Abstracts

Thursday, May 1

Session L3: Energy Production Impacts

1:30 – 3:00 pm | Room 261

Assessment of GHG (Greenhouse Gas) Emissions in a Tropical Brazilian Reservoir

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Abstract
Although thermoelectricity is still the most used technology to obtain energy worldwide, hydroelectricity has been largely employed as an alternative source for energy generation. This tendency becomes evident due to the amount of dams that has been built around the world, especially in developing countries. Unlike thermoelectricity, hydroelectricity had been considered to provide GHG free energy. However, recent studies have pointed out the role of reservoirs in terms of GHG emissions. In this sense, reservoirs can be either emitters or absorbers of carbon, depending on the local conditions.

The production and subsequent emission of these gases varies largely, as a function of several factors, such as soil usage, water quality, morphology and hydrology of the reservoir and other characteristics of the water basin. Moreover, the production and emission of GHGs varies within the reservoir, due to different depths or local discharges. Therefore, it is important to monitor limnological parameters and GHG emissions to better understand this phenomenon as well as to draw conclusions applicable for a sound management of reservoirs.

Volta Grande (River Grande., Brazil) is a run-of-the-river reservoir, with a short residence time (17 days) and low nutrient (nitrogen and phosphorus) concentrations. It is located in a humid tropical climate, in a savanna biome.

CO2 flux ranged from 2.35 to 58.35 mmol•m-2•d-1 and CH4 ranged from 90.32 to 649.53 µmol•m-2•d-1. Our results for both CO2 and CH4 fluxes are lower compared to other studies carried out in tropical reservoirs.

Despite the initial presence of flooded biomass, most of it was already oxidized in the early years following the filling of the reservoir. Additionally, the input of organic matter that would be oxidized is apparently low since the water level does not change significantly throughout the year. Therefore, although located in a tropical area, Volta Grande Reservoir emits less CO2 and CH4 than other similar impoundments.

Disinfection By-products Formed during the Treatment of Produced Waters at Wastewater Treatment Plants

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Abstract
Disinfection by-products (DBPs) are routinely measured in drinking water but less frequently in other treated waters such as wastewater. Produced waters are fluids that are co-produced with oil and gas production, and include brines with elevated concentrations of bromide (up to thousands of mg/L), an important inorganic precursor of several toxic DBPs. To determine if wastewater treatment plants in Pennsylvania that accept produced waters discharge greater amounts of brominated DBPs, water samples were collected from below outfalls of both commercial wastewater treatment plants (CWT) and publicly owned wastewater treatment plants (POTW) and analyzed for 29 DBPs (both regulated and non-regulated). Sites below CWTs had elevated concentrations (up to 8.5 µg/L) of dibromochloronitromethane. The water at one of the CWT outfalls was also analyzed for DBP precursors and had elevated concentrations of bromide (75 mg/L) and other organic DBP

precursors (phenol at 15 µg/L). Waters below POTW outfalls had elevated numbers (up to 15) and concentrations of DBPs, especially brominated and iodinated trihalomethanes (THMs) (up to 12 µg/L total THM concentration) and brominated haloacetonitriles (up to 0.91 µg/L total haloacetonitriles). The resulting data indicate that higher concentrations of brominated DBPs are discharged in the effluents of CWTs or POTWs that treat produced waters than POTWs that do not treat produced waters. This finding is important to water quality because there are hundreds of known, or suspected, DBPs many of which are toxic or presumed to be toxic to humans and aquatic organisms. To date, however, there are few occurrence studies conducted on DBPs as contaminants of environmental concern (in addition to DBPs being a drinking water/human health issue).

Wheeling, West Virginia Experience with Frackwater: What "Brinewater" and "Residual Waste" Trucks are Really Carrying

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Abstract
Failure of aerobic digesters and reports that workers fell ill at the Wheeling, West Virginia sewage treatment plant lead to an investigation by West Virginia Department of Environmental Protection. The WVDEP has the authority to regulate industrial users of municipal sewage treatment plants. Trucks carrying Marcellus Shale "brinewater" or "residual waste" were sampled as they entered one such industrial facility. Data from brinewater trucks sampled by WVDEP was obtained by a citizen group via a Freedom of Information Act request. Of the 13 trucks sampled 5 (38%) would be considered Hazardous Waste if not for federal exemptions from the Resource Conservation and Recovery Act (RCRA). One truck carried approximately 5,000 gallons of pH 1.5 liquids, and another truck had 600 ppb of benzene. Three trucks had excessive radiation, including one truck which registered 1,483+/- 287 pCi/L radium, and 4,846+/- 994 pCi of gross alpha radiation. The WVDEP investigation led to a Consent Decree with $400,000 fine levied by the state against the City and the company was ordered to stop dumping "treated" brinewater into the municipal sewage treatment system. Since then another application for a frackwater treatment plant was received by the City. This plant, 2 km upstream of Wheeling's Ohio River water intake, is purported to "recycle" frackwater thus requiring no air or water quality permits. Frackwater samples compared with primary drinking water standards revealed 1 of 13 samples (8%) met standards. Standards were exceeded 30 times in 12 samples including arsenic (2 samples), barium (7), selenium (1), benzene (4), gross alpha (7), and radium (9). Secondary standards were exceeded in all samples a total of 80 times. Some samples were worse than others. For instance, brinewater trucked from an open pit in Pennsylvania contained 834 mg/L of barium, or 417 times the primary drinking standard, while another sample from a compressor station in West Virginia had benzene at 1320 µg/L, exceeding the 5 µg/L standard by a factor of 262X. First responders and citizens should know that "brinewater" and "residual waste" can contain hazardous waste and toxic substances. Local ordinances may be the only means of preventing communities from becoming hazardous waste destinations.

Preliminary Interpretation of the Impacts of Marcellus Shale Extraction Activities on Small Streams, Based on Volunteer Collected Data

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Abstract
Shale gas monitoring efforts have multiplied in Pennsylvania and the surrounding region as concerned individuals and organizations seek to learn more about how shale gas development may impact their local streams. In 2010, the Alliance for Aquatic Resource Monitoring (ALLARM), an organization based out of Dickinson College's Environmental Studies Department, developed a protocol for volunteers to monitor small streams for shale gas extraction impacts, specifically to detect pollution events. Since then, ALLARM has trained over 1,000 volunteers in Pennsylvania, New York, and West Virginia to monitor water quality (conductivity, barium, strontium, and total dissolved solids) and physical (stream stage and visual observations) parameters prior to, during, and after shale gas wells have been developed.

Volunteers have a good sense of the status of their individual monitoring sites; however broader implications of regional shale gas extraction can only be determined by looking at the cumulative dataset. This talk with examine three years of water quality results from hundreds of monitoring sites in Pennsylvania, New York, and West Virginia, and suggest possible relationships between the water quality results and other contributing factors, such as watershed size, geology, landscape and land use, and well development characteristics. The implications of these results in regard to sampling design and the detection of a shale gas impact signature in small streams will be discussed.