Massachusetts Department of Public Health
Bureau of Environmental Health

Updates on Environmental Radiation Monitoring Activities at Pilgrim Nuclear Power Station (PNPS)

November 2015

Outline

I. MDPH and Nuclear Power Facilities

II. PNPS Real-Time Monitoring System

III. Routine Environmental Monitoring in Emergency Planning Zones

IV. Tritium in Groundwater Investigation Update

V. Summary

I. MDPH and Nuclear Power Facilities

- Conduct environmental radiation monitoring outside the fence line (MGL 111, section 5k)
  - NRC maintains jurisdiction inside fence line
- Collect fees from facilities that generate LLRW (345 CMR 3.03(2)
  - NRC maintains oversight of storage and disposal
- Provide technical support on ongoing tritium in groundwater investigation (non-regulatory role)

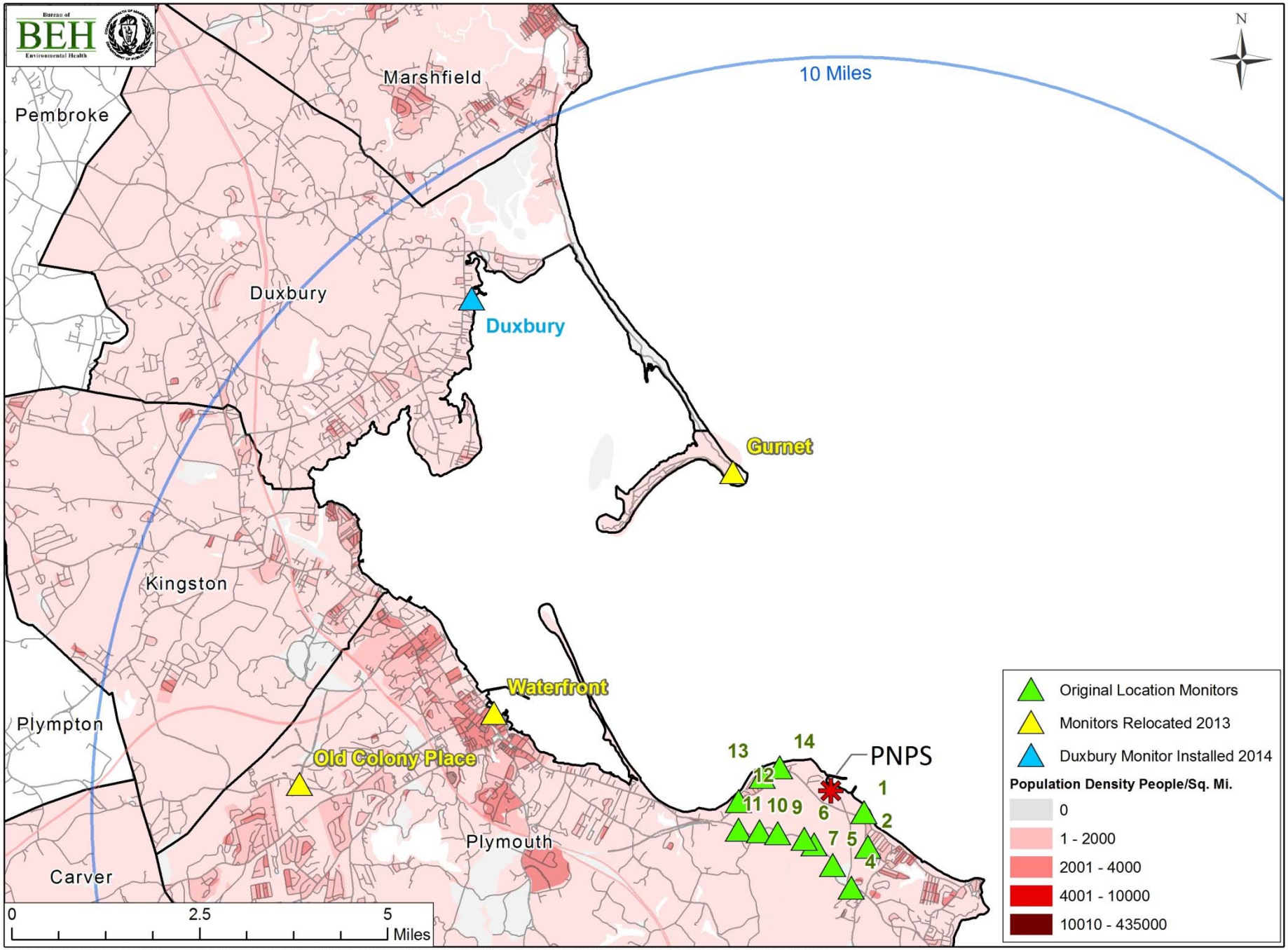
II. PNPS Real-Time Monitoring System

- MDPH-owned network of 15 radiation monitors
  - 14 located in Plymouth
  - 1 in Duxbury (purchased with town funds)
- Measure gamma radiation in real time
- Data are reported to a central computer remotely accessible and routinely checked by MDPH staff
- Emergency alerts sent to senior MDPH officials and MEMA staff when radiation detected above three times typical background readings

PNPS Real-Time Monitoring System

- Three existing monitors were relocated in 2013
  - Gurnet Point
  - Plymouth Waterfront
  - Old Colony Place
- Duxbury monitor integrated in 2014
  - Funding provided by Town of Duxbury
