Docket No. 50-213
CY-06-062

Attachment 1
Annual Radioactive Effluent Release Report

May 2006

# HADDAM NECK PLANT

## CONNECTICUT YANKEE ATOMIC POWER COMPANY
Haddam, Connecticut

## ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT

January-December 2005

Docket No. 50-213

LICENSE NUMBER DPR-61

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## 1.0 INTRODUCTION

As required by the Connecticut Yankee Quality Assurance Program (QAP), this Annual Radioactive Effluent Release Report for the year 2005 is submitted in accordance with 10 CFR 50.36a, "Technical Specifications on Effluents from Nuclear Power Reactors." A summary of the quantities of Radioactive Liquid and Gaseous Effluents and Solid Waste released from the Haddam Neck Plant is presented in this document. The material provided is consistent with the objectives outlined in the Radiological Effluent Monitoring and Offsite Dose Calculation Manual (REMODCM). The information submitted is formatted to the general outline described in Regulatory Guide 1.21, "Measuring, Evaluating, and Reporting Radioactivity in Solid Wastes and Releases of Radioactive Materials in Liquid and Gaseous Effluents from Light-Water-Cooled Nuclear power Plants".

Haddam Neck is currently in the process of decommissioning. In support of the decommissioning effort, radioactive liquid was processed and batch released from Temporary FRAC Tanks in 2005. The radwaste system utilized filters and demineralizers to process radioactive liquid prior to controlled release to the environment. The RCA Yard Drain System is categorized as a continuous release liquid pathway. The major contributors to this release point during 2005 were the External Containment Sump, Groundwater Processing System effluent and rainwater.

The transfer of nuclear fuel from the Spent Fuel Pool (SFP) to storage casks was completed in March 2005. The loaded storage casks were transported to the Independent Spent Fuel Storage Installation (ISFSI) for storage until transferred to the Department of Energy for final internment. During the preparation of canisters for the movement of the spent fuel, elevated Kr-85 concentrations were detected in the effluent of the Spent Fuel Building ventilation. The duration and quantity of noble gas (Kr-85) released was quantified and include in this annual report.

The mixed mode elevated gaseous release pathway from the Main Stack was removed during 2004. The temporary ventilation units that replaced the former stack continue to be included in the gaseous effluent monitoring program. As the decommissioning project creates new potential gaseous release pathways, baseline data will be collected and, if necessary, the release point will be added to the monitoring program. The Alternate Containment Access, Alternate Containment and PAB Ventilation, Containment Foyer, and Tank Farm Tent are examples of miscellaneous pathways that were routinely monitored.

## 2.0 Summary

Tables 1 through 9 summarize the quantity of radioactive gaseous and liquid effluents, respectively, for each quarter of 2005. The gaseous release tables are a summation of all monitored release points in 2005 (i.e., Spent Fuel Pool exhaust, CTMT Foyer, CTMT Lower Level Access, and CTMT Alternate Access Point). The liquid release tables are a summation of continuous and batch release from all monitored release points for 2005. Table 10 provides the quarterly and annual doses from liquids, particulate and gaseous effluents to the whole body and maximally exposed organ. Table 11 summarizes the waste that was shipped off-site for burial or disposal during the year 2005.

The radioactive effluent monitoring program for 2005 was conducted in accordance with QAP Appendix C, Section 2.5. The results of the monitoring program indicate that the Haddam Neck Plant was successful in maintaining radioactive effluent releases to the environment as low as reasonably achievable.

The effluent dose contributions for this report are significantly less than regulatory limits.

## 3.0 Supplemental Information

### 3.1 Regulatory Limits

This program conforms to 10 CFR 50.36a for the control of radioactive effluents and for maintaining the dose to MEMBERS OF THE PUBLIC from radioactive effluents as low as reasonably achievable. The program shall be contained in the REMODCM, shall be implemented by procedures, and shall include remedial actions to be taken whenever the program limits are exceeded. The program shall include the following elements:

a. Limitations on the functional capability of radioactive liquid and gaseous monitoring instrumentation, including surveillance tests and set point determinations, in accordance with the methodology described in the REMODCM;

b. Limitations on the concentrations of radioactive material released in liquid effluents to unrestricted areas, conforming to the pre-1994 concentration values in 10 CFR Part 20, Appendix B (from 20.1 to 20.602), Table II, Column 2;

c. Monitoring, sampling, and analysis of radioactive liquid and gaseous effluents in accordance with 10 CFR 20.1302 and with the methodology and parameters described in the REMODCM;

d. Limitations on the annual and quarterly doses or dose commitment to a MEMBER OF THE PUBLIC from radioactive materials in liquid effluents released from the facility to unrestricted areas, conforming to 10 CFR Part 50, Appendix I;

e. Determination of cumulative dose contributions from radioactive effluents for the current calendar year in accordance with the methodology and parameters described in the REMODCM performed at least every 92 days. A determination of projected dose contributions from radioactive effluents in accordance with the methodology in the REMODCM performed at least every 92 days.

f. Limitations on the functional capability and use of the liquid and gaseous effluent treatment systems to ensure that appropriate portions of these systems are used to reduce releases of radioactivity when the projected doses in a period of 31 days would exceed 2% of the guidelines for the annual dose or dose commitment, conforming to 10 CFR Part 50, Appendix I;

g. Limitations on the dose rate resulting from radioactive material released in gaseous effluents from the site to areas at or beyond the SITE BOUNDARY shall be as follows:

    1. for noble gases: less than or equal to a dose rate of 500 mrem/yr to the total body and less than or equal to a dose of 3000 mrem/yr to the skin; and

    2. for tritium and all radionuclides in particulate form with half-lives greater than 7 days; less than or equal to a dose rate of 1500 mrem/yr to any organ;

h. Limitations on the annual and quarterly air doses from noble gases released in gaseous effluents from the unit to areas beyond the SITE BOUNDARY, conforming to 10 CFR Part 50, Appendix I;

i. Limitations on the annual and quarterly doses to a MEMBER OF THE PUBLIC from tritium and all radionuclides in particulate form with half-lives greater than 8 days in gaseous effluents released from each facility to areas beyond the SITE BOUNDARY, conforming to 10 CFR Part 50, Appendix I; and

j. Limitations on the annual dose or dose commitment to any MEMBER OF THE PUBLIC at points beyond the SITE BOUNDARY due to releases of radioactivity and to radiation from uranium fuel cycle sources, confirming to 40 CFR Part 190.

