LA-UR-12-21358

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Title:	**Baseline Polychlorinated Biphenyls (PCBs) on the Pajarito Plateau and Northern New Mexico, Poster, Individual Permit for Storm Water, NPDES Permit No. NM0030759**
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Intended for:	Public
Purpose:	This poster was prepared for the December 2012 Individual Permit for Storm Water (IP) public meeting. The purpose of the meeting was to update the public on implementation of the permit as required under Part 1.I (7) of the IP (National Pollutant Discharge Elimination System Permit No. NM0030759). The poster will be available on Los Alamos National Laboratory's (LANL's) public website.

Baseline Polychlorinated Biphenyls (PCBs) on the Pajarito Plateau and Northern New Mexico

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Introduction

Stormwater runoff was analyzed at select locations in the upper Rio Grande watershed, including the Pajarito Plateau and the northeast flanks of the Jemez Mountains. This project was part of a cooperative investigation by the U.S. Department of Energy (DOE), the New Mexico Environment Department DOE–Oversight Bureau, and Los Alamos National Laboratory (LANL). The entire sampling network is shown in Figure 1.

Objectives

The objectives of this study were to establish (1) baseline levels of PCB concentrations in precipitation and snowpack; (2) baseline levels of PCB concentrations in stormwater in northern New Mexico streams and arroyos that are tributaries to the Rio Grande and Rio Chama; (3) the range of PCB concentrations found in the Rio Grande during base flow (relatively quiet hydrologic periods) and storm flow conditions; (4) baseline levels of PCBs in stormwater from undeveloped watersheds of the Pajarito Plateau and the northeast flank of the Jemez Mountains near Los Alamos; (5) the concentrations of PCBs in urban runoff from the Los Alamos townsite adjacent to LANL; and (6) how to use these findings to target significant sources of PCBs. This presentation includes a subset of the results from the larger regional study. Analysis of the complete data will be presented in an upcoming report to be released in June.

Methods

Surface water samples were collected using automated samplers and single-stage sample bottles.

PCB concentrations were measured by U.S. Environmental Protection Agency (EPA) Method 1668A, a high-precision analytical method capable of measuring concentrations as low as a few parts per quadrillion.

The results were statistically reviewed to identify any anomalous contamination present at the sites.

The results were then compared with New Mexico Water Quality Control Commission (NMWQCC) water-quality criteria (WQC). WQC for total PCBs in water are 0.64 ng/L (0.64 ppt) for the protection of human health and 14 ng/L for the protection of wildlife habitats and aquatic life.

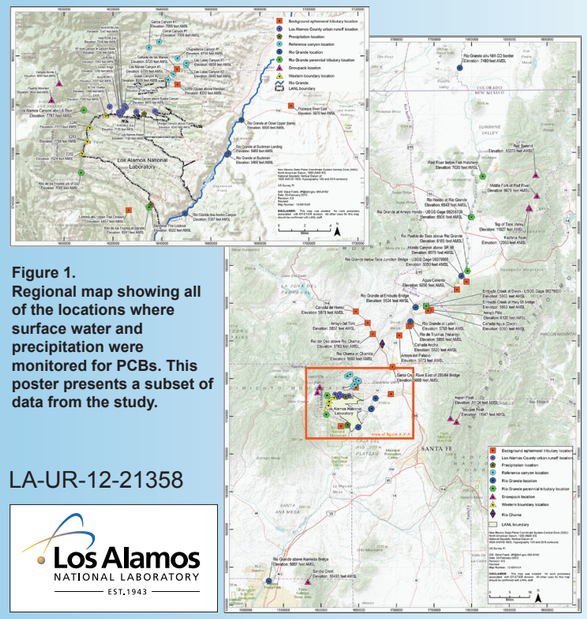

Figure 1.
Regional map showing all of the locations where surface water and precipitation were monitored for PCBs. This poster presents a subset of data from the study.

