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Literature Review of Stabilization/Solidification of Volatile Organic Compounds and the Implications for Hanford Grouts

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FOR THE UNITED STATES
DEPARTMENT OF ENERGY

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Chemical Technology Division

LITERATURE REVIEW OF STABILIZATION/SOLIDIFICATION OF VOLATILE ORGANIC COMPOUNDS AND THE IMPLICATIONS FOR HANFORD GROUTS

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S. C. Osborne

Date Published-September 1993

Prepared for
Westinghouse Hanford Company
(Activity No. EW 10 10 03 0)

Prepared by the
OAK RIDGE NATIONAL LABORATORY
Oak Ridge, Tennessee 37831
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MARTIN MARIETTA ENERGY SYSTEMS, INC.
for the
U.S. DEPARTMENT OF ENERGY
under contract DE-AC05-84OR21400

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ACRONYMS

BDAT	best demonstrated available technology
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
DST	double-shell tanks
EPA	U.S. Environmental Protection Agency
GTF	grout treatment facility
ORNL	Oak Ridge National Laboratory
OTA	Office of Technology Assessment
RCRA	Resource Conservation and Recovery Act
ROD	record of decision
S/S	stabilization/solidification
SARA	Superfund Amendments and Reauthorization Act
SITE	Superfund Innovation Technology Evaluation
TCEt	1,1,1-trichloroethane
TCLP	toxicity characteristic leaching procedure
VOC	volatile organic compound
WHC	Westinghouse Hanford Company

PREFACE

This report meets requirements for Milestone 3.3, "Final Report (Based on Literature Findings) of Selected Organics Treatment Options and Recommendations for Hanford Wastes," as described in Statement of Work TMG-SOW-H-91, Rev. 0, in support of the Westinghouse Hanford Grout Disposal Program.

EXECUTIVE SUMMARY

Stabilization/solidification technology is one of the most widely used techniques for the treatment and ultimate disposal of both radioactive and chemically hazardous wastes. Cement-based products, commonly referred to as *grouts*, are the predominant materials of choice because of their low processing costs, compatibility with a wide variety of disposal scenarios, and ability to meet stringent processing and performance requirements. Such technology is being utilized in a grout treatment facility by the Westinghouse Hanford Company (WHC) for the disposal of various wastes located on the Hanford Reservation, including 106-AN wastes.

As of September 25, 1990, the U.S. Environmental Protection Agency (EPA) replaced the EP-Toxicity Procedure with the Toxicity Characteristic Leaching Procedure (TCLP) for determining whether a waste whose status is unknown is characteristically hazardous. This new procedure changed the status of many wastes throughout the United States from "not characteristically hazardous" to "characteristically hazardous" because several organic compounds were added to the metals and pesticides/herbicides already regulated. There was also concern that the potential presence of organics might make the Hanford grouts subject to the land-ban restrictions. WHC was concerned that the double-shell tanks supernate was potentially characteristically hazardous by TCLP definition, or subject to land-ban restrictions, because of the suspected presence of the following organics: acetone, methyl ethyl ketone, methyl isobutyl ketone, and 1,1,1-trichloroethane.

These four organics are defined as volatile organic compounds (VOCs) by EPA. (The TCLP lists extractant-concentration limits for a large number of organics not regulated by the EP-Toxicity procedure, and the limits for these four are nonlisted, 7.2 mg/L, nonlisted, and 30 mg/L, respectively. Land-ban restrictions limit the TCLP leachate concentration of acetone to 0.59 mg/L. All four compounds are targeted for treatment under the land-ban restrictions and within the waste codes by the best demonstrated available technology (BDAT). (The BDAT reference numbers are 222, 34, 229, and 45, respectively.)[1] Even if the supernate were not characteristically hazardous by TCLP definition, WHC was concerned that the regulators of EPA and the state of Washington might still require proof of the organic retention capabilities of the grout and engineered barriers because of the potential presence of these organics.

A literature search on stabilization/solidification of VOCs revealed three previous reviews on this topic, two covering the pre-1985 period and one covering the post-1985 period. Not all of the relevant literature was in hand at the time this report was written, but the availability of two of the reviews (including the post-1985 review) made the review fairly complete.

Stabilization/solidification has routinely been used for remediation of Superfund sites, sometimes even when organic contamination (including VOCs) was present. Despite this, stabilization/solidification of organics is not widely accepted in the regulatory community. In fact, it is not accepted for Resource Conservation and Recovery Act wastes and land-banned wastes and is under attack for Comprehensive Environmental Response, Compensation, and Liability Act and Superfund Amendments and Reauthorization Act wastes. Thus, if VOCs are present at levels of regulatory concern (doubtful at the high temperatures of the double-shell tanks waste), it is questionable that regulators will accept stabilization/solidification and subsequent burial.

There is good evidence that clays, particularly modified clays, bond or degrade organics. However, organics, especially hydrophilic organics, are generally aqueous leachable from stabilization/solidification products. The additives do help retard the leaching rate and can help the Westinghouse Hanford Company grouts retain the VOCs, but it must be assumed the VOCs will eventually be released. VOC evaporative losses do occur during processing, but a significant fraction should be retained in the waste form at normal temperatures (the high temperatures of the Westinghouse Hanford Company wastes and grouts should cause them higher losses).

It is recommended that Westinghouse Hanford Company verify the presence of VOCs in the double-shell tanks waste, receive regulatory approval for stabilization/solidification if VOCs are present, use commercial additives for organics if VOCs are present and approval is received, and test the effectiveness of these additives before investing in them.

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LITERATURE REVIEW OF STABILIZATION/SOLIDIFICATION OF VOLATILE ORGANIC COMPOUNDS AND THE IMPLICATIONS FOR HANFORD GROUTS

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ABSTRACT

A literature review was conducted on the stabilization/solidification of volatile organic compounds (VOCs). Based on this literature, it is likely that the limestone-containing grout will not permanently immobilize VOCs and that no presently available additives can guarantee permanent immobilization. The Westinghouse Hanford Company grout may be fairly effective at retarding aqueous leaching of VOCs, and commercial additives can improve this performance. Significant VOC losses do occur during stabilization/solidification, and the high temperatures of the Westinghouse Hanford Company waste and grout should exacerbate this problem. In fact, these high temperatures raise doubts about the presence of VOCs in the double-shell tanks supernates.

1. INTRODUCTION

Stabilization/solidification (S/S) technology is one of the most widely used techniques for the treatment and ultimate disposal of both radioactive and chemically hazardous wastes. Cement-based products, commonly referred to as *grouts,* are the predominant materials of choice because of their low processing costs, compatibility with a wide variety of disposal scenarios, and ability to meet stringent processing and performance requirements.

Such technology is being utilized in a grout treatment facility (GTF) by the Westinghouse Hanford Company (WHC) for the disposal of various wastes located on the Hanford Reservation, including 106-AN wastes. This document reports the results of the literature review on organic immobilization in grouts by the Oak Ridge National Laboratory (ORNL) in support of the WHC Grout Technology Program.

2. BACKGROUND

A grout waste form is generated in the WHC GTF. In this facility, a dry-solids blend is combined with the radioactive supernate, a low-level-liquid radioactive waste from the double-shell tanks (DSTs), in equipment located adjacent to the DSTs. (Only the solids in the DSTs are considered transuranic or high-level waste.) The resulting fresh grout is then pumped to a permanent disposal site where it forms and hardens inside an engineered barrier protecting against the intrusion of groundwater and the subsequent release of the waste constituents of concern. The grout must meet stringent process and product performance criteria dictated by the difficulties of formulating a mix to meet the regulatory and processing requirements. Once an acceptable formulation is achieved, the processing can be addressed more realistically.

As of September 25, 1990, the Environmental Protection Agency (EPA) replaced the EP-Toxicity Procedure with the Toxicity Characteristic Leaching Procedure (TCLP) for determining whether a waste whose status is unknown is characteristically hazardous. This new procedure changed the status of many wastes throughout the United States from "not characteristically hazardous" to "characteristically hazardous." The main reason this procedure changed the status of many wastes was the addition of several organic compounds to the eight metals and six pesticides/herbicides regulated under the EP-Toxicity test. There was also concern that the potential presence of organics might make the Hanford grouts subject to the land-ban restrictions. WHC was concerned that the DST supernate was potentially characteristically hazardous by TCLP definition because of the suspected presence of the following organics: acetone, methyl ethyl ketone, methyl isobutyl ketone, and 1,1,1-trichloroethane (TCEt).

These four organics are defined as volatile organic compounds (VOCs) by EPA. (The TCLP lists extractant concentration limits for a large number of organics not regulated by the EP-Toxicity procedure, and the limits for these four are nonlisted, 7.2 mg/L, nonlisted, and 30 mg/L, respectively. All four compounds are targeted for treatment under the land-ban restrictions and within the waste codes by the best demonstrated available technology (BDAT). The BDAT reference numbers are 222, 34, 229, and 45, respectively.[1]) Even if the supernate were not characteristically hazardous by TCLP definition, WHC was concerned that the regulators of EPA and the state of Washington might still require proof of the organic retention capabilities of the grout and engineered barriers because of the potential presence of these organics. The purpose of this project was to review the literature on the effectiveness of grouts in retaining organics and make recommendations to WHC, based on this review, about WHC formulation modifications or additives to improve the organic retention capabilities of the WHC grouts. The high vapor pressures of these organic compounds at the temperatures of these supernates, the activity coefficients of the organics (especially the hydrophobic organics), and the length of time these wastes have been stored leads one to suspect that little if any of these compounds presently remains in the DST supernate. Only the precipitates and solids present in the DST waste provide a potential mechanism for significant retention of the VOCs in the solution. However, measuring organic concentrations at the levels required by TCLP is difficult for fairly clean water and much more difficult for the chemically and radiologically harsh DST supernate. At the time this report was written, the DST supernates had not been analyzed for these VOCs; it may not be possible to measure these wastes with the accuracy necessary to satisfy regulatory concerns. This project was constrained from estimating the potential for VOC retention in the DST supernates, and organic analysis was also beyond the scope of this project. We understand that such an estimation and analysis effort is being pursued by others at WHC and Battelle Pacific Northwest Laboratories. The focus of this project was to evaluate the organic retention capabilities of grouts, not whether such organics will actually be in the WHC grouts.

3. OBJECTIVES AND CONSTRAINTS

The objectives of this project were (1) to conduct a computer literature search on S/S of VOCs, (2) to acquire as many of the relevant references as possible within the time schedule of the project, (3) to review these references, and (4) to make recommendations on retaining VOCs in grouts. The time period of this review covers at least 1972 through 1990. This project was constrained from estimating whether significant levels of VOCs might be present in the DST supernate.

4. LITERATURE SEARCH

The references listed in Sect. 8 were obtained from (1) a DIALOG^R computer search, (2) a recent literature review, and (3) references compiled during a previous project at ORNL. Appendix A lists the relevant output from the computer search. The list of literature includes three previous literature reviews related to the topic of discussion: (1) a recent review concentrated mainly on post-1985 literature on the effectiveness of S/S of hazardous organic waste (18 references), (2) a review up to 1985 on the S/S of organic liquid wastes and sludges (125 references), and (3) a review done in 1985 of clay-aromatic interactions with a view to their use in hazardous waste (76 references).[2,41,42] Reference 2 was the review used to help compile the references listed in Sect. 8; and the references from this review, but not from the other two reviews, were included because this review has not been published yet (i.e., the references, not listed by the other two sources for this report's references, were listed to guarantee that WHC had knowledge of all the potential references).

