MW-110S	Ru-103(pCi/L)	-0.1	5.2	9.4	25-Jun-03
MW-110S	Ru-106(pCi/L)	-4	24	46	25-Jun-03
MW-110S	Sb-124(pCi/L)	-1.2	9.6	20	25-Jun-03
MW-110S	Sb-125(pCi/L)	1.39	12	23	1-Feb-02
MW-110S	Sb-125(pCi/L)	-1.1	6.4	12	25-Jun-03
MW-110S	Se-75(pCi/L)	2.4	3.4	5.6	25-Jun-03
MW-110S	Sr-89(pCi/L)	-0.235	0.34	0.6	18-Feb-02
MW-110S	Sr-89(pCi/L)	-2	17.2	39	25-Jun-03
MW-110S	Sr-90(pCi/L)	0.0494	0.23	0.39	18-Feb-02
MW-110S	Sr-90(pCi/L)	0.339	0.333	0.603	4-Aug-02
MW-110S	Sr-90(pCi/L)	0.169	0.266	0.545	25-Aug-02
MW-110S	Sr-90(pCi/L)	-0.0227	0.295	0.683	8-Dec-02
MW-110S	Sr-90(pCi/L)	0.238	0.273	0.528	24-Jan-03
MW-110S	Sr-90(pCi/L)	0.322	0.319	0.597	7-May-03
MW-110S	Sr-90(pCi/L)	0.1	0.96	1.6	25-Jun-03
MW-110S	Sr-90(pCi/L)	0.16	0.204	0.423	23-Nov-03
MW-110S	Sr-90(pCi/L)	0.439	0.36	0.687	18-Jan-04
MW-110S	Sr-90(pCi/L)	-0.753	0.648	1.7	6-Apr-04

Table A-1
Peninsula Evaluation
Laboratory Analytical Data Reported for Groundwater From HNP Peninsula Wells
Connecticut Yankee Haddam Neck Plant
Haddam Neck, CT

Well ID	Nuclide/Analyte (unit)	Net Concentration	2-Sigma TPU	Actual MDC	Analysis Date
MW-110S	Sr-90(pCi/L)	0.689	0.637	1.3	13-Jul-04
MW-110S	Tc-99(pCi/L)	8.44	7.78	11.3	10-Aug-02
MW-110S	Tc-99(pCi/L)	7.58	7.53	11.2	24-Aug-02
MW-110S	Tc-99(pCi/L)	2.61	7.11	10.8	19-Nov-02
MW-110S	Tc-99(pCi/L)	6.4	8.31	11.5	24-Jan-03
MW-110S	Total U(pCi/L)	0.0122	0.00135	0.00978	30-Jan-04
MW-110S	Zn-65(pCi/L)	-1.1	7.2	14	25-Jun-03
MW-110S	Zr-95(pCi/L)	-2.5	5.8	12	25-Jun-03
MW-110S	Ag-108m(pCi/L)	3.33	3.71	5.29	20-Oct-04
MW-110S	Am-241-gamma(pCi/L)	-3.88	16.6	28.8	20-Oct-04
MW-110S	Bicarb. Alkalinity(ug/L)	16.2	-	1.45	13-Oct-04
MW-110S	Boron(ug/L)	284	-	0.54	29-Oct-04
MW-110S	Ca cation(ug/L)	34300	-	5.54	29-Oct-04
MW-110S	Carb. Alkalinity(ug/L)	2	-	1.45	13-Oct-04
MW-110S	Cl Ion(ug/L)	63.8	-	0.322	25-Oct-04
MW-110S	Co-60(pCi/L)	-3.47	3.02	4.5	20-Oct-04
MW-110S	Cs-134(pCi/L)	0.351	3.42	5.67	20-Oct-04
MW-110S	Cs-137(pCi/L)	-0.901	2.77	4.98	20-Oct-04
MW-110S	Eu-152(pCi/L)	-0.0135	7.57	13.6	20-Oct-04
MW-110S	Eu-154(pCi/L)	-4.01	9.26	13.7	20-Oct-04
MW-110S	Eu-155(pCi/L)	-3.75	11.5	19.4	20-Oct-04
MW-110S	Gross Alpha(pCi/L)	-0.716	0.632	1.78	19-Oct-04
MW-110S	Gross Beta(pCi/L)	4.46	1.54	2.75	19-Oct-04
MW-110S	H-3(pCi/L)	1670	198	254	8-Oct-04
MW-110S	K cation(ug/L)	4980	-	16.5	29-Oct-04
MW-110S	Mg cation (ug/L)	5130	-	5.18	29-Oct-04
MW-110S	Mn-54(pCi/L)	-1.79	2.96	4.99	20-Oct-04
MW-110S	Na cation(ug/L)	19400	-	14.4	29-Oct-04
MW-110S	Nb-94(pCi/L)	1.55	2.29	4.67	20-Oct-04
MW-110S	Sr-90(pCi/L)	0.358	0.434	0.937	18-Oct-04
MW-110S	Sulfate anion(ug/L)	23.8	-	0.193	22-Oct-04
MW-110S	Total U(pCi/L)	0	0	0.2	13-Oct-04
MW-111S	AcTh-228(pCi/L)	0	13.6	27	23-Jun-03
MW-111S	Ag-108m(pCi/L)	0.00724	1.56	2.69	7-Nov-02
MW-111S	Ag-108m(pCi/L)	-0.146	1.1	1.96	23-Jan-03
MW-111S	Ag-108m(pCi/L)	0.653	1.36	2.69	2-May-03
MW-111S	Ag-108m(pCi/L)	-0.3	2.6	5.3	23-Jun-03
MW-111S	Ag-108m(pCi/L)	-0.994	2.08	3.53	24-Nov-03
MW-111S	Ag-108m(pCi/L)	-3.31	3.86	6.23	28-Jan-04
MW-111S	Ag-108m(pCi/L)	1.84	1.67	3.3	1-Apr-04
MW-111S	Ag-108m(pCi/L)	0.104	1.3	2.3	19-Jul-04
MW-111S	Ag-110m(pCi/L)	-0.5	5.6	11	23-Jun-03
MW-111S	Am-241 (gamma)(pCi/L)	6.85	12	23	30-Jan-02
MW-111S	Am-241 (gamma)(pCi/L)	-4.53	3.51	5.55	31-Jul-02
MW-111S	Am-241 (gamma)(pCi/L)	1.57	3.71	6.63	29-Aug-02
MW-111S	Am-241 (gamma)(pCi/L)	-9.59	15.7	26.2	7-Nov-02
MW-111S	Am-241 (gamma)(pCi/L)	-1.03	3.42	5.89	23-Jan-03
MW-111S	Am-241 (gamma)(pCi/L)	2.92	2.41	4.23	2-May-03
MW-111S	Am-241 (gamma)(pCi/L)	-0.306	10.3	18.1	24-Nov-03

Table A-1
Peninsula Evaluation
Laboratory Analytical Data Reported for Groundwater From HNP Peninsula Wells
Connecticut Yankee Haddam Neck Plant
Haddam Neck, CT

Well ID	Nuclide/Analyte (unit)	Net Concentration	2-Sigma TPU	Actual MDC	Analysis Date
MW-111S	Am-241 (gamma)(pCi/L)	2.12	11.4	19	1-Apr-04
MW-111S	Am-241 (gamma)(pCi/L)	-5.14	9.11	13.1	19-Jul-04
MW-111S	Am-241(pCi/L)	0	0.153	0.169	31-Jul-02
MW-111S	Am-241(pCi/L)	-0.00353	0.00709	0.178	26-Aug-02
MW-111S	Am-241(pCi/L)	0.0784	0.125	0.209	30-Jan-03
MW-111S	Am-241(pCi/L)	-0.014	0.0724	0.264	5-Apr-04
MW-111S	Ba-140(pCi/L)	10	32	61	23-Jun-03
MW-111S	Be-7(pCi/L)	39	50	83	23-Jun-03
MW-111S	Boron(ug/L)	55.5	-	0.54	26-Jul-04
MW-111S	C-14(pCi/L)	0.369	3.77	8.24	5-Aug-02
MW-111S	C-14(pCi/L)	2.75	3.67	7.85	10-Aug-02
MW-111S	C-14(pCi/L)	2.59	3.67	7.88	16-Jan-03
MW-111S	Ce-141(pCi/L)	0.3	11.2	20	23-Jun-03
MW-111S	Ce-144(pCi/L)	-8	22	40	23-Jun-03
MW-111S	Cm-242(pCi/L)	-0.0216	0.0433	0.517	31-Jul-02
MW-111S	Cm-242(pCi/L)	-0.00916	0.0131	0.262	26-Aug-02
MW-111S	Cm-242(pCi/L)	-0.0106	0.0212	0.253	30-Jan-03
MW-111S	Cm-243,244(pCi/L)	-0.0127	0.0254	0.303	31-Jul-02
MW-111S	Cm-243,244(pCi/L)	-0.00355	0.00714	0.179	26-Aug-02
MW-111S	Cm-243,244(pCi/L)	-0.0175	0.0249	0.247	30-Jan-03
MW-111S	Co-57(pCi/L)	-5	24	43	23-Jun-03
MW-111S	Co-58(pCi/L)	1.3	5.2	9.8	23-Jun-03
MW-111S	Co-60(pCi/L)	3.78	9.1	20	30-Jan-02
MW-111S	Co-60(pCi/L)	1.6	1.5	3.36	31-Jul-02
MW-111S	Co-60(pCi/L)	-0.44	1.69	3.03	29-Aug-02
MW-111S	Co-60(pCi/L)	0.0892	1.82	3.37	7-Nov-02
MW-111S	Co-60(pCi/L)	-0.956	1.8	3.04	23-Jan-03
MW-111S	Co-60(pCi/L)	-1.2	1.96	3.29	2-May-03
MW-111S	Co-60(pCi/L)	0.3	4.2	8.5	23-Jun-03
MW-111S	Co-60(pCi/L)	-0.211	2.88	5.51	24-Nov-03
MW-111S	Co-60(pCi/L)	2.1	4.71	9.83	28-Jan-04
MW-111S	Co-60(pCi/L)	0.367	2.24	3.78	1-Apr-04
MW-111S	Co-60(pCi/L)	0.0721	1.44	2.6	19-Jul-04
MW-111S	Cr-51(pCi/L)	17	68	120	23-Jun-03
MW-111S	Cs-134(pCi/L)	1.68	6.7	13	30-Jan-02
MW-111S	Cs-134(pCi/L)	-0.00376	1.45	2.72	31-Jul-02
MW-111S	Cs-134(pCi/L)	-0.385	1.67	2.94	29-Aug-02
MW-111S	Cs-134(pCi/L)	0.793	2.07	3.81	7-Nov-02
MW-111S	Cs-134(pCi/L)	0.285	1.42	2.74	23-Jan-03
MW-111S	Cs-134(pCi/L)	-0.283	2.11	3.91	2-May-03
MW-111S	Cs-134(pCi/L)	0.6	3.8	7.5	23-Jun-03
MW-111S	Cs-134(pCi/L)	1.98	2.46	5.23	24-Nov-03
MW-111S	Cs-134(pCi/L)	-1.37	5.14	9.11	28-Jan-04
MW-111S	Cs-134(pCi/L)	3.33	2.4	4	1-Apr-04
MW-111S	Cs-134(pCi/L)	0.418	1.47	2.6	19-Jul-04
MW-111S	Cs-137(pCi/L)	-5.09	7.6	13	30-Jan-02
MW-111S	Cs-137(pCi/L)	-0.566	1.41	2.42	31-Jul-02
MW-111S	Cs-137(pCi/L)	-0.0175	1.55	2.8	29-Aug-02
MW-111S	Cs-137(pCi/L)	1.24	2	3.69	7-Nov-02

Table A-1
Peninsula Evaluation
Laboratory Analytical Data Reported for Groundwater From HNP Peninsula Wells
Connecticut Yankee Haddam Neck Plant
Haddam Neck, CT

Well ID	Nuclide/Analyte (unit)	Net Concentration	2-Sigma TPU	Actual MDC	Analysis Date
MW-111S	Cs-137(pCi/L)	-0.893	1.59	2.69	23-Jan-03
MW-111S	Cs-137(pCi/L)	-0.00904	2.04	3.82	2-May-03
MW-111S	Cs-137(pCi/L)	-3.5	3.6	8.5	23-Jun-03
MW-111S	Cs-137(pCi/L)	-0.852	2.58	4.5	24-Nov-03
MW-111S	Cs-137(pCi/L)	-4	4.39	7.09	28-Jan-04
MW-111S	Cs-137(pCi/L)	-2.13	2.27	3.06	1-Apr-04
MW-111S	Cs-137(pCi/L)	0.663	1.33	2.4	19-Jul-04
MW-111S	Eu-152(pCi/L)	-7.1	20	35	30-Jan-02
MW-111S	Eu-152(pCi/L)	0.284	3.49	6.16	31-Jul-02
MW-111S	Eu-152(pCi/L)	1.12	3.99	7.1	29-Aug-02
MW-111S	Eu-152(pCi/L)	-0.578	4.91	8.41	7-Nov-02
MW-111S	Eu-152(pCi/L)	0.356	3.67	6.47	23-Jan-03
MW-111S	Eu-152(pCi/L)	1.36	4.51	8.53	2-May-03
MW-111S	Eu-152(pCi/L)	-0.7	8	14	23-Jun-03
MW-111S	Eu-152(pCi/L)	-5.39	5.79	9.4	24-Nov-03
MW-111S	Eu-152(pCi/L)	-2.78	11.8	20.2	28-Jan-04
MW-111S	Eu-152(pCi/L)	-0.273	5.42	9.21	1-Apr-04
MW-111S	Eu-152(pCi/L)	-1.01	4.03	6.58	19-Jul-04
MW-111S	Eu-154(pCi/L)	-22.6	24	37	30-Jan-02
MW-111S	Eu-154(pCi/L)	-0.871	4.57	8.26	31-Jul-02
MW-111S	Eu-154(pCi/L)	2.02	3.85	8.05	29-Aug-02
MW-111S	Eu-154(pCi/L)	0.167	5.1	9.41	7-Nov-02
MW-111S	Eu-154(pCi/L)	-2.77	4.48	7.48	23-Jan-03
MW-111S	Eu-154(pCi/L)	2.11	4.97	11.1	2-May-03
MW-111S	Eu-154(pCi/L)	0.9	11.4	23	23-Jun-03
MW-111S	Eu-154(pCi/L)	2.83	8.04	16.4	24-Nov-03
MW-111S	Eu-154(pCi/L)	4.94	14.6	29	28-Jan-04
MW-111S	Eu-154(pCi/L)	3.44	5.58	11.3	1-Apr-04
MW-111S	Eu-154(pCi/L)	-1.74	4.11	6.99	19-Jul-04
MW-111S	Eu-155(pCi/L)	15.3	19	35	30-Jan-02
MW-111S	Eu-155(pCi/L)	0.422	2.76	4.83	31-Jul-02
MW-111S	Eu-155(pCi/L)	3.79	2.84	5.32	29-Aug-02
MW-111S	Eu-155(pCi/L)	-1.35	5.27	8.9	7-Nov-02
MW-111S	Eu-155(pCi/L)	-1.38	3.11	5.13	23-Jan-03
MW-111S	Eu-155(pCi/L)	-2.12	3.56	6.06	2-May-03
MW-111S	Eu-155(pCi/L)	1.8	11.6	20	23-Jun-03
MW-111S	Eu-155(pCi/L)	2.65	5.33	10	24-Nov-03
MW-111S	Eu-155(pCi/L)	-0.372	10.2	17.9	28-Jan-04
MW-111S	Eu-155(pCi/L)	4.25	7.07	12.8	1-Apr-04
MW-111S	Eu-155(pCi/L)	-0.2	4.6	8.03	19-Jul-04
MW-111S	Fe-55(pCi/L)	5.61	2.6	6.49	25-Jul-02
MW-111S	Fe-55(pCi/L)	4.48	2.44	8.73	30-Aug-02
MW-111S	Fe-55(pCi/L)	-11.5	3.44	5.4	1-Feb-03
MW-111S	Fe-59(pCi/L)	-7	13.2	29	23-Jun-03
MW-111S	Gross Alpha(pCi/L)	0.68	0.85	0.56	13-Feb-02
MW-111S	Gross Alpha(pCi/L)	1	0.592	0.673	16-Jul-02
MW-111S	Gross Alpha(pCi/L)	0.345	0.391	0.696	21-Aug-02
MW-111S	Gross Alpha(pCi/L)	0.541	0.521	0.892	6-Nov-02
MW-111S	Gross Alpha(pCi/L)	0.355	0.391	0.671	21-Jan-03

Table A-1
Peninsula Evaluation
Laboratory Analytical Data Reported for Groundwater From HNP Peninsula Wells
Connecticut Yankee Haddam Neck Plant
Haddam Neck, CT

Well ID	Nuclide/Analyte (unit)	Net Concentration	2-Sigma TPU	Actual MDC	Analysis Date
MW-111S	Gross Alpha(pCi/L)	0.548	0.469	0.701	2-May-03
MW-111S	Gross Alpha(pCi/L)	1.03	1.38	2.2	23-Jun-03
MW-111S	Gross Alpha(pCi/L)	0.308	0.396	0.714	23-Nov-03
MW-111S	Gross Alpha(pCi/L)	0.382	0.408	0.657	29-Jan-04
MW-111S	Gross Alpha(pCi/L)	0.731	0.509	0.678	22-Apr-04
MW-111S	Gross Alpha(pCi/L)	-0.239	1.03	2.49	22-Jul-04
MW-111S	Gross Beta(pCi/L)	4.23	1.6	0.98	13-Feb-02
MW-111S	Gross Beta(pCi/L)	5.31	1.66	2.42	16-Jul-02
MW-111S	Gross Beta(pCi/L)	2.76	1.53	2.86	21-Aug-02
MW-111S	Gross Beta(pCi/L)	7.39	1.96	2.56	6-Nov-02
MW-111S	Gross Beta(pCi/L)	5.01	1.65	2.49	20-Jan-03
MW-111S	Gross Beta(pCi/L)	3.24	1.51	2.66	2-May-03
MW-111S	Gross Beta(pCi/L)	5.1	2.2	2.8	23-Jun-03
MW-111S	Gross Beta(pCi/L)	4.12	1.58	2.62	22-Nov-03
MW-111S	Gross Beta(pCi/L)	5.52	1.84	2.62	27-Jan-04
MW-111S	Gross Beta(pCi/L)	4.95	1.41	2.37	22-Apr-04
MW-111S	Gross Beta(pCi/L)	2.06	1.18	2.2	22-Jul-04
MW-111S	H-3(pCi/L)	-46.6	120	210	7-Feb-02
MW-111S	H-3(pCi/L)	129	174	273	27-Jul-02
MW-111S	H-3(pCi/L)	165	169	259	18-Aug-02
MW-111S	H-3(pCi/L)	222	129	274	21-Nov-02
MW-111S	H-3(pCi/L)	120	128	292	25-Jan-03
MW-111S	H-3(pCi/L)	-0.903	107	253	2-May-03
MW-111S	H-3(pCi/L)	-100	240	350	23-Jun-03
MW-111S	H-3(pCi/L)	299	147	306	9-Nov-03
MW-111S	H-3(pCi/L)	-3.37	119	278	22-Jan-04
MW-111S	H-3(pCi/L)	63.2	165	269	5-Apr-04
MW-111S	H-3(pCi/L)	233	180	288	20-Jul-04
MW-111S	I-131(pCi/L)	8	84	160	23-Jun-03
MW-111S	K-40(pCi/L)	7	54	100	23-Jun-03
MW-111S	La-140(pCi/L)	12	38	70	23-Jun-03
MW-111S	Mn-54(pCi/L)	-3.24	8.7	16	30-Jan-02
MW-111S	Mn-54(pCi/L)	1.64	1.84	3.71	31-Jul-02
MW-111S	Mn-54(pCi/L)	-1.41	1.66	2.72	29-Aug-02
MW-111S	Mn-54(pCi/L)	0.245	1.86	3.35	7-Nov-02
MW-111S	Mn-54(pCi/L)	0.547	1.59	3.02	23-Jan-03
MW-111S	Mn-54(pCi/L)	0.202	2.28	4.3	2-May-03
MW-111S	Mn-54(pCi/L)	0.6	3.6	7	23-Jun-03
MW-111S	Mn-54(pCi/L)	-1.31	2.61	4.5	24-Nov-03
MW-111S	Mn-54(pCi/L)	-3.8	5.02	8.12	28-Jan-04
MW-111S	Mn-54(pCi/L)	0.442	1.82	3.35	1-Apr-04
MW-111S	Mn-54(pCi/L)	0	1.85	2.29	19-Jul-04
MW-111S	Nb-94(pCi/L)	3.08	18	35	30-Jan-02
MW-111S	Nb-94(pCi/L)	0.0993	1.39	2.57	31-Jul-02
MW-111S	Nb-94(pCi/L)	-1.21	1.28	2.05	29-Aug-02
MW-111S	Nb-94(pCi/L)	-0.812	1.56	2.67	7-Nov-02
MW-111S	Nb-94(pCi/L)	-0.612	1.34	2.33	23-Jan-03
MW-111S	Nb-94(pCi/L)	-0.0828	1.62	3.11	2-May-03
MW-111S	Nb-94(pCi/L)	0	4.2	8.1	23-Jun-03

