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MEMORANDUM

TO: Radiation Control Program
FROM: Environmental Toxicology Program
CC: BEH Director; BEH Deputy Director
DATE: April 22, 2016
SUBJECT: PNPS Tritium in Groundwater Investigation Update

PURPOSE

This document describes the results of an on-going investigation of levels of tritium in groundwater and surface water at Pilgrim Nuclear Power Station (PNPS) in Plymouth, MA.

OVERVIEW

- The fourth quarter 2015 results are consistent with previous findings of cyclic fluctuations in the level of tritium in groundwater, as well as the absence of detectable tritium in surface water.
- On-site efforts by the owner and operator of PNPS (Entergy) are focused on identifying the sources of tritium and monitoring for potential new sources.
- Staff from the MDPH Bureau of Environmental Health continue to review new information from the monitoring efforts and maintain regular contact with the Massachusetts Emergency Management Agency (MEMA), the Nuclear Regulatory Committee (NRC), and Entergy officials to discuss on-going investigation activities at PNPS.

INTRODUCTION

This document describes recent results of the ongoing investigation of tritium in groundwater and surface water at the Pilgrim Nuclear Power Station (PNPS) located in Plymouth, MA. The history of the tritium in groundwater investigation and previous investigation updates are available online[1].

Entergy collects samples at 23 groundwater monitoring wells and two surface water locations at weekly, monthly, and quarterly intervals. The sampling frequency is based on recent trends and historical analysis of

[1] Previous PNPS Tritium in Groundwater Investigation Updates are available here: http://www.mass.gov/eohhs/gov/departments/dph/programs/environmental-health/exposure-topics/radiation/environmental-monitoring.html

possible groundwater sources of tritium. Once collected, Entergy sends the samples to an independent analytical lab, Teledyne, and provides a duplicate (or "split") sample to MDPH for analysis at the Massachusetts Environmental Radiation Lab (MERL). Entergy reports the Teledyne results to MDPH, MEMA, and NRC officials.

This letter updates results from both Entergy and MERL for sampling performed during the fourth quarter of 2015. These results were compared to conservative (health protective) screening levels of 3,000 picocuries per liter (pCi/L), or 1/10th the NRC-approved level of tritium in non-drinking water sources; as well as 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.

RESULTS

Of the 23 on-site groundwater monitoring wells that are routinely monitored[2], only MW-216 had levels of tritium detected above 3,000 picocuries per liter (pCi/L) during the fourth quarter. All results were well below the EPA drinking water standard of 20,000 pCi/L. Results for the fourth quarter of 2015 showed continued stabilization and reduction in the tritium levels in *weekly* sampled wells. Results for the three *monthly* sampled wells ranged from levels just over the detection limit (~300 pCi/L), to approximately 1,000 pCi/L; MW-211 showed a late-year increase to 1,990 pCi/L. Results for *quarterly* monitored wells ranged from levels that are not detectable to 635 pCi/L. No tritium was detected in surface water samples collected during the fourth quarter of 2015.

Entergy reported results of gamma analysis of hard-to detect radionuclides for samples collected from all 23 groundwater wells and 2 surface water monitoring locations in August 2015. No hard-to-detect radionuclides were detected in these samples with the exception of two naturally-occurring radionuclides: Ac-228 and Th-228, in MW-204 and MW-217, respectively. These were both measured at low levels just above the detection limit.

DISCUSSION

Fourth quarter 2015 monitoring results show cyclic fluctuations in the tritium levels in groundwater at PNPS and an overall decrease in tritium since the investigation began in 2010. The investigation continues to focus on tritium detected in wells MW-216 and MW-218.

MDPH monitors weekly results for MW-216. This well has historically shown cyclical fluctuations in tritium levels with higher results detected during October and early November of each year (Figure 1(c)). The 4th quarter 2015 results showed the same cyclic trend at a lower magnitude (from 2,480 to 4,110 pCi/L). Entergy reports that residual water in the engineered "seismic gap" that bisects the Reactor Bay and Turbine building is believed to be the primary source of tritium detected in MW-216. Following the resealing of the "seismic gap" in spring 2015, Entergy personnel have regularly conducted physical inspections of the Condenser Bay during routine down-power events to confirm the area is dry and that no standing water is present to contribute to this pathway.

[2] Groundwater and surface water monitoring locations and summary tables by quarter are available on the MDPH website: http://www.mass.gov/eohhs/gov/departments/dph/programs/environmental-health/exposure-topics/radiation/environmental-monitoring.html

MDPH monitors weekly results for MW-218, located on the west side of the Power Block. Tritium levels in MW-218 have fluctuated (between 962 and 5,831 pCi/L) since this well was installed in September 2013, and stabilized during the fourth quarter (from 1,280 to 1,880 pCi/L). This fall, Entergy worked with ERM to conduct pump tests of MW-218 with the stated goal of characterizing the groundwater flow at this well. Reported results indicated the flow gradient in this well remained unchanged from previous findings. Entergy continues to attribute tritium detected in MW-218 to residual tritium present in up-gradient subsurface soil associated with a break in the neutralization sump discharge line identified in 2013.

