



UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION I
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January 7, 2011

Mr. Michael Colomb
Site Vice President
Entergy Nuclear Operations, Inc.
Vermont Yankee Nuclear Power Station
185 Old Ferry Road
P.O. Box 500
Brattleboro, VT 05302-0500

SUBJECT: VERMONT YANKEE NUCLEAR POWER STATION – GROUND WATER
MONITORING INSPECTION REPORT 05000271/2010010

Dear Mr. Colomb:

On November 18, 2010, the U.S. Nuclear Regulatory Commission (NRC) completed a ground water monitoring inspection at the Vermont Yankee Nuclear Power Station. The enclosed inspection report documents the results of our inspection. The inspection results were discussed with you, and other members of your staff, on November 18, 2010. This inspection was conducted from August 16 to November 18, 2010, to assess your performance relative to the continued monitoring and remediation of residual onsite ground water contamination of a previous advanced off-gas pipe tunnel leak. This included a review of your actions to establish sufficient ground water monitoring program means and protocols to monitor and assess the residual contaminant plume condition; review of progress in the development of an effective Conceptual Site Model (CSM) on which to base your Long Term Ground Water Monitoring Program, including remediation activities; and examination of the methods applied to assess and calculate the radiological dose consequence to members of the public and the off-site environment. This inspection was conducted in accordance with NRC Inspection Procedures 71152, "Problem Identification and Resolution", and 71153, "Follow-up of Events and Notices of Enforcement Discretion."

The inspection examined activities conducted under your license as they relate to safety and compliance with the Commission's rules and regulations, and with the conditions of your license. The inspection involved field walkdowns; observations of monitoring wells and ground water sampling activities; examination of selected procedures, calculations and examination of records; and interviews with station personnel.

Based on the results of this inspection, no findings of significance were identified. NRC inspectors confirmed that Entergy Nuclear-Vermont Yankee (ENVY) effectively evaluated the contaminated ground water with respect to off-site effluent release limits; properly evaluated the resultant radiological impact to the public's health and safety (which was determined by Entergy and confirmed by NRC's independent review to be minimal); and complied with all applicable regulatory requirements and standards pertaining to radiological effluent monitoring, dose assessment, and radiological evaluation.

While Entergy's performance to monitor and evaluate ground water conditions met NRC regulatory requirements, our inspectors identified several procedural commitments that ENVY has yet to fully establish and implement. These were related to formally establishing a long-term ground water monitoring program, completion of the CSM and a site characterization hydrogeological report; and applicable updates to the licensing basis, which includes the Final Safety Analysis Report and the Offsite Dose Calculation Manual. Regarding the site characterization of Vermont Yankee, the depth of tritium migration has yet to be fully defined with respect to the bedrock aquifer beneath the site. To accomplish that end, Entergy has provisions in its corrective action program for continued sampling of deep-water wells onsite (including at least one additional sample in the Construction Office Building well, a former drinking water well for which sampling efforts were ceased in October 2010). The NRC will continue to review Entergy's progress to complete these site characterization activities during inspections planned for early 2011.

In accordance with 10 CFR 2.390 of the NRC's "Rules of Practice," a copy of this letter, its enclosure, and your response (if any) will be available electronically for the public inspection in the NRC Public Docket Room or from the Publicly Available Records component of NRC's document system (ADAMS). ADAMS is accessible from the NRC Web site at <http://www.nrc.gov/reading-rm/adams.html> (the Public Electronic Reading Room).

Sincerely,



Darrell J. Roberts, Director
Division of Reactor Safety

Docket No. 50-271
License No. DPR-28

Enclosure: Inspection Report 05000271/2010010
w/Attachments: Supplemental Information

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/RA/
 Darrell J. Roberts, Director
 Division of Reactor Safety

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U. S. NUCLEAR REGULATORY COMMISSION

REGION I

Docket Nos.: 50-271

License Nos.: DPR-28

Report No.: 05000271/2010010

Licensee: Entergy Nuclear Operations, Inc.

Facility: Vermont Yankee Nuclear Power Station

Location: 320 Governor Hunt Road
Vernon, Vermont 05354-9766

Dates: August 16 – November 18, 2010

Inspectors: J. Noggle, CHP, Senior Health Physicist, Team Leader
T. Nicholson, Sr. Technical Advisor for Radionuclide Transport
Office of Nuclear Regulatory Research (RES)
D. Beissel, Senior Hydrogeologist, Office of Nuclear Reactor
Regulation (NRR)
T. Mack, Supervisory Hydrogeologist, U.S. Geological Survey
(USGS)

Approved by: Pamela J. Henderson, Chief
Plant Support Branch 2
Division of Reactor Safety

SUMMARY OF FINDINGS

IR 05000271/2010010; 08/16/2010 – 11/18/2010; Vermont Yankee Nuclear Power Station;
Contaminated Ground Water Monitoring Inspection.

The report covers the event follow-up of the tritium ground water contamination condition at Vermont Yankee Nuclear Power Station that was previously reported in January 2010. The NRC's program for overseeing the safe operation of commercial nuclear power reactors is described in NUREG-1649, "Reactor Oversight Process," Revision 4, dated December 2006.

