

Marcellus Shale Gas and Source Water Protection

WVDEP 4/28/2010

WV Rural Water Association

www.wvrwa.org

- USDA FSA Source
Water Protection -
Lewis Baker



- USEPA Source
Water Protection –
Erica Johnson



Source Water Definitions

USEPA: Source water is untreated water from streams, rivers, lakes or underground aquifers that is used to provide public drinking water, as well to supply private wells used for human consumption.

USDA: Source water is surface and ground water that is consumed by rural residents.

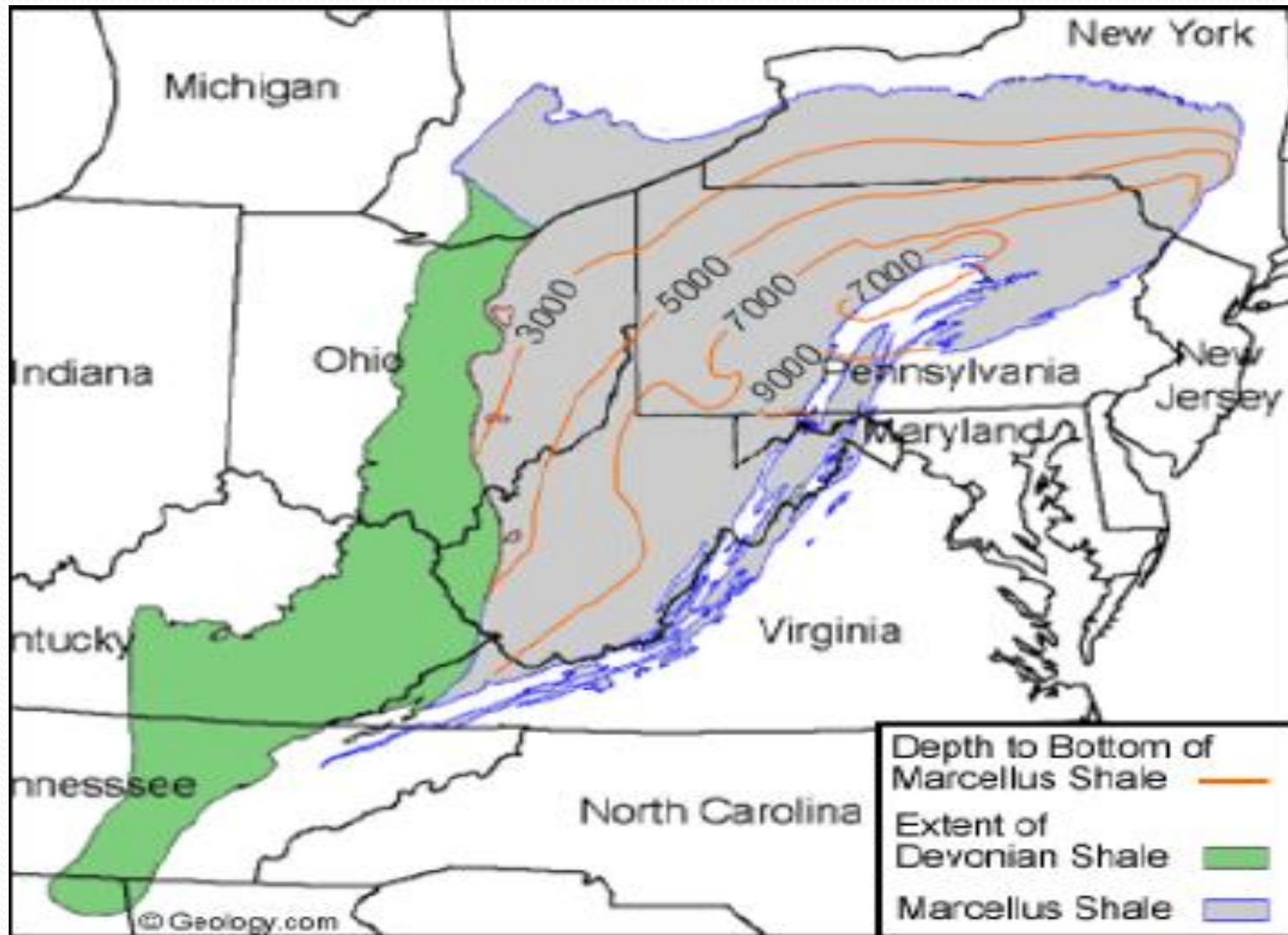
Source Water Protection Plans

- Identify local or regional source waters to be protected, working with federal, state and local partners