3.2 Maximum Permissible Effluent Concentrations

| | | |
|---|---|---|
| a. | Fission and activation gases | Pre-1994 concentration values in 10 CFR Part 20, Appendix B (from 20.1 to 20.602), Table II, Column 1 |
| b. | Iodines | Pre-1994 concentration values in 10 CFR Part 20, Appendix B (from 20.1 to 20.602), Table II, Column 1 |
| c. | Particulates, (half lives>8 days) | Pre-1994 concentration values in 10 CFR Part 20, Appendix B (from 20.1 to 20.602), Table II, Column 1 |
| d. | Liquid Effluents | Pre-1994 concentration values in 10 CFR Part 20, Appendix B (from 20.1 to 20.602), Table II, Column 2 |
| e. | Total noble gas concentration | Pre-1994 concentration values in 10 CFR Part 20, Appendix B (from 20.1 to 20.602), Table II, Column 1 |

3.3 Average Energy – Not Applicable

3.4 Measurements and Approximations of Radioactivity

a. Fission and Activation Gases

During spent fuel transfer evolutions the noble gas effluent release was accounted for by integrating the Spent Fuel Exhaust Radiation Monitor chart recordings. The results for radioactivity from gaseous effluents and the effluent flow rate were used to determine the total amount of activity released.

Continuous Discharge – The Fuel Building Exhaust Vent samples are analyzed monthly. Activity levels determined are assumed constant for the surveillance interval.

Batch Discharges – There were no batch releases via this pathway in 2005.

There are no gaseous effluent release pathways associated with ISFSI Operations.

b. Iodine's

Iodine surveillance no longer applies due to the elapsed time since final plant shutdown from power operations.

c. Particulates

Particulate release pathways were continuously sampled using air filters. The particulate filters were analyzed weekly for gamma radioactivity, monthly for gross alpha and gross beta activity. Particulate filters exhibiting a positive gross beta were saved for quarterly Sr-90 analysis. The results for radioactivity from gaseous effluents and the effluent flow rate were used to determine the total amount of activity released. Detected particulate activity is reported in Tables 1 through 4.

There are no gaseous effluent release paths associated with ISFSI operations.

d. Liquid Effluents

Continuous Discharges

The RCA Yard Drain continuous release pathway was sampled at the Yard Drain 6 sample point with an automatic composite sampler or by obtaining daily grab samples. As necessary, grab samples were obtained from individual release sources to the RCA Yard Drain system and a separate composite generated in order to properly account for the radioactivity released. Composites were analyzed each week for gamma emitting radionuclides and tritium. Analyses were performed to the minimum detection levels for environmental media. Composite samples were analyzed monthly for gross alpha and quarterly for Fe-55 and Sr-90.

The results of the composite analyses from the previous month or quarter were used to estimate the quantities of these radionuclides in liquid effluents during the current month or quarter. The total radioactivity in liquid effluent releases was determined from the measured concentrations of each radionuclide present and the total volume of the effluent released during the period of discharge.

Batch Releases

Each batch release was sampled and analyzed for gamma emitting radionuclides prior to release. Composite samples were analyzed monthly for gross alpha and quarterly for Fe-55 and Sr-90. The results of the composite analyses from the previous month or quarter were used to estimate the quantities of these radionuclides in liquid effluent during the current month or quarter. The total radioactivity in liquid effluent releases was determined from the measured concentrations of each radionuclide present and the total volume of the effluent released during periods of discharge.

There are no liquid effluent release paths associated with ISFSI operations.

e. Total Noble Gas Concentration

Refer to Table 5.

3.5 Batch Releases

a. Liquids

1. Number of Batch Releases: 9
2. Total time period for batch releases: 2347 minutes
3. Maximum time period for a batch release: 405 minutes
4. Average time period for batch releases: 261 minutes
5. Minimum time period for a batch release: 46 minutes
6. Average stream flow during periods of release of effluents into a flowing stream: 15,500
7. Maximum gross release concentration (uCi/ml): 2.82E-3 (2.82E-3 of H-3)

b. Gaseous

1. Number of batch releases: 0
2. Total time period for batch releases: Not Applicable
3. Maximum time period for a batch release: Not Applicable
4. Average time period for batch releases: Not Applicable
5. Minimum time period for batch release: Not Applicable
6. Maximum gross release rate (uCi/sec): Not Applicable

3.6 Unplanned Releases

a. Liquid – There were no unplanned releases in 2005

b. Gaseous – There were no unplanned releases in 2005

## 4 Related Information

Sections 4.1.1 through 4.1.4 provide the status of reportable items per requirements of the ODCM.

4.1.1 Radioactive Effluent Monitoring Instrumentation

Requirement: Radioactive effluent monitoring instrumentation channels are required to be operable in accordance with the ODCM.

With less than the minimum number of channels operable and reasonable efforts to return the instrument(s) to operable status within 30 days being unsuccessful, the ODCM requires an explanation for the delay in correcting the inoperability in the next Annual Effluent Release Report.

Response: No radioactive effluent monitoring instrumentation was out of service for more than 30 consecutive days during the reporting period when required to be operable by the Offsite Dose Calculation Manual.

4.1.2 Liquid Radwaste Treatment System

Requirement: With radioactive liquid waste being discharged without treatment, with estimated doses in excess of the limits in ODCM, a report must be submitted to the Commission in the Annual Effluent Release Report for the period.

Response: The above requirements of ODCM were met during the this period, and therefore, no report is required.

4.1.3 Gaseous Radwaste Treatment System

Requirement: With radioactive gaseous waste being discharged without treatment with doses in excess of the limits in ODCM, a report must be submitted to the Commission in the Annual Effluent Release Report for the period.

Response: The above requirements of ODCM were met during this period, and therefore no report is required.