No findings of significance were identified.

EXECUTIVE SUMMARY

Background:

On January 7, 2010, Entergy Nuclear -Vermont Yankee (ENVY) informed the NRC that tritium was detected in a ground water monitoring well (GZ-3) at an initial concentration of approximately 17,000 picocuries per liter (pCi/L) in water. ENVY initiated a prompt investigation that included mapping of the ground water tritium plume and investigating potential structures, systems, and components, such as buried pipes and tanks, to determine the source and cause of the contamination. As a result of this effort, ENVY successfully identified the cause, and subsequently terminated the source of the contamination in February 2010.

On January 25, 2010, Region I initiated an inspection of this abnormal release event to examine the licensee's performance, and determine if the contaminated ground water affected, or could affect, public health and safety. This inspection included the combined efforts of Region I-based inspectors, as well as hydrogeologists from NRC's Office of Nuclear Reactor Regulation (NRR) and Office of Nuclear Regulatory Research (RES), and the U.S. Geological Survey (USGS). The inspection included continuing review and assessment of ENVY's performance and response to the ground water contamination event, including the licensee's actions to monitor and assess the on-site ground water contamination condition sufficiently to assure and maintain public health and safety, and protection of the environment.

Status of Ground Water Contamination Monitoring and Remediation Activities:

On February 15, 2010, ENVY identified and successfully terminated the source of the tritium contaminated ground water. ENVY determined that the source was due to leakage from an underground pipe tunnel that contained leaking components associated with the Advanced Off-Gas (AOG) system. Remedial actions to extract contaminated ground water in the vicinity of the AOG leakage were initiated on March 25, 2010. The activity was initially terminated on November 8, 2010 upon the extraction of 307,000 gallons and was resumed on December 30, 2010. Residual ground water contamination is expected to continue its migration to the Connecticut River.

Subsequent sampling in November 2010 in a deep well in the surface soils or overburden directly above the bedrock aquifer indicated a tritium concentration of approximately 500,000 pCi/L. The inspectors determined that the direction of ground water flow is toward the Connecticut River and away from any drinking water sources. The extent of vertical migration of the residual tritium to the bedrock aquifer remains to be determined. Notwithstanding, based on review of all available information and data to date, there continues to be reasonable assurance that public health and safety has not been, nor is expected to be, adversely affected by the current on-site ground water contaminant plume condition.

Ground water contamination levels in the tritium plume have decreased significantly in wells adjacent to the leak source, but have increased in down-gradient wells (GZ-3, 4, 14 and 22D) due to the expected continued migration of the tritiated ground water plume, both laterally and vertically, to the Connecticut River.

ENVY estimated the contaminated ground water release conditions, including quantification of the offsite liquid release (2.79 Curies of tritium) and its dose impact (0.00035 mrem). These dose calculations have been reviewed and independently verified by the NRC and determined to be a small fraction of the "As Low As is Reasonably Achievable" dose objective specified in 10 CFR 50, Appendix I for liquid effluent releases, i.e., significantly less than 3 mrem in a year. NRC will continue to inspect the licensee's performance in this area and confirm conformance to applicable regulatory requirements.

NRC Evaluation of Licensee Performance:

1. The NRC inspectors determined that there has been no impact to public health and safety due to the ground water contamination event. Plant-related radioactivity, including tritium has not been detected in any on or off-site drinking water well (the COB well was removed from use in January 2010 when tritium was detected in GZ-3) or any off-site environmental monitoring location.
2. Inspectors concluded that ENVY is continuing to implement ground water and environmental monitoring protocols to provide on-going radiological oversight and assessment of the on-site contaminated ground water condition to confirm that public health and safety is not, nor is expected to be, adversely affected. This assessment is supported by current sampling and analytical data; the termination of active leakage in February 2010; and the determination that, to date, there has been no plant-related radioactivity detected in any off-site environmental monitoring location, including surface or ground water.
3. Upon identification of an abnormal radiological effluent release affecting ground water, the inspectors determined that the licensee implemented actions that conformed to the radiological survey requirements of 10 CFR 20.1501 to ensure compliance with dose limits for individual members of the public as specified in 10 CFR 20.1302.
4. Inspectors determined that ENVY's current hydrogeologic site characterization has yet to be completed. This Conceptual Site Model (CSM) would provide the basis for determining ground water flow and transport behavior to support ground water flow effluent release assumptions that apply to potential migration in both the shallow water table and the bedrock aquifer.
5. Inspectors found that ENVY has significantly enhanced its onsite ground water monitoring network. However, additional actions have yet to be completed in order to assure effective long-term ground water monitoring of the residual tritium plume, several of which rely on completion of the CSM. Specifically, ENVY has yet to complete its long-term ground water monitoring program, including updating the licensing basis in the Final Safety Analysis Report and revision of the Offsite Dose Calculation Manual, to include the current characterization of the hydrology and geology related to radionuclide transport, ground water monitoring locations, and public dose calculation methodology. Many of these open items were previously reported in the May 20, 2010, Inspection Report. The inspectors determined that the timeliness of ENVY's efforts to complete these items reflected a reasonable prioritization of activities relative to the licensee's long-term ground water monitoring program. Future NRC inspections will evaluate the licensee's progress in completing these activities.

