

**Massachusetts Department of Public Health  
Radiation Control Program (RCP)  
Untreated Radioactive Wastewater Analysis  
Pilgrim Nuclear Power Plant**

**Date: May 19, 2023**

**BACKGROUND**

In 2022, Holtec, the owner operator of the decommissioning project at Pilgrim Nuclear Plant announced their intention to release 1.1 million gallons of radioactive wastewater into Cape Cod Bay. Subsequently, in March 2023, Holtec, applied for a surface water discharge permit (NPDES) to discharge water from the spent nuclear-fuel pool into Cape Cod Bay. The pending application would modify an existing MassDEP permit.

The Plymouth legislative delegation, including Senator Edward Markey, the MA State Inter-agency Pilgrim Working Group and the Nuclear Decommissioning Citizens Advisory Panel (NDCAP) expressed interest in obtaining baseline information on pollutants including radionuclides in the untreated water. At their request, on April 5, 2023, representatives from DPH and MassDEP collected untreated water samples at the Pilgrim plant. The samples collected were split between Holtec, MassDEP and DPH. MassDEP utilized GEL Labs in South Carolina to analyze their samples for non-radioactive pollutants. DPH utilized our Massachusetts Environmental Radiation Laboratory (MERL) located at the Massachusetts State Public Health Laboratory.

**Standard Analytical Methods and QA/QC**

The analysis conducted by the MERL follows analytical methods compatible with and in some cases developed by the United States Environmental Protection Agency (EPA), the United States Food and Drug Administration (FDA), the United States Nuclear Regulatory Commission (NRC). The analytical data reports also contain information of Quality Assurance (QA) and Quality Control (QC) procedures conducted as part of the sample analysis.

For radioanalysis, the MERL utilizes the same computer library of principle gamma emitting radionuclides as the NRC. As part of the MERL quality control program, Proficiency Test (PT) samples are routinely sent to the MERL for analysis of samples containing multiple gamma-emitting radionuclides. The FDA's Winchester Engineering and Analytical Center (WEAC) reviews and reports the MERL's proficiency performance results.

**Split Sampling**

Members of the Nuclear Decommissioning Citizens Advisory Panel (NDCAP) and the public raised concerns that reactor wastewater samples lacked regulatory oversight as they are collected, analyzed, and reported by Holtec. To address these concerns, MassDEP and the MDPH agreed to observe the sample collection and split samples of the untreated water with Holtec.

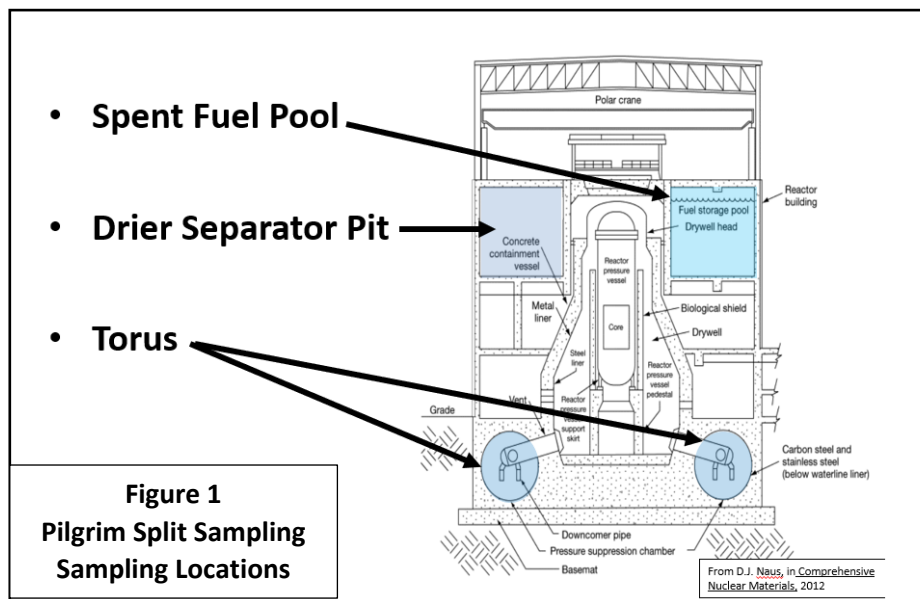
Split samples typically consist of a single field sample that is divided into two separate sub-samples for subsequent independent laboratory analysis. Any discrepancy between the two sub-samples may suggest a lack of precision or repeatability introduced during sample collection or lab analysis.

