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UNITED STATES ENVIRONMENTAL
PROTECTION AGENCY WASHINGTON, D.C.
20460

April 24, 1996

The Honorable Michael J. Collins
Maryland General Assembly
Senate of Maryland
216 James Building
Annapolis, Maryland 21401-1991

Dear Senator Collins:

Thank you for your letter of March l, 1996 to Administrator Browner urging the Environmental Protection Agency (EPA) to look into the performance and safe applicability of cold-mix technologies and bioremediation for petroleum-contaminated sites.

As indicated in my earlier response to you on March 25, 1996, we have been gathering the latest information on these technologies from our research laboratory in Cincinnati, Ohio to provide you with some valid information.

To respond to your specific concerns, we'll be addressing the issues pertaining to cold-mixing technologies and bioremediation separately in the following paragraphs.

Cold-mixing Technologies: All asphalt-based or cement-based mixtures are generally covered under Solidification/Stabilization (S/S) technologies by EPA. The term cold-mix for Portland cement mixtures may not be scientifically appropriate because of the fact that a mixture of Portland cement and water causes an exothermic reaction, thereby generating some heat.

Appropriateness of S/S for organics is addressed specifically in the attached report (Attachment 1), "Solidification/Stabilization: Is it always appropriate?" by Carlton Wiles et al. from the EPA research laboratory in Cincinnati, OH. It is clearly stated in this report that the opportunities to capture and contain organic materials in a cement-based solidification process are limited (p. 4). Also, referring to the EPA document cited in your letter, EPA/530/R-93/012, it states that all other factors being approximately equal, destruction or extraction technologies are preferred to S/S because they eliminate or remove the

contaminant as opposed to just immobilizing it (p. 2-59). It also states that S/S treatment is frequently appropriate for the residuals remaining after the use of one of these other technologies, or for soils after the use of one of these other technologies, or for soils and sludges containing low concentrations of organics (p. 4-48). In general, generic binders such as Portland cement do a poor job of immobilizing organics, with the exception of highly polar compounds in low to moderate concentrations (p. 2-59). While this is true, Portland cement is rarely used by itself as a binder to S/S organic waste. Additives such as carbon or modified clays are usually added to the S/S formula. However, the long term effectiveness of these additives has not been established.

About leaching possibilities of contaminants once treated by S/S technologies, results of leach tests for a few organics are shown on Figure 2, at the back of Attachment 1. Very limited data exists on leaching possibilities of the S/S treated matrix. Leach tests shown on Figure 2 were conducted on cement containing charcoal with adsorbed phenol, 3-chlorophenol, and 2,3-dichlorophenol. There is always a possibility that contaminants can leach from any medium if they are present. This is especially true for non-aqueous phases mixed with non-compatible material. For these reasons, treatability tests incorporating leaching evaluation and physical durability are recommended.

As indicated in EPA's Best Demonstrated Available Technology (BDAT) background document for hazardous soils, August 1993, (p. 4-95) organic hazardous constituents have not been shown to be stabilized using cementitous and pozzolanic stabilization agents because organic hazardous constituents generally do not react to form insoluble silicates or hydroxides. Thus, the Resource Conservation and Recovery Act (RCRA) program would not consider S/S technologies as a BDAT for treatment of commonly encountered petroleum wastes. However, EPA generally established performance standards for hazardous constituents achieved by the BDAT. Any technology (except dilution) that meets those performance standards is permissible under our rules.

The role of volatilization during S/S is addressed in the attached paper (Attachment 2) by Terrence M. Lyons et al. of EPA's research laboratory in Cincinnati. This paper presents results of a bench-scale treatability study designed to quantify the release of volatile organic compounds (VOCs) during and after ex situ S/S treatment. Control of air emissions from waste management facilities is addressed in detail in several EPA publications (EPA/625/R-92/012, Nov 92; EPA/625/R-92/003, Aug 92; EPA-451/R-93-0O1, Mar 93; and EPA-453/R-94-070a, Sep 94). EPA has recognized that volatilization of volatile organics with cold mixing processes can occur. At a minimum, control and capture of these emissions are recommended.