5. DISCUSSION OF THE LITERATURE

With the three previous reviews and the advantage of a previous project on this subject, the literature search and list of literature (the 47 references in Sect. 8, plus those in the reviews) were fairly complete, although there is never a guarantee that every possible reference has been found. Unfortunately, only 14 of these references were in hand in time for review for this report (refs. 2, 7, 8, 10, 12, 13, 15, 21, 22, 31, 32, 33, 42, 44, and 47). The text of the newsletter articles was included in the computer search printout and thus was available; although these articles contained some interesting qualitative information, there was little technical content that could be used to give quantitative recommendations (refs. 34–40). At the time this report was written, only an abstract, sometimes only the title and authors, was available for the remainder of the references in Sect. 8 (refs. 1, 3, 4–6, 9, 11, 14, 16–20, 23–30, 41, and 43–46). The literature review of reference 2 did give more information on its references, which are included in Sect. 8 (refs. 1, 4–6, 12–14, 16–18, 20, 23, 27–28, 31, 41, and 45–46). Thus, this report cannot be considered a complete or thorough review of the literature available for this topic. A fair job was done by using the two reviews (refs. 2 and 42) and the other literature in hand.

5.1 PREVIOUS LITERATURE REVIEWS

The following two quotations from Tittlebaum et al. summarize their conclusions about the S/S of organic liquid wastes and sludges before 1985:

1. Few adequately documented studies have been reported on the performance (physical and chemical stability) of solidified and/or stabilized mixtures containing hazardous organic wastes.[2]
2. Almost no published information exists on the nature, strength, and permanence of the bonds formed in the solidification and/or stabilization process.[41]

The Warren et al. review about organic interactions with clays covering the same time period (i.e., pre-1985) is not nearly so negative, as the following quoted conclusion demonstrates:

> "However, the use of these minerals as an additive to a cementitious system would seem to offer a promising method of dealing with organic waste material and might cause an accelerated degradation of the waste."[42]

This positive assessment did not conclusively address all of the concerns expressed about effective practical use of clays in S/S of organics. The Warren et al. review acknowledges (1) that a given clay will not work for all organics, and a combination of clays will likely be needed for the variable combination of organics found in wastes and (2) that such an application still requires research and development and is not a mature technology yet.

The more recent review of Brown et al., on the effectiveness of S/S of hazardous organic wastes, is even more negative than that of Tittlebaum et al., as evidenced by the following quoted conclusions:

> 1. Therefore, the use of S/S of organic wastes at TSD (treatment, storage, and disposal) facilities may not be appropriate because there are other treatment options which will destroy ORGANICS and eliminate any concern about the return of the ORGANICS to the environment after treatment.
> 2. Concerns regarding the conflict between goals for minimization of waste volumes and the inherent increase in waste volumes associated with S/S of WASTES still remain.[2]

Conclusion number one implies that the objective of a hazardous waste treatment, storage, and disposal facility should be destruction of organics, not retention.

Brown et al. provides an excellent review of the literature on this topic since 1985 and defers to Tittlebaum et al. for the pre-1985 period. However, the authors not only cite the literature and its results and conclusions, but also draw their own conclusions, sometimes unjustifiably by unwarranted extrapolation of referenced experimental work. Sometimes, such extrapolations from two unrelated papers are used together to support the authors' contentions. Basically, the authors have adopted the regulatory perspective that the destruction of the organics is the only acceptable treatment alternative and that S/S has not been conclusively proven to destroy the organics. Indeed, S/S has not been demonstrated to destroy the organics in the manner of incineration, but the review acknowledges some evidence for alteration and/or bonding of organics to clays or waste form matrices. The review makes valid and thoughtful arguments from this perspective but sometimes goes too far in its desire to discredit S/S. For example, some of the more extreme arguments could be interpreted to mean that one molecule of organic would be unacceptable, because if it combined with just one molecule of water, then the concentration would exceed regulatory limits.

Brown et al. raise a valid point that the use of S/S for wastes contaminated with organics depends on regulatory, political, and legal arguments, as well as technical arguments. They recognize the usefulness of S/S for remediation of Superfund sites but question the validity of S/S for such wastes under Resource Conservation and Recovery Act (RCRA) and the land-ban restrictions (i.e., S/S is a valuable tool to remedy past mistakes but not to dispose of wastes currently being generated). (The WHC DST supernate likely falls in the latter category despite having been generated years ago, because the former category implies a waste dispersed in the environment and not easily retrieved.) They make this point in the following two sentences:

> For those WASTES which are land banned because of the ORGANICS concentration, the rules do not require that the BDAT be used for processing WASTES, however, the ORGANICS content of treatment residues cannot exceed those obtained using BDAT. In contrast, the objective of an S/S treatment is to bind ORGANICS in a manner which would restrict their release to the environment, but it is not generally expected to reduce the concentration of ORGANICS in waste residues other than by dilution or by the possible loss of ORGANIC vapors into the air during the treatment.[2]

In summary, the key questions are (1) whether current regulatory interpretations allow the organics to remain in the treated waste, (2) what total concentration is allowed, (3) what the regulatory methods are for measuring the total concentration, (4) whether advancements in S/S of organics results in degradation of the organics, (5) whether the degradation products are environmentally acceptable, (6) whether TCLP can be used as the means of judging S/S treatment as opposed to total concentration, and (7) whether the conflict between waste volume minimization and the typical volume increase experienced in S/S can be resolved.

5.2 FIELD APPLICATIONS

S/S of wastes containing organics is not universally accepted in the regulatory community, but it has been used in remediation frequently throughout the country (refs. 8–11, 14–15, 17, 21–27, 34–37, 39, and 44). The Office of Technology Assessment (OTA) Report Brief had the following two negative conclusions about the implementation of the Superfund Amendments and Reauthorization Act (SARA) of 1986: (1) the Superfund program does not consistently select the permanently effective treatment technologies that are preferred by SARA and (2) future cleanups are likely because of the frequent use of the impermanent technologies, land disposal and containment.[22] The tone of this brief was weighted heavily in favor of incineration of organic wastes for Superfund sites over other technologies, including S/S, although no discussion was presented about whether environmental protection resulted if organic concentrations were low and little or no volume reduction resulted from incineration. The brief presents ten case studies of the selection of remedial actions at Superfund sites, four of which used S/S of organics as part of the selected remedial action (Chemical Control Corp., Elizabeth, N.J.; Pristine, Inc., Reading, Ohio; Sand Springs Petrochemical Complex, Tulsa County, Okla.; and Tacoma Tar Pits, Tacoma, Wash.), including one that was in situ vitrification (Pristine, Inc.).

The list of references includes two records of decision (RODs), for Velsicol Chemical Corp., Ill., and Commencement Bay/Near Shore, Wash., that selected S/S as part of the remedial action treatment of wastes that contained organics, including VOCs.[9,10] The Velsicol ROD used chemical stabilization as part of the selected remedial action, but the ROD did not give details (e.g., what the reagents would be, how much would be needed) of the chemical stabilization, although estimates had been made of the effect on mobility and costs. Such details may have been given in the feasibility study that preceded the ROD and selected the remedial action from among the alternatives. This ROD did claim demonstrated effectiveness for chemical stabilization in the following quotation:

> Chemical stabilization has been demonstrated to provide significant treatment benefits through immobilization of site-specific contaminants. Although not equivalent to the destruction of wastes using incineration, with proper management of residuals, stabilization technology is considered effective and less costly, and is consistent with management requirements for the existing 5/6 Pond.[9]

The Commencement Bay ROD used polymer cement stabilization as part of the selected remedial action. The polymers were identified as silicate polymers, but it is not clear what was meant (pozzolanic reactions, proprietary silicate reactions, combination of cement and solution grouts such as sodium silicate, etc.).[10]

Other sites that intend to use or have used S/S for wastes contaminated with organics include Pepper's Steel and Alloys, Burnt Fly Bog, ARCO Sand Springs, Michigan Liquid Disposal, and Saco (refs. 11, 34–36, and 39).

Also, some laboratory studies and field demonstrations have been done on the effectiveness of S/S of wastes containing organics. The Hazcon process was tested in the laboratory by the Waterways Experiment Station for use at the Rocky Mountain Arsenal in Denver, Colo., and tested in a field demonstration at Douglassville, Penn., by the Superfund Innovative Technology Evaluation (SITE) program (refs. 21, 24–26, 37, and 40). Apparently, the initial reaction from Douglassville was positive in that a high concentration of organics was successfully solidified into a fairly strong monolithic waste form, but later results concluded that the organics were only encapsulated and not stabilized; that is, the organics were desorbed or leached relatively easily, and eventually 100% would be released to the environment. The results were similar for the Waterways Experiment Station laboratory study. It appears that the Hazcon reagent is useful for overcoming the interference of some organics in the setting of cement, but it does not necessarily help greatly in retaining the organics. This seems logical because the Hazcon process was originally developed to help solidify oily sludge ponds and drilling muds from oil well drilling. These wastes were difficult to solidify because of the high organic content, but they are not subject to environmental regulations [or at least not to RCRA, Comprehensive Environmental Compensation, Response, and Liability Act (CERCLA), and SARA]. It may be that this product was not previously subjected to leach testing because of this special exemption, despite the vendor claim to Waterways Experiment Station of effective stabilization against aqueous leaching; but this project has no proof of such claims one way or the other.

Another SITE demonstration evaluated the effectiveness of the Solidtech process in stabilizing wastes containing organics from the Imperial Oil Co./Champion Chemicals Superfund site.[14,15] This evaluation observed high physical stability and negligible leaching of organics (including VOCs) and concluded that the Solidtech process effectively stabilized the contaminants in this demonstration. Brown et al. do not find the evidence for organic immobilization, especially for VOCs, conclusive.[2]

The SITE demonstration at Hialeah, Florida, was intended mainly as a demonstration of in situ S/S, but it used the International Waste Technology process with wastes containing organics.[27] A copy of this reference was not in hand for this review, but Brown et al. provide some insight into the demonstration.[2] Once again, effective reduction of leaching organics (including VOCs) was observed, implying that the vendor and the SITE program may have concluded that organics were effectively stabilized, but Brown et al. do not find the results to be conclusive.

Brown et al. usually cite the following two reasons for inconclusive results when negligible organics leached from the products: (1) organic concentrations were too low to be conclusive, and (2) there was no proper accounting for evaporation to know how much of the organics was in the product and how much had evaporated.[2] These criticisms are valid, especially for the field demonstrations. In general, studies have been conducted as treatability studies, where the existing concentrations in the waste were not boosted by spiking, even if low, and evaporative losses during treatment were not monitored. Current organic analytical techniques are quite sensitive to the presence of a given compound, but quantitation can be quite inaccurate, especially for soils and sludges. (It is acknowledged that evaporation is allowable, even desirable, but it is maintained that reproducible and predictable evaporation during S/S has not been demonstrated and that "permanent" immobilization of organics has not been demonstrated.) Spence et al. specifically designed their laboratory study to overcome these two limitations in evaluating the effectiveness of four vendor formulations in immobilizing eight VOCs.[32,33]

Although the sludge from a Superfund site provided the basic matrix for the study, Spence et al. spiked this sludge with enough of the eight VOCs to guarantee measurable concentrations in the leachates, and the amount of VOCs that evaporated during mixing with the vendor reagents and during curing was measured.[32,33] Thus, mass-transfer parameters and the fractions evaporated during preparation were estimated. Not surprisingly, the different reagents had varying degrees of success with the different compounds; that is, a given reagent might be more successful than another for one compound but less successful for another compound. Also, not surprisingly, the hydrophilic compounds proved to be the ones least immobilized during aqueous leaching. It was concluded that significant amounts of VOCs would be retained during S/S treatment, that S/S was only moderately successful in immobilizing VOCs, that S/S was a viable remedial action candidate for the target waste (sludge heavily contaminated with metals but only slightly contaminated with VOCs), and that S/S was not suitable for high organic concentrations (individual VOC concentrations above 0.01 wt % appear treatable, but not necessarily those as high as 0.1 wt %). (Higher concentrations of heavier, less mobile semivolatile species appear treatable, probably because of their hydrophobic nature and affinity for solid surfaces.)

