Massachusetts Department of Public Health
Bureau of Environmental Health

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

April 2014

Outline

I. MDPH and Nuclear Power Facilities

II. PNPS Real-Time Monitoring System – Updates and Enhancements

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 (NRC maintains jurisdiction inside)
- 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)

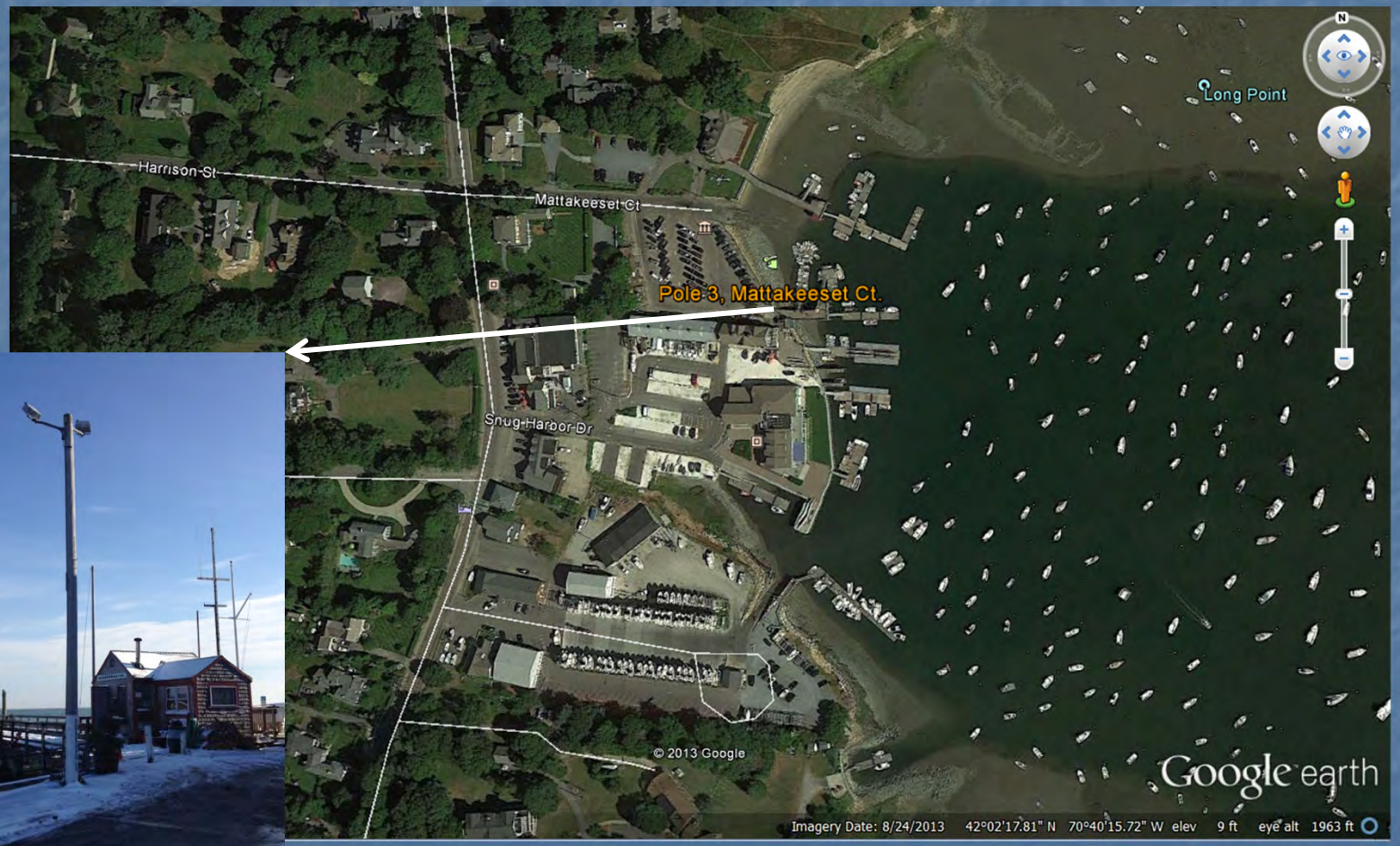
II. PNPS Real-Time Monitoring System – Updates and Enhancements

