# Connecticut Yankee Atomic Power Company

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**Haddam Neck Plant**
**License Termination Plan (LTP) Revision 5**
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The information available at the time of initial classification support classification of the southern unit of the Discharge Canal (from the Canal Road to the river) as a Class 3 area. More recent information (i.e., the 1999 AREOR) reported a concentration of 0.50+/-0.10 pCi/g for Co-60, which is approximately 15% of the Co-60 "base case" soil DCGL. Given the higher potential for residual radioactivity, the entire discharge canal has been reclassified as a Class 2. This example demonstrates the CYAPCO Survey Area/Unit classification process, which includes a unit reclassification process that drives the most appropriate classification.

In addition to the spills identified above, the HSA identified a number of leaks and unplanned liquid releases that have occurred during the operational lifetime of HNP. The majority of the occurrences were confined to the Radiologically Controlled Area. The leaks and unplanned releases were associated with equipment failures and operational events associated with components within the Containment Building, Primary Auxiliary Building, outside storage tanks, and the radioactive waste processing systems. The most significant unplanned liquid release occurred in 1984, the result of a failure of the reactor cavity seal. Although this event did not result in any release outside of the buildings it is considered the most significant because of the large volume of water involved. This water, released to the basement of containment, was pumped through the purification system to the Refueling Water Storage Tank (RWST). Smears of the seal ring indicated 350 mR/hr gamma, 5.4 rad/hr beta with 120,000 dpm alpha. RWST radiation levels ranged from 65 to 200 mR/hr as a result of relocating water during this period. Surveys in the basement of Containment on August 23, 1984, indicated contamination levels to 295 mrad/hr beta and 6300 dpm/100 $cm^2$ alpha. Sampling the yard drains concluded that no liquid radioactivity was released to the environment.

Examples of typical events involving radioactive liquid leaks and unplanned releases are presented in Table 2-3. A record of unplanned liquid releases is maintained on site in accordance with the requirements of 10CFR50.75(g) and is identified in the affected area assessment in the Haddam Neck Plant Characterization Report (Reference 2-2) and in the Historical Site Assessment Supplement (Reference 2-3).

The principal impact of these events is to the ground within the Radiologically Controlled Area (RCA). Migration of radioactivity to subsurface soils has occurred in the area of the Primary Auxiliary Building and the Refueling Water Storage Tank, adjacent to the Containment Building. Radioactivity has also been detected in groundwater wells on site. Assessments of radioactivity in soils and groundwater are further discussed in Sections 2.3.3.1.3 through 2.3.3.1.7. Radioactive materials from leaks have also impacted the area in the southeast corner of the protected area, a leach field south of the protected area (but within the owner controlled area), and drain systems leading from the RCA. All of these areas were within the owner controlled area.

Table 2-3
Examples of Unplanned Liquid Release Events

| Date | CYAPCO Reference Document No. | Location of Event | Survey Area Number (Figs 2-1 through 2-7) | Medium | Event Description |
|---|---|---|---|---|---|
| 11/1/73 | AO-73-11 | RWST | 9312-0005 | Liquid | Valve Leak, 270 liters of liquid released to storm drain. |
| 1/28/76 | PIR 76-15 | "A" Recycle Test Tank | 9312-0005 | Liquid | 15 gal. of liquid leaked from tank to diked area |
| 5/22/76 | LER 76-13/990 | PAB Below Drumming Room Floor | 9312-0006 | Liquid | Leakage from drain line below floor |
| 2/24/77 | LER 77-2 | "A" Recycle Test Tank | 9312-0005 | Liquid | 1000 gal. of radioactive water released to diked area around tank. |
| 2/23/79 | PIR 79-27 | Main Stack | 9312-0001 | Liquid | Manway leakage following SG blowdown rupture disk actuation. 20 gal to yard area. |
| 3/6/79 | PIR 79-38 | Main Stack | 9312-0001 | Liquid | Manway leakage following SG blowdown rupture disk actuation |
| 3/28/83 | PIR 83-37 | Septic Tank | 9520-0001 | Liquid | 84 gal. of water from Chem Lab to Septic Tank |
| 8/21/84 | PIR 84-136 | Containment Building | 9312-0001 | Liquid | Reactor cavity seal ring failure. 200,000 gals of water drained to lower levels of Containment Building |
| 2/24/89 | PIR 89-35 | Leach Field, 115 kV yard | 9522, 9312 | Liquid | 50 gal. release from SFB floor drain, line discharges to 115 kV yard |
| 9/14/90 | PIR 90-239 | RWST | 9312-0005 | Liquid | 6 gallon per day leak from RWST identified from inventory monitoring |
| 8/12/91 | PIR 91-149 | Pipe Trench | 9312-0006 | Liquid | 400 gal. release from open valve to pipe trench |

characterization will continue throughout the decommissioning process, an initial amount of characterization data is necessary to support preparation of the LTP.

The site characterization process focused on data for structures, systems and the site environs, considering radiological, hazardous and state-regulated materials. Groundwater is included in the assessment of the site environs. In addition, activation analyses have been performed on components and structures subjected to neutron flux, to support planning efforts.

The information provided in this section summarizes the characterization of the HNP site. The data is based on surveys, samples and analysis performed through the end of 1999 and is the planning basis for remediation activities, establishment of area classifications, and the development of the Final Status Survey Plan. The figures included in this section depict the plant site at the time of plant shutdown.

### 2.3.2 Methodology

A Data Quality Objective (DQO) approach was applied to the characterization process. This approach focused the effort on gathering sufficient information to achieve the objectives identified in Section 2.1. The site characterization process began with the consolidation of information gathered during the HAS, radiological survey and sample analysis data maintained within the HNP document control program, and current site radiological data maintained by the Radiation Protection Department. This information has been augmented with the results from surveys performed in support of Decommissioning Operations Contractor (DOC) proposal development. The HAS provides the basis for identifying suspect areas outside of those designed to contain radioactivity or those expected to be impacted by normal operations of a nuclear plant.

To facilitate the evaluation of information, available data were sorted by building or structure, and by land areas. A second sort of information was developed based on systems. A unique characterization report was developed for each building or structure with a cross reference to those systems contained within those areas. The characterization process was controlled by site procedures. These procedures established a consistent approach to the evaluation of each area for radiological, hazardous and state-regulated materials that are known to exist or are potential contaminants in structures, systems or soils within that area. The procedural process included the evaluation or determination of:

- the structure or area bounded by the evaluation;
- systems contained within the area, if any;
- HAS identification of events that may have impacted the area;
- area use, present and historic;
- materials of construction;
- presence of radioactive or hazardous material storage areas;
- radiological survey information including extent of area containing radioactivity, radionuclides, exposure rates and contamination levels, both present and historic; and
- potential for migration of contaminants from contiguous areas.

The evaluation of each area included a walkdown of the area by a professional experienced in radiological hazards and a second professional experienced in hazardous and state-regulated materials.

Fuel cladding failures occurring during operations, primarily affected the Reactor Coolant System, as well as liquid systems that interfaced with the Reactor Coolant System. As the result of leaks during operation and refueling outage maintenance activities, it is acknowledged that Transuranics (TRUs) may have been released from these systems to surrounding rooms or cubicles. These rooms, cubicles and systems were monitored extensively during outages for personnel protection purposes, and the resulting data obtained from monitoring activities were used to classify them as Class 1. The upper areas of the Containment and Containment dome were initially classified as Class 2. These areas are currently planned for demolition and disposal as radioactive waste.

During the planning of characterization activities, Transuranics activity was considered in survey design by reviewing the operational history and operational surveys of the area. If TRU activity was suspected in an area, proper instruments were selected, smears counted for alpha activity and soil samples analyzed for Am-241, a predominant alpha emitter at the HNP.

Upon completion of the records review and the walkdown of each area, a characterization report for that area was completed. The characterization report for each area contains:

- a description of the area;
- survey units;
- summary of radiological, hazardous, and state-regulated material conditions within the area;
- classification of the area in accordance with the categories defined by MARSSIM;
- radiologically impacted systems within the area; and
- additional sampling and analysis necessary to support remediation.

The area characterization reports have been compiled in the "Connecticut Yankee Haddam Neck Plant Characterization Report" dated January 6, 2000 (Reference 2-2). Additional information is provided in the "Haddam Neck Plant Historical Site Assessment Supplement" (Reference 2-3).