The EPA review of mobile technologies for Superfund wastes asserts that S/S is well suited for treating sludges and soils containing up to 20 vol % organics and that some vendors can handle up to 100% organics, although a more typical maximum is 20 to 40%.[8] Webster indicates that one benefit of S/S is encapsulation of wastes in a low permeability product but that organophilic agents can help stabilize organics when high concentrations (>30%) are mingled with inorganic wastes.[44] Alternatively, incineration, biological treatment, or recovery processes can be employed in conjunction with stabilization to remove the organics before S/S of the inorganic portion.[44]

5.3 ORGANIC LOSSES DURING GROUT FORMATION

Two studies measured losses during implementation of S/S; both were laboratory studies (refs. 7, 32, 33, 38, 45, and 46). The objectives of the two studies were different. The studies conducted by Weitzman in collaboration with various colleagues were intended to measure the level of VOC evaporation during mixing of the waste with S/S reagents and during the cure of the product. Spence et al. were measuring the immobilization, or leachability, of VOCs and the amount that evaporated during leach sample preparation and curing in order to estimate the VOCs retained, stabilized, or immobilized in the sample prior to leaching.

The Weitzman study used a synthetic waste matrix of soil and water.[7] Latex paint sludge was part of the waste matrix in some tests to evaluate the effect the presence of organic solids would have. The waste matrix was added to a 5-gal pail, followed by water, the VOC spike, and stabilizer (50% fly ash and 50% Portland cement or lime kiln dust, no special reagents such as organophilic clay for organic stabilization). The pail was placed in a Lundberg mixer, the mixer was mounted in a wind tunnel, the mixer was turned on, and mixing continued for 60 to 90 min. After the mixing, the pail was removed and sealed with its lid, and then air was pulled through the pail headspace at a controlled rate for 30 days. The wind-tunnel gas flowrate and VOC concentration were monitored continuously during mixing, and the VOC emissions from the pail were measured for 3 or 4 h every 3 or 4 days. These details are important because it is not surprising that 80 to 90% of the VOCs was lost following these procedures.[2] This procedure did not thoroughly mix the VOCs into the synthetic waste solids before the stabilizer is added. In other words, the VOC compounds were left on top without being mixed into either the surrogate soil or a cementitious waste form. Also, vendors do not use a cement-fly ash or lime-fly ash formulation alone to stabilize organics. These ingredients are used as the main binding constituents of most S/S formulations.

Spence et al. had considerable difficulty trying to mix a VOC spike into a sludge sample prior to stabilizing, using a procedure similar to the previous one.[32,33] About 90% of the VOCs dumped on the sludge was lost during mixing of the spike into the sludge. For this reason, the sludge was sampled before stabilization inside a glovebox. The VOC content of the sludge samples was measured and used as the sludge VOC content before stabilization. The sludge was spiked inside a hood, sampled, transferred to a glovebox, mixed with vendor reagents designed for organic retention, packed in molds, sealed inside a pipe with little headspace, and cured for 28 days. The VOC concentration of the glovebox air was measured after the samples were sealed inside the pipe, and the VOC concentration of the pipe air was measured prior to opening the pipe, removing the samples, and starting aqueous leaching inside zero-headspace extraction vessels. These two VOC concentrations measured in air were used to estimate the amount of VOCs evaporated during sample preparation and the amount retained in the samples prior to leaching. In general, less than 50% of the VOCs in the sludge after spiking was evaporated during mixing and curing. (The amount evaporated during the 28 days of curing was negligible compared to that evaporated during mixing, because the headspace of the pipe was practically negligible.)

Both of these laboratory studies were conducted at room temperature, with the understanding that the exothermic hydration reactions were free to proceed and the resulting mixes free to come to thermal equilibrium with their surroundings. The resulting temperatures would be far lower than that expected for the Hanford grouts. Consequently, one would expect higher VOC losses during mixing of the Hanford grouts under the same conditions (except temperature) than from either of these two studies. These two studies were not consistent (one showing losses during mixing of >90% and the other <50%) because of differences in apparatus and procedures. The Weitzman study dumped the VOCs as a concentrated spike on top of the surrogate waste with no mechanical mixing, a procedure guaranteed to evaporate a volatile material. Spence et al. dispersed the VOCs in the sludge matrix before mixing it with S/S reagents and measuring losses.

Neither laboratory study was a scaled representation of the mixing and VOCs loss that would be expected from a field S/S. The Weitzman mixing may have been more representative of excavation and mixing, and the Spence mixing more representative of in situ S/S. Basically, these results were qualitative estimates of losses during field S/S at best. The Weitzman studies hint, but do not definitively establish, that mass transfer of VOCs via the gas phase may be equal to or greater than the transfer via the aqueous phase. This possibility is not surprising considering the high volatility and hydrophobic nature of some of these compounds. Some regulatory positions imply that losses to the air are allowed and are desired over losses to groundwater and aquifers.

5.4 BASIC STUDIES OF ORGANIC IMMOBILIZATION

Permanent bonding and degradation of organics with clays and modified clays have been reported (refs. 2, 12–13, 29–31, and 42). Apparently, the affinity of organics, particularly pesticides/herbicides, for clays has been well known for some time.[42] The interlamellar areas of the clays adsorb organic molecules, catalyze free radical oxidation of these molecules (degradation), and stabilize the reaction products. Hydration of the clay adversely affects these beneficial effects; the bonding of the active sites with water apparently is stronger than the adsorptive bonding with the organics. The interlamellar cations bonding the clay layers apparently catalyze ligand-forming reactions, and the polymers formed adsorb on the clay surface (dimers, trimers, and tetramers are the polymers referred to). Substituting quaternary ammonium compounds for these cations (forming organophilic clays) made the local environment more conducive to organic molecules and organic adsorption in an aqueous environment. The following abstract summarizes the interaction of organics with clays:

> This paper reviews the history of clay-aromatic interactions particularly in the areas of the "benzidine-blue" reaction; pesticides and benzene and its derivatives with a view to the use of clay minerals as an additive to cementitious materials in order to bind organic compounds in hazardous and toxic wastes. It is concluded that these minerals can act as catalysts in a free radical oxidation and that absorption onto the clay surface accelerates the reaction and stabilizes products. The extent of hydration of the clay affects the strength of the acid sites on the clay surface which in turn can affect adsorption. Adsorption and reactions are also dependent on the ligand-forming properties of the exchangeable cations in the clay as well as the extent to which they cause the clay layers to expand, transition metals and quaternary ammonium cations being more reactive than alkali and alkali earth cations.[42]

Despite this evidence of organic interaction with clays, there was no strong or irrefutable evidence of immobilization of organics after S/S.[2,41] There is apparently a gap between the scientific understanding of the interactions that do occur between organics and clays and the application of this knowledge to treatment of hazardous and toxic organic wastes. It is possible, in some cases, that the technology is being misapplied (e.g., wrong clays, incorrect modification, wrong organic compounds for clay interactions, too little clay or too much organic). It is important to note that not all of the proprietary treatments use clays. Some S/S treatments (meaning additives used as part of the solidification reagents, and not some pretreatment separate from S/S such as incineration or extraction) may depend on physical encapsulation, and others that do not use clays may rely on degradation. Most of the open literature involves clays, leading to the focus on clays of this report.

Part of the problem in application may be regulatory and political, not technical. For example, S/S may be accepted for a Superfund site if treatability studies clearly demonstrate treatment goals can be achieved. But acceptance may not be automatic for RCRA or land-banned wastes, even if S/S achieves BDAT performance. The reason is regulatory and political interpretation of the relevant laws and regulations. Basically, a proposed treatment must meet or exceed BDAT performance. BDAT performance is measured either by total analysis for the contaminant before and after treatment or TCLP testing before and after treatment (the regulatory community is divided on these issues). The regulatory community is well aware that an S/S treatment might mask the analysis of compounds still present or that evaporation of VOCs might occur during treatment. The BDAT for organics is incineration, and some in the regulatory community will accept nothing less than clear and unequivocal proof of conversion of organics into "innocuous" components (carbon dioxide and water). This is an oversimplified but fairly accurate statement of the most extreme position. The OTA Report Brief takes this position without actually stating it. Its position is that if organics are present, then incineration should be the treatment of record. Other treatments can be considered as long as the result is the same, for example, chemical oxidation or destruction in aqueous systems or extraction with later destruction or recycling of the extracted organics. This is a reasonable position defined by the relevant laws. The intent of the land-ban restrictions is that none of these organic compounds will be landfilled where they might be released into the environment later. The OTA Report Brief takes that position with respect to Superfund sites where regulators more readily accept S/S (depending upon the area of the country and the regulator). The OTA Report Brief position, while more or less correct for RCRA or land-banned wastes, is extreme for Superfund sites because contamination often is dilute and dispersed widely in the soil and groundwater. RCRA wastes are currently being generated, the quantities are at a minimum and the concentrations at a maximum, and the waste can be treated by incineration or its equivalent to remove or reduce the organics prior to disposal. CERCLA and SARA wastes might involve volumes that are orders of magnitude higher and concentrations that are orders of magnitude lower than the original waste. It may be more ecologically and environmentally destructive to dig up an entire region in order to incinerate every particle of soil contaminated with trace quantities of organics than to do nothing. That is the reason innovative technologies such as in situ S/S, in situ extraction, and in situ bioremediation are being studied by EPA and others.

Recent evidence appears to demonstrate permanent bonding of organics with S/S additives (refs. 12–13 and 29–31). Brown et al. thought those laboratory results might be misleading as to the S/S of actual wastes, because the observed bonding occurred for the organic compound in isolation with the organophilic clay (i.e., dry and not in the presence of the binder reagents and other "nasty" wastes).[2] The effect of aqueous systems on these interactions has already been mentioned, although the modification to an organophile counteracts these effects to some extent. Brown et al. contend that the main observed interaction was reversible adsorption, meaning that these compounds will eventually be released into the environment and that the effect of S/S will be to dilute and delay this release. Much of the reported empirical evidence on S/S supports this contention. It is pointed out that the concentration of organic relative to the additive (or modified clay) might account for part of the difference. For example, the concentration used by Soundararajan in his studies was orders of magnitude below that claimed to be effective by proponents of S/S. It is possible that very little organic actually degrades or bonds per unit weight of clay and that the organic that reacts is only a fraction of the organic needed to force access to the active sites. Such possibilities give rise to competing desires. It is desirable to bond the organic permanently, but if the active sites can only bond a tiny fraction of the molecules present, it may be more desirable to have catalysis of degradation and release of the degradation products (if they are innocuous) so that the reacting continues. The literature hints that degradation is catalyzed, but that the reaction products collect on the clay surface, potentially blocking the catalysis sites. It appears clear that permanent bonding and degradation occurs; it is not clear how much clay or time is required per unit of organic to permanently bond or degrade most of a given amount of organic. The available literature seems to indicate that permanent bonding and degradation occurs, but not for a significant amount of the organics treated. Most of the organics are reversibly adsorbed, and the beneficial effect of S/S is to attenuate the release rate. The waste forms may be designed so that the release rates are small enough to allow dilution and biodegradation to innocuous concentrations. None of this is known conclusively, and improvements may be made to the reagents. More basic studies are needed on the bonding and degradation capabilities and limitations of modified clays outside the complicated environment of wastes and S/S before such permanent immobilization of organics can be claimed for S/S. It is established that these additives interact with organics and can help retain organics during aqueous leaching (i.e., the mass transfer resistance of the waste forms is improved).

