

People are exposed to naturally occurring radioactive material (NORM) every day, from material present in rocks, food, water and the air around us. In fact, just about everything contains some traces of radioactivity, as the earth is constantly exposed to radiation from the sun and cosmic rays.

These natural sources of radiation are also found in geological formations, such as granite, and in the Marcellus Shale and other rocks that produce oil and natural gas. In Pennsylvania, monitoring for NORM in oil and gas production is carried out by three bureaus within the Department of Environmental Protection (DEP): the Bureau of Oil and Gas, Radiation Protection and Waste Management. These divisions of DEP have monitored for NORM at more than 400 oil and gas well locations, nine pipeyard storage facilities and 500 miles of dirt roads where brine water is applied for dust suppression and ice control. Those inspections found levels of NORM in those operations do not present a potential concern to public health or the environment.

## Treatment of NORM in Flowback Water

After the well stimulation process is completed, water is “flowed-back” from the wellbore to the surface. This water can contain levels of NORM, with most of it consisting of the isotopes formed from the radioactive decay of uranium-238 (U-238) and thorium-232 (Th-232). The primary radionuclide monitored in NORM wastes is radium-226 (Ra-226) of the U-238 decay series. Radium-228 (Ra-228), formed in the Th-232 decay series, also occurs in NORM waste, but usually at lower concentrations.

Flowback water is currently being recycled at levels up to 90 percent by some companies, greatly reducing the amount of water that must be treated at permitted facilities.

The water destined for treatment is commonly trucked to one of six permitted industrial wastewater treatment plants in Pennsylvania, as well as several plants that pre-treat the water and discharge into municipal sewage treatment facilities. Some fluids are also transported to other facilities which treat the fluid for reuse with no discharge to the stream, or to deep injection wells, most of which are located outside of the Commonwealth. An increasingly smaller amount is taken directly to municipal sewage treatment facilities, where it can make up only one percent of the facilities’ total flow.

The process of transporting and delivering the water to these facilities is regulated, with paperwork to track the shipment of water from a well location to the treatment plant.

## Industrial Treatment Facilities

Pennsylvania’s six industrial treatment plants have been treating water from oil and natural gas development for many years, and must comply with permit conditions established by the state to protect water quality in the receiving stream or river. These plants must also monitor their discharges and report the results to DEP as required by their permits to ensure compliance with state regulations.

Processes used at these facilities are effective in treating NORM contained in flowback water.



Sampling at seven streams and rivers by DEP in late 2010 found NORM levels to be at or below “background,” the amount found in the environment around us.

These include chemical flocculation processes and filtration treatments for NORM, in addition to other treatment processes which reduce metals, oil and grease, and other constituents prior to discharging treated water into a stream or river.

All of these different types of treatment plants have the capacity to meet the current wastewater treatment needs of Pennsylvania’s Marcellus Shale and conventional oil and gas industries. Additional treatment plants employing new technology to meet stringent Total Dissolved Solids (TDS) limitations are being planned and permitted around the state to supplement this capacity and serve the future needs of the industry.

## DEP Sampling, November-December 2010

DEP collected water samples from seven waterways in November and December, 2010 at locations downstream from wastewater plants that treat water from Marcellus shale drilling operations. These water

samples were analyzed for the presence of NORM, and all of them were found to be at or below “background” levels that are found in Pennsylvania. The samples also reflect the “raw” water present in the creek or river, prior to it entering a public water suppliers’ intake, where it is treated before being put into a drinking water distribution system.

The samples were collected from the Allegheny River at Kennerdell in Venango County; Beaver River in Beaver County; Conemaugh River in Indiana County; Monongahela River in Washington County; South Fork Ten Mile Creek in Greene County; Tioga River in Tioga County; and the West Branch of the Susquehanna River in Lycoming County.

PIOGA supports future sampling efforts to ensure the protection of water supplies in the Commonwealth.

## Advanced “Zero Discharge” Treatment Facility

Pennsylvania is leading the nation in developing technologies to protect the environment, including flowback water treatment technology that results in 100 percent of treated water to be recycled and returned for additional well stimulation procedures. This facility includes the following process:

