00003705

United States Environmental Protection Agency

Office of Air Quality Planning and Standards
Research Triangle Park NC 27711

EPA-450/3-78-031
June 1978

Air

EPA

Assessment of Human Exposures to Atmospheric Benzene

Final

PENGAD-Bayonne, N.J.
PLAINTIFF'S EXHIBIT
830

Re
Ambient Air
Benzene
Concentration

This report is being circulated by Technical Literature Section. If you know of someone else who should see this report, please write that person's initials on a piece of paper, insert it in the book pocket and return the report to TLS. We will continue circulation.

DO NOT give this report directly to someone else.

DO NOT write anyone's initials on the cover of this report.

In the absence of adequate atsospheric monitoring data, dispersion modeling was undertaken to provide approximate estimates of benzene concentrations in the vicinity of specific locations. Chapters III through V describe dispersion modeling analysis and results for three benzene point sources. In Chapter VIII, the Hanna-Gifford dispersion equation was used to estimate average annual benzene concentrations in suburban areas (see Table VIII-5). If a background concentration of *0.5* ppb is included, the estimated concentrations ranged from 0.73 to *2.0* ppb for suburban areas in six large cities and appear to be reasonably close to the suburban values found in Battelle's atmospheric monitoring study (see Table X-5).

The highest benzene concentrations determined by dispersion modeling for a short period were estimated in the vicinity of major intersections. As shown in Table X-8, 8-hour average concentrations ranged from 12 to 28 ppb. Annual average benzene concentrations, however, are similar to tnosa messured by Battelle along a major commuting arterial (Site 2 on Table X-5).

The selected benzene exposure settings for determining total exposure are shown in Table X-9. These estimates represent a combination of the best nonitoring and modeling data available to date and our best judgment. Although limitations may be involved in using dispersion modeling data in conjunction with monitoring data, the methodology employed in this type of analysis does provide a more realistic evaluation of total exposure to an individual.

Several additional studies are worth noting. A recent study by Messer Associates, fnc., for the U.S. Department of Transportation (1977) analyzed the health effects of bicycling in an urban environment by studying 10 male subjects bicycling or driving through the streets of Washington, D.C., under systematically varied conditions. No major adverse short-term effects were noted, but the carboxyhemoglobin (COHb) levels measured for the motorist controls were slightly higher than those for the bicyclists. The authors theorized (1) that the carbon monoxide (CO) encountered in traffic slow-downs and intersection delays may have may, to a large extent, explain why the sampling stations on that side registered lower readings.

As discussed in Chapter VIII, most of the limited atmospheric monitoring data have been collected in the vicinity of urban areas. Robinson et al. (1973) reported the results of studies measuring hydrocarbon concentrations in the nonurban atmosphere. The measurements taken in the continental United States are s[illegible] Table X-7. They range from 0.3 to 1.1 ppb, with an average of 0.7 ppb. These results appear to be consistent with the widespread nature of benzene emissions and benzene's low atmospheric reactivity.

Radian Corporation (1978) monitored ambient benzene in Burnet, Texas, (a rural community) for Shell Oil Corporation. Three 24-hour samples were collected on consecutive days under variable meteorologic conditions. Complete quality control information was unavailable for these data. Measured benzene concentrations ranged from 3 to 4 ppb. The measurements are not consistent with others taken in remote areas. No explanation was offered for these results.

Table X-7

BENZENE CONCENTRATIONS IN REMOTE AIR SAMPLES FROM THE CONTINENTAL UNITED STATES

State	Location	Date	Benzene Concentration (ppb)
California	Point Reyes	12/9/71	0.3
Idaho	Hells Canyon	11/6/71	
	Sample 1		0.8
	Sample 2		0.8
idaho	Moscow Mountain	7/16/71	
	Ground		0.9
	Airborne		0.8
Vermont	Camel's Hump	9/8/71	1.1
Washington	Brethway-Gunderson	8/4/71	
	Ground		0.4
	Airborne		0.5

Source: Washington State University (1971) as cited in Robinson et al. (1973).

ESTIMATES OF ANNUAL AVERAGE BENZENE CONCENTRATIONS IN FOUR URBAN AREAS

City	10^9 Vehicle Miles Traveled	Registered Automobiles	Land Area (10^8 m^2)	Q_{evap} (10^{-9} g/s m^2)	Q_{tail} (10^{-9} g/s m^2)	Q_T (10^{-9} g/s m^2)	Average Annual Wind Speed (m/s)	Benzene Concentration ($\mu g/m^3$)	Benzene Concentration (ppb)
Dallas									
City	6.14	619,684	6.9	5.08	62.2	67.3	5	3.03	.95
Suburbs	5.36	540,786	43.0	.719	8.80	9.52		0.43	.13
Los Angeles									
City	10.2	2,044,203	12.0	9.63	59.3	68.9	2	7.75	2.4
Suburbs	21.5	4,299,073	54.0	4.53	28.0	32.5		3.66	1.1
St Louis									
City	2.86	378,280	1.[illegible]	13.5	126.0	1[illegible]0.0	4	7.88	2.5
Suburbs	7.71	1,020,219	61.0	.944	8.80	9.[illegible]		0.55	.17
Chicago									
City	18.8	1,860,292	5.8	18.2	227.0	[illegible]45.0	[illegible]	13.78	4.3
Suburbs	23.5	2,327,206	[illegible]8.0	1.49	18.6	20.1		1.13	.35

*1976 projection.

Q_{evap} = Evaporative emissions from automobiles.

Q_{tail} = Tailpipe emissions from automobiles.

Q_T = Total automobile emissions

Source: Schewe. 1977