6. SUMMARY AND CONCLUSIONS

6.1 IMPACT ON WESTINGHOUSE HANFORD COMPANY

The impact of organics in Hanford supernates on the WHC grout program depends on two different perspectives: (1) regulatory interpretation and approval and (2) technical performance. Regulatory interpretation and approval is beyond the scope of this project and report, but WHC needs to investigate what the regional and local regulatory position will be if these supernates prove to contain hazardous organics. Previous interpretations imply that removal of the organics may be required prior to S/S. Processes are available for doing this, but further development of the processes will be required for application to these difficult and chemically harsh DST wastes. The more innovative processes (e.g., chemical oxidation and sorptive separation) may be difficult to implement. (An innovative technique of A. J. Mattus of ORNL offers the hope of destroying both organics and nitrates in these aqueous solutions, but it is an unproven technology and may take years of development.)

The simplest approach may be the best. In the unlikely event that these VOCs do prove to be present and the regulators require their removal, air stripping may remove the VOCs still present after all these years at the temperatures of the DST waste. VOCs held in the solids might buffer the solution VOCs and require long stripping times. If this is unacceptable, the supernate can be separated from the solids, as was intended for S/S, and stripping performed on the supernate alone. This may require the construction of a stripping unit in addition to the GTF already in place if facilities are not available to accomplish the stripping. Negotiations with regulators will establish the level of treatment required of the air from the stripping process prior to its release (the radioactivity will undoubtedly necessitate passing the air through a high-efficiency particulate air filter prior to discharge and the potential VOCs may require passing the air through an activated charcoal bed or similar treatment).

This project was constrained to assessing the effectiveness of the Hanford grout disposal in retarding VOCs release and assessing what, if any, additives might improve performance, based on the literature review, rather than assessing the suggested pretreatments. The DST wastes, Hanford grouts, and Hanford grout disposal present several important differences from the S/S of hazardous and toxic wastes discussed in the literature:

1. Most obvious, but not so important in this discussion, is the radioactivity of the waste. The radioactivity dictated the need for minimizing exposure of personnel, the design of the GTF and grout, and the design of the multi-barrier disposal, making it important from those aspects.
2. The grout is quite soupy, unlike the thick grouts generated in S/S of soils. The excess water creates a weaker product and more mass transfer pathways.
3. Perhaps most important is the high temperature of the waste and grouts. These temperatures make it less likely that even the hydrophilic ketones will be in the waste or will be retained in the grouts. Also, these temperatures will form different chemical and morphological waste form matrices than those usually formed in S/S. The effect of this structural difference on VOC retention is unknown. The higher temperatures likely will adversely affect VOC adsorption, although degradation reaction rates may increase.

4. The engineered barriers for the Hanford multi-barrier design are better and more extensive than those in most remedial actions using S/S. Usually a RCRA cap and sometimes a lined landfill is used, but not grout inside a concrete container and surrounded by gravel and asphalt vapor barriers. The Hanford grout was not designed as the primary leaching barrier. The design prevents water access to the grout far better than many S/S remedial actions in which soil is treated and placed back in the same location, even if RCRA caps are used. It is far more likely that this separation from a wet environment, combined with the high temperatures, will lead to evaporation of VOCs and vapor phase transport.

The criterion for leachability is a leachability index of 6.0 or better. The leachability index for the mobile nitrate ion was surprisingly high for the limestone grouts (around 8.0) and perhaps can be attributed to the use of granulated blast furnace slag, an excellent leach-resistant component. The leachability index for the VOCs would be expected to be about the same as that of the nitrate using this grout, because nitrate leachability is considered to be a measure of the physical barrier to leaching. Organophilic clays or proprietary reagents for organic retention would be expected to improve the VOC leachability index of this limestone grout moderately. Based on the nitrate leachability index, the VOC leachability index of the 106-AN grout would be expected to exceed 8.0. Based on the past performance of commercially available products, a given additive could be expected to improve one of the VOCs or a class of the VOCs, but a different additive may be required for each VOC or class to improve all of the VOCs. The expected improvement would be on the order of increasing the leachability index above 9.0; that is, the VOCs would still be leachable but at a slower rate. These estimates are speculation, and the leachability indices of the VOCs for these grouts should be measured.

6.2 RECOMMENDATIONS FOR WESTINGHOUSE HANFORD COMPANY

With regard to VOCs in the DST supernate, it is recommended that WHC:

1. Either estimate the partitioning of any VOCs between the supernate and headspace after these many years or measure whether any VOCs are really present, preferably the latter, if possible (e.g., by gas chromatography–mass spectroscopy).
2. Ascertain what the regulatory position will be if VOCs are in this waste, that is, whether S/S and the planned disposal will be allowed and, if so, what the performance criteria will be (e.g., what TCLP concentration) or, if not, what level of VOC removal will be required.
3. If the desire is to avoid risks, add commercially available additives for each VOC of interest to the grout formulation. This process will likely involve two to four modified clays plus other reagents and will probably increase the cost of the grout formulation significantly. Specifically, one clay modified for organophilic compounds such as the ketones and another modified for organophobic halogenated compounds such as TCEt would be recommended. Other general organic sorbents or solvents may be incorporated into the waste form. The effectiveness of these additives for these VOCs in the surrogate wastes and in the WHC grout at the high temperatures of the materials should be demonstrated prior to acceptance. TCLP testing of the WHC grout using surrogate wastes spiked with VOCs could test the sensitivity of the WHC grout to VOC concentration and the effectiveness of additives; that is, the testing could serve as treatability studies. It appears that no treatability exclusion would be required as long as surrogate wastes are being tested. [CAUTION: The real waste could behave significantly differently from the surrogate waste.]

7. ACKNOWLEDGMENT

The efforts of Ivan Morgan, Mike Gilliam, and George Kamp and the support of the Robins Air Force Base, the Hazardous Waste Remedial Actions Program of the Department of Energy, and the Waste Management Technology Center on a previous project at ORNL involving volatile organic immobilization in cementitious waste forms contributed significantly to better understanding of the role of grouts in immobilizing organics and are gratefully acknowledged. The support of Jeff Voogd, Earl McDaniel, Mike Gilliam, and WHC for this project is also gratefully acknowledged.

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APPENDIX A: RESULTS OF THE COMPUTER LITERATURE SEARCH

```
          159329  WASTE
          833464  FORM? ?
            2074  WASTE(W)FORM? ?
     S1       47  (VOC? ? OR VOLATILE(W)ORGANIC? ?) AND (STABILIZ? OR
                  SOLIDIF?) AND (CEMENT? ? OR GROUT? ? OR CONCRETE? ? OR
                  WASTE(W)FORM? ?)
?rd s1
>>>Duplicate detection is not supported for File 340.

>>>Records from unsupported files will be retained in the RD set.
...completed examining records
     S2       42  RD S1 (unique items)
?t 2/5/1-42

 2/5/1     (Item 1 from file: 5)
0007655585     BIOSIS Number: 90033192
  SITE PROGRAM UPDATE EVALUATION OF WASTE STABILIZED BY THE SOLIDITECH SITE
TECHNOLOGY
  GRUBE W E JR
  U.S. ENVIRON. PROT. AGENCY, CINCINNATI, OHIO 45268, USA.
  J AIR WASTE MANGE ASSOC 40 (3). 1990.  310-316.   CODEN: JAWAE
  Language: ENGLISH
  Subfile: BA (Biological Abstracts)
  The Soliditech technology demonstration was conducted at the Imperial Oil
Company/Champion  Chemicals  Superfund Site in Monmouth County, New Jersey.
Contamination at this site includes PCBs, lead (with various other metals),
and  oil  and  grease. The Soliditech process mixes the waste material with
proprietary  additives,  pozzolanic materials, and water, in a batch mixer.
Technical   criteria   used   to   evaluate   its   effectiveness   include  (1)
short-term  extraction  and engineering tests; (2) long-term extraction and
leaching  tests; (3) petrographic examination; and (4) structural integrity
observations.  Three  different  waste  types.sbd.contaminated  soil, waste
filter  cake  material,  and oily sludge.sbd.and a sand blank were treated.
Fourteen  cubic  yards  of  treated  waste  monoliths,  and nearly 300 cast
cylindrical  mold  samples were produced. Neither PCBs nor volatile organic
compounds   were   detected   in  the  TCLP  extracts  of  treated  wastes.
Significantly reduced amounts of metals were detected in the TCLP, EP, BET,
and  ANS  16.1  extracts  of  treated  wastes  compared  to  untreated. Low
concentrations  of phenols and cresols were detected in post-treatment TCLP
extracts.  The  pH  of  treated  waste  was near 12. Unconfined compressive
strength of treated wastes was high; permeability was very low. Weight loss
after  wet/dry  and  freeze/thaw  cycles  was  very  low.  Portland  cement
contributed  several  metals  to  the  treated waste. Physical stability of
treated wastes was high. Data from all extraction and leaching tests showed
negligible  release  of  contaminants.  Phenols  and cresols appeared to be
formed  during  the  stabilization  reactions.  Morphologic  observations
confirmed  changes  in  physical stability of large blocks of treated waste
over time.

Descriptors/Keywords: CONTAMINATION GOVERNMENT PROGRAMS SUPERFUND
  INNOVATIVE TECHNOLOGY EVALUATION CLEANUP POLYCHLORINATED BIPHENYLS METALS
  WASTE MANAGEMENT OIL INDUSTRY CHEMICAL INDUSTRY
Concept Codes:
  *00508  General Biology-Institutions, Administration and Legislation
  *10050  Biochemical Methods-General
  *22506  Toxicology-Environmental and Industrial Toxicology
  *37014  Public Health: Environmental Health-Sewage Disposal and Sanitary
           Measures
  *37015  Public Health: Environmental Health-Air, Water and Soil
           Pollution
```

10060 Biochemical Studies-General
10069 Biochemical Studies-Minerals

2/5/2 (Item 2 from file: 5)
0005756322 BIOSIS Number: 83018629
ENCLOSED THERMAL SOIL AERATION FOR REMOVAL OF VOLATILE ORGANIC CONTAMINATION AT THE MCKIN SUPERFUND SITE GRAY MAINE USA
WEBSTER D M
U.S. ENVIRONMENTAL PROTECTION AGENCY, WASTE MANAGEMENT DIVISION, BOSTON, MASSACHUSETTS.
J AIR POLLUT CONTROL ASSOC 36 (10). 1986. 1156-1163. CODEN: JPCAA
Full Journal Title: Journal of the Air Pollution Control Association
Language: ENGLISH
Subfile: BA (Biological Abstracts)

During the winter and spring of 1986 sandy soils contaminated with volatile organic chemicals were successfully treated during a pilot study of an enclosed thermal soil aeration process at the McKin Superfund site in Gray, Maine. Excavated soil containing up to 3310 ppm of trichloroethylene (TCE) was fed into a large rotating drum and mixed at 300.degree. F. Aerated soil was then solidified with cement and water and returned to the on-site excavation location. Exhausted air from the enclosed aeration process was treated in a baghouse, a scrubber, and a vapor phase carbon bed prior to atmospheric release. Continuous air monitoring for organic vapors and particulates took place at the site perimeter and for organic vapors at on-site locations. Techniques to minimize uncontrolled volatization of organic chemicals from the soil during excavation and aeration and to control dust emissions were implemented. Results of this pilot study indicate that concentrations of volatile organic contaminants routinely were reduced to nondetectable levels and achieved site-specific soil performance targets established by the U.S. Environmental Protection Agency. The pilot study was conducted by Canonie Environmental Services Corporation and funded by private companies under order from EPA.

