VSTJeen 4/18/16

Department of Toxic Substances Control

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Community Protection and Hazardous Waste Reduction Initiative
Pilot Project Proposal Form

Instructions
This form contains fillable fields. Mouseover each field for additional instructions. Not all fields need to be completed for submission, and general responses are acceptable if more specific responses have not been developed.

1.0 Pilot Project Summary

Identify the primary components of this pilot project.

Waste Stream:	legacy waste- contaminated soils- DDT, PCBs, halogenated and petroleum
Industry:	legacy wastes from clean up sites and disposal sites
Geography:	CA, US, international
Stakeholders:	EJ neighbors of clean up and disposal sites
Government:	All

2.0 Pilot Project Details

Describe this pilot project and how it fits with the overall goals and objectives of the CPHWR Initiative. Characterize the waste(s) to be reduced and the implications.

Research the potential of Supercritical Water Oxidation on all legacy wastes- on-going cleanup sites, existing landfills.

Research scale projects, portable/transportable units. Goal- to clean up sites in-situ, not have to move contamination too much, clean up at the source, have the unit go to the problem area.

Safer to treat the wastes at the source vs move from one site to another. Instead of transporting the waste, have the treatment units go to the source.

Once soils are treated, then waste water needs to be treated. Scale a project that deals with both- large amounts of contaminated soils and then how to treat the water.

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3.0 Pilot Project Characteristics

Identify any applicable characteristics of this pilot project.

[✓] Source reduction or elimination
[✓] Provides a permanent solution
[✓] Minimizes or avoids disposal
[✓] Avoids media shifting

[✓] Long term reductions
[✓] Replicable
[ ] Short term reductions
[✓] Scalable

[✓] Decreases high volume waste
[✓] Decreases toxicity of waste
[✓] Decreases high toxicity waste
[✓] Reduces waste treatment impacts

[✓] Economically beneficial
[✓] Stakeholders willing to participate
[✓] Represents a viable alternative
[✓] Benefits EJ community

[ ] Other:

Describe how this pilot project addresses the characteristics identified above.

Treat the contaminated soils waste at the source.

Until the point when we generate none of this waste stream, we need to better manage contaminated soils. To more from one site to another without treatment is not a good solution.

No new contaminated soils disposal sites- would benefit EJ communities. Temporary impact at the source of contamination until cleaned up, but no legacy waste remains behind.

See Cynthia Babich's proposal for more detail

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4.0 Pilot Project Considerations

Identify resources, tools and/or experts which can be used to gather information in support of this pilot project.

Learn from existing pilot projects

Identify other agencies that may have jurisdiction where this pilot project will be implemented.

EPA, Cal EPA, DTSC

Identify areas of potential competing considerations and objectives (including technical, legal, environmental, social, and economic factors).

none known

Discuss other possible benefits in addition to decreasing the volume and toxicity of hazardous waste.

scale up to larger volume waste, other contaminants treatment. In situ treatment vs moving dirt around would be preferred.

What are other key items to consider in completing this pilot project?

transferring sludge to another media, assuming there is a sludge waste

Identify the various approaches to implementing this pilot project.

try different types of contaminated soils and liquids. In-situ would be preferred

United States Environmental Protection Agency

Engineering Issue

Technology Alternatives for the Remediation of PCB Contaminated Soils and Sediments

Table of Contents

EPA/600/S-13/079

1.0 PURPOSE

The U.S. Environmental Protection Agency (EPA) Engineering Issue papers are a series of documents that summarize the available information on specific contaminants, selected treatment and site remediation technologies, and related issues. This Engineering Issue paper is intended to provide remedial project managers (RPMs), on-scene coordinators (OSCs), contractors, and other state or private remediation managers with information to facilitate the selection of appropriate treatment and disposal alternatives for soil and dredged sediment contaminated with polychlorinated biphenyls (PCBs). This information includes the type of data and site characteristics needed by site cleanup managers to evaluate *ex-situ* technologies for potential applicability to their hazardous waste sites. This Engineering Issue paper does not address in situ alternatives for sediment (e.g. monitored natural recovery or capping). For a more comprehensive guidance concerning remedial alternatives specifically for sediments see the "Contaminated Sediment Remediation Guidance for Hazardous Waste Sites," EPA-540-R-05-012, U.S. Environmental Protection Agency, December 2005 [01]; "A Risk-Management Strategy for PCB-Contaminated Sediments National Research Council," National Academies Press., May 2001 [02]; and "Reference Guide to Non-Combustion Technologies for Remediation of Persistent Organic Pollutants (POPs) in Stockpiles and Soil," EPA-542-R-05-006, U.S. Environmental Protection Agency (EPA), 2005 [03].

This Engineering Issue paper provides an overview of PCB contamination and remediation, and was developed from peer reviewed literature, scientific documents, EPA reports, web site sources, input from experts in the field, and other pertinent information. It should be noted that some remediation technologies covered in this paper, while documented to be effective in PCB waste remediation, may not be commercially available or widely used at this time. Also, emerging and innovative technologies discussed herein, while not currently widely used, may see continued growth and use.