Table A-1
Peninsula Evaluation
Laboratory Analytical Data Reported for Groundwater From HNP Peninsula Wells
Connecticut Yankee Haddam Neck Plant
Haddam Neck, CT

Well ID	Nuclide/Analyte (unit)	Net Concentration	2-Sigma TPU	Actual MDC	Analysis Date
MW-111S	Nb-94(pCi/L)	-0.638	2.24	4.03	24-Nov-03
MW-111S	Nb-94(pCi/L)	-0.151	4.84	8.92	28-Jan-04
MW-111S	Nb-94(pCi/L)	1.2	1.57	3.25	1-Apr-04
MW-111S	Nb-94(pCi/L)	-0.669	1.33	2.2	19-Jul-04
MW-111S	Nb-95(pCi/L)	-3.6	9.2	19	23-Jun-03
MW-111S	Ni-63(pCi/L)	1.21	2.75	4.15	25-Jul-02
MW-111S	Ni-63(pCi/L)	4.14	2.06	2.95	30-Aug-02
MW-111S	Ni-63(pCi/L)	0.917	2.61	3.68	1-Feb-03
MW-111S	Pu-238(pCi/L)	-0.00828	0.0166	0.198	8-Aug-02
MW-111S	Pu-238(pCi/L)	0	0.08	0.0885	26-Aug-02
MW-111S	Pu-238(pCi/L)	0	0.0897	0.0992	24-Jan-03
MW-111S	Pu-239,240(pCi/L)	0.0412	0.0827	0.112	8-Aug-02
MW-111S	Pu-239,240(pCi/L)	0	0.0799	0.0884	26-Aug-02
MW-111S	Pu-239,240(pCi/L)	-0.00732	0.0147	0.175	24-Jan-03
MW-111S	Pu-241(pCi/L)	6.14	3.21	6.41	16-Aug-02
MW-111S	Pu-241(pCi/L)	-11.8	3.58	8.24	1-Sep-02
MW-111S	Pu-241(pCi/L)	6.12	3.53	6.47	31-Jan-03
MW-111S	Ru-103(pCi/L)	3.2	7.2	13	23-Jun-03
MW-111S	Ru-106(pCi/L)	15	28	50	23-Jun-03
MW-111S	Sb-124(pCi/L)	-14.9	17.2	41	23-Jun-03
MW-111S	Sb-125(pCi/L)	20.3	19	40	30-Jan-02
MW-111S	Sb-125(pCi/L)	7.3	9.6	16	23-Jun-03
MW-111S	Se-75(pCi/L)	3	5.8	10	23-Jun-03
MW-111S	Sr-89(pCi/L)	-0.467	0.54	0.91	13-Mar-02
MW-111S	Sr-90(pCi/L)	0.209	0.29	0.37	13-Mar-02
MW-111S	Sr-90(pCi/L)	0.321	0.336	0.629	4-Aug-02
MW-111S	Sr-90(pCi/L)	0.258	0.362	0.722	25-Aug-02
MW-111S	Sr-90(pCi/L)	0.0839	0.245	0.527	24-Jan-03
MW-111S	Sr-90(pCi/L)	0.346	0.212	0.388	31-Jan-04
MW-111S	Sr-90(pCi/L)	0.0142	0.307	0.788	6-Apr-04
MW-111S	Sr-90(pCi/L)	-0.0552	0.485	1.11	13-Jul-04
MW-111S	Tc-99(pCi/L)	1	0.1	11.3	10-Aug-02
MW-111S	Tc-99(pCi/L)	4.54	7.5	11.3	10-Aug-02
MW-111S	Tc-99(pCi/L)	5.85	7.48	11.3	24-Aug-02
MW-111S	Tc-99(pCi/L)	2.93	8.14	11.6	24-Jan-03
MW-111S	Total U(pCi/L)	0.0397	0.00408	0.00978	2-Feb-04
MW-111S	Zn-65(pCi/L)	-7.4	11	24	23-Jun-03
MW-111S	Zr-95(pCi/L)	-3	10.6	21	23-Jun-03
MW-112S	AcTh-228(pCi/L)	-5.7	13.4	29	23-Jun-03
MW-112S	Ag-108m(pCi/L)	0.739	1.35	2.48	7-Nov-02
MW-112S	Ag-108m(pCi/L)	-0.0695	1.05	1.85	23-Jan-03
MW-112S	Ag-108m(pCi/L)	0.0986	2.23	3.99	8-May-03
MW-112S	Ag-108m(pCi/L)	-0.9	3.4	6.5	23-Jun-03
MW-112S	Ag-108m(pCi/L)	0.212	1.7	3.1	24-Nov-03
MW-112S	Ag-108m(pCi/L)	0.678	3.85	7.09	21-Jan-04
MW-112S	Ag-108m(pCi/L)	0.403	1.67	3.08	1-Apr-04
MW-112S	Ag-108m(pCi/L)	0.723	1.7	3.19	20-Jul-04
MW-112S	Ag-108m(pCi/L)	-0.747	1.8	3.03	19-Oct-04
MW-112S	Ag-110m(pCi/L)	-2.8	5.6	12	23-Jun-03

Table A-1
Peninsula Evaluation
Laboratory Analytical Data Reported for Groundwater From HNP Peninsula Wells
Connecticut Yankee Haddam Neck Plant
Haddam Neck, CT

Well ID	Nuclide/Analyte (unit)	Net Concentration	2-Sigma TPU	Actual MDC	Analysis Date
MW-112S	Am-241 (gamma)(pCi/L)	24.5	26	50	1-Feb-02
MW-112S	Am-241 (gamma)(pCi/L)	-1.25	2.61	3.64	29-Jul-02
MW-112S	Am-241 (gamma)(pCi/L)	-0.117	1.59	2.52	29-Aug-02
MW-112S	Am-241 (gamma)(pCi/L)	1.01	7.26	12.6	7-Nov-02
MW-112S	Am-241 (gamma)(pCi/L)	-0.722	1.82	2.69	23-Jan-03
MW-112S	Am-241 (gamma)(pCi/L)	-1.56	2.99	4.55	8-May-03
MW-112S	Am-241 (gamma)(pCi/L)	3.97	4.52	8.65	24-Nov-03
MW-112S	Am-241 (gamma)(pCi/L)	0.342	11.1	19.7	1-Apr-04
MW-112S	Am-241 (gamma)(pCi/L)	-18.8	18.2	27.3	20-Jul-04
MW-112S	Am-241(pCi/L)	0	0.0677	0.0936	5-Apr-04
MW-112S	Am-241-gamma(pCi/L)	-6.04	15.7	18.6	19-Oct-04
MW-112S	Ba-140(pCi/L)	0	32	66	23-Jun-03
MW-112S	Be-7(pCi/L)	30	46	79	23-Jun-03
MW-112S	Boron(ug/L)	47.8	-	0.54	26-Jul-04
MW-112S	Boron(ug/L)	77.1	-	0.54	29-Oct-04
MW-112S	Ce-141(pCi/L)	3.5	12	21	23-Jun-03
MW-112S	Ce-144(pCi/L)	1	26	47	23-Jun-03
MW-112S	Co-57(pCi/L)	-14	28	53	23-Jun-03
MW-112S	Co-58(pCi/L)	1.2	4.8	9.1	23-Jun-03
MW-112S	Co-60 (pCi/L)	0.929	2.21	4.29	19-Oct-04
MW-112S	Co-60(pCi/L)	-4.83	7.9	13	1-Feb-02
MW-112S	Co-60(pCi/L)	1.06	1.6	3.93	29-Jul-02
MW-112S	Co-60(pCi/L)	0.672	1.48	2.99	29-Aug-02
MW-112S	Co-60(pCi/L)	0.668	1.82	3.59	7-Nov-02
MW-112S	Co-60(pCi/L)	0.43	1.1	2.32	23-Jan-03
MW-112S	Co-60(pCi/L)	0.283	2.67	5.27	8-May-03
MW-112S	Co-60(pCi/L)	1	4.4	8.4	23-Jun-03
MW-112S	Co-60(pCi/L)	0.855	2.41	5.03	24-Nov-03
MW-112S	Co-60(pCi/L)	1.56	5.29	10.9	21-Jan-04
MW-112S	Co-60(pCi/L)	-0.535	2.36	4.17	1-Apr-04
MW-112S	Co-60(pCi/L)	-0.456	1.87	3.39	20-Jul-04
MW-112S	Cr-51(pCi/L)	-26	74	140	23-Jun-03
MW-112S	Cs-134(pCi/L)	-6.18	8.8	12	1-Feb-02
MW-112S	Cs-134(pCi/L)	-0.135	1.45	2.64	29-Aug-02
MW-112S	Cs-134(pCi/L)	0.0704	1.77	3.24	7-Nov-02
MW-112S	Cs-134(pCi/L)	0.43	1.41	2.69	23-Jan-03
MW-112S	Cs-134(pCi/L)	0.539	2.7	5.12	8-May-03
MW-112S	Cs-134(pCi/L)	-1.2	4.4	9.2	23-Jun-03
MW-112S	Cs-134(pCi/L)	0.29	2.61	4.98	24-Nov-03
MW-112S	Cs-134(pCi/L)	1.79	5.49	10.6	21-Jan-04
MW-112S	Cs-134(pCi/L)	1.51	1.88	3.7	1-Apr-04
MW-112S	Cs-134(pCi/L)	1.16	2.38	3.26	20-Jul-04
MW-112S	Cs-134(pCi/L)	-2.29	2.11	3.33	19-Oct-04
MW-112S	Cs-137(pCi/L)	-6.84	8	13	1-Feb-02
MW-112S	Cs-137(pCi/L)	-1.3	1.99	3.35	29-Jul-02
MW-112S	Cs-137(pCi/L)	-1.08	1.21	1.96	29-Aug-02
MW-112S	Cs-137(pCi/L)	0.501	1.64	3.01	7-Nov-02
MW-112S	Cs-137(pCi/L)	-0.289	1.18	2.11	23-Jan-03
MW-112S	Cs-137(pCi/L)	0.423	2.64	4.92	8-May-03

Table A-1
Peninsula Evaluation
Laboratory Analytical Data Reported for Groundwater From HNP Peninsula Wells
Connecticut Yankee Haddam Neck Plant
Haddam Neck, CT

Well ID	Nuclide/Analyte (unit)	Net Concentration	2-Sigma TPU	Actual MDC	Analysis Date
MW-112S	Cs-137(pCi/L)	-0.1	3.8	7.5	23-Jun-03
MW-112S	Cs-137(pCi/L)	1.04	2.54	4.87	24-Nov-03
MW-112S	Cs-137(pCi/L)	-2.77	4.8	8.17	21-Jan-04
MW-112S	Cs-137(pCi/L)	-0.335	1.98	3.44	1-Apr-04
MW-112S	Cs-137(pCi/L)	0	2.15	4.43	20-Jul-04
MW-112S	Cs-137(pCi/L)	0.452	1.73	3.26	19-Oct-04
MW-112S	Eu-152(pCi/L)	-2.57	19	34	1-Feb-02
MW-112S	Eu-152(pCi/L)	-1.19	4.7	8.33	29-Jul-02
MW-112S	Eu-152(pCi/L)	-2.18	3.16	5.29	29-Aug-02
MW-112S	Eu-152(pCi/L)	0.354	4.17	7.44	7-Nov-02
MW-112S	Eu-152(pCi/L)	-2.03	3.48	5.84	23-Jan-03
MW-112S	Eu-152(pCi/L)	-0.342	6.56	11.7	8-May-03
MW-112S	Eu-152(pCi/L)	-3.1	8.6	16	23-Jun-03
MW-112S	Eu-152(pCi/L)	0.205	5.29	9.62	24-Nov-03
MW-112S	Eu-152(pCi/L)	-11.6	11.8	19.1	21-Jan-04
MW-112S	Eu-152(pCi/L)	3.51	5.91	11	1-Apr-04
MW-112S	Eu-152(pCi/L)	0.143	5.48	9.35	20-Jul-04
MW-112S	Eu-152(pCi/L)	6.1	11.4	9.94	19-Oct-04
MW-112S	Eu-154(pCi/L)	-3.38	20	39	1-Feb-02
MW-112S	Eu-154(pCi/L)	-0.846	4.05	8.07	29-Jul-02
MW-112S	Eu-154(pCi/L)	-1.81	3.82	6.67	29-Aug-02
MW-112S	Eu-154(pCi/L)	-3.51	5.5	9.32	7-Nov-02
MW-112S	Eu-154(pCi/L)	0.945	3.89	7.63	23-Jan-03
MW-112S	Eu-154(pCi/L)	-1.5	5.83	11	8-May-03
MW-112S	Eu-154(pCi/L)	9.9	12.6	20	23-Jun-03
MW-112S	Eu-154(pCi/L)	2.75	8.26	16.5	24-Nov-03
MW-112S	Eu-154(pCi/L)	-2.56	15.9	29.8	21-Jan-04
MW-112S	Eu-154(pCi/L)	-2.12	5.74	10	1-Apr-04
MW-112S	Eu-154(pCi/L)	0.712	4.67	9.11	20-Jul-04
MW-112S	Eu-154(pCi/L)	-1.33	5.6	10.1	19-Oct-04
MW-112S	Eu-155(pCi/L)	17.1	27	49	1-Feb-02
MW-112S	Eu-155(pCi/L)	-3.59	3.37	5.4	29-Jul-02
MW-112S	Eu-155(pCi/L)	-0.0644	2.56	4.51	29-Aug-02
MW-112S	Eu-155(pCi/L)	-1.28	3.77	6.48	7-Nov-02
MW-112S	Eu-155(pCi/L)	0.36	2.31	4.13	23-Jan-03
MW-112S	Eu-155(pCi/L)	-2.11	4.81	8.11	8-May-03
MW-112S	Eu-155(pCi/L)	-11.7	13.6	26	23-Jun-03
MW-112S	Eu-155(pCi/L)	-4.52	4.57	7.1	24-Nov-03
MW-112S	Eu-155(pCi/L)	4.67	9.4	17	21-Jan-04
MW-112S	Eu-155(pCi/L)	-1.82	7.35	12.6	1-Apr-04
MW-112S	Eu-155(pCi/L)	-5.38	6.64	11.2	20-Jul-04
MW-112S	Eu-155(pCi/L)	5.55	7.65	13.4	19-Oct-04
MW-112S	Fe-59(pCi/L)	-6.9	13.8	30	23-Jun-03
MW-112S	Gross Alpha(pCi/L)	0.0668	0.318	0.788	6-Nov-02
MW-112S	Gross Alpha(pCi/L)	0.382	0.403	0.685	21-Jan-03
MW-112S	Gross Alpha(pCi/L)	0.356	0.403	0.717	8-May-03
MW-112S	Gross Alpha(pCi/L)	0.28	1.06	2.1	23-Jun-03
MW-112S	Gross Alpha(pCi/L)	0.213	0.43	0.931	23-Nov-03
MW-112S	Gross Alpha(pCi/L)	0.166	0.29	0.595	22-Jan-04

Table A-1
Peninsula Evaluation
Laboratory Analytical Data Reported for Groundwater From HNP Peninsula Wells
Connecticut Yankee Haddam Neck Plant
Haddam Neck, CT

Well ID	Nuclide/Analyte (unit)	Net Concentration	2-Sigma TPU	Actual MDC	Analysis Date
MW-112S	Gross Alpha(pCi/L)	0.259	0.466	0.96	22-Apr-04
MW-112S	Gross Alpha(pCi/L)	1.56	1.1	1.77	22-Jul-04
MW-112S	Gross Alpha(pCi/L)	0.0914	0.564	1.24	19-Oct-04
MW-112S	Gross Beta(pCi/L)	3.61	1.49	2.51	6-Nov-02
MW-112S	Gross Beta(pCi/L)	1.99	1.36	2.62	20-Jan-03
MW-112S	Gross Beta(pCi/L)	1.21	1.26	2.58	7-May-03
MW-112S	Gross Beta(pCi/L)	2.02	1.74	2.7	23-Jun-03
MW-112S	Gross Beta(pCi/L)	2.62	1.39	2.55	22-Nov-03
MW-112S	Gross Beta(pCi/L)	0.914	1.2	2.5	20-Jan-04
MW-112S	Gross Beta(pCi/L)	0.778	1.17	2.38	22-Apr-04
MW-112S	Gross Beta(pCi/L)	0.641	0.944	1.97	22-Jul-04
MW-112S	Gross Beta(pCi/L)	1.63	1.18	2.29	19-Oct-04
MW-112S	H-3 (pCi/L)	144	175	286	8-Oct-04
MW-112S	H-3(pCi/L)	-173	130	240	11-Feb-02
MW-112S	H-3(pCi/L)	50.6	170	277	27-Jul-02
MW-112S	H-3(pCi/L)	59.2	160	259	18-Aug-02
MW-112S	H-3(pCi/L)	25.2	117	277	21-Nov-02
MW-112S	H-3(pCi/L)	-89.8	115	293	25-Jan-03
MW-112S	H-3(pCi/L)	28.5	107	249	1-May-03
MW-112S	H-3(pCi/L)	-100	220	340	23-Jun-03
MW-112S	H-3(pCi/L)	-57.5	125	306	9-Nov-03
MW-112S	H-3(pCi/L)	159	119	253	14-Jan-04
MW-112S	H-3(pCi/L)	32	165	272	4-Apr-04
MW-112S	H-3(pCi/L)	102	169	277	19-Jul-04
MW-112S	I-131(pCi/L)	-20	88	170	23-Jun-03
MW-112S	K-40(pCi/L)	21	54	96	23-Jun-03
MW-112S	La-140(pCi/L)	0	36	76	23-Jun-03
MW-112S	Mn-54(pCi/L)	-3.08	7.9	14	1-Feb-02
MW-112S	Mn-54(pCi/L)	1.82	2.13	4.72	29-Jul-02
MW-112S	Mn-54(pCi/L)	-1.01	1.27	2.06	29-Aug-02
MW-112S	Mn-54(pCi/L)	-0.528	1.86	3.24	7-Nov-02
MW-112S	Mn-54(pCi/L)	-0.791	1.43	2.39	23-Jan-03
MW-112S	Mn-54(pCi/L)	0.301	2.59	4.94	8-May-03
MW-112S	Mn-54(pCi/L)	1	3.8	7	23-Jun-03
MW-112S	Mn-54(pCi/L)	3.36	2.47	5.36	24-Nov-03
MW-112S	Mn-54(pCi/L)	0.294	5.28	9.81	21-Jan-04
MW-112S	Mn-54(pCi/L)	0	0	3.64	1-Apr-04
MW-112S	Mn-54(pCi/L)	1.69	1.82	3.57	20-Jul-04
MW-112S	Mn-54(pCi/L)	-0.0897	2.06	3.67	19-Oct-04
MW-112S	Nb-94(pCi/L)	5.63	7.6	16	1-Feb-02
MW-112S	Nb-94(pCi/L)	-0.865	1.87	3.22	29-Jul-02
MW-112S	Nb-94(pCi/L)	-0.0692	1.2	2.19	29-Aug-02
MW-112S	Nb-94(pCi/L)	-0.566	1.66	2.88	7-Nov-02
MW-112S	Nb-94(pCi/L)	-0.941	1.17	1.87	23-Jan-03
MW-112S	Nb-94(pCi/L)	1.9	2.4	4.98	8-May-03
MW-112S	Nb-94(pCi/L)	-1.8	4.6	9	23-Jun-03
MW-112S	Nb-94(pCi/L)	0.202	2.38	4.47	24-Nov-03
MW-112S	Nb-94(pCi/L)	1.1	4.42	8.75	21-Jan-04
MW-112S	Nb-94(pCi/L)	1.63	1.66	3.26	1-Apr-04

Table A-1
Peninsula Evaluation
Laboratory Analytical Data Reported for Groundwater From HNP Peninsula Wells
Connecticut Yankee Haddam Neck Plant
Haddam Neck, CT