REPORT DETAILS

4. OTHER ACTIVITIES

4OA2 Problem Identification and Resolution

Background

In January 2010, following the licensee's detection of onsite ground water tritium contamination, the NRC determined that the licensee's subsurface Conceptual Site Model (CSM) of the Vermont Yankee (VY) site, which had been developed in response to the Nuclear Energy Institute's (NEI) 07-07 Ground Water Protection Initiative (GPI), was not sufficiently detailed. The NRC found the initial CSM did not provide sufficient specificity to identify the source area for the H-3 (tritium) leak, or include fundamental definition of the ground water flow units (e.g., depths and extents), or their hydraulic and transport relationships and parameters. Based upon hydrogeologic investigations begun in response to the tritium leak, ENVY significantly updated the CSM to account for site-specific ground water flow and transport processes, properties and conditions.

The initial detection of the tritium leak was in monitoring well GZ-3 (see Attachment A, Figure 1) located on the Connecticut River bank. The source of the contamination was not readily discernable due to an absence of monitoring wells adjacent to the plant systems, structures and components (SSCs) containing radioactive fluids, as recommended in the NEI 07-07 Ground Water Protection Initiative. Subsequently, ENVY examined numerous candidate SSCs for possible sources of the leak, and then installed a series of ground water monitoring wells to aid in identifying the tritium leak source. By February 6, 2010, monitoring well GZ-10 was installed next to the Advanced Off-Gas (AOG) building where subsurface pipes within a pipe tunnel conveyed fluids carrying radionuclides. GZ-10 monitoring data was instrumental in determining the specific leak location from the AOG pipe tunnel. The initial tritium concentration at GZ-10 was approximately 2.5 million pCi/L. This leakage was confirmed to be from an underground concrete pipe tunnel associated with the AOG system. By November 15, 2010, 31 new ground water monitoring wells had been installed on site.

a. Inspection Scope

The licensee initiated Condition Report, CR-VTY-2010-0541, on February 8, 2010, to assess and correct gaps in the licensee's implementation of the NEI Industry Ground Water Protection Initiative, NEI 07-07, based on findings from an NEI peer review on January 25, 2010; and the subsequent identification of deficiencies by an NRC inspection conducted in accordance with Temporary Instruction (TI) 2515-173. The status of this condition report was previously reviewed and documented in Inspection Report No. 05000271/2010006 issued on May 20, 2010 (ADAMS Accession No. ML101400040).

During this current inspection activity, the NRC reviewed the remaining ground water monitoring program elements that were incomplete at the time of the earlier inspection to confirm and assess ENVY's actions relative to the establishment, implementation, and

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maintenance of a long-term ground water monitoring program to oversee and assess the current ground water contamination condition, and detect new or changed ground water conditions.

b. Findings and Observations

No findings were identified.

The inspectors determined that the licensee established a set of site-specific ground water monitoring program procedures. However, one of these procedures, Administrative Procedure PP-GPP-7605, "Ground Water Protection Program", approved July 22, 2010, specified implementation of certain program requirements that were not established or implemented as of November 18, 2010. These requirements included convening a Ground Water Protection Expert Panel (GPEP) to approve the ground water contamination risk profile, including the assessment of station work practices that may adversely affect ground water contamination; GPEP approval of the site ground water monitoring plan; and the updating of the ground water-related licensing documents, such as the Updated Final Safety Analysis Report, to reflect current hydrogeology information, and the Offsite Dose Calculation Manual (ODCM), to indicate ground water monitoring locations and ground water effluent pathway dose calculation methodology.

Administrative Procedure PP-GPP-7605 constitutes a self-imposed standard associated with an Agency issue of concern (i.e., an existing ground water contamination condition). The failure to establish the requirements specified in this procedure was an issue of minor significance per Inspection Manual Chapter 0612, Section 0612-11. Specifically, the failure to complete these administrative actions did not adversely affect public radiation safety. The ground water leak was terminated before NRC regulatory limits were approached; and the residual tritium plume was monitored in the shallow water table aquifer, and reported in accordance with regulatory requirements. The inspectors determined that the timeliness of ENVY's efforts to complete these items reflected a reasonable prioritization of activities relative to the licensee's long-term ground water monitoring program. Based on its minor significance, the performance deficiency did not meet the threshold for being characterized as an NRC finding.

4OA3 Event Follow-up (IP 71153 – 1 sample)

.1 Ground Water Sampling

a. Inspection Scope

As previously reported in NRC Inspection Report No. 05000271/2010006, dated May 20, 2010 (ADAMS Accession No. ML101400040), the NRC compared two sets of licensee laboratory split sample results, comparing analytical measurement results of the Vermont Yankee onsite site radiochemistry laboratory with a licensee contracted offsite laboratory, and determined there was agreement between these laboratory analytical results. To provide further verification, during this inspection on August 19, September 22, and October 2, 2010, the NRC witnessed the collection of seventeen duplicate water

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samples that included Connecticut River; ground water monitoring wells, inside and outside of the plume area; and drinking water supply samples for independent measurement and comparison with licensee's analytical results from the duplicate split samples. Sample identity was assured by chain-of-custody procedures that included sample collection observation by the NRC inspector. The NRC samples were analyzed by an independent laboratory.