### 2.3.3 Site Characterization/HSA Results

2.3.3.1 Radiological Status

2.3.3.1.1 Systems

An extensive review of systems was conducted to determine those systems that contain radioactive materials or in which radioactive material was detected at some time during

**Table 2-10**
**MARSSIM Classifications**

| | | | | | Area ($m^2$) | | | |
|---|---|---|---|---|---|---|---|---|
| **Survey Area Code** | **Survey Area Code Description** | **Survey Unit Code** | **Survey Unit Code Description** | **MARSSIM Class.** | **Floor Area** | **Total Area** | **Ratio (Total Area: Floor Area)** | **Figure No.** |
| 9106 | Discharge Canal | 0001 | Sediment to Ave. High Water Level | 1 | N/A | 1,917 | N/A | 2-2 |
| | | 0002 | Sediment to Ave. High Water Level | 2 | N/A | 5,520 | N/A | 2-2<br>2-3 |
| | | 0003 | Sediment to Ave. High Water Level | 2 | N/A | 8,292 | N/A | 2-3 |
| | | 0004 | Sediment to Ave. High Water Level | 2 | N/A | 9,900 | N/A | 2-3 |
| | | 0005 | Sediment to Ave. High Water Level | 2 | N/A | 9,632 | N/A | 2-4 |
| | | 0006 | Sediment to Ave. High Water Level | 2 | N/A | 9,716 | N/A | 2-4<br>2-5 |
| | | 0007 | Sediment to Ave. High Water Level | 2 | N/A | 8,692 | N/A | 2-5 |

**Table 2-10**
**MARSSIM Classifications**

| | | | | | Area ($m^2$) | | | |
|---|---|---|---|---|---|---|---|---|
| **Survey Area Code** | **Survey Area Code Description** | **Survey Unit Code** | **Survey Unit Code Description** | **MARSSIM Class.** | **Floor Area** | **Total Area** | **Ratio (Total Area: Floor Area)** | **Figure No.** |
| | | 0008 | Sediment to Ave. High Water Level | 2 | N/A | 9,763 | N/A | 2-5 |
| | | 0009 | Sediment to Ave. High Water Level | 2 | N/A | 9,933 | N/A | 2-5 |
| | | 0010 | Sediment to Ave. High Water Level | 2 | N/A | 9,512 | N/A | 2-5 |
| | | 0011 | Sediment to Ave. High Water Level | 2 | N/A | 6,394 | N/A | 2-5 |
| | | 0012 | Peninsula Wetlands | 2 | N/A | 7,272 | N/A | 2-4 |
| | | 0013 | Peninsula Wetlands | 2 | N/A | 9,011 | N/A | 2-5 |
| | | 0014 | Canal Sediment | 1 | N/A | 1,870 | N/A | 2-2 |
| | | 0015 | Canal Sediment Within SU 9106-007 | 1 | N/A | 1,170 | N/A | 2-5 |

**Table 2-10**
**MARSSIM Classifications**

| | | | | | Area ($m^2$) | | | |
|---|---|---|---|---|---|---|---|---|
| **Survey Area Code** | **Survey Area Code Description** | **Survey Unit Code** | **Survey Unit Code Description** | **MARSSIM Class.** | **Floor Area** | **Total Area** | **Ratio (Total Area: Floor Area)** | **Figure No.** |
| 9302 | Northwest Protected Area Grounds | 0000 | Land Area | 3 | N/A | 6,410 | N/A | 2-2 |
| 9304 | Southwest Protected Area Grounds | 0001 | Land Area | 3 | N/A | 4,800 | N/A | 2-2 |
| | | 0002 | Land Area | 1 | N/A | 1,268 | N/A | 2-2 |
| 9306 | South Central Protected Area Grounds | 0000 | Land Area | 2 | N/A | 4,780 | N/A | 2-2 |
| 9312 | Northeast Protected Area Grounds | 0001 | Containment Footprint/DWST | 1 | N/A | 1,980 | N/A | 2-2 |
| | | 0002 | Spent Fuel Bldg Area | 1 | N/A | 1,806 | N/A | 2-2 |
| | | 0003 | Terry Turbine/CST | 1 | N/A | 1,481 | N/A | 2-2 |

**Table 2-10**
**MARSSIM Classifications**

| | | | | | Area ($m^2$) | | | |
|---|---|---|---|---|---|---|---|---|
| **Survey Area Code** | **Survey Area Code Description** | **Survey Unit Code** | **Survey Unit Code Description** | **MARSSIM Class.** | **Floor Area** | **Total Area** | **Ratio (Total Area: Floor Area)** | **Figure No.** |
| 9312 | | 0004 | North RCA from EDG Bldg Eastward | 1 | N/A | 1,586 | N/A | 2-2 |
| | | 0005 | Tank Farm and Resin Facility | 1 | N/A | 1,454 | N/A | 2-2 |
| | | 0006 | PAB Footprint | 1 | N/A | 1,749 | N/A | 2-2 |
| | | 0007 | RRF Bldg/115kV East Footprint | 1 | N/A | 1,566 | N/A | 2-2 |
| | | 0008 | 115kV West Side GW Treatment Facility | 1 | N/A | 1,348 | N/A | 2-2 |
| | | 0009 | East Trench North | 1 | N/A | 1,511 | N/A | 2-2 |
| | | 0010 | East Trench South/MWST A&B | 1 | N/A | 1,365 | N/A | 2-2 |

**Table 2-10**
**MARSSIM Classifications**

| | | | | | Area ($m^2$) | | | |
|---|---|---|---|---|---|---|---|---|
| **Survey Area Code** | **Survey Area Code Description** | **Survey Unit Code** | **Survey Unit Code Description** | **MARSSIM Class.** | **Floor Area** | **Total Area** | **Ratio (Total Area: Floor Area)** | **Figure No.** |
| 9313 | Central Site Grounds | 0000 | Land Area | 2 | N/A | 5,850 | N/A | 2-2 |
| 9504 | Bypass Road and Secondary Parking lot (Add N. Portion of 9502) (Info Only) | 0000 | Land Area | 2 | N/A | 5,692 | N/A | 2-1 |
| 9506 | North Site Grounds (Non-Protected Area) (Add EOF Parking Area from 9510) (Info Only) | 0000 | Land Area | 3 | N/A | 11,244 | N/A | 2-1 |
| 9508 | Pond | 0000 | Land Area and Pond Sediment | 3 | N/A | 10,831 | N/A | 2-1 |
| 9512 | Northwest Site Grounds (Non-Protected Area) (Remove Truck Monitor and Roadway) (Info Only) | 0000 | Land Area | 3 | N/A | 30,701 | N/A | 2-1 |
| 9514 | Primary Parking Lot West (Add the S. Portion of 9502) Add Truck Monitor and Roadway From 9512) (Info Only) | 0000 | Land Area | 3 | N/A | 18,757 | N/A | 2-1 |
| | Primary Parking Lot East | 0001 | Land Area | 2 | N/A | 8,739 | N/A | 2-1 |

**Table 2-10**
**MARSSIM Classifications**

| | | | | | Area ($m^2$) | | | |
|---|---|---|---|---|---|---|---|---|
| **Survey Area Code** | **Survey Area Code Description** | **Survey Unit Code** | **Survey Unit Code Description** | **MARSSIM Class.** | **Floor Area** | **Total Area** | **Ratio (Total Area: Floor Area)** | **Figure No.** |
| 9520 | Southwest Site Storage Area | 0001 | Land Area, North Peninsula | 2 | N/A | 9,870 | N/A | 2-2 |
| | | 0002 | Land Area, North Peninsula | 2 | N/A | 9,845 | N/A | 2-2<br>2-3 |
| | | 0003 | Land Area, North Peninsula | 2 | N/A | 8,106 | N/A | 2-3 |
| | | 0004 | Land Area, North Peninsula | 1 | N/A | 1,983 | N/A | 2-3 |
| | | 0005 | Land Area, North Peninsula | 1 | N/A | 1,887 | N/A | 2-3 |
| 9521 | Southeast Pond | 0000 | Land Area and Pond Sediment | 3 | N/A | 23,100 | N/A | 2-7 |

**Table 2-10**
**MARSSIM Classifications**

| | | | | | Area ($m^2$) | | | |
|---|---|---|---|---|---|---|---|---|
| **Survey Area Code** | **Survey Area Code Description** | **Survey Unit Code** | **Survey Unit Code Description** | **MARSSIM Class.** | **Floor Area** | **Total Area** | **Ratio (Total Area: Floor Area)** | **Figure No.** |
| 9522 | Southeast Site Grounds | 0001 | Land Area | 2 | N/A | 6,972 | N/A | 2-2 |
| | | 0002 | Land Area | 1 | N/A | 1,913 | N/A | 2-2 |
| | | 0003 | Land Area 150m East of Load distribution Tower | 1 | N/A | 1,997 | N/A | 2-2 |
| | | 0004 | Land Area | 1 | N/A | 1,386 | N/A | 2-2 |
| | | 0005 | East Side Land of Canal | 1 | N/A | 1,947 | N/A | 2-2 |
| | | 0006 | South RCA Land Area | 1 | N/A | 1,987 | N/A | 2-2 |
| | | 0007 | South RCA Land Area | 1 | N/A | 1,952 | N/A | 2-2 |

