Cleanup of an Oil and Mixed Chemical Spill at Dittmer, Missouri, April-May, 1977

Harry Gilmer
U.S. Environmental Protection Agency
Kansas City, Missouri
and
Frank J. Freestone
U.S. Environmental Protection Agency
Edison, New Jersey

INTRODUCTION

In response to neighbor complaints of odors, fire and obnoxious smoke and deteriorating creek quality, the Missouri Conservation Commission (MCC) and the Department of Natural Resources (MDNR) made a series of investigations of the Albert Harris Property located in Dittmer, Jefferson County. These investigations, which began March 24, 1977 and continued through April 1, revealed that Mr. Harris was operating an illegal solid waste disposal site in conjunction with a container reconditioning operation.

The containers were being supplied by the Bliss Drain Oil Company of St. Louis, Missouri and Sauget, Illinois. Upon delivery of the containers to Mr. Harris, the contents would be emptied into a pit adjacent to an intermittent branch of Calvey Creek, a tributary of the Meramec River; the empty containers were then reconditioned for sale. At one point, the pit was set afire to lower the level of the contents; a neighbor requested the Fire Department to extinguish the fire that threatened to engulf the area with smoke and flame.

Because of the seriousness of the situation, the MDNR appealed to the U.S. EPA Region VII Emergency Response Section (EMER) on April 4 for assistance. The telephoned report indicated that immediate action was needed. Therefore, the Toxic Substances Coordinator and a representative from the Waste Management Section visited the Harris site on April 5.

Although a notice of violation had been left with the Harris family on March 25, directing that the MDNR be notified prior to removal or destruction of material at the dump, all containers had been removed, the top layer of soil removed, the pit had been filled in and the area covered with straw. However, EPA took samples of soil from the middle of the dump, of stream sediment and miscellaneous dead aquatic life below the dump area for later analysis. The area was carefully inspected and upon return to EPA Regional Headquarters, the two EPA inspectors reported to EMER that the situation was indeed serious.

The stream had many indications of receiving oil from the dump area. There were puddles of black oil in the stream adjacent to the pit. Extensive oil films and sheens were visible on the stream below the dump site; there was no indication of oil sheen upstream. An objectionable, but unidentifiable, odor was encountered in the stream gully Stream sediment when disturbed, released globules of oily materials. The stream appeared devoid of aquatic life and many dead organisms were present in the relatively still pools of the stream.

Actions Taken

As a result of the report by the Solid Waste and Toxic Substances investigators, a meeting of the Regional Response Team (RRT) was called. After presentation of the investigation evidence by EPA and state representatives, a site visit by RRT members, and the determination of a lack of cooperation by the property owner involved, a Federal Cleanup Action was initiated. Access to the property where the pit was located required a search warrant. A team was assembled and prepared to serve the warrant and initiate cleanup on Saturday, April 9 at 10:00 AM.

At approximately 6:30 AM, April 9, the MDNR-St. Louis Regional Office received an urgent telephone call from a neighbor of Mr. Harris' describing extensive preparation for dirt removal. Upon receiving this information the search team proceeded immediately to the Harris property. The warrant was served and the man directing "coverup" of the pit was instructed to cease his activity and withdraw his equipment. A spill cleanup contractor was then authorized to dig an exploratory trench in the vicinity of the disposal pit using a backhoe. Although the area had been freshly covered with dirt and straw, there was visual evidence that oil had entered the creek bed. The three exploratory trenches that were dug yielded overwhelming evidence of the disposal pit's existence and that entry of oil into the creek had occurred.

The intermittent stream was inspected from its sources at a pond above the Harris property to its confluence with Calvey Creek. The effects of an oil spill were still evident in the unnamed stream for a length of approximately 2000 ft. below the Harris property. There were numerous springs, particularly on the pit side of the stream, feeding the stream. All aquatic life appeared to be dead and various organisms were decaying. Throughout the length of the stream unpleasant "chemical" odors persisted diminishing in intensity near Calvey Creek.

The soil in the pit was contaminated with a complex mixture of many materials. An oily substance that appeared to be petroleum oil was evident in the pit, floating in the

stream and retained by debris and sediment in the stream. A Polychlorinated Biphenyl (PCB), Aroclor 1260, was identified at a concentration of 2% by weight in the mixture of oil and solvents (see Figure 1). Further, a unique compound, Bromophenylchlorophenylether (BPCPE) was isolated at a concentration of 8.6% by weight in the oil. Information gathered over the course of the spill showing the extent of contamination involved is presented in Table I. The BPCPE was subsequently identified as being manufactured only once by Monsanto in a small quantity and disposed of in the Harris pit. This material formed a positive "tracer" to link downstream environmental impacts to the wastes in the pit.