  - Memorandum of Agreement signed November 22, 2013 (MDPH maintains ownership)

PNPS - Real-Time Monitors



Map created by BEH-GIS, MDPH. Geographic data courtesy of the Office of Geographic Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs.

PNPS Real-Time Monitoring System

- Real-time radiation monitor system has been enhanced with state-of-the-art anemometers (wind speed and direction sensors) that are solar powered and transmit data wirelessly to a central computer
- MDPH consulted with experts to ensure anemometers were placed at optimal locations designed to take the sea breeze effects into account:
  - Plymouth Waterfront
  - Gurnet Point
  - Old Colony Place
  - Duxbury
- Continuous wind speed and direction data are being logged at 1 minute, 10 minute, and hourly intervals and transmitted to a central location remotely accessible by MDPH staff like the radiation data

PNPS Real-Time Monitoring System

- Real-Time radiation monitor and anemometer at Gurnet Point:

PNPS Real-Time Monitoring System

Completed Activities

- Anemometers (wind speed and direction sensors) are calibrated by MDPH contractor according to industry standards
- Data are visually verified by MDPH staff from a desktop computer on a regular basis to ensure data are being reported to the central computer

Next Steps

- Meteorological data would need to be validated and verified according to EPA's Quality Assurance standards for summaries of wind speed and direction data (e.g., wind roses) to be produced