- The MDPH real-time monitoring system currently has 14 monitors
- Three monitors were relocated in 2013
  - Gurnet Point
  - Plymouth Waterfront
  - Old Colony Place
- All three have co-located wind speed and direction measuring capacity
- As with all monitors, data is reported to a central computer remotely accessible and checked daily by MDPH staff
- Monitors are calibrated annually according to Envinet specifications to ensure data quality

PNPS Real-Time Monitoring System – Updates and Enhancements

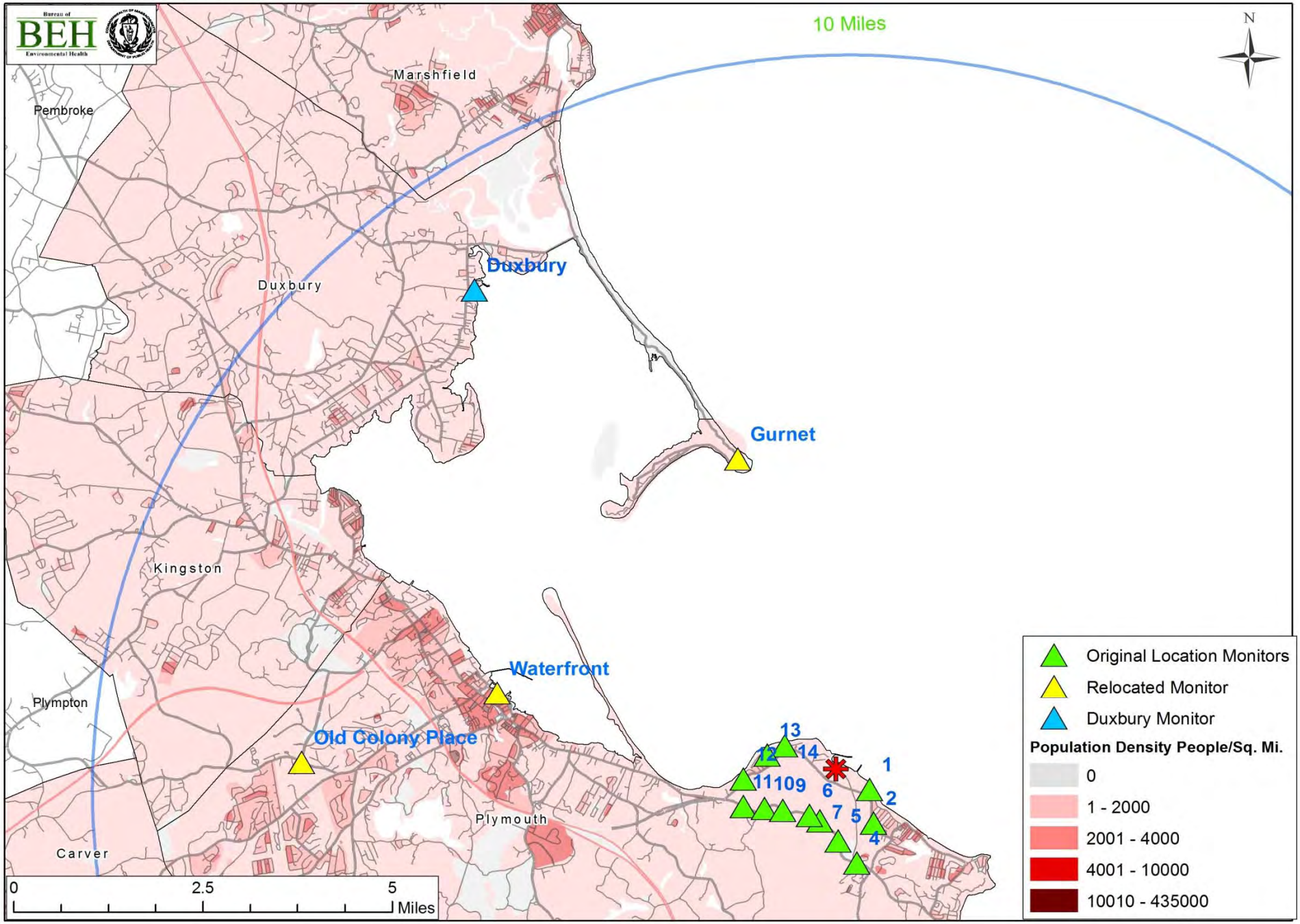
- Duxbury Monitor
  - Funding provided by Town of Duxbury
  - Memorandum of Agreement signed November 22, 2013 (MDPH maintains ownership)
  - Radiation Monitor received from manufacturer March 2014
  - MDPH worked with Duxbury and Utility companies to secure pole access at the Duxbury Harbormaster site
  - Duxbury monitor to be integrated into Real-Time monitoring system Spring 2014