4.1.4 Lower Limit of Detection for Radiological Analysis

| | |
|---|---|
| Requirement: | ODCM requires that when unusual circumstances result in LLD's Higher than required, the reasons shall be documented in the Annual Radioactive Effluent Release Report. |
| Response: | All samples were counted in such a manner as to satisfy the specified a priori lower limits of detection. |

4.2 Radioactive Effluent Condition Reports

Table 12 lists the condition reports generated during the year 2005 and actions taken to resolve the individual issues.

## 5.0 Summary of REMODCM Revisions in the Year 2005

### 5.1 Revision number: Change #2005-01

Date: 3/29/05

Summary:
This change was performed to replace "Technical Specifications" with "QAP". The ODCM requirements have been relocated to the Quality Assurance Program. Additionally, the change removed all release pathways, instrumentation and associated analysis for release paths that no longer exists due to the transfer of fuel to long term storage, and the progress of the decommissioning (i.e., noble gas release path, spent fuel pool exhaust, rad-monitor R-22) and added some flexibility to the "point of discharge" for liquid releases to accommodate the decommissioning progress. An example of additional discharge points is the use of the next manhole or catch basin associated with Yard Drain 6 as the previous section is isolated to support decommissioning. Other changes either reduced or eliminated some of the REMP sampling locations that are no longer applicable due to the stage of the decommissioning (i.e., particulate, vegetation and milk).

### 5.2 Revision number: Change #2005-02

Date: 12/21/05

Summary:
Table E-1 – Changed items 2, 4, and 5 to an annual schedule and coordinated the sample collection period to be performed once bulk water of the spent fuel pool had been released. Additional changes replaced the "Unit Manager" with "Designated Manager" to be consistent with the QAP.

TABLE 1

Connecticut Yankee Atomic Power Station
Effluent and Waste Disposal Annual Report
First and Second Quarters, 2005
Gaseous Effluents-Summation of All Releases

| | Unit | 1st Quarter | 2nd Quarter | Est. Total Error, % |
|---|---|---|---|---|
| **A. Fission and Activation Gases** | | | | |
| 1. Total Release | Ci | 2.37E+1 | N/A* | 2.50E+1 |
| 2. Average release rate for period | uCi/sec | 3.01E+00 | N/A* | |
| 3. Percent of regulatory limit | % | 3.10E-1 | N/A* | |
| **B. Iodines** | | | | |
| 1. Total Iodine-131 | Ci | N/A* | N/A* | 2.50E+1 |
| 2. Average release rate for period | uCi/sec | N/A* | N/A* | |
| 3. Percent of regulatory limit | % | N/A* | N/A* | |
| **C. Particulates** | | | | |
| 1. Particulates with T-1/2 > 8 days | Ci | 9.15E-6 | 2.27E-6 | 2.50E+1 |
| 2. Average release rate for period | uCi/sec | 1.19E-6 | 2.88E-7 | |
| 3. Percent of regulatory limit | % | 3.56E-4 | 8.93E-5 | |
| 4. Gross alpha radioactivity | Ci | 5.87E-8 | N/D* | |
| **D. Tritium** | | | | |
| 1. Total release | Ci | 3.76E-1 | 9.70E-2 | 2.50E+1 |
| 2. Average release rate for period | uCi/sec | 4.78E-2 | 1.23E-2 | |
| 3. Percent of regulatory limit | % | 7.38E-3 | 1.90E-3 | |

N/D*= Not Detected
N/A*= Not Applicable

TABLE 2

Connecticut Yankee Atomic Power Station
Effluent and Waste Disposal Annual Report
Third and Fourth Quarters, 2005
Gaseous Effluents-Summation of All Releases

| | Unit | 3rd Quarter | 4th Quarter | Est. Total Error, % |
|---|---|---|---|---|
| **A. Fission and Activation Gases** | | | | |
| 1. Total Release | Ci | N/A* | N/A* | 2.50E+1 |
| 2. Average release rate for period | uCi/sec | N/A* | N/A* | |
| 3. Percent of regulatory limit | % | N/A* | N/A* | |
| **B. Iodines** | | | | |
| 1. Total Iodine-131 | Ci | N/A * | N/A* | 2.50E+1 |
| 2. Average release rate for period | uCi/sec | N/A* | N/A* | |
| 3. Percent of regulatory limit | % | N/A* | N/A* | |
| **C. Particulates** | | | | |
| 1. Particulates with T-1/2 > 8 days | Ci | 1.09E-6 | 1.22E-6 | 2.50E+1 |
| 2. Average release rate for period | uCi/sec | 1.38E-7 | 1.55E-7 | |
| 3. Percent of regulatory limit | % | 7.79E-5 | 2.62E-5 | |
| 4. Gross alpha radioactivity | Ci | N/D* | N/D* | |
| **D. Tritium** | | | | |
| 1. Total release | Ci | 7.84E-2 | 5.56E-2 | 2.50E+1 |
| 2. Average release rate for period | uCi/sec | 9.97E-3 | 7.07E-3 | |
| 3. Percent of regulatory limit | % | 1.54E-3 | 1.09E-3 | |

N/D*= Not Detected
N/A*= Not Applicable

TABLE 3

Connecticut Yankee Atomic Power Station
Effluent and Waste Disposal Annual Report
First and Second Quarters, 2005
Gaseous Effluents-Elevated & Ground Releases

