

# MatCon® Technical Paper

## Evaluation of RAP as Clean Fill

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A thorough investigation of six reclaimed asphalt pavements (RAP) has concluded that all of the RAP samples meet or exceed the strict EPA guidelines for leachate.

Heritage Research Group of Indianapolis, Indiana, performed the investigation for the Illinois Asphalt Pavement Association. The study included a Toxic Characteristic Leachability Procedure (TCLP) on samples of RAP collected from six geographic areas in Illinois. The goal of the testing program was to determine if the RAP contained materials that would make it environmentally unsuitable for clean fill. In certain situations RAP, which is produced by milling asphalt pavement, is unsuitable for recycling but could be used on site for clean fill.

Using six sample sites, which represented a wide geographical cross section of Illinois, ensured that different aggregates, as well as asphalt sources, were included in the study. RAP samples from the sites were received directly from Illinois Department of Transportation personnel.

### Sample Analysis

The sample analysis was performed in two parts. The first part was physical property testing of the RAP. This included asphalt content and aggregate gradation analysis, and Absorb Recovery to look at the physical properties of the recovered asphalt cement.

The second part of the analysis was environmental testing. It involved testing for Polychlorinated Biphenyls (PCBs) on the RAP samples before leachate testing. Identical samples were also prepared for the TCLP for each RAP source. Following the TCLP, the leachate was tested for semivolatile organics, Polynuclear Aromatic Hydrocarbons (PAHs), and metals.

Tests were performed in accordance with EPA procedures:

PCB Extraction	SW846-3550
PCB Analysis	SW846-8080
TLCP Procedure	SW846-1311
Semivolatiles GC/MS	SW846-3510
PAHs	SW846-8310
Metals	SW846-3010

A summary report of the results is listed in [Table 1 below](#).

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**Laboratory Test Results**

Results from the physical property testing indicates that these RAP samples are typical in aggregate gradation, asphalt content, and asphalt residue properties to other RAP materials tested by Heritage Research Group.

Heritage tested for PCBs on the RAP samples, not on the leachate after TCLP. There is currently no known method of testing for PCBs on leachate. No PCBs were found in any sample at the parts per million detection limits tested. TCLP leachate did not contain any of the standard semivolatile compounds normally tested for at the parts per billion detection limits.

**PAHs**

The PAHs showed up only in trace levels. Concentration of naphthalene, the most volatile PAH, was under a half a part per billion, which is well within any guidelines tested for this material. Benzo (A) pyrene, a known carcinogen, which is often used as a marker compound for PAHs, was not found in any sample at the parts per billion detection limits reported.

The metal barium was detected in samples from sites #2, #3 and #4. The barium concentrations were 200 to 300 times below the maximum contaminant levels for TCLP under the Resource Conservation and Recovery Act (RCRA) for hazardous materials by characteristic. The concentrations were also below national drinking water standards for this metal.

Chromium and lead were also detected in samples from site #2. The concentrations were below RCRA hazardous materials characteristic levels.

The leachate from site #2 met RCRA guidelines for hazardous materials but did not meet national drinking water standards. It is important to point out, however, that samples from site #1 met all guidelines. Both sites were taken from the same project at different locations. This could indicate that contamination of the pavement surface was a possible cause for having a low, but measurable, level of metals. Barium could result from a lube additive from crankcase drippings. The same is true for chromium, a wear metal. Lead could be from crankcase oil or leaded gasoline or both.

Background samples from soils along the roadside have been studied in the literature. It is not unusual to find much higher levels of lead than encountered in this sample due to the use of leaded gasoline in the past.

**Conclusions**

After a thorough investigation of these samples, it can be ascertained that all of these samples meet current guidelines for the TCLP maximum concentration for the contaminants by characteristic. Due to asphalt's non-volatile viscoelastic properties this is not surprising. The migration of metals and inorganics are impaired greatly by the matrix of asphalt and aggregate. However, contaminants which may be spread on the road surface later through spills or accidents could change these characteristics.

The results on this representative group of samples would suggest that RAP is a very safe non-leachable material.

**TCLP Test Results**

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Contaminant	Site Number & Quantity Detected	Detection Limit	RCRA Char. Level
<b>PAH's</b>		ug/L	
Naphthalene	#1 - 0.49, #3-0.030	0.13	
Acenaphthylene	BDL*	.20	
Acenaphthene	BDL	0.13	
Flourene	BDL	0.015	
Phenanthrene	BDL	0.13	
Anthracene	BDL	0.017	
Fluorathene	BDL	0.017	
Pyrene	BDL	0.060	
Benzo (A) Anthracene	#5-0.017	0.017	
Chrysene	BDL	0.033	
Benzo (B) Fluoranthene	BDL	0.023	
Benzo (K) Fluoranthene	#5-0.050	0.017	
Benzo (A) Pyrene	BDL	0.240	
Dibenzp (A.H) Anthracene	BDL	0.068	
Benzo (G,H,I) Perylene	BDL	0.110	
Indeno (1,2,3-cd) Pyrene	BDL	0.022	
<b>Metals</b>		mg/L	mg/L
Barium	#2-0.40, #3-0.36, #4-0.33	0.200	100.0
Cadmium	BDL	0.200	1.0
Chromium	#2-0.52	0.050	5.0
Lead	#2-1.80	0.200	5.0
Silver	BDL	0.040	5.0
Arsenic	BDL	0.005	5.0
Selenium	BDL	0.025	1.0
Mercury	BDL	0.005	0.2
<b>Semi-Volatile</b>		uh/L	mg/L
1,4 Dichlorobenzene	BDL	50	7.5
2,4 Dinitrotoluene	BDL	50	0.13
Hexachlorobenzene	BDL	50	.013
Hexachlorobutadiene	BDL	50	0.5
Hexachloroethane	BDL	50	3.0
Nitrobenzene	BDL	250	2.0
Pyridine	BDL	120	5.0
Cresylic Acid	BDL	50	
2 Methyl Phenol	BDL	50	
3 Methyl Phenol	BDL	50	
4 Methyl Phenol	BDL	250	
Pentachlorophenol	BDL	250	100.0
2,4,5-Trichlorophenol	BDL	50	400.0
2,4,6-Trichlorophenol	BDL	--	2.0
<b>PCB's</b>		mg/KG	
PCB Arochlor 1016	BDL		
PCB Arochlor 1221	BDL		
PCB Arochlor 1232	BDL		

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PCB Arochlor 1242	BDL
PCB Arochlor 1248	BDL
PCB Arochlor 1254	BDL
PCB Arochlor 1260	BDL
PCB Arochlor 1262	BDL

\*BDL = Below Detection Limits

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