Discarded Spray Paint Cans and the San Diego River: A special scoping study

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ABSTRACT

Spray paint cans from graffiti are a common source of trash found near overpasses along the San Diego River during clean-up events. While the impacts on water were not well determined through this study, evidence suggests that soil contamination from direct or indirect contact with paint is occurring at several locations. Detectable VOC results from Forester Creek in a water sample are trichloroethene – 1 µg/kg; in the control soil sample is isopropyltoluene – 14 µg/kg. Detectable VOC results at Hazard Center Drive (under Route 163) in a soil sample are ethylbenzene – 96 µg/kg, m,p-xylene – 530 µg/kg, o-xylene – 390 µg/kg, isopropylbenzene – 8.2 µg/kg, n-propylbenzene – 7 µg/kg, 1,3,5-trimethylbenzene – 20 µg/kg, and 1,2,4-trimethylbenzene – 74 µg/kg.

INTRODUCTION

The San Diego River and its watershed are vital ecological, economical and recreational resources within San Diego County representing a nearly 440 square miles watershed that encompasses 5 drinking water reservoirs and provides habitat for over 28 species of endangered or threatened plants and animals. The River provides recreational value along its 52 mile route from the mountainous headwaters near Julian to the coastline terminus at the San Diego River mouth. To help preserve the biodiversity and expand on the recreation the river has to offer, San Diego River Park Foundation, (SDRPF) volunteers monitor the quality of San Diego River water and surrounding land, clean-up and restore habitat, maintain trails, conserve open space and build parks and park amenities.

Through the survey and clean-up events, volunteers typically document and encounter significant volumes of spray paint cans within the river or the surrounding riparian and wetland habitats. The discarded spray paint cans are associated with large areas of graffiti that vandalize roadway abutments crossing the river. The cans are found in varying states of decomposition and volumes of hazardous material content. This study will help determine whether significant concentrations of volatile organic compounds, (VOCs) related to spray paint exist and if they occur in proximity to known graffiti sites.

Anthropogenic sources of VOCs include paint, protective coatings, refining process of petroleum and automobile emissions[i]. The United States Environmental Protection Agency has a general definition of a VOC as “any compound of carbon, excluding carbon monoxide, carbon dioxide, carbonic acid, metallic carbides or carbonates, and ammonium carbonate, which participates in atmospheric photochemical reactions” [ii]. These “atmospheric photochemical reactions” usually result in the degradation of the tropospheric ozone layer and contributes to global climate change. Contamination of VOCs in water and soil can be released into the atmosphere and can harm plants and animals.

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METHODOLOGY

Seven sampling locations along the lower San Diego River and Forester Creek were selected based on their proximity to known graffiti sites. Table 1 below lists each general location, site ID and type of samples collected. Samples were labeled and chain of custody was filled out. Locations where sample collection occurred were marked by a GPS unit. All samples were analyzed by H&P Mobile Geochemistry, Inc. in Carlsbad, California using Volatile Organic Compounds by EPA Method 5030B/8260B. Decontamination was done after each sample site and gloves worn during both sampling and decontamination. Method 8260 involved the use of solid samples, in this case which is soil, ran by a Gas Chromatography/Mass Spectrometry (GC/MS) to test for VOCs. Method 5030 is the aqueous sample version of 8260[iii].

Table 1: *Site Abbreviations, Locations and Samples*

Site ID	Location	Type of Samples Collected
WH	West Hills Parkway	W, S
F	Forrester Creek	W, S
A	Admiral Baker Golf Course – Under Friars Rd. bridge	W, S
W	Ward Rd. 24 Hour Fitness	W, S
H	Hazard Center Drive – Under 163	W, S
E	Estuary – Under I-5	W, S
TB	San Diego River Park Foundation Office	W (trip blanks)
EB	Ward Rd. 24 Hour Fitness	W (equipment rinsate blank)

W = water samples
S = soil samples

Water Sample Collection

A glass bottle was rinsed three times with water from the bank of the river. Sediments were avoided as much as possible, but if sediments did enter, they were allowed to settle to the bottom of the bottle. Water was poured slowly and carefully down the inside wall of the glass vial to prevent formation of air bubbles and filled to the top until it formed a meniscus. Water was added to the cap, flipped quickly onto the vial and closed tightly; this ensured the Teflon top will rise up. Air bubbles were checked for by turning the jar upside down and tapping. When bubbles still appeared, the 40 mL vial was refilled, if necessary, and water added to the cap step was repeated.