| | | Continuous Mode | | Batch Mode | |
|---|---|---|---|---|---|
| **Nuclides Released** | **Unit** | **1st Quarter** | **2nd Quarter** | **1st Quarter** | **2nd Quarter** |
| **1. Fission Gases** | | | | | |
| Krypton-85 | Ci | 2.37E+1 | N/A* | N/A* | N/A* |
| Krypton-85m | Ci | N/A* | N/A* | N/A* | N/A* |
| Krypton-87 | Ci | N/A* | N/A* | N/A* | N/A* |
| Krypton-88 | Ci | N/A* | N/A* | N/A* | N/A* |
| Xenon-133 | Ci | N/A* | N/A* | N/A* | N/A* |
| Xenon-135 | Ci | N/A* | N/A* | N/A* | N/A* |
| Xenon-135m | Ci | N/A* | N/A* | N/A* | N/A* |
| Xenon-138 | Ci | N/A* | N/A* | N/A* | N/A* |
| Unidentified | Ci | N/A* | N/A* | N/A* | N/A* |
| Total for period | Ci | N/A* | N/A* | N/A* | N/A* |
| **2. Iodines** | | | | | |
| Iodine-131 | Ci | N/A* | N/A* | N/A* | N/A* |
| Iodine-133 | Ci | N/A* | N/A* | N/A* | N/A* |
| Iodine-135 | Ci | N/A* | N/A* | N/A* | N/A* |
| Total for period | Ci | N/A* | N/A* | N/A* | N/A* |
| **3. Particulates** | | | | | |
| Strontium-89 | Ci | N/A* | N/A* | N/A* | N/A* |
| Strontium-90 | Ci | 1.29E-6 | 5.82E-7 | N/A* | N/A* |
| Cesium-134 | Ci | N/A* | N/A* | N/A* | N/A* |
| Cesium-137 | Ci | 1.54E-6 | 8.35E-7 | N/A* | N/A* |
| Cobalt-60 | Ci | 6.32E-6 | 8.54E-7 | N/A* | N/A* |
| Barium-Lanthanum-140 | Ci | N/A* | N/A* | N/A* | N/A* |
| Others- | | | | | |
| Plutonium-238 | Ci | N/A* | N/A* | N/A* | N/A* |
| Curium-243,244 | Ci | N/A* | N/A* | N/A* | N/A* |
| Uranium-234 | Ci | N/A* | N/A* | N/A* | N/A* |
| Uranium-238 | Ci | N/A* | N/A* | N/A* | N/A* |
| Thorium-232 | Ci | N/A* | N/A* | N/A* | N/A* |
| Radium-226 | Ci | N/A* | N/A* | N/A* | N/A* |
| Gross Alpha | Ci | 5.87E-8 | N/D* | N/D* | N/D* |

N/D*= Not Detected
N/A*= Not Applicable

TABLE 4

Connecticut Yankee Atomic Power Station
Effluent and Waste Disposal Annual Report
Third and Fourth Quarters, 2005
Gaseous Effluents-Elevated & Ground Releases

| | | Continuous Mode | | Batch Mode | |
|---|---|---|---|---|---|
| **Nuclides Released** | **Unit** | **3rd Quarter** | **4th Quarter** | **3rd Quarter** | **4th Quarter** |
| **1. Fission Gases** | | | | | |
| Krypton-85 | Ci | N/A* | N/A* | N/A* | N/A* |
| Krypton-85m | Ci | N/A* | N/A* | N/A* | N/A* |
| Krypton-87 | Ci | N/A* | N/A* | N/A* | N/A* |
| Krypton-88 | Ci | N/A* | N/A* | N/A* | N/A* |
| Xenon-133 | Ci | N/A* | N/A* | N/A* | N/A* |
| Xenon-135 | Ci | N/A* | N/A* | N/A* | N/A* |
| Xenon-135m | Ci | N/A* | N/A* | N/A* | N/A* |
| Xenon-138 | Ci | N/A* | N/A* | N/A* | N/A* |
| Unidentified | Ci | N/A* | N/A* | N/A* | N/A* |
| Total for period | Ci | N/A* | N/A* | N/A* | N/A* |
| **2. Iodines** | | | | | |
| Iodine-131 | Ci | N/A* | N/A* | N/A* | N/A* |
| Iodine-133 | Ci | N/A* | N/A* | N/A* | N/A* |
| Iodine-135 | Ci | N/A* | N/A* | N/A* | N/A* |
| Total for period | Ci | N/A* | N/A* | N/A* | N/A* |
| **3. Particulates** | | | | | |
| Strontium-89 | Ci | N/A* | N/A* | N/A* | N/A* |
| Strontium-90 | Ci | 5.86E-7 | 1.23E-7 | N/A* | N/A* |
| Cesium-134 | Ci | N/A* | N/A* | N/A* | N/A* |
| Cesium-137 | Ci | 2.89E-7 | 5.43E-7 | N/A* | N/A* |
| Cobalt-60 | Ci | 2.20E-7 | 5.50E-7 | N/A* | N/A* |
| Barium-Lanthanum-140 | Ci | N/A* | N/A* | N/A* | N/A* |
| Others- | | | | | |
| Plutonium-238 | Ci | N/A* | N/A* | N/A* | N/A* |
| Curium-243,244 | Ci | N/A* | N/A* | N/A* | N/A* |
| Uranium-234 | Ci | N/A* | N/A* | N/A* | N/A* |
| Uranium-238 | Ci | N/A* | N/A* | N/A* | N/A* |
| Thorium-232 | Ci | N/A* | N/A* | N/A* | N/A* |
| Radium-226 | Ci | N/A* | N/A* | N/A* | N/A* |
| Gross Alpha | Ci | N/D* | N/D* | N/A* | N/A* |

N/D*= Not Detected
N/A*= Not Applicable

TABLE 5

Connecticut Yankee Atomic Power Station
Effluent and Waste Disposal Annual Report
January-December 2005
Gaseous Effluents-Ground Level Release

Plant;
Connecticut Yankee processed several Transportable Storage Canisters in the first quarter of 2005, which contained spent fuel element assemblies. The processing of these canisters resulted in 23.7 Curies of Krypton-85 being released to the environment. This activity was released through the Spent Fuel Pool Exhaust.

The Main Stack was demolished in 2004. Therefore, the gaseous / particulates released from the facility are considered as a ground level release.

ISFSI;
There are no gaseous or particulate release pathways associated with ISFSI operations.