These ground water samples were obtained to provide an independent check of ENVY's analytical results and to independently verify if there was any measurable radioactivity detectable in the environment due to migration of ground water contaminants offsite. These split samples consisted of complete measurement analyses for all radionuclides present in Vermont Yankee's radioactive waste streams, which included gamma-emitting radionuclides, hydrogen-3 (tritium), strontium-90, nickel-63, iron-55, and alpha-emitting radionuclides to ensure that all applicable radionuclides were identified, assessed and included in dose calculations that characterized the effluent releases.

b. Findings and Observations

No findings were identified.

No plant-related radionuclides were detected in any Connecticut River samples or any drinking water samples derived from on-site ground water wells. Only tritium and naturally occurring radionuclides were detected from on-site ground water monitoring wells within the on-site residual tritium plume. To assess the accuracy of the positive tritium results, the NRC inspectors used the statistical comparison criteria specified in NRC Inspection Procedure 84750, "Radioactive Waste Treatment, and Effluent and Environmental Monitoring Analyses." This statistical comparison indicated agreement between the NRC contracted laboratory results and the licensee's laboratory results.

.2 Ground Water Tritium Contamination

a. Inspection Scope

The scope of this inspection included a continuing review of ENVY's remediation efforts and ground water monitoring of the residual on-site ground water tritium contamination condition and the licensee's actions to complete a ground water monitoring program to effectively assess the current ground water conditions, and the licensee's ability to detect any future leaks that may impact the ground water. In addition to NRC health physics specialists and NRC hydrogeologists, a U.S. Geological Survey (USGS) supervisory hydrogeologist from the USGS New Hampshire/Vermont Office also participated in this inspection.

During this inspection effort, the inspectors interviewed several ENVY technical and management personnel; reviewed data, records, technical drawings, and procedures; and conducted direct inspection and observed the licensee's and their contractor's performance over the course of several on-site visits.

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NRC inspectors reviewed one of ENVY's key remedial actions to extract contaminated ground water from the highest concentration center of the plume, which began on March 25, 2010. The licensee terminated this initial remediation activity on November 8, 2010. This action was estimated to have removed about 300 mCi or approximately 10% of the total tritium activity, and assisted in decreasing the plume's concentration in monitoring wells near the leak source. Subsequent to the inspection on December 30, 2010, the licensee resumed ground water extraction activities from two ground water monitoring wells exhibiting the highest tritium concentrations.

NRC inspectors reviewed ENVY's investigations; numerous site hydrogeology, geophysical and radionuclide survey activities; measurement of ground water gradients; estimates of hydraulic and transport parameters; and ENVY's determination of the extent of radionuclide release. The inspectors also reviewed the use of this information to support the calculation of radiological liquid effluent releases from the leakage via the ground water pathway and calculation of the corresponding safety impact of radiation dose to the public due to this abnormal leakage event.

b. Findings and Observations

No findings of significance were identified.

Hydrogeology Assessment

1.0 Conceptual Site Model (CSM)

Though not a NRC regulatory requirement, the development and testing of a CSM was identified in NEI-07-07, "Industry Ground Water Protection Initiative – Final Guidance Document", dated August 2007, which states: "Perform hydrogeologic and geologic studies to determine predominant ground water flow characteristics and gradients." The licensee's CSM to address this industry guidance was in development, but not finalized at the completion of this inspection. The licensee's CSM will be reviewed in a subsequent inspection. Notwithstanding, the CSM, as currently developed, provided detailed information derived from ground water monitoring wells, tritium concentrations sampled over time, and water-table levels (see Attachment A, Figure 1). The CSM also provided vertical definition and spatial relationships in the overburden but not in the bedrock aquifer.

To investigate the vertical extent of the tritium plume, ENVY developed six deep overburden monitoring wells that terminated just above the bedrock interface (i.e., GZ-12D, GZ-13D, GZ-14D, GZ-18D, GZ-19D and GZ-22D). Subsequent ground water samples showed mixed results with some of these wells indicating less than 2,000 pCi/L, implying very little downward migration to the underlying bedrock interface. However, sample results from two wells (GZ-12D and GZ-22D), indicated concentrations of 65,000 and 500,000 pCi/L, respectively, suggesting the potential for downward migration to the underlying bedrock aquifer.

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From review and assessment of the available data, NRC's hydrogeologic review indicated that the underlying gneiss bedrock aquifer was not confined; and ground water hydraulic level measurements from the three onsite and two offsite deep bedrock aquifer wells indicated a general upward ground water flow direction to the overburden, and into the Connecticut River. Upon close inspection, the hydrographs for the Construction Office Building (COB) drinking water well (no longer in service) in the bedrock aquifer, and for monitoring wells GZ-13D and GZ-14D in the overburden, as well as the Connecticut River stage, showed some connectivity to the daily cyclical rising and falling of the Connecticut River at the Vernon Pond due to the operation of the hydroelectric dam at Vernon. These ground water water-table trends (also known as ground water gradients) implied protection from contamination reaching the deeper bedrock drinking water aquifer. However, data from one well (GZ-12) suggested the potential for downward flow to the bedrock aquifer when compared to the COB well levels. Further ENVY investigations remain to complete its CSM and formally establish a site-specific long-term monitoring program. As new wells have been installed, additional data has been collected on tritium concentrations and ground water potentiometric heads (a measurement of water table elevation). Entergy officials indicated to NRC inspectors that they plan to continue additional sampling of these wells to evaluate and verify the CSM, and determine the effectiveness of remediation methods, such as ground water extraction and monitored natural attenuation.

