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John L. Bove<sup>a</sup>; Paul Dalven<sup>ab</sup>; Ved P. Kukreja<sup>ac</sup>

<sup>a</sup> Department of Chemistry, The Cooper Union, New York, New York, U.S.A. <sup>b</sup> School of Applied Science Columbia Univ., NYC <sup>c</sup> Environmental Trace Substances Research Center, University of Missouri, Columbia, Missouri

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# Airborne di-Butyl and di-(2-Ethylhexyl)-phthalate at Three New York City Air Sampling Stations

JOHN L. BOVE, PAUL DALVENT† and VED P. KUKREJA‡

*Department of Chemistry, The Cooper Union, 51 Astor Place, New York, New York 10003, U.S.A.*

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Since some phthalate esters may be teratogenic, it is important that ambient concentrations of these compounds should be established for proper medical evaluation.

The 1975 yearly average concentrations of di-butyl phthalate at three air sampling stations in New York City (Queens, Brooklyn and Staten Island) were 3.73, 5.69 and 3.28 nanograms per cubic meter respectively. The yearly average concentrations of di(2-ethylhexyl)-phthalate for the same period at the corresponding stations were 10.20, 16.79 and 14.20 nanograms per cubic meter respectively. The data were obtained by a G.C.-M.S. technique.

KEY WORDS: Phthalate esters, air pollutants.

## INTRODUCTION

The possible teratogenicity of some phthalate esters has been reported.<sup>1</sup> In a later study Metcalf *et al.*<sup>2</sup> reported that "the biomagnification of DEHP together with its teratogenic properties and its enormous rate of production and ubiquitous use indicate the need for much further study of its environmental distribution and fate. Present data suggest the need for restrictions on the use and waste disposal of DEHP". It has been estimated that 900 million pounds of esters of phthalic acid are manufactured each year in the United States,<sup>3</sup> and, with their widespread use (from plasticizers to

†Present address: School of Applied Science, Columbia Univ., NYC.

‡Present address: Environmental Trace Substances Research Center, University of Missouri, Columbia, Missouri.

speciality chemical agents), it is no wonder that growing interest is focused on the impact phthalates may have on our health. Little information is now available characterizing their environmental movement. In one study<sup>4</sup> researchers using computerized gas chromatography/mass spectrometry reported levels of  $0.88$  to  $1.9 \times 10^{-9}$  gram/gram in the Charles River of Boston, while in another study<sup>5</sup> an investigator using gas chromatography analyzed samples from another body of water and found concentrations of  $600 \times 10^{-9}$  gram/gram for di-(2-ethylhexyl) phthalate (DEHP).

While investigating the fate of some airborne organic compounds in New York City air, we had occasion to analyze samples collected over a one year period (January to December 1975) at three New York City aerometric sampling stations (the Tilden High School Station, Brooklyn, the Seaview Hospital Station, Staten Island, and the Andrew Jackson High School Station, Queens). In addition, three long term high volume samples collected at Sterling Forest, New York (supplied by the New York University Environmental Medicine Laboratory) were analyzed for both di-butyl and di-(2-ethylhexyl) phthalate. These values from the Sterling Forest site were used as comparisons to the City values found in the three boroughs.

## EXPERIMENTAL

The soiled glass fiber filters ( $8'' \times 10''$ ) were placed into a Soxhlet extractor along with 125–150 ml of benzene (Burdick Jackson) and refluxed for 6 hours.<sup>6</sup> The extracts were filtered through a fritted-glass Buchner funnel (ASTM 10–20), and the benzene removed using an all-glass rotary evaporator. The residues were transferred to 10 ml vials with the aid of methylene chloride (Burdick Jackson), and the solvent finally removed by passing a stream of filtered, dry nitrogen over the warmed solution. After adding a measured quantity of internal standard to the resulting residues, the analyses were accomplished with GC/MS coupled with a dedicated mini-computer data system. Recognizing the ubiquitous presence of phthalate ester in many laboratories, care was taken to account for the small analytical blanks from all analyses.

## RESULTS AND DISCUSSION

Pollutant results for the New York City stations analyzed are summarized in Table I. This tabulates and compares the monthly values at the Queens (Sector 23), Brooklyn (sector 27), and the Staten Island (sector 34) sampling stations for total suspended particulate matter (TSPM), the di-butyl and di-(2-ethylhexyl) phthalate (DBP and DEHP respectively), and the benzene extractable organics (BEO). The yearly average concentrations of DBP at

TABLE I

1975 Monthly Average Concentrations of Total Suspended Particulate Matter (TSPM), di-Butyl and di-(2-Ethylhexyl)-phthalate (DBP and DEHP), and Benzene Extractable Organics (BEO) at the Andrew Jackson High School Station (Sector 23<sup>a</sup>), the Tilden High School Station (Sector 27<sup>b</sup>), and the Seaview Hospital Station (Sector 34<sup>c</sup>)

