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Project Summary

Ambient Monitoring for PCB Near Three Landfills in the Bloomington, Indiana Area

D. L. Sgontz and J. E. Howes, Jr.

A monitoring program was conducted to determine PCB levels in ambient air on and in the vicinity of three landfills in the Bloomington, Indiana area. Fixed-height measurements were made at locations on the sites where capacitors containing PCB were exposed and at nominally upwind and downwind locations. Vertical PCB concentration profiles were also obtained at five elevations above selected hot spots. Sampling was performed over 8-hour daytime periods (approximately 0900-1700 hours) and over 24-hour periods at various on- and off-site locations. Polyurethane foam (PUF) cartridges used either with DuPont personal-type sampling pumps or EPA-developed high volume samplers were used for collection of PCB from the ambient air. At Neal's Landfill, airborne PCB concentrations measured 180 cm above five hot spots during 8-hour daytime sampling periods, ranged from 0.4 to 18 μg/scm. PCB levels observed along the downwind perimeter of the site ranged from 0.2 to 1.8 μg/scm. Upwind PCB concentrations measured during the 4-day monitoring period ranged from <0.05 to 0.1 μg/scm. Ambient air PCB concentrations measured at 180 cm above two hot spots on Neal's Dump during 8-hour daytime periods ranged from 0.6 to 19 μg/scm. Over the 3-day monitoring period, PCB levels determined near residences adjacent to the site ranged from <0.04 to 0.2 μg/scm. At Lemon Lane Landfill, ambient air PCB levels measured at 180 cm above three hot spots during 8-hour daytime sampling periods ranged from 6 to 193 μg/scm. Over the 4-day monitoring period, upwind airborne PCB concentrations were fairly constant at approximately 0.05 μg/scm and levels measured downwind of the landfill ranged from 0.3 to 0.8 μg/scm. Generally, the airborne PCB levels measured at hot spots on the landfills appear to be correlated with the quantity of exposed capacitors, i.e., those visible at or above ground level. PCB emission rates and thus airborne levels were probably maximized by the unseasonably warm, dry weather which prevailed throughout the field study period.

This Project Summary was developed by EPA's Environmental Monitoring Systems Laboratory, Research Triangle Park, NC, to announce key findings of the research project that is fully documented in a separate report of the same title (see Project Report ordering information at back).

Introduction

Three landfills in the Bloomington, Indiana, area have been used for disposal of capacitors containing polychlorinated biphenyls (PCBs). The landfill sites are identified as: Neal's Landfill, Neal's Dump, and Lemon Lane Landfill. Visual surveys of these sites have indicated several areas where capacitors are visible at or above ground level. In most of these areas, leakage of the capacitors is suspected due to apparent wetting of the soil and damage to the surrounding vegetation. As a consequence of the leakage, PCBs may be emitted, thus creating an air pollution problem.

During June and July 1983, a field program was conducted to monitor PCB levels in the ambient air at selected locations on and surrounding the three landfill areas. Airborne PCB measurements on the sites were performed at localized areas (hot spots) where leaking capacitors were evident. Measurements were made at locations in the vicinity of the sites to determine upwind background levels and downwind emission levels. Three types of samples were obtained during the study to measure ambient air concentrations and emission patterns. All sampling was performed with systems which employed polyurethane foam (PUF) cartridges for collection of PCBs from the ambient air. (a) Battery-operated, personal-type pumps were used to sample during 8-hour daytime periods at a fixed height above hot spots and at upwind locations. (b) EPA high-volume systems were used to sample for 8- and 24-hour periods at hot spots and upwind and downwind points. (c) Arrays of five battery-operated sampling systems operated at different heights above ground level were used to determine the vertical concentration profiles at hot spot areas during 8-hour daytime periods. The quantity of PCBs collected in the PUF cartridges during sampling was determined by extraction and analysis of the extract by electron-capture gas chromatography using EPA Method 608. Meteorological conditions (wind speed and direction, temperature, and relative humidity) were monitored during sampling at the sites to assist in interpretation of the PCB measurements.

