

**REPORT
ON
LEACHING EXPERIMENT
OF
PLASTIC MATERIALS**

PREPARED BY:
EMANUEL HOROWITZ, Ph.D
14100 NORTH GATE DRIVE
SILVER SPRING, MD 20906

FEBRUARY 21, 1997

PURPOSE:

The objective of the leaching experiment was to determine if heavy metals; Cadmium (Cd), Lead (Pb), Mercury (Hg) and Barium (Ba), were extracted from the plastic materials listed in Table 1 after being separately immersed in distilled water and 50%V (by volume) ethyl alcohol for six months at room temperature

PROCEDURE:

Samples of plastics were conditioned to constant weight at room temperature, placed in individual labeled glass jars containing 250 milliliters of solvent (distilled water or 50%v ethyl alcohol), sealed and were allowed to remain undisturbed for six months. There were sixteen jars in this experiment, eight contained distilled water ("A" samples) and eight contained 50%v ethyl alcohol ("B" samples).

After six months the plastic samples were individually removed from the jars. The jars were again sealed and submitted to the Analytical Chemistry Laboratory at Artech Testing, L.L.C., 14554 Lee Road, Chantilly, VA 20151-1639 (Tel .703-378-7263). The liquid in each jar was analyzed for Cadmium (Cd), Lead (Pb), Mercury (Hg) and Barium (Ba). In addition, samples taken from the original solvents used in this experiment, distilled water and ethyl alcohol (100% or 200 proof) were analyzed for Cadmium, Lead, Mercury and Barium.

All liquid samples were analyzed by atomic absorption spectroscopy (AAS) using a Buck Model 200A instrument. A single injection into a cold vapor accessory was used for the Mercury determination. Mercury was measured in accordance with the EPA Method 7470A which has a detection limit of 0.2 micrograms per liter (ppb). The EPA Method 7130, with a detection limit of 5 micrograms per liter (ppb) was used in the analysis for Cadmium. The analysis for Lead was conducted in accordance with the EPA Method 7420 which has a detection limit of 100

micrograms per liter (ppb). Barium was analyzed in accordance with EPA Method 7080A which has a detection limit of 100 micrograms per liter (ppb).

RESULTS

None of the metals were present in any of the submitted liquid samples or in the original solvents at or above the detection limit.

DISCUSSION

The EPA maximum allowable concentrations for drinking water for the metals, Cadmium, Lead, Mercury and Barium, are listed below:

	<u>REGULATORY LEVEL*</u> <u>MILLIGRAMS PER LITER mg/L (ppm)</u>
Cadmium	1.0
Lead	5.0
Mercury	0.2
Barium	100.0

None of these metals was found to be present at the parts per million (ppm) level in the samples analyzed. This is the regulatory level specified by EPA. In fact, none of these metals were found to be present at the limits of detection of the EPA Methods which were at the parts per billion (ppb) level. These limits, for each of the metals discussed, are listed below:

	<u>EPA METHOD DETECTION LIMIT</u> <u>MICROGRAMS PER LITER, mc/L (ppb)</u>
Cadmium	5
Lead	100
Mercury	0.2
Barium	100

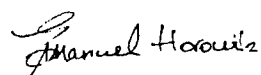
· Table 7-1: Maximum Concentration of Contaminants for Toxicity Characteristic. Revision 2, September 1994, pp. 17-18.

Conclusion

After soaking at room temperature, in distilled water or 50%v ethyl alcohol for six months in a sealed glass jar, no Cadmium, Lead, Mercury or Barium was extracted from the plastic samples listed in Table 1 as determined by the prescribed EPA analytical methodology, down to the detection limits at the parts per billion (ppb) level.

The report from the Analytical Chemistry Laboratory, including the analytical results for each of the liquid samples analyzed as well as the two original solvents used in the experiment, is attached.

Prepared By:

A handwritten signature in cursive script, appearing to read "Emanuel Horowitz".

Emanuel Horowitz, Ph.D.

TABLE 1.