PNPS Real-Time Monitoring System – Updates and Enhancements



Duxbury Location by Harbormaster's Office

PNPS - Real-Time Monitors



PNPS Real-Time Monitoring System – Updates and Enhancements

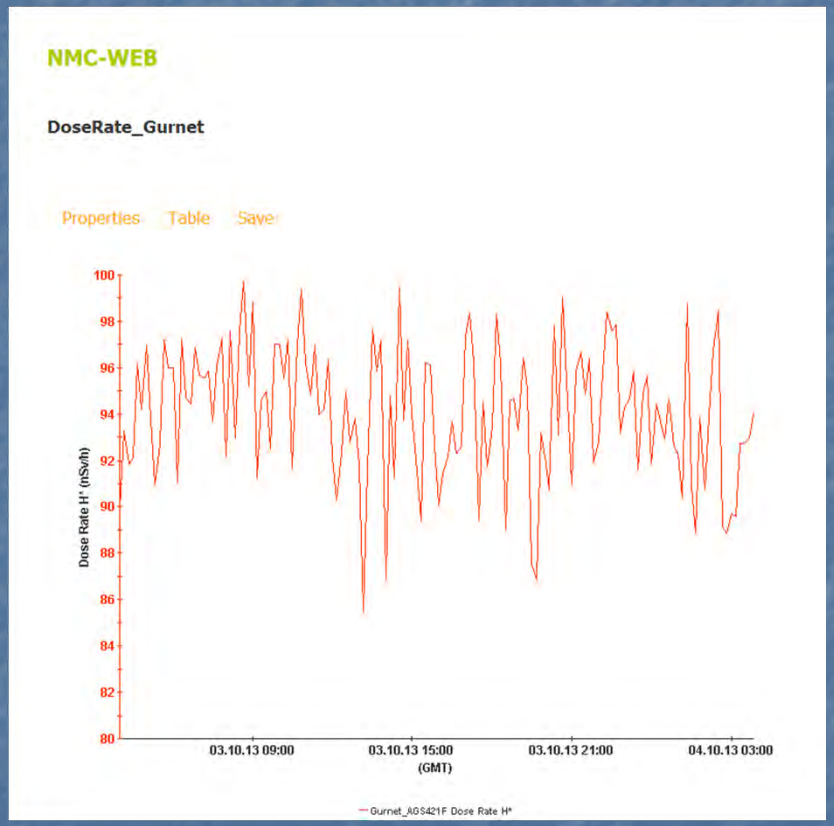
- Real-time radiation monitor system has been enhanced with state-of-the-art anemometers (wind speed and direction sensors) that are solar powered and transmit data wirelessly to a central computer
- MDPH consulted with experts to ensure anemometers were placed at optimal locations designed to take the sea breeze effects into account:
  - Plymouth Waterfront
  - Gurnet Point
  - Old Colony Place
  - Duxbury (Spring 2014)
- 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
- These enhancements provide a robust system of watchfulness