Figure 1: Oil and chemical wastes disposal pit adjacent to an unnamed stream tributary to the Meramec River.

Table I: Selected Results of Chemical Analyses of Various Soils, Sediments, Water and Biota

Item Analyzed	Date Collected	Concentrations of Contaminants: Aroclor 1260	BPCPE*
Oil in trench	4/11/77	22 (wt)	8.62 (wt)
Earthworms & tadpoles in stream below pit	4/6/77	27 ppm	present
Soil at pit	4/6/77	52 ppm	present
Creek sediment	4/6/77	516 ppm	present
Soil at edge of pit	4/6/77	226 ppm	present
Water in creek	3/25/77	15-20 ppb	present
below pit	3/28/77	116 ppb	present
Fish from Calvey Creek	4/18/77		
Redhorse		81 ppb	73 ppb
Largemouth Bass & Green Sunfish		630 ppb	390 ppb
Smallmouth Bass		37 ppb	26 ppb
Redhorse		95 ppb	65 ppb
Minnows		330 ppb	1,760 ppb
Minnows		190 ppb	280 ppb

*Bromophenylchlorophenylether

As a result of the exploratory trenching and site survey, several actions were decided upon, including stream bypassing, land-fill disposal, on-site treatment and analysis of the contaminated stream water, excavation and administrative support from the U.S. Coast Guard Gulf Strike Team. On Monday, April 11, the work began as personnel and equipment arrived on scene. By Tuesday, April 12, disposal arrangements were made at a chemical landfill operated by Earthline Company at Wilsonville, Illinois.

Two dams and a bypass were installed in the stream while arrangements were being made for the disposal of contaminants. The first dam was intended to contain the clean water upstream of the pit area and form an impoundment to feed a bypass system to prevent the clean water from coming in contact with contaminants from the pit area and in the stream bed. The low flow of the stream (approximately 15 gpm) permitted the use of a gravity flow bypass fabricated from 6 in. flexible PVC tubing. Because of thick undergrowth and a very small slope to the stream, the 2500 ft. bypass had to be laid in the stream bed—which subsequently interfered somewhat with stream cleanup activities. The second dam was installed to contain water that surfaced in the intermittent stream over the length of the bypass. This lower dam was constructed just upstream of the end of the gravity bypass and impounded a small flow (5–10 gpm) of water that had come in contact with the contaminated stream bed.

The Mobile Physical-Chemical Treatment System of the Environmental Emergency Response Unit (EERU)[3] from Edison, New Jersey was used to treat this small contaminated flow (see Figure 2). This system was monitored in its operations by an on-site analytical chemistry laboratory,[4] also brought from Edison. The EERU treatment system was operated for EPA by Mason & Hanger Silas Mason Co., Inc. The Mobile Spills Laboratory was operated by EPA personnel from the Edison, New Jersey spills research group.

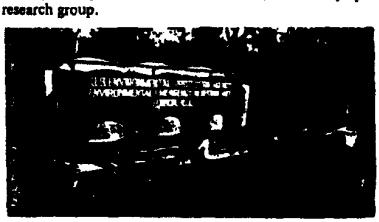

Figure 2: The Mobile Physical-Chemcial Treatment System being employed to treat contaminated water from the small stream. Despite bypassing of a majority of the stream flow, the intermittent nature of the stream, in combination with springs originating in the vicinity of the contaminated pit required that a small flow of contaminated water be treated.

The stream water being delivered to the Treatment System had approximately 19 μg/ml PCB (Aroclar 1260). After treatment with the sand filtration and carbon adsorption steps, the PCB concentration of the discharged water was less than 0.05 to 0.2 μg/ml.

A spills cleanup contractor, O.H. Materials, Inc., brought

men and equipment to excavate the pit, clean the contaminated debris fro the stream bed and package the contaminated materials. Excavation was performed with a bulldozer and a backhoe. As excavation proceeded, numerous drums containing paints, solvents and unknown waste materials were uncovered. Many of the drums ruptured as they were removed from the pit. The contaminated materials (including crushed waste drums) were placed in steel drums (Department of Transportation designation 17H) for transport to and burial in the landfill site.

