Issue/Title: Pilgrim Nuclear Power Station (PNPS): Tritium in Groundwater Monitoring Wells

Topic: PNPS Updates as of May 9, 2014

Previous Plans: Routine testing results from groundwater monitoring well samples collected during the weeks of February 10, February 24, March 10, 2014, and March 24, 2014 were reported by Entergy. Split sample results for the weeks of February 10, February 24, and March 10, 2014 were also reported by MERL, and split sample results for the week of March 24, 2014 are currently being analyzed by MERL.

Table 1[1]: Week of February 10th

Location	Date	MERL pCi/L	GEL pCi/L
MW 201	2/10/2014	NDA(300)*	NDA(368)*
MW 202	2/10/2014	NDA(300)*	NDA(363)*
MW 202 I	2/10/2014	1,688	1,740
MW 203	2/10/2014	-	-
MW 204	2/10/2014	320	NDA(366)*
MW 205	2/10/2014	903	607
MW 206	2/10/2014	340	NDA(366)*
MW 207	2/10/2014	398	MDA(366)*
MW 208-S	2/10/2014	NDA(300)*	NDA(366)*
MW 208-I	2/10/2014	NDA(300)*	NDA(365)*
MW 209	2/10/2014	884	769
MW 210	2/10/2014	NDA(300)*	NDA(375)*
MW 211	2/10/2014	1,221	1,010
MW 212	2/10/2014	NDA(300)*	NDA(368)*
MW 213	2/10/2014	NDA(300)*	NDA(366)*
MW 214	2/17/2014	NDA(300)*	NDA(366)*
MW 215	2/10/2014	896	819
MW 216	2/10/2014	3,721	2,720
MW 217	2/10/2014	343	NDA(365)*
MW 218	2/10/2014	2,898	2,410
MW 219	2/10/2014	3,868	3,100
MW 3	2/10/2014	NDA(300)*	NDA(367)*
MW 4R	2/10/2014	317	NDA(363)*
SW-boat ramp	2/10/2014	NDA(300)*	**
SW-intake	2/10/2014	NDA(300)*	NDA(361)*

Table 2: Week of February 24th

Location	Date	MERL pCi/L	GEL pCi/L
MW 201	2/24/2014	NDA(300)*	NDA(366)*
MW 202	2/24/2014	-	-
MW 202 I	2/24/2014	-	-
MW 203	2/24/2014	-	-
MW 204	2/24/2014	-	-
MW 205	2/24/2014	617	466
MW 206	2/24/2014	390	662
MW 207	2/24/2014	-	-
MW 208-S	2/24/2014	-	-
MW 208-I	2/24/2014	-	-
MW 209	2/24/2014	997	698
MW 210	2/24/2014		-
MW 211	2/24/2014	1,303	1,010
MW 212	2/24/2014	-	-
MW 213	2/24/2014	-	-
MW 214	2/24/2014	-	-
MW 215	2/24/2014	970	819
MW 216	2/24/2014	2,713	2,510
MW 217	2/24/2014	-	-
MW 218	2/24/2014	2,280	2,000
MW 219	2/24/2014	721	854
MW 3	2/24/2014	-	-
MW 4R	2/24/2014	637	NDA(350)*
SW-boat ramp	2/24/2014	-	-
SW-intake	2/24/2014	NDA(300)*	NDA(337)*

*** NDA = not detected at less than activity value listed**
**** Analysis pending**
- not analyzed this week

[1] PNPS screening level for tritium in groundwater monitoring wells is 3,000 pCi/L, which is 1/10th of the NRC-approved Pilgrim Offsite Dose Calculation Manual standard for tritium in non-drinking water sources. The EPA drinking water standard is 20,000 pCi/L. The nearest municipal drinking water wells are approximately 2.5 miles from the plant.