Additionally, NRC inspectors observed that the present CSM, as developed at the time of this inspection, did not describe or explain the potential migration of tritium into the COB well, as implied by a previously collected single sample of 1040 pCi/L. Accordingly, in order to ensure sufficient monitoring of the hydraulic protection offered by ground water extraction or natural attenuation processes; and timely detection of new or changed ground water conditions, such as those caused by any future leaks; the NRC inspectors identified some information gaps and technical uncertainties that, if left unresolved, could potentially invalidate certain assumptions in ENVY's CSM and long-term ground water monitoring program. In response, ENVY is taking the following actions (as captured in CR-VTY-2010-0541) to provide further clarification and confidence in the accuracy of ground water flow and tritium contaminant transport relative to its CSM, and assure sufficient protection of the drinking water aquifer beneath the site:

- Conducting an evaluation of ground water flow relationships between the overburden units and bedrock aquifer;
- Conducting an evaluation of hydraulic ground water relationships between the water table and bedrock aquifer, and the influence of the Vernon Pond water level fluctuations (created by the Trans-Canada hydroelectric dam on the Connecticut River);
- Monitoring of seasonal changes to the ground water gradients, flow directions, and recharge for the overburden units and bedrock aquifer;

- Testing and confirmation of the updated CSM using monitoring data from the Ground Water Monitoring Program (GWMP) and comparisons with numerical simulations (i.e., MODFLOW code simulations) of flow and transport scenarios;
- Performing additional sampling of the COB well to confirm that the bedrock aquifer was not adversely affected by the tritium contamination; and
- Evaluating the advisability of establishing the COB well as a deep aquifer ground water monitoring well in the long term ground water monitoring program.

2.0 Remediation Program

While not a NRC regulatory requirement, ENVY implemented a remediation program on March 25, 2010, to extract contaminated ground water in the highest concentration center of the plume, suspended extraction activities on November 8, 2010, after removal of 307,000 gallons of tritiated ground water, and restarted ground water extraction activities on December 30, 2010. The initial extraction activity removed approximately 300 mCi or approximately 10% of the total tritium activity, and assisted in decreasing the plume's concentration and extent. The objective of the licensee's remediation program is to preclude tritium migration to the bedrock aquifer and to minimize releases of tritium to the Connecticut River. The need for, and selection of locations for, ground water extraction was based on the pre-existing CSM. The extraction well (EW-1A) location was selected to center on the tritium plume's highest concentrations as interpolated from tritium concentrations in GZ-7 and GZ-21, which are down-gradient (at a lower water-table location) of the initial leak source adjacent to well GZ-10. EW-1A produced initially 3.5 gallons per minute (gpm) and later 1.5 gpm with tritium concentrations initially as high as 1 million pCi/L. Because of the subsequent greatly reduced tritium concentrations in GZ-10 (non detectable), this remediation method appeared to be effective.

As the high concentration portion of the tritium plume's centerline advanced horizontally towards the Connecticut River, the extraction well activities moved from well EW-1A to well GZ-15, then to wells EW-2 and GZ-14 near the site boundary. Once the remediation program extracted 307,000 gallons on November 8, 2010, it was terminated to review its effect. Approximately 9,000 gallons of the extracted contaminated ground water was processed and then recycled for reuse inside the plant. The remaining tritiated water was shipped off-site and subsequently processed for disposal.

After the inspection had been completed, on December 30, 2010, ENVY restarted contaminated ground water extraction from GZ-14 and GZ-22D, which at that time represented the measured ground water locations of highest tritium radioactivity to further mitigate the release of tritiated ground water to the Connecticut River and any release to bedrock aquifer. This action is documented in condition report no. CR-VTY-2010-0541.

3.0 Long-Term Ground Water Monitoring Program (LTGWMP)

At the conclusion of this inspection, the site-specific LTGWMP had not been completed and finalized as discussed in Section 4OA2 of this report. This aspect will be examined in a subsequent inspection. Notwithstanding, ENVY has continued to implement ground water and environmental monitoring protocols that provided on-going radiological oversight and assessment of the on-site contaminated ground water condition sufficient to confirm that public health and safety has not been affected.

Radiological Assessment

Notwithstanding some of the remaining uncertainties in the licensee's CSM referenced above, the regional ground water gradient and flow direction indicates ground water flow in both the overburden and bedrock aquifers is towards the Connecticut River and that there is no current direct drinking water ingestion pathway to any member of the public. Therefore, for the current condition, the previous draft revision of offsite radiological effluent release and offsite dose calculations, dated May 9, 2010, remains valid. A review of the licensee assumptions and calculations was previously reviewed by the inspectors and documented in the May 20, 2010, inspection report. That dose assessment has not changed as documented in that report.