This study was conducted to provide EPA Region V with data on background airborne levels and the magnitude and distribution of PCB emissions into the atmosphere on and around the three landfill areas. EPA Region V will use results to assess the impact of the PCB emissions from the landfills on the public welfare and to determine the need for remedial action to reduce the emissions into the environment.

Experimental

Sampling Procedures

Three different sampling procedures, i.e., (a) low-volume, (b) vertical profile, and (c) high-volume were used to measure ambient air PCB concentrations and emission patterns on and in the vicinity of the landfill sites.

DuPont P-4000A battery-operated, low volume samplers (flow rate ~3.8 L/min) were used to sample the ambient air at hot spots on the landfill sites and at upwind locations. The samplers were positioned with inlets of the PUF cartridges at 1.8 m above ground level. Sampling at hots spots was performed immediately downwind of the hot spot area over 8-hr daytime periods from approximately 0900 to 1700 hrs CDT.

Measurements of the vertical PCB concentration profiles were performed with a vertical array of five DuPont low volume samplers. The array was positioned directly over a hot spot area with inlets of the PUF cartridges at 2, 30, 60, 120, and 180 cm above ground level. Sampling was performed for 8-hr periods from approximately 0900 to 1700 hrs CDT.

EPA high volume systems (flow rate ~8 cfm) were used to collect 8- or 24-hr samples upwind of the sites, at hot spots on the sites, and along the downwind perimeter of the sites. The EPA samplers were situated with the inlets approximately 1.2 m above ground level and were located, to the extent possible, in areas where air flow was unrestricted in the windward direction.

At hot spots, the high volume samplers were positioned immediately downwind of the hot spot area. Eight-hour samples were collected concurrently with the low volume samples, i.e., during sampling periods from approximately 0900 to 1700 CDT. The 24-hr samples were collected from approximately 0800 hr to 0800 hr the following day.

Analysis Procedures

Analysis for PCBs in the PUF cartridges (and high volume filters) was performed according to the procedure described in the EPA Manual of Analytical Methods. The steps in the analysis procedure included: (a) Soxhlet extraction of the foam plugs (and filters in the case of high volume samplers) with 5 percent ether in hexane; (b) concentration of the extract to 1 mL and; (c) determination of PCBs in an aliquot of the extract by electron capture-gas chromatography using EPA Method 608. These analyses were performed by Southwest Research Institute.

Meteorological Measurements

Continuous measurements of wind speed, wind direction, and ambient temperature were performed with Meteorological Research, Inc. (MRI) portable weather stations. One unit was located at Neal's Landfill during the entire study. A second unit was used to collect meteorological data at Neal's Dump and Lemon Lane Landfill during the PCB monitoring periods at these sites. Strip chart data from the meteorological systems were manually reduced to obtain hourly averages. Relative humidity data were obtained from wet- and dry-bulb temperature measurements made periodically during daytime sampling periods.

Results and Discussion

The monitoring results from the low volume sampling show that PCBs are being introduced into the atmosphere from leaking capacitors at each of the three landfills. Generally, the airborne levels measured at hot spots on the sites appear to correlate with the number of exposed, leaking capacitors. The highest PCB concentrations in ambient air were found on Lemon Lane Landfill. At This site, levels measured in three different areas with exposed capacitors during 8-hour daytime periods ranged from 6 to 193 μg/scm. The highest values (40 to 193 μg/scm) were observed immediately above the large bank of exposed capacitors along the south end of the site. PCB levels measured by low volume sampling at the five hot spots on Neal's Landfill during 8-hour daytime periods ranged from 0.4 to 20 μg/scm. At Neal's Dump, PCB concentrations detected at two hot spots during 8-hour daytime monitoring with low volume samplers ranged from 0.6 to 19 μg/scm.