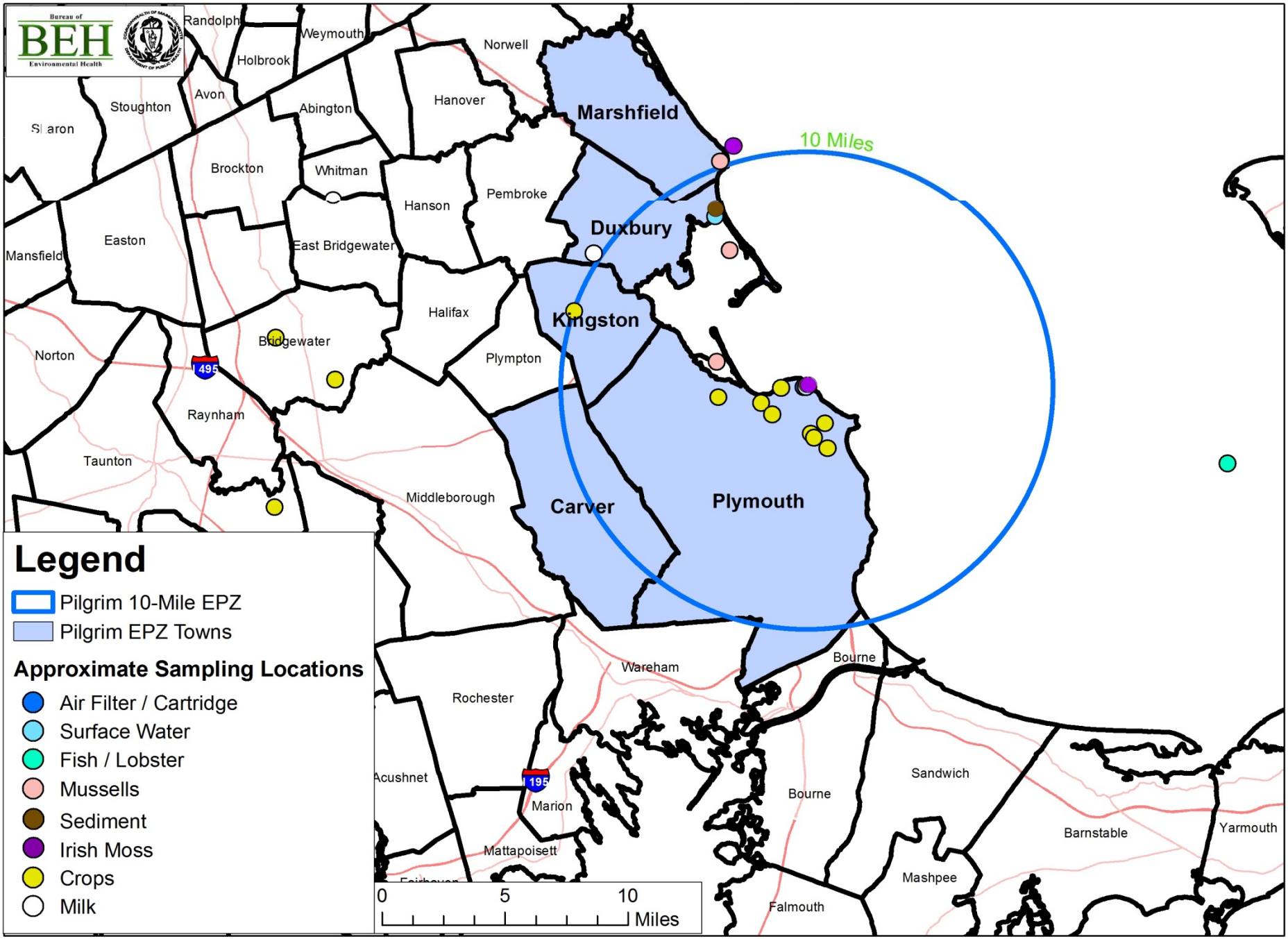
III. Routine Environmental Monitoring in Emergency Planning Zones

- Routine Monitoring - PNPS
  - Conducted as part of MDPH regulatory requirements
  - Samples collected both within and outside 10-mile Emergency Planning Zone (EPZ)
  - Analysis by Massachusetts Environmental Radiation Laboratory (MERL)
  - Sampling includes air, surface water, sediment, milk, shellfish, lobster, fish, Irish moss, crops (e.g. cranberries)

Routine Environmental Monitoring in Emergency Planning Zones

Media	Frequency	Location in EPZ	Location Outside EPZ	Collected By	Analyzed By
Air Filter / Cartridge	Weekly	PNPS	Boston	MDPH	MDPH/MERL
TLDs	Quarterly	EPZ Communities	Boston	MDPH	MDPH/MERL
Real-time Air	Real-time	Plymouth, Duxbury	None	MDPH	MDPH/MERL
Surface Water	Monthly Composite	Discharge Canal, Powder Point Bridge, Duxbury (as background)	None	Entergy	MDPH/MERL
Fish	Twice per Year	Discharge Canal	Cape Cod Bay	Entergy	MDPH/MERL
Lobster	Once per Year	Discharge Canal	Cape Cod Bay	Entergy	MDPH/MERL
Mussels	Twice per Year	Discharge Canal, Plymouth Harbor, Duxbury Bay (as background)	Green Harbor, Marshfield	Entergy	MDPH/MERL
Sediment	Twice per Year	Discharge Canal	Green Harbor. Marshfield	Entergy	MDPH/MERL
Irish Moss	Twice per Year	Discharge Canal	Brant Rock, Marshfield	Entergy	MDPH/MERL
Crops	Once per Year	Plymouth	Bridgewater, Kingston, East Taunton	Entergy, MDPH	MDPH/MERL
Milk	Monthly	None	O'Neil Farm (as indicator)	MDPH	MDPH/MERL