Staff from the MDPH Bureau of Environmental Health will continue to review information obtained from the latest groundwater monitoring, and will maintain regular contact with MEMA, NRC, and Entergy to discuss on-going investigation activities at PNPS.

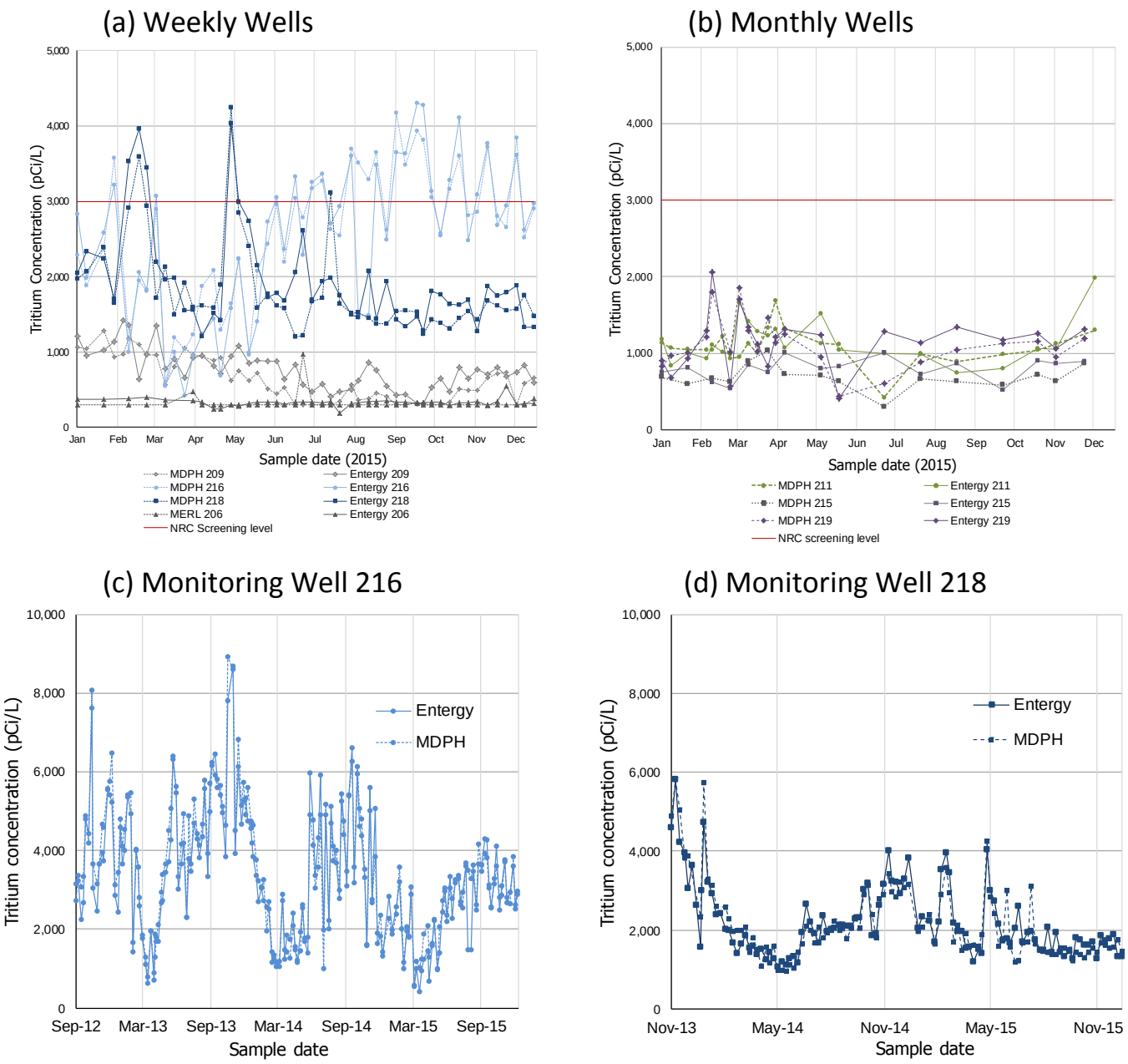

Figure 1. Current and historic analytical testing results from tritium in groundwater samples collected from 4 weekly and 3 monthly monitoring wells (MW) at Pilgrim Nuclear Power Station (PNPS). Results for the 16 quarterly groundwater wells and 2 surface wells are not shown. Data are plotted separately based on PNPS operator (solid lines) or MDPH (dotted lines) produced results. The solid red line at 3,000 pCi/L represents the screening level which is 1/10th of the 30,000 pCi/L NRC determined level of concern. (a) Results from weekly samples collected during 2015 showing a maximum level of 4,247 on May 12, 2015 at MW-218; (b) Monthly well results for 2015 shows recent uptick for MW-211 to 1,990 pCi/L; (c) Historic monitoring results for MW-216; (d) Historic monitoring results for MW-218.