**Table 2-10**
**MARSSIM Classifications**

| | | | | | Area ($m^2$) | | | |
|---|---|---|---|---|---|---|---|---|
| **Survey Area Code** | **Survey Area Code Description** | **Survey Unit Code** | **Survey Unit Code Description** | **MARSSIM Class.** | **Floor Area** | **Total Area** | **Ratio (Total Area: Floor Area)** | **Figure No.** |
| 9523 | Southeast Wetland Area | 0000 | Land Area | 3 | N/A | 106,000 | N/A | 2-7 |
| 9524 | South Side Grounds (Non-Protected Area) | 0000 | Land Area | 3 | N/A | 110,000 | N/A | 2-7 |
| 9525 | Southeast Site Road | 0000 | Land Area | 3 | N/A | 28,000 | N/A | 2-7 |
| 9526 | Northeast Mountain Side | 0000 | Land Area | 3 | N/A | 44,700 | N/A | 2-7 |
| | | 0001 | Land Area | 2 | NA | 6,536 | N/A | 2-7 |
| | | 0002 | Land Area | 2 | N/A | 6,069 | N/A | 2-7 |
| 9527 | East Mountain Side | 0001 | Land Area | 2 | N/A | 8,600 | N/A | 2-7 |
| | | 002 | Land Area | 2 | N/A | 9,740 | N/A | 2-7 |

**Table 2-10**
**MARSSIM Classifications**

| | | | | | Area ($m^2$) | | | |
|---|---|---|---|---|---|---|---|---|
| **Survey Area Code** | **Survey Area Code Description** | **Survey Unit Code** | **Survey Unit Code Description** | **MARSSIM Class.** | **Floor Area** | **Total Area** | **Ratio (Total Area: Floor Area)** | **Figure No.** |
| | | 0003 | Land Area | 2 | N/A | 8,200 | N/A | 2-7 |
| | | 0004 | Land Area | 2 | N/A | 5,400 | N/A | 2-7 |
| | | 0005 | Land Area | 2 | N/A | 5,777 | N/A | 2-2 |
| | | 0006 | Land Area | 1 | N/A | 790 | N/A | 2-2 |
| 9528 | Southeast Mountain Side | 0000 | Land Area | 3 | N/A | 575,488 | N/A | 2-7 |
| | | 0002 | Land Area | 2 | N/A | 9,752 | N/A | 2-7 |
| | | 0003 | Land Area | 2 | N/A | 9,447 | N/A | 2-7 |

**Table 2-10**
**MARSSIM Classifications**

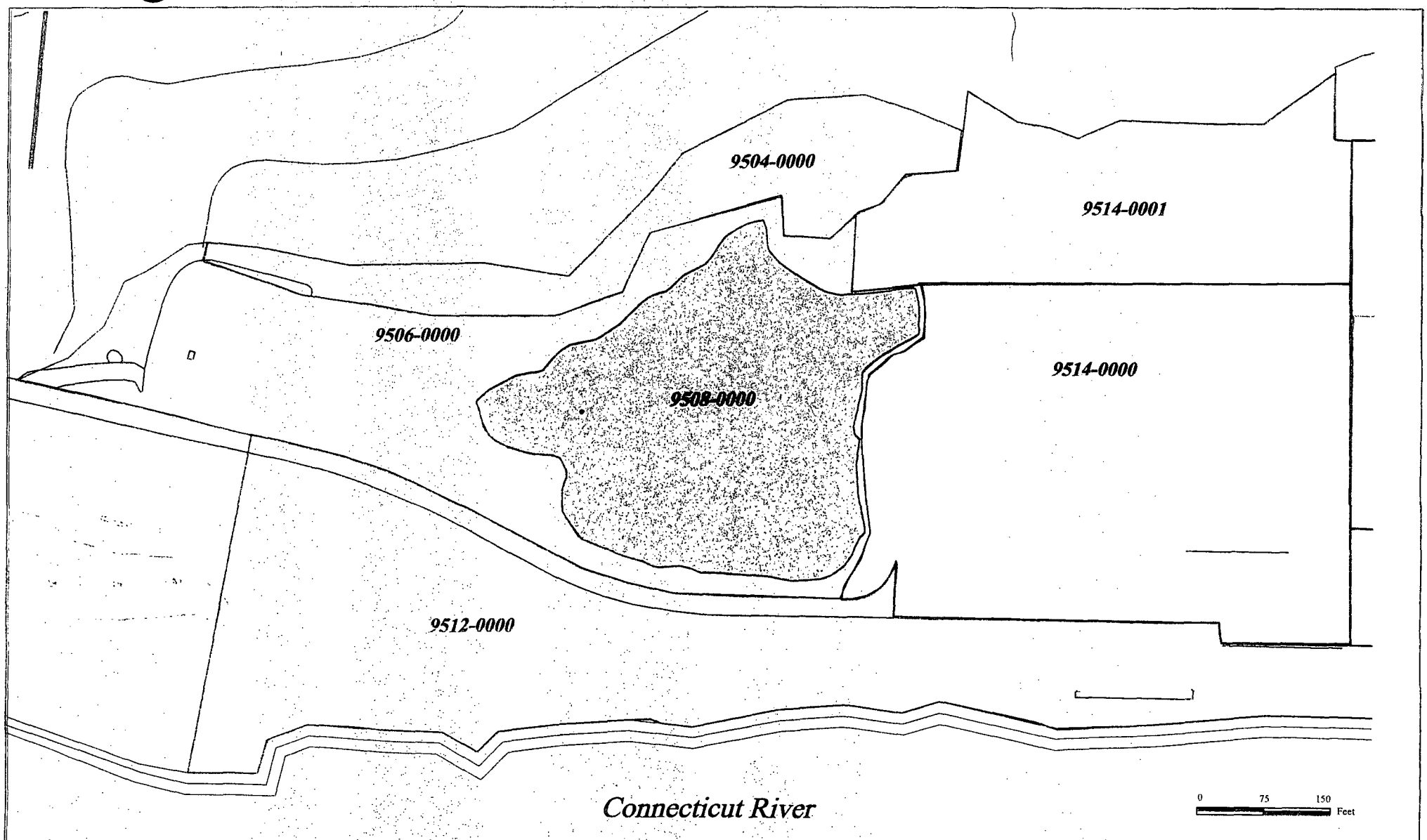
| | | | | | Area ($m^2$) | | | |
|---|---|---|---|---|---|---|---|---|
| **Survey Area Code** | **Survey Area Code Description** | **Survey Unit Code** | **Survey Unit Code Description** | **MARSSIM Class.** | **Floor Area** | **Total Area** | **Ratio (Total Area: Floor Area)** | **Figure No.** |
| | | 0004 | Land Area | 2 | N/A | 3,058 | N/A | 2-7 |
| 9530 | Central Peninsula Area | 0001 | Land Area Bounded by and Immediately Adjacent to the Road | 2 | N/A | 8,000 | N/A | 2-3<br>2-4 |
| | | 0002 | Western Half of Diked Area and Immediately Surrounding Sides | 2 | N/A | 5,000 | N/A | 2-4 |
| | | 0003 | Eastern Half of Diked Area and Immediately Surrounding Sides | 2 | N/A | 5,000 | N/A | 2-4 |
| | | 0004 | Open Land Areas | 3 | N/A | 97,000 | N/A | 2-4 |
| 9531 | South End of Peninsula | 0000 | Land Area | 3 | N/A | 118,000 | N/A | 2-5 |
| 9532 | East Side Grounds (Non-Protected Area) | N/A | N/A | Non-impacted | N/A | 375,600 | N/A | 2-7 |

**Table 2-10**
**MARSSIM Classifications**

| | | | | | Area ($m^2$) | | | |
|---|---|---|---|---|---|---|---|---|
| **Survey Area Code** | **Survey Area Code Description** | **Survey Unit Code** | **Survey Unit Code Description** | **MARSSIM Class.** | **Floor Area** | **Total Area** | **Ratio (Total Area: Floor Area)** | **Figure No.** |
| 9535 | South East Landfill Area | 0001 | Land Area | 1 | N/A | 1,900 | N/A | 2-7 |
| | | 0002 | Land Area | 2 | N/A | 3,600 | N/A | 2-7 |
| 9536 | Construction Piles Near Rifle Range | 0000 | Land Area | 2 | N/A | 2,200 | N/A | 2-7 |
| 9537 | Permitted Landfill Area | 0000 | Land Area | 2 | N/A | 2,200 | N/A | 2-7 |
| 9538 | Material Storage Area | 0000 | Land Area | 2 | N/A | 4,200 | N/A | 2-7 |
| 9539 | ISFSI Haul Road | 0001 | ISFSI Haul Road (Northern Section) | 2 | N/A | 9,332 | N/A | 2-3<br>2-4 |
| | | 0002 | ISFSI Haul Road (Southern Section) | 2 | N/A | 7,239 | N/A | 2-4 |