Pilgrim Nulcear Power Station Approximate MDPH Sampling Locations



Routine Environmental Monitoring in Emergency Planning Zones

- 2011-2013 routine monitoring results

(**NORM** - Naturally Occurring Radioactive Material, including potassium-40, berylllium-7, and lead-214)

Media	Detected	Comment
Air	NORM	at background
Surface Water	NORM	at background
Fish	NORM Cs-137 (6.9 -10.1 pCi/L) ***all 3 years***	Cs-137 based on one bluefish sample each year (of 4-5 fish samples) from PNPS. Level is just above MERL detection limit and below literature-based description of atomic fallout
Lobster	NORM	at background
Mussels	NORM	at background
Sediment	NORM	at background
Irish Moss	Zinc-65 (43.8 pCi/kg) ***2013 only***	Zinc-65 detected slightly above MERL detection limit in 1 Irish moss samples in 2013. Amount is below level of health concern
Crops	NORM	at background
Milk	NORM	at background

Routine Environmental Monitoring in Emergency Planning Zones

- More splits were accepted by MERL (e.g., more crops, lobster, and sediment samples) in 2012 than in 2011 due to increased capacity as the lab ramped up operation after reopening in late 2010
- In 2013, a second background cranberry sampling location in East Bridgewater was added in response to community input
- The feasibility of using milk from Plimoth Plantation was explored but cows are not producing milk nor are there plans for future milk production, MDPH also explored the possibility of goat's milk, but similar barriers exist
  - Monthly milk samples have been collected at O'Neil Farm in Duxbury since 2011

IV. Tritium in Groundwater Investigation

- Entergy began monitoring for tritium in groundwater in 6 monitoring wells at PNPS in 2007 in response to a Nuclear Energy Institute (NEI) Initiative
- Following 2010 tritium release to groundwater discovered at Vermont Yankee Power Plant in VT, MDPH officials met with Entergy to discuss on-going MDPH assessment of Entergy's implementation of the NEI initiative and installation of additional groundwater monitoring wells at PNPS
- 6 new groundwater monitoring wells installed in spring 2010