PNPS Real-Time Monitoring System – Updates and Enhancements

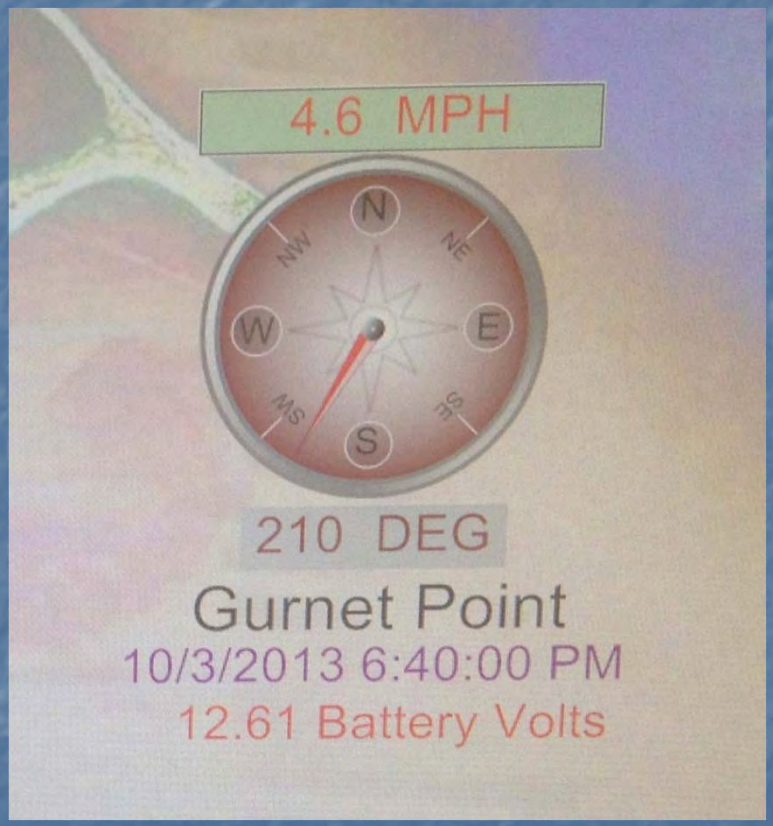
- Real-Time radiation monitor and anemometer at Gurnet Point:

PNPS Real-Time Monitoring System – Updates and Enhancements

Gurnet Radiation Monitor Software Output



Gurnet Anemometer Software Output



PNPS Real-Time Monitoring System – Updates and Enhancements

- Anemometers (wind speed and direction sensors) are calibrated upon installation by MDPH contractor according to industry standards
- Calibrations will occur on a semi-annual basis
- 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
- MDPH will validate and verify the meteorological data being collected according to EPA's Quality Assurance standards
- After one year of data collection and quality assurance, summaries of wind speed and direction data (e.g., wind roses) and accuracy statistics will be available

PNPS Real-Time Monitoring System – Updates and Enhancements

- Future use of data under discussion:
  - Simultaneously collected meteorological data and radiation data can be displayed and analyzed together
  - Environmental monitoring reports will be supplemented with meteorological data collected
  - MDPH is in discussions with MEMA on use of validated meteorological data to support site specific modeling efforts