The analysis of the split samples provides a baseline assessment of both radioactive and non-radioactive pollutants in the untreated wastewater. Holtec will conduct separate sampling and analysis to support its applications submitted to EPA and MassDEP to discharge this wastewater to Cape Cod Bay.

### SAMPLE COLLECTION, SHIPMENT, AND ANALYSIS

On April 5, 2023, representatives from MassDEP and DPH met at the Pilgrim Station to observe the collection and take possession of the samples of the untreated water. In addition, a representative of the Town of Plymouth Department of Natural Resources, David Gould, was in attendance.

Sampling was conducted at three locations: the spent fuel pool, dryer separator pit, and the torus. The DPH samples collected for radio-analysis were properly labeled and then transported to the MERL by RCP staff. See Figure 1 below:



### Analytical Parameters

As discussed at previous NDCAP meetings, the radioanalytical parameters (MERL library) are from the Nuclear Regulatory Commission list of principle gamma emitters; they also included Tritium. The library is maintained by DPH's Radiation Control Program (RCP) and used for routine environmental sampling for both the Seabrook and Pilgrim Nuclear Power Stations.

## SAMPLE RESULTS

Split samples collected from the Dryer Separator pit/ Reactor Cavity, Spent Fuel Pool and the Torus were analyzed April 13 and 19<sup>th</sup>, 2023, at the Massachusetts Environmental Radiation Laboratory. The MERL sample results were as anticipated; there were no unexpected radionuclides. As the plant conditions are dynamic due to decommissioning work in progress and because the samples were from different storage locations, some variation in concentration detected was observed and was expected. There were four principle gamma emitters (Manganese-54, Cobalt-60, Zinc-65 and Cesium-137) and Tritium (H-3 a beta radiation emitter) detected. Table 1 includes the results for the DPH and Holtec radioanalytical samples.

TABLE 1

Sample #1 (Reactor Cavity)			<b><u>MERL – HOLTEC RESULTS COMPARISON</u></b>
Analyte	MERL	Holtec	
H3	3.17E-03	3.05E-03	<p><b>All results in uCi/mL</b></p> <p><b>All MERL gamma samples were:</b></p> <ul style="list-style-type: none"> <li>○ <b>analyzed in a 150 mL geometry, 3 cm above the detector to minimize deadtime. All gamma samples were analyzed for 30 minutes.</b></li> <li>○ <b>acidified to pH less than 2 with nitric acid as per procedure. Deadtime ranged from 0.06 to 2.75%.</b></li> </ul> <p><b>All MERL Tritium samples were:</b></p> <ul style="list-style-type: none"> <li>○ <b>analyzed for 100 minutes using a 60 mL aliquot and our standard H3 distillation process. Samples were not treated with acid prior to analysis.</b></li> </ul> <p><b>HOLTEC RESULTS PROVIDED ON MAY 4, 2023</b></p>
Mn-54	4.56E-05	3.26E-05	
Co-60	8.71E-04	6.24E-04	
Zn-65	1.57E-04	1.17E-04	
Cs-137	1.01E-02	7.41E-03	
Sample #2 (Spent Fuel Pool)			
Analyte	MERL	Holtec	
H3	3.19E-03	3.24E-03	
Mn-54	4.27E-05	3.25E-05	
Co-60	8.53E-04	6.01E-04	
Zn-65	1.69E-04	1.18E-04	
Cs-137	1.01E-02	7.27E-03	
Sample #3 (Torus)			
Analyte	MERL	Holtec	
H3	3.25E-03	3.25E-03	
Mn-54	9.99E-07	9.98E-07	
Co-60	1.32E-05	9.35E-06	
Cs-137	1.85E-04	1.27E-04	

## COMPARISON WITH HOLTEC RESULTS

Both the HOLTEC and MERL sample sets detected four principle gamma emitters (Manganese-54, Cobalt-60, Zinc-65 and Cesium-137) and Tritium (H-3 a beta radiation emitter). There were no unexpected radionuclides identified in either set of samples.

The gamma values in HOLTEC and MERL's samples are in close proximity, within the same order of magnitude. There are small differences in the concentrations of gamma emitters for both sample sets, which is to be expected. Differences in the analysis for the count time as well as in the analytical equipment used at both laboratories including detector type, detection geometry, analyte size may account for the variations.

The analysis of the untreated water samples was for informational purposes and for approximating what radionuclides may be in the various plant locations. Additional detailed analysis including "difficult to detect radionuclides" (e.g., Carbon -14, Strontium-89/90, transuranics) would be required post waste clean-up and treatment.