Table 3. Week of March 10th

Location	Date	MERL pCi/L	GEL pCi/L
MW 201	3/10/2014	NDA(300)*	NDA(311)*
MW 202	3/10/2014	-	-
MW 202 I	3/10/2014	-	-
MW 203	3/10/2014	-	-
MW 204	3/10/2014	-	-
MW 205	3/10/2014	818	718
MW 206	3/10/2014	585	430
MW 207	3/10/2014	-	-
MW 208-S	3/10/2014	-	-
MW 208-I	3/10/2014	-	-
MW 209	3/10/2014	846	713
MW 210	3/10/2014		-
MW 211	3/10/2014	1,275	1,030
MW 212	3/10/2014	-	-
MW 213	3/10/2014	-	-
MW 214	3/10/2014	-	-
MW 215	3/10/2014	939	713
MW 216	3/10/2014	1,348	1,250
MW 217	3/10/2014	-	-
MW 218	3/10/2014	2,008	1,420
MW 219	3/10/2014	9,621	8,790
MW 3	3/10/2014	-	-
MW 4R	3/10/2014	NDA(300)*	346
SW-boat ramp	3/10/2014	-	-
SW-intake	3/10/2014	NDA(300)*	NDA(351)*

Table 4. Week of March 24th

Location	Date	MERL pCi/L	GEL pCi/L
MW 201	3/24/2014	**	ND(394)*
MW 202	3/24/2014	-	-
MW 202 I	3/24/2014	-	-
MW 203	3/24/2014	-	-
MW 204	3/24/2014	-	-
MW 205	3/24/2014	**	750
MW 206	3/24/2014	**	ND(400)*
MW 207	3/24/2014	-	-
MW 208-S	3/24/2014	-	-
MW 208-I	3/24/2014	-	-
MW 209	3/24/2014	**	816
MW 210	3/24/2014	-	-
MW 211	3/24/2014	**	935
MW 212	3/24/2014	-	-
MW 213	3/24/2014	-	-
MW 214	3/24/2014	-	-
MW 215	3/24/2014	**	734
MW 216	3/24/2014	**	1,050
MW 217	3/24/2014	-	-
MW 218	3/24/2014	**	1,860
MW 219	3/24/2014	**	5,390
MW 3	3/24/2014	-	-
MW 4R	3/24/2014	**	**
SW-boat ramp	3/24/2014	-	-
SW-intake	3/24/2014	**	NDA(311)

*** NDA = not detected at less than activity value listed**
**** Analysis pending**
- not analyzed this week

MW205 and MW206 Trends:

MW205 and MW206 have continued to indicate historically low tritium in groundwater results for the past six months. However, at the request of MDPH, weekly sampling of MW205 was initiated the week of January 27, 2014 in order to better monitor potential down-gradient migration of tritium in groundwater originating from the area of MW219 and catch basin 10 (CB-10) where higher tritium levels were detected in groundwater in December 2013.

MW205 Weekly results to date:

Date	Entergy Result (pCi/L)	MERL Result (pCi/L)
1/27/2014	544	677
2/3/2014	430	582
2/10/2014	607	903
2/17/2014	452	598
2/24/2014	466	617
3/3/2014	418	514
3/10/2014	718	818
3/17/2014	429	Pending
3/24/2014	750	Pending
3/31/2014	502	Pending

Entergy groundwater monitoring results for MW206 (sampled on a bi-weekly basis) showed no detectable tritium for the week of February 10th, 662 pCi/L of tritium detected the week of February 24th, 430 pCi/L of tritium detected for the week of March 10th, and no detectable tritium for the week of March 24th. MERL split sample results for MW206 for the weeks of February 10th, February 24th, and March 10th were generally consistent with Entergy results and MERL split sample results for MW206 are pending for the week of March 24th.

New Wells Installed in Response to the Neutralization Sump Discharge Line Investigation (MW218 and MW219):

MW218 Results:

MW218 is being sampled weekly, like all new wells, and results to date are as follows:

MW218 Results to Date

Date	Entergy Result (pCi/L)	MERL Result (pCi/L)
11/18/2013	4,590	4,887
11/25/2013	5,810	5,831
12/2/2103	4,220	5,045
12/9/2013	3,950	3,823
12/16/2013	3,070	3,879
12/23/2013	3,650	3,545
12/30/2013	2,630	3,292
1/6/2014	1,580	2,346
1/13/2014	4,730	5,733
1/20/2014	3,220	3,293
1/27/2014	2,930	3,147
2/3/2014	2,400	2,607
2/10/2014	2,410	2,898
2/17/2014	2,030	2,582
2/24/2014	2,000	2,280
3/3/2014	1,680	1,973
3/10/2014	1,420	2,008
3/17/2014	1,640	Pending
3/24/2014	1,860	Pending
3/31/2014	1,550	Pending

As previously reported, the elevated tritium levels detected in MW218 are believed to be attributed to the separation in the neutralization sump discharge line discovered in April 2013, which is located up-gradient from this well.