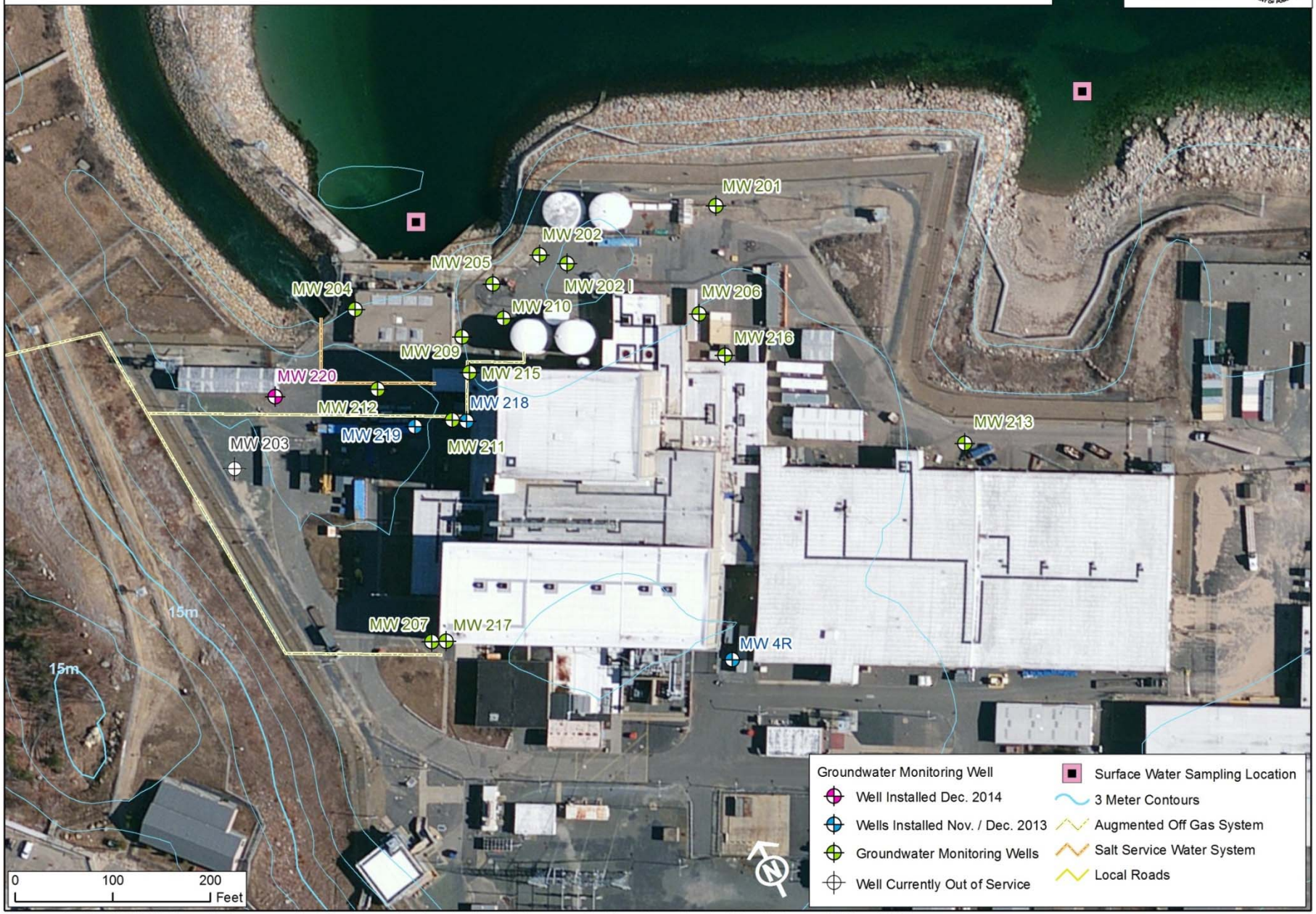
Tritium in Groundwater Investigation

- Based on tritium levels measured in a new well (MW-205), and a review of available site specific groundwater information, MDPH recommended that Entergy install additional monitoring wells and begin collecting surface water samples immediately off-shore from PNPS
- MDPH and MEMA representatives also requested increased communications, more frequent monitoring, regular review and discussion of groundwater and surface water data collected, and a comprehensive investigation to determine the source(s) of tritium in groundwater

Tritium in Groundwater Investigation

- Since September 2010, MDPH has provided regular updates on the on-going tritium investigation, which has resulted in the installation of additional groundwater monitoring wells to evaluate specific sources of interest, bringing the current total to 23
- Regular updates and data collected to date can be found on MDPH's website: http://www.mass.gov/dph/environmental_health
- No offsite impacts from tritium in the groundwater have been detected offsite from PNPS