TABLE 6

Connecticut Yankee Atomic Power Station
Effluent and Waste Disposal Annual Report
First and Second Quarters, 2005
Liquid Effluents-Summation of All Releases

| | Unit | 1st Quarter | 2nd Quarter | Est. Total Error, % |
|---|---|---|---|---|
| **A. Fission and Activation Products** | | | | |
| 1. Total Release (not including tritium, gases,alpha) | Ci | 9.42E-4 | 4.28E-4 | 2.50E+1 |
| 2. Average diluted concentration during period | .uCi/ml | 9.72E-7 | 1.90E-6 | |
| 3. Percent of applicable limit | % | 9.21E-2 | 3.85E-2 | |
| **B. Tritium** | | | | |
| 1. Total Release | Ci | 1.63E-1 | 1.34E-1 | 2.50E+1 |
| 2. Average diluted concentration during period | .uCi/ml | 5.75E-5 | 3.72E-5 | |
| 3. Percent of applicable limit | % | 1.91E-2 | 1.24E-2 | |
| **C. Dissolved and Entrained Gases** | | | | |
| 1. Total Release | Ci | N/A* | N/A* | 2.50 E+1 |
| 2. Average diluted concentration during period | .uCi/ml | N/A* | N/A* | |
| 3. Percent of applicable limit | % | N/A* | N/A* | |
| **D. Gross Alpha Radioactivity** | | | | |
| 1. Total release | Ci | N/D | N/D | 2.50E+1 |
| 2. Average diluted concentration during period | .uCi/ml | N/A* | N/A | |
| **E. Volume of Waste Released (prior to dilution)** | Liters | 1.58E+7 | 1.99E+7 | 1.0E+1 |
| **F. Volume of Dilution Water Used During Period** | Liters | N/A | N/A | 1.0E+1 |

N/D*= Not Detected
N/A*= Not Applicable

TABLE 7

Connecticut Yankee Atomic Power Station
Effluent and Waste Disposal Annual Report
Third and Fourth Quarters, 2005
Liquid Effluents-Summation of All Releases

| | Unit | 3rd Quarter | 4th Quarter | Est. Total Error, % |
|---|---|---|---|---|
| **A. Fission and Activation Products** | | | | |
| 1. Total Release (not including tritium, gases,alpha) | Ci | 1.69E-4 | 1.12E-4 | N/A |
| 2. Average diluted concentration during period | .uCi/ml | 1.75E-6 | 4.19E-7 | |
| 3. Percent of applicable limit | % | 3.39E-2 | 5.17E-2 | |
| **B. Tritium** | | | | |
| 1. Total Release | Ci | 2.91E-2 | 2.76E-2 | N/A |
| 2. Average diluted concentration during period | .uCi/ml | 4.09E-5 | 2.90E-4 | |
| 3. Percent of applicable limit | % | 1.36E-2 | 9.66E-2 | |
| **C. Dissolved and Entrained Gases** | | | | |
| 1. Total Release | Ci | N/A | N/A | N/A |
| 2. Average diluted concentration during period | .uCi/ml | N/A | N/A | |
| 3. Percent of applicable limit | % | N/A | N/A | |
| **D. Gross Alpha Radioactivity** | | | | |
| 1. Total release | Ci | N/D | N/D | N/A |
| 2. Average diluted concentration during period | .uCi/ml | N/A | N/A | |
| **E. Volume of Waste Released (prior to dilution)** | Liters | 3.95E+6 | 5.46E+6 | N/A |
| **F. Volume of Dilution Water Used During Period** | Liters | N/A | N/A | N/A |

N/D*= Not Detected
N/A*= Not Applicable

TABLE 8

Connecticut Yankee Atomic Power Station
Effluent and Waste Disposal Annual Report
First and Second Quarters, 2005
Liquid Effluents

| | | Continuous Mode | | Batch Mode | |
|---|---|---|---|---|---|
| **Nuclides Released** | **Unit** | **1st Quarter** | **2nd Quarter** | **1st Quarter** | **2nd Quarter** |
| Strontium-89 | Ci | N/A* | N/D* | N/D* | N/D* |
| Strontium-90 | Ci | 3.66E-5 | 5.71E-5 | 3.19E-5 | N/D* |
| Cesium-134 | Ci | N/A* | N/D* | N/D* | N/D* |
| Cesium-137 | Ci | 5.05E-4 | 1.46E-4 | 1.27E-4 | 1.13E-5 |
| Iodine-131 | Ci | N/A* | N/D* | N/D* | N/D* |
| Cobalt-58 | Ci | N/A* | N/D* | N/D* | N/D* |
| Cobalt-60 | Ci | 7.23E-6 | 5.95E-6 | 9.83E-5 | 2.63E-5 |
| Iron-55 | Ci | N/A* | N/D* | 1.36E-4 | 1.81E-4 |
| Zinc-65 | Ci | N/A* | N/D* | N/D* | N/D* |
| Manganese-54 | Ci | N/A* | N/D* | N/D* | N/D* |
| Chromium-51 | Ci | N/A* | N/D* | N/D* | N/D* |
| Zirconium-Niobium-95 | Ci | N/A* | N/D* | N/D* | N/D* |
| Molybdenum-99 | Ci | N/A* | N/D* | N/D* | N/D* |
| Technetium-99m | Ci | N/A* | N/D* | N/D* | N/D* |
| Barium-Lathanium-140 | Ci | N/A* | N/D* | N/D* | N/D* |
| Cerium-141 | Ci | N/A* | N/D* | N/D* | N/D* |
| Others- Iron-55 | Ci | N/A* | N/D* | N/D | N/D* |
| Antimony-125 | Ci | N/A* | N/D* | N/D* | N/D* |
| Unidentified | Ci | N/A* | N/D* | N/D* | N/D* |
| Total for period (above) | Ci | 5.49E-4 | 2.09E-4 | 3.93E-4 | 2.19E-4 |
| Xenon-133 | Ci | N/A* | N/D* | N/D* | N/D* |
| Xenon-135 | Ci | N/A* | N/D* | N/D* | N/D* |