Well ID	Nuclide/Analyte (unit)	Net Concentration	2-Sigma TPU	Actual MDC	Analysis Date
MW-112S	Nb-94(pCi/L)	0.816	1.73	3.22	20-Jul-04
MW-112S	Nb-94(pCi/L)	1.1	1.7	3.26	19-Oct-04
MW-112S	Nb-95(pCi/L)	-2.7	10	20	23-Jun-03
MW-112S	Ru-103(pCi/L)	-8.7	6	14	23-Jun-03
MW-112S	Ru-106(pCi/L)	1	38	73	23-Jun-03
MW-112S	Sb-124(pCi/L)	-7.4	16.2	37	23-Jun-03
MW-112S	Sb-125(pCi/L)	9.21	20	38	1-Feb-02
MW-112S	Sb-125(pCi/L)	-4.5	10.6	21	23-Jun-03
MW-112S	Se-75(pCi/L)	0.9	5.2	9.5	23-Jun-03
MW-112S	Sr-90(pCi/L)	5.49	1.28	0.634	18-Jan-04
MW-112S	Sr-90(pCi/L)	-0.0217	0.291	0.765	6-Apr-04
MW-112S	Sr-90(pCi/L)	0.697	0.59	1.19	13-Jul-04
MW-112S	Sr-90(pCi/L)	0.173	0.359	0.823	14-Oct-04
MW-112S	Total U (pCi/L)	0.0155	0.00163	0.00978	30-Jan-04
MW-112S	Zn-65(pCi/L)	-18.3	11.2	27	23-Jun-03
MW-112S	Zr-95(pCi/L)	-2.9	10.4	21	23-Jun-03
MW-113S	AcTh-228(pCi/L)	2.5	14	27	23-Jun-03
MW-113S	Ag-108m(pCi/L)	-0.34	1.16	1.98	7-Nov-02
MW-113S	Ag-108m(pCi/L)	-0.855	1.33	2.19	23-Jan-03
MW-113S	Ag-108m(pCi/L)	0.79	1.75	3.4	8-May-03
MW-113S	Ag-108m(pCi/L)	-0.9	4.2	8	23-Jun-03
MW-113S	Ag-108m(pCi/L)	0.205	2.02	3.65	22-Nov-03
MW-113S	Ag-108m(pCi/L)	0.432	3.55	6.51	19-Jan-04
MW-113S	Ag-108m(pCi/L)	-0.727	1.87	3.23	1-Apr-04
MW-113S	Ag-108m(pCi/L)	1.57	1.42	2.1	19-Jul-04
MW-113S	Ag-108m(pCi/L)	0.542	1.6	3.05	19-Oct-04
MW-113S	Ag-110m(pCi/L)	2.6	5.6	10	23-Jun-03
MW-113S	Am-241 (gamma)(pCi/L)	-12.4	22	38	1-Feb-02
MW-113S	Am-241 (gamma)(pCi/L)	0.965	4.69	8.51	29-Jul-02
MW-113S	Am-241 (gamma)(pCi/L)	-0.27	5.35	9.25	29-Aug-02
MW-113S	Am-241 (gamma)(pCi/L)	-3.41	3.27	4.91	7-Nov-02
MW-113S	Am-241 (gamma)(pCi/L)	-1.4	6.68	11.5	23-Jan-03
MW-113S	Am-241 (gamma)(pCi/L)	0.245	5.12	9.05	8-May-03
MW-113S	Am-241 (gamma)(pCi/L)	3.5	10.9	19.4	22-Nov-03
MW-113S	Am-241 (gamma)(pCi/L)	-1.41	14	24.2	19-Jan-04
MW-113S	Am-241 (gamma)(pCi/L)	0.435	15.2	26.7	1-Apr-04
MW-113S	Am-241 (gamma)(pCi/L)	-0.0669	7.55	12.2	19-Jul-04
MW-113S	Am-241(pCi/L)	-0.0131	0.0679	0.248	5-Apr-04
MW-113S	Am-241-gamma(pCi/L)	1.9	15.6	24.2	19-Oct-04
MW-113S	Ba-140(pCi/L)	-35	26	79	23-Jun-03
MW-113S	Be-7(pCi/L)	43	44	67	23-Jun-03
MW-113S	Boron(ug/L)	110	-	0.54	26-Jul-04
MW-113S	Boron(ug/L)	130	-	0.54	29-Oct-04
MW-113S	Ce-141(pCi/L)	2.2	12	21	23-Jun-03
MW-113S	Ce-144(pCi/L)	-9	26	47	23-Jun-03
MW-113S	Co-57(pCi/L)	8	28	48	23-Jun-03
MW-113S	Co-58(pCi/L)	-4	6.4	14	23-Jun-03
MW-113S	Co-60(pCi/L)	-0.398	6.6	13	1-Feb-02
MW-113S	Co-60(pCi/L)	2.09	2.21	5.27	29-Jul-02

Table A-1
Peninsula Evaluation
Laboratory Analytical Data Reported for Groundwater From HNP Peninsula Wells
Connecticut Yankee Haddam Neck Plant
Haddam Neck, CT

Well ID	Nuclide/Analyte (unit)	Net Concentration	2-Sigma TPU	Actual MDC	Analysis Date
MW-113S	Co-60(pCi/L)	0.935	1.94	3.74	29-Aug-02
MW-113S	Co-60(pCi/L)	-0.055	1.59	2.96	7-Nov-02
MW-113S	Co-60(pCi/L)	0.957	2.01	3.93	23-Jan-03
MW-113S	Co-60(pCi/L)	2.09	2.29	5.31	8-May-03
MW-113S	Co-60(pCi/L)	2.7	4.2	7.2	23-Jun-03
MW-113S	Co-60(pCi/L)	0.587	2.42	5.05	22-Nov-03
MW-113S	Co-60(pCi/L)	-1.92	5.18	9.29	19-Jan-04
MW-113S	Co-60(pCi/L)	-0.406	2.22	3.99	1-Apr-04
MW-113S	Co-60(pCi/L)	2.58	2.8	4.55	19-Jul-04
MW-113S	Co-60(pCi/L)	0.923	1.73	3.62	19-Oct-04
MW-113S	Cr-51(pCi/L)	-22	74	140	23-Jun-03
MW-113S	Cs-134(pCi/L)	3.25	6.4	13	1-Feb-02
MW-113S	Cs-134(pCi/L)	0.0822	1.89	3.41	29-Aug-02
MW-113S	Cs-134(pCi/L)	1.79	1.75	3.47	7-Nov-02
MW-113S	Cs-134(pCi/L)	0.135	1.87	3.41	23-Jan-03
MW-113S	Cs-134(pCi/L)	1.58	2.48	5.1	8-May-03
MW-113S	Cs-134(pCi/L)	2.3	4.6	8.1	23-Jun-03
MW-113S	Cs-134(pCi/L)	0.0732	3.62	6.59	22-Nov-03
MW-113S	Cs-134(pCi/L)	-4.62	5.59	9.01	19-Jan-04
MW-113S	Cs-134(pCi/L)	-0.614	1.95	3.33	1-Apr-04
MW-113S	Cs-134(pCi/L)	0.548	1.36	2.52	19-Jul-04
MW-113S	Cs-134(pCi/L)	0.324	2.02	3.73	19-Oct-04
MW-113S	Cs-137(pCi/L)	2.9	6.9	14	1-Feb-02
MW-113S	Cs-137(pCi/L)	0.672	2.12	4.17	29-Jul-02
MW-113S	Cs-137(pCi/L)	-0.559	1.77	3.04	29-Aug-02
MW-113S	Cs-137(pCi/L)	-0.633	1.69	2.94	7-Nov-02
MW-113S	Cs-137(pCi/L)	1.06	1.9	3.51	23-Jan-03
MW-113S	Cs-137(pCi/L)	-1.76	1.59	2.32	8-May-03
MW-113S	Cs-137(pCi/L)	-3.3	4.6	9.7	23-Jun-03
MW-113S	Cs-137(pCi/L)	-1.01	2.26	4	22-Nov-03
MW-113S	Cs-137(pCi/L)	3.38	4.53	9.04	19-Jan-04
MW-113S	Cs-137(pCi/L)	-0.281	1.8	3.16	1-Apr-04
MW-113S	Cs-137(pCi/L)	-0.106	1.27	2.26	19-Jul-04
MW-113S	Cs-137(pCi/L)	-0.496	1.86	3.28	19-Oct-04
MW-113S	Eu-152(pCi/L)	8.76	18	35	1-Feb-02
MW-113S	Eu-152(pCi/L)	-1.9	6.01	10.5	29-Jul-02
MW-113S	Eu-152(pCi/L)	1.53	4.34	7.73	29-Aug-02
MW-113S	Eu-152(pCi/L)	1.5	3.42	6.28	7-Nov-02
MW-113S	Eu-152(pCi/L)	3.08	4.32	8.01	23-Jan-03
MW-113S	Eu-152(pCi/L)	-1.01	5.69	9.94	8-May-03
MW-113S	Eu-152(pCi/L)	-1.1	9.4	17	23-Jun-03
MW-113S	Eu-152(pCi/L)	-1.99	6.74	11.7	22-Nov-03
MW-113S	Eu-152(pCi/L)	-5.47	12.5	21	19-Jan-04
MW-113S	Eu-152(pCi/L)	5.93	5.03	9.81	1-Apr-04
MW-113S	Eu-152(pCi/L)	3.33	3.7	6.6	19-Jul-04
MW-113S	Eu-152(pCi/L)	-0.713	5.87	9.94	19-Oct-04
MW-113S	Eu-154(pCi/L)	4.4	16	34	1-Feb-02
MW-113S	Eu-154(pCi/L)	8.12	8.28	18.1	29-Jul-02
MW-113S	Eu-154(pCi/L)	-1.07	5.59	9.92	29-Aug-02

Table A-1
Peninsula Evaluation
Laboratory Analytical Data Reported for Groundwater From HNP Peninsula Wells
Connecticut Yankee Haddam Neck Plant
Haddam Neck, CT

Well ID	Nuclide/Analyte (unit)	Net Concentration	2-Sigma TPU	Actual MDC	Analysis Date
MW-113S	Eu-154(pCi/L)	1.15	4.58	8.83	7-Nov-02
MW-113S	Eu-154(pCi/L)	2.41	5.32	10.5	23-Jan-03
MW-113S	Eu-154(pCi/L)	0.461	6.31	12.7	8-May-03
MW-113S	Eu-154(pCi/L)	-7.8	12.4	29	23-Jun-03
MW-113S	Eu-154(pCi/L)	-2.28	6.68	12.3	22-Nov-03
MW-113S	Eu-154(pCi/L)	-10.2	11	16.6	19-Jan-04
MW-113S	Eu-154(pCi/L)	0.512	4.77	9.21	1-Apr-04
MW-113S	Eu-154(pCi/L)	-1.33	3.85	6.49	19-Jul-04
MW-113S	Eu-154(pCi/L)	1.12	5.24	10.3	19-Oct-04
MW-113S	Eu-155(pCi/L)	-10.3	25	42	1-Feb-02
MW-113S	Eu-155(pCi/L)	4.75	4.32	8.5	29-Jul-02
MW-113S	Eu-155(pCi/L)	1.83	3.92	6.85	29-Aug-02
MW-113S	Eu-155(pCi/L)	-0.47	2.59	4.57	7-Nov-02
MW-113S	Eu-155(pCi/L)	0.629	3.48	6.3	23-Jan-03
MW-113S	Eu-155(pCi/L)	-5.38	3.89	5.83	8-May-03
MW-113S	Eu-155(pCi/L)	4.9	12.2	21	23-Jun-03
MW-113S	Eu-155(pCi/L)	3.54	5.83	10.9	22-Nov-03
MW-113S	Eu-155(pCi/L)	1.68	10.5	18.8	19-Jan-04
MW-113S	Eu-155(pCi/L)	-1.5	6.98	11.9	1-Apr-04
MW-113S	Eu-155(pCi/L)	-0.381	4.84	8.41	19-Jul-04
MW-113S	Eu-155(pCi/L)	5.65	7.51	13.9	19-Oct-04
MW-113S	Fe-59(pCi/L)	3.8	12.2	23	23-Jun-03
MW-113S	Gross Alpha(pCi/L)	2.95	1.76	1.87	6-Nov-02
MW-113S	Gross Alpha(pCi/L)	1.82	0.936	1.02	21-Jan-03
MW-113S	Gross Alpha(pCi/L)	0.892	0.82	1.34	8-May-03
MW-113S	Gross Alpha(pCi/L)	0.3	1.68	3.2	23-Jun-03
MW-113S	Gross Alpha(pCi/L)	1.38	1.62	3.12	22-Nov-03
MW-113S	Gross Alpha(pCi/L)	0.668	0.833	1.53	14-Jan-04
MW-113S	Gross Alpha(pCi/L)	0.542	0.963	1.93	22-Apr-04
MW-113S	Gross Alpha(pCi/L)	0.989	1.26	2.38	22-Jul-04
MW-113S	Gross Alpha(pCi/L)	0.347	1.36	2.88	19-Oct-04
MW-113S	Gross Beta(pCi/L)	31.4	5.59	3.63	6-Nov-02
MW-113S	Gross Beta(pCi/L)	30.3	5.26	3.4	20-Jan-03
MW-113S	Gross Beta(pCi/L)	23.4	4.12	2.81	7-May-03
MW-113S	Gross Beta(pCi/L)	16.8	3.2	2.9	23-Jun-03
MW-113S	Gross Beta(pCi/L)	23.4	4.08	3.12	22-Nov-03
MW-113S	Gross Beta(pCi/L)	22.7	3.98	2.94	12-Jan-04
MW-113S	Gross Beta(pCi/L)	16.3	2.07	2.73	22-Apr-04
MW-113S	Gross Beta(pCi/L)	8.3	1.79	2.54	22-Jul-04
MW-113S	Gross Beta(pCi/L)	17.5	1.97	2.3	19-Oct-04
MW-113S	H-3(pCi/L)	-111	130	240	11-Feb-02
MW-113S	H-3(pCi/L)	166	179	272	28-Jul-02
MW-113S	H-3(pCi/L)	159	170	263	18-Aug-02
MW-113S	H-3(pCi/L)	160	126	278	21-Nov-02
MW-113S	H-3(pCi/L)	83.2	126	290	25-Jan-03
MW-113S	H-3(pCi/L)	149	114	248	1-May-03
MW-113S	H-3(pCi/L)	-150	220	340	23-Jun-03
MW-113S	H-3(pCi/L)	118	113	252	9-Nov-03
MW-113S	H-3(pCi/L)	215	123	246	1-Jan-04

Table A-1
Peninsula Evaluation
Laboratory Analytical Data Reported for Groundwater From HNP Peninsula Wells
Connecticut Yankee Haddam Neck Plant
Haddam Neck, CT

Well ID	Nuclide/Analyte (unit)	Net Concentration	2-Sigma TPU	Actual MDC	Analysis Date
MW-113S	H-3(pCi/L)	30.6	157	260	5-Apr-04
MW-113S	H-3(pCi/L)	180	163	263	19-Jul-04
MW-113S	H-3(pCi/L)	141	167	272	8-Oct-04
MW-113S	I-131(pCi/L)	-56	82	170	23-Jun-03
MW-113S	K-40(pCi/L)	-5	48	100	23-Jun-03
MW-113S	La-140(pCi/L)	-41	30	91	23-Jun-03
MW-113S	Mn-54(pCi/L)	1.61	5.3	11	1-Feb-02
MW-113S	Mn-54(pCi/L)	1.22	2.98	5.85	29-Jul-02
MW-113S	Mn-54(pCi/L)	0.172	1.89	3.41	29-Aug-02
MW-113S	Mn-54(pCi/L)	0.0113	1.75	3.13	7-Nov-02
MW-113S	Mn-54(pCi/L)	0.5	1.97	3.6	23-Jan-03
MW-113S	Mn-54(pCi/L)	0.976	1.87	3.95	8-May-03
MW-113S	Mn-54(pCi/L)	1.1	4.4	8.2	23-Jun-03
MW-113S	Mn-54(pCi/L)	1.79	2.53	5.2	22-Nov-03
MW-113S	Mn-54(pCi/L)	2.53	5.04	9.84	19-Jan-04
MW-113S	Mn-54(pCi/L)	2.64	2	2.83	1-Apr-04
MW-113S	Mn-54(pCi/L)	-0.167	1.33	2.32	19-Jul-04
MW-113S	Mn-54(pCi/L)	0.458	2.01	3.68	19-Oct-04
MW-113S	Nb-94(pCi/L)	3.14	6	12	1-Feb-02
MW-113S	Nb-94(pCi/L)	-0.0919	2.19	4.14	29-Jul-02
MW-113S	Nb-94(pCi/L)	1.91	1.65	3.24	29-Aug-02
MW-113S	Nb-94(pCi/L)	-0.153	1.4	2.55	7-Nov-02
MW-113S	Nb-94(pCi/L)	-0.036	1.59	2.86	23-Jan-03
MW-113S	Nb-94(pCi/L)	-0.583	2.02	3.7	8-May-03
MW-113S	Nb-94(pCi/L)	-0.8	3.6	7.3	23-Jun-03
MW-113S	Nb-94(pCi/L)	0.892	2.17	4.36	22-Nov-03
MW-113S	Nb-94(pCi/L)	2.14	4.75	9.32	19-Jan-04
MW-113S	Nb-94(pCi/L)	2.78	2.4	3.39	1-Apr-04
MW-113S	Nb-94(pCi/L)	0.713	1.24	2.28	19-Jul-04
MW-113S	Nb-94(pCi/L)	0.312	1.79	3.27	19-Oct-04
MW-113S	Nb-95(pCi/L)	-6.4	8.6	19	23-Jun-03
MW-113S	Ru-103(pCi/L)	-1.4	7.4	14	23-Jun-03
MW-113S	Ru-106(pCi/L)	11	36	67	23-Jun-03
MW-113S	Sb-124(pCi/L)	13.6	16.4	25	23-Jun-03
MW-113S	Sb-125(pCi/L)	2.54	18	33	1-Feb-02
MW-113S	Sb-125(pCi/L)	-2.9	11.8	23	23-Jun-03
MW-113S	Se-75(pCi/L)	1.6	5.6	9.8	23-Jun-03
MW-113S	Sr-89(pCi/L)	-9.7	18.4	44	23-Jun-03
MW-113S	Sr-90(pCi/L)	0.66	1.04	1.7	23-Jun-03
MW-113S	Sr-90(pCi/L)	0.579	0.308	0.562	23-Nov-03
MW-113S	Sr-90(pCi/L)	0.838	0.418	0.719	16-Jan-04
MW-113S	Sr-90(pCi/L)	0.373	0.354	0.739	6-Apr-04
MW-113S	Sr-90(pCi/L)	0.665	0.602	1.23	13-Jul-04
MW-113S	Sr-90(pCi/L)	0.217	0.359	0.802	14-Oct-04
MW-113S	Total U(pCi/L)	0.0716	0.0108	0.00978	19-Jan-04
MW-113S	Zn-65(pCi/L)	1.3	11.2	21	23-Jun-03
MW-113S	Zr-95(pCi/L)	0.2	8.6	17	23-Jun-03
MW-117S	AcTh-228(pCi/L)	-5.7	18	36	23-Jun-03
MW-117S	Ag-108m(pCi/L)	1.63	1.39	2.62	7-Nov-02

Table A-1
Peninsula Evaluation
Laboratory Analytical Data Reported for Groundwater From HNP Peninsula Wells
Connecticut Yankee Haddam Neck Plant
Haddam Neck, CT