The dose assessment provided a detailed ingestion pathway and age-group specific dose assessment, as specified in the Vermont Yankee Offsite Dose Calculation Manual (VY ODCM). The calculations were reviewed and verified to adhere to the specifications of the VY ODCM, and the dose assessment methodology reflected in Regulatory Guide 1.109, "Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I".

The calculations utilized ground water flow rates derived from site-specific water table (overburden) unit permeability measurements and included a multiplication factor of 2.5 to incorporate any uncertainty and provide for conservatism in the results. The tritium ground water release used in these calculations was based on integrating ground water monitoring well sample measurements within the tritium plume volume from early February 2010, when the plume had reached its maximum extent and immediately prior to terminating the leak. These assumptions reflected reasonable conservative assumptions of total contaminants released and transit time to the Connecticut River.

ENVY's calculations estimated a total tritium ground water release for this event of approximately 2.79 Ci. The radiological impact of this quantity of tritium released to the Connecticut River was calculated for a theoretically maximum exposed individual from all identified liquid pathways to the most sensitive human age group. This resultant dose calculation to a child was 0.00026 mrem in one year. In addition to the above stated exposure pathways, if there was also a direct drinking pathway from the Connecticut River down stream from the Vernon Dam, the dose to a child would be 0.00035 mrem in one year.

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The current effluent release and dose calculation results are in accordance with NRC regulatory requirements and represent a very small fraction of the 3-mrem-per-year liquid effluent release criteria specified in 10 CFR 50, Appendix I. The official 2010 ground water effluent release calculations will be reviewed by the NRC again based on the official NRC effluent report for 2010, which is expected to be reported by mid-May of 2011.

Regulatory Assessment

From the initial identification in January 2010 of an abnormal radiological effluent release affecting ground water through the current inspection period, the licensee has made surveys of the concentrations of radioactive materials in the ground water that were reasonable to evaluate the potential radiological hazards as specified in 10 CFR 20.1501 to ensure compliance with dose limits for individual members of the public of 100 mrem per year as specified in 10 CFR 20.1302. This included: (1) investigating and evaluating the radiological conditions and potential hazards affecting ground water conditions, on- and off-site; (2) providing the required annual report of the condition, and determining that the calculated hypothetical dose to the maximally exposed member of the public was well below established NRC regulatory requirements for liquid radiological release; (3) confirming, through off-site environmental sampling and analyses, that plant-related radioactivity was not distinguishable from background; and (4) initiating appropriate actions to mitigate and remediate the conditions to assure that NRC regulatory dose limits to members of the public and the environment were not exceeded.

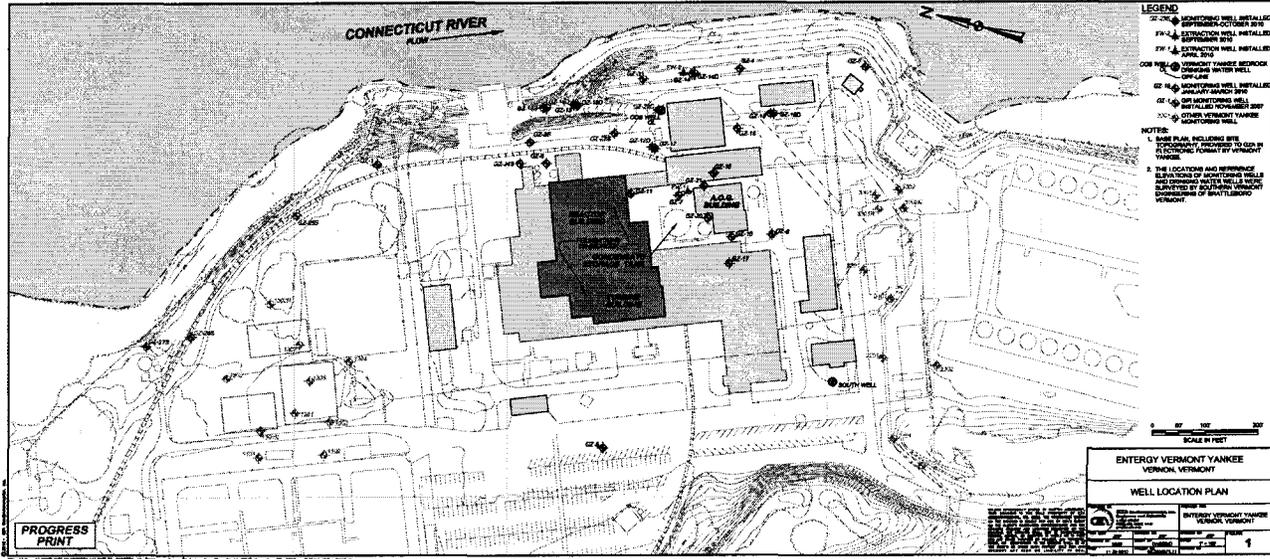
40A6 Meetings, including Exit

The inspectors presented the preliminary inspection results to Mr. M. Colomb, and other members of ENVY staff, at an exit meeting on November 18, 2010. The inspectors verified that none of the information in this report is proprietary. One Entergy drawing and two Entergy hydrographs, which were instrumental in providing inspectors with a visual representation of the water gradient in the bedrock aquifer and horizontal tritium plume map impact on the site, are provided in Attachment A to this report.