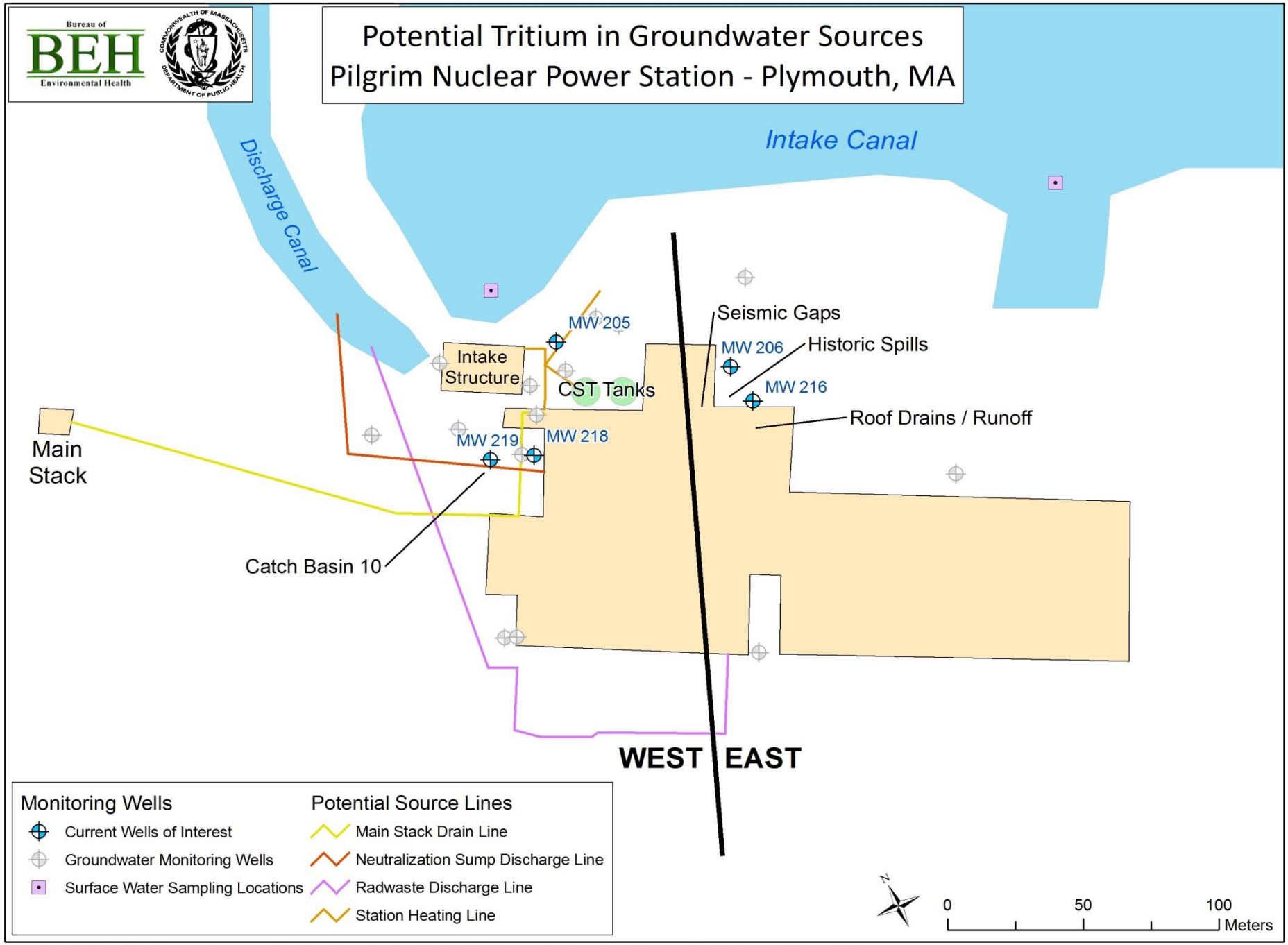
Approximate Locations of Groundwater Monitoring Wells & Surface Water Samples - Focused Area
Pilgrim Nuclear Power Station - Plymouth, MA



Map created by BEH-GIS, MDPH. Geographic data courtesy of the Office of Geographic Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs and ESRI.

Tritium in Groundwater Investigation

- Potential sources evaluated to date include:
  - The radwaste discharge line
  - The main stack drain line
  - The station heating line
  - The condensate storage tanks
  - Historic spills
  - The neutralization sump discharge line and catch basin 10
  - Seismic gaps
  - Precipitation deposition via roof drains and runoff
  - Air conditioning condensate drainage
- The investigation currently has two focus areas – the east and west side of the reactor building



Map created by BEH-GIS, MDPH. Geographic data courtesy of the Office of Geographic Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs and ESRI.

Tritium in Groundwater Investigation

- MW-219 (west side) installed December 2013
  - Elevated tritium detected following discharges to catch basin (CB) 10 in December 2013
  - The suspected tritium source for MW-219 is CB 10, located along the permitted neutralization sump discharge pathway
  - This is consistent with tritium detections downgradient, on the west side of the reactor building (MW-205, MW209, MW211, MW-215)
- Inspection, investigation and cleaning of CB10 completed in Fall 2014
- To date, tritium detections have followed a decreasing trend
  - 2015 results are all below NRC reporting level of 3,000 pCi/L