- Delineate SWP Area within which those sources originate
- Inventory known and potential sources of contamination within the SWP Area
- Develop contingency plans, implement protection methods

Marcellus Shale – Why Now ?

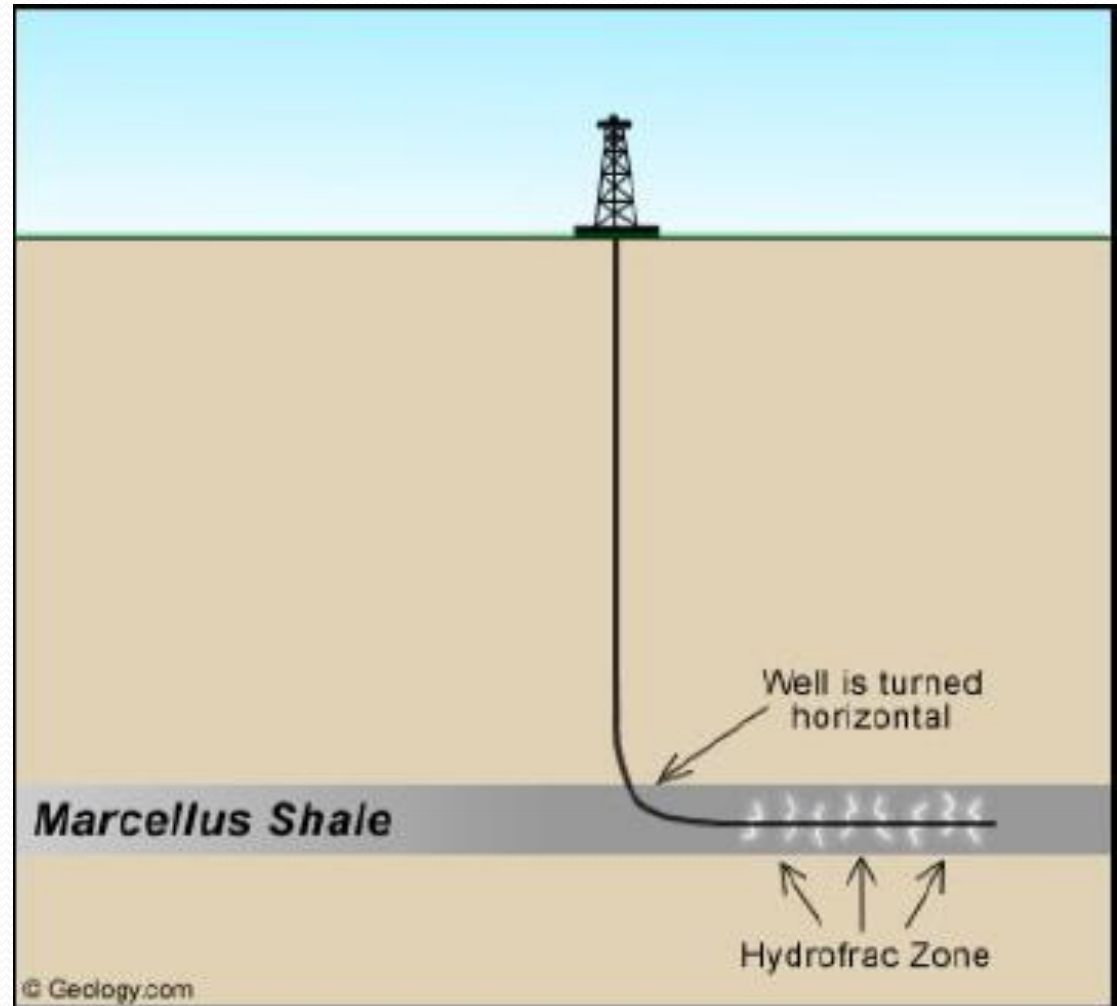
- For many years it has been known that natural gas exists in the Marcellus Shale
- Advances in horizontal drilling, hydraulic fracturing, and higher natural gas prices in recent years have made shale gas wells more profitable
- The success of the Barnett Shale in Texas has spurred the search for other sources of shale gas across the United States
- Estimates of recoverable natural gas reserves from the Marcellus Shale range from 50 – 200 trillion cubic feet

