

PRETREATMENT CORNER

Marcellus Shale Gas Well Operations Impact on Pretreatment Programs

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Large volumes of water are used in the hydraulic fracturing operations when gas wells are drilled, which ultimately have an impact on our water resources. Where does the water come from? On the flip side, two types of wastewater are generated from gas well development and use, initial flow back water from fracturing and then production brines from the long term use of the gas well. So what happens to the wastewater? What types of contaminants are found in the frac and brine wastewaters?

Gas well drilling in the Marcellus Shale in Pennsylvania started to take off after a gas well that went into production in 2005 showed higher gas yields than previously drilled wells, as a result of new drilling technologies. Since that time PA DEP has revised permitting policies, developed training programs and implemented new requirements for the oil and gas extraction industry. The latest DEP document publicized is the April 11, 2009 *Permitting Strategy for High Total Dissolved Solids (TDS) Wastewater Discharges (Permitting Strategy)*. The *Permitting Strategy* was developed primarily with the Marcellus Shale gas well extraction industry in mind but may have an impact on other industries in the future.

There are several disposal options for the frac and brine wastewaters, just as there are for any industrial establishment, which may include the following: (1) onsite treatment facilities with direct discharge to a receiving stream permitted under the NPDES program and subject to the Oil and Gas Well Extraction effluent guidelines at 40 CFR §437; (2) onsite or mobile treatment with transportation as a residual waste to a POTW and subject to Local Limits; (3) transportation to a centralized waste treatment facility as a residual waste and then discharged directly to the receiving stream (subject to 40 CFR §437) or transported again to a POTW (subject to Local Limits). Acceptance by a POTW of this residual waste, even if pretreated before arriving at the POTW, may require additional pretreatment at the POTW facility to meet future discharge standards.

The *Permitting Strategy* proposes that regulations will be finalized by January 1, 2011, which will control Barium, Chloride, Strontium, Sulfate and Total Dissolved Solids (TDS) in effluent discharges to receiving streams. DEP is proposing to modify 25 PA Code §95 by establishing effluent standards as follows:

Barium: 10 mg/L

Chloride: Daily Maximum of 250 mg/L (same as secondary drinking water standard)

Strontium: 10 mg/L

Sulfate: Daily Maximum of 250 mg/L (same as secondary drinking water standard)

TDS: Monthly Average of 500 mg/L (same as secondary drinking water standard)

TDS: Daily Maximum of 750 mg/L

The above Chloride, Sulfate and TDS pollutant values are already contained in Table 3 of 25 PA Code §93.7 as ambient water quality criteria to protect public water supplies, but by making the values effluent standards, water quality based effluent limits determined during the permitting stage by DEP, may result in more stringent NPDES permit limits. In addition, Local Limits, when calculated as an NPDES limit, may become very stringent depending on the dilution effect of the receiving stream, as compared to calculating a Local Limit based on water quality criteria.

Throughout the regulatory process, DEP will identify existing stream conditions that may be impaired due to acid mine drainage, for example, and as a result may restrict TDS discharge allocations for new sources of TDS and authorize more stringent water quality based effluent permit limits. Where sufficient assimilative capacity exists in the receiving stream, a new TDS discharge may receive effluent limits

based on mass loading allocations. This thought process is very similar to the TMDL process for calculating wasteload allocations for a specific receiving stream.

Other pollutants of concern in the frac wastewaters may be derived from the hydraulic fracture solutions used in the drilling process. Some of the more common hydraulic solutions are comprised of various alcohol blends, ethylene and propylene glycols, glutaraldehyde and petroleum distillates. Recent test data provided to a POTW from a drilling company shows other pollutants detected in frac and/or brine wastewaters at levels higher than domestic strength wastewater such as, Ammonia Nitrogen, BOD, COD, Hardness, Total Kjeldahl Nitrogen and Sodium.

High levels of TDS are not only restricted to the oil and gas well extraction industry. Your own pretreatment program may identify food processing facilities and landfill leachate as types of other industries with high levels of Chloride and Sodium, which contribute to the high TDS concentrations. Research indicates Chloride in excess of 1,000 mg/L, Sodium in excess of 5,000 mg/L and TDS in excess of 10,000 mg/L may cause stress on activated sludge microorganisms. It is not clear if DEP will restrict the above proposed effluent standards to only oil and gas well extraction wastewaters or if the standards will be applied to all discharges under the NPDES program. Something to ponder for the future.