Tritium in Groundwater Investigation

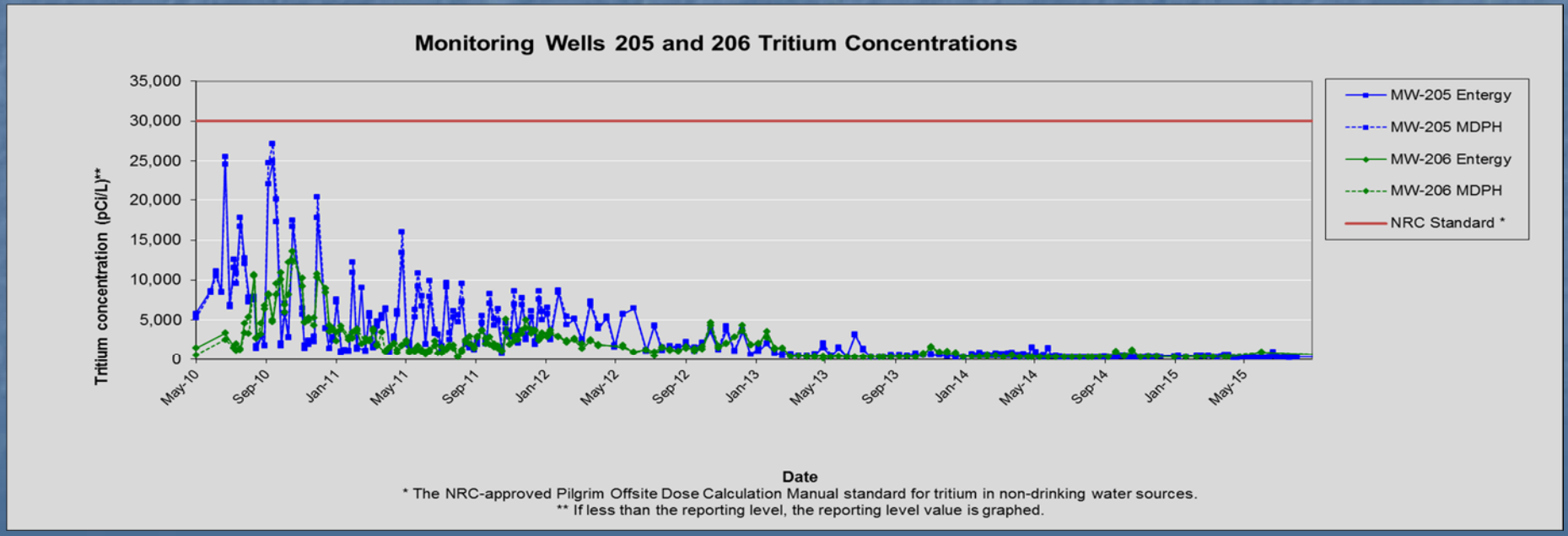
- MW-218 (west side) installed November 2013
- The suspected source for MW-218 is residual tritium contamination from the break in the neutralization sump discharge line identified in 2013
  - Pipeline extended from the reactor building to CB 10 and taken out of service in Spring 2013
  - Consistent with tritium levels in downgradient wells on the west side of the reactor building (MW-205, MW-209, MW-211, MW-215)
- 2015 weekly results range from 1,210 pCi/L to 4,247 pCi/L

Tritium in Groundwater Investigation

- MW-216 (east side) installed September 2012: Well is up gradient of MW-206 and MW-201
- 2015 weekly results range from 472 pCi/L to 3,572 pCi/L
- Theories under investigation:
  - Catch Basins / Roof Drains
  - Historic Spills
  - Seismic Gaps
- Cyclical fluctuations of tritium observed with higher levels detected during October and early November

Tritium in Groundwater Investigation

- Data for MW-205 and MW-206, the initial wells with elevated tritium levels, have been trending downward
- Wells will continue to be closely monitored to determine whether any patterns emerge



V. Summary

- MDPH will continue to conduct environmental monitoring consistent with statutory roles
- Enhanced monitoring capacity associated with relocated/new monitors, wind speed and direction sensors; enhancements allow for exploring future data uses
- Routine sampling results will be available on an annual basis
- Tritium in Groundwater Investigation Updates will continue to focus on monitoring result trends and on-going investigations of potential tritium sources

QUESTIONS?

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