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**Update of the Tritium in Groundwater Investigation at  
Pilgrim Nuclear Power Station, Plymouth, MA  
July - December 2018**

The purpose of this report is to provide an update on the monitoring of tritium in groundwater and surface water during the last six months of 2018 at the Pilgrim Nuclear Power Station (PNPS) located in Plymouth, MA. The history of the investigation, which began in 2010, and previous update reports are available online<sup>1</sup>.

## **BACKGROUND**

Entergy collects samples at 23 groundwater wells and one surface water location on-site at PNPS. The sampling intervals for the last six months of 2018 ranged from weekly to quarterly, and are based on past monitoring results and analysis of possible tritium pathways in groundwater. Well and surface water samples are sent by Entergy to an independent analytical lab, Teledyne, and duplicate (or "split") samples are provided to the Massachusetts Department of Public Health (DPH) for analysis at the Massachusetts Environmental Radiation Lab (MERL). Entergy regularly reports the Teledyne results to DPH, the Massachusetts Emergency Management Agency (MEMA), and the Nuclear Regulatory Committee (NRC). Summaries of both laboratory results are on the DPH website<sup>2</sup>.

This letter updates results from both Entergy and MERL for sampling performed during the last six months of 2018. Results were compared to a conservative, health-protective screening level of 3,000 picocuries per liter (pCi/L), or 1/10<sup>th</sup> the NRC-approved level of 30,000 pCi/L tritium in non-drinking water sources, and to the US Environmental Protection Agency (EPA) drinking water standard for tritium of 20,000 pCi/L. The closest municipal drinking water wells are 2.5 miles from PNPS and are not expected to be impacted by on-site tritium sources.

## **SUMMARY**

- Sampling results for 8 of 23 routinely sampled groundwater wells indicate no detectable tritium. No detectable tritium was measured in surface water samples. With the exception of

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<sup>1</sup> Previous PNPS Tritium in Groundwater Investigation Updates are available here:

<https://www.mass.gov/lists/environmental-monitoring-data-for-tritium-in-groundwater-at-pilgrim-nuclear-power-station>

MW-211, MW-215, MW-216, and MW-219, tritium levels in the remaining 15 wells were detectable and either stable or tended to decrease over time. Results were less than the EPA drinking water standard for tritium of 20,000 pCi/L in all wells except for MW-219.

- Tritium levels at MW-219 peaked at 40,500 pCi/L in July. Tritium levels steadily decreased starting in mid-September, stabilizing at about 1,000 pCi/L starting in November. Sampling frequency for MW-219 remained at a weekly interval through the end of 2018. Tritium levels in MW-215, which is downgradient from MW-219, reached a peak of 3,394 pCi/L at the end of December.
  - Tritium levels exceeded the screening level of 3,000 pCi/L at MW-211 and MW-216. Tritium levels in MW-211 (which peaked at 4,020 pCi/L) were attributed to a leak that was identified in the early fall. Levels at MW-216 have historically peaked in the fall while, during this monitoring period, they peaked in August at 3,009 pCi/L.
  - Entergy identified potential sources of tritium in MW-211 and MW-219 in early fall, and installed containment systems to capture the tritiated water while they worked on implementing permanent solutions, which have effectively addressed the problems.
  - As stated earlier, the closest municipal drinking water wells are 2.5 miles from PNPS and are not expected to be impacted by on-site tritium sources.
- On-site efforts by Entergy have continued to focus on identifying sources of tritium and monitoring for new sources.
  - Staff from the DPH Bureau of Environmental Health continues to review new information from the monitoring efforts and to maintain regular contact with MEMA, NRC, and Entergy.

## RESULTS

Of the 23 on-site groundwater wells that are routinely monitored<sup>2</sup>, four (MW-211, MW-215, MW-216 & MW-219) had tritium levels greater than the screening level of 3,000 pCi/L during the second half of 2018. With the exception of MW-219, tritium levels were less than the EPA drinking water standard of 20,000 pCi/L.

Tritium levels in MW-219 reached a peak of 40,500 pCi/L at the end of July. Tritium levels in MW-219 steadily decreased between mid-September and the end of October; with the exception of one sample in November and one in December, tritium levels stabilized at approximately 1,000 pCi/L. Tritium levels in MW-215 started increasing in mid-November, reaching a peak of 3,394 pCi/L at the end of December. Given that MW-215 is downgradient from MW-219, elevated tritium levels in MW-215 were not unexpected.

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<sup>2</sup> Summary tables of groundwater and surface water monitoring results are on the DPH website:  
<https://www.mass.gov/lists/environmental-monitoring-data-for-tritium-in-groundwater-at-pilgrim-nuclear-power-station#summaries---results->

Tritium levels in MW-211, which were historically less than 2,000 pCi/L, started to increase at the end of June. Tritium levels in MW-211 reached a peak of 4,020 pCi/L in mid-September, decreasing to less than 2,000 pCi/L by the end of November. The maximum tritium level in MW-216, of 3,009 pCi/L, occurred in August.

The source of the tritium in MW-219, a leak in a hinge pin cover on a feedwater check valve in the steam tunnel, was identified in late summer/early fall. Entergy subsequently installed a containment system to divert tritiated water from entering the groundwater, and the leak was permanently fixed in February 2019. A leaking valve in the closed cooling system in the old executive office building was identified as a potential source of tritium in MW-211. Entergy repaired the valve, installed a containment system, and also re-grouted the expansion joints and sealed the floor in the vicinity of the leaking valve.

Figure 1 shows sampling results in 2018 for the four wells at which tritium levels exceeded the screening level of 3,000 pCi/L (MW-211, MW-215, MW-216 and MW-219), as well as historic wells of interest (MW-216, MW-218 and MW-219). MW-219 was sampled weekly throughout the last 6 months of 2018; sampling frequency at MW-211 was increased from quarterly to weekly in August. MW-215, MW-216 and MW-218 were sampled every third week.

The target sampling frequency for MW-206 is also every third week, due to its location in a preferential pathway of water from seismic gaps (i.e., separation joints between different parts of a building that allow independent movement during an earthquake); tritium levels in this well were low, ranging from non-detectable to 406 pCi/L. Results for the 17 wells sampled quarterly ranged from non-detectable to 1,430 pCi/L at MW-202I. No tritium was detected in surface water samples collected during the second half of 2018.