SAMPLE IDENTIFICATION

<u>SAMPLE</u>	<u>LEACHING SOLVENT</u>
1A: Flexite Supreme	Distilled Water
1A: Flexite Supreme	Distilled Water
3B: Flexite Supreme	50%v Ethyl Alcohol
4B: Flexite Supreme	50%v Ethyl Alcohol
5A: Flexite +	Distilled Water
6A: Flexite +	Distilled Water
7B: Flexite +	50%v Ethyl Alcohol
8B: Flexite +	50%v Ethyl Alcohol
9A: Flexite MP	Distilled Water
10A: Flexite MP	Distilled Water
11B: Flexite MP	50%v Ethyl Alcohol
12B: Flexite MP	50%v Ethyl Alcohol
13A: North Therm	Distilled Water
14B: North Therm	Distilled Water
15B: North Therm	50%v Ethyl Alcohol
16B: North Therm	50%v Ethyl Alcohol

TABLE 7-1.

MAXIMUM CONCENTRATION OF CONTAMINANTS FOR TOXICITY CHARACTERISTIC

Contaminant	Regulatory Level (mg/L)
Arsenic	5.0
Barium	100.0
Benzene	0.5
Cadmium	1.0
Carbon tetrachloride	0.5
Chlordane	0.03
Chlorobenzene	100.0
Chloroform	6.0
Chromium	5.0
o-Cresol	200.0 ¹
m-Cresol	200.0 ¹
p-Cresol	200.0 ¹
Cresol	200.0 ¹
2,4-D	10.0
1,4-Dichlorobenzene	7.5
1,2-Dichloroethane	0.5
1,1-Dichloroethylene	0.7
2,4-Dinitrotoluene	0.13 ²
Endrin	0.02
Heptachlor (and its hydroxide)	0.008
Hexachlorobenzene	0.13 ²
Hexachloro-1,3-butadiene	0.5
Hexachloroethane	3.0
Lead	5.0
Lindane	0.4
Mercury	0.2
Methoxychlor	10.0
Methyl ethyl ketone	200.0
Nitrobenzene	2.0
Pentachlorophenol	100.0
Pyridine	5.0 ²
Selenium	1.0
Silver	5.0
Tetrachloroethylene	0.7
Toxaphene	0.5

(continued) Revision 2 September 1994

Table 7-1
(continued)

Contaminant	Regulatory Level (mg/L)
Trichloroethylene	0.5
2,4,5-Trichlorophenol	400.0
2,4,6-Trichlorophenol	2.0
2,4,5-TP (Silvex)	1.0
Vinyl chloride	0.2

¹If o-, m-, and p-cresol concentrations cannot be differentiated, the total cresol (D026) concentration is used. The regulatory level of total cresol is 200 mg/L.

²Quantitation limit is greater than the calculated regulatory level. The quantitation limit therefore becomes the regulatory level.

SEVEN - 18

Revision 2
September 1994



ARTECH TESTING, L.L.C.

14554 LEE ROAD · CHANTILLY, VA 20151-1632
703 378-7263 · 800 283-7848 · FAX 703 378-7274

February 7, 1997

Dr. Manny Horowitz
14100 North Gate Drive
Silver Spring, Maryland 20906

Subject: Analysis of Liquids for Heavy Metals

Reference: ARTECH C70023

Dear Dr. Horowitz

Eighteen samples of liquid were submitted to ARTECH for determination of the levels of Cadmium (Cd), Lead (Pb), Mercury (Hg) and Barium (Ba) present. The samples were analyzed using a Buck Model 200A Atomic Absorption Spectrophotometer (AAS). The Mercury determination required the use of a Cold Vapor accessory with the AAS. Barium was analyzed in accordance with EPA Method 7080A which has a detection limit of 100 micrograms per liter (ppb). Cadmium was analyzed in accordance with EPA Method 7130 which has a detection limit of five micrograms per liter (ppb). Lead was analyzed in accordance with EPA Method 7420 which has a detection limit of 100 micrograms per liter (ppb). Mercury was analyzed in accordance with EPA Method 7470A which has a detection limit of 0.2 micrograms per liter (ppb). The results for Cd, Pb and Ba were measured from an average of six readings. Hg was measured using a single injection into the Cold Vapor accessory.