Well ID	Nuclide/Analyte (unit)	Net Concentration	2-Sigma TPU	Actual MDC	Analysis Date
MW-117S	Ag-108m(pCi/L)	-0.699	1.39	2.31	23-Jan-03
MW-117S	Ag-108m(pCi/L)	-0.295	1.87	3.33	8-May-03
MW-117S	Ag-108m(pCi/L)	-0.6	3	6	23-Jun-03
MW-117S	Ag-108m(pCi/L)	0.698	1.69	3.29	22-Nov-03
MW-117S	Ag-108m(pCi/L)	0.475	2.95	5.5	21-Jan-04
MW-117S	Ag-108m(pCi/L)	0.603	2.27	3.92	1-Apr-04
MW-117S	Ag-108m(pCi/L)	-0.686	2.03	3.04	4-Aug-04
MW-117S	Ag-108m(pCi/L)	-0.51	1.24	2.13	17-Oct-04
MW-117S	Ag-110m(pCi/L)	-5	7.4	15	23-Jun-03
MW-117S	Am-241 (gamma)(pCi/L)	-9.08	28	49	1-Feb-02
MW-117S	Am-241 (gamma)(pCi/L)	-0.842	6.3	11.2	29-Jul-02
MW-117S	Am-241 (gamma)(pCi/L)	2.18	2.98	5.5	29-Aug-02
MW-117S	Am-241 (gamma)(pCi/L)	0.435	5.57	9.42	7-Nov-02
MW-117S	Am-241 (gamma)(pCi/L)	0.61	5.36	9.23	23-Jan-03
MW-117S	Am-241 (gamma)(pCi/L)	-5.34	8.03	13.2	8-May-03
MW-117S	Am-241 (gamma)(pCi/L)	-5.22	5.44	8.66	22-Nov-03
MW-117S	Am-241 (gamma)(pCi/L)	-17.9	16.5	22.8	1-Apr-04
MW-117S	Am-241 (gamma)(pCi/L)	-2.76	18.3	27.5	4-Aug-04
MW-117S	Am-241(pCi/L)	-0.0415	0.0364	0.27	5-Apr-04
MW-117S	Am-241-gamma(pCi/L)	0.857	9.09	13.5	17-Oct-04
MW-117S	Ba-140(pCi/L)	10	24	47	23-Jun-03
MW-117S	Be-7(pCi/L)	-13	46	90	23-Jun-03
MW-117S	Boron(ug/L)	68.5	-	0.54	22-Jul-04
MW-117S	Boron(ug/L)	71.8	-	0.54	22-Oct-04
MW-117S	Ce-141(pCi/L)	-10.1	12.6	24	23-Jun-03
MW-117S	Ce-144(pCi/L)	-19	28	52	23-Jun-03
MW-117S	Co-57(pCi/L)	14	28	47	23-Jun-03
MW-117S	Co-58(pCi/L)	-2	5.6	12	23-Jun-03
MW-117S	Co-60(pCi/L)	-5.13	6	11	1-Feb-02
MW-117S	Co-60(pCi/L)	-2.33	3.42	5.61	29-Jul-02
MW-117S	Co-60(pCi/L)	-0.454	1.97	3.51	29-Aug-02
MW-117S	Co-60(pCi/L)	2.76	1.86	3.94	7-Nov-02
MW-117S	Co-60(pCi/L)	2.44	2.01	4.11	23-Jan-03
MW-117S	Co-60(pCi/L)	0.508	2.65	5.23	8-May-03
MW-117S	Co-60(pCi/L)	-3.3	5	11	23-Jun-03
MW-117S	Co-60(pCi/L)	-0.0708	1.99	4.04	22-Nov-03
MW-117S	Co-60(pCi/L)	-2.08	4.05	7.18	21-Jan-04
MW-117S	Co-60(pCi/L)	-1.42	2.34	4.01	1-Apr-04
MW-117S	Co-60(pCi/L)	2.12	2.22	4.71	4-Aug-04
MW-117S	Co-60(pCi/L)	-0.647	1.42	2.39	17-Oct-04
MW-117S	Cr-51(pCi/L)	-26	90	170	23-Jun-03
MW-117S	Cs-134(pCi/L)	-3.71	5.2	8.6	1-Feb-02
MW-117S	Cs-134(pCi/L)	-0.357	1.93	3.39	29-Aug-02
MW-117S	Cs-134(pCi/L)	-1.5	1.99	3.25	7-Nov-02
MW-117S	Cs-134(pCi/L)	1.22	1.92	3.61	23-Jan-03
MW-117S	Cs-134(pCi/L)	-1.71	2.98	5.07	8-May-03
MW-117S	Cs-134(pCi/L)	0.6	4.2	7.9	23-Jun-03
MW-117S	Cs-134(pCi/L)	1.36	2.36	4.87	22-Nov-03
MW-117S	Cs-134(pCi/L)	-2.14	3.81	6.44	21-Jan-04

Table A-1
Peninsula Evaluation
Laboratory Analytical Data Reported for Groundwater From HNP Peninsula Wells
Connecticut Yankee Haddam Neck Plant
Haddam Neck, CT

Well ID	Nuclide/Analyte (unit)	Net Concentration	2-Sigma TPU	Actual MDC	Analysis Date
MW-117S	Cs-134(pCi/L)	1.65	2.3	4.45	1-Apr-04
MW-117S	Cs-134(pCi/L)	0.0363	1.96	3.54	4-Aug-04
MW-117S	Cs-134(pCi/L)	0.316	1.45	2.54	17-Oct-04
MW-117S	Cs-137(pCi/L)	-4.64	5.8	9.3	1-Feb-02
MW-117S	Cs-137(pCi/L)	0.727	2.42	4.84	29-Jul-02
MW-117S	Cs-137(pCi/L)	-0.799	1.48	2.47	29-Aug-02
MW-117S	Cs-137(pCi/L)	-0.998	2.01	3.43	7-Nov-02
MW-117S	Cs-137(pCi/L)	-0.58	1.86	3.21	23-Jan-03
MW-117S	Cs-137(pCi/L)	-0.898	2.51	4.38	8-May-03
MW-117S	Cs-137(pCi/L)	-3.5	4.2	9.3	23-Jun-03
MW-117S	Cs-137(pCi/L)	0.645	2.13	4.21	22-Nov-03
MW-117S	Cs-137(pCi/L)	-1.5	3.85	6.78	21-Jan-04
MW-117S	Cs-137(pCi/L)	-2.67	2.36	3.76	1-Apr-04
MW-117S	Cs-137(pCi/L)	-0.372	2.37	4.08	4-Aug-04
MW-117S	Cs-137(pCi/L)	1.2	1.22	2.3	17-Oct-04
MW-117S	Eu-152(pCi/L)	-2.4	14	24	1-Feb-02
MW-117S	Eu-152(pCi/L)	5.49	7.27	14	29-Jul-02
MW-117S	Eu-152(pCi/L)	2.51	3.66	6.85	29-Aug-02
MW-117S	Eu-152(pCi/L)	-0.179	4.15	7.13	7-Nov-02
MW-117S	Eu-152(pCi/L)	-1.78	4.32	7.31	23-Jan-03
MW-117S	Eu-152(pCi/L)	-1.8	6.32	10.9	8-May-03
MW-117S	Eu-152(pCi/L)	5.7	9.8	17	23-Jun-03
MW-117S	Eu-152(pCi/L)	0.0293	5.85	10.4	22-Nov-03
MW-117S	Eu-152(pCi/L)	7.67	9.71	19	21-Jan-04
MW-117S	Eu-152(pCi/L)	3.21	7.2	12.6	1-Apr-04
MW-117S	Eu-152(pCi/L)	-0.0575	6.31	11.2	4-Aug-04
MW-117S	Eu-152(pCi/L)	1.42	3.98	6.72	17-Oct-04
MW-117S	Eu-154(pCi/L)	3.04	13	25	1-Feb-02
MW-117S	Eu-154(pCi/L)	-5.44	10	17.1	29-Jul-02
MW-117S	Eu-154(pCi/L)	0.194	4.56	8.59	29-Aug-02
MW-117S	Eu-154(pCi/L)	1.04	4.71	8.91	7-Nov-02
MW-117S	Eu-154(pCi/L)	-1.06	5.56	9.79	23-Jan-03
MW-117S	Eu-154(pCi/L)	-1.44	7.07	13.1	8-May-03
MW-117S	Eu-154(pCi/L)	2.7	11.8	23	23-Jun-03
MW-117S	Eu-154(pCi/L)	0.685	5.56	11.6	22-Nov-03
MW-117S	Eu-154(pCi/L)	4.68	10.5	23.4	21-Jan-04
MW-117S	Eu-154(pCi/L)	0.292	4.71	9.27	1-Apr-04
MW-117S	Eu-154(pCi/L)	2.22	5.7	11.4	4-Aug-04
MW-117S	Eu-154(pCi/L)	3.79	3.98	6.23	17-Oct-04
MW-117S	Eu-155(pCi/L)	5.89	16	29	1-Feb-02
MW-117S	Eu-155(pCi/L)	1.31	4.79	8.79	29-Jul-02
MW-117S	Eu-155(pCi/L)	0.278	2.77	4.8	29-Aug-02
MW-117S	Eu-155(pCi/L)	4.43	3.97	7.15	7-Nov-02
MW-117S	Eu-155(pCi/L)	-2.26	3.8	6.38	23-Jan-03
MW-117S	Eu-155(pCi/L)	5.06	5.6	10.4	8-May-03
MW-117S	Eu-155(pCi/L)	-3.2	13.2	24	23-Jun-03
MW-117S	Eu-155(pCi/L)	0.321	4.03	7.39	22-Nov-03
MW-117S	Eu-155(pCi/L)	-2.4	6.45	11.3	21-Jan-04
MW-117S	Eu-155(pCi/L)	-4.09	8.64	15	1-Apr-04

Table A-1
Peninsula Evaluation
Laboratory Analytical Data Reported for Groundwater From HNP Peninsula Wells
Connecticut Yankee Haddam Neck Plant
Haddam Neck, CT

Well ID	Nuclide/Analyte (unit)	Net Concentration	2-Sigma TPU	Actual MDC	Analysis Date
MW-117S	Eu-155(pCi/L)	-2.22	9.14	15.1	4-Aug-04
MW-117S	Eu-155(pCi/L)	-0.664	4.56	7.92	17-Oct-04
MW-117S	Fe-59(pCi/L)	-5.2	11.6	26	23-Jun-03
MW-117S	Gross Alpha(pCi/L)	1.59	1.07	1.26	6-Nov-02
MW-117S	Gross Alpha(pCi/L)	0.715	0.759	1.27	21-Jan-03
MW-117S	Gross Alpha(pCi/L)	0.902	0.833	1.34	7-May-03
MW-117S	Gross Alpha(pCi/L)	3.8	2.2	2.9	23-Jun-03
MW-117S	Gross Alpha(pCi/L)	0.467	1.02	2.25	22-Nov-03
MW-117S	Gross Alpha(pCi/L)	1.31	1.31	2.24	22-Jan-04
MW-117S	Gross Alpha(pCi/L)	1.21	1.49	2.97	22-Apr-04
MW-117S	Gross Alpha(pCi/L)	0.41	0.837	1.44	29-Jul-04
MW-117S	Gross Alpha(pCi/L)	0.425	0.678	1.33	14-Oct-04
MW-117S	Gross Beta(pCi/L)	8.36	2.28	3.05	6-Nov-02
MW-117S	Gross Beta(pCi/L)	7.66	2.11	2.86	20-Jan-03
MW-117S	Gross Beta(pCi/L)	8.13	2.24	3.05	7-May-03
MW-117S	Gross Beta(pCi/L)	11.66	1.94	2.1	23-Jun-03
MW-117S	Gross Beta(pCi/L)	9.49	2.77	3.97	22-Nov-03
MW-117S	Gross Beta(pCi/L)	9.65	2.78	3.96	20-Jan-04
MW-117S	Gross Beta(pCi/L)	5.41	1.8	3.23	22-Apr-04
MW-117S	Gross Beta(pCi/L)	7.28	1.55	2.3	29-Jul-04
MW-117S	Gross Beta(pCi/L)	6.91	1.42	2.17	14-Oct-04
MW-117S	H-3(pCi/L)	-234	120	240	11-Feb-02
MW-117S	H-3(pCi/L)	-74.6	156	272	28-Jul-02
MW-117S	H-3(pCi/L)	107	165	261	18-Aug-02
MW-117S	H-3(pCi/L)	99.1	122	279	21-Nov-02
MW-117S	H-3(pCi/L)	34	123	294	25-Jan-03
MW-117S	H-3(pCi/L)	61.5	109	249	1-May-03
MW-117S	H-3(pCi/L)	-80	220	340	23-Jun-03
MW-117S	H-3(pCi/L)	55.3	110	253	9-Nov-03
MW-117S	H-3(pCi/L)	31.1	112	255	14-Jan-04
MW-117S	H-3(pCi/L)	33.3	171	283	4-Apr-04
MW-117S	H-3(pCi/L)	25.1	194	324	30-Jul-04
MW-117S	H-3(pCi/L)	140	215	352	7-Oct-04
MW-117S	I-131(pCi/L)	-20	108	200	23-Jun-03
MW-117S	K-40(pCi/L)	-37	40	100	23-Jun-03
MW-117S	La-140(pCi/L)	12	28	54	23-Jun-03
MW-117S	Mn-54(pCi/L)	-0.196	4.6	8.5	1-Feb-02
MW-117S	Mn-54(pCi/L)	0.635	3.55	6.93	29-Jul-02
MW-117S	Mn-54(pCi/L)	-0.735	1.92	3.27	29-Aug-02
MW-117S	Mn-54(pCi/L)	0.0975	2.01	3.56	7-Nov-02
MW-117S	Mn-54(pCi/L)	-0.499	1.8	3.16	23-Jan-03
MW-117S	Mn-54(pCi/L)	1.6	2.98	5.74	8-May-03
MW-117S	Mn-54(pCi/L)	-0.4	3.8	7.7	23-Jun-03
MW-117S	Mn-54(pCi/L)	-1.04	2.24	3.85	22-Nov-03
MW-117S	Mn-54(pCi/L)	2.62	3.35	7.51	21-Jan-04
MW-117S	Mn-54(pCi/L)	-0.03	2.5	3.89	1-Apr-04
MW-117S	Mn-54(pCi/L)	-1.04	2.18	3.83	4-Aug-04
MW-117S	Mn-54(pCi/L)	-0.0955	1.6	2.36	17-Oct-04
MW-117S	Nb-94(pCi/L)	-4.63	4.6	7.5	1-Feb-02

Table A-1
Peninsula Evaluation
Laboratory Analytical Data Reported for Groundwater From HNP Peninsula Wells
Connecticut Yankee Haddam Neck Plant
Haddam Neck, CT

Well ID	Nuclide/Analyte (unit)	Net Concentration	2-Sigma TPU	Actual MDC	Analysis Date
MW-117S	Nb-94(pCi/L)	0.368	2.31	4.63	29-Jul-02
MW-117S	Nb-94(pCi/L)	-0.0923	1.44	2.58	29-Aug-02
MW-117S	Nb-94(pCi/L)	0.2	1.61	2.95	7-Nov-02
MW-117S	Nb-94(pCi/L)	0.00816	1.67	3	23-Jan-03
MW-117S	Nb-94(pCi/L)	0.72	2.6	4.93	8-May-03
MW-117S	Nb-94(pCi/L)	2.4	3.4	5.5	23-Jun-03
MW-117S	Nb-94(pCi/L)	-1.41	2.07	3.5	22-Nov-03
MW-117S	Nb-94(pCi/L)	1.23	3.36	7	21-Jan-04
MW-117S	Nb-94(pCi/L)	0.259	1.91	3.48	1-Apr-04
MW-117S	Nb-94(pCi/L)	1.22	1.93	3.64	4-Aug-04
MW-117S	Nb-94(pCi/L)	-0.0533	1.2	2.07	17-Oct-04
MW-117S	Nb-95(pCi/L)	0.3	7.4	14	23-Jun-03
MW-117S	Ru-103(pCi/L)	2.5	5.6	9.9	23-Jun-03
MW-117S	Ru-106(pCi/L)	1	38	73	23-Jun-03
MW-117S	Sb-124(pCi/L)	-7.4	14.8	35	23-Jun-03
MW-117S	Sb-125(pCi/L)	3.66	13	23	1-Feb-02
MW-117S	Sb-125(pCi/L)	3.6	11.6	21	23-Jun-03
MW-117S	Se-75(pCi/L)	-3.2	5.6	11	23-Jun-03
MW-117S	Sr-89(pCi/L)	-1	20	45	23-Jun-03
MW-117S	Sr-90(pCi/L)	1.28	0.602	0.812	24-Jan-03
MW-117S	Sr-90(pCi/L)	1.41	0.882	1.53	7-May-03
MW-117S	Sr-90(pCi/L)	1.4	1.08	1.7	23-Jun-03
MW-117S	Sr-90(pCi/L)	1.42	0.443	0.57	23-Nov-03
MW-117S	Sr-90(pCi/L)	0.765	0.331	0.512	18-Jan-04
MW-117S	Sr-90(pCi/L)	0.196	0.457	1.09	6-Apr-04
MW-117S	Sr-90(pCi/L)	0.791	0.516	0.952	17-Jul-04
MW-117S	Sr-90(pCi/L)	0.813	0.617	1.18	14-Oct-04
MW-117S	Total U(pCi/L)	0.0073	0.00113	0.00978	30-Jan-04
MW-117S	Zn-65(pCi/L)	17	20	34	23-Jun-03
MW-117S	Zr-95(pCi/L)	-3.7	9	19	23-Jun-03
MW-13	Am-241 (gamma)(pCi/L)	1.51	24	42	1-Feb-02
MW-13	Am-241 (gamma)(pCi/L)	0.573	2.89	5.17	29-Jul-02
MW-13	Co-60(pCi/L)	1.4	5.9	13	1-Feb-02
MW-13	Co-60(pCi/L)	1.01	2.24	5.16	29-Jul-02
MW-13	Cs-134(pCi/L)	-2.37	5.8	10	1-Feb-02
MW-13	Cs-137(pCi/L)	-0.0769	6.8	13	1-Feb-02
MW-13	Cs-137(pCi/L)	1.09	2.51	5.02	29-Jul-02
MW-13	Eu-152(pCi/L)	3.03	20	38	1-Feb-02
MW-13	Eu-152(pCi/L)	1.73	5.7	10.9	29-Jul-02
MW-13	Eu-154(pCi/L)	4.97	18	38	1-Feb-02
MW-13	Eu-154(pCi/L)	5.32	8.39	18.3	29-Jul-02
MW-13	Eu-155(pCi/L)	8.87	24	43	1-Feb-02
MW-13	Eu-155(pCi/L)	1.54	4.53	8.06	29-Jul-02
MW-13	H-3(pCi/L)	-189	130	240	11-Feb-02
MW-13	H-3(pCi/L)	-57.7	157	267	28-Jul-02
MW-13	Mn-54(pCi/L)	-1.84	6.3	12	1-Feb-02
MW-13	Mn-54(pCi/L)	0.517	2.81	5.59	29-Jul-02
MW-13	Nb-94(pCi/L)	1.15	6	12	1-Feb-02
MW-13	Nb-94(pCi/L)	1.62	2.39	5.05	29-Jul-02

Table A-1
Peninsula Evaluation
Laboratory Analytical Data Reported for Groundwater From HNP Peninsula Wells
Connecticut Yankee Haddam Neck Plant
Haddam Neck, CT

Well ID	Nuclide/Analyte (unit)	Net Concentration	2-Sigma TPU	Actual MDC	Analysis Date
MW-13	Sb-125(pCi/L)	-0.343	19	34	1-Feb-02
MW-2	Ag-108m(pCi/L)	0.0793	1.33	2.35	23-Jan-03
MW-2	Ag-108m(pCi/L)	0.666	1.61	2.93	4-Aug-04
MW-2	Ag-108m(pCi/L)	-0.0755	1.26	2.13	17-Oct-04
MW-2	Am-241 (gamma)(pCi/L)	0.308	2.11	3.21	23-Jan-03
MW-2	Am-241 (gamma)(pCi/L)	-2.02	9.69	17.3	4-Aug-04
MW-2	Am-241(pCi/L)	-0.00733	0.0147	0.175	30-Jan-03
MW-2	Am-241-gamma(pCi/L)	0.474	7.73	13.3	17-Oct-04
MW-2	Boron(ug/L)	15.5	-	0.54	22-Jul-04
MW-2	Boron(ug/L)	18	-	0.54	22-Oct-04
MW-2	C-14(pCi/L)	-0.481	3.55	7.89	15-Jan-03
MW-2	Cm-242(pCi/L)	0	0.108	0.12	30-Jan-03
MW-2	Cm-243,244(pCi/L)	0	0.0901	0.0997	30-Jan-03
MW-2	Co-60(pCi/L)	-0.0304	1.74	3.26	23-Jan-03
MW-2	Co-60(pCi/L)	1.08	3.74	3.73	4-Aug-04
MW-2	Co-60(pCi/L)	-0.168	1.48	2.62	17-Oct-04
MW-2	Cs-134(pCi/L)	-0.938	2.02	3.42	23-Jan-03
MW-2	Cs-134(pCi/L)	0.129	1.89	3.52	4-Aug-04
MW-2	Cs-134(pCi/L)	0.507	1.44	2.59	17-Oct-04
MW-2	Cs-137(pCi/L)	0.797	1.64	3.09	23-Jan-03
MW-2	Cs-137(pCi/L)	0.322	1.88	3.51	4-Aug-04
MW-2	Cs-137(pCi/L)	1.73	1.3	2.49	17-Oct-04
MW-2	Eu-152(pCi/L)	-0.631	4.22	7.36	23-Jan-03
MW-2	Eu-152(pCi/L)	3.88	5.35	9.78	4-Aug-04
MW-2	Eu-152(pCi/L)	1.72	3.62	6.39	17-Oct-04
MW-2	Eu-154(pCi/L)	3.31	5.19	10.4	23-Jan-03
MW-2	Eu-154(pCi/L)	1.6	4.82	9.56	4-Aug-04
MW-2	Eu-154(pCi/L)	-0.447	3.89	6.94	17-Oct-04
MW-2	Eu-155(pCi/L)	3.25	3.09	5.57	23-Jan-03
MW-2	Eu-155(pCi/L)	-1.68	6.8	11.9	4-Aug-04
MW-2	Eu-155(pCi/L)	1.89	5.17	8.78	17-Oct-04
MW-2	Fe-55(pCi/L)	-8.15	3.68	5.72	1-Feb-03
MW-2	Gross Alpha(pCi/L)	-0.06	0.334	0.967	21-Jan-03
MW-2	Gross Alpha(pCi/L)	0.416	0.66	1.29	28-Jul-04
MW-2	Gross Alpha(pCi/L)	1.04	0.797	1.39	14-Oct-04
MW-2	Gross Beta(pCi/L)	2.75	1.48	2.7	20-Jan-03
MW-2	Gross Beta(pCi/L)	4.43	1.43	2.46	28-Jul-04
MW-2	Gross Beta(pCi/L)	3.47	1.29	2.27	14-Oct-04
MW-2	H-3(pCi/L)	229	134	291	25-Jan-03
MW-2	H-3(pCi/L)	-251	229	397	2-Aug-04
MW-2	H-3(pCi/L)	439	193	300	7-Oct-04
MW-2	Mn-54(pCi/L)	0.453	1.91	3.47	23-Jan-03
MW-2	Mn-54(pCi/L)	-0.154	1.92	3.47	4-Aug-04
MW-2	Mn-54(pCi/L)	0.0633	1.25	2.2	17-Oct-04
MW-2	Nb-94(pCi/L)	-0.987	1.66	2.74	23-Jan-03
MW-2	Nb-94(pCi/L)	1.33	1.66	3.28	4-Aug-04
MW-2	Nb-94(pCi/L)	-0.922	1.14	1.89	17-Oct-04
MW-2	Ni-63(pCi/L)	1.51	2.75	3.83	1-Feb-03
MW-2	Pu-238(pCi/L)	0.0295	0.0753	0.176	23-Jan-03