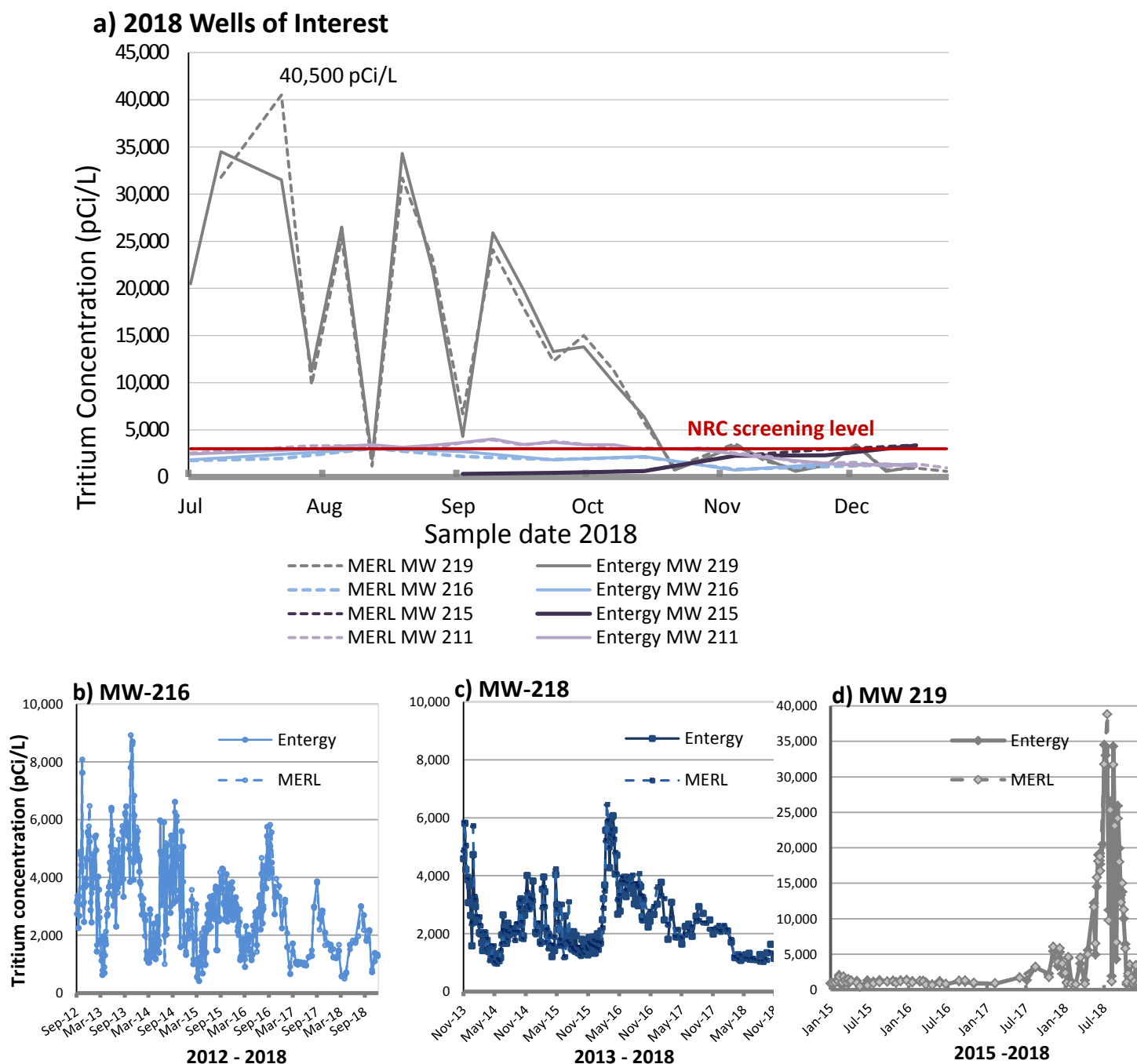
## **DISCUSSION**

Monitoring results for the last six months of 2018 showed stabilization or reduction in groundwater tritium levels at most wells. Tritium levels in MW-216, which historically have been highest in September and November, peaked at 3,009 pCi/L in August, with lower levels throughout the remainder of the year. Tritium levels at MW-218, another historic well of interest, have stabilized at approximately 1,000 pCi/L.

Tritium levels at MW-219 peaked at 40,500 pCi/L on July 30. Starting in mid-September, tritium levels steadily decreased and have now stabilized at approximately 1,000 pCi/L. Entergy identified the source of tritium in MW-219 and subsequently installed a containment system to divert tritiated water from entering the groundwater. Entergy also took steps to address the source of tritium – a valve leak in the steam tunnel, which is now resolved. Tritium levels in MW-211, which increased to 4,020 pCi/L in August, subsequently decreased once the source was identified and the issue remedied. The increase in tritium levels in MW-215 is expected, given its downgradient location from MW-219, although the maximum level in MW-215 should not be as high as the maximum observed in MW-219.

Periodic reduced power events at the plant have continued to allow entry to the high-radiation Condenser Bay area to check and repair any leaks and inspect the seismic gap areas that were previously sealed.

Staff from the DPH Bureau of Environmental Health will continue to review groundwater monitoring results, and maintain contact with MEMA, NRC, and Entergy to discuss on-going tritium in groundwater activities at PNPS.



**Figure 1.** 2018 results for wells with tritium levels greater than 3,000 pCi/L and historical results for three wells of interest (MW-216, MW-218 and MW-219) from tritium in groundwater samples collected from Pilgrim Nuclear Power Station (PNPS). Data are plotted separately based on PNPS operator (solid lines) or DPH (dotted lines) produced results. The solid red line at 3,000 pCi/L represents the screening level, which is  $1/10^{\text{th}}$  of the 30,000 pCi/L NRC level of concern. **a)** Results from samples collected from July through December 2018 for wells with tritium levels greater than 3,000 pCi/L (MW-211, MW-215, MW-216 and MW-219) showing a maximum level of 40,500 on July 30, 2018 at MW-219. **b -d)** Historical monitoring results for MW-216, MW-218 and MW-219.