United States
Environmental Protection
Agency

Hazardous Waste Engineering
Research Laboratory
Cincinnati OH 45268

Research and Development

EPA/600/S2-85/105 Jan. 1986

EPA

Project Summary

Decontamination Techniques for Mobile Response Equipment Used at Waste Sites (State-of-the-Art Survey)

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A state-of-the-art review of facility and equipment decontamination, contamination assessment, and contamination avoidance has been conducted. This review, based on an intensive literature search and a survey of various equipment manufacturers, provides preliminary background material on the subject. The information developed here constitutes an important "head start" for those who need to establish preventive measures, decontamination plans, and procedures for response personnel and cleanup equipment used at hazardous waste sites.

The study discusses various decontamination methods, such as use of solvents to wash off contaminants, use of chemical means to degrade contaminants, and use of physical means to remove contaminants. Chemical and physical testing methods designed to assess the nature of the contaminant and the quantity and extent of contamination were also investigated. Also discussed in the full report are procedures that can be used to prevent contamination of response equipment and personnel. These preventive procedures are: enclosures to prevent spread of contaminants, safety features on response equipment to prevent spills and leaks, protective coatings on response equipment surfaces, and use of protective clothing and furnishings for personnel.

Three case studies were also reviewed: The Three Mile Island cleanup, the "Vulcanus" incinerator ship cleanup (dioxins and PCBs), and PCB cleanups in Binghamton, New York. The review has identified several methods that could be of value in effectively decontaminating response equipment units, such as a mobile incinerator at a reasonable cost.

This Project Summary was developed by EPA's Hazardous Waste Engineering Research Laboratory, Cincinnati, OH, to announce key findings of the research project that is fully documented in a separate report of the same title (see Project Report ordering information at back).

Introduction

A state-of-the-art review of facility and equipment decontamination methods was conducted by the U.S. Environmental Protection Agency (EPA) to provide waste site response personnel with an introduction into the area of contamination avoidance and decontamination techniques that may be applicable to mobile response equipment. The full report, based on an intensive literature search and a survey of various equipment manufacturers, provides preliminary background material on the subject. The information presented constitutes an important "head start" for those who need to establish preventive measures, decontamination plans, and procedures for response personnel and cleanup equipment at hazardous waste sites.

Mobile response equipment that was developed by the Releases Control Branch of the EPA Hazardous Waste Engineering Research Laboratory is also in need of contamination control and decontamination procedures. The response unit primarily in need of these procedures is the EPA-developed Mobile Incineration System, which has been used for incinerating dioxin-contaminated soils. The full report refers to the decontamination of the mobile incinerator, while providing information applicable to other types of mobile response units.

Decontamination methods generally rely on fundamental techniques for treating an assortment of hazardous/unwanted substances. Areas that demand surface decontamination, include:

- Nuclear waste activities
- Chemical/biochemical warfare agent cleanup
- Chemical process tank cleaning
- Drum recycling.

An overview of decontamination methods relative to these areas is provided in the full report's introduction, and specific case examples are also outlined in greater detail.

The remainder of the report discusses methods commonly used by chemical manufacturing industries for reducing or preventing contamination of equipment at hazardous waste sites and outlines methods to quantitatively measure the levels of contaminants. This helps to define decontamination procedures and safety criteria to be used following contaminant detection and evaluation. Test cases where contamination avoidance/decontamination activities were actually employed are also described.

Contamination Avoidance

One mode of minimizing exposure potential to contaminants present at waste sites is through contamination avoidance to reduce or prevent contamination of mobile response equipment. Four methods of contamination avoidance are discussed in the full report. These methods appear to be most effective and economically feasible. The methods include:

- Enclosed structures and secondary containment for the mobile response units (e.g. mobile incinerator)
- Mobile equipment safety features to prevent spills and leaks
- Protective coatings for the mobile response equipment
- Protective clothing and equipment for personnel

Assessing Contamination Levels

After a contaminated area and associated components are identified, a series of chemical and/or physical tests are performed to quantitatively measure the levels of contaminants present in the subject area. The full report outlines considerations which must be addressed when performing surface sampling and analysis using applicable chemical and physical tests. In addition, it notes various difficulties in analyzing for compounds such as dioxin.