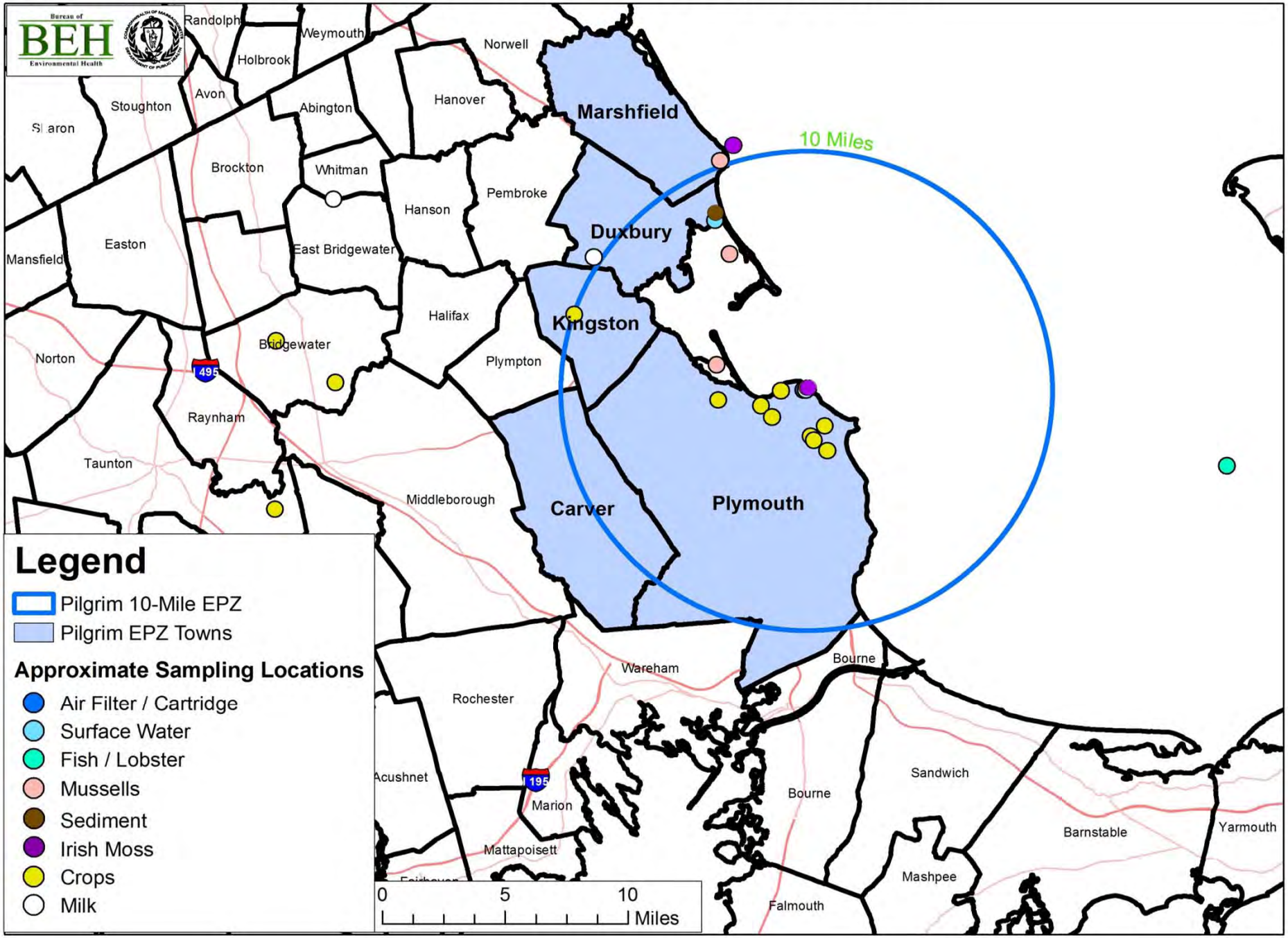
III. Routine Environmental Monitoring in Emergency Planning Zones

- 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 routine monitoring results

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

Media	Detected	Comment
Air	NORM	At Background
Surface Water	NORM	At Background
Fish	NORM Cesium-137 (6.9 pCi/kg)	Cs-137 based on 1 fish (out of 5) from PNPS (i.e., bluefish). Level is just above MERL detection limit, and below literature-based descriptions of historical atomic fallout
Lobster	NORM	At Background
Mussels	NORM	At Background
Sediment	NORM	At Background
Irish Moss	NORM	At Background
Crops	NORM	At Background
Milk	NORM	At Background

Routine Environmental Monitoring in Emergency Planning Zones

- 2012 routine monitoring results

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

Media	Detected	Comment
Air	NORM	At Background
Surface Water	NORM	At Background
Fish	NORM Cesium-137 (10.1 pCi/kg)	Cs-137 based on 1 fish (out of 5) from PNPS (i.e., bluefish). Level is just above MERL detection limit, and below literature-based descriptions of historical atomic fallout
Lobster	NORM	At Background
Mussels	NORM	At Background
Sediment	NORM	At Background
Irish Moss	NORM	At Background
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 (MW205), 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