Table A-1
Peninsula Evaluation
Laboratory Analytical Data Reported for Groundwater From HNP Peninsula Wells
Connecticut Yankee Haddam Neck Plant
Haddam Neck, CT

Well ID	Nuclide/Analyte (unit)	Net Concentration	2-Sigma TPU	Actual MDC	Analysis Date
MW-2	Pu-239,240(pCi/L)	0	0.0902	0.0998	23-Jan-03
MW-2	Pu-241(pCi/L)	11.2	3.62	6.34	31-Jan-03
MW-2	Sr-90(pCi/L)	0.413	0.315	0.539	24-Jan-03
MW-2	Sr-90(pCi/L)	-0.131	0.374	1.02	17-Jul-04
MW-2	Tc-99(pCi/L)	2.65	8.06	11.4	24-Jan-03
MW-3	Ag-108m(pCi/L)	0.574	1.45	2.58	19-Jul-04
MW-3	Ag-108m(pCi/L)	0.548	1.59	2.68	17-Oct-04
MW-3	Am-241 (gamma)(pCi/L)	-12.4	17.4	19.3	19-Jul-04
MW-3	Am-241-gamma(pCi/L)	3.79	9.42	15.6	17-Oct-04
MW-3	Boron(ug/L)	5.67	-	0.54	26-Jul-04
MW-3	Boron(ug/L)	7.95	-	0.54	22-Oct-04
MW-3	Co-60(pCi/L)	0.383	1.49	2.78	19-Jul-04
MW-3	Co-60(pCi/L)	1.11	1.51	2.69	17-Oct-04
MW-3	Cs-134(pCi/L)	0.0365	1.69	2.9	19-Jul-04
MW-3	Cs-134(pCi/L)	-0.1	1.65	2.86	17-Oct-04
MW-3	Cs-137(pCi/L)	-0.627	1.48	2.47	19-Jul-04
MW-3	Cs-137(pCi/L)	1.14	1.5	2.76	17-Oct-04
MW-3	Eu-152(pCi/L)	-0.884	4.31	7.42	19-Jul-04
MW-3	Eu-152(pCi/L)	-2.57	4.64	7.54	17-Oct-04
MW-3	Eu-154(pCi/L)	-2.25	4.05	6.85	19-Jul-04
MW-3	Eu-154(pCi/L)	-0.879	3.67	6.56	17-Oct-04
MW-3	Eu-155(pCi/L)	-1.4	6.34	10.4	19-Jul-04
MW-3	Eu-155(pCi/L)	2.81	5.86	10.4	17-Oct-04
MW-3	Gross Alpha(pCi/L)	-0.168	0.763	1.81	26-Jul-04
MW-3	Gross Alpha(pCi/L)	0.483	0.954	1.93	14-Oct-04
MW-3	Gross Beta(pCi/L)	0.788	0.765	1.49	26-Jul-04
MW-3	Gross Beta(pCi/L)	1.53	1.33	2.58	14-Oct-04
MW-3	H-3(pCi/L)	15.6	147	245	20-Jul-04
MW-3	H-3(pCi/L)	100	167	274	7-Oct-04
MW-3	Mn-54(pCi/L)	0.202	1.39	2.55	19-Jul-04
MW-3	Mn-54(pCi/L)	-1.81	1.42	2.2	17-Oct-04
MW-3	Nb-94(pCi/L)	-0.436	1.4	2.34	19-Jul-04
MW-3	Nb-94(pCi/L)	0.611	1.32	2.38	17-Oct-04
MW-3	Sr-90(pCi/L)	0.582	0.599	1.24	13-Jul-04
Supply Well B	Sr-90(pCi/L)	1.02	0.35	0.45	30-Jan-02
Supply Well B	Sr-90(pCi/L)	0.199	0.289	0.579	24-Jan-03
Supply Well E	Sr-90(pCi/L)	0.366	0.34	0.56	30-Jan-02
TW-1	Am-241 (gamma)(pCi/L)	5.25	14	26	1-Feb-02
TW-1	Am-241 (gamma)(pCi/L)	-0.569	9.48	16.5	29-Jul-02
TW-1	Co-60(pCi/L)	-4.58	9.4	17	1-Feb-02
TW-1	Co-60(pCi/L)	1.05	4.01	7.84	29-Jul-02
TW-1	Cs-134(pCi/L)	-3.77	8.3	15	1-Feb-02
TW-1	Cs-137(pCi/L)	-12.2	9.3	13	1-Feb-02
TW-1	Cs-137(pCi/L)	2.25	3.16	6.19	29-Jul-02
TW-1	Eu-152(pCi/L)	-2.26	23	42	1-Feb-02
TW-1	Eu-152(pCi/L)	1.77	7.1	13.1	29-Jul-02
TW-1	Eu-154(pCi/L)	-2.26	26	53	1-Feb-02
TW-1	Eu-154(pCi/L)	3.94	9.84	19.7	29-Jul-02
TW-1	Eu-155(pCi/L)	5.35	18	33	1-Feb-02

Table A-1
Peninsula Evaluation
Laboratory Analytical Data Reported for Groundwater From HNP Peninsula Wells
Connecticut Yankee Haddam Neck Plant
Haddam Neck, CT

Well ID	Nuclide/Analyte (unit)	Net Concentration	2-Sigma TPU	Actual MDC	Analysis Date
TW-1	Eu-155(pCi/L)	-0.954	6.82	12	29-Jul-02
TW-1	H-3(pCi/L)	-342	120	250	11-Feb-02
TW-1	H-3(pCi/L)	-13.3	161	267	28-Jul-02
TW-1	Mn-54(pCi/L)	5.97	9.9	21	1-Feb-02
TW-1	Mn-54(pCi/L)	-4.21	3.84	5.98	29-Jul-02
TW-1	Nb-94(pCi/L)	0.713	8.3	17	1-Feb-02
TW-1	Nb-94(pCi/L)	1.21	3.03	5.87	29-Jul-02
TW-1	Sb-125(pCi/L)	21.5	23	48	1-Feb-02
TW-1 Rep.	Eu-155(pCi/L)	22.8	15	30	1-May-02

Notes:
Results in BOLD print exceed the sample MDC
Shaded results exceed the 2-sigma total propagated uncertainty for the analysis

Table A-2
Peninsula Evaluation
Summary of Historical Groundwater Detections Compared to MCLs
Connecticut Yankee Haddam Neck Plant
Haddam Neck, CT

Well ID	Nuclide/Analyte (unit)	Net Concentration	Actual MDC	Analysis Date	Non-Dose MCL	Fraction of Non-Dose MCL	Isotope Equivalent Concentration [1] (pCi/L)	Fraction of Equivalent Concentration	Equivalent Concentration Sum-of-Fractions
MW-110S	Gross Beta(pCi/L)	2.79	0.88	13-Feb-02	50	0.06			
	Gross Beta(pCi/L)	4.07	2.81	16-Jul-02	50	0.08			
	H-3(pCi/L)	2980	268	27-Jul-02			20000	0.15	
	Pu-241(pCi/L)	6.91	6.84	14-Aug-02			300	0.02	
	H-3(pCi/L)	1470	259	18-Aug-02			20000	0.07	0.17
	Gross Beta(pCi/L)	6.51	2.68	21-Aug-02	50	0.13			
	H-3(pCi/L)	2390	278	14-Nov-02			20000	0.12	0.12
	Gross Beta(pCi/L)	4.39	2.62	5-Dec-02	50	0.09			
	Gross Beta(pCi/L)	4.28	2.59	20-Jan-03	50	0.09			
	H-3(pCi/L)	2050	289	25-Jan-03			20000	0.10	
	Pu-241(pCi/L)	13.2	8.16	31-Jan-03			300	0.04	0.15
	Gross Beta(pCi/L)	7.47	2.74	7-May-03	50	0.15			
	H-3(pCi/L)	1430	256	8-May-03			20000	0.07	0.07
	H-3(pCi/L)	1370	330	25-Jun-03			20000	0.07	0.07
	Gross Beta(pCi/L)	7.3	2.7	25-Jun-03	50	0.15			
	H-3(pCi/L)	1420	297	9-Nov-03			20000	0.07	0.07
	Gross Beta(pCi/L)	3.99	2.73	22-Nov-03	50	0.08			
	H-3(pCi/L)	1290	255	14-Jan-04			20000	0.06	0.06
	Gross Beta(pCi/L)	4.7	2.58	20-Jan-04	50	0.09			
	Total U (ug/L)	0.0122	0.00978	30-Jan-04	30	0.00			
	H-3(pCi/L)	2050	282	3-Apr-04			20000	0.10	0.10
	Gross Beta(pCi/L)	1.88	1.27	13-Apr-04	50	0.04			
	H-3(pCi/L)	1010	310	19-Jul-04			20000	0.05	0.05
	Gross Beta(pCi/L)	4.35	2.05	22-Jul-04	50	0.09			
	H-3(pCi/L)	1670	254	8-Oct-04			20000	0.08	0.08
	Gross Beta(pCi/L)	4.46	2.75	19-Oct-04	50	0.09			
MW-111S	Gross Beta(pCi/L)	4.23	0.98	13-Feb-02	50	0.08			
	Gross Alpha(pCi/L)	0.68	0.56	13-Feb-02	15	0.05			
	Gross Beta(pCi/L)	5.31	2.42	16-Jul-02	50	0.11			
	Gross Alpha(pCi/L)	1	0.673	16-Jul-02	15	0.07			
	Ni-63(pCi/L)	4.14	2.95	30-Aug-02			50	0.08	0.08
	Gross Beta(pCi/L)	7.39	2.56	6-Nov-02	50	0.15			
	Gross Beta(pCi/L)	5.01	2.49	20-Jan-03	50	0.10			
	Gross Beta(pCi/L)	3.24	2.66	2-May-03	50	0.06			
	Gross Beta(pCi/L)	5.1	2.8	23-Jun-03	50	0.10			
	Gross Beta(pCi/L)	4.12	2.62	22-Nov-03	50	0.08			
	Gross Beta(pCi/L)	5.52	2.62	27-Jan-04	50	0.11			
	Total U (ug/L)	0.0397	0.00978	2-Feb-04	30	0.00			
	Gross Beta(pCi/L)	4.95	2.37	22-Apr-04	50	0.10			
	Gross Alpha(pCi/L)	0.731	0.678	22-Apr-04	15	0.05			
MW-112S	Gross Beta(pCi/L)	3.61	2.51	6-Nov-02	50	0.07			
	Gross Beta(pCi/L)	2.62	2.55	22-Nov-03	50	0.05			
	Sr-90(pCi/L)	5.49	0.634	18-Jan-04			8	0.69	0.69
	Total U (ug/L)	0.0155	0.00978	30-Jan-04	30	0.00			
MW-113S	Gross Beta(pCi/L)	31.4	3.63	6-Nov-02	50	0.63			
	Gross Alpha(pCi/L)	2.95	1.87	6-Nov-02	15	0.20			
	Gross Beta(pCi/L)	30.3	3.4	20-Jan-03	50	0.61			
	Gross Alpha(pCi/L)	1.82	1.02	21-Jan-03	15	0.12			
	Gross Beta(pCi/L)	23.4	2.61	7-May-03	50	0.47			
	Gross Beta(pCi/L)	16.8	2.9	23-Jun-03	50	0.34			
	Gross Beta(pCi/L)	23.4	3.12	22-Nov-03	50	0.47			
	Sr-90(pCi/L)	0.579	0.562	23-Nov-03			8	0.07	0.07
	Gross Beta(pCi/L)	22.7	2.94	12-Jan-04	50	0.45			
	Sr-90(pCi/L)	0.838	0.719	16-Jan-04			8	0.10	0.10
	Total U (ug/L)	0.0716	0.00978	19-Jan-04	30	0.00			
	Gross Beta(pCi/L)	16.3	2.73	22-Apr-04	50	0.33			
	Gross Beta(pCi/L)	8.3	2.54	22-Jul-04	50	0.17			
	Gross Beta(pCi/L)	17.5	2.3	19-Oct-04	50	0.35			
MW-117S	Gross Beta(pCi/L)	8.36	3.05	6-Nov-02	50	0.17			
	Gross Alpha(pCi/L)	1.59	1.26	6-Nov-02	15	0.11			
	Gross Beta(pCi/L)	7.66	2.86	20-Jan-03	50	0.15			
	Sr-90(pCi/L)	1.28	0.812	24-Jan-03			8	0.16	0.16
	Gross Beta(pCi/L)	8.13	3.05	7-May-03	50	0.16			
	Gross Beta(pCi/L)	11.66	2.1	23-Jun-03	50	0.23			
	Gross Alpha(pCi/L)	3.8	2.9	23-Jun-03	15	0.25			
	Gross Beta(pCi/L)	9.49	3.97	22-Nov-03	50	0.19			
	Sr-90(pCi/L)	1.42	0.57	23-Nov-03			8	0.18	0.18
	Sr-90(pCi/L)	0.765	0.512	18-Jan-04			8	0.10	0.10
	Gross Beta(pCi/L)	9.65	3.96	20-Jan-04	50	0.19			
	Gross Beta(pCi/L)	5.41	3.23	22-Apr-04	50	0.11			
	Gross Beta(pCi/L)	7.28	2.3	29-Jul-04	50	0.15			
	Gross Beta(pCi/L)	6.91	2.17	14-Oct-04	50	0.14			

Table A-2
Peninsula Evaluation
Summary of Historical Groundwater Detections Compared to MCLs
Connecticut Yankee Haddam Neck Plant
Haddam Neck, CT

Well ID	Nuclide/Analyte (unit)	Net Concentration	Actual MDC	Analysis Date	Non-Dose MCL	Fraction of Non-Dose MCL	Isotope Equivalent Concentration [1] (pCi/L)	Fraction of Equivalent Concentration	Equivalent Concentration Sum-of-Fractions
MW-2	Gross Beta(pCi/L)	2.75	2.7	20-Jan-03	50	0.06			
	Pu-241(pCi/L)	11.2	6.34	31-Jan-03			300	0.04	0.04
	Gross Beta(pCi/L)	4.43	2.46	28-Jul-04	50	0.09			
	H-3(pCi/L)	439	300	7-Oct-04			20000	0.02	0.02
	Gross Beta(pCi/L)	3.47	2.27	14-Oct-04	50	0.07			
Supply Well B	Sr-90(pCi/L)	1.02	0.45	30-Jan-02			8	0.13	0.13

Notes:
1) Isotope Equivalent Concentration = concentration of an individual isotope, which would result in an MCL exceedance

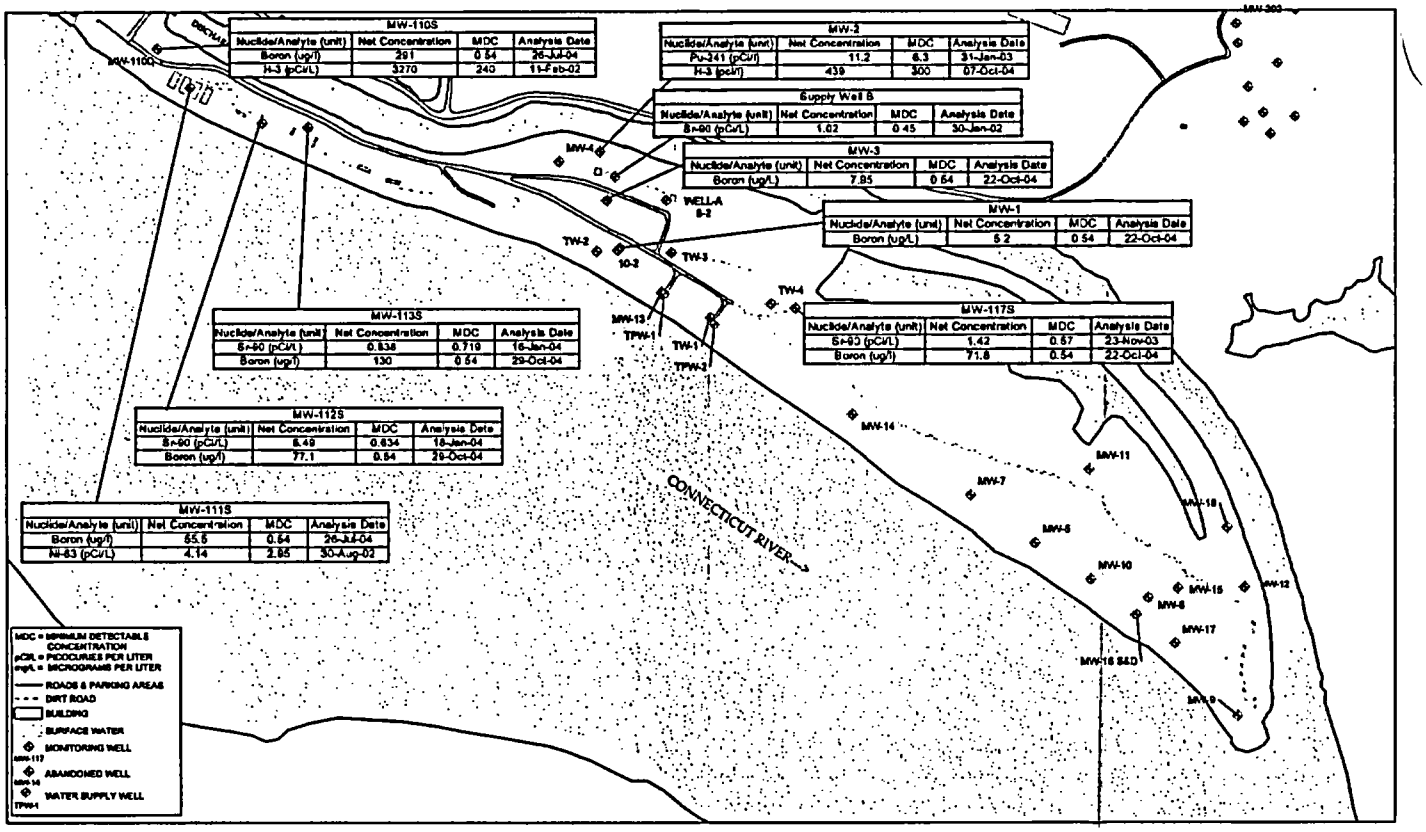

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FIGURE A-1
MAXIMUM CONCENTRATION OF CONTAMINANTS OF CONCERN
EXCEEDING METHOD DETECTABLE CONCENTRATION IN PENINSULA WELLS, HADDAM NECK PLANT
HADDAM NECK, CT

Table A-3
Radionuclides Detected in Discharge Canal Sediment Samples
FSS Survey Unit 9106 Sediment Samples
Peninsula Evaluation
Haddam Neck Plant, Haddam Neck CT