Soil Sample Collection

The scoop used to gather soil samples was cleaned with diluted soap and deionized water, (DI). Samples were extracted at the ground level by cutting out a “plug” that would fit into the sample jar. Much care was taken to keep the soil plug completely intact to avoid damaging the sample. In situations where the plug did break, a different plug was cut out.

Quality Control

To maintain quality control, field blanks of water samples and spiked soil samples were taken. Field blanks were taken at the San Diego River Park Office (trip blanks) and Ward Road (equipment rinsate blanks). The two Trip Blanks (TB) were made prior to leaving the office by filling two 40mL vials with DI water, labeled them TB1 and TB2 respectively, and placed one in each of the two coolers. The Equipment Blank (EB) was taken at Ward Rd. after Ward Rd. samples were taken. To collect samples for the EBs, the rinse technique from every site was used, and DI was poured over the "rinsed" spoon. Then the 40mL VOA was filled to halfway and next, DI was used to rinse the already cleaned bottle and filled to the rest of the 40mL. This represented the midway point and potentially the most contaminated area. This was done to document possible contamination from site to site via equipment. To make the spiked soil samples, samples were directly sprayed with paint from old, rusted spray cans found from previous cleanups to produce samples that represent the maximum concentrations of VOCs from direct contact with the paint. The only site with the spiked sample is Forrester Creek (FS2).

Equipment (Appendix Document)

RESULTS

Two of the seven sampling locations indicated presence of VOCs and or Semi VOCs in soil samples. Only one of the 7 sampling locations indicated presence of VOC in the water sample. Table 2 below lists the sample IDs and detected results.

Table 2: *Sites with Detectable VOC/Semi VOCs*

Sample ID	Site Name	VOC/Semi VOC Detected	Result	Common Source(s)
FW1	Forester Creek Water 1	Tricholoroethene	1	Solvents[iv]
FS0	Forester Creek Soil Control	Isopropyltoluene (Cymene)	14	Paint manufacturing[v]
FS2	Forester Creek Soil 2	Ethylbenzene	19	Paint[vi]
		m,p- Xylene	73	Paint[vi]
		o-Xylene	39	Paint[vi]
HS1	Under 163 Soil	Ethylbenzene	96	Paint[vi]
		m,p- Xylene	530	Paint[vi]
		o-Xylene	390	Paint[vi]
		Isopropylbenzene (Cumene)	8.2	Fuels, Paint Thinner, Corrosion Resistant Paint[vii]
		n-Propylbenzene	7	Petroleum[viii]
		1,3,5 Trimethylbenzene	20	Petroleum[viii]
		1,2,4 Trimethylbenzene	74	Petroleum[viii]

Control indicates sample location chosen at random
Results are in units: µg/kg

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DISCUSSION

Based on the results, the areas with detectable amounts of VOCs come from Forester Creek (excluding FS2, the spiked sample), and Hazard Center Drive under California State Route 163. The specific VOCs directly from paint as their sources are isopropyl toluene, ethyl benzene, m-xylene, p-xylene and o-xylene which indicates that the spray paint cans and its use in graffiti found near the sampling sites has an impact on the soil. Isopropyl toluene, also known as cymene, comes from paint manufacturers where cymene is added "as a source of essential oils in an effort to add fragrance to natural paint"[ix]. Interestingly, the Hazard Center Drive site showed VOCs from petroleum sources (n-propylbenzene, 1,3,5-trimethylbenzene, 1,2,4-trimethylbenzene) along with paint products. While it was theorized that the petroleum sources may have come from an accident on the highway overhead, these VOCs could also be from nonpoint sources like deposition from the atmosphere or transportation by rainwater.

CONCLUSION

Finding the detectable levels of VOCs at Forester Creek and Hazard Center Drive are important in implicating the common sources of VOCs. These findings also show that an impact on soil still has a residual effect even after precipitation. Since it rained for two days prior to sampling, it is possible that the VOCs could have been washed off. With the previous problem presented, more studies need to be done when there is better weather. These studies should ideally be for a longer term and require more sampling periods.

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QUESTIONS OR REQUESTS FOR APPENDICIES

Contact the Healthy River, Healthy Communities Program Coordinator, Shannon by e-mail: shannon@sandiegoriver.org or by phone: 619-297-7380 ext. 103

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