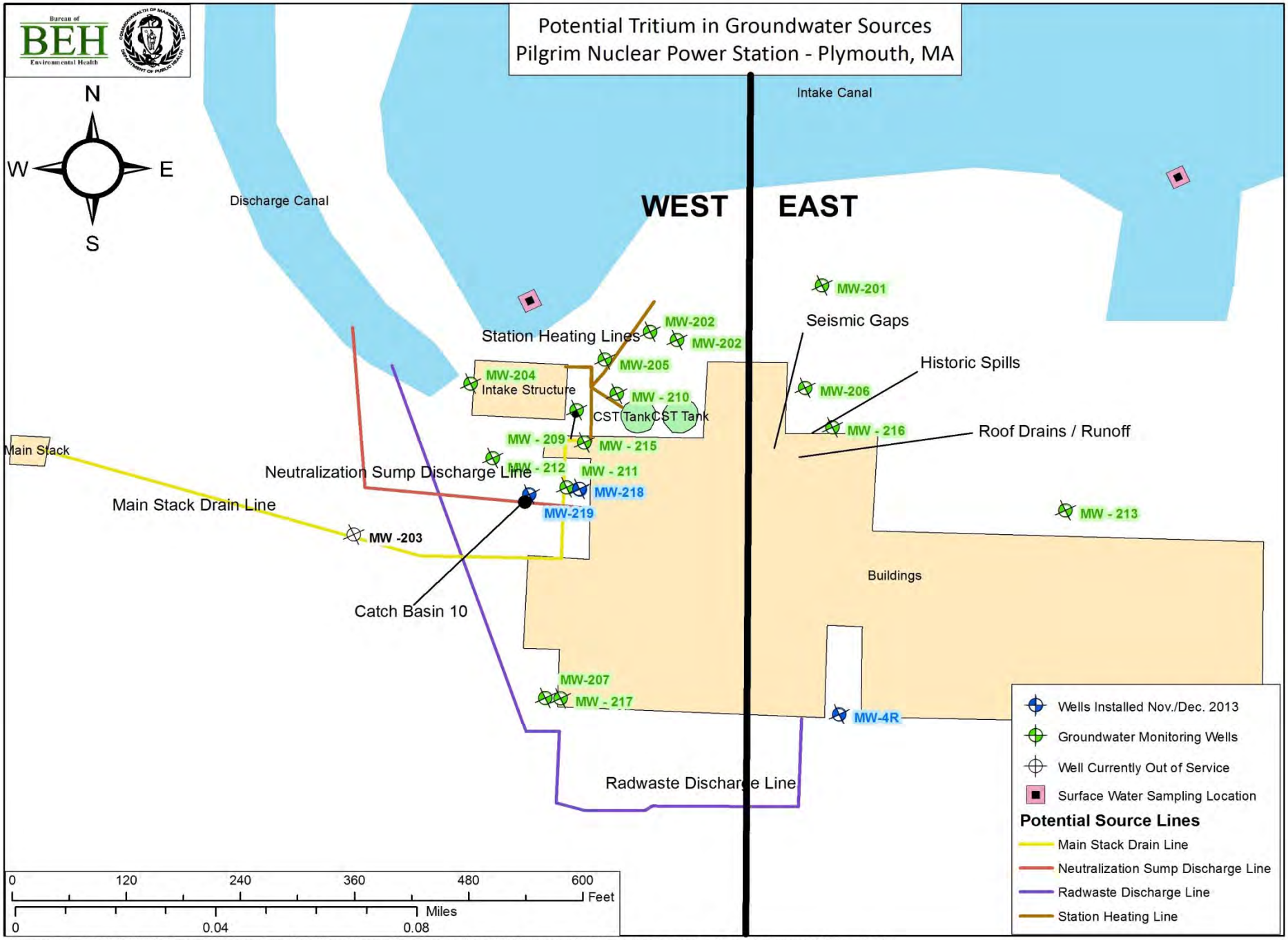
Tritium in Groundwater Investigation

- 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 22
- 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

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
- The investigation currently has two main focus areas – the west side and the east 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