N/D*= Not Detected
N/A*= Not Applicable

TABLE 9

Connecticut Yankee Atomic Power Station
Effluent and Waste Disposal Annual Report
Third and Fourth Quarters, 2005
Liquid Effluents

| | | Continuous Mode | | Batch Mode | |
|---|---|---|---|---|---|
| **Nuclides Released** | **Unit** | **3rd Quarter** | **4th Quarter** | **3rd Quarter** | **4th Quarter** |
| Strontium-89 | Ci | N/A* | N/A* | N/A* | N/A* |
| Strontium-90 | Ci | 1.07E-5 | 1.36E-5 | N/A* | 8.93E-6 |
| Cesium-134 | Ci | N/A* | N/A* | N/A* | N/A* |
| Cesium-137 | Ci | 3.97E-5 | 5.74E-5 | 7.84E-6 | 3.95E-6 |
| Iodine-131 | Ci | N/A* | N/A* | N/A* | N/A* |
| Cobalt-58 | Ci | N/A* | N/A* | N/A* | N/A* |
| Cobalt-60 | Ci | N/A* | N/A* | N/A* | 4.83E-6 |
| Iron-59 | Ci | N/A* | N/A* | 1.11E-4 | 2.32E-5 |
| Zinc-65 | Ci | N/A* | N/A* | N/A* | N/A* |
| Manganese-54 | Ci | N/A* | N/A* | N/A* | N/A* |
| Chromium-51 | Ci | N/A* | N/A* | N/A* | N/A* |
| Zirconium-Niobium-95 | Ci | N/A* | N/A* | N/A* | N/A* |
| Molybdenum-99 | Ci | N/A* | N/A* | N/A* | N/A* |
| Technetium-99m | Ci | N/A* | N/A* | N/A* | N/A* |
| Barium-Lathanium-140 | Ci | N/A* | N/A* | N/A* | N/A* |
| Cerium-141 | Ci | N/A* | N/A* | N/A* | N/A* |
| Others- Iron-55 | Ci | N/A* | N/A* | N/A* | N/A* |
| Antimony-125 | Ci | N/A* | N/A* | N/A* | N/A* |
| Unidentified | Ci | N/A* | N/A* | N/A* | N/A* |
| Total for period (above) | Ci | 5.04E-5 | 7.10E-5 | 1.19E-4 | 4.09E-5 |
| Xenon-133 | Ci | N/A* | N/A* | N/A* | N/A* |
| Xenon-135 | Ci | N/A* | N/A* | N/A* | N/A* |

N/D*= Not Detected
N/A*= Not Applicable

TABLE 10

Connecticut Yankee
Maximum Off-Site Doses/Dose Commitments to Members of the Public
from Liquid and Gaseous Effluents for 2005
(10CFR50, Appendix I)

| | Dose (mrem) | | | | |
|---|---|---|---|---|---|
| Source | 1st Quarter | 2nd Quarter | 3rd Quarter | 4th Quarter | Year[1] |
| Liquid Effluents | | | | | |
| Total Body Dose | 6.44E-2 | 1.77E-2 | 5.04E-3 | 6.89E-3 | 9.40E-2 |
| | | | | | |
| Organ Dose** | 1.02E-1 | 3.09E-2 | 8.27E-3 | 1.54E-1 | 1.54E-1 |
| | | | | | |
| Airborne Effluents | | | | | |
| Organ Dose (Tritium + Part.)** | 5.11E-2 | 1.47E-2 | 1.26E-2 | 5.89E-3 | 8.43E-2 |
| | | | | | |
| Noble Gases | | | | | |
| Beta Air (mrad) | 4.29E-1 | N/A | N/A | N/A | 4.29E-1 |
| | | | | | |
| Gamma Air (mrad) | 3.78E-3 | N/A | N/A | N/A | 3.78E-3 |
| | | | | | |

** Maximum of the following organs; Bone, GI-LLI, Kidney, Liver, Lung, Thyroid

TABLE 11
Connecticut Yankee Atomic Power Station
Effluent and Waste Disposal Report
January 1st – December 31st 2005
Solid Waste and Irradiated Fuel Shipments

**A. Solid Waste Shipped Offsite for Burial or Disposal (Not Irradiated Fuel)**

1. Type of Waste

A. Spent Resins, Filter, Sludge, etc
SFP HDLF WDB Sludge/Water

| Waste Class | Unit | | % Error (Ci) |
|---|---|---|---|
| A | $m^3$ | 0.00E+00 | +/- 25% |
| | Ci | 0.00E+00 | |
| B | $m^3$ | 5.00E+00 | +/- 25% |
| | Ci | 1.85E+01 | |
| C | $m^3$ | 1.14E+01 | +/- 25% |
| | Ci | 4.14E+01 | |
| Total | $m^3$ | 6.14E+01 | +/- 25% |
| | Ci | 5.99E+01 | |

B. Dry Active Waste

Dry Active Waste 20" DAW in 20' High Top DAW Super Sack
DAW in Intermodal FP/TRU in 20' S/L FP/TRU in B-25
DAW in B-25 Barge Spoils
Dry Active Waste 4 Soil

| Waste Class | Unit | | % Error (Ci) |
|---|---|---|---|
| A | $m^3$ | 5.62E+04 | +/- 25% |
| | Ci | 4.79E+01 | |
| B | $m^3$ | 0.00E+00 | +/- 25% |
| | Ci | 0.00E+00 | |
| C | $m^3$ | 6.82E+00 | +/- 25% |
| | Ci | 6.33E+00 | |
| Total | $m^3$ | 5.63E+04 | +/- 25% |
| | Ci | 5.43E+01 | |

C. Irradiated Hardware
NST IN-SITU NST Wide Mouth 195

| Waste Class | Unit | | % Error (Ci) |
|---|---|---|---|
| A | $m^3$ | 1.23E+02 | +/- 25% |
| | Ci | 2.59E+01 | |
| B | $m^3$ | 0.00E+00 | +/- 25% |
| | Ci | 0.00E+00 | |
| C | $m^3$ | 4.13E-01 | +/- 25% |
| | Ci | 9.78E+01 | |
| Total | $m^3$ | 1.24E+02 | +/- 25% |
| | Ci | 1.24E+02 | |

D. Other Waste
Combined Packages Demolition Rubble

| Waste Class | Unit | | % Error (Ci) |
|---|---|---|---|
| A | $m^3$ | 2.55E+04 | +/- 25% |
| | Ci | 1.79E+01 | |
| B | $m^3$ | 3.73E+01 | +/- 25% |
| | Ci | 1.79E+01 | |
| C | $m^3$ | 1.41E+01 | +/- 25% |
| | Ci | 6.99E+01 | |
| Total | $m^3$ | 2.55E+04 | +/- 25% |
| | Ci | 1.06E+02 | |