**Table 2-10**
**MARSSIM Classifications**

| | | | | | Area ($m^2$) | | | |
|---|---|---|---|---|---|---|---|---|
| **Survey Area Code** | **Survey Area Code Description** | **Survey Unit Code** | **Survey Unit Code Description** | **MARSSIM Class.** | **Floor Area** | **Total Area** | **Ratio (Total Area: Floor Area)** | **Figure No.** |
| 9801 | Subsurface soils in Radiologically Controlled Area (excluding 9308) | 0000 | Subsurface Soil | A* | N/A | 15,788 | N/A | 2-6 |
| 9802 | Subsurface soils associated with surface soil survey area 9308 and subsurface soil areas within the industrial area but outside the radiologically controlled area | 0000 | Subsurface Soil | B* | N/A | 18,292 | N/A | 2-6 |
| 9803 | Subsurface soils associated with parking lot, Warehouses 1 & 2, and Steam Generator Mockup Bldg | 0000 | Subsurface Soil | C* | N/A | 35,485 | N/A | 2-6 |
| 9804 | Subsurface area associated with Southeast Grounds (Non-Protected Area) | 0000 | Subsurface Soil | A* | N/A | 11,568 | N/A | 2-6 |
| 9805 | Subsurface soils associated with peninsula (excluding area 9531) | 0000 | Subsurface Soil | C* | N/A | 104,207 | N/A | 2-6 |
| 9806 | Subsurface soils associated with surface soil portions of survey area 9535 (South East Landfill) | 0000 | Subsurface Soil | A* | N/A | 4250 | N/A | 2-6 |
| 9807 | Subsurface Soils associated with 9520-0004 | 0000 | Subsurface Soil | B* | N/A | 1983 | N/A | 2-6 |




Plant North

CONNECTICUT YANKEE ATOMIC POWER COMPANY

CY UPDATE SURVEY UNIT BOUNDARIES

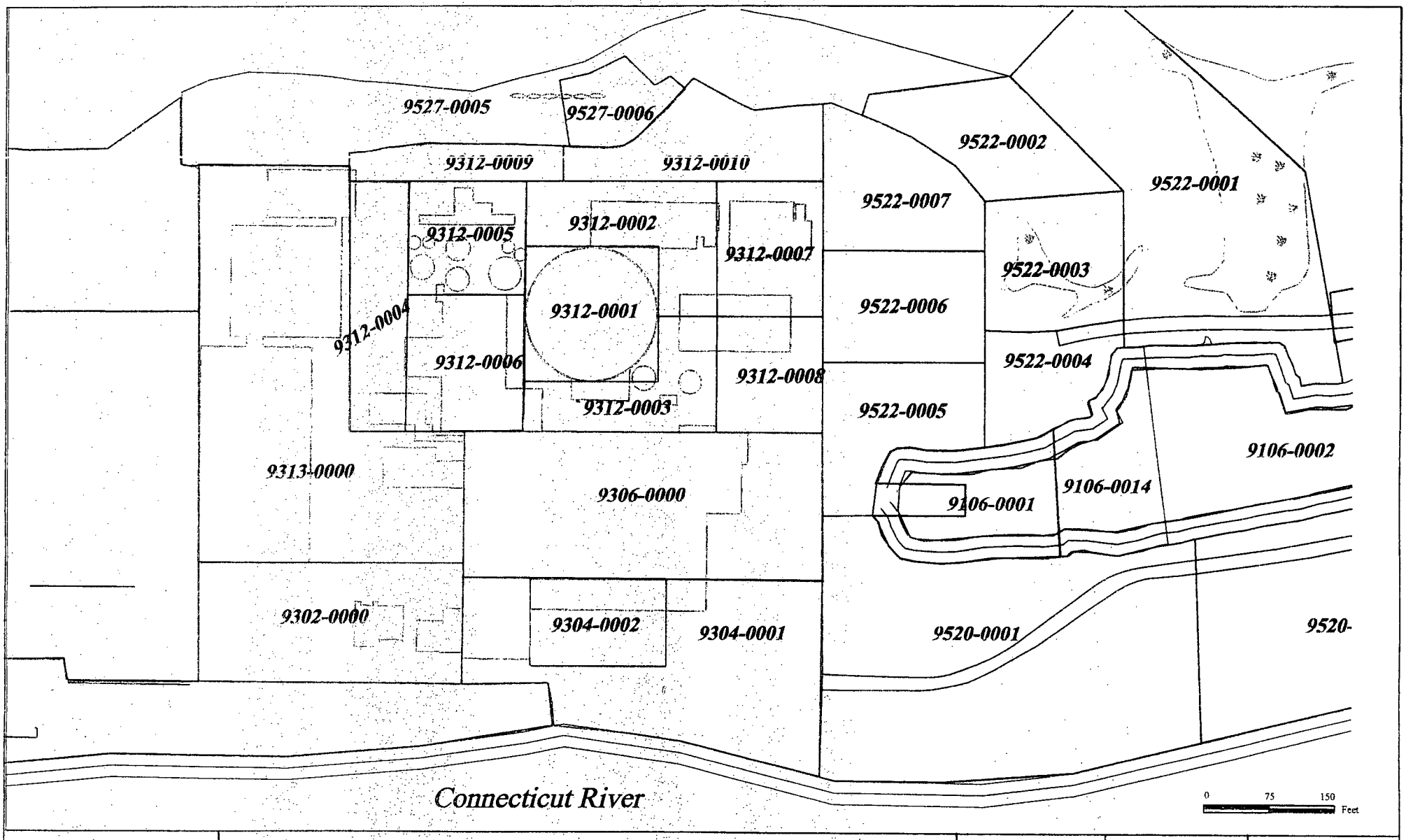
Surface Areas

| | |
|---|---|
| INITIAL CREATION DATE: | APRIL 2002 |
| REVISED BY: | J McCARTHY |
| REVISION DATE: | FEBRUARY 2007 |
| LTP REVISION #: | 5 |
| MAP #: | FIGURE 2-1 |