Marcellus Shale underlies WV

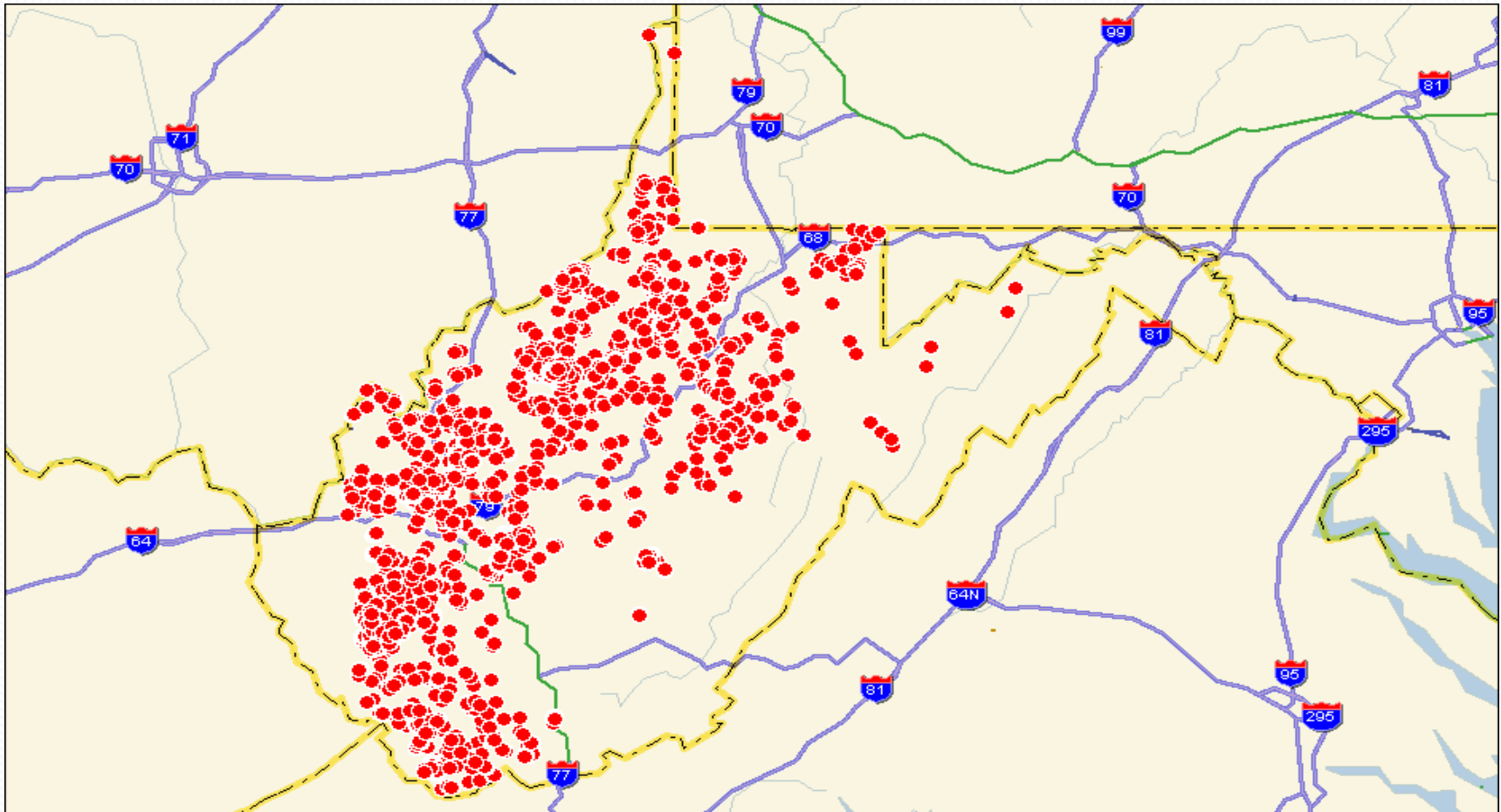


Horizontal Gas Well Drilling

- Drill vertically to desired depth in the formation
- Drill rods are then turned (horizontal) in order to drill perpendicular to naturally occurring vertical fractures

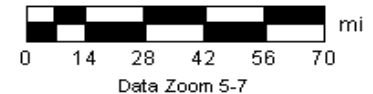


Marcellus wells permitted since 2004



 DeLORME

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Frack Trucks at Well Site



High Bromides in Brine

- Salty water from flooded coal mines may contain 1,000 ppb of bromide
- Brine produced by Oil & Gas wells may contain 1,000,000 ppb of bromide
- Large volume of brine from new Marcellus gas wells, (million gallons of brine per well)
- Brine disposal options may include injection into old gas wells or coal mines, land disposal, deicing of roads, wastewater plants and illegal dumping. Most of the brine has not been injected back underground, and is therefore ending up in surface streams.

Bromide as DBP Precursor

- Bromide becomes Bromate if Ozone is used as a disinfectant. Bromate MCL is 10 ppb.
- Bromide and Organic Matter become TriHaloMethane Disinfection By-Products, if Chlorine is used to disinfect. THM DBPs MCL is 80 ppb.
- Bromide concentration in uncontaminated source water is typically 100 ppb or so. DBPs increase with higher bromides.