Descriptors/Keywords: EPA VOLATILIZATION CONTROL DUST EMISSION CONTROL TRICHLOROETHYLENE
Concept Codes:
*01008 Methods, Materials and Apparatus, General-Field Methods
*07504 Ecology; Environmental Biology-Bioclimatology and Biometeorology
*10050 Biochemical Methods-General
*10511 Biophysics-Bioengineering
*37015 Public Health: Environmental Health-Air, Water and Soil Pollution
*52801 Soil Science-General; Methods (1970-)
*52805 Soil Science-Physics and Chemistry (1970-)
00508 General Biology-Institutions, Administration and Legislation
10618 External Effects-Temperature as a Primary Variable-Hot (1971-)
22506 Toxicology-Environmental and Industrial Toxicology
23001 Temperature: Its Measurement, Effects and Regulation-General Measurement and Methods

2/5/3 (Item 1 from file: 40)
0205241 Enviroline Number: *90-002789
AIR EMISSIONS FROM HAZARDOUS WASTE STABILIZATION,
DE PERCIN PAUL R. (EPA, CINCINNATI, OH) AND ; WEITZMAN LEO (ACUREX CORP, RESEARCH TRIANGLE PARK, NC),
EPA/APCA MEASUREMENT OF TOXIC AND RELATED AIR POLLUTANTS INTL SYM, RESEARCH TRIANGLE PARK, NC, MAY 88, P413(5)
THE ORIGINAL DOCUMENT IS AVAILABLE FROM BOWKER

CONF PAPER VOC EMISSIONS FROM THE STABILIZED WASTES DURING CURING HAVE BEEN DETERMINED TO BE SIGNIFICANT. TWO TYPES OF WASTES WERE TESTED: AN

INORGANIC WASTE MADE OF SOIL AND WATER, AND AN ORGANIC WASTE MADE OF SOIL, WATER, AND LATEX PAINT SLUDGE. THE WASTES WERE STABILIZED WITH A MIXTURE OF 50% FLYASH AND 50% PORTLAND CEMENT OR LIME KILN DUST. MEASUREMENTS FOUND THAT STABILIZATION DOES NOT REDUCE THE VOC EMISSIONS SIGNIFICANTLY. DURING THE STABILIZING PROCESS, EMISSIONS FROM THE WASTES WERE SIGNIFICANTLY HIGHER THAN FROM THE SAME MATERIAL BEING TREATED IN THE SAME MANNER BUT WITHOUT THE ADDITION OF SOLIDIFICATION AGENTS. (1 TABLE)

Descriptors: *HAZARDOUS WASTE MANAGEMENT ; *VOLATILE ORGANIC COMPOUNDS ; *TECHNOLOGY IMPACT ASSESSMENT ; *AIR POLLUTION INDICATORS ; *ORGANIC COMPOUNDS ; *MONITORING, ENV-AIR ; *AIR SAMPLING ; *HAZARDOUS WASTE DISPOSAL ; *FLYASH ; *SOLIDIFICATION ; *MEASUREMENTS & SENSING ; AIR POLLUTION RESEARCH ; HAZARDOUS WASTES

Review Classification: 01

2/5/4 (Item 1 from file: 50)
0664309 0S051-02311

Pilot study of enclosed thermal soil aeration for removal of volatile organic contamination at the Mckin Superfund site.

Webster, D. M.

U.S. Environment Protection Agency, Waste Management Div., Boston, Massachusetts, USA.

Journal of the Air Pollution Control Association, USA 1986. 36 (10): 1156-1163 (5 ref., 3 fig., 3 tab.)

Language: English
Document Type: NP (Numbered Part)
Status: NEW
Subfile: 0S (Soils and Fertilizers)

Sandy soils contaminated with volatile organic chemicals were successfully treated during a pilot study of an enclosed thermal soil aeration process at the McKin Superfund site in Maine. Excavated soil containing up to 3310 ppm of trichloroethylene was fed into a large rotating drum and mixed at 300degF. Aerated soil was then solidified with cement and water and returned to the on-site excavation location. Exhausted air from the enclosed aeration process was treated in a baghouse, a scrubber, and a vapor phase carbon bed prior to atmospheric release. Continuous air monitoring for organic vapors and particles took place at the site perimeter and for organic vapors at on-site locations. Techniques to minimize uncontrolled volatilization of organic chemicals from the soil during excavation and aeration and to control dust emissions were implemented. Results of this pilot study indicate that concentrations of volatile organic contaminants routinely were reduced to nondetectable levels and achieved site-specific soil performance targets established by the U.S. Enviromental Protection Agency.

Descriptors: public health engineering; removal; volatile contaminants; soil aeration; usa; maine; organic compounds
Decimal Codes: 0S962.8; 0S954.7; 0S133; (741); 0S95; 0S13
Geographic Names: USA: Maine
Section Heading Codes: 0S96280095
Section Headings: 9 OTHER TOPICS - 96 APPLIED SCIENCES- 962-9 ENGINEERING. TECHNOLOGY (SC=0S962000)

2/5/5 (Item 1 from file: 156)
02302238 Subfile: NTIS-PB89-196703
Contract Number: EPA-ROD-R05-88-081

Superfund Record of Decision (EPA Region 5): Velsicol Chemical Corporation, Marshall, Illinois (First Remedial Action), September 1988.

Anon

Environmental Protection Agency, Washington, DC. Office of Emergency and Remedial Response.

Source: Govt Reports Announcements & Index (GRA&I), Issue 17, 1989
Journal Announcement: 8911
TD3: The Velsicol Chemical Corporation (VCC) is a manufacturing facility located in east-central Illinois, approximately one mile north of the City of Marshall, Clark County, Illinois. A total of 334 acres onsite are leased for crop farming. VCC was in operation between the mid-1930s and August 1987, and occupied an area of approximately 420 acres, 172 of which were used for production or disposal practices for petroleum derivatives including resins, solvents, and pesticides, including chlordane manufacturing. All process wastewater has been deep-well injected onsite since 1965 and the majority of the waste solids and sludges generated at the facility were disposed of in Pond 5/6 until 1980 when the firm ceased operations. Accidental and intentional offsite releases of wastes were noted during the period the ponds were in operation. In the 1980s, all contaminated soil and visually contaminated sediments were consolidated and stabilized with cement and fly ash, and covered with a temporary clay cap and vegetation. The primary contaminants of concern affecting the soil, sediments, surface water and ground water are VOCs including benzene and other organics including PAHs and pesticides. The selected remedial action for the site is included. Final rept.

Descriptors/Keywords:

Earth fills; Industrial wastes; Site surveys; Hazardous materials; Ponds; Chemical industry; Waste disposal, Water pollution, Solid waste disposal, Ground water, Benzene, Surface water, Soils, Aromatic polycyclic hydrocarbons, Pesticides, Cost analysis, Public health; Superfund; Remedial action; Solid waste management; Velsicol Chemical Corporation; Land reclamation; Marshall(Illinois), Liquid waste disposal, Land disposal, Volat
Order Information: NTIS/PB89-196703, 98p NTIS Prices: PC A05/MF A01

2/5/6 (Item 2 from file: 156)
02103969 Subfile: NTIS-PB89-225544
Contract Number: EPA-ROD-R10-88-011
Superfund Record of Decision (EPA Region 10): Commencement Bay/Near Shore, WA. (First Remedial Action), December 1988.
Anon
Environmental Protection Agency, Washington, DC. Office of Emergency and Remedial Response.
Source: Govt Reports Announcements & Index (GRA&I), Issue 22, 1989
Journal Announcement: 9001
TD3: The Tacoma Tar Pits site covers approximately 30 acres within the Commencement Bay-Nearshore/Tideflats site in Tacoma, Pierce County, Washington. Currently there is concern for the site's impact on surface water quality; many local industries use ground water from onsite wells. The primary contaminants of concern affecting surface water and soil include: benzene, PAHs, PCBs, and lead. The selected remedial action for the site includes: excavation of all contaminated soils exceeding 1% total PAHs and all surface soils exceeding a 10 sup -6 lifetime cancer risk level with stabilization of all excavated soils in a polymer/cement mixture; capping of the stablized matrix with asphalt; channeling and managing of surface waters; ground water monitoring; and removal and treatment of ponded water. Portions on this report are not fully legible. See also PB85214179.

Descriptors/Keywords:

Industrial wastes; Hazardous materials; Waste disposal, Polyaromatic hydrocarbons, Site surveys, Licenses, Public health, Cost analysis,

Commencement Bay, Lead(Metal), Water pollution; Superfund program; Remedial action; Land reclamation; Solid waste management; Tacoma(Washington), Volatile organic compounds
Order Information: NTIS/PB89-225544, 107p NTIS Prices: PC A06/MF A01

2/5/7 (Item 1 from file: 636)
00981828
"Stabilization/Solidification of Wastes Containing Volatile Organic Compounds in Commercial Cementitious Waste Forms"
Waste Treatment Technology News December 00, 1990 V. 6 NO. 2
ISSN: 0885-003 WORD COUNT: 190
PUBLISHER: Business Communications Company, Inc.

[Indexers: Advanced containment]

The report, by R.D. Spence, T.M. Gilliam, I.L. Morgan, and S.G. Osborne (Oak Ridge National Laboratory), and is available from NTIS (703-487-4650) as DE90012188/ABS. "Stabilization/solidification is one of the most widely used techniques for the treatment and ultimate disposal of both radioactive and chemically hazardous wastes but it does not have regulatory approval for treating organics. Application with a volatile organic compounds is particularly controversial since it was believed that the necessary mechanical mixing and exothermic cementitious reactions would vaporize the volatile organic compounds. The objective of this study was to establish whether stabilization/solidification is a viable alternative for a sludge heavily contaminated (about 1%) with relatively immobile metals, but lightly contaminated (<0.04%) with volatile organic compound that was contaminating the groundwater. The mass balance indicated that over 50% of the volatile organic compound was retained in the laboratory preparation of the cementitious samples cured for 28 days. The performance tests indicated the commercial products could attain leachability indexes from 7 to over 9 for the eight volatile organic compounds studied and distribution coefficients of over 10 could be attained for all eight and over 100 for some compounds."

ENDUSTRY: Environment (EV)

2/5/8 (Item 2 from file: 636)
00969443
Remediation technologies touted at HazMat conference
SUPERFUND November 16, 1990 V. 4 NO. 24
ISSN: 0892-2985 WORD COUNT: 637
PUBLISHER: Pasha Publications, Inc.

Success stories ranging from bench-scale tests to full-scale cleanups were offered in a presentation entitled, "Something Old, Something New," at the recent HazMat West conference in Long Beach, Calif.

In situ volatilization removes solvents William Gallant of Roy Weston said his company removed about 3,000 pounds of solvents, cooling oil and kerosene from a site in California using in situ volatilization. At the site a 2,000-gallon, concrete-lined tank had leaked halogenated and aromatic compounds into a plume extending 95 feet deep.

First Weston removed and disposed of the top 12 feet of soil, then used vapor extraction to clean the rest of the plume in situ. Starting with concentrations of 261 mg/kg of volatile organic compounds, the system cleaned the site to non-detectible amounts.

The in situ system consisted of two vapor extraction wells and seven vacuum monitoring vents. The vapor came out of the wells and through a blower to a heat exchanger before passing through three carbon extraction beds, each with about 500 pounds of carbon.

Weston operated the vapor extraction unit for 21 days to achieve its cleanup goal.

Soil washing gets lead out

Robert Evangelista of CH2M Hill described a soil washing bench-scale test for cleaning lead from contaminated soils at battery reclamation sites at Lee Farm in Wisconsin and Sapp Battery in Florida.

Different analyses were used for the soils at the two sites because the criteria for measuring cleanup effectiveness differed. At Lee Farm, the goal was less than 5 mg/l of EP tox lead, while the Florida site's goal was 79 ppm total lead. EP tox lead at Lee Farm ranged as high as 68.7 mg/l. No EP tox analysis was done on the Sapp Battery site.

One of the first things CH2M Hill found it had to do at both sites was to classify the soil according to grain size. Three size categories were used: greater than 0.25 inch, 0.1 mm to 0.25 inch and less than 0.1 mm.
After separating the soils by size, technologists used ethylenediaminetetraacidic acid (EDTA) in a 20% solution as a chelating agent to extract lead from the soil. The material then passed through an EDTA polish rinse before going through three polish rinses.