Location ID	Radionuclide	Result (pCi/g)	2-Sigma TPU (pCi/g)	MDC (pCi/g)	Date
9106-0011-1618D-01	Am-241	0.0692	0.0784	0.0626	5/5/2004
9106-SD-1621-C-00	C-14	0.23	0.0928	0.149	7/21/2004
9106-SD-1619-C-00	C-14	0.232	0.0959	0.154	7/21/2004
9106-0002-1609C-01	C-14	0.242	0.11	0.178	6/30/2004
9106-SD-1621-C-01	C-14	0.253	0.103	0.165	7/21/2004
9106-0001-1604C-01	C-14	0.266	0.108	0.172	6/30/2004
9106-0004-1605D-01	C-14	0.272	0.0963	0.156	5/5/2004
9106-0011-1618D-01	Co-60	0.0471	0.026	0.0193	5/5/2004
9106-0002-1610C-05	Co-60	0.0581	0.0372	0.0367	6/29/2004
9106-0002-1608C-01	Co-60	0.0625	0.0312	0.0323	6/30/2004
9106-0003-1611C-01	Co-60	0.0741	0.0429	0.0423	6/29/2004
9106-0006-1609D-02	Co-60	0.0914	0.0476	0.0396	5/5/2004
9106-0001-1602C-09	Co-60	0.092	0.0355	0.0341	6/30/2004
9106-0007-1612D-01	Co-60	0.102	0.0522	0.0399	5/6/2004
9106-0003-1612C-01	Co-60	0.129	0.0392	0.0371	6/29/2004
9106-0001-1604C-01	Co-60	0.151	0.0323	0.0273	6/30/2004
9106-0007-1611D-02	Co-60	0.155	0.0635	0.064	5/6/2004
9106-SD-1620-C-01	Co-60	0.204	0.0536	0.0344	7/21/2004
9106-0009-1615D-01	Co-60	0.224	0.0554	0.0369	5/5/2004
9106-0011-1617D-02	Co-60	0.247	0.0359	0.0251	5/5/2004
9106-0003-1602D-02	Co-60	0.286	0.0549	0.0441	5/5/2004
9106-0011-1617D-01	Co-60	0.345	0.0814	0.0656	5/5/2004
9106-SD-1620-C-00	Co-60	0.35	0.0425	0.0254	7/21/2004
9106-0003-1613C-01	Co-60	0.365	0.0622	0.0423	6/29/2004
9106-SD-1619-C-01	Co-60	0.433	0.0676	0.0324	7/21/2004
9106-0007-1611D-01	Co-60	0.446	0.084	0.0559	5/6/2004
9106-0006-1609D-01	Co-60	0.455	0.0846	0.0452	5/5/2004
9106-0006-1608D-01	Co-60	0.468	0.0604	0.0324	5/5/2004
9106-0009-1614D-01	Co-60	0.567	0.0852	0.0458	5/6/2004
9106-0006-1608D-02	Co-60	0.614	0.0753	0.0416	5/5/2004
9106-SD-1618-C-00	Co-60	0.723	0.0796	0.035	7/21/2004
9106-SD-1619-C-00	Co-60	0.902	0.107	0.0365	7/21/2004
9106-0001-1605C-01	Co-60	1	0.0718	0.0329	7/1/2004
9106-0001-1602C-01	Co-60	1.02	0.0969	0.0322	6/30/2004
9106-0001-1606C-01	Co-60	1.04	0.0983	0.0355	7/1/2004
9106-0011-1616D-02	Co-60	1.05	0.102	0.0375	5/5/2004
9106-0002-1610C-01	Co-60	1.2	0.0946	0.0416	6/29/2004
9106-0002-1609C-01	Co-60	1.38	0.127	0.0449	6/30/2004
9106-0003-1613C-04	Co-60	1.49	0.136	0.0396	6/29/2004
9106-0004-1605D-02	Co-60	1.85	0.14	0.0361	5/5/2004
9106-SD-1621-C-00	Co-60	2.04	0.158	0.0341	7/21/2004
9106-SD-1621-C-01	Co-60	2.35	0.196	0.0427	7/21/2004
9106-0004-1605D-01	Co-60	3.04	0.251	0.0689	5/5/2004
9106-0003-1611C-05	Cs-137	0.0197	0.0144	0.0155	6/29/2004
9106-0003-1602D-01	Cs-137	0.033	0.0147	0.0216	5/5/2004
9106-0003-1603D-01	Cs-137	0.0346	0.0192	0.0222	5/4/2004
9106-0003-1612C-04	Cs-137	0.0379	0.018	0.0201	6/29/2004
9106-0009-1614D-02	Cs-137	0.0561	0.0293	0.0322	5/6/2004

Table A-3
Radionuclides Detected in Discharge Canal Sediment Samples
FSS Survey Unit 9106 Sediment Samples
Peninsula Evaluation
Haddam Neck Plant, Haddam Neck CT

Location ID	Radionuclide	Result (pCi/g)	2-Sigma TPU (pCi/g)	MDC (pCi/g)	Date
9106-0001-1607C-01	Cs-137	0.0612	0.0368	0.0473	7/1/2004
9106-0011-1618D-01	Cs-137	0.0647	0.0212	0.0223	5/5/2004
9106-0004-1604D-01	Cs-137	0.0659	0.0413	0.0335	5/4/2004
9106-0011-1616D-01	Cs-137	0.0728	0.0308	0.0286	5/6/2004
9106-0001-1602C-09	Cs-137	0.0783	0.0287	0.0306	6/30/2004
9106-0009-1615D-01	Cs-137	0.0893	0.0399	0.0401	5/5/2004
9106-0007-1612D-01	Cs-137	0.104	0.0517	0.0431	5/6/2004
9106-0001-1604C-01	Cs-137	0.109	0.0269	0.0202	6/30/2004
9106-0006-1609D-02	Cs-137	0.121	0.0426	0.0389	5/5/2004
9106-0011-1617D-02	Cs-137	0.123	0.0318	0.0231	5/5/2004
9106-0003-1602D-02	Cs-137	0.125	0.0361	0.0406	5/5/2004
9106-SD-1619-C-01	Cs-137	0.129	0.0464	0.0349	7/21/2004
9106-0007-1611D-02	Cs-137	0.13	0.0698	0.0612	5/6/2004
9106-SD-1620-C-01	Cs-137	0.172	0.0391	0.0324	7/21/2004
9106-0003-1611C-01	Cs-137	0.203	0.0579	0.043	6/29/2004
9106-0006-1608D-01	Cs-137	0.207	0.0368	0.0289	5/5/2004
9106-0006-1608D-02	Cs-137	0.212	0.0553	0.0393	5/5/2004
9106-0002-1610C-05	Cs-137	0.222	0.0565	0.0412	6/29/2004
9106-0006-1609D-01	Cs-137	0.222	0.0497	0.0331	5/5/2004
9106-0007-1612D-02	Cs-137	0.223	0.0402	0.039	5/6/2004
9106-0003-1612C-01	Cs-137	0.229	0.0408	0.03	6/29/2004
9106-0011-1617D-01	Cs-137	0.237	0.0777	0.0618	5/5/2004
9106-0003-1613C-01	Cs-137	0.24	0.0519	0.0393	6/29/2004
9106-SD-1619-C-00	Cs-137	0.247	0.0456	0.0358	7/21/2004
9106-SD-1618-C-00	Cs-137	0.259	0.048	0.0313	7/21/2004
9106-0007-1611D-01	Cs-137	0.313	0.0733	0.056	5/6/2004
9106-SD-1620-C-00	Cs-137	0.316	0.0381	0.027	7/21/2004
9106-0011-1616D-02	Cs-137	0.361	0.0604	0.0427	5/5/2004
9106-0001-1602C-01	Cs-137	0.367	0.0491	0.0363	6/30/2004
9106-SD-1621-C-00	Cs-137	0.394	0.0603	0.0404	7/21/2004
9106-0001-1605C-01	Cs-137	0.41	0.0458	0.0364	7/1/2004
9106-0003-1613C-04	Cs-137	0.444	0.052	0.0332	6/29/2004
9106-0001-1606C-01	Cs-137	0.464	0.062	0.0366	7/1/2004
9106-0009-1614D-01	Cs-137	0.475	0.0697	0.0442	5/6/2004
9106-0004-1605D-02	Cs-137	0.482	0.0728	0.0407	5/5/2004
9106-SD-1621-C-01	Cs-137	0.561	0.0861	0.0475	7/21/2004
9106-0004-1605D-01	Cs-137	0.592	0.132	0.0731	5/5/2004
9106-0002-1610C-01	Cs-137	1.28	0.0885	0.0467	6/29/2004
9106-0002-1609C-01	Cs-137	1.32	0.147	0.0402	6/30/2004
9106-0003-1612C-01	Fe-55	46.9	32.1	31	6/29/2004
9106-0002-1609C-01	Fe-55	49.9	31.3	31.1	6/30/2004
9106-0011-1618D-01	Ni-63	24.2	11.4	18.4	5/5/2004
9106-0011-1618D-02	Ni-63	25.9	15.5	25.4	5/5/2004
9106-0009-1615D-02	Ni-63	34.7	16	25.8	5/6/2004
9106-0003-1612C-01	Pu-239	0.0214	0.021	0.0145	6/29/2004
9106-0004-1605D-01	Pu-239	0.593	0.254	0.195	5/5/2004
9106-0006-1607D-02	Sr-90	0.0202	0.0102	0.0185	5/5/2004
9106-0009-1613D-02	Sr-90	0.0246	0.0108	0.0172	5/5/2004

Table A-3
Radionuclides Detected in Discharge Canal Sediment Samples
FSS Survey Unit 9106 Sediment Samples
Peninsula Evaluation
Haddam Neck Plant, Haddam Neck CT

Location ID	Radionuclide	Result (pCi/g)	2-Sigma TPU (pCi/g)	MDC (pCi/g)	Date
9106-SD-1618-C-01	Sr-90	0.025	0.0118	0.0191	7/21/2004
9106-0007-1612D-02	Sr-90	0.0259	0.0102	0.0161	5/6/2004
9106-0009-1613D-01	Sr-90	0.0295	0.0125	0.0199	5/5/2004
9106-0011-1617D-02	Sr-90	0.0302	0.00995	0.0154	5/5/2004
9106-0007-1611D-01	Sr-90	0.0307	0.0105	0.0163	5/6/2004
9106-0006-1609D-01	Sr-90	0.0308	0.0104	0.0161	5/5/2004
9106-0009-1614D-02	Sr-90	0.0311	0.0108	0.0169	5/6/2004
9106-0003-1602D-02	Sr-90	0.0315	0.0124	0.0213	5/5/2004
9106-SD-1620-C-00	Sr-90	0.0343	0.0116	0.0165	7/21/2004
9106-0009-1614D-01	Sr-90	0.0346	0.0106	0.0164	5/6/2004
9106-0011-1617D-01	Sr-90	0.0358	0.0118	0.0183	5/5/2004
9106-SD-1618-C-00	Sr-90	0.0362	0.00997	0.0121	7/21/2004
9106-0003-1603D-02	Sr-90	0.0377	0.0131	0.0208	5/4/2004
9106-SD-1621-C-00	Sr-90	0.0384	0.0114	0.0151	7/21/2004
9106-0007-1611D-02	Sr-90	0.0402	0.0108	0.0164	5/6/2004
9106-0004-1606D-01	Sr-90	0.0403	0.0134	0.0221	5/5/2004
9106-0007-1610D-02	Sr-90	0.0431	0.0107	0.0161	5/6/2004
9106-0006-1608D-02	Sr-90	0.0479	0.012	0.0182	5/5/2004
9106-0007-1612D-01	Sr-90	0.0525	0.0124	0.0184	5/6/2004
9106-SD-1620-C-01	Sr-90	0.0544	0.0122	0.0135	7/21/2004
9106-SD-1619-C-01	Sr-90	0.0635	0.0126	0.00983	7/21/2004
9106-0004-1604D-01	Sr-90	0.0652	0.0181	0.0281	5/4/2004
9106-SD-1621-C-01	Sr-90	0.0667	0.0136	0.0148	7/21/2004
9106-0006-1609D-02	Sr-90	0.0681	0.0126	0.0181	5/5/2004
9106-0004-1605D-01	Sr-90	0.0702	0.0192	0.0295	5/5/2004
9106-0006-1608D-01	Sr-90	0.0716	0.0156	0.022	5/5/2004
9106-0004-1604D-02	Sr-90	0.0756	0.0158	0.0203	5/5/2004
9106-0004-1606D-02	Sr-90	0.141	0.0203	0.0198	5/5/2004
9106-0004-1605D-01	Tc-99	0.449	0.221	0.359	5/5/2004

Notes:
pCi/g = picocuries per gram
TPU = total propagated uncertainty
MDC = minimum detectable concentration

Table A-4
Radionuclides Detected in Discharge Canal Sediment Samples Compared to Soil Screening Concentrations
FSS Survey Unit 9106
Peninsula Evaluation
Haddam Neck Plant, Haddam Neck, CT

Radionuclide	Number of Detections	Minimum Concentration (pCi/g)	Minimum Exceeds Soil Screening		Maximum Concentration (pCi/g)	Maximum Exceeds Soil Screening Concentration?		Average Concentration (pCi/g)	Average Exceeds Soil Screening	
			Low	High		Low	High		Low	High
Am-241	1	0.07	Not Established		0.07	Not Established		0.07	Not Established	
Co-60	71	0.01	no	no	9	yes	no	0.5	yes	no
Pu-241	1	6.60	Not Established		6.6	Not Established		6.6	Not Established	
Sr-90	43	0.02	no	no	0.26	yes	no	0.06	no	no
Tc-99	1	0.45	Not Established		0.45	Not Established		0.45	Not Established	
C-14	10	0.02	Not Established		0.27	Not Established		0.17	Not Established	
Pu-239	2	0.02	Not Established		0.59	Not Established		0.31	Not Established	
Ni-63	3	0.01	Not Established		34.7	Not Established		16.98	Not Established	
Fe-55	2	0.03	no	no	49.9	no	no	32.28	no	no
Cs-137	64	0.01	no	no	13.6	yes	no	0.53	no	no

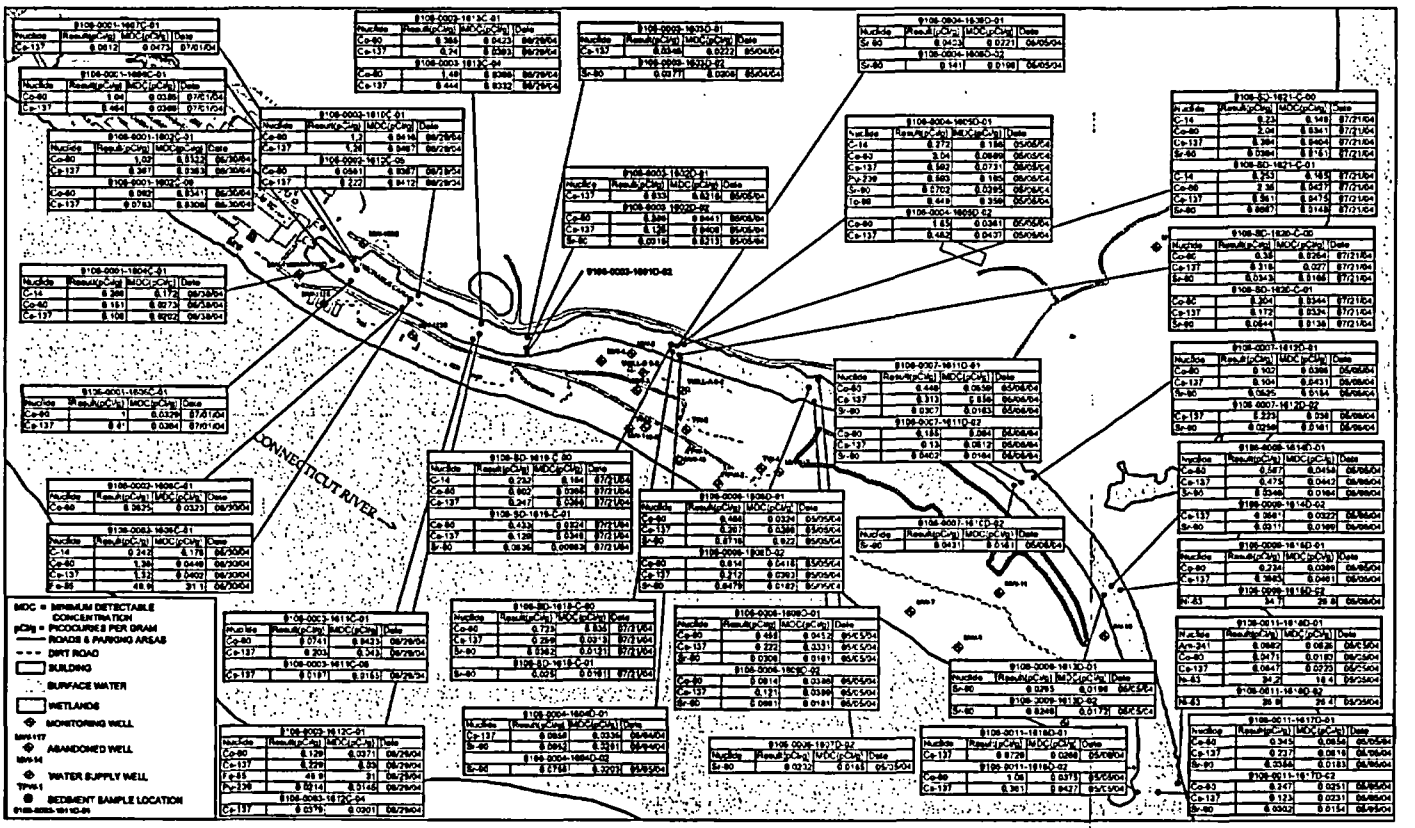

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FIGURE A-2

PENINSULA EVALUATION

CONCENTRATION OF CONTAMINANTS OF CONCERN EXCEEDING THE MINIMUM DETECTABLE CONCENTRATION IN THE DISCHARGE CANAL SEDIMENTS AT THE HADDAM NECK PLANT

HADDAM NECK, CT

Radionuclides Detected in Soil Samples Compared to Soil Screening Concentrations
FSS Survey Unit 9530-01 Soil Samples
Peninsula Evaluation
Haddam Neck Plant, Haddam Neck CT

Location ID	Radionuclide	Result (pCi/g)	MDC (pCi/g)	Date	Estimated Soil Screening Concentration - Low [1] (pCi/g)	Result exceeds low soil screening concentration?	Estimated Soil Screening Concentration - High [2] (pCi/g)	Result exceeds high soil screening concentration?	Estimated Equilibrium Groundwater concentration, Low Kd [3] (pCi/L)	Estimated Equilibrium Groundwater concentration, High Kd [4] (pCi/L)
9530-01-001C	Cs-137	0.221	0.0613	8/18/2004	4.60	No	29.80	No	9.61	1.48
9530-01-002C	Cs-137	0.394	0.015	8/18/2004	4.60	No	29.80	No	17.13	2.64
9530-01-003C	Cs-137	0.374	0.0484	8/18/2004	4.60	No	29.80	No	16.26	2.51
9530-01-004C	Cs-137	0.0739	0.0475	8/18/2004	4.60	No	29.80	No	3.21	0.50
9530-01-005C	Cs-137	0.116	0.044	8/18/2004	4.60	No	29.80	No	5.04	0.78
9530-01-006C	Cs-137	0.098	0.0668	8/18/2004	4.60	No	29.80	No	4.26	0.66
9530-01-007C	Cs-137	0.167	0.0264	8/18/2004	4.60	No	29.80	No	7.26	1.12
9530-01-007C	Tc-99	0.455	0.327	8/18/2004	Not Determined		Not Determined			
9530-01-008C	Cs-137	0.105	0.0382	8/18/2004	4.60	No	29.80	No	4.57	0.70
9530-01-009C	Cs-137	0.126	0.048	8/18/2004	4.60	No	29.80	No	5.48	0.85
9530-01-010C	Cs-137	0.468	0.056	8/18/2004	4.60	No	29.80	No	20.35	3.14
9530-01-012C	Cs-137	0.276	0.0446	8/18/2004	4.60	No	29.80	No	12.00	1.85
9530-01-014C	Cs-137	0.183	0.0554	8/18/2004	4.60	No	29.80	No	7.96	1.23
9530-01-015C	Cs-137	0.166	0.047	8/18/2004	4.60	No	29.80	No	7.22	1.11
9530-01-016C	Cs-137	0.09	0.0469	8/19/2004	4.60	No	29.80	No	3.91	0.60
9530-01-017C	Cs-137	0.256	0.0454	8/19/2004	4.60	No	29.80	No	11.13	1.72
9530-01-019C	Cs-137	0.228	0.0505	8/19/2004	4.60	No	29.80	No	9.91	1.53
9530-01-020C	Cs-137	0.2	0.0472	8/19/2004	4.60	No	29.80	No	8.70	1.34
9530-01-021C	Cs-137	0.228	0.0646	8/19/2004	4.60	No	29.80	No	9.91	1.53
9530-01-022C	C-14	0.626	0.407	8/19/2004	Not Determined		Not Determined			
9530-01-022C	Cs-137	0.0973	0.0572	8/19/2004	4.60	No	29.80	No	4.23	0.65
9530-01-024C	Cs-137	0.176	0.0484	8/19/2004	4.60	No	29.80	No	7.65	1.18
9530-01-025C	Cs-137	0.135	0.0533	8/19/2004	4.60	No	29.80	No	5.87	0.91
9530-01-026C	Cs-137	0.124	0.0459	8/19/2004	4.60	No	29.80	No	5.39	0.83
9530-01-027C	Cs-137	0.0902	0.053	8/19/2004	4.60	No	29.80	No	3.92	0.61
9530-01-028C	Cs-137	0.125	0.0513	8/19/2004	4.60	No	29.80	No	5.43	0.84
9530-01-029C	Cs-137	0.191	0.0391	8/19/2004	4.60	No	29.80	No	8.30	1.28
9530-01-030C	Cs-134	0.0639	0.0618	8/19/2004	4.60	No	29.80	No	2.78	0.43
9530-01-030C	Cs-137	0.0645	0.0464	8/19/2004	4.60	No	29.80	No	2.80	0.43
								Avg Cs-137 (pCi/L)	7.98	1.23
								Avg Cs-134 (pCi/L)	2.78	0.43

Notes:

1) This value was calculated as $K_{d\ value}$ * nuclide MCL equivalent concentration. The soil type with the lowest K_d value was used in this case.