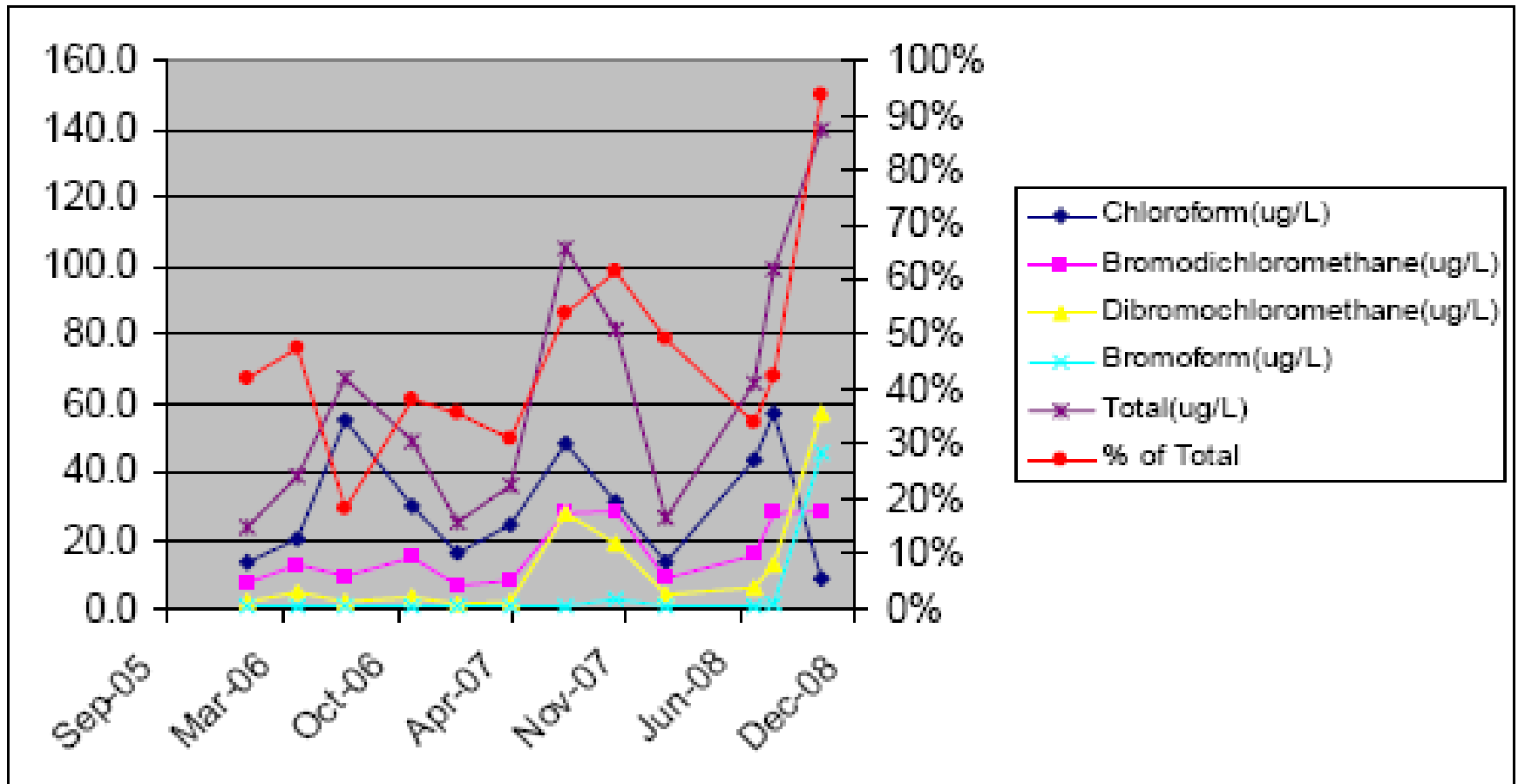
Bromine atoms are heavier than chlorine atoms. So more THMs by weight as bromine atoms replace chlorine atoms on THM molecules.

DBP	Individual Species	Chemical Formula	Molecular Weight
Trihalomethane	Chloroform	CHCl_3	119 g/mol
	Bromodichloromethane	CHCl_2Br	164 g/mol
	Dibromochloromethane	CHClBr_2	208 g/mol
	Bromoform	CHBr_3	253 g/mol

