

3.071 Assessing the impact of the Martin Drake coal-fired power plant on ambient mercury concentrations in Colorado Springs, CO, USA.

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Abstract:

Mercury (Hg) is a bioaccumulative neurotoxin emitted from both natural and anthropogenic sources. Due to the complex chemistry that Hg undergoes in the atmosphere, the spatial impacts of Hg emissions range from local to global in scale. As Hg is primarily introduced to terrestrial and aquatic ecosystems through atmospheric deposition, characterizing the emissions from individual sources is paramount to effectively mitigating ecosystem Hg contamination. Presently in the U.S., coal combustion for electricity generation is the largest source of Hg to the atmosphere. Colorado Springs is home to the Martin Drake coal-fired power plant (CFPP), which provides a significant fraction of the electricity for the local community but has been the center of much scrutiny due to increasing concerns over the age of the plant, its impact on local air quality, and emissions of greenhouse gases that contribute to global warming. While monitoring and modeling efforts have considered the plant's emissions of criteria air pollutants such as sulfur dioxide (SO₂), there has to our knowledge been no active monitoring of hazardous air pollutants, such as Hg. To quantify Hg concentrations in the ambient atmosphere and assess the impact that this CFPP has on the local environment, during summer 2016 we continuously measured total gaseous Hg (TGM) and carbon dioxide (CO₂) at a site approximately one mile north-northwest of the plant where SO₂, carbon monoxide (CO), and meteorological parameters are also continuously measured. We use this data to elucidate the dominant chemical and meteorological signatures associated with enhancements in ambient Hg. We augment these measurements with air mass transport modeling using the HYbrid Single Particle Lagrangian Integrated Trajectory (HYSPLIT) model to identify the major source locations associated with observed Hg enhancements, and to determine whether the Martin Drake CFPP emissions significantly elevate ambient Hg concentrations in Colorado Springs.