2) This value was calculated as Kd value * nuclide MCL equivalent concentration. The soil type with the highest K_d value was used in this case.

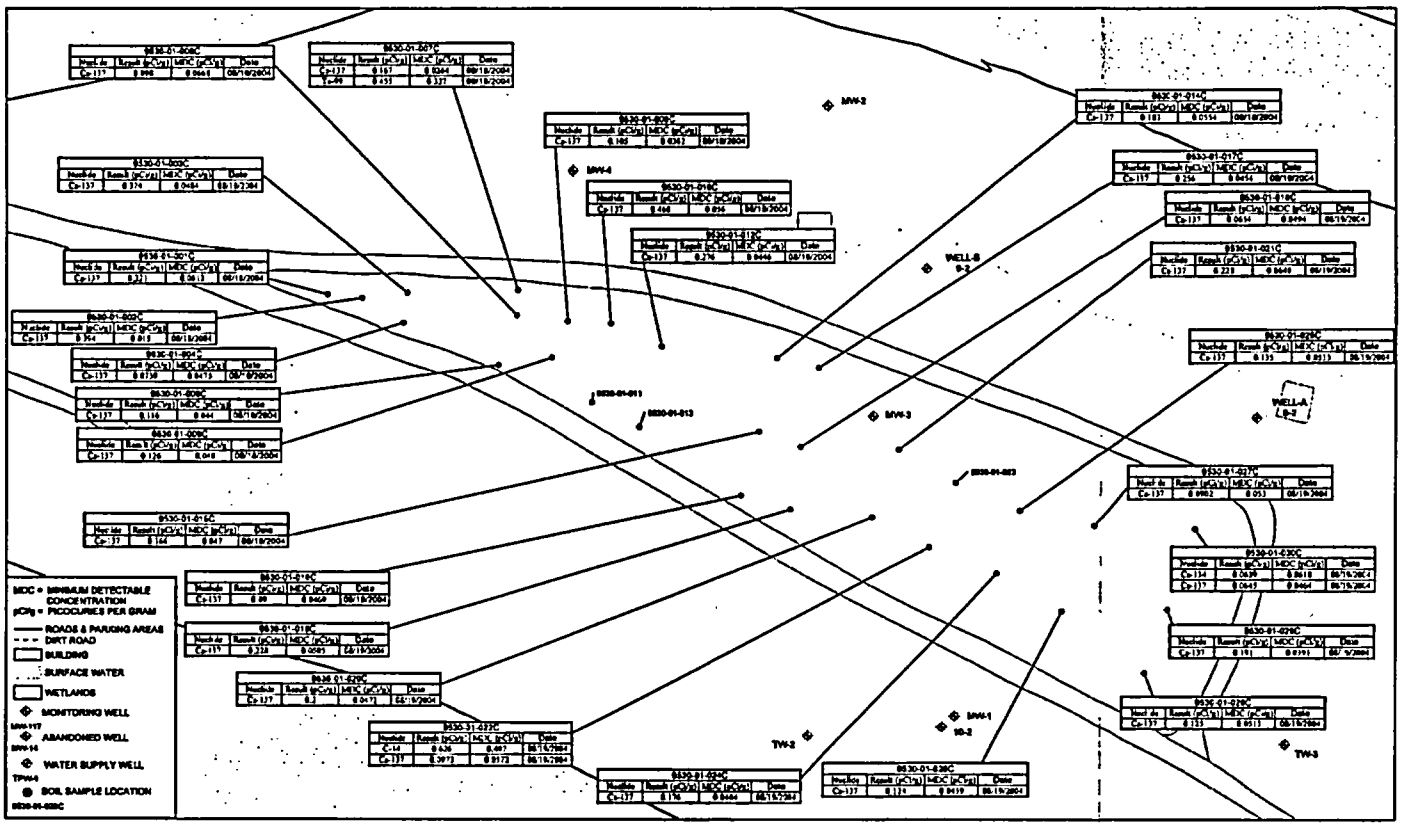
3) This value was calculated as measured soil concentration/Kd. The lowest Kd was used.

4) This value was calculated as ı pCi/L = picocuries per liter

pCi/g = picocuries per gram

TPU = total propagated uncertainty

MDC = minimum detectable concentration



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0 100 200 Feet

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FIGURE A-3
PENINSULA EVALUATION
CONCENTRATION OF CONTAMINANTS OF CONCERN IN SOIL,
PENINSULA FINAL STATUS SURVEY UNIT 9530-01, HADDAM NECK PLANT
HADDAM NECK, CT

Radionuclides Detected in Soil Samples Compared to Soil Screening Concentrations
FSS Survey Unit 9530-02 Soil Samples
Peninsula Evaluation
Haddam Neck Plant, Haddam Neck CT

Location ID	Radionuclide	Result (pCi/g)	MDC (pCi/g)	Date	Estimated Soil Screening Concentration - Low [1] (pCi/g)	Result exceeds low soil screening concentration?	Estimated Soil Screening Concentration - High [2] (pCi/g)	Result exceeds high soil screening concentration?	Estimated Equilibrium Groundwater concentration, Low Kd [3] (pCi/L)	Estimated Equilibrium Groundwater concentration, High Kd [4] (pCi/L)
9530-02-016C	Cs-137	0.303	0.0521	08/18/04	4.60	No	29.80	No	13.17	2.03
9530-02-017C	Cs-137	0.104	0.0422	08/18/04	4.60	No	29.80	No	4.52	0.70
9530-02-017-C01	C-14	0.238	0.171	09/21/04	Not Determined		Not Determined			
9530-02-018C	Cs-137	0.112	0.0411	08/18/04	4.60	No	29.80	No	4.87	0.75
9530-02-019C	Cs-137	0.137	0.0529	08/18/04	4.60	No	29.80	No	5.96	0.92
9530-02-019-C01	Cs-137	0.0902	0.0346	09/21/04	4.60	No	29.80	No	3.92	0.61
9530-02-021C	Cs-137	0.0694	0.057	08/18/04	4.60	No	29.80	No	3.02	0.47
9530-02-023C	Cs-137	0.147	0.0498	08/18/04	4.60	No	29.80	No	6.39	0.99
9530-02-024C	Cs-137	0.0896	0.0362	08/18/04	4.60	No	29.80	No	3.90	0.60
9530-02-024-C01	Cs-137	0.0633	0.0308	09/21/04	4.60	No	29.80	No	2.75	0.42
9530-02-025C	Cs-137	0.13	0.0367	08/18/04	4.60	No	29.80	No	5.65	0.87
9530-02-026C	Cs-137	0.142	0.0403	08/18/04	4.60	No	29.80	No	6.17	0.95
9530-02-026-C01	Cs-137	0.0421	0.0384	09/20/04	4.60	No	29.80	No	1.83	0.28
9530-02-027C	Cs-137	0.0848	0.0356	08/18/04	4.60	No	29.80	No	3.69	0.57
9530-02-028C	Cs-137	0.12	0.046	08/18/04	4.60	No	29.80	No	5.22	0.81
9530-02-029-C01	Cs-137	0.0437	0.0252	09/20/04	4.60	No	29.80	No	1.90	0.29
9530-02-030C	Cs-137	0.0963	0.0224	08/18/04	4.60	No	29.80	No	4.19	0.65
								Avg Cs-137 (pCi/L)	4.99	0.65

Notes:
1) This value was calculated as K_d value * Soil Screening Concentration. The soil type with the lowest K_d value was used in this case.
2) This value was calculated as Kd value * Soil Screening Concentration. The soil type with the highest K_d value was used in this case.
3) This value was calculated as measured soil concentration/Kd. The lowest Kd was used.
4) This value was calculated as measured soil concentration/Kd. The highest Kd was used.
pCi/g = picocuries per gram pCi/L = picocuries per liter
TPU = total propagated uncertainty
MDC = minimum detectable concentration

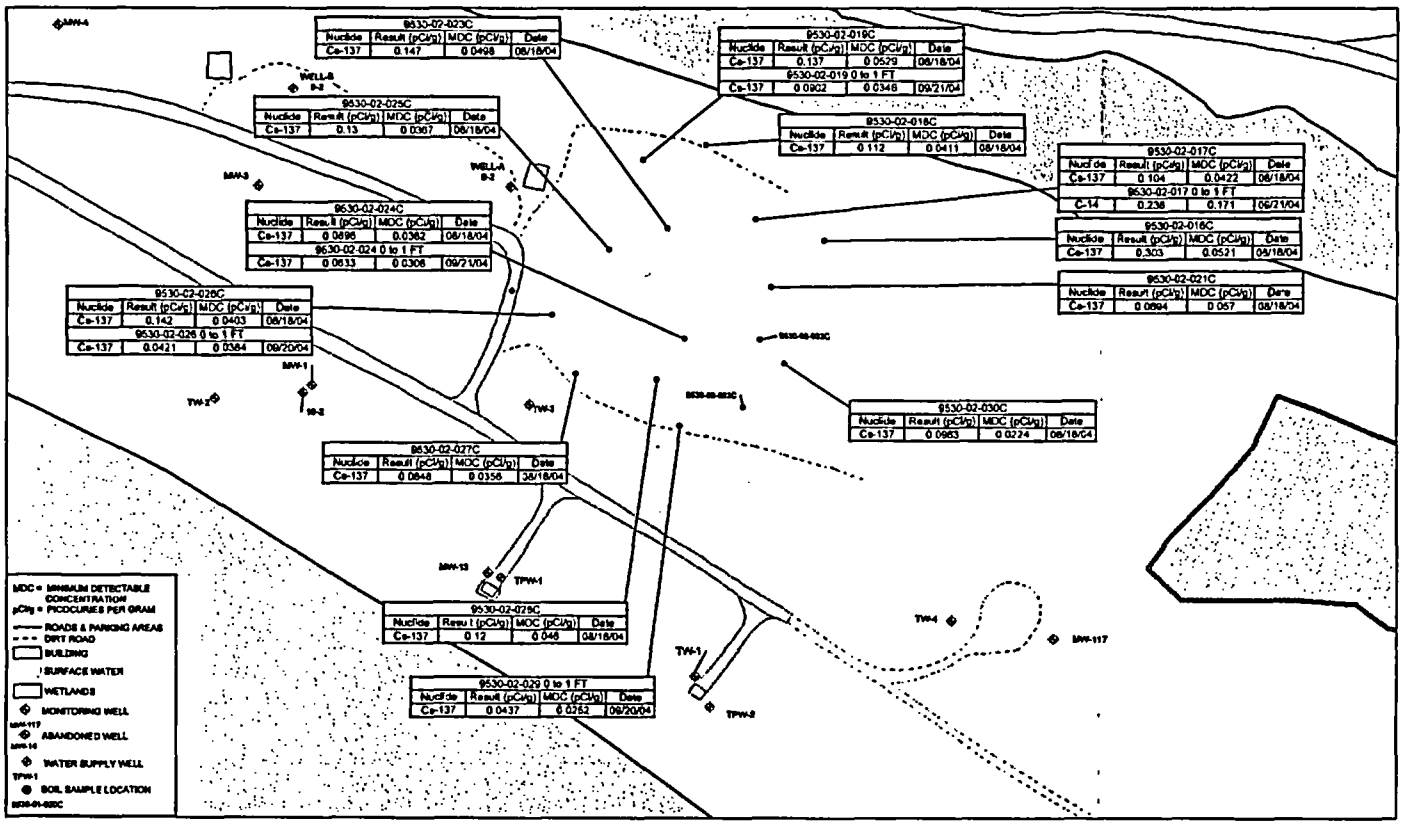

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FIGURE A-4

PENINSULA EVALUATION
CONCENTRATION OF CONTAMINANTS OF CONCERN IN SOIL EXCEEDING MINIMUM DETECTABLE CONCENTRATION
PENINSULA FINAL STATUS SURVEY UNIT 9530-02, HADDAM NECK PLANT
HADDAM NECK, CT

Radionuclides Detected In Soil Samples Compared to Soil Screening Concentrations
FSS Survey Unit 9530-03 Soil Samples
Peninsula Evaluation
Haddam Neck Plant, Haddam Neck CT

Location ID	Radionuclide	Result (pCi/g)	MDC (pCi/g)	Date	Estimated Soil Screening Concentration - Low[1] (pCi/g)	Result exceeds low soil screening concentration?	Estimated Soil Screening Concentration - High[2] (pCi/g)	Result exceeds high soil screening concentration?	Estimated Equilibrium Groundwater concentration, Low Kd[3] (pCi/L)	Estimated Equilibrium Groundwater concentration, High Kd[4] (pCi/L)
9530-03-001C	Cs-137	0.27	0.0549	8/18/2004	4.6	No	29.8	No	11.74	1.81
9530-03-002C	Cs-137	0.388	0.0416	8/18/2004	4.6	No	29.8	No	16.87	2.60
9530-03-003C	Cs-137	0.205	0.0443	8/17/2004	4.6	No	29.8	No	8.91	1.38
9530-03-004C	Cs-137	0.14	0.063	8/18/2004	4.6	No	29.8	No	6.09	0.94
9530-03-005C	Cs-137	0.126	0.0238	8/18/2004	4.6	No	29.8	No	5.48	0.85
9530-03-006C	Cs-137	0.125	0.0329	8/17/2004	4.6	No	29.8	No	5.43	0.84
9530-03-006C	Mn-54	0.0365	0.0326	8/17/2004	Not Determined		Not Determined			
9530-03-006C	Sr-90	0.0114	0.0113	8/17/2004	0.08	No	0.352	No	1.14	0.26
9530-03-007C	Cs-137	0.14	0.0401	8/17/2004	4.6	No	29.8	No	6.09	0.94
9530-03-008C	Cs-137	0.125	0.0261	8/17/2004	4.6	No	29.8	No	5.43	0.84
9530-03-008-C01	Cs-137	0.133	0.0234	9/21/2004	4.6	No	29.8	No	5.78	0.89
9530-03-009C	Cs-137	0.0901	0.0276	8/17/2004	4.6	No	29.8	No	3.92	0.60
9530-03-010C	Cs-137	0.249	0.0425	8/17/2004	4.6	No	29.8	No	10.83	1.67
9530-03-011C	Cs-137	0.191	0.0351	8/17/2004	4.6	No	29.8	No	8.30	1.28
9530-03-011-C01	C-14	0.223	0.155	9/21/2004	Not Determined		Not Determined			
9530-03-011-C01	Fe-55	46.9	31.3	9/21/2004	320	No	2400	No	293.13	39.08
9530-03-012C	Cs-137	0.169	0.0429	8/17/2004	4.6	No	29.8	No	7.35	1.13
9530-03-013C	Cs-137	0.236	0.0433	8/18/2004	4.6	No	29.8	No	10.26	1.58
9530-03-014C	Cs-137	0.304	0.0395	8/17/2004	4.6	No	29.8	No	13.22	2.04
9530-03-015C	Cs-137	0.213	0.0296	8/17/2004	4.6	No	29.8	No	9.26	1.43
9530-03-015C	Fe-55	60.7	49.9	8/17/2004	320	No	2400	No	379.38	50.58
								Avg Cs-137 (pCi/L)	8.05	1.14
								Avg Sr-90 (pCi/L)	1.14	0.26
								Avg Fe-55 (pCi/L)	336.25	44.83

Notes:
1) This value was calculated as K_d value * MCL Equivalent Concentration. The soil type with the lowest K_d value was used in this case.
2) This value was calculated as Kd value * MCL Equivalent Concentration. The soil type with the highest K_d value was used in this case.
3) This value was calculated as measured soil concentration/Kd. The lowest Kd was used.
4) This value was calculated as ı pCi/L = picocuries per liter
pCi/g = picocuries per gram
TPU = total propagated uncertainty

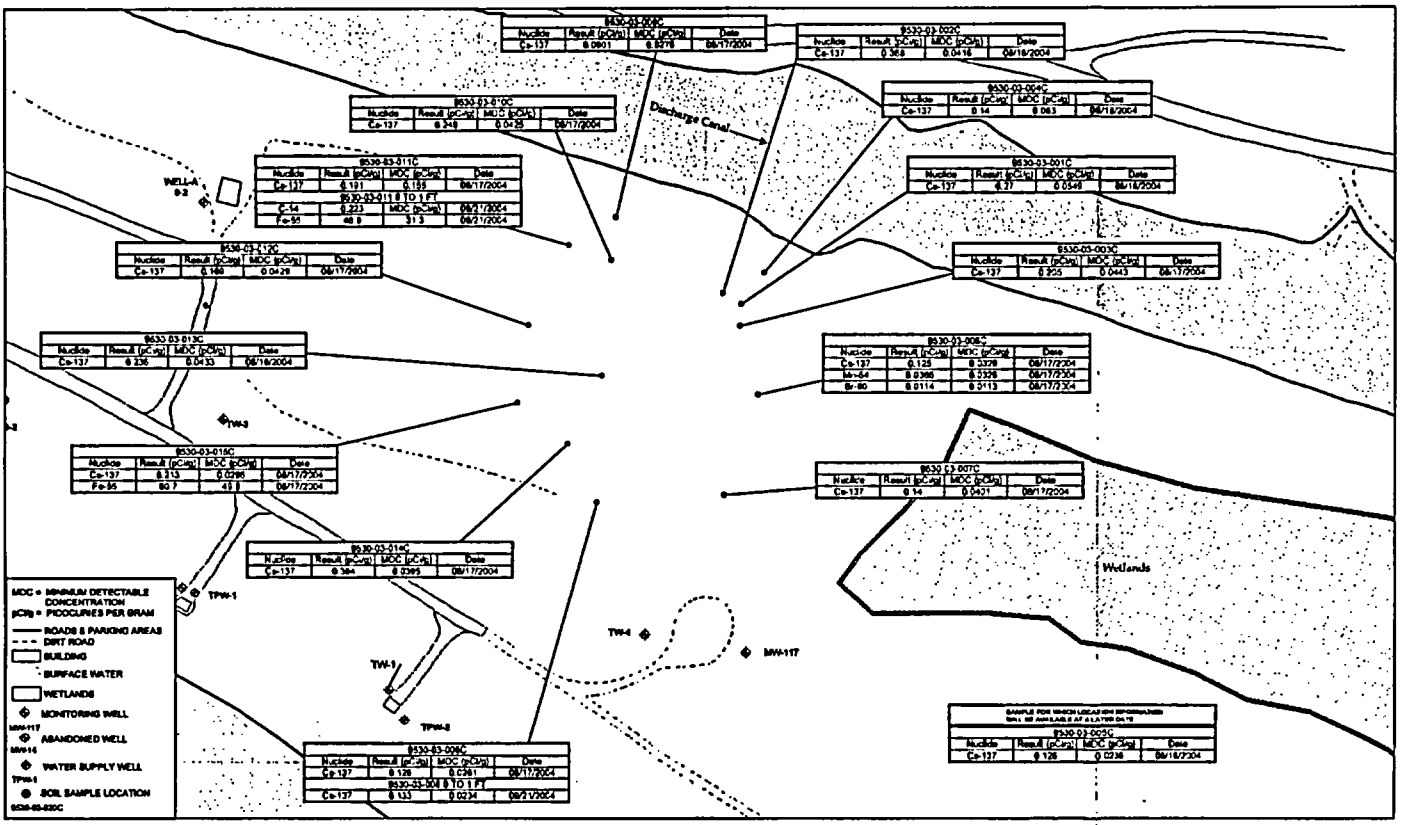

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FIGURE A-5

PENINSULA EVALUATION
CONCENTRATION OF CONTAMINANTS OF CONCERN IN SOIL EXCEEDING MINIMUM DETECTABLE CONCENTRATION
PENINSULA FINAL STATUS SURVEY UNIT 9530-03, HADDAM NECK PLANT
HADDAM NECK, CT