Bromide and THM DBPs

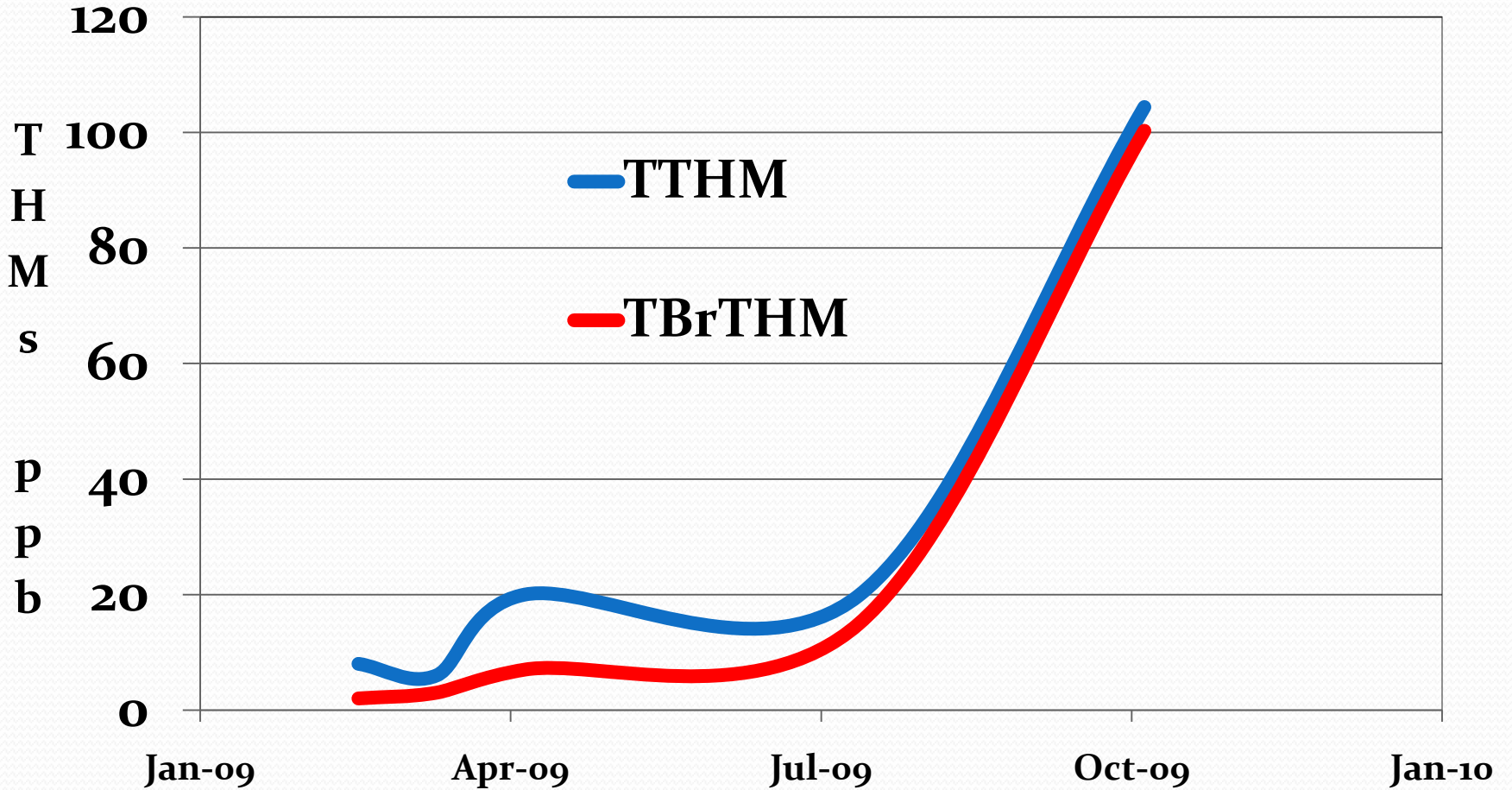
Monongahela River

Authority of the Borough of Charleroi



Brominated THMs

West Union, WV



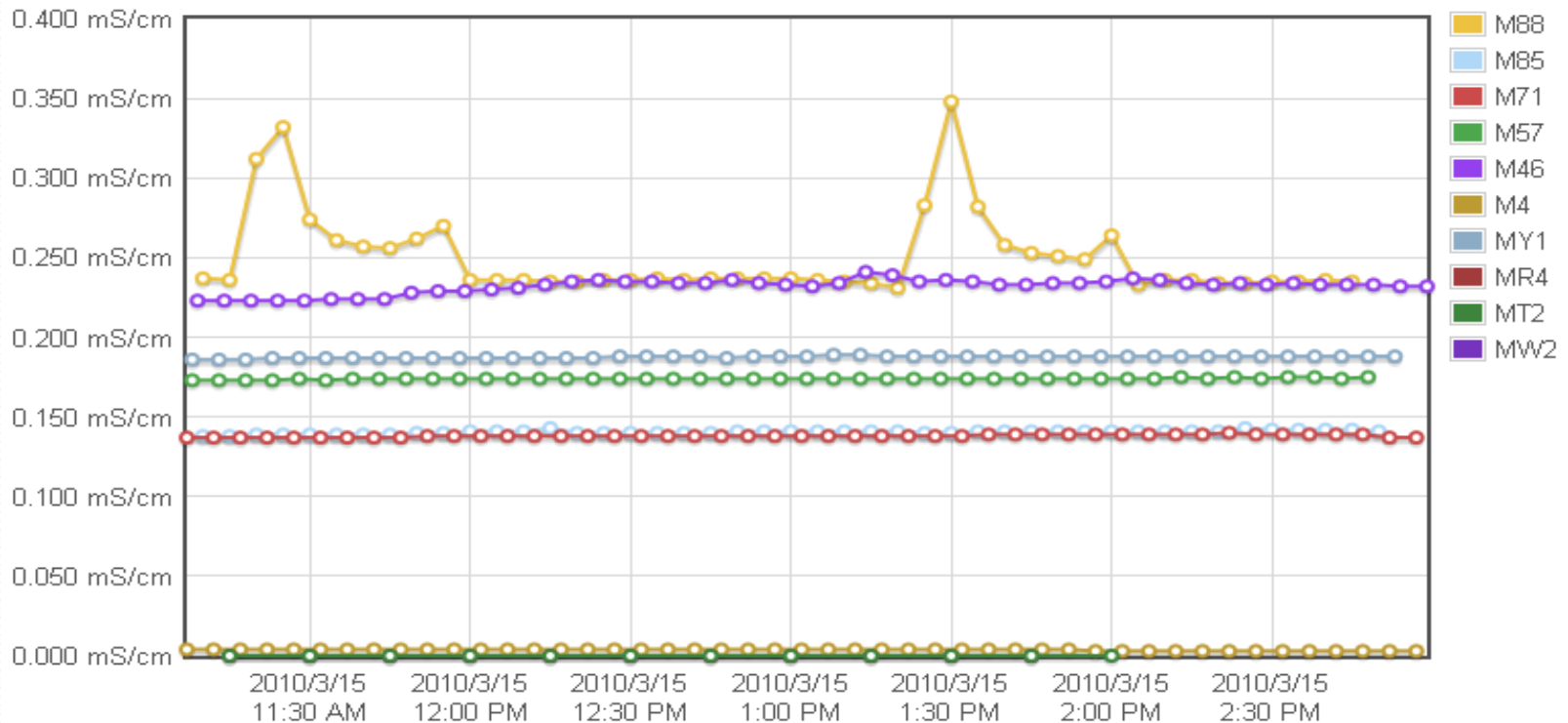
Continuous Monitoring of Source Water

- Electronic probes for pH, Temp, Conductivity (“TDS”), even nitrates and other ions
- Allows for real time indication of water quality, for greater awareness of water treatment needs
- Provides for **early warning system**, monitoring of spills (conductivity for brine, etc)
- Being used by public water supplies in Pittsburgh, Philadelphia, other areas, coming to WV’s Monongahela Basin, etc
- RAIN meetings in Morgantown, Philippi on 4/13/2010
- Source Water Protection Grant \$ may be available

www.3RAIN.org

Monitoring on Monongahela River

Conductivity Trend Graph



New WVDEP O&G Marcellus Regs ?

- Increase presumptive distance from wellheads, and include the horizontal segments ?
- Gas operators should identify and **notify** nearest PWS downstream of Marcellus wells before fracing, regardless of distance
- Operators to call again to nearest downstream PWS immediately if spill occurs
- Water quality samples of streams before, during and after fracing, including TDS, Cl, Br, Ba, etc
- Provide alternate water supply until source water is OK again, when needed, after spills