LEGEND

= Pond

= Wet Land



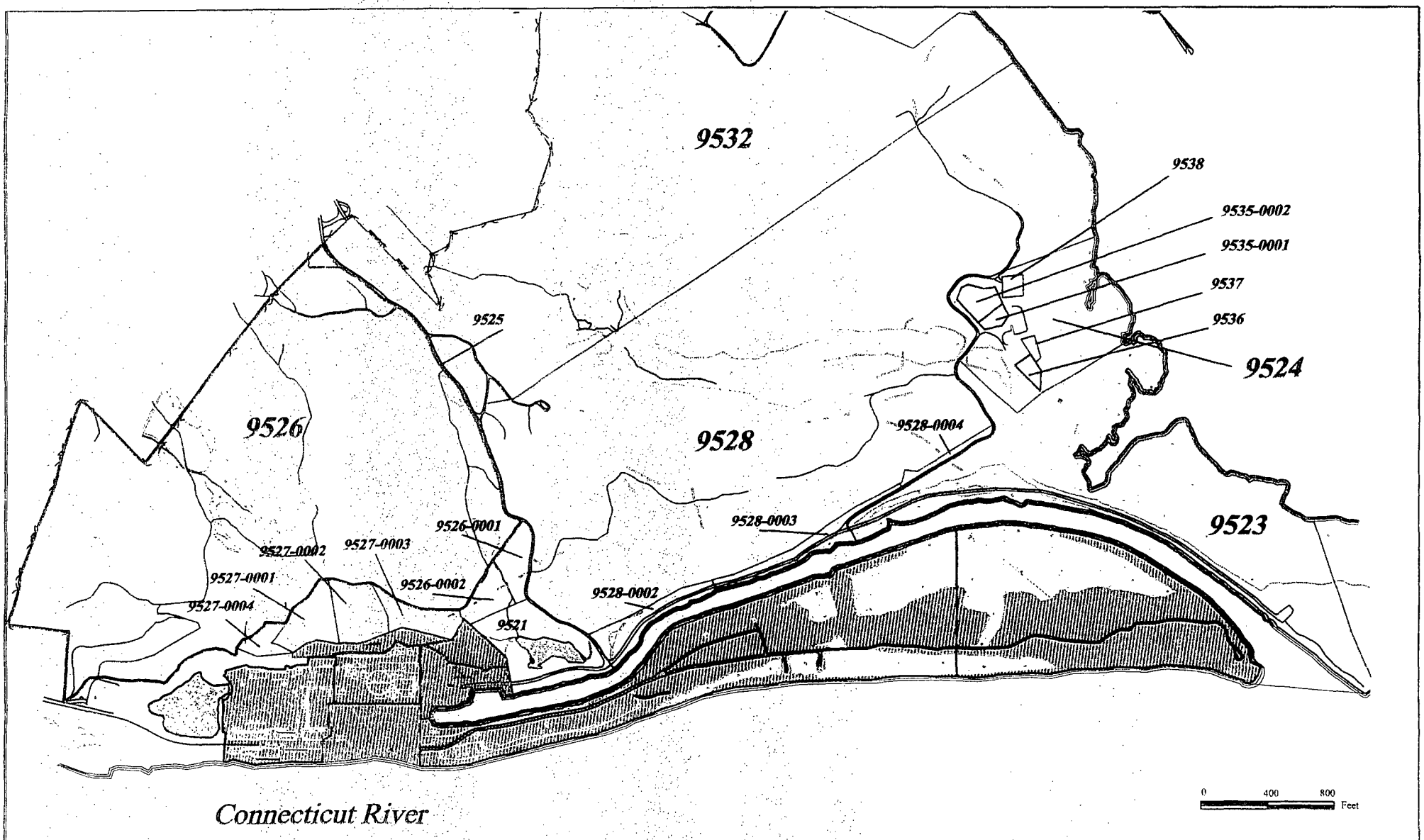

Plant North

CONNECTICUT YANKEE ATOMIC POWER COMPANY

CY UPDATE SURVEY UNIT BOUNDARIES

Surface Areas

| | | |
|---|---|---|
| INITIAL CREATION DATE: | APRIL 2002 | LEGEND |
| REVISED BY: | J McCARTHY | - Wet Land |
| REVISION DATE: | JANUARY 2007 | |
| LTP REVISION #: | 5 | |
| MAP #: | FIGURE 2-2 | |




Plant North

CONNECTICUT YANKEE ATOMIC POWER COMPANY
GENERAL ARRANGEMENT DRAWING
Surface Areas

| | | |
|---|---|---|
| INITIAL CREATION DATE: | APRIL 2002 | LEGEND |
| REVISED BY: | J McCARTHY | = Refer to Figures 2-1 through 2-6 |
| REVISION DATE: | FEBRUARY 2007 | |
| LTP REVISION #: | 5 | |
| MAP #: | FIGURE 2-7 | |

Depending on the values of the applicable DCGLs, an alternative method of using material specific backgrounds may be used during final status surveys. This alternative method will involve the determination of the ambient area background in the survey unit and will only be applicable to beta-gamma detecting instruments. This determination will be made prior to performing a final status survey at a location within a survey area that is of sufficient distance (or attenuation) from the surfaces to eliminate beta particles originating from the surface from reaching the detector. At such a location, the ambient background radiation will be due only to ambient gamma radiation and will be a background component of all surface measurements. The average background determined at this location can be used as a conservative estimate since it is expected to be less than the material specific background for the material in the room because it does not fully account for the naturally occurring radioactivity in the materials. Using this lower ambient background will result in conservative calculated residual radioactivity levels. If the average background reading exceeds a predetermined value, the survey would be terminated and an investigation performed to determine and eliminate the reason for the elevated reading. Each of the survey unit readings would subtract this average background value and the Sign Test applied.

Whether or not they are radionuclide specific, all background measurements should account for both spatial variability over the area being assessed and the precision of the instrument or method being used to make the measurements. Thus, the same materials or areas may require more than one background assessment to provide the requisite background information for the various survey instruments or methods expected to be used for final status surveys. The results of these background assessments provides the basis for determining the mean and its associated standard deviation.

### 5.4.6 Area Preparation: Isolation and Control

Before final status survey activities can begin in an area, a transition must occur where planned decommissioning activities that may cause the spread of contamination in the area of consideration or any adjacent areas are completed or properly controlled and the area is subsequently assessed to scope the required isolation and control measures. This includes establishing if the area is ready for final survey activities and identifying any work practice issues that must be addressed in survey planning and design. Determination of readiness for final status survey will be based on characterization and/or remediation surveys indicating that the residual radioactive material is likely to comply with the final status survey criteria.

During and following this assessment, the remediation of an area for the purposes of removal of residual radioactivity, a Remedial Action Survey (RAS) will be performed. This RAS will include scanning and sampling of the areas, as necessary, using appropriate instrumentation to ensure the intended remediation has been accomplished. If no further remediation is required, a turnover survey may be performed as necessary. Data from the RAS may be used for the turnover survey and as input to the design and DQOs for the surface and subsurface FSS.

It is noted, however, that characterization efforts for groundwater contamination are still ongoing and the survey areas to which the $H_{ExistingGW}$ term are applied may change. Those changes will be communicated to the NRC. This change may be caused by changes in the location of the plume, detection of groundwater contamination at locations outside the plume or changes to the capture zone or detection of groundwater contamination at locations outside the zone. The Phase 2 Hydrogeologic Work Plan, as described in Section 2.3.1.6, will provide additional characterization of groundwater that will be used to better define the groundwater contamination plume.

Prior to the request to release of any portion of the site from the license, CYAPCO will prepare and make available for inspection a capture zone analysis provided to the NRC in January 2005, based on data collected as part of the Phase 2 Hydrogeological Work Plan, to better define the capture zone distance, Reference 5-13. The "capture zone" is the area surrounding a hypothetical well to be used by the resident farmer, from which existing groundwater contamination could be drawn into the resident farmer's well. The analysis used to determine this area used the hydrogeological conditions and parameters assumed in the Resident farmer Scenario as described in Chapter 6 of the LTP.

**Table 5-3**
**Survey Units Affected by Groundwater Contamination**

| Existing | Future Groundwater |
|---|---|
| Groundwater Zone of Influence | Concrete |
| 9302 | 9302 |
| 9304-1&2 | 9304-1&2 |
| 9306 | 9306 |
| 9312-1 Thru 10 | 9312-1 Thru 10 |
| 9313 | 9313 |
| 9522-5, 6 & 7 | 9522-5, 6 & 7 |
| 9801 | 9801 |
| 9802 | 9802 |
| 9106-1, 2, 3, 4 & 14 | N/A |
| 9512 | N/A |
| 9514 | N/A |
| 9520-1, 2, 3, 4 & 5 | N/A |
| 9521 | N/A |
| 9522-1, 2, 3 & 4 | N/A |
| 9527-1, 2, 3, 4, 5 & 6 | N/A |
| 9528-0, 2 & 3 | N/A |
| 9530-1, 2, 3 & 4 | N/A |
| 9539-0001 | N/A |
| 9803 | N/A |
| 9804 | N/A |
| 9805 | N/A |
| 9807 | N/A |

The compliance formulation for these resident farmer exposure scenarios is re-written as:

(Equation 5-5)

$$1 \geq \sum(i)\left[\frac{DCGL^{i}_{OP-Soil}}{DCGL^{i}_{Base-Soil}} + \frac{DCGL^{i}_{OP-ExistingGW}}{DCGL^{i}_{Base-ExistingGW}} + \frac{H_{FutureGW}}{25}\right]$$

For simplicity Equation 5-5 may be re-written as:

$$1 \geq \sum(i)\left[f^{i}_{Soil} + f^{i}_{ExistingGW} + f^{i}_{FutureGW}\right] \quad \text{(Equation 5-6)}$$

Where, for a given radionuclide $i$, $f^{i}_{Soil}$ is the fraction of the total dose from soil. $f^{i}_{ExistingGW}$ is the fraction to the total dose from existing contamination in groundwater $f_{FutureGW}$ is the fraction of the base case DCGL 25 mrem/yr dose that is calculated by the Basement Fill Model.

The use of this equation requires that only one variable be unknown. Therefore, values for Future Groundwater dose and $f_{ExistingGW}$ will need to be selected in order to calculate $f_{Soil}$. As the building surface operational DCGL are independent of soil and groundwater dose contribution, they will be set based on an ALARA evaluation and/or an administrative dose level at or below 25 mrem/yr.