Radionuclides Detected in Soil Samples Compared to Soil Screening Concentrations
FSS Survey Unit 9530-04 Soil Samples
Peninsula Evaluation
Haddam Neck Plant, Haddam Neck CT

Location ID	Nuclide	Result (pCi/g)	MDC (pCi/g)	Date	Estimated Soil Screening Concentration - Low [1] (pCi/g)	Result exceeds low soil screening concentration?	Estimated Soil Screening Concentration - High [2] (pCi/g)	Result exceeds high soil screening concentration?	Estimated Equilibrium Groundwater concentration, Low Kd [3] (pCi/L)	Estimated Equilibrium Groundwater concentration, High Kd [4] (pCi/L)
9530-04-001C	Cs-137	0.193	0.0375	8/23/2004	4.6	No	29.8	No	8.39	1.30
9530-04-003C	Cs-137	0.123	0.0341	8/23/2004	4.6	No	29.8	No	5.35	0.83
9530-04-004C	Cs-137	0.219	0.0481	8/23/2004	4.6	No	29.8	No	9.52	1.47
9530-04-005C	Cs-137	0.0915	0.0385	8/23/2004	4.6	No	29.8	No	3.98	0.61
9530-04-006C	Cs-137	0.172	0.0364	8/24/2004	4.6	No	29.8	No	7.48	1.15
9530-04-007C	Cs-137	0.188	0.0457	8/24/2004	4.6	No	29.8	No	8.17	1.26
9530-04-009C	Cs-137	0.106	0.0312	8/24/2004	4.6	No	29.8	No	4.61	0.71
9530-04-010C	Cs-137	0.375	0.0365	8/24/2004	4.6	No	29.8	No	16.30	2.52
9530-04-011C	Cs-137	0.136	0.0313	8/24/2004	4.6	No	29.8	No	5.91	0.91
9530-04-012C	Cs-137	0.0798	0.035	8/24/2004	4.6	No	29.8	No	3.47	0.54
9530-04-012-C01	Cs-137	0.0753	0.0294	9/15/2004	4.6	No	29.8	No	3.27	0.51
9530-04-013C	Cs-137	0.0891	0.0225	8/24/2004	4.6	No	29.8	No	3.87	0.60
9530-04-013C	Pu-239	0.0712	0.0483	8/24/2004	Not Determined		Not Determined			
9530-04-013-C01	Cs-137	0.0797	0.0437	9/15/2004	4.6	No	29.8	No	3.47	0.53
9530-04-014C	Cs-137	0.0904	0.0545	8/24/2004	4.6	No	29.8	No	3.93	0.61
9530-04-014-C01	Cs-137	0.0564	0.0434	9/15/2004	4.6	No	29.8	No	2.45	0.38
9530-04-015C	Cs-137	0.0986	0.0249	8/24/2004	4.6	No	29.8	No	4.29	0.66
9530-04-015-C01	Cs-137	0.0734	0.025	9/15/2004	4.6	No	29.8	No	3.19	0.49
9530-04-016C	Cs-137	0.153	0.0458	8/24/2004	4.6	No	29.8	No	6.65	1.03
9530-04-016-C01	Cs-137	0.0752	0.0306	9/15/2004	4.6	No	29.8	No	3.27	0.50
9530-04-017C	Cs-137	0.192	0.038	8/24/2004	4.6	No	29.8	No	8.35	1.29
9530-04-018C	Cs-137	1.13	0.0443	8/24/2004	4.6	No	29.8	No	49.13	7.58
9530-04-018C	Sr-90	0.0502	0.0209	8/24/2004	0.08	No	0.352	No	5.02	1.14
9530-04-018-C01	C-14	0.255	0.169	9/15/2004	Not Determined		Not Determined			
9530-04-019C	Cs-137	0.0797	0.0363	8/24/2004	4.6	No	29.8	No	3.47	0.53
9530-04-020C	Cs-137	0.169	0.048	8/24/2004	4.6	No	29.8	No	7.35	1.13
								Avg Cs-137 (pCi/L)	6.14	0.93
								Avg Sr-90 (pCi/L)	5.02	1.14

Notes:

1) This value was calculated as K_d value * MCL Equivalent Concentration. The soil type with the lowest K_d value was used in this case.

2) This value was calculated as Kd value * MCL Equivalent Concentration. The soil type with the highest K_d value was used in this case.

3) This value was calculated as measured soil concentration/Kd. The lowest Kd was used.

4) This value was calculated : pCi/L = picocuries per liter

pCi/g = picocuries per gram

TPU = total propagated uncertainty

MDC = minimum detectable concentration

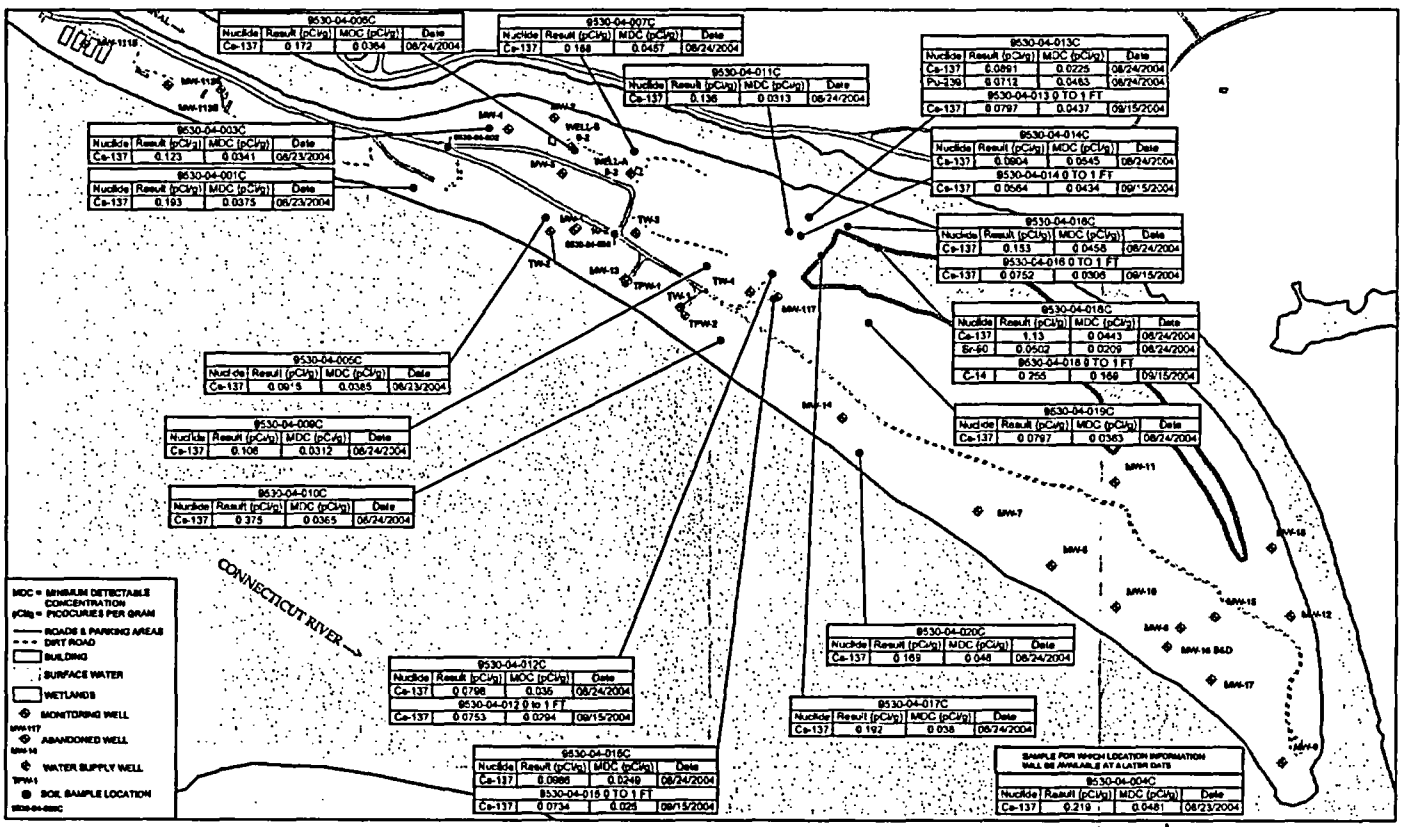

FIGURE A-6

PENINSULA EVALUATION
CONCENTRATION OF CONTAMINANTS OF CONCERN IN SOIL EXCEEDING MINIMUM DETECTABLE CONCENTRATION
PENINSULA FINAL STATUS SURVEY UNIT 9530-04, HADDAM NECK PLANT
HADDAM NECK, CT

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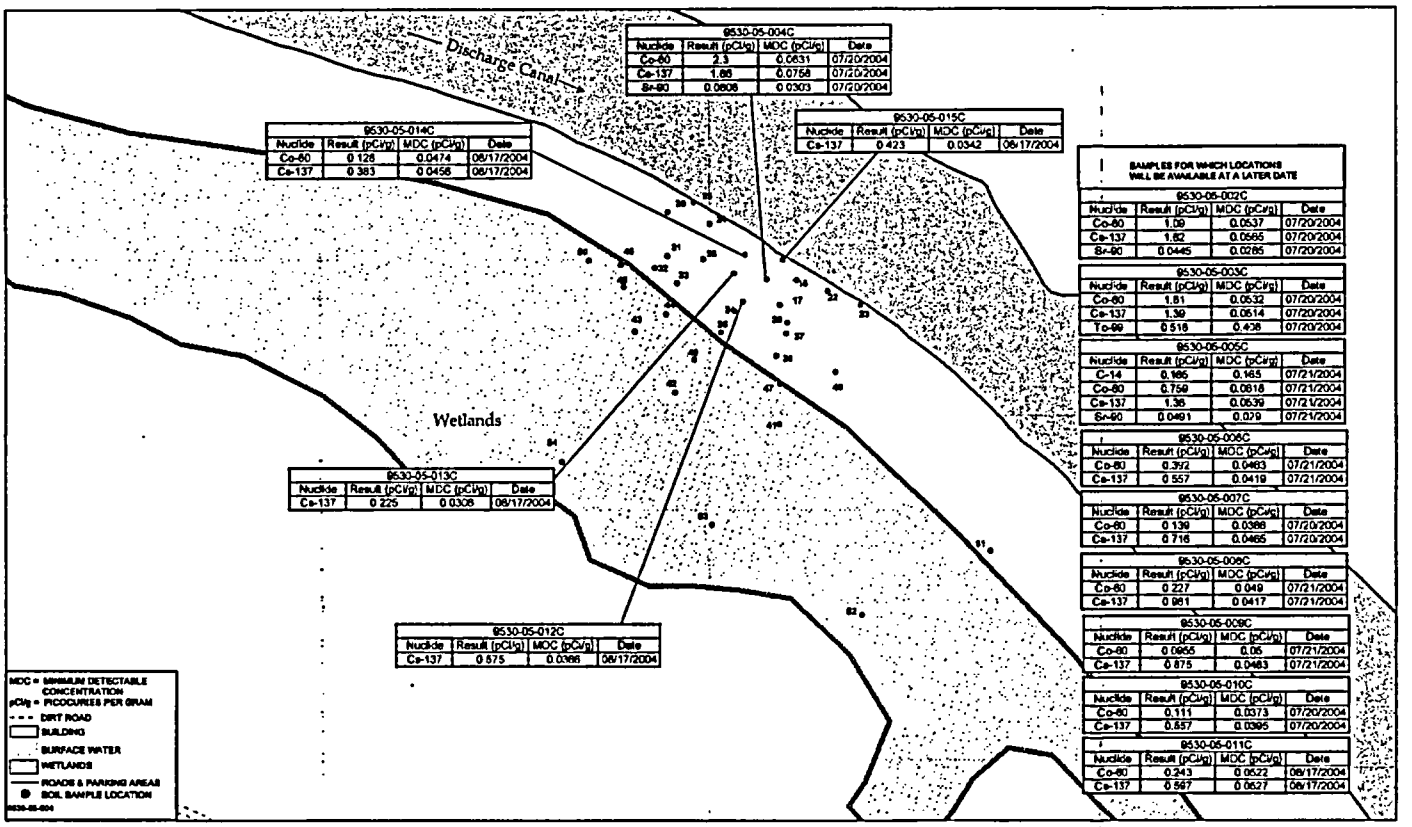
Radionuclide Detections and Groundwater Protection Soil Screening Criteria Concentrations
FSS Survey Unit 9530-05 Soil Samples
Peninsula Evaluation
Haddam Neck Plant, Haddam Neck CT

Location ID	Radionuclide	Result (pCi/g)	MDC (pCi/g)	Date	Estimated Soil Screening Concentration - Low [1] (pCi/g)	Result exceeds low soil screening concentration?	Estimated Soil Screening Concentration - High [2] (pCi/g)	Result exceeds high soil screening concentration?	Estimated Equilibrium Groundwater concentration, Low Kd [3] (pCi/L)	Estimated Equilibrium Groundwater concentration, High Kd [4] (pCi/L)
9530-05-002C	Co-60	1.09	0.0537	7/20/2004	0.2	Yes	22	No	545.00	4.95
9530-05-002C	Cs-137	1.62	0.0565	7/20/2004	4.6	No	29.8	No	70.43	10.87
9530-05-002C	Sr-90	0.0445	0.0285	7/20/2004	0.08	No	0.352	No	4.45	1.01
9530-05-003C	Co-60	1.61	0.0532	7/20/2004	0.2	Yes	22	No	805.00	7.32
9530-05-003C	Cs-137	1.39	0.0514	7/20/2004	4.6	No	29.8	No	60.43	9.33
9530-05-003C	Tc-99	0.518	0.408	7/20/2004	Not Determined		Not Determined			
9530-05-004C	Co-60	2.3	0.0631	7/20/2004	0.2	Yes	22	No	1150.00	10.45
9530-05-004C	Cs-137	1.66	0.0758	7/20/2004	4.6	No	29.8	No	72.17	11.14
9530-05-004C	Sr-90	0.0808	0.0303	7/20/2004	0.08	Yes	0.352	No	8.08	1.84
9530-05-005C	C-14	0.165	0.165	7/21/2004	Not Determined		Not Determined			
9530-05-005C	Co-60	0.759	0.0618	7/21/2004	0.2	Yes	22	No	379.50	3.45
9530-05-005C	Cs-137	1.36	0.0539	7/21/2004	4.6	No	29.8	No	59.13	9.13
9530-05-005C	Sr-90	0.0491	0.029	7/21/2004	0.08	No	0.352	No	4.9	1.1
9530-05-006C	Co-60	0.392	0.0463	7/21/2004	0.2	Yes	22	No	196.0	1.8
9530-05-006C	Cs-137	0.557	0.0419	7/21/2004	4.6	No	29.8	No	24.2	3.7
9530-05-007C	Co-60	0.139	0.0386	7/20/2004	0.2	No	22	No	69.5	0.6
9530-05-007C	Cs-137	0.716	0.0465	7/20/2004	4.6	No	29.8	No	31.1	4.8
9530-05-008C	Co-60	0.227	0.049	7/21/2004	0.2	Yes	22	No	113.5	1.0
9530-05-008C	Cs-137	0.961	0.0417	7/21/2004	4.6	No	29.8	No	41.8	6.4
9530-05-009C	Co-60	0.0955	0.05	7/21/2004	0.2	No	22	No	47.8	0.4
9530-05-009C	Cs-137	0.875	0.0483	7/21/2004	4.6	No	29.8	No	38.0	5.9
9530-05-010C	Co-60	0.111	0.0373	7/20/2004	0.2	No	22	No	55.5	0.5
9530-05-010C	Cs-137	0.557	0.0395	7/20/2004	4.6	No	29.8	No	24.2	3.7
9530-05-011C	Co-60	0.243	0.0522	8/17/2004	0.2	Yes	22	No	121.5	1.1
9530-05-011C	Cs-137	0.597	0.0527	8/17/2004	4.6	No	29.8	No	26.0	4.0
9530-05-012C	Cs-137	0.575	0.0366	8/17/2004	4.6	No	29.8	No	25.0	3.9
9530-05-013C	Cs-137	0.225	0.0306	8/17/2004	4.6	No	29.8	No	9.8	1.5
9530-05-014C	Co-60	0.128	0.0474	8/17/2004	0.2	No	22	No	64.0	0.6
9530-05-014C	Cs-137	0.383	0.0456	8/17/2004	4.6	No	29.8	No	16.7	2.6
9530-05-015C	Cs-137	0.423	0.0342	8/17/2004	4.6	No	29.8	No	18.4	2.8
								Avg Cs-137 (pCi/L)	33.7	5.0
								Avg Sr-90 (pCi/L)	5.8	1.3
								Avg Co-60 (pCi/L)	322.5	2.9

Notes:
1) This value was calculated as K_d value * MCL Equivalent Concentration. The soil type with the lowest K_d value was used in this case.
2) This value was calculated as K_d value * MCL Equivalent Concentration. The soil type with the highest K_d value was used in this case.
3) This value was calculated as ı pCi/L = picocuries per liter
4) This value was calculated as measured soil concentration/Kd. The highest Kd was used.
pCi/g = picocuries per gram
TPU = total propagated uncertainty
MDC = minimum detectable concentration



9530-05-004C

Nuclide	Result (pCi/g)	MDC (pCi/g)	Date
Co-60	2.3	0.0631	07/20/2004
Cs-137	1.66	0.0758	07/20/2004
Sr-90	0.0606	0.0303	07/20/2004

9530-05-014C

Nuclide	Result (pCi/g)	MDC (pCi/g)	Date
Co-60	0.126	0.0474	06/17/2004
Cs-137	0.383	0.0456	06/17/2004

9530-05-015C

Nuclide	Result (pCi/g)	MDC (pCi/g)	Date
Cs-137	0.423	0.0342	06/17/2004

9530-05-013C

Nuclide	Result (pCi/g)	MDC (pCi/g)	Date
Cs-137	0.225	0.0308	06/17/2004

9530-05-012C

Nuclide	Result (pCi/g)	MDC (pCi/g)	Date
Cs-137	0.675	0.0366	06/17/2004

SAMPLES FOR WHICH LOCATIONS WILL BE AVAILABLE AT A LATER DATE

9530-05-002C

Nuclide	Result (pCi/g)	MDC (pCi/g)	Date
Co-60	1.09	0.0537	07/20/2004
Cs-137	1.82	0.0565	07/20/2004
Sr-90	0.0445	0.0285	07/20/2004

9530-05-003C

Nuclide	Result (pCi/g)	MDC (pCi/g)	Date
Co-60	1.81	0.0532	07/20/2004
Cs-137	1.39	0.0614	07/20/2004
Tc-99	0.516	0.436	07/20/2004

9530-05-005C

Nuclide	Result (pCi/g)	MDC (pCi/g)	Date
C-14	0.166	0.165	07/21/2004
Co-60	0.759	0.0618	07/21/2004
Cs-137	1.36	0.0539	07/21/2004
Sr-90	0.0491	0.029	07/21/2004

9530-05-006C

Nuclide	Result (pCi/g)	MDC (pCi/g)	Date
Co-60	0.392	0.0463	07/21/2004
Cs-137	0.557	0.0419	07/21/2004

9530-05-007C

Nuclide	Result (pCi/g)	MDC (pCi/g)	Date
Co-60	0.139	0.0386	07/20/2004
Cs-137	0.716	0.0465	07/20/2004

9530-05-008C

Nuclide	Result (pCi/g)	MDC (pCi/g)	Date
Co-60	0.227	0.049	07/21/2004
Cs-137	0.981	0.0417	07/21/2004

9530-05-009C

Nuclide	Result (pCi/g)	MDC (pCi/g)	Date
Co-60	0.0955	0.05	07/21/2004
Cs-137	0.875	0.0483	07/21/2004

9530-05-010C

Nuclide	Result (pCi/g)	MDC (pCi/g)	Date
Co-60	0.111	0.0373	07/20/2004
Cs-137	0.857	0.0395	07/20/2004

9530-05-011C

Nuclide	Result (pCi/g)	MDC (pCi/g)	Date
Co-60	0.243	0.0522	06/17/2004
Cs-137	0.597	0.0627	06/17/2004

N

0 100 200 Feet

CH2MHILL

FIGURE A-7

PENINSULA EVALUATION
CONCENTRATION OF CONTAMINANTS OF CONCERN IN SOIL EXCEEDING MINIMUM DETECTABLE CONCENTRATION
PENINSULA FINAL STATUS SURVEY UNIT 9530-05, HADDAM NECK PLANT
HADDAM NECK, CT