MW219 Results:

MW219 is being sampled weekly and results to date are as follows:

MW219 Results

Date	Entergy Result (pCi/L)	MERL Result (pCi/L)
12/9/2013	2,120	NA*
12/16/2013	8,480	10,499
12/23/2013	7,600	6,484
12/30/2013	69,000	70,599
1/6/2014	20,000	21,012
1/9/2014	12,200	13,764
1/13/2014	2,470	2,736
1/20/2014	1,900	2,191
1/27/2014	3,010	3,450
2/3/2014	5,210	5,516
2/10/2014	3,100	3,868
2/17/2014	972	1,068
2/24/2014	854	721
3/3/2014	5,550	5,962
3/10/2014	8,790	9,621
3/17/2014	8,190	Pending
3/24/2014	5,390	Pending
3/31/2014	1,720	Pending

*Sample collected as part of well installation procedures; not routine sampling.

As previously reported, MW219 is located directly down-gradient from CB-10 and thus, tritium detected in MW219 may be attributed to permitted neutralization sump discharges that occurred through a temporary above ground line in December 2013. CB-10 is being further investigated and is the likely cause of the elevated tritium in this well. Tritium results for samples collected from MW219 during the weeks of March 3rd and 10th show an upward trend. Entergy reports that this could be attributed to snow

and rain runoff that is flushing tritium from soil around CB-10. MDPH will continue to monitor results for MW219 and other down-gradient wells closely.

MW4R Results:

MW4R is located near the southeast corner of the deep foundation of the reactor and turbine buildings. MR4R is up-gradient of MW216 and MW206. MW4R was installed the week of November 4, 2013 to replace the previous MW4 well and tritium results from this new well continue to be similar to historical results for MW4 (i.e., not detected to slightly above detection limits (~350 pCi/L for Entergy and 300 pCi/L for MERL)). The most recently available Entergy results indicate no detectable tritium for the weeks of February 10th, February 17th, and February 24th, 430 pCi/L of tritium detected the week of March 3rd, 346 pCi/L of tritium detected the week of March 10th, and 555 pCi/L of tritium detected the week of March 17th. Entergy results for the week of March 24th and March 31st are currently being analyzed by their contract lab. MERL split sample results for MW4R for the weeks of February 10th, February 17th, February 24th, March 3rd, and March 10th were generally consistent with Entergy results, and MERL split sample results for the weeks of March 24th and March 31st are currently being analyzed by MERL.

Other Wells Sampled on a Weekly Basis:

MW209 and MW211 are down-gradient of the area of the neutralization sump discharge line separation and are also currently being sampled weekly. Weekly sampling results from Entergy for MW209 for the weeks of February 10th through March 31st ranged from 669 pCi/L to 978 pCi/L. MERL split sample results for MW209 for the weeks of February 10th, February 17th, February 24th, March 3rd, and March 10th were generally consistent with Entergy results, and MERL split sample results for MW209 for the weeks of March 17th, March 24th, and March 31st are currently being analyzed by MERL. Weekly sampling results from Entergy for MW211 for the weeks of February 10th through March 31st ranged from 932 pCi/L to 1,210 pCi/L. MERL split sample results for MW211 were generally consistent with Entergy results for the weeks of February 10th, February 17th, February 24th, March 3rd, and March 10th, 2014, and MERL split sample

results for MW211 for the weeks of March 17th, March 24th, and March 31st are currently being analyzed by MERL.