None of the analyses were present in any of the samples at or above the detection limit. If ARTECH can be of any further assistance, on this or other matters, please contact us at any time.

Sincerely,
ARTECH Testing, LLC

Karl Schweier



ARTECH TESTING, L.L.C.

14554 LEE ROAD · CHANTILLY, VA 20151-1632
703 378-7263 · 800 283-7848 · FAX 703 378-7274

February 12, 1997

Dr. Manny Horowitz
14100 North Gate Drive
Silver Spring, Maryland 20906

Subject: Analysis of Liquids for Heavy Metals (Amended
Report)

Reference: ARTECH C70023

Dear Dr. Horowitz:

Eighteen samples of liquid were submitted to ARTECH for determination of the levels of Cadmium (Cd), Lead (Pb), Mercury (Hg) and Barium (Ba) present. The samples were analyzed using a Buck Model 200A Atomic Absorption Spectrophotometer (AAS). The Mercury determination required the use of a Cold Vapor accessory with the AAS.

Barium was analyzed in accordance with EPA Method 7080A which has a detection limit of 100 micrograms per liter (ppb). Cadmium was analyzed in accordance with EPA Method 7130 which has a detection limit of five micrograms per liter (ppb). Lead was analyzed in accordance with EPA Method 7420 which has a detection limit of 100 micrograms per liter (ppb). Mercury was analyzed in accordance with EPA Method 7470A which has a detection limit of 0.2 micrograms per liter (ppb). The results for Cd, Pb and Ba were measured from an average of six readings. Hg was measured using a single injection into the Cold Vapor accessory.

None of the analyses were present in any of the samples at or above the detection limit. The Maximum Concentration of Contaminants for Toxicity Characteristics from EPA SW-846 allowed for the elements analyzed is 100.0 milligrams per liter (ppm) for Barium, 1.0 milligrams per liter (ppm) for Cadmium, 5.0 milligrams per liter (ppm) for Lead and 0.2 milligrams per liter (ppm) for Mercury. A copy of Table 7-1 (Maximum Concentration of Contaminants for Toxicity Characteristic) is enclosed. A table of the individual results is also attached.

If ARTECH can be of any further assistance, on this or other matters, please contact us at any time.

Sincerely,
ARTECH Testing, LL

A handwritten signature in cursive script, appearing to read 'Karl Schweier'.

Karl Schweier
Chemist

Barium Sample ID	Direct Read (ppb)	Average
Distilled H2O	< 100, < 100, < 100, < 100, < 100, < 100	< 100
200 Proof Ethyl Alcohol	< 100, < 100, < 100, < 100, < 100, < 100	< 100
1A Flexite Supreme	< 100, < 100, < 100, < 100, < 100, < 100	< 100
2A Flexite Supreme	< 100, < 100, < 100, < 100, < 100, < 100	< 100
3B Flexite Supreme	< 100, < 100, < 100, < 100, < 100, < 100	< 100
4B Flexite Supreme	< 100, < 100, < 100, < 100, < 100, < 100	< 100
5A Flexite +	< 100, < 100, < 100, < 100, < 100, < 100	< 100
6A Flexite +	< 100, < 100, < 100, < 100, < 100, < 100	< 100
7B Flexite +	< 100, < 100, < 100, < 100, < 100, < 100	< 100
8B Flexite +	< 100, < 100, < 100, < 100, < 100, < 100	< 100
9A Flexite MP	< 100, < 100, < 100, < 100, < 100, < 100	< 100
10A Flexite MP	< 100, < 100, < 100, < 100, < 100, < 100	< 100
11B Flexite MP	< 100, < 100, < 100, < 100, < 100, < 100	< 100
12B Flexite MP	< 100, < 100, < 100, < 100, < 100, < 100	< 100
13A Norththerm	< 100, < 100, < 100, < 100, < 100, < 100	< 100
14A Norththerm	< 100, < 100, < 100, < 100, < 100, < 100	< 100
15B Norththerm	< 100, < 100, < 100, < 100, < 100, < 100	< 100
16B Norththerm	< 100, < 100, < 100, < 100, < 100, < 100	< 100