E. Sum of all 4 Categories Above

| Waste Class | Unit | | % Error (Ci) |
|---|---|---|---|
| A | $m^3$ | 8.18E+04 | +/- 25% |
| | Ci | 9.17E+01 | |
| B | $m^3$ | 4.23E+01 | +/- 25% |
| | Ci | 3.64E+01 | |
| C | $m^3$ | 3.27E+01 | +/- 25% |
| | Ci | 2.15E+02 | |
| Total | $m^3$ | 8.19E+04 | +/- 25% |
| | Ci | 3.44E+02 | |

## 2. Estimate of Major Nuclide Composition (by type of waste).

### A. Spent Resins, Filter, Sludge, etc (Class A, B & C Combined)

| Nuclide | % Abundance | Curies |
|---|---|---|
| H-3 | 0.748 | 4.49E-01 |
| C-14 | 0.451 | 2.71E-01 |
| Fe-55 | 4.705 | 2.82E+00 |
| Co-57 | 0.010 | 6.02E-03 |
| C0-60 | 16.493 | 9.89E+00 |
| Ni-59 | 0.097 | 5.81E-02 |
| Ni-63 | 14.661 | 8.79E+00 |
| Sr-90 | 0.706 | 4.23E-01 |
| Cs-134 | 0.676 | 4.05E-01 |
| Cs-137 | 59.740 | 3.58E+01 |
| Ce-144 | 0.356 | 2.14E-01 |
| Eu-154 | 0.014 | 8.34E-03 |
| Np-237 | 0.000 | 1.15E-04 |
| Pu-238 | 0.054 | 3.23E-02 |
| Pu-239 | 0.011 | 6.39E-03 |
| Pu-240 | 0.011 | 6.39E-03 |
| Pu-241 | 1.115 | 6.69E-01 |
| Am-241 | 0.112 | 6.71E-02 |
| Am-243 | 0.001 | 6.06E-04 |
| Cm-242 | 0.000 | 2.21E-04 |
| Cm-243 | 0.019 | 1.16E-02 |
| Cm-244 | 0.019 | 1.16E-02 |

### B. Dry Active Waste

| Nuclide | % Abundance | Curies |
|---|---|---|
| H-3 | 6.398 | 3.47E+00 |
| C-14 | 4.227 | 2.29E+00 |
| Mn-54 | 0.000 | 7.92E-05 |
| Fe-55 | 13.864 | 7.52E+00 |
| Co-60 | 16.358 | 8.88E+00 |
| Ni-59 | 0.111 | 6.01E-02 |
| Ni-63 | 21.885 | 1.19E+01 |
| Sr-89 | 0.000 | 1.52E-04 |
| Sr-90 | 2.398 | 1.30E+00 |
| Nb-94 | 0.000 | 2.59E-04 |
| Tc-99 | 10.182 | 5.53E+00 |
| I-129 | 0.204 | 1.11E-01 |
| Cs-134 | 0.760 | 4.13E-01 |
| Cs-137 | 13.797 | 7.49E+00 |
| Ce-144 | 1.545 | 8.39E-01 |
| Eu-152 | 0.055 | 2.97E-02 |
| Eu-154 | 0.091 | 4.93E-02 |
| U-233 | 0.001 | 3.82E-04 |
| U-234 | 0.001 | 3.82E-4 |
| U-238 | 0.001 | 7.27E-04 |
| Np-237 | 0.000 | 2.13E-05 |

| | | |
|---|---|---|
| Pu-238 | 0.269 | 1.46E-01 |
| Pu-239 | 0.067 | 3.64E-02 |
| Pu-240 | 0.063 | 3.42E-02 |
| Pu-241 | 7.313 | 3.97E+00 |
| Am-241 | 0.291 | 1.58E-01 |
| Cm-242 | 0.000 | 1.18E-04 |
| Cm-243 | 0.055 | 2.99E-02 |
| Cm-244 | 0.048 | 2.58E-02 |

C. Irradiated Hardware

| Nuclide | % Abundance | Curies |
|---|---|---|
| H-3 | 0.003 | 3.16E-03 |
| C-14 | 0.003 | 4.09E-03 |
| Mn-54 | 0.003 | 3.12E-03 |
| Fe-55 | 32.641 | 4.04E+01 |
| C0-60 | 48.051 | 5.94E+01 |
| Ni-59 | 0.126 | 1.55E-01 |
| Ni-63 | 16.787 | 2.08E+01 |
| Sr-90 | 0.001 | 1.27E-03 |
| Nb-94 | 0.000 | 4.56E-04 |
| Tc-99 | 0.000 | 9.82E-05 |
| Ag-108m | 2.371 | 2.93E+00 |
| I-129 | 0.000 | 2.34E-04 |
| Cs-137 | 0.003 | 3.61E-03 |
| Ce-144 | 0.008 | 9.50E-03 |
| Pu-238 | 0.000 | 1.17E-04 |
| Pu-239 | 0.000 | 2.82E-05 |
| Pu-240 | 0.000 | 2.83E-05 |
| Pu-241 | 0.004 | 4.58E-03 |
| Am-241 | 0.000 | 1.91E-04 |
| Cm-243 | 0.000 | 1.92E-05 |
| Cm-244 | 0.000 | 1.92E-05 |

