Atmospheric Deposition of PCBs in Northern New Mexico

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Introduction
Polybrominated biphenyls (PCBs) are persistent organic pollutants (POPs) that are observed globally in environmental media, including those regions with no anthropogenic development or industrial activity. In 2005 Los Alamos National Laboratory (LANL) began using the congener method (EPA method 1668A) for PCB analysis, and began to detect PCBs in surface water and storm water runoff, even at remote locations with no industrial activity. These findings suggest that the source for PCBs may be related to atmospheric deposition.

Results and Discussion
Fifty-three wet deposition samples were analyzed for PCBs using the PCB congener method (EPA Method 1668A). Total PCB values for precipitation, summed from congener results, range from a minimum of 0.002 ng/L to 4.1 ng/L with an average value of 0.624 ng/L, a median value of 0.338 ng/L, and a standard deviation of 0.85 ng/L. A statistical summary is shown in Table 1, and box plots are shown in Figure 4. Both the highest and lowest values were observed at the Valles Caldera Headquarters monitoring location, a remote landscape with no known PCB use. Two dry deposition samples have been collected from Valles Caldera Headquarters as well. The first sample, collected in July 2015, was 11,000,000 ng/g. The second sample, collected in July 2016, was 12,600,000 ng/g. Less than a gram of material accumulated during study.

Snowpack samples were collected from 9 locations in northern New Mexico, with elevations ranging from 7,000 to 12,000 ft. Samples were collected from 2008 through 2013 and exhibited a wide range of values, from 0.008 ng/g to 4.58 ng/g, with an average value of 0.750 ng/L (Figure 4 and Table 1). The relationship between elevation and PCB concentrations is shown in Figure 5. There is a weak correlation between elevated PCBs in snowpack collected from locations close to cities, i.e., Sandia Crest, Tesuque Peak, and Kachina Peak and lower concentrations collected at locations distant from urban development. Although the correlation between altitude and PCB concentrations shows some correlation (Figure 5), it is not consistent or clear. Snow is often mixed with windblown organic and inorganic material in the southwestern United States, especially in the spring as well as enrichment of particulates in the snow pack during melting adding to the complex dynamics of PCBs archived in snow pack.

Conclusion
The results of this study inform on the probable linkages between PCB concentrations in atmospheric deposition and PCB concentrations observed in surface and storm water in Northern New Mexico. Measurable PCBs are observed in precipitation and dust at all locations monitored. Atmospheric-derived PCB concentrations are not high enough to directly account for concentrations observed in storm water. However, PCBs are archived in terrestrial sediments and organic material that is mobilized and transported in storm water runoff and surface water. This represents a nonpoint source regional term that, from a regulatory standpoint, is difficult to manage. A new paradigm should be considered to account for the PCB global source term when regulating environmental media, especially surface and storm water.