The researchers found the EDTA to be an effective extracting agent but the EDTA polish rinse was detrimental to the process. The whole process worked in reducing the Lee Farm EP Tox lead to less than 5 mg/l, but did not clean the Sapp Battery soil to less than 79 ppm.

The researchers also found that incorporating high soil loading with shorter reaction time improves the process efficiency. Evangelista estimated the costs for the system at $300-$500/cubic yard.

John Wesnousky of the California Health Services Dept.'s remedial technology unit reported on a number of case studies of remediation systems in California.

Land farming and stabilization fixes

In two instances of above-ground biological treatment (land farming) systems to clean hydrocarbon compounds such as waste and diesel oils, researchers found that while the systems work, adding stimulants to the soil to enhance the process didn't give any better results than the natural oxygenation and water added to control piles.

Three California projects looked at silicate/cement stabilization for metal contamaminated soils. A lab-scale test showed Ensotech's patented Landtreat and Ensol products cut concentrations of cadmium, copper, lead, nickel, zinc, silver, mercury, cobalt and chromium as well as a mixture of copper, lead and nickel to below the soluble limit threshold concentration (STLC) for each substance as specified in California law.

A bench-scale test of Silicate Technology Corp.'s stabilization process showed significant reductions in soluble lead concentrations, but a good bit of that may have been the result of chemical reactions that changed the lead to an insoluble solution.

Finally, a pilot-scale demonstration of the Trezek silicate stabilization process reduced leachable metal concentrations of lead, zinc and cadmium to below their soluble threshold limits at the Tamco Steel Plant in Rancho Cucamonga.

INDUSTRY: Environment (EV)

2/5/9 (Item 3 from file: 636)
00686461
Solidification releases VOCs
SUPERFUND August 28, 1989 V. 3 NO. 18
ISSN: 0892-2985 WORD COUNT: 124
PUBLISHER: Pasha Publications, Inc.

Hazardous-waste solidification encourages a massive release of volatile organics into the air, according to research by Acurex Corp. and EPA.

Acurex and EPA found that as much as 90% of the VOCs added to test samples volatilized during solidification and as much as 60% of the remainder volatilized during the following month. VOC emissions during stabilization were significantly higher than from control samples treated the same way except for the addition of solidifying agents.

The researchers created the waste samples by mixing soil, water and latex paint sludge, then doping the mixture with volatile acetone or trichloroethylene, or semi-volatile n-pentanol. Acurex's Leo Weitzman and EPA's Paul de Percin said in a paper they solidified the waste with a 50/50 fly ash/lime kiln dust mix and portland cement.

INDUSTRY: Environment (EV)

2/5/10 (Item 4 from file: 636)
00676708
EPA finds Hazcon process organics leach
SUPERFUND July 31, 1989 V. 3 NO. 16
ISSN: 0892-2985 WORD COUNT: 638
PUBLISHER: Pasha Publications, Inc.

Despite earlier findings to the contrary, Hazcon Inc.'s solidification treatment process doesn't immobilize organic contaminants, according to an EPA report.

Hazcon's process does a great job of solidifying mixtures of soil and concrete in the presence of organics, the report said. Hazcon overcame the problem of organics' keeping concrete from curing with a chemical additive it calls Chloranan. The chemical allowed curing even when organics accounted for as much as 25% by weight of the soil in a Superfund Innovative Technology Evaluation program pilot.

But EPA's tests showed no reduction in the leachability of organics from the solidified mass. A recently completed applications analysis report said these results agree with most other pilot tests of Hazcon's technology. For example, leach tests removed more than 86% of total organic carbon from liquids Hazcon solidified from Rocky Mountain Arsenal's Basin F. But a series of tests the American Petroleum Institute sponsored showed the process cut the leachability of volatile organics from refinery wastes by 99%.

EPA found the process immobilized heavy metals and produced blocks of concrete that were structurally sound. The long-term integrity of the concrete remains unknown.

The agency concluded the best uses for the process are immobilizing heavy metals in soils and sludges full of oil and grease and handling soil containing lots of immobile organics that needs stabilizing. But if the organics are mobile and toxic, then a treatability test is a must.

Hazcon's SITE pilot at a Superfund site in Douglassville, Pa., appeared to have no effect on the leachability or organics. The toxics characteristics leaching procedure removed less than 1 ppm of volatile organics from soils containing as much as 150 ppm, with or without treatment. This procedure also leached 3 ppm of phenols from treated and untreated soil. The TCLP would appear to put solidification at a severe disadvantage, because it involves crushing the solidified mass, exposing interstitial wastes. But EPA got results in the same order of magnitude with two tests borrowed from the nuclear industry that leave the treated waste intact.
The pilot produced concreted soil with unconfined compressive strengths of 220-2,959 psi -- well above the 15-150 psi achieved by competitors and the EPA guideline of 50 psi. Permeability was 10-8 centimeters per second -- an order of magnitude beyond EPA's standard for hazardous waste landfill liners.

But the pilot more than doubled the waste volume.

To get insight into long-term integrity, EPA subjected solidified samples to 12 wet/dry and freeze/thaw cycles, then checked for erosion by measuring weight loss. Results were very low -- less than 1%, and a mere 0.3% higher than for control samples.

Microstructural analysis hinted at a long-term potential for degradation. EPA found the cement matrix to be porous, incompletely hydrated and containing undispersed soil aggregates. This could be a result of insufficient mixing, easily corrected with a more vigorous mixer.

EPA's economic analysis indicated Hazcon's process costs $97 to $205 per ton. The most important variables are the ratio of chemical and cement additives to waste and the size of the treatment unit.
Cement costs $50 per ton and Chloranan costs $66.67 per ton. EPA found that cutting back from a ton each to two-thirds of a ton each per ton of waste soil cuts the cost by 23% to 40%.

Scaling up from a 300 pound-per-minute pilot to a 2,300 pound-per-minute full-scale unit reduces the labor cost per ton from $50-$65 to $6.50-$8.50, reducing total cost by 27% to 40%.

Next in importance is the on-stream time: Hazcon hopes for 90%, the Douglassville pilot was up 70% of the time. The difference changes the total by 2% to 12%. Analytical costs, equipment rentals and consumables also affect the bottom line.

For a copy of the Hazcon pilot's applications analysis report, write EPA's Center for Environmental Research Information at 26 West Martin Luther King Drive, Cincinnati, Ohio 45268, or call the SITE hot line at 800-424-9346 (382-3000 in Washington).

INDUSTRY: Environment (EV)

2/5/11 (Item 5 from file: 636)
00633038
DOE FIVE-YEAR CLEANUP PLAN TO FOCUS ON NEW TECHNOLOGIES
HAZARDOUS WASTE NEWS April 10, 1989 V. 11 NO. 15
ISSN: 0275-374X WORD COUNT: 759
PUBLISHER: Business Publishers, Inc.

Deflecting earlier criticism that the Department of Energy is ill-equipped to head the cleanup of contaminated defense plants, Energy Secretary James Watkins told Congress that DOE's five-year waste management and cleanup plan will include a major effort in researching and developing new cleanup technologies. The plan is due in August.

Watkins, before a House Armed Services panel April 3, outlined the plan which he said will "help re-establish DOE's credibility with the public and with the states" on defense plant waste management.

Removal of DOE's Cleanup Role Suggested

Watkins' defense of DOE's cleanup of defense plants followed a March 15 hearing by the Senate Budget Committee, when Chairman James Sasser (D-Tenn.) warned that "if DOE cannot make a clear and convincing case that it has the expertise to handle this program and does not develop a credible environmental plan within the year, I believe that serious consideration should be given to removing the cleanup responsibilities from the Department of Energy and placing them in a separate entity."

Watkins said DOE will work with the National Academy of Sciences and state and federal regulatory bodies to: assess the extent of environmental degradation and impairment; establish priorities to immediately address potential health effects and to prevent further spread of contamination; and establish a research program to fund development of the best and most critically needed technology.

The department also will develop a remedial action plan for each site; work with Congress and state regulatory agencies to meet cleanup requirements; and recommend sources of funding and methods of oversight to ensure that resources are effectively used and that program goals are achieved.

Part of Watkins' environmental plan calls for new emphasis on technology developments to keep pace with environmental cleanup requirements. The department will seek to minimize waste currently produced, and develop technologies in chemical extraction and bioremediation, Watkins told the Armed Services' DOE Nuclear Facilities Subcommittee.
To conduct cleanups, robotic-applied technologies are envisioned to reduce hazards to workers engaged in decontamination and decommissioning work.

Last week, he said several new technologies are being pursued at DOE sites based on effectiveness, applicability to current environmental problems and potential cost savings, he said. One is the plasma reactor at the

Magnetohydrodynamic Facility in Butte, Mont. The reactor will treat hazardous waste at temperatures in excess of 17,000 degrees Fahrenheit to break down the hazardous materials into carbon, hydrogen and oxygen. This is an advanced technology that may apply to future cleanup activities, Watkins added.

Vacuum extraction of trichloroethylene (TCE) at Lawrence Livermore National Laboratory (LLNL) Site 300 is showing effective cleanup of ground water contaminated with solvents. TCE in pumped ground water is being destroyed by an ultraviolet treatment system at the Kansas City Plant. A pilot vapor vacuum extraction system at the main LLNL site has demonstrated removal and destruction of over 3,000 lb. of spilled gasoline hydrocarbon contaminants in the first 200 hours of operation. DOE is also testing in-situ vitrification, detoxification of waste acids and supercritical water oxidation of hazardous organic solvents.
Watkins also outlined work already completed or planned at a number of sites:

Savannah River Plant, Aiken, S.C. The closure plan for seepage basins F and H is being reviewed by the state and the Environmental Protection Agency. Efforts will begin next year to backfill and install a clay cap in accordance with RCRA requirements. The effluent treatment system began operations in November to eliminate the discharge of separations process waste waters to seepage basins. This facility represents state-of-the-art technology in filtration, ion exchange, reverse osmosis and evaporation. The M-Area settling basin closure is in progress and will be completed in 1990. This will eliminate the direct discharge of untreated liquid wastes to the environment. Construction will begin in fiscal 1990 on facilities for the solidification and permanent disposal of waste salt solutions from the 300-M area fuel fabrication facility.

Rocky Flats Plant, Denver, Colo. Sludge is being removed from the solar ponds, with final closure scheduled for 1996. Ground water contaminated with volatile organics from the 881 Hillside area is scheduled for treatment and reinjection starting this year. All deadlines have been met so far in the compliance agreement with the state and EPA. Shipments of transuranic waste to Idaho have been resumed.
Hanford Reservation, Richland, Wash. Efforts are underway to meet tri-party RCRA compliance agreement requirements. For example, last August, the grout treatment facility began solidification of liquids stored in double-shell tanks. Some 35 ground-water monitoring wells in 1989 and 45 additional wells in 1990 will be installed in the single-shell tank farm. The preparation of 58 RCRA Part B operating permits is underway to meet the 1990 RCRA deadline.

ENDUSTRY: Environment (EV)

2/5/12 (Item 6 from file: 636)
00547538
EPA wants to solidify Saco wastes
SUPERFUND August 29, 1988 V. 2 NO. 18
ISSN: 0892-2935 WORD COUNT: 1218
PUBLISHER: Pasha Publications, Inc.

EPA Region 1 has proposed to solidify and contain hazardous sludges and monitor the groundwater at the Saco Tannery Waste Pits Superfund site in

Saco, Maine, at a projected cost $33.5 million.

A leather tannery had dumped process wastes into two unlined lagoons and 53 pits at the site from 1959 to the early 1980s. The wastes -- chromium sludges, solvents, acids, caustics, leather shavings and hides -- pose a threat of soil, surface water and groundwater contamination.