The Table of Contents shows the type of information covered in this paper. Important information has been summarized, while references and web site links are provided for readers interested in additional information. The web site links, verified as accurate at the time of publication, are subject to change.

2.0 INTRODUCTION

PCBs are now considered the most widespread pollutant on the planet. In industrial countries, the contamination originates from inadequate disposal and leaks from equipment. In remote areas where PCBs were not used, the contamination resulted from atmospheric transport [04]. PCBs are comprised of a class of synthesized organic compounds of up to 209 chlorinated biphenyls, with different physical and chemical characteristics [05, 06]. A biphenyl is a structure comprised of two benzene rings linked by a single carbon-carbon bond. The PCBs are prepared by direct chlorination of the biphenyl ring. Isomers are compounds having the same number of chlorine atoms, and congeners are compounds which bear different number of chlorine atoms. The congeners are designated by describing the position of the chlorine atoms on the biphenyl ring or, more simply, by the IUPAC (International Union of Pure & Applied Chemistry) numbering system. The congeners differ in their physical properties according to the number and the position of chlorine atoms [04, 07]. The high-chlorinated biphenyls are less water-soluble and less volatile than the low-chlorinated ones. The degree of chlorine substitution influences their biodegradability that decreases with increasing chlorination. The toxicity for the biota is related to the number of chlorines but prime importance is their position on the biphenyl ring. The congeners that take a co-planar configuration, such as congener 77 (3,3',4,4'-tetrachlorobiphenyl), are the more toxic ones [04, 08]. Commercially produced PCB mixtures were marketed in the U.S. primarily under the trade name "Aroclor". The various Aroclor formulations contain approximately 175 of the possible 209 identified PCB congeners. For example, Aroclor 1242 contains 42% of chlorine with a predominance of congeners bearing three and four chlorine atoms; Aroclor 1260 has 60% chlorine content with a predominance of six- and seven-chlorinated congeners. These mixtures typically contain more than 70 different congeners and were sold under different names (Aroclor, Phenoclor, Clophen, Delor and Kanechlor), depending on the manufacturer [04]. Due in part to mounting evidence that PCBs persist in the environment and pose a variety of environmental and health hazards, Congress enacted the Toxic Substance Control Act (TSCA) in 1976, which directed the EPA to regulate the disposal, storage, spill response, cleanup, and labeling of PCB containing substances. Domestic manufacturing, processing, and distribution of commercial mixtures and uses of PCBs were banned in the U.S. in 1979. These chemicals are now only manufactured in the U.S. for analytical standards and scientific research [08].

Of the 209 PCB congeners, 12 have dioxin-like effects on humans. Most PCBs are oily liquids, the color of which darkens and the viscosity increases with a corresponding increase in the number of chlorine atoms. PCBs with fewer chlorine atoms are more soluble, amenable to chemical and biological degradation, and less persistent in the environment. However, as a chemical class, PCBs are chemically and biologically stable, hydrophobic, do not conduct electricity, possess a low volatility at ambient temperatures and have no known taste or smell. PCBs are soluble in organic or hydrocarbon solvents, oils, fats, and slightly soluble in water.

The specific properties that made PCBs valuable for industrial applications include extreme stability, chemical inertness, resistance to heat, and high electrical resistivity or a high dielectric constant [09]. These same properties also contributed to the environmental legacy of PCBs. Due to their widespread use in industry, large amounts of PCBs have been released into the environment. It has been estimated that 31% of the total world production of PCBs (370,000 tons) have already been released to the environment. More than 60% remain in use or in storage. Only 4% have been destroyed [10]. PCBs have been found at 410 out of 1290 National Priority List (NPL) sites identified by EPA [11]. PCBs enter the environment as mixtures containing a variety of individual chlorinated biphenyl components, known as congeners. Environmental transport processes such as vaporization, dissolution, and sorption do not act on all congeners equally, resulting in environmental concentrations of individual PCB congeners that may differ substantially from those present in the original commercial mixture. This process is known as weathering. Some congeners are more efficiently biotransformed by microbial action in soil than others [12, 13]. The extent of biotransformation can be dependent on environmental conditions (i.e. aerobic versus anaerobic) and the microorganisms present. These biotic and abiotic changes in congener composition may alter the toxicity of the mixture, making it more or less toxic than the commercial product. Because the PCB mixtures are lipophilic, they accumulate in the adipose tissue of organisms. The extent of chlorine substitution affects biotransformation. PCBs with higher chlorine contents are less biodegradable, making them a greater bioaccumulation risk [14].

PCBs readily adsorb to organic materials, sediments, and soils. Consequently, PCBs are widespread in the environment, whereby humans are exposed through multiple pathways. Levels in air, water, sediment, soil, and foods can vary over several orders of magnitude, often depending on proximity to a source of release into the environment. Through a process known as biomagnification, PCBs pass up the food chain at ever intensifying levels, accumulating in the tissues of the organisms that consume affected fauna [15]. Certain soil and sediment properties including soil density, particle size distribution, moisture content, and permeability are known to affect the mobility of PCBs.