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What are PCBs?

PCBs are mixtures of synthetic organic chemicals with the same basic chemical structure and physical properties that range from oily liquids to waxy solids. No known natural sources of PCBs exist. Because of their nonflammability, chemical stability, high boiling point, and electrical insulating properties, PCBs were historically used in hundreds of industrial and commercial applications. These applications included electrical, heat transfer, and hydraulic equipment; plasticizers in paints, plastics, calking, and rubber products; pigments, dyes, and carbonless copy paper; and many other uses. More than 1.5 billion pounds of PCBs were manufactured in the U.S. until the domestic manufacture of commercial mixtures, known as Aroclors, stopped in 1977. Approximately 450 million pounds of PCBs have been released to the environment.

Approximately 209 individual congener results are generated from a single PCB analysis using EPA Method 1668A. These results provide a pattern or signature of the origin of the PCBs (provenance).

Results

Precipitation

Precipitation delivers a diffuse source of PCBs to the landscape throughout northern New Mexico. As with radioactive fallout, PCBs are found globally in the atmosphere and periodically are rained out to the ground. A starting point in evaluating baseline PCB concentrations in northern New Mexico surface waters is quantifying PCB levels in precipitation. The results are presented below in Figures 2 and 3 and Table 1.

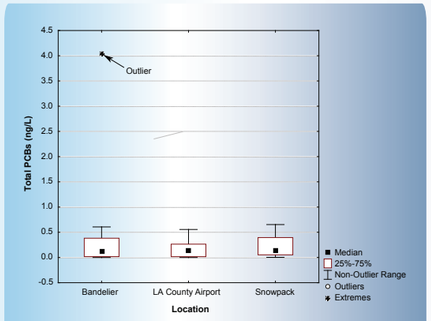

Figure 2. Box plot of total PCB concentrations in precipitation and snowpack samples collected in northern New Mexico

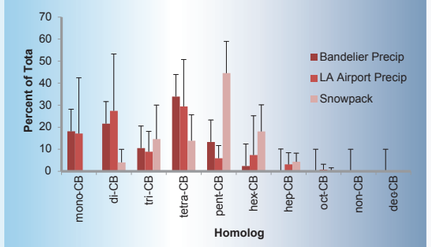

Figure 3. PCB homolog distribution in precipitation

Baseline Stormwater PCBs

Sampling locations were selected to avoid areas of any known contamination and to provide reasonable estimates of baseline concentrations, including a wide variety of bedrock source areas and sediment textures. Surface water samples were collected from two primary groups of locations: tributaries that enter the LANL's western boundary and tributaries in a remote area north of the community of Los Alamos (Figure 1). The results are shown in Figures 4 and 5. Table 1 shows a statistical analysis of these data.

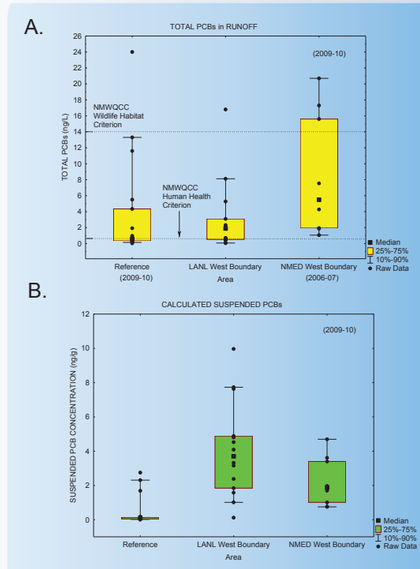

Figure 4. Box plots of (A) total and (B) suspended PCB concentrations in baseline runoff Reference Watersheds and Western Boundary locations (see location map; Figure 1).