After putting the site on the Superfund list, EPA in 1983 sent in removal contractors who removed 6,600 gallons of acid waste, neutralized remaining sludge with lime, capped it and erected a fence. A subsequent risk assessment concluded no one should develop the site residentially without a cleanup, mainly because of risks from direct contact and drinking groundwater.

EPA isolated two cleanup goals: to reduce concentrations of 11 key contaminants to acceptable levels and to immobilize chromium sludges that present a groundwater threat.

The agency wants to spend $33.2 million on the source control remedy. EPA would truck away standing water for off-site treatment, excavate the sludge for on-site solidification and build a RCRA landfill to hold the solidified sludge.

As for the other source remedies mulled:

-- a $5.9 million soil cover would reduce the direct contact threat, but wouldn't halt leaching or involve treatment;

-- field tests gave EPA "serious reservations" about the effectiveness of a $14.8 million in-situ solidification remedy;

-- solidification alone ($27.2 million) would be too risky, since erosion could crumble the solidified mass;

-- on-site landfilling alone ($28.5 million) would be tough because the sludge is so soft;

-- on-site soil washing, the most expensive option considered ($105.6 million), would simply concentrate the contaminants and hasn't been demonstrated for sludge treatment; and

-- on-site incineration ($91.3 million) would be fine, except it could oxidize the chromium, making it more toxic. EPA contractors developed a post-incineration chromium recovery process, but it needs more work.

EPA offered an interesting reason not to treat groundwater: Since contaminant levels are fairly near the cleanup targets, EPA could reach the targets without treatment simply by pumping. Clean and dirty water would enter the extraction wells and mix, producing acceptably clean water.

The EPA project manager is Marina Meier at 617-573-9638.

- Joslyn proposes off-site disposal remedy

Joslyn Corp. has proposed an off-site disposal remedy for the most contaminated soil at a Superfund site in Minnesota.

State authorities scheduled a public meeting on the proposal for late August.

Joslyn wants to dig up about 30,000 cubic yards of soil contaminated with creosote and pentachlorophenol at its former wood-treating facility in Brooklyn Center, Minn. Joslyn wants to send the soil to Oklahoma in lined and covered rail cars. The company expects to send 80 rail car loads.

Joslyn will leave less-contaminated soil alone until the company completes a remedial investigation and feasibility study of the site.

The Minnesota Pollution Control Agency approved a groundwater pump-and-

treat remedy earlier this year for the site. A contractor is building the facility.

- Government breaks off SRSNE talks

EPA and Connecticut authorities have given up on cleanup negotiations with the owners of a Superfund site in Southington, Conn.

EPA has started a remedial investigation and feasibility study with federal Superfund money. EPA and Connecticut Dept. of Environmental Protection lawyers plan to pursue legal remedies under Superfund and RCRA.
The government broke off negotiations after deciding Solvents Recovery Service of New England (SRSNE) had inadequately responded to a request for short-term improvements at the hazardous waste facility. EPA and the state had tried to work with the company to get it to improve operations, remedy the site and comply with regulations.

The company has distilled and recovered solvents at the site since 1955. The city of Southington installed two drinking water wells within 2,000 feet of the site, one in 1965 and the other in 1976. The state determined in 1976 that both tapped water contaminated with volatile organic compounds (VOCs). EPA later confirmed the VOCs came from the solvent recovery operation.

Key contacts are Ed Parker at the DEP and Maggie Leshen with EPA Region 1 in Boston.

- EPA wants to bio-treat New Mexico site

EPA has proposed bioremediation for a Superfund site in Clovis, N.M.

The operators of a switchyard in Clovis along the Atchison, Topeka and Santa Fe (AT&SF) railroad have dumped wastewater into the Santa Fe Lake since the early 1900s. They washed railway hopper cars at the switchyard from 1962 to 1982, discharging water bearing residues from potash, cement, fertilizer, grain and coke into the playa lake.

EPA added the lake to the Superfund National Priorities List after concern surfaced in Clovis that the lake's dirty waters might harm underlying groundwater -- the town's sole source of drinking water.

The agency has since decided the groundwater is clean. But to make sure it stays that way, EPA will remedy the surface contamination. EPA found high levels of arsenic, boron, chloride, fluoride, phenolics, sulfate, dissolved solids and organic compounds in the lake's waters. EPA also found that boron, barium, lead, chromium, hydrocarbons, phenolics and organics had concentrated in the lake sediments.

EPA proposed to transfer contamination from the lake waters to the top layer of sediments at a cost of $400,000 by spraying the water onto dry areas of the shrinking lake's bed for evaporation.

The agency wants to dredge contaminated sediments, aerate them for biodegradation of sulfates and petroleum products and cap them. EPA put capital cost at $672,000 and operating costs at $270,000 for the first three years and $54,000 for the following 27 years. EPA wants to bioremediate soils in place by aerating them and adding nutrients at a cost of $42,000 for the first year and $116,000 over the next 29 years.

EPA also considered fixation remedies. Although fixation would do a better job on inorganics, the process often doesn't fix organics and erosion could eventually free all the contaminants, the agency said.

Tim Underwood is the EPA Region 6 project manager for the AT&SF site (214-655-6735).

- EPA proposes UNC groundwater remedy

EPA Region 6 has proposed an $8 million to $9 million pump-and-treat remedy for the United Nuclear Corp. Superfund site a mile south of the Navajo Indian Reservation in New Mexico.

United Nuclear Corp. pumped 3.5 million tons of wet, acidic uranium mill tailing into ponds at the site from 1977 to 1982. The liquids have since seeped from the unlined ponds into three underlying aquifers. A dam of one of the ponds burst in 1979, sending 90 million gallons of tailings and water into a stream. Two years later the site went onto the National Priorities List.

EPA picked the simplest and least expensive of three options for groundwater extraction well configurations. The other two options would have pumped more water from more aquifers. Also, EPA chose a mister/pond evaporation treatment alternative over a column evaporation alternative because it is cheaper.

Overlapping jurisdictions have made the cleanup more administratively complex than most. Besides being a Superfund site, the facility comes under the Nuclear Regulatory Commission's mill licensing authority. The company has proposed a reclamation plant to NRC. EPA hopes to integrate that plan and any work done under EPA's aegis.

EPA took samples last year that demonstrated groundwater contamination hasn't exceeded cleanup standards.

INDUSTRY: Environment (EV)

2/5/13 (Item 7 from file: 636)
00529065
- Hazcon SITE test shows good results
SUPERFUND June 20, 1988 V. 2 NO. 13
ISSN: 0892-2985 WORD COUNT: 448
PUBLISHER: Pasha Publications, Inc.

Preliminary results are in from a successful Superfund Innovative Technology Evaluation (SITE) program test of Hazcon Inc.'s solidification technology at the Douglassville Superfund site in Douglassville, Pa.

The technology has succeeded in encapsulating the site's mostly organic contaminants in a cement matrix. Permeabilities of the solidified soils range from 10(-8) to 10(-9) centimeters per second, well into the "impermeable" range.

The material demonstrated unconfined compressive strengths of 200 to 1,500 psi -- with the most compressive material containing the least organics. Hazcon attributes the high compressive strength to its Chloranan additive, without which some of the samples would have had no compressive strength.

EPA's toxicity characteristics leaching procedure winnowed a leachate containing a mere 1.5 ppm or less of each metal, and volatile and semi-volatile organic compound. Original concentrations were in the 100 ppm range.

EPA's laboratory has so far been unable to quantify the polychlorinated biphenyl (PCB) content of the leachate. The site generally contains 80 ppm of PCBs. EPA had injected the test soils with 125 ppm of toluene and results show the leachate contains 1.3 to 28 ppm of toluene. Oil and grease content of the leachate is only 0.2 ppm, even though oil and grease account for 25% by weight of the contaminated soil.

No metal concentrations were detectable in the leachate, except for lead and zinc. Lead content dropped from as high as 24,000 ppm in the soil to 30-50 ppm in the leachate. The leachate contained about the same amount of zinc.

A Hazcon official stressed that the conditions of a TCLP test are far more stringent than would likely be encountered by a large block of solidified soil buried in the ground.

After six months of burial, the 10-cubic-meter concrete blocks will be uncovered and cored again. EPA's SITE contractor, Envirosponse, will look for signs of degradation of the blocks.
The treatment process was tested for four days in October 1987, just weeks after an article in Superfund focused on major delays caused by the lack of regulations allowing Hazcon to take samples to its Houston laboratory for treatability tests. Eventually, Hazcon gave up its efforts to get samples to its laboratory. The company turned down an offer by EPA to use the agency's laboratories in Cincinnati and went into the site cold.

To account for unexpected variations in waste concentration, Hazcon used conservative ratios in its cement-soil mixtures. While this bolstered the chances for technical success, it raised the apparent cost of the technology.

Hazcon has a cryogenic grinding system that can reduce the particle size of wastes and ensure that they will mix well with the cement. The process, which uses liquid nitrogen, raises treatment costs by 20% to 30%.

INDUSTRY: Environment (EV)

2/5/14 (Item 8 from file: 636)
00529043
Arco to fix Sand Springs whether by cement or fire
SUPERFUND June 06, 1988 V. 2 NO. 12
ISSN: 0892-2335 WORD COUNT: 633
PUBLISHER: Pasha Publications, Inc.

Atlantic Richfield Co. has consented with EPA Region 6 to remedy an Oklahoma site by incineration or stabilization -- whichever EPA prefers after seeing the results of a stabilization demonstration project.

Arco, one of 300 potentially responsible parties identified by EPA, has agreed to perform the remedy at its own expense and repay EPA for some $1.7 million in past costs.

The consent decree, which EPA headquarters and the Justice Dept. have yet to review, sets a path for resolving a fundamental dispute over the remedy for the Sand Springs Petrochemical Complex in Sand Springs, Okla.

The feasibility study done by EPA's contractor presented a strong argument for going with an estimated $67 million incineration job. EPA found that incineration meets the most cleanup criteria. But Arco proposed to remedy the site by solidifying the hazardous wastes with cement, which EPA projected would cost $38 million. The state and local citizens support Arco's proposal. Arco has backed its proposal with an unlimited warranty: If the remedy ever fails, the company will return and do "whatever is appropriate" to remedy the site.

The agency dislikes the solidification alternative because it has not been proven to bind permanently wastes high in organics such as those at Sand Springs. Plus, an Arco pilot test showed the stabilized wastes would likely require a structure to support an overlying RCRA cap because compressive strength would be just 1.8 psi -- much less than the recommended psi of 150.

The pilot further showed the concrete matrix to contain chunks of waste the size of a fist, raising concerns about leachability. While no methodology was found for testing long-term stability, a modified leaching test revealed obvious degradation of the cement matrix.

In addition, the solidification pilot indicated the process would emit a lot of volatile organics into the air. This could be a problem since the site is in Tulsa County, an ozone non-attainment area.

Even so, an incineration pilot did nothing to allay the concerns of local citizens worried about potential incinerator emissions. A Shirco pilot unit filled a warehouse with black smoke last summer after upsets attributed either to variations in the feed material's Btu content or to operator error.

Sand Springs officials have further expressed concern that a mobile incinerator could discourage businesses from locating in Sand Springs -- and could become a permanent fixture that treats wastes from elsewhere.

In another development, EPA has proposed "natural remediation" for the site's groundwater. The agency estimates this would cost $450,000, while any of several treatment options would cost some $7.5 million.

Because the site is adjacent to the Arkansas River, contaminants that flow into the ground travel to the river, which dilutes them by a factor of 737, according to a state model. The model showed that contamination moves toward the river very slowly. The groundwater meets state industrial waste water discharge limits. It does not meet federal drinking water standards, but they don't apply because no one drinks water from the river, which as one source said, "is not pristine anyway."

Arco has avoided liability for several trichloroethylene (TCE) plumes from upgradient sources. EPA intends to do a preliminary assessment and site inspection (PA/SI) focusing on the plumes, which could emanate from any of 12 upgradient industries.