The following example is provided to illustrate the use of the operational DCGLs for land areas that have the potential for existing and future groundwater dose, with the following assumptions:

- $f_{Soil} = 0.3$
- $f_{ExistingGW} = 0.2$
- Therefore, Future Groundwater Dose (fraction of 25 mrem/yr) = 0.5

The above determination will be made prior to the performance of any final status surveys of soils or building surveys in areas where existing groundwater contamination will impact the potential dose. This determination will be provided in the FSS Report or a technical support document and will be applied to the affected survey areas.

The following table provides an example of the building surface operational DCGL for Cs-137 using the fractional values from above.

| | 1" | 2" | 2 1/2 " | 3" | 4" | 8" | 10" | 12" | 14" | 16" | 18" | 20" | 24" |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Radionuclide** | | | | | | | | | | | | | |
| H-3 | 1.30E+03 | 2.61E+03 | 3.26E+03 | 3.91E+03 | 5.21E+03 | 1.04E+04 | 1.30E+04 | 1.56E+04 | 1.82E+04 | 2.08E+04 | 2.34E+04 | 2.61E+04 | 3.13E+04 |
| C-14 | 1.94E+04 | 3.89E+04 | 4.86E+04 | 5.83E+04 | 7.77E+04 | 1.55E+05 | 1.94E+05 | 2.33E+05 | 2.72E+05 | 3.11E+05 | 3.50E+05 | 3.89E+05 | 4.66E+05 |
| Mn-54 | 1.33E+04 | 2.66E+04 | 3.32E+04 | 3.98E+04 | 5.31E+04 | 1.06E+05 | 1.33E+05 | 1.59E+05 | 1.86E+05 | 2.12E+05 | 2.39E+05 | 2.66E+05 | 3.19E+05 |
| Fe-55 | 1.54E+04 | 3.09E+04 | 3.86E+04 | 4.63E+04 | 6.17E+04 | 1.23E+05 | 1.54E+05 | 1.85E+05 | 2.16E+05 | 2.47E+05 | 2.78E+05 | 3.09E+05 | 3.70E+05 |
| Co-60 | 8.03E+04 | 1.61E+05 | 2.01E+05 | 2.41E+05 | 3.21E+05 | 6.42E+05 | 8.03E+05 | 9.63E+05 | 1.12E+06 | 1.28E+06 | 1.44E+06 | 1.61E+06 | 1.93E+06 |
| Ni-63 | 3.80E+04 | 7.60E+04 | 9.50E+04 | 1.14E+05 | 1.52E+05 | 3.04E+05 | 3.80E+05 | 4.56E+05 | 5.32E+05 | 6.08E+05 | 6.84E+05 | 7.60E+05 | 9.12E+05 |
| Sr-90 | 4.68E+01 | 9.35E+01 | 1.17E+02 | 1.40E+02 | 1.87E+02 | 3.74E+02 | 4.68E+02 | 5.61E+02 | 6.55E+02 | 7.48E+02 | 8.42E+02 | 9.35E+02 | 1.12E+03 |
| Nb-94 | 3.43E+04 | 6.85E+04 | 8.56E+04 | 1.03E+05 | 1.37E+05 | 2.74E+05 | 3.43E+05 | 4.11E+05 | 4.80E+05 | 5.48E+05 | 6.17E+05 | 6.85E+05 | 8.22E+05 |
| Tc-99 | 6.10E+03 | 1.22E+04 | 1.53E+04 | 1.83E+04 | 2.44E+04 | 4.88E+04 | 6.10E+04 | 7.32E+04 | 8.54E+04 | 9.76E+04 | 1.10E+05 | 1.22E+05 | 1.46E+05 |
| Ag-108m | 3.43E+05 | 6.85E+05 | 8.56E+05 | 1.03E+06 | 1.37E+06 | 2.74E+06 | 3.43E+06 | 4.11E+06 | 4.80E+06 | 5.48E+06 | 6.17E+06 | 6.85E+06 | 8.22E+06 |
| Cs-134 | 2.09E+04 | 4.18E+04 | 5.22E+04 | 6.26E+04 | 8.35E+04 | 1.67E+05 | 2.09E+05 | 2.51E+05 | 2.92E+05 | 3.34E+05 | 3.76E+05 | 4.18E+05 | 5.01E+05 |
| Cs-137 | 2.42E+04 | 4.83E+04 | 6.04E+04 | 7.25E+04 | 9.66E+04 | 1.93E+05 | 2.42E+05 | 2.90E+05 | 3.38E+05 | 3.86E+05 | 4.35E+05 | 4.83E+05 | 5.80E+05 |
| Eu-152 | 6.70E+04 | 1.34E+05 | 1.68E+05 | 2.01E+05 | 2.68E+05 | 5.36E+05 | 6.70E+05 | 8.04E+05 | 9.38E+05 | 1.07E+06 | 1.21E+06 | 1.34E+06 | 1.61E+06 |
| Eu-154 | 4.68E+04 | 9.35E+04 | 1.17E+05 | 1.40E+05 | 1.87E+05 | 3.74E+05 | 4.68E+05 | 5.61E+05 | 6.55E+05 | 7.48E+05 | 8.42E+05 | 9.35E+05 | 1.12E+06 |
| Eu-155 | 3.00E+05 | 6.00E+05 | 7.50E+05 | 9.00E+05 | 1.20E+06 | 2.40E+06 | 3.00E+06 | 3.60E+06 | 4.20E+06 | 4.80E+06 | 5.40E+06 | 6.00E+06 | 7.20E+06 |
| Pu-238 | 1.88E+02 | 3.75E+02 | 4.69E+02 | 5.63E+02 | 7.50E+02 | 1.50E+03 | 1.88E+03 | 2.25E+03 | 2.63E+03 | 3.00E+03 | 3.38E+03 | 3.75E+03 | 4.50E+03 |
| Pu-239 | 1.71E+02 | 3.41E+02 | 4.26E+02 | 5.12E+02 | 6.82E+02 | 1.36E+03 | 1.71E+03 | 2.05E+03 | 2.39E+03 | 2.73E+03 | 3.07E+03 | 3.41E+03 | 4.09E+03 |
| Pu-241 | 2.85E+03 | 5.70E+03 | 7.13E+03 | 8.55E+03 | 1.14E+04 | 2.28E+04 | 2.85E+04 | 3.42E+04 | 3.99E+04 | 4.56E+04 | 5.13E+04 | 5.70E+04 | 6.84E+04 |
| Am-241 | 8.33E+01 | 1.67E+02 | 2.08E+02 | 2.50E+02 | 3.33E+02 | 6.66E+02 | 8.33E+02 | 9.99E+02 | 1.17E+03 | 1.33E+03 | 1.50E+03 | 1.67E+03 | 2.00E+03 |
| Cm-243 | 1.15E+02 | 2.31E+02 | 2.88E+02 | 3.46E+02 | 4.61E+02 | 9.22E+02 | 1.15E+03 | 1.38E+03 | 1.61E+03 | 1.84E+03 | 2.07E+03 | 2.31E+03 | 2.77E+03 |

Part of the planning for the final status survey of a particular survey unit will include an evaluation of the surfaces to be monitored. For conventional instrumentation, surface anomalies will be identified as part of this process and will be taken into account when selecting efficiencies to convert instrument readings to activity and in the calculation of the corresponding MDCs. Conservative values will be chosen based upon surface conditions. If the condition of the surface in the area changes in a more conservative direction (e.g. shorter detector to surface distance), the effect on the MDC will be assessed but may not be re-derived. If the condition of the surface changes in a non-conservative direction (e.g. different construction material which has higher natural radioactivity) the MDC will be assessed and re-derived.

Expansion joints, stress cracks, floor/wall interfaces, and penetrations into floors and walls for piping, conduit, anchor bolts, etc., are potential sites for accumulation of contamination and pathways for migration into sub-floor soil and hollow wall spaces. Roof surfaces and drainage points are also important survey locations. In some cases, it may be necessary to core, drill, or use other methods as necessary to gain access to areas for sampling.

#### 5.7.3.1.1 Activity Beneath Surfaces

Floors, walls, and ceilings of structures may have surface irregularities such as cracks and crevices that require special consideration in the survey process. Such considerations may consist of fixed measurements, longer count times, adjustments to counting efficiencies, sampling of material, or any combinations of these approaches.

Plant areas where residual radioactive material beneath a painted surface is known or suspected to be present will also require special consideration. Sampling will be performed, as appropriate, to confirm or deny the presence of residual activity. If activity is found, the samples should be used to determine both the radionuclides that are present and the density-thickness of the paint layer(s) in order to assess the need for correction factors for counting efficiencies. Such corrections, if required, will be determined following the guidance given in Section 5 of NUREG-1507. The effect of any such corrections on instrument MDCs will be assessed to ensure that measurements can still be performed with the required sensitivity relative to the applicable DCGLs.