EPA's Office of Emergency and Remedial Response (OERR or Superfund) has issued draft guidance on the use of S/S for organics. The guidance states that S/S is not appropriate for sites containing VOCs only. This guidance suggests use of a severe solvent extraction procedure to indicate whether the organics are bound. Several Superfund sites have had at least a portion of the remedy involve cold mix processing of organic waste. Two large sites are provided as examples. The Sand Spring site in Oklahoma involved S/S of petroleum waste, containing heavier hydrocarbons, and the Craig Farm site in Pennsylvania involved S/S of resorcinol waste. The S/S treated wastes were placed in lined land disposal units based on the recommendation of EPA's Office of Research and Development (ORD).

ORD has limited experience in the utilization of S/S-treated wastes that were not characteristically-hazardous per RCRA after treatment. This includes studies of using cement products for light duty construction materials with ash from municipal waste combustion (primary metals) incorporated into the cement product.

Generally, there are site specific limitations on the use of treated mixtures depending upon the type of waste treated, soil type, and probability of waste migration. EPA Region I approved the stabilization of polychlorinated biphenyls (PCB) contaminated soil (<10 mg/kg) into an asphalt emulsion-mix that was to be covered.

Bioremediation Technologies: Biopiles or ex situ landfarming treatment technologies, which fall within the category of bioremediation, are discussed below.

Although Bioremediation (which includes land treatment) is widely accepted for the treatment of petroleum contaminated soils, the processes used and the rates of degradation that can be achieved are very different. Although land treatment units have been extensively used for treatment of petroleum- contaminated soils, available data with EPA do not indicate routine ex situ treatment of petroleum-contaminated soils by biopiles or landfarming to 10 parts per million (ppm). There is a declining trend on the use of landfarming technology for treatment of petroleum-contaminated sites. An in situ treatment bioremediation technology known as bioventing is being used increasingly to treat petroleum-contaminated soils. It is an effective and relatively inexpensive technology which is growing exponentially in the marketplace. ORD along with the US Air Force has been principally involved in its development and evaluation. Over the past 3-4 years it has been applied to about lOOO sites. We anticipate a significant reduction in

off-site treatment of these wastes, given the costs, effectiveness and minimal site disruption with its use.

Pertaining to the claims referenced in your letter about reductions in total petroleum hydrocarbons (TPH), EPA is not aware of a bioremediation technology that would degrade any concentration of petroleum-contaminated soils to 10 ppm in 30 days. Three critical factors in assessing biodegradability are the soil type, concentration, and type of product being treated. Without accounting for these factors specifically, it is difficult to make a judgment regarding the actual rate and extent of degradation. Generally, bioremediation technologies (bioventing) take about six months to two years for degrading organic wastes (EPA-510-B-94-003, Oct 94, p. III-3).

Polynuclear aromatic hydrocarbons (PAHs), especially those that are predominant in crude oils, such as the di-, tri- and tetracyclic aromatics, are much more difficult to degrade than aliphatic hydrocarbons, but are degradable to some extent. As the ring structure becomes more complex, the compound becomes more persistent. Pyrogenic PAHs, such as benzopyrene, are significantly more resistant, but fortunately don't exist in high concentrations in crude oils. The tetracyclic aromatics and above will not biodegrade in 30 days even under optimized laboratory conditions.

Volatilization may be significant depending upon the age of the material and if it is exposed at the ground surface. Aged material is less likely to volatilize but depending upon any agitation (tilling, aeration) and environmental conditions, fluctuations in volatilization can occur. Several EPA documents, referred to earlier, address the capture and control of organic air emissions from waste management facilities.

An EPA publication, "Bioremediation in the Field," EPA/540/N-95/500, No. 12, Aug 1995, is attached (Attachment 3) for further information. Also, bioremediation in the field search system (BFSS) database is available on EPA's Cleanup Information (CLU-IN) bulletin board service (301-589-8366, data line) for downloading.

I hope this letter addresses your concerns. If your office staff wishes to discuss any specific concerns or issues related to these technologies, please have them contact Subijoy Dutta, of my staff, at (703) 308-8608.

Sincerely yours,

Michael H. Shapiro, Director
Office of Solid Waste

Enclosure

Attachment

SENATE OF MARYLAND
Annapolis, Maryland 21401-1991

March 1, 1996

The Honorable Carol M. Browner, Administrator
United States Environmental Protection Agency 410
M Street, S.W.
Washington, D.C. 20460

Dear Administrator Browner:

The Maryland State Senate this year has begun considering legislation designed to limit the State's liability from actions taken in response to releases of petroleum from above-ground and underground sources. Before us this Session is proposed legislation that directs the Maryland Department of the Environment (MDE) to maximize the use of technologies that destroy the contamination found in soil and groundwater when they respond to petroleum releases. While Senate Bill 668 (see attached) only pertains to the funds directly under MDE's control, the issue is critical to generators throughout tho State.