Decontamination of Mobile Response Equipment

Chemical and physical properties of hazardous substances in the water or soil being treated are major considerations in designing equipment decontamination procedures. Procedures for decontamination may be divided into three categories:

- Solvent and solubilization methods
- Chemical degradation of surface contaminants
- Physical decontamination methods.

Each procedure utilizes different mechanisms for removing contaminants. They vary with regard to operation efficiency, safety, cost, and requirements for pretreatment and cleanup steps. The full report provides a comprehensive overview of these methods.

Case Studies

Published documentation on the following decontamination projects was assessed to identify techniques potentially applicable to the chemical decontamination of mobile treatment units:

- *Binghamton State Office Building*: Decontamination of PCBs, dibenzofurans, and dibenzodioxins following a building fire;
- *Incinerator Ship M/T "Vulcanus"*: Decontamination of 2,3,7,8-TCDD from ship surfaces and holding tanks during and following incineration operations;
- *Three Mile Island Reactor No. 2*: Decontamination of radiation from a variety of surfaces.

Decontamination methods developed and tested for these projects include the use of nonionic detergents, salt water and acetone rinses, and electropolishing techniques.

Sufficient evidence on the actual effectiveness of the methods used in these projects was available only for the Binghamton Office Building decontamination project. The specific nonionic detergents which were applied to the building reduced the level of PCB, dibenzodioxin, and dibenzofuran contamination to levels that were acceptable for human exposure.

Other aspects of these case studies were also considered. The personnel protection plans, which were documented for two of the three cases, indicate that several approaches for personnel protection may be implemented. These methods include isolating contaminated areas, using disposable protective clothing, and monitoring work space air and surface areas to avoid unpredicted exposures.

Conclusions and Recommendations

The decontamination and contamination avoidance methods outlined in this Project Summary, such as the physical and chemical cleaning methods, protective coatings, personnel protective clothing and equipment, and containment structures, have a wide range of advantages. The following paragraphs present several promising decontamination scenarios, based on combinations of the methods described in the full report.

Seamless surface coatings of heat and chemically resistant, durable polymers will increase the ease and effectiveness of most decontamination methods that are used for mobile response units. Also, the presence of a drainage and collection system beneath the mobile units to contain rinses and other surface cleaning wastes will facilitate the decontamination process.

Decontamination can be simple. Vacuuming can effectively remove gross contamination such as particulates from coated surfaces. Final decontamination may then be accomplished using either detergents and high pressure water or wet abrasive blasting. Spent wash and rinse waters may be collected and properly stored for incineration, or off-site disposal.

Vacuuming, or an initial water rinse to remove gross contamination, followed by the application of a solvent, or acid-based foam or gel, is another approach. After allowing time for contaminant solubiliza-

tion, the formulation may be rinsed off and collected for disposal. This process may be repeated to accomplish sufficient decontamination.

Areas of mobile response units that are most heavily contaminated, such as the loading area and hopper system on the mobile incinerator, may be stripped to bare metal to ensure the highest level of decontamination. One of the most promising techniques is exposure to high intensity UV light or flash blasting, which destroys contaminants at temperature flashes of 2,760°C. In some cases, heavily contaminated areas may be disassembled and cleaned separately via high pressure FREON™* or ultrasonic cleaning.

*Mention of trademarks or commercial products does not constitute endorsement or recommendation for use by the U S Environmental Protection Agency

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The complete report, entitled "Decontamination Techniques for Mobile Response Equipment Used at Waste Sites (State-of-the-Art Survey)," (Order No. PB 85-247 021/AS; Cost: $11.95, subject to change) will be available only from:
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