#### 5.7.3.1.2 Below-Grade Building Foundations

##### 5.7.3.1.2.1 Basement

Exterior surfaces of below-grade basements will be evaluated using the historical site assessment and other pertinent records to determine the potential for sub-surface contamination on these surfaces of below-grade basements. One method available to evaluate the exterior surfaces is the use of core bores through foundation or walls and the taking of soil samples at locations having a high potential for the accumulation and migration of radioactive contamination to sub-surface soils. These biased locations for soil and concrete assessment could include stress cracks, floor and wall interfaces, penetrations through walls and floors for piping, run-off from exterior walls, and leaks or spill in adjacent outside areas, etc. If the soil is found to be free of residual radioactivity at the biased locations, it will be assumed that the exterior surface of the foundation is

also free of residual activity. Otherwise, additional sampling may be necessary to determine the extent of decontamination and remediation efforts. Another method available for evaluating the exterior surfaces of below-grade foundations is gamma well logging. Soil in biased locations next to the exterior of the buildings may be evaluated using this technique. This technique can provide for rapid isotopic analysis of soils without sampling.

Basement concrete that is to remain will be characterized to determine the extent of any volumetric contamination of the concrete in accordance with Table 5-10. The results will be used in the calculation of the Basement Fill Model.

#### 5.7.3.1.2.2 Footings

After completion of final status survey activities of the remaining portions of structures, some concrete may remain in the form of building footings.

There are several building foundations that are to remain. The current approach includes the demolition of the buildings generally to four feet below grade. This will remove ground-level floors and portions of footings and foundation supports. Surfaces of these below-grade structures will be evaluated using the historical site assessment and other pertinent records to determine the potential for sub-surface contamination on the surfaces of the foundations. Soil samples will be taken in the vicinity of the footings/foundation. If the soil is found to be free of residual radioactivity at the biased locations, it will be assumed that the exterior surface of the foundation is also free of residual activity. If soil samples contain residual radioactivity, the exterior surfaces will be sampled or assessed as follows:

These footings will be sampled using concrete sampling (at least 3 samples per footing or group of footings) or assessed using the results of nearby soil samples. The following methodology will be used:

- The average of the soil samples result (for plant-related radionuclides detected) will be calculated for each footing (at least 3 samples per footing or group of footings).

- For Tritium:

  - Using the soil distribution coefficient data (Kds) shown in Table F-1 and equation 6-1 of the LTP, the groundwater concentration in equilibrium with the soil concentrations in the last bullet will be determined.
  - Using the concrete distribution coefficients shown in Table F-4 of the LTP and equation 6-1 the concrete concentrations in equilibrium with the groundwater concentrations calculated in the last bullet will be determined.

- For radionuclides other than H-3:
    - At least six pairs of concrete samples with adjacent soil samples will be collected at locations affected by plant leakage and/or groundwater contamination.
    - The average and %CV (coefficient of variation) of the ratios of concrete concentrations to soil concentrations will be calculated.
    - IF the %CV of the data is less than 25%, the average ratio will be used to determine concrete concentrations from adjacent soil samples.
    - If the %CV is 25% or greater, more samples will be taken until a satisfactory variance is calculated or the worst case ratio will be used.

The results of this sampling or assessment will then be used as input to the calculation of future groundwater dose using the basement fill model as discussed in Chapter 6.

The results of sampling and/or assessment of the external surfaces will be used in the design and DQOs of the subsurface FSS to be performed in the area. Following any required remediation approximately 4 feet of backfill soil would be placed over the footings.

The need for a final status survey of the areas with below grade structures will be determined on a graded approach.

For footings and other structures to remain that have a very low or no potential for contamination such as:

- Buildings outside the RCA; and
- Buildings shown by characterization sampling to be free of residual radioactivity;

the final status survey will consist of a survey and subsurface FSS of the area including the subsurface structures.

**5.7.3.1.3 Sewer Systems, Plumbing**

Residual radioactivity in sanitary piping or floor drains will be evaluated in the same manner as for non-structural plant systems or components, discussed in Sections 5.4.7.5 and 5.6. Assessment of residual activity levels in piping or floor drains will be via sampling of sediments, fixed measurements, scanning, or a combination of these methods, as appropriate.

All non-RCA sanitary systems at the Haddam Neck Plant drain to on-site leach fields. These systems are independent of other plant systems and all surface water or storm drains. If any residual radioactivity is suspected in portions of the sanitary plumbing systems, evaluations for both the leach fields and the associated system piping may be required. Radiological assessments of piping will be made as described in Section 5.6 of this plan, i.e., by full length surveys of interior surfaces. Evaluations required for any affected leach fields will be made as described in Section 5.7.3.2.2 of this plan, for sub-surface activity. All operable RCA-located systems

currently drain to the aerated drains system and are part of the normal plant effluent. Thus, there are no leach fields associated with these systems. During the plant lifetime, toilet facilities, showers and sinks, contained within the RCA, drained to the plant sanitary system and associated leach field. Any piping associated with the systems, which is proposed to remain following decommissioning will be evaluated as described below.

#### 5.7.3.1.4 Ventilation Ducts - Interiors

Radiological assessments of ventilation systems will be made by taking measurements at appropriate access points where activity levels should be representative of those on the interior surfaces. Assessments may also be made using in-situ gamma-spectroscopy provided adequate instrument efficiencies and detection limits can be achieved. Exterior surfaces of such systems will be evaluated as part of the building or structure in cases where the system is attached to it or is otherwise an integral component.

#### 5.7.3.1.5 Piping and Embedded Piping

The construction of the Haddam Neck Plant was such that there is not expected to be a significant amount of embedded piping to consider in the final survey effort. Most of the radiologically affected piping is in pipe trenches, and thus can be accessed and removed as necessary. Currently approximately 1000 feet of embedded piping is forecasted to remain after Final Status Survey. Any affected embedded piping remaining at the time of Final Status Survey is expected to be in wall penetrations between areas. Sections of such piping are not expected to be very long (no longer than the wall thickness) and thus should be able to be sampled or surveyed as appropriate to evaluate residual activity levels against the applicable release criteria. The Final Status Survey design of areas containing embedded piping will address this media during the DQO process. Expected outputs of the DQO process include defining the appropriate type of data to collect; survey measurement processes and survey instrument sensitivity; potential contaminants and appropriate DCGL for the assumed exposure pathway.

#### 5.7.3.1.6 Activated Concrete

Although concrete cores have been obtained in Containment, they were not obtained in areas subject to the highest levels of neutron activation. Areas subject to the highest neutron activation are currently inaccessible, and, therefore, specific characterization data is not yet available in all areas. However, neutron activation data from Maine Yankee, Trojan and Yankee Nuclear Power Station indicate that H-3 and Fe-55 are present in the highest concentrations. Other radionuclides such as C-14, Co-60, Eu-152 and Ni-63 are also present. Based upon these data, the activation products Eu-152 and Eu-154 were included in the list of radionuclides expected to be present at HNP (Table 2-12).

As the decommissioning progresses and high dose rate components are removed, additional characterization of structures within Containment, including activated concrete and structural components, will take place. These characterization samples will typically be analyzed by gamma spectroscopy with some samples being analyzed for "hard-to-detect" radionuclides. Therefore, a representative sample of characterization and final status survey samples will be screened for neutron activation.

- Internal dose from ingestion of
  - Plant foods grown in media containing residual radioactivity and irrigated with water containing residual radioactivity,
  - Meat and milk from livestock fed with fodder grown in soil containing residual radioactivity and water containing residual radioactivity,
  - Drinking water (containing residual radioactivity) from a well,
  - Fish from a pond containing residual radioactivity, and
  - Media containing residual radioactivity.

### 6.3.3 Building Occupancy Scenario

Scenario Definition:

The building occupancy scenario, based upon NUREG/CR-5512, Volume 1, was selected to estimate human radiation exposure resulting from residual radioactivity in concrete from standing buildings and building foundations/basements that could reasonable be occupied and to determine corresponding DCGLs. CYAPCO will not leave any basements in place that can be reasonably occupied. These DCGLs are also used to bound residual contamination levels on metal surfaces such as embedded piping to be subsequently used in the calculation of the "future groundwater" dose due to contamination on these metal surfaces.

Critical Group:

Given the fact that the buildings associated with the HNP site are commercial, the average member of the critical group is an adult engaging in light industrial work within the buildings following decommissioning of the site. He/she occupies a commercial facility in a normal manner without deliberately disturbing sources of residual radioactivity. The dose from residual radioactivity in the concrete from the standing building is evaluated for the average member of the critical group as required by 10 CFR Part 20, Subpart E, and described in NUREG -1727, Appendix C.