D. Other Waste

| Nuclide | % Abundance | Curies |
|---|---|---|
| H-3 | 1.551 | 1.08E+00 |
| C-14 | 0.145 | 1.01E-01 |
| Cl-36 | 0.000 | 1.00E-07 |
| Mn-54 | 0.000 | 1.31E-04 |
| Fe-55 | 5.453 | 3.81E+00 |
| Co-60 | 7.267 | 5.07E+00 |
| Ni-59 | 0.199 | 1.39E-01 |
| Ni-63 | 6.425 | 4.49E+00 |
| Zn-65 | 0.000 | 1.69E-06 |
| Kr-85 | 0.003 | 2.37E-03 |
| Sr-89 | 0.000 | 1.12E-06 |
| Sr-90 | 0.247 | 1.73E-01 |
| Nb-94 | 0.002 | 1.32E-03 |

| | | |
|---|---|---|
| Tc-99 | 0.032 | 2.24E-02 |
| I-129 | 0.001 | 4.70E-04 |
| Cs-134 | 0.052 | 3.62E-02 |
| Cs-137 | 77.875 | 5.44E+01 |
| Ba-133 | 0.000 | 7.98E-07 |
| Ce-144 | 0.213 | 1.49E-01 |
| Eu-154 | 0.080 | 5.58E-02 |
| Eu-155 | 0.000 | 3.98E-06 |
| Po-210 | 0.000 | 4.61E-07 |
| Np-237 | 0.000 | 2.67E-05 |
| Pu-238 | 0.020 | 1.43E-02 |
| Pu-239 | 0.004 | 2.47E-03 |
| Pu-240 | 0.004 | 2.87E-03 |
| Pu-241 | 0.405 | 2.83E-01 |
| Am-241 | 0.032 | 2.21E-02 |
| Cm-242 | 0.000 | 1.48E-05 |
| Cm-243 | 0.005 | 3.76E-03 |
| Cm-244 | 0.006 | 4.13E-03 |

**3. Solid Waste Disposition**

| Number of Shipments | Mode of Transportation(Truck/Rail) | Destination |
|---|---|---|
| 26 | Ameritech Environmental / CSXT | ALARON Corporation |
| 318 | RACE Logistics, LLC | ALARON Corporation |
| 3 | Hittman Transport | Barnwell Waste Mgmt Facility |
| 2 | R&R Trucking | Barnwell Waste Mgmt Facility |
| 1 | Hittman Transport | Diversified Scientific Services |
| 3 | Hittman Transport | Duratek, Inc. (BCO) |
| 377 | Hittman Transport | Duratek, Inc. (GR) |
| 15 | Interstate Freight | Duratek, Inc. (GR) |
| 6 | R&R Trucking | Duratek, Inc. (GR) |
| 396 | RACE Logistics, LLC | Duratek, Inc. (GR) |
| 3 | RSB Logistics | Duratek, Inc. (GR) |
| 51 | Southern Freight | Duratek, Inc. (GR) |
| 161 | Ameritech Environmental / CSXT | Energy Solutions (Bulk) |
| 125 | RACE Logistics, LLC | Energy Solutions (Bulk) |
| 1 | RSB Logistics | Energy Solutions (Containerized) |
| 54 | Ameritech Environmental / CSXT | RACE, LLC |
| 1206 | RACE Logistics, LLC | RACE, LLC |
| 1 | R&R Trucking | Toxco Material Mgmt. Center |
| 1 | RACE Logistics, LLC | Toxco Material Mgmt. Center |

**B. Irradiated Fuel Shipments (Disposition):** None Shipped

**C. Additional Requirements; Summation of all Shipment Types**

| Waste Class | Volume ($m^3$) | Curies Shipped | % Error (Ci) |
|---|---|---|---|
| A | 8.18E+04 | 9.17E+01 | +/- 25% |
| B | 4.23E+01 | 3.64E+01 | +/- 25% |
| C | 3.27E+01 | 2.15E+02 | +/- 25% |
| Total | 8.19E+04 | 3.44E+02 | +/- 25% |

# Table 12
# Radioactive Effluent Condition Reports

| Condition Report # | Issue Description | Date of Discovery | Initial Corrective Actions Taken | Final Corrective Actions Taken |
|---|---|---|---|---|
| 05-0013 | HP environmental air sampler found off (unplugged). | 1/4/2005 | Contacted the DEMCO foreman and the electricians. After the breaker was reset and the air sampler was still not on, the extension cord was found unplugged inside the air lock roll up door. The air sampler was plugged back in, restarted and the air sampler filter was changed out. Notified HP supervision. The air sampler filter was dropped off at the HP count room for analysis. | 1. Attached identification tags on the ends of the extension cord to prevent inadvertent de-energizing.<br>2. Evaluated and bounded the potential release of radioactive material. |
| 05-0417 | Radioactive liquid was observed being released via an unmonitored pathway. Since the water did not go to the YD-6, it was not being monitored in accordance with the REMODCM. The approved pathway is to YD-6 (CB-11) and not the ground outside GS-7. | 5/6/2005 | Notified Management. CR CLOSED TO CR05-0416 per MRT 5-9-05. | 1. Unclogged the drain line |
| 05-0442 | Environmental Monitoring of HEPA Exhaust | 5/16/2005 | Started the environmental air sampler. Notified HP Supervision. | 1. Evaluation of activities determined that no release of radioactive material occurred. |
| 05-0573 | HP/Chemistry Environmental Air Sampling | 7/27/2005 | Dug the RASP pump out from under a pile of hoses, checked power, found another power cord, changed out the air sampler filter and restarted the air sampler. HP Supervision was notified. | 1. Communicated to the craft through thee supervisors' safety meeting to contact Health Physics prior to moving sampling equipment.<br>2. Evaluated activities and determined that no release ot radioactive material had occurred. |

# Table 12
# Radioactive Effluent Condition Reports

| | | | | |
|---|---|---|---|---|
| 05-0613 | CR05-0613: R-1 vent stack monitor-sampling pump found de-energized | 8/15/2005 | Ran another extension from an existing power cord to sampler pump and re-energized pump. | 1. Re-powered R-1 from a more secure power supply.<br>2. Electrical safety was discussed at the supervisors safety meeting for communication to the craft.<br>3. Evaluated effluents for potential release of radioactive material. |
| 05-0614 | CR05-0614: Environmental air sampler | 8/15/2005 | Attempted to restart air sampler. Informed oncoming shift of issue so that remedial actions could be performed which would allow Chemistry to restart the environmental air sample | 1. The fan, which shorted the breaker due to rainwater and called attention to the loss of power to the air sampler, was taken out of service.<br>2. Power was restored to the air sampler.<br>3. Electrical safety and the care of electrical equipment exposed to the elements were discussed at the supervisors' safety meeting for communication to the craft. |

Docket No. 50-213
CY-06-062

Attachment 2

Revision 18 to Radiological Effluent Monitoring and
Offsite Dose Calculation Manual, and
List of Changes

May 2006