PCB emissions from leaking capacitors were also detected in the ambient air downwind from the landfill areas. At Neal's Landfill, PCB concentrations measured at four downwind locations ranged from 0.2 to 1.8 μg/scm with the highest values being observed at the locations closest (~12-30 m) and most directly downwind of the hot spots. During the monitoring period, PCB levels measured at a location upwind of Neal's Landfill were $\leq$0.1 μg/scm. The PCB levels found at two locations downwind of Lemon Lane Landfill ranged from 0.3 to 0.8 μg/scm. The downwind sampling locations were approximately 0.3 to 0.4 km from the hot spots on the landfill. Background PCB concentrations measured upwind of Lemon Lane Landfill were $\leq$ 0.1 μg/scm. PCB levels determined at locations designated upwind and downwind of Neal's Dump did not show a significant difference. However, the samplers could not be placed at the optimum upwind/downwind locations due to unavailability of electrical power and to interference from the heavily

wooded area nominally downwind of the landfill.

At Neal's Landfill and Lemon Lane Landfill, measurements were performed to determine the vertical distribution of PCBs in the air above hot spots. PCB concentrations measured at a 2 cm elevation above hot spots at the two sites ranged from 367 to 1108 μg/scm with a median of 804 μg/scm. The median concentration at 180 cm elevation was 11 μg/scm, seven times lower than at the 2 cm height. Variations in the vertical concentration profiles at a given location are probably due primarily to wind conditions since the ambient temperatures were fairly uniform throughout the various sampling days.

In general, the procedures and equipment used for the PCB monitoring performed very satisfactorily and, based on the QC/QA data, appear to have provided high quality results. Data recovery for measurements made with the low volume sampling systems was 95 percent and for the high volume sampler measurements the data recovery was 76 percent. Data loss with the high volume sampling systems was due primarily to failure of high volume sampler motors and the motor generator units. Replacement of the motor in the high volume sampler with a by-pass type would significantly increase the reliability of the high volume sampling system.

Weather during the entire period that the PCB monitoring was performed was unseasonably warm and dry. Daily high temperatures during the sampling at Neal's Landfill and Neal's Dump on June 29 and 30 were about 32°C (90°F). During the period July 12 through 21, high temperatures on days that sampling was performed were at or in excess of 38°C (100°F). There was no rainfall on any sampling day nor very little precipitation during the interim periods. The results obtained from this study probably represents "upper limit" estimates of the airborne PCB levels.

Conclusions

(a) PCB levels measured at hot spots on the landfills exceeded upwind background levels, thus indicating that PCBs from the leaking capacitors are being emitted into the air.

(b) Based on measurements at hot spots, it appears that PCB emission levels are generally correlated with the number of exposed, leaking capacitors. In general, higher concentrations were measured at locations where more capacitors were visible at or above ground level.

(c) PCB concentrations which exceeded background (upwind) levels were observed at sampling locations downwind of the landfills.

(d) Airborne PCB concentrations above hot spots vary with height; levels at 2 cm above ground level are from 40 to 100 times higher than the levels at an elevation of 180 cm.

(e) Unseasonably warm, dry weather that prevailed during the monitoring program probably maximized PCB emissions. Thus, levels observed during this study may represent "upper limit" values.

(f) The methodology employed to measure PCB levels in the ambient air performed well. Quality assurance data gathered during the study demonstrates that both the low and high volume methods yielded reliable, reproducible data and that comparable results are obtained by the two methods.

D. L. Sgontz and J. E. Howes, Jr. are with Battelle's Columbus Laboratories, Columbus, OH 43201.
***Barry E. Martin** is the EPA Project Officer (see below).*
The complete report, entitled "Ambient Monitoring for PCB Near Three Landfills in the Bloomington, Indiana Area," (Order No. PB 85-233 492/AS; Cost: $14.50, subject to change) will be available only from:
National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161
Telephone: 703-487-4650
The EPA Project Officer can be contacted at:
Environmental Monitoring Systems Laboratory
U.S. Environmental Protection Agency
Research Triangle Park, NC 27711

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