On April 13, the first truck load of contaminated soil in drums was dispatched to the landfill. Personnel involved in the packaging portion of the cleanup operation wore protective suits with breathing and cooling air flows supplied through separate umbilical lines. Personnel operating the mechanical equipment wore similar protective suits with self-contained breathing apparatus, however, without cooling provisions (see Figure 3).

Figure 3: Cleanup contractor personnel in protective clothing and breathing apparatus excavate the pit and package the contaminated materials in 55 gallon drums.

The contact personnel also cleaned contaminated debris from the 2000 ft. of stream most severely impacted by the spill. This debris was placed in drums along with the excavated materials. The pit excavation ultimately reached dimensions of approximately 80 ft. by 60 ft. with an average depth of six ft. A total of 4,318 drums of contaminated soil and debris were removed from the site and landfilled.

It was soon recognized after onset of activities that a total cleanup would be impossible, and that the soil surrounding the pit area and in the stream bed would continue to leach contaminants into the stream water for some time, despite all practical cleanup efforts. Further, the Mobile Physical-Chemical Treatment System could not be used indefinitely. These conditions led to the decision to fabricate and install a field-improvised carbon treatment system to provide long term treatment to the stream water. A dam was placed across the stream at a point approximately 2000 ft. downstream of the pit. This dam formed an impoundment suitable for the emplacement of a small float-actuated submersible pump having a capacity approximately equal to the average stream flow (35 gpm). Greater stream flows will flow over the dam—since treatment of storm flows was not practical.

The impounded water is to be pumped to a carbon adsorption column built on a design provided in an EPA research publication on field improvised water treatment systems.[3] The treatment system consists of three five-micron bag filters and a 100 ft^3 gravity flow carbon adsorption column built from a 12 ft long by 4 ft ID concrete culvert buried six feet in the ground on a reinforced concrete base. The culvert was filled to a depth of eight feet with carbon from the EERU.

Initial experience indicates that the bag filters must be changed frequently to offset clogging with suspended materials, however, the overall treatment effectiveness of the unit is good. Chemical analysis indicates typical PCB concentrations of 85 $\mu g/ml$ influent, 4.6 $\mu g/ml$ after the bag filters and less than 0.2 $\mu g/ml$ in the effluent for an overall treatment effectiveness of 99% removal (see Figure 4).

Backfilling of the pit was accomplished using clay excavated from a bank on the Harris Property. The clay was firmly packed, then covered with Bentonite, which was then stabilized with another layer of clay and then firmly packed. The sealing of the pit area appears to have been effective, since the contaminant level in the stream has consistently decreased since the activities ceased on May 29.

Figure 4: Field improvised filtration and carbon adsorption unit. This system was installed to provide continuing protection after departure of the principal cleanup crew. Note the small dam with overflow culverts installed. The float-actuated pump which feeds the carbon system is shown in the lower left corner of the photograph.

Lessons Learned

The spill was caused by one of the most unforgivable of environmental insults: illegal and indiscriminant dumping of chemical wastes. Mixed waste spills are extremely difficult to mitigate and are costly to deal with, particularly in water.[4] The Dittmer experience resulted in costs in excess of $515,000 to undo the environmental problems of what was basically a soil contamination situation.

Experience with the contaminated stream bed pointed out the effectiveness of a bypass arrangement to permit stream bed cleaning and to minimize the flow of contaminated water that must be treated. Hence, small carbon treatment systems are needed as well as large ones for re-

sponse to a variety of spill situations. As a result, the Environmental Emergency Response Team has fabricated a 15 gpm sand filter and carbon column combination for use where the large unit is not needed.

One limitation of the relatively small mobile analytical laboratory was the necessity to choose between PCB and oil analysis. It was not possible, because of cross-contamination problems, to provide both analyses. The PCB analysis was subsequently chosen as being both definitive for the PCB and a suitable indicator for oils--since the PCB's were apparently dissolved in the oils.

The field-improvised treatment system was successfully designed, fabricated and made operational within nine days. One of the most difficult problems associated with long term post-spill treatment is not technical, however. The problem is defining willing parties to be responsible for continuing maintenance requirements. The long term effectiveness of the system is a direct function of the reliability of regularly scheduled maintenance by trained personnel.

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