Exposure Pathways:

The potential exposure pathways, described in NUREG/CR-5512, Volume 1, are depicted on Figure 6-4 and listed below:

- Direct exposure to external radiation from
  - Source
  - Material deposited on the floor
  - Submersion in airborne dust
- Internal dose from inhalation of airborne radionuclides
- Internal dose from inadvertent ingestion of radionuclides from the source

**Table 6-2**
**Base Case DCGLs for Groundwater**

| Radionuclide | Groundwater DCGL (pCi/l) |
|---|---|
| H-3 | 6.52E+05 |
| C-14 | 9.01E+03 |
| Mn-54 | 2.42E+04 |
| Fe-55 | 6.54E+04 |
| Co-60 | 1.14E+03 |
| Ni-63 | 3.15E+04 |
| Sr-90 | 2.51E+02 |
| Nb-94 | 6.75E+03 |
| Tc-99 | 2.64E+04 |
| Ag-108m | 4.24E+03 |
| Cs-134 | 3.42E+02 |
| Cs-137 | 4.31E+02 |
| Eu-152 | 7.33E+03 |
| Eu-154 | 5.05E+03 |
| Eu-155 | 3.25E+04 |
| Pu-238 | 1.51E+01 |
| Pu-239 | 1.36E+01 |
| Pu-241 | 4.60E+02 |
| Am-241 | 1.32E+01 |
| Cm-243 | 1.94E+01 |

## 6.8 DCGLs for Concrete

A few of the building basements and footings at HNP will remain in place and be surveyed or assessed for residual radioactivity. Presently CYAPCO's plan is to backfill these partial structures with clean material from off-site or on-site material shown to meet the soil DCGLs once the final status survey or assessment of the structure has been completed. The site dose contribution from these basements will be calculated using the Basement Fill Model as discussed in Section 6.8.2. Presently, the only remaining building after license termination will be the Emergency Operations Facility (EOF) which will be free released in accordance with applicable station procedures.

### 6.8.1 DCGLs for Concrete: Buildings Standing

#### 6.8.1.1 Dose Model

Presently the only building to remain on-site is the Emergency Operations Facility (EOF). The plan is to free release this structure in accordance with current regulations. The structure is located outside the industrial area at the extreme north boundary of the owner controlled area.

Using the parameter values above with equations 6-4 and 6-6, the calculated groundwater concentrations and dose are conservative as a result of the following simplifying assumptions.

- The concrete surfaces are assumed to be represented by a semi-infinite geometry.
- No credit is taken for the barrier to diffusion that the incore instrument area containment liner provides.
- The Brookhaven Study assumes that 2.5 feet of grout (flowable fill) will be placed above the activated concrete region of the In-Core Sump. The depth of grout placed above the activated region will actually be 5 feet, thereby providing additional resistance to transport.

The analysis provided by Reference 6-19 is specifically for the containment and spent fuel pool basements taken together. Other adjacent subsurface structures such as the cable vault portion of the containment and other footings will be inventoried in a similar manner and added to the containment dilution volume footings assessed after completion of the spent fuel pool Basement Fill Model Calculation will be included with the discharge tunnel inventory. This approach will also be used for other basements that remain (i.e. "B" Switchgear and the discharge tunnels) although the released radioactivity from these additional basements will be assumed to migrate and be included with the discharge tunnel inventories.

#### 6.8.2.3 Future Groundwater Dose Calculation for Surface Contamination on Embedded Piping

The last source to be evaluated in determining the future groundwater dose from buried structures and components is that resulting for the surface contamination contained on embedded piping to remain after termination of the license.

Embedded piping is that which is present in the containment or spent fuel pool basement and will not be removed or grouted. This source will be included in the calculation of the containment interior groundwater concentration. Surface activity surveys will be performed in accordance with Section 5.4.7.4 using building occupancy DCGLs determined by an ALARA evaluation or administrative limit. Using the radionuclide mix from these and other characterization surveys, each pipe will be assumed to be contaminated to levels equivalent to a total contamination level corresponding to building occupancy DCGL being used. Using this inventory, a CFR value of 1.0 will be used along with the total surface area, and, equations 6-4 and 6-6 will be used to calculate the future groundwater dose and concentrations. These values will be added to their respective values for the concrete case discussed in 6.8.2.2. This is a conservative approach since it assumes:

1. that the total inventory of radioactivity for each radionuclide is released to the groundwater/backfill soil system assumed in the containment basement in the first year after release of this area from the NRC license, and
2. that all surfaces are contaminated to a level equivalent to the building occupancy DCGL.

#### 6.8.2.4 Summary of All Future Groundwater Dose Calculations

Sections 6.8.2.2 and 6.8.2.3 show the method to be used to determine the future groundwater doses due to the individual sources, buried concrete, the in-core instrumentation area steel liner and embedded piping. The individual doses will next be summed to determine the total future groundwater dose from all sources. This calculated dose will be used to supply the "future groundwater" dose component of the compliance equation (5-1). In the case of the containment basement, the future groundwater dose will be calculated as given in the methodology above. This calculation will be performed concurrent with the survey of the containment and be available for NRC review prior to the backfilling of the containment basement.

This approach will also be used for other basements that remain (i.e. "B" Switchgear and the discharge tunnels) although the released radioactivity from these additional basements will be assumed to migrate and be included with the discharge tunnel inventories.

## 6.9 Operational DCGLs

Since additional scenarios, beyond those described above, may be created by combining pathways from different scenarios (e.g., resident farmer with the future groundwater dose calculated using the Basement Fill Model), a method to assess doses from these combined pathways is necessary. Additionally, any initial residual radioactivity in groundwater that exists will also contribute to total dose. For example, a resident farmer may locate his residence and raise crops on soil containing residual radioactivity and use groundwater that is in contact with a buried basement, which may also contain residual radioactivity. Soil and groundwater DCGLs for these combined scenarios along with the future groundwater dose calculated using the Basement Fill Model will be determined on an operational basis, using the base case DCGLs for soil and groundwater and future groundwater dose, calculated in Sections 6.6, 6.7, and 6.8. Section 5.4.7.1 describes, in detail, the methodology to account for all of these contributions.

This cost estimate was prepared by Northeast Utilities Service Company (NUSCo) using the TLG Services, Inc., estimating model in accordance with 10 CFR 50.82(a)(8)(iii). The assumed method of decommissioning anticipated a prompt decommissioning technique commonly referred to as DECON. After other revisions to the decommissioning cost estimate as described below, on August 15, 2006, the Company filed a rate settlement with FERC which is pending FERC approval.

## 7.2 Decommissioning Cost Estimate

### 7.2.1 Cost Estimate Previously Docketed in Accordance with 10 CFR 50.82 and 10 CFR 50.75 Post Shutdown

A letter from CYAPCO to the USNRC dated August 22, 1997 (Reference 7-3) was docketed detailing the PSDAR. This submittal contained a site-specific decommissioning cost estimate. In accordance with 10 FR 50.82(a)(8)(iii), CYAPCO submitted the site-specific decommissioning cost estimate to the USNRC in a letter dated August 25, 1998 (Reference 7-4). The estimate included with the PSDAR had been filed with the FERC prior to docketing. This estimate was the basis for which CYAPCO collected its rates and its anticipated decommissioning expenses. This cost estimate was prepared by NUSCo in 1996 using the TLG model for estimating decommissioning costs. It was prepared in sufficient detail to identify an activity by activity work breakdown complete with costs for radioactive waste, utility labor, contractor labor, energy, materials and equipment.

In August of 1998, the presiding Administrative Law Judge (ALJ) in the FERC case issued an opinion to the FERC Commissioners that the estimate was "unreliable for rate-making" and recommendations were made identifying appropriate remedies based on the factual data submitted from CYAPCO and intervening parties. CYAPCO prepared a revised cost estimate and engaged in settlement discussion with the certain intervening parties to the rate case. A settlement agreement incorporating the revised decommissioning funding plan was reached in April 2000 and submitted to the FERC for their review and approval. The settlement was approved by the FERC in April 2000.

### 7.2.2 Summary of the Site Specific Decommissioning Cost Estimate

The previous FERC approved decommissioning cost estimate was based on the April 7, 2000 Offer of Settlement between CYAPCO and the Connecticut Department of Public Utility Control and the Connecticut Department of Consumer Counsel (Reference 7-5). A copy of the FERC-approved Settlement Offer is provided in Appendix C. This FERC-approved decommissioning cost estimate completely replaced and superseded the 1996 cost estimate prepared by Northeast Utilities Service Company using the TLG Services estimating model.