MW216 is located just down-gradient from the end of the deep foundation on the northeast corner of the turbine and reactor buildings. Weekly sampling results from Entergy for MW216 for the weeks of February 10th through March 31st ranged from 1,050 pCi/L to 2,890 pCi/L. MERL split sample results for MW216 for the weeks of February 10th, February 17th, February 24th, March 3rd, and March 10th were generally consistent with Entergy results. MERL split sample results for the week of March 17th, March 24th, and March 31st are currently being analyzed by MERL. As noted in previous updates, Entergy has reported that dissolved oxygen and conductivity levels routinely measured in all groundwater monitoring wells are lower for MW216 than in other wells, and they continue to work with their contractor to better understand what this may mean in terms of identifying a potential tritium source contributing to this well. Other plans being considered to investigate potential sources of tritium in MW216 include: an investigation of the catch basins in the area of MW216 and MW206 that accept roof drain runoff; a precipitation study to determine the role of tritium washout; an evaluation of the conductivity and dissolved oxygen in MW216; an evaluation of water migration from inside the plant to groundwater via seismic gaps[2] between the reactor and turbine buildings; and an evaluation of the contribution of historic spills to the current level of tritium in groundwater.

Other Wells Sampled on a Bi-Weekly Basis:

Entergy results for other wells (MW201 and MW215) sampled during the weeks of February 10th, February 24th, March 10th, March 17th, March 24th, and March 31st were within their typical ranges detected since the groundwater monitoring for tritium began. MERL split sample results for MW201 and MW215 for the weeks of February 10th, February 24th, and March 10th were generally consistent with Entergy results. MERL

[2] "Seismic gaps" are engineered spaces between two foundations that allow them to move independently in a seismic event.

split sample results for MW201 and MW215 for the weeks of March 17th, March 24th, and March 31st are currently being analyzed by MERL.

Wells Sampled on a Quarterly Basis:

The week of February 10th was also a comprehensive sampling round, which included monitoring wells MW202, MW202I, MW204, MW207, MW208, MW208I, MW210, MW212, MW213, MW214, MW217, and MW3. Entergy results for these wells showed no-detectable tritium, with the exception of MW202I, which indicated 1,740 pCi/L. MERL results for all the wells sampled on a quarterly basis showed no detectable tritium or tritium just above the limit of detection (300 pCi//L) with the exception of MW202I, which indicated 1,688 pCi/L of tritium detected. Entergy reported that the detection in MW202I could be due to surface infiltration from melting snow piles nearby or could be the leading edge of a plume of tritium from areas up-gradient (i.e. the neutralization sump discharge line separation and CB-10). Entergy took additional samples from MW202 and MW202I the week of March 3, 2014, showing no detectable tritium for MW202, and 956 pCi/L for MW202I. MERL split sample results for MW202 and MW202I from the week of March 3, 2014 indicated 353 pCi/L of tritium detected for MW202, and 1,189 pCi/L of tritium detected for MW202I. MDPH has requested that Entergy collect additional samples from MW202 and MW202I to further evaluate the detections in MW202I.

Surface Water Results:

As previously noted, no tritium has been detected in any surface water sample taken as part of the tritium in groundwater investigation since sampling began in 2010. Since the discovery of elevated tritium in MW219, both Entergy and MERL have expedited collection of surface water samples at the location downstream of MW205. Results to date are shown below:

Surface water downstream of MW205 Results

Date	Entergy Result (pCi/L)	MERL Result (pCi/L)
11/25/2013	NDA < 308	NDA < 300
12/9/2013	NDA < 366	NDA < 300
12/23/2013	NDA < 331	NDA < 300
1/6/2014	NDA < 379	NDA < 300
1/13/2014	NDA < 347	NDA < 300
1/20/2014	NDA < 348	NDA < 300
2/3/2014	NDA < 404	NDA < 300
2/10/2014	NDA < 361	NDA < 300
2/17/2014	NDA < 376	NDA < 300
2/24/2014	NDA < 337	NDA < 300
3/3/2014	NDA < 355	NDA < 300
3/10/2014	NDA < 351	NDA < 300
3/17/2014	NDA < 329	Pending
3/24/2014	NDA < 311	Pending
3/31/2014	NDA < 367	Pending

In addition, the week of February 10th was a comprehensive round, and a surface water sample was also taken from the boat ramp area. Entergy results for the boat ramp area are still pending and MERL results indicate no detectable tritium.

