

Use of Congener Homologs to Evaluate PCBs in the Rio Grande Near Los Alamos National Laboratory, New Mexico

RENEAU, Steven L.¹, DRAKOS, Paul G.², and SCHULTZ-FELLENZ, Emily S.¹; ¹EES-16, MS D452, Los Alamos National Laboratory, Los Alamos, NM, 87545, sreneau@lanl.gov; ²Glorieta Geoscience, Inc., 1723 Second Street, Santa Fe, NM, 87505

Polychlorinated biphenyls (PCBs) are a class of organic chemicals that had widespread use in electrical transformers and other industrial applications. Although production in the U.S. was stopped in 1977 because of environmental concerns, PCBs are persistent in the environment and present risks to human health and ecosystems in many areas. The New Mexico Department of Game and Fish has issued fish advisories in the Rio Grande both upriver and downriver of Los Alamos National Laboratory (LANL), as well as in Abiquiu and Cochiti Reservoirs, because of elevated PCB concentrations in fish. The New Mexico Environment Department has also required LANL to implement mitigation actions in the Los Alamos Canyon watershed because of elevated PCB concentrations measured in storm water runoff in this watershed.

PCBs have a strong affinity for sediment and organic matter, adsorbing onto particles and being transported in the suspended load of streams. PCBs include 209 *congeners* that are distinguished based on the number and arrangement of chlorine atoms on the biphenyl rings. These congeners can in turn be grouped into 10 *homologs* based on the number of chlorine atoms. Variations in the percentage of these 10 homologs in samples of environmental media can be used to compare samples and evaluate similarities or differences in possible sources for PCBs.

In 2008 and 2009, we sampled recent sediment deposits along the Rio Grande upriver and downriver from Los Alamos Canyon and other canyons draining LANL to help evaluate sources and concentrations of PCBs in the river. These samples were collected during November-December low-water conditions, and included a range of particle size and geomorphic settings in each sample area (e.g., high-water deposits from snowmelt runoff and slackwater deposits representing late-season flows). Sediment samples were also collected from four areas within the Los Alamos Canyon watershed, which includes the primary potential LANL sources of PCBs reaching the Rio Grande, to allow comparison with homolog signatures along the river.

The sediment samples from the Rio Grande show that the homolog signatures in each area vary between sampled layers, indicating variability in the sources of sediment and associated PCBs in each depositional event. The 2008 samples, on average, also differ from the 2009 samples, indicating variability in sources between the two years. However, the average homolog signatures from each sample area in each year are generally similar above and below Los Alamos Canyon, but differ from the signatures in sediment samples collected in the Los Alamos Canyon watershed. This indicates that, based on homolog patterns, there are no recognizable LANL contributions to PCBs in the Rio Grande from the Los Alamos Canyon watershed.

Data on PCB concentrations in sediment can be compared with estimates of sediment flux to estimate average annual PCB flux in the Rio Grande and in lower Los Alamos Canyon. Use of the average PCB concentration along the Rio Grande at Otowi Bridge (0.000076 mg/kg) and the average annual suspended sediment flux (2,100,000 Mg/yr) yields an estimated PCB flux of 0.16 kg/yr. In lower Los Alamos Canyon, the average PCB concentration of 0.0026 mg/kg and the estimated average suspended sediment flux of 2000 Mg/yr yield a PCB flux of 0.005 kg/yr, or 3% of the total in the Rio Grande. These flux estimates, although preliminary, support the interpretation based on homolog signatures that Los Alamos Canyon is a minor contributor to PCBs in the Rio Grande.