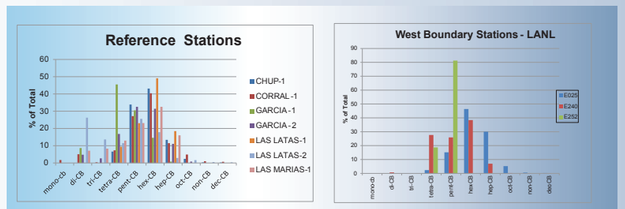

Figure 5. Homolog plots of (A) PCBs at Reference locations and (B) Western Boundary stations LANL results. Note (1) lighter homologs characteristic of Reference Watershed stations (bimodal distribution) with more of a precipitation signature (see Figure 2) and (2) higher chlorinated homologs in the Western Boundary stations.

	Median (ng/L)	UTL (ng/L)	Max Conc. (ng/L)	Percentage of Results Greater Than NM Health Standard (0.64 ng/L)	Percentage of Results Greater Than NM Wildlife Standard (14 ng/L)
Precipitation	0.12	0.68	0.61	0	0
Snowpack	0.14	0.7	0.65	8	0
Rio Grande/Rio Chama					
• Base flow	0.01	—	1.36	6	0
• Stormwater (runoff)	0.24	—	51.4	39	3
Northern NM Tributaries Stormwater	5.5	24	30.6	91	22
Baseline Pajarito Plateau Stormwater					
• Reference sites (flows originating on Plateau)	0.4	11.7	11.6	28	0
• Western Boundary sites (flows originating on Jemez Mountains)	2.1	19.5	20.7	78	17
• Combined	0.97	13	20.7	56	10
Urban Runoff Los Alamos Townsite	12	98	144	98	46

Table 1. Statistical analysis of NMED and LANL PCB study. Note select outliers were excluded from the data set according to accepted environmental statistical practices. See full report for details.

Urban Stormwater Runoff PCBs

Stormwater samples were collected in the townsite to measure PCB concentrations in locations representing storm runoff from a relatively small urban environment. Samplers were placed in ephemeral tributary channels around the edge of the urban development; no urban runoff samplers were placed below any known areas of concentrated contamination. A majority of samplers were located to collect stormwater samples from housing developments, schools, and a golf course. In addition to monitoring the townsite perimeter, sampling was also conducted in drainage channels downstream from LANL administrative offices (Figure 1). The results are shown below in Figure 6. Table 1 shows statistical analysis of the data.

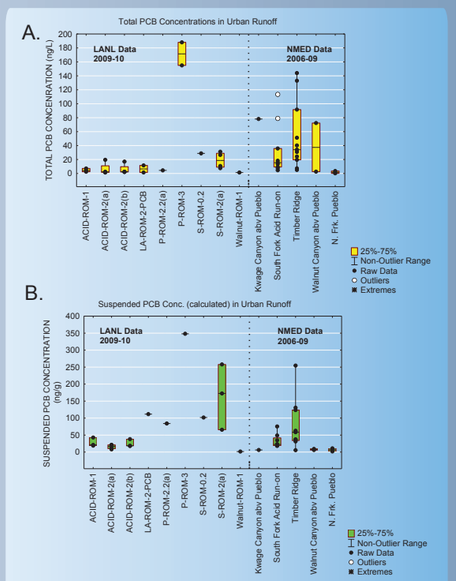

Figure 6. Box plot of (A) total and (B) suspended PCB concentrations in Los Alamos County and LANL urban runoff (see location map; Figure 1).

Conclusion

PCB concentrations in precipitation are almost always below the WQC human health criterion of 0.64 ng/L; the calculated upper tolerance limit (UTL) is 0.68 ng/L. Combined baseline results from Reference Watershed and Western Boundary stations show more than half the results are greater than the human health criterion and have a calculated UTL of 13 ng/L, just below the wildlife standard of 14 ng/L, suggesting the human health criterion may not be attainable in many circumstances. Also, the results from developed urban landscapes show exceedance of the human health criterion 98% of the time and a calculated UTL of 98 ng/L, several times higher than the wildlife standard (Table 1).