- MW219 (west side) installed December 2013
  - Weekly tritium results range from 2,120 pCi/L to 69,000 pCi/L, with a maximum of 69,000 pCi/L detected on 12/30/2013.
- Discharges to catch basin (CB) 10 occurred December 3rd, 10th, and 20th, 2013
- The suspected tritium source for MW219 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 (MW205, MW209, MW211, MW215)
- To date, tritium detections have followed a decreasing trend since the maximum was detected

Tritium in Groundwater Investigation

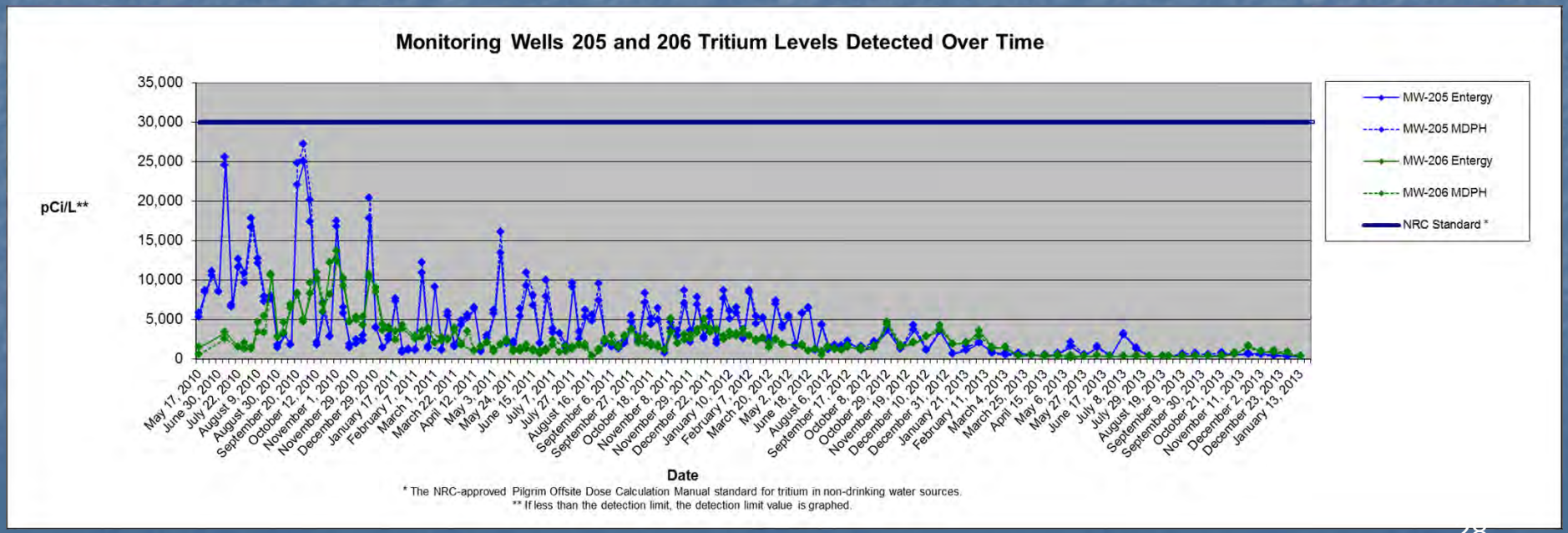
- MW218 (west side) installed November 2013:
  - Weekly tritium results range from 1,580 to 5,810 pCi/L, with a maximum of 5,180 pCi/L detected on 11/25/2013
- The suspected source for MW218 is residual tritium contamination from the break in the neutralization sump discharge line in Spring 2013
- Pipeline 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 (MW205, MW209, MW211, MW215)

Tritium in Groundwater Investigation

- MW216 (east side) installed September 2012:
  - consistently ~5,000 pCi/L of tritium detected since installation
- It is up gradient of MW206 and MW201
- Latest Theories Under Investigation:
  - Catch Basins / Roof Drains
  - Historic Spill
  - Radwaste Discharge Line
  - Seismic Gaps.

Tritium in Groundwater Investigation

- Data for MW205 and MW206, 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 neutralization sump discharge line, catch basin 10, and other potential sources such as seismic gaps

QUESTIONS?

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