



**pennsylvania**

DEPARTMENT OF ENVIRONMENTAL PROTECTION



Office of Waste, Air, Radiation & Remediation

# **Pennsylvania DEP TENORM Study 2013 End of Year Update**

# Background

- **Technologically Enhanced Naturally Occurring Radioactive Material**
  - Consists of naturally occurring radioactive material whose radionuclide concentrations have been increased above levels encountered in the natural state by human activities.

# Background

Generation of TENORM has increased significantly. This is mainly due to the recent expansion in natural gas exploration and production in Pennsylvania.

There are many issues with TENORM that must be managed effectively.

These issues include:

- Potential worker radiation exposure
- Public radiation exposure
- Environmental (water, etc.) contamination



# DEP TENORM Study

- The intention to conduct a comprehensive TENORM study was announced on Jan. 24, 2013.

## ❖ Study Purpose

- > Evaluate radiation exposure to the public and workers
- > Evaluate environmental impacts

# Participants

- Perma-Fix Environmental Services, Inc. - Consultant
- DEP Central Office Program and Regional Office Staff

# Study Plan

- DEP and Perma-Fix collaborated to develop the TENORM Study Plan.
- The Final Study Plan was posted to the DEP website on April 3, 2013.

# Study Plan

- One set of comments/questions was received.
- Additional well pads were added to the list of those already scheduled to be sampled based on the comments.

# Site Categories

- Waste Water Treatment Plants (WWTPs)
- Landfills
- Sludge Loads to Landfills
- Well Pads
- Underground Natural Gas Storage Sites



# Site Categories

- Gas-Fired Electricity Generating Facilities
- Compressor Stations
- Beneficial Use Sites
- Decommissioned Well Casings

# 2013 Completed Field Work

- 184 Site Visits
- 114 Locations
- 1,000 Samples Analyzed

# 2013 Completed Field Work

- 25 WWTP's / 73 Visits (3 Rounds)
- 48 Landfills (9 Extensively Sampled)
- 1 Set of facilities to evaluate the effect of transport on sludge radioactivity
- 20 Well Pads / 41 Visits

# 2013 Completed Field Work

- 13 Beneficial use sites
- 1 Decommissioned well casings disposal site
- 7 Facilities that compress, store and utilize natural gas