Enclosure

Attachment A

Figure 1, Vermont Yankee Ground Water Monitoring Well Map*



* Indicates a drawing obtained from ENVY for purposes of inspection review and assessment.

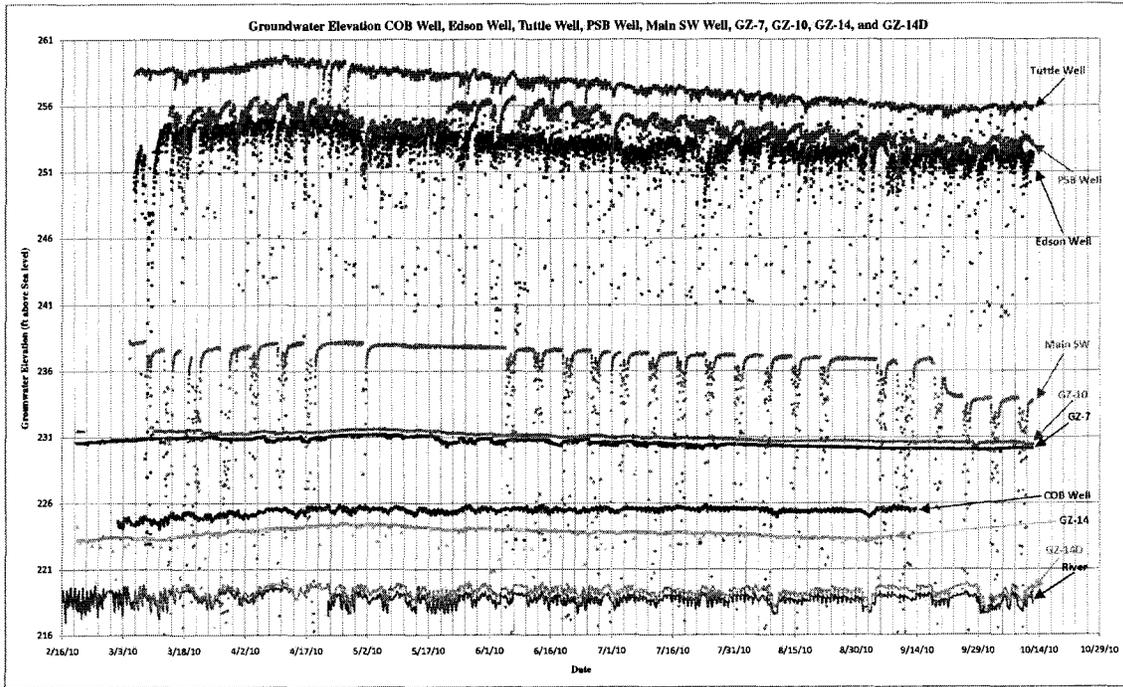
Table 1
Vermont Yankee Ground Water Monitoring Well Tritium Data

<u>Monitoring Well</u>	<u>Tritium Concentrations (pCi/L)</u>	<u>Dates</u>
GZ-1	ND	5/10 – 11/10
GZ-2	ND	5/10 – 11/10
GZ-3	71,000 → 180,000	5/10 – 11/10
GZ-4	7,900 → 59,000	5/10 – 11/10
GZ-5	ND	5/10 – 11/10
GZ-6	ND	5/10 – 11/10
GZ-7	1,200,000 → 3,700	5/10 – 11/10
GZ-9	ND	5/10 – 11/10
GZ-10	1,660 → ND	5/10 – 11/10
GZ-11	ND	5/10 – 11/10
GZ-12	480,000 → 5,600	5/10 – 11/10
GZ-12D	63,000 – 90,000	11/10
GZ-13	ND	5/10 – 11/10
GZ-13D	1,100 → 2,800	5/10 – 11/10
GZ-14	280,000 → 500,000	5/10 – 11/10
GZ-14D	ND	5/10 – 11/10
GZ-15	760,000 → 58,000	5/10 – 11/10
GZ-16	ND	5/10 – 11/10
GZ-17	ND	5/10 – 11/10
GZ-18	ND	11/10
GZ-18D	700 – 1,500	11/10
GZ-19	ND	5/10 – 11/10
GZ-19D	ND	5/10 – 11/10
GZ-20	163,000 → ND	5/10 – 11/10
GZ-21	2,000,000 → 15,200	5/10 – 11/10
GZ-22D	467,000 – 508,000	11/10

ND Indicates no detectable activity

→ Denotes the trend of tritium concentration from the earliest to most recent sample data, where applicable