Maryland has many different types of petroleum-contaminated soil treatment facilities operating state-wide. These facilities utilize technologies as varied as bioremediation, cold-mix soil-cement, cold-mix asphalt, brick-kiln incorporation, landfilling and thermal desorption. While each technology type has its proponents, of concern is whether the treatment technologies currently operating in the State can adequately provide the cleanup levels mandated by State regulation and claimed by the providers of the service.

The MDE has used a standard of 10 parts per million (ppm) Total Petroleum Hydrocarbon (TPH) as a cut-off level below which treated soil is considered non-contaminated and eligible for unrestricted use. Under this criteria, large quantities of soil have been treated in the State, much from out-of-state sources and disproportional to the amount generated within the state. Several of these technologies are not approved for use in most states, which gives cause for concern that perhaps Maryland is not aware of the ramifications that can arise from the use of some of these technologies.

We have been informed that a considerable amount of investigation has been conducted by the Environmental Protection Agency regarding severa1 of the specific treatment technologies in question - bioremediation and cold-mixing. Recognizing that petroleum releases from underground storage tanks are not considered, at least at this time, a hazardous waste, none-the-less there apparently has been a great deal of work done by your RCRA office in deciding "Best Demonstrated Available Technologies" (BDAT) for a large variety of wastes that fall under "land ban" restrictions. The studies seem to indicate that organic contaminants are not considered candidates for treatment by using either asphalt-based cold-mix or Portland cement cold-mix technologies. Apparently the concern by researchers is similar to the concern of this legislative body, that is, that organic contaminants will tend to leach even after treatment. Also, I have been informed that your Superfund office in Cincinnati, Ohio arrived at the same conclusion, and has developed a guidance document (EPA/530/R-93/012) which indicates that this practice should be avoided.

Bioremediation is an accepted means by which many contaminated sites can be remediated to decreased contaminant levels while leaving the contaminated soil in place. However, in Maryland there are treatment facilities which claim remediation of any petroleum contaminated soil at their offsite locations in thirty days to levels of 10 ppm or less TPH. While this would be of tremendous benefit to the State, I've been told by industry experts that this is not a physical or microbiological possibility. Apparently there are recalcitrant compounds routinely found in petroleum, such as polynuclear aromatic hydrocarbons and oxygenates which have bioremedial half-lives that are routinely measured in terms of years. I've also been informed that the means by which MDE determines whether a treated contaminated soil is "clean" is by use of a test (8015M, purge and trap) that only measures the VOCs, therefore not measuring non-VOC hydrocarbons when testing for acceptability as to unrestricted use.

We are therefore soliciting your response to the following inquiries:

1) Are the use of cold-mix technologies appropriate for hydrocarbon-contaminated soil? Is there any possibility of the contaminants leaching once treated by these methods? Are there any instances where RCRA would consider the cold-mixing of a hydrocarbon contaminated hazardous waste, containing compounds similar to those found in commonly encountered petroleum, a BDAT? What role does volatilization play in the disappearance of volatile organic compounds during cold-mixing? Does EPA allow the use of cold-mix technologies to treat hydrocarbon-contaminated soil at Superfund sites? If so, what

conditions are placed on the post-treatment use of this mixture? Lastly, are these cold-mix treatment mixtures allowed to be used in an unrestricted manner?

2) Is EPA aware of any form of biopiles or ex-situ landfarming that can routinely treat hydrocarbon-contaminated soils to levels of 10 parts per million of total petroleum hydrocarbons? Are there any instances where EPA has found that bioremediation can be used to treat any petroleum-contaminated soil to a level of 10 parts per million total petroleum hydrocarbons within 30 days? Are certain hydrocarbons such as polynuclear aromatic hydrocarbons or oxygenates recalcitrant to bioremediation? What role does volatilization play in the bioremediation of volatile organic compounds?

Your Agency's prompt response to these questions will enable us to proceed forward with our deliberations in this matter. Mr. Steve Verch of my office is available to speak with your staff member assigned to respond to this request. He can be reached at (301) 858-3642. Thank you for your efforts in this matter.

Sincerely,

Michae1 J. Collins
Senator