# Underground Storage





# Underground Storage



# Nat. Gas-Fired Pwr. Plant



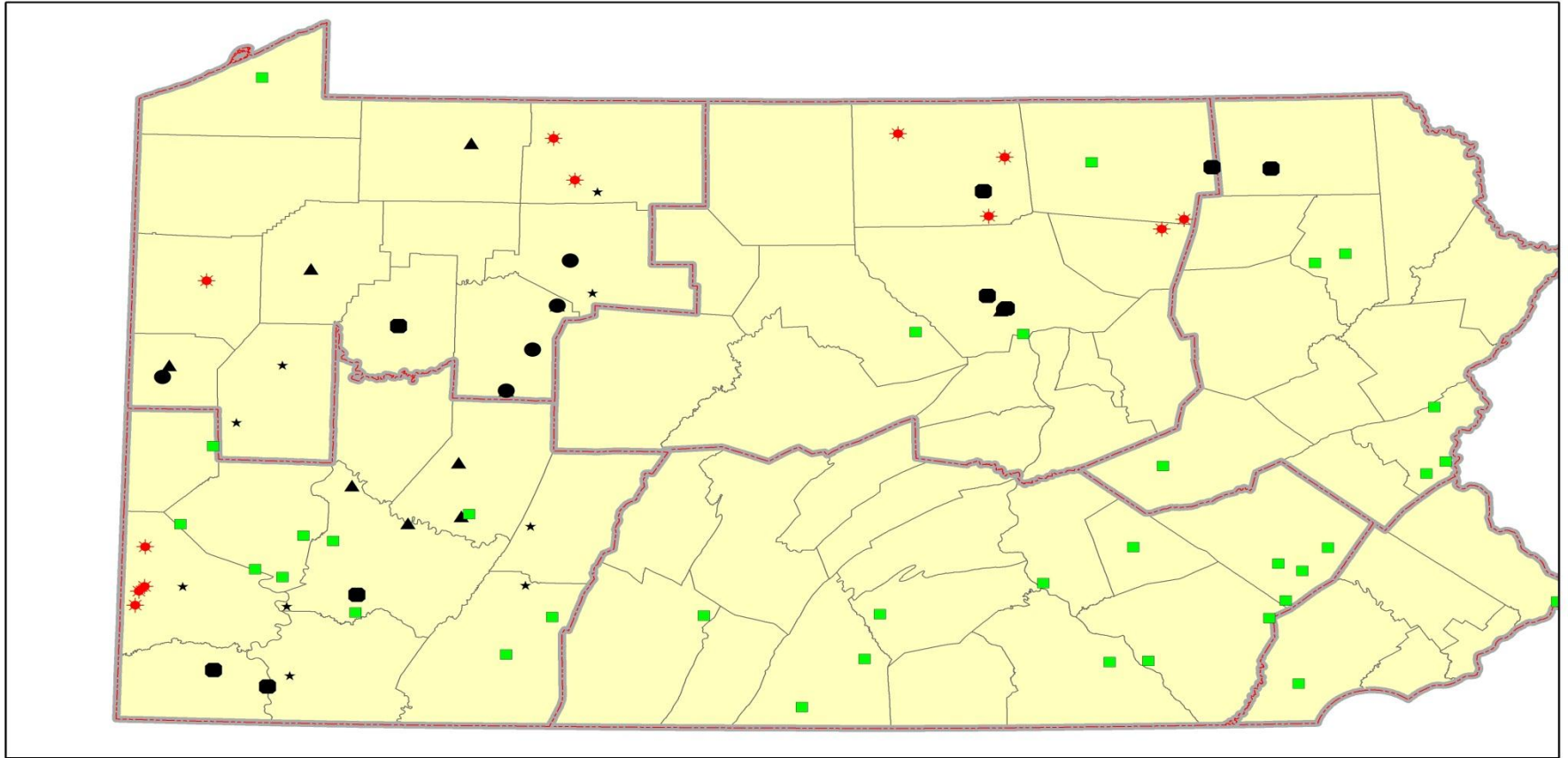


# Well Pad Flowback







# Sampling Map



## Legend

-  Well Pads
-  Leachate
-  Centralized Waste Treatment Facility
-  Publicly Owned Treatment Works
-  Zero Liquid Discharge
-  Landfills

-  County Boundaries
-  PA DEP Regional Boundaries

# Sample Types

- Natural Gas Samples
- Liquid Samples (i.e., frac water, flowback water)
- Solid Samples (i.e., drill cuttings, sludge)
- Radiation Surveys
- 'Swipe' Samples

# Sample Analysis

- The samples are being analyzed for the presence of Alpha, Beta and Gamma Radiation.
- The gas is being sampled for the presence of Radon.

# Remaining Field Work

- Well pad sampling (18 visits to 11 pads)
- Continued landfill leachate collection (5 facilities)
- Landfill 'Bulking' operations (2 facilities)
- Beneficial use sites (4 sites)

# Remaining Field Work

- Gas-fired power plants (1 facility)
- Gas storage facilities (4 facilities)
- Compressor stations (1 facility)
- Gas processing facilities (1 facility)

# Remaining Field Work

- Wastewater impoundments (2 facilities)
- Evaluating the effect of transport on sludge radioactivity (5 events)

# Lessons Learned

- Well pad field work schedule changes
- Technical challenges
- Science-based study plan additions

# Schedule

- Most field work to be completed by the end of February.
- Sample analysis, data analysis, and report preparation (including peer review) from March through August.
- Final study report planned for completion in 2014.



# TENORM Study Information

- Study related documents are available at [www.dep.state.pa.us](http://www.dep.state.pa.us), keyword: “TENORM”
- Updates are being provided to the appropriate DEP Advisory Committees



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**If there are any questions,  
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