MONTH	TSPM(d) Micrograms/m <sup>3</sup>			DBP(e)			DEHP(e)			BEO		
	Sector	Sector	Sector	Sector	Sector	Sector	Sector	Sector	Sector	Sector	Sector	
	23	27	34	23	27	34	23	27	34	23	27	34
January	85.43	59.52	63.71	4.90	4.93	3.87	10.89	11.96	18.58	3.87	3.08	4.15
February	NDA	61.21	NDA	NDA	8.49	NDA	NDA	15.41	NDA	NDA	4.13	NDA
March	47.39	52.71	56.63	2.93	5.03	4.33	10.91	12.30	13.06	1.76	2.56	2.54
April	53.42	70.31	65.72	3.00	4.84	2.72	4.93	12.48	13.50	1.88	2.96	2.54
May	NDA	89.38	68.58	NDA	3.17	2.22	NDA	14.72	12.23	NDA	3.89	2.67
June	NDA	67.28	67.25	NDA	1.99	1.80	NDA	10.06	11.02	NDA	2.39	2.06
July	NDA	74.41	56.97	NDA	3.48	0.14	NDA	14.05	8.96	NDA	3.84	1.63
August	NDA	63.51	55.34	NDA	5.00	1.80	NDA	15.48	13.58	NDA	3.45	1.87
September	57.19	54.74	51.67	4.40	4.79	7.38	8.81	17.93	12.15	1.43	3.04	3.26
October	98.78	73.65	73.64	2.98	10.28	2.81	12.15	28.60	22.15	3.98	5.24	3.53
November	69.53	65.69	79.74	4.15	5.31	5.69	13.52	23.24	16.76	3.79	5.01	3.56
December	NDA	57.96	NDA	NDA	10.99	NDA	NDA	25.30	NDA	NDA	5.66	NDA

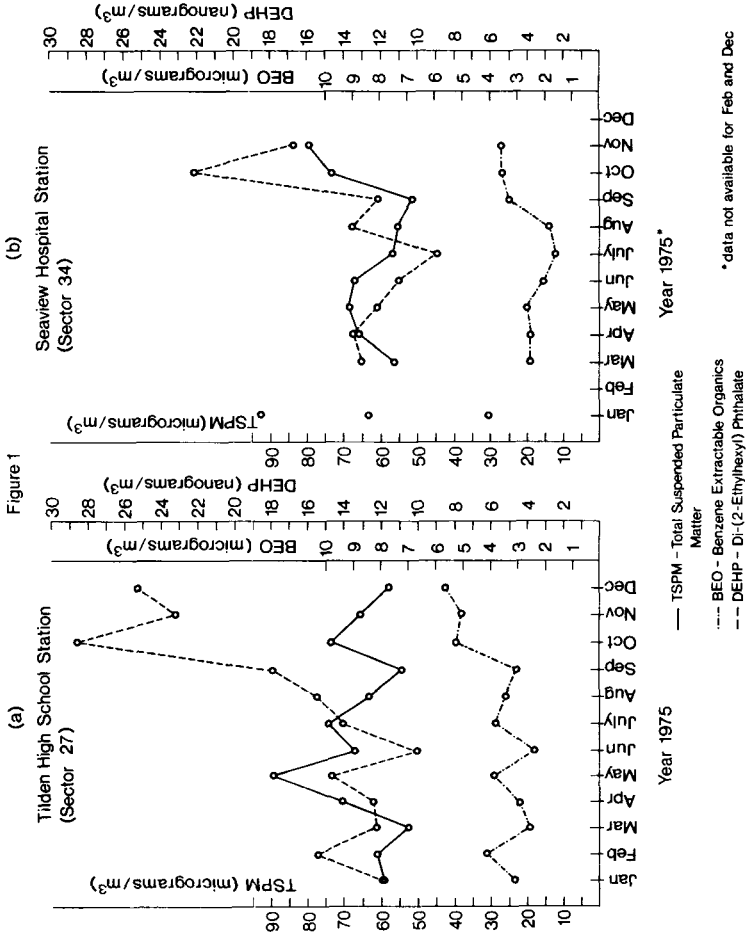
a) Analytical data based on 16 available samples

b) Analytical data based on 74 available samples

c) Analytical data based on 138 available samples

d) TSPM data were provided by the New York City Department of Air Resources

e) The analytical blanks were subtracted from the reported values



stations 23, 27 and 34 for 1975 were 3.73, 5.69 and 3.28 nanograms per cubic meter respectively. The yearly average concentrations for DEHP for the same period at the corresponding stations were 10.20, 16.79 and 14.20 nanograms per cubic meter respectively. Average concentrations for both phthalate esters are slightly higher at the Brooklyn sampling station (sector 27) than at the other two stations sampled. Part of this difference may be due to number of samples available for analysis (138 samples were available at station 27, 74 at station 34, and only 16 at station 23), and part of the difference might be attributed to other factors related to City sources of phthalates.†

When concentrations of DEHP, TSPM and BEO were plotted against time for stations 27 and 34‡ the three pollutants seem to track each other. At both stations (27 and 34) the DEHP values peaked appreciably for the month of October. This maximum in the monthly values seems to indicate some DEHP related activity for October in the City, however, no explanation for this phenomenon is apparent at this time. These results are shown in Figure 1.

Analyses of three long-term high volume samples collected at Sterling Forest, New York showed extremely low values of both DBP and DEHP—samples collected over the periods 9/5/74–10/3/74, 11/15/74–12/3/74, and 12/15/74–3/21/75 gave values of 0.36 and 2.15, 1.72 and 4.14, and 1.3 and 2.10 nanograms/m<sup>3</sup> for DBP and DEHP respectively. The finding of high urban and low suburban values indicates that the two pollutants (DBP and DEHP) are probably associated with the activities characteristic of city living.

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†The analyses of several stack samples at the Brooklyn Greenpoint Municipal Incinerator indicates large amounts of DEHP and smaller amounts of DBP. These phthalate esters are present because they escape the fate of incineration.

‡Data for station 23 was not included in the concentration/time plot because of the paucity of data.

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