Cadmium Sample ID	Direct Read (ppb)	Average
Distilled H2O	< 5, < 5, <5, < 5, < 5,	< 5
200 Proof Ethyl Alcohol	< 5, < 5, <5, < 5, < 5,	< 5
1A Flexite Supreme	< 5, < 5, <5, < 5, < 5,	< 5
2A Flexite Supreme	< 5, < 5, <5, < 5, < 5,	< 5
3B Flexite Supreme	< 5, < 5, <5, < 5, < 5,	< 5
4B Flexite Supreme	< 5, < 5, <5, < 5, < 5,	< 5
5A Flexite +	< 5, < 5, <5, < 5, < 5,	< 5
6A Flexite +	< 5, < 5, <5, < 5, < 5,	< 5
7B Flexite +	< 5, < 5, <5, < 5, < 5,	< 5
8B Flexite +	< 5, < 5, <5, < 5, < 5,	< 5
9A Flexite MP	< 5, < 5, <5, < 5, < 5,	< 5
10A Flexite MP	< 5, < 5, <5, < 5, < 5,	< 5
11B Flexite MP	< 5, < 5, <5, < 5, < 5	< 5
12B Flexite MP	< 5, < 5, <5, < 5, < 5,	< 5
13A Norththerm	< 5, < 5, <5, < 5, < 5,	< 5
14A Norththerm	< 5, < 5, <5, < 5, < 5,	< 5
15B Norththerm	< 5, < 5, <5, < 5, < 5,	< 5
16B Norththerm	< 5, < 5, <5, < 5, < 5,	< 5

Lead Sample ID	Direct Read (ppb)	Average
Distilled H2O	< 100, < 100, < 100, < 100, < 100, < 100	< 100
200 Proof Ethyl Alcohol	< 100, < 100, < 100, < 100, < 100, < 100	< 100
1A Flexite Supreme	< 100, < 100, < 100, < 100, < 100, < 100	< 100
2A Flexite Supreme	< 100, < 100, < 100, < 100, < 100, < 100	< 100
3B Flexite Supreme	< 100, < 100, < 100, < 100, < 100, < 100	< 100
4B Flexite Supreme	< 100, < 100, < 100, < 100, < 100, < 100	< 100
5A Flexite +	< 100, < 100, < 100, < 100, < 100, < 100	< 100
6A Flexite +	< 100, < 100, < 100, < 100, < 100, < 100	< 100
7B Flexite +	< 100, < 100, < 100, < 100, < 100, < 100	< 100
8B Flexite +	< 100, < 100, < 100, < 100, < 100, < 100	< 100
9A Flexite MP	< 100, < 100, < 100, < 100, < 100, < 100	< 100
10A Flexite MP	< 100, < 100, < 100, < 100, < 100, < 100	< 100
11B Flexite MP	< 100, < 100, < 100, < 100, < 100, < 100	< 100
12B Flexite MP	< 100, < 100, < 100, < 100, < 100, < 100	< 100
13A Norththerm	< 100, < 100, < 100, < 100, < 100, < 100	< 100
14A Norththerm	< 100, < 100, < 100, < 100, < 100, < 100	< 100
15B Norththerm	< 100, < 100, < 100, < 100, < 100, < 100	< 100
16B Norththerm	< 100, < 100, < 100, < 100, < 100, < 100	< 100

Mercury Sample ID	Direct Read (ppb)
Distilled H2O	< 0.2
200 Proof Ethyl Alcohol	< 0.2
1A Flexite Supreme	< 0.2
2A Flexite Supreme	< 0.2
3B Flexite Supreme	< 0.2
4B Flexite Supreme	< 0.2
5A Flexite +	< 0.2
6A Flexite +	< 0.2
7B Flexite +	< 0.2
8B Flexite +	< 0.2
9A Flexite MP	< 0.2
10A Flexite MP	< 0.2
11B Flexite MP	< 0.2
12B Flexite MP	< 0.2
13A Norththerm	< 0.2
14A Norththerm	< 0.2
15B Norththerm	< 0.2
16B Norththerm	< 0.2