Soil Results:

Complete data for Entergy and MERL soil samples collected last year have been received. Soil samples were collected in July 2013 from excavations down to the neutralization sump discharge line in three locations (i.e. at the separation, approximately 10 feet from catch basin 10 [CB10], and at CB10). Results are shown in the table below.

July 2013 Soil Sample Results

Location	Depth	Entergy Tritium (pCi/kg)	Entergy Mn-54 (pCi/kg)	MERL Mn-54 (pCi/kg)	Entergy Cs-137 (pCi/kg)	MERL Cs-137 (pCi/kg)	Entergy Co-60 (pCi/kg)	MERL Co-60 (pCi/kg)
Separation	3 feet	1,300	138	139	604	889	304	328
Separation	5 feet	5,760	146	153	997	1,460	350	463
Separation	5.5 – 6 feet	26,100	148	-	1,600	-	2,530	-
Separation	6 – 7 feet	34,300	295	424	1,910	2.490	832	1,150
10 feet from CB-10	3 feet	ND(648)	ND(42.3)	ND(10.4)	ND(37.5)	39.5	ND(28.6)	ND(15.6)
10 feet from CB-10	5 feet	ND(615)	ND(49.5)	ND(17.0)	72.5	82.7	ND(38.0)	ND(17.9)
10 feet from CB-10	5.5 – 6 feet	ND(608)	ND(3.02)	-	ND(55.5)	-	ND(40.8)	-
10 feet from CB-10	6 – 7 feet	ND(580)	ND(4.03)	ND(10.9)	ND(40.4)	29.9	ND(32.5)	ND(15.9)
CB-10	3 feet	ND(611)	ND(35.3)	ND(27.2)	ND(51.5)	46.7	ND(40.2)	ND(27.0)
CB-10	5 feet	ND(989)	ND(39.3)	ND(15.3)	ND(37.2)	NDA(14.1)	ND(30.6)	ND(14.5)
CB-10	5.5 – 6 feet	ND(613)	ND(45.8)	-	ND(50.2)	-	ND(41.2)	-
CB-10	6 – 7 feet	ND(605)	ND(45.1)	ND(11.3)	ND(54.2)	16.4	ND(46.7)	ND(17.6)

For two locations (i.e. 10 feet from CB-10, and CB-10), soil sample results at all depths indicated that tritium, manganese-54, cesium-137, and cobalt-60 were non-detect or at levels considered background (i.e. cesium-37 can be 10 to 1000 pCi/kg in soils nationwide due to historical fallout from atomic bomb testing). However, at the separation excavation location soil sample results indicated the presence tritium, manganese-54, cesium-137, and cobalt-60 above typical background levels in soil, particularly at the depths closest to the separation (e.g. 6 to 7 feet below ground surface). Also, hard-to-detect analyses of soil samples reported by Entergy indicated no detectable radionuclides (e.g. strontium-90) from any of the locations or depths. The presence of cobalt-60, managanese-54, and cesium-137 in soil at the neutralization sump discharge line separation excavation location indicates the need for further

investigation (additional soil sampling), characterization and/or remediation of the potential source(s).

Investigation Plans:

Entergy has reported that they are working with their consultant and on-site resources to finalize investigation plans to focus on potential sources of tritium in groundwater and to potentially remediate soil contamination. These include: further characterization of soil contamination in the area of the separation, a plan to address the results of the characterization and deciding on plans for permanent replacement of the neutralization sump discharge line; investigating and cleaning CB-10; confirming the neutralization sump discharge line break and CB- 10 as sources of tritium in groundwater on the west side of the reactor; determining and confirming potential source(s) of tritium in MW216 (e.g., seismic gaps) on the east side of the reactor; and determining the frequency of groundwater monitoring well sampling going forward. Entergy will share these plans in greater detail at an upcoming meeting between Entergy, Commonwealth Agency staff, and the NRC.

Looking Forward:

MDPH will continue to closely follow all investigational activities that are currently underway at PNPS, notably MW219 and MW216 results, and detailed investigation plans.