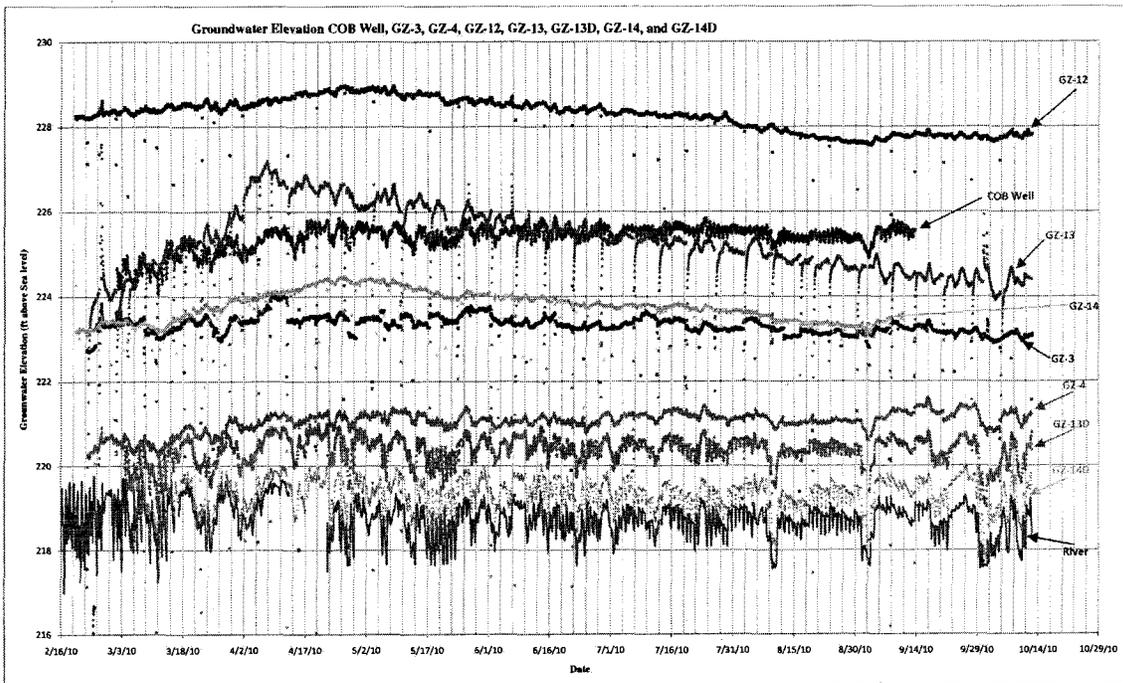
Vermont Yankee Nuclear Power Station
Vernon, Vermont



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Vernon, Vermont



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CZA GeoEnvironmental, Inc

ATTACHMENT B
SUPPLEMENTAL INFORMATION
KEY POINTS OF CONTACT

Licensee Personnel

S. Skibniowsky	Environmental and Effluents Chemistry Specialist
J. Hardy	Chemistry Manager
M. Shaw	Principal Hydrogeologist, GZA GeoEnvironmental, Inc.

LIST OF ITEMS OPENED, CLOSED AND DISCUSSED

Opened and Closed

None.

LIST OF DOCUMENTS REVIEWED

Procedures:

EN-CY-111, "Ground water Monitoring"
EN-CY-109, Rev. 2, "Sampling and Analysis of Ground water monitoring Wells"
EN-CY-108, Rev. 3, "Monitoring of Non-radioactive Systems"
EN-RP-113, Rev. 4, "Response to Contaminated Spills/Leaks"
OP 4605, Rev. 45, "Environmental Radiation Sampling and Analysis"
CHAD-7605-01, "Ground water Monitoring Plan"
PP-GPP-7605, "Ground water Protection Program"
EGAD-7605-01, "Ground water Contamination Risk Profile"
Draft, Vermont Yankee Ground water Monitoring Plan, Revision 1

Condition Reports:

CR-VTY-2010-0541

Other Documents

State of New Hampshire Hydrogeology assessment of Vermont Yankee
VYNPS Radiation Protection Department Report No. 10-001, Rev. 3, "Simplified Dose Analysis for Tritium in Well GZ Wells"
Areva NP, Inc. Document No. 47-9133403, February 26, 2010, "Pathway Dose Assessment for Vermont Yankee Ground water Release to the Connecticut River"
ENVY Document, May 9, 2010, "Pathway Dose Assessment for Vermont Yankee Ground water Release to the Connecticut River"

LIST OF ACRONYMS

AOG	Advanced Off-Gas
CFR	Code of Federal Regulations
COB	Construction Office Building
CR	Condition Report
CSM	Conceptual Site Model
CST	Condensate Storage Tank
ENVY	Entergy Nuclear Vermont Yankee
FSAR	Final Safety Analysis Report
GPEP	Groundwater Protection Expert Panel
GPI	Groundwater Protection Initiative
LTGMP	Long Term Ground water Monitoring Program
NEI	Nuclear Energy Institute, Inc.
NRC	Nuclear Regulatory Commission
NRR	Nuclear Reactor Regulation
ODCM	Offsite Dose Calculation Manual
PSB	Plant Services Building
RCA	Root cause analysis
RES	Nuclear Regulatory Research
ODCM	Off-site Dose Calculation Manual
pCi/L	pico-Curies per Liter
USGS	United States Geological Survey