The site is on some 25 to 50 feet of alluvium along the Arkansas River. Beneath the sand is the Coffeyville formation, a thick shale with thin tongues of sandstone.

An oil refinery was operated on the 235-acre site through the 1940s by Sinclair, which later merged into Arco. A solvent recycler operated in the late 1960s and early 1970s at the Glen Wynn subsite. The light liquid organics at Glen Wynn will be incinerated off site if the bulk of the site's 130,000 cubic yards of wastes are stabilized. The site has several thousand cubic yards of sulfuric acid sludge in unlined pits. The pH is 2.1. Also, lagoons, pits and spray ponds contain heavy metals and organics.

Key contacts are Pat Sieminski with EPA Region 6, Dennis Hrebec with the Oklahoma Dept. of Health and John Miller with Arco.

INDUSTRY: Environment (EV)

2/5/15 (Item 9 from file: 636)
00520867
Treatability studies set for Burnt Fly Bog
SUPERFUND May 09, 1988 V. 2 NO. 10
ISSN: 0892-2985 WORD COUNT: 556
PUBLISHER: Pasha Publications, Inc.

A portion of the Burnt Fly Bog Superfund site in New Jersey will get a $2 million interim containment remedy and treatability tests of four treatment technologies, if the state has its way.

In its quest for a final remedy for the bog's westerly wetlands area, the state intends to test on-site incineration, the Basic Extraction Sludge Treatment (BEST) process, the potassium-ethylene glycol (KPEG) process and bioremediation for their ability to reduce polychlorinated biphenyl (PCB) concentrations to 5 ppm and lead concentrations to 250 ppm.

The New Jersey Dept. of Environmental Protection has proposed to surround the westerly wetlands area of the 1,700-acre bog with a fence and provide a gated access road. At the downgradient end of the area would go a sediment collection basin to keep lead-contaminated soil from eroding into Deep Run. Some 5,800 tons of leaded and PCB contaminated soil that has ventured too near the stream would have to be excavated.
A remedial investigation estimated that mobile incineration would cost anywhere form $200 to $700 per ton. The cost of burning 125,000 tons of the westerly area's contaminated soil was put at $25 million to $90 million. The study focused on rotary kiln, fluidized bed, infrared and high temperature pyrolysis technologies.

The BEST process, developed by Resources Conservation Co. of Bellevue, Wash., removes oils and water from solids with the solvent triethylamine. Estimated cost is $150 to $250 per cubic yard and 80,000 cubic yards would be treated at a total cost of $12 million to $20 million.

The KPEG process dechlorinates organic chemicals. Galson Research Corp. of Syracuse, N.Y., has developed applications for treatment of PCBs and dioxins. The process would have no effect on lead.

Cost is put at $100 to $200 per ton of contaminated soil. If 100,000 tons were treated, total cost would be $10 million to $20 million.

The state intends to try a bioremediation process developed by Bio-

Clean Inc. of Webster, Minn. Bio-Clean destroys PCBs and other organics -- but not lead -- by mixing the contaminated soil with air and naturally adapted microbes in a bacterial digester.

At a cost of $250 per cubic yard for 64,000 cubic yards, the estimated cleanup cost is $16 million. But that does not count material handling, lead fixation and water treatment.

These four technologies are among 14 finalists of 50 original contestants. The state rejected in-situ vitrification and fixation/solidification because they would destroy wetlands and unpredictably affect the local hydrogeology. The state turned down ultrasonic/utraviolet treatment because of its especially early stage of development.

Meanwhile Chemical Waste Management Inc. is set to begin a $3.2 million offsite disposal job in fulfillment of a November 1983 Record of Decision. Chemwaste will remedy the bog's uplands area, where several hazardous waste lagoons follow a "subtle ridge."

Chemwaste will remove 10,000 tons of sludge and chemical wastes, 46,850 tons of contaminated soil and debris and 500,000 gallons of liquid waste containing PCBs, lead and volatile and semi-volatile organics. The company will mix the sludges with soil and kiln dust in cement mixers for stabilization prior to offsite disposal.
CECOS International of Buffalo, N.Y., will take the wastes to its facility for a charge of $8.9 million. Ebasco Services Inc. of Lyndhurst, N.J., will oversee the job.

Contact at the New Jersey Dept. of Environmental Protection is Debra Miller at 609-984-3081.

INDUSTRY: Environment (EV)

2/5/16 (Item 10 from file: 636)
00504183
Dispute over remedy brings Mich. talks to halt
SUPERFUND February 00, 1988 V. 2 NO. 3
ISSN: 0892-2985 WORD COUNT: 654
PUBLISHER: Pasha Publications, Inc.

A dispute over the remedy kept negotiators from reaching a set on the Liquid Disposal Superfund site in Utica, Mich., before a deadline last week.

The impasse opens the door to a separate settlement for a de minimis cash-out for the site's hundreds of small-volume responsible parties (PRPs).

A steering committee representing large-volume contributors to the site favors soil flushing over the $22 million solidification, containment and groundwater treatment remedy EPA chose on Sept. 30. The PRPs say their remedy would be more appropriate and would cost only half as much.

In settlement talks EPA has offered to allow the steering committee to fund remedial design for both the remedy it likes and the one EPA chose, then let EPA decide which to act upon. The committee declined, countering with an $18.5 million cashout proposal that EPA found unacceptable.

EPA's chosen remedy is to solidify contaminated soil and waste materials with fly ash and portland cement to "greatly reduce or eliminate" their mobility, and to further protect against mobility by surrounding the solidified materialswith a slurry wall and covering the pile with an impermeable cap. Thewall and cap also will protect the pile from erosion by slightly contaminated waters flowing into the site. The remedy also calls for groundwater pumping and treatment with activated carbon.

In EPA's view, solidification works well on heavy metals and might work for the low concentration (less than 1% or 10,000 ppm) of VOCs in the soil given the use of certain proprietary additives. If not, vacuum extraction orsome other process may be necessary to supplement solidification by removing volatile organics.

EPA recognized, however, concerns expressed by Michigan officials that vacuum extraction would not work well atthe site because the soil is not uniformly permeable.

EPA did not consider soil flushing in the final remedy selection process because it would involve circulating a large volume of groundwater. Since the upgradient groundwater is slightly contaminated, this "would have an unknown effect on the local groundwater system," EPA said in the ROD. Plus, soil flushing would be impeded during Michigan's long, cold winter.

The responsible parties also contend there is no need to remedy ashallow downgradient aquifer because the aquifer is so saline that itshould be classified as an unusable Class III aquifer. EPA believes the aquifer can be-and in fact is-used for drinking water.

Negotiations have stretched without result over a 60-day period, plus a 30-day extension, during which EPA was not allowed to begin remedial work. The agency is free now to begin the estimated two-year, $500,000 remedial design process.

De minimis cashout hopes revive While the PRP steering committee and EPA tried to iron out their differences on remedy,they deferred the volatile matter of a de minimis cashout settlement.Shortly after EPA issued its ROD, the steering committee had proposedto the site's 720 PRPs a settlement with a de minimis cashout offer. The de minimis parties roundly rejected the offer.

The small-volume parties organized a group, Small Companies Organized to Negotiate an Environmental Settlement (SCONES), and proposed a counter-offer.

They disliked several elements in the steering committee's offer. The 110%to 190% premium was too high. They preferred defining de minimis parties on the basis of percentage rather than volumetric contribution, and anyway, the 100,000-gallon volume cut-off was too low. Further, they wanted a proposal based on a specific projected cleanup cost. The 204-member SCONES countered with an offer that defined de minimis parties as those

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**See online bluesheet in File 415.

    File 636:PTS NEWSLETTER DATABASE_87-91/Jan. 8
             (Copr. 1990 Predicasts)
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    File 669:FEDERAL REGISTER_04 JAN 88 - 31 Dec 1990
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"Official Cites, Pagination and Tables available as of February 1990!"
         "Data for 901221 will be made available directly."

    File   6:NTIS - 64-91/9101B2
             (COPR. 1991 NTIS)

    File 340:CLAIMS/U.S. PATENTS ABSTRACTS_

Chemical patents from 1950 - Oct/90,
Electrical and Mechanical patents 1963 - Oct/90
Patent number: 2492948-4967417

      Set  Items  Description
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?t 2/3/2-22 from 669


 2/3/18     (Item 2 from file: 669)

00089286
Approval  and Promulgation of Implementation Plans; California (South Coast
  Air  Basin);  Plans  for  Ozone  and  Carbon Monoxide  ACTIONS: Notice of
  proposed rulemaking and notice of public hearing.
                       Vol. 55, No. 172
                             Part II
                           55 FR 36458
                  Wednesday, September 5, 1990

 2/3/19     (Item 3 from file: 669)

00082661
Hazardous  Waste  Treatment,  Storage,  and Disposal Facilities-Organic Air
  Emission Standards for Process Vents and Equipment Leaks
                        Vol. 55, No. 120
                            Part III
                           55 FR 25454
                     Thursday, June 21, 1990

 2/3/20     (Item 4 from file: 669)

00080969
Land Disposal Restrictions for Third Third Scheduled Wastes
                        Vol. 55, No.106
                            Part II
                           55 FR 22520
                      Friday, June 1, 1990

 2/3/21     (Item 5 from file: 669)

00077107
Lead-Based   Paint:   Interim   Guidelines   for   Hazard   Identification   and
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Abatement in Public and Indian Housing
Vol. 55, No. 75
Part II
55 FR 14556
Wednesday, April 18, 1990

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00076062
Notice Proposing To Grant a Conditional Variance to the Department of Energy Waste Isolation Pilot Plant (WIPP) From Land Disposal Restrictions
Vol. 55, No. 67
Part VII
55 FR 13068
Friday, April 6, 1990

2/3/23 (Item 7 from file: 669)

00073361
National Oil and Hazardous Substances Pollution Contingency Plan
Vol. 55, No. 46
Part II
55 FR 8666
Thursday, February 8, 1990

2/3/24 (Item 8 from file: 669)

0064377
Land Disposal Restrictions for Third Scheduled Wastes
Vol. 54, No. 224
Wednesday, November 22, 1989

2/3/25 (Item 9 from file: 669)

0061974
Burning of Hazardous Waste in Boilers and Industrial Furnaces
Vol. 54, No. 206
Thursday, October 26, 1989

2/3/26 (Item 10 from file: 669)

0058056
National Emission Standards for Hazardous Air Pollutants; Benzene Emissions From Chemical Manufacturing Process Vents, Industrial Solvent Use, Benzene Waste Operations, Benzene Transfer Operations, and Gasoline Marketing System
Vol. 54, No. 177
Thursday, September 14, 1989

2/3/27 (Item 11 from file: 669)

0056977
Mining Waste Exclusion
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Friday, September 1, 1939

2/3/28 (Item 12 from file: 669)

0047575
National Primary and Secondary Drinking Water Regulations

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Monday, May 22, 1989

2/3/29 (Item 13 from file: 669)

0034704
Land Disposal Restrictions for Second Third Scheduled Wastes
Vol. 54, No. 7
Wednesday, January 11, 1989

2/3/30 (Item 14 from file: 669)

0031703
National Pollutant Discharge Elimination System Permit Application Regulations for Storm Water Discharges
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Wednesday, December 7, 1988

2/3/31 (Item 15 from file: 669)

0024552
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Vol. 53, No. 185
Friday, September 23, 1988

2/3/32 (Item 16 from file: 669)

0022190
Solid Waste Disposal Facility Criteria
Vol. 53, No. 168
Tuesday, August 30, 1988

2/3/33 (Item 17 from file: 669)

0013850
Hazardous Waste Management System: Identification and Listing of Hazardous Waste; Final Exclusion Rule
Vol. 53, No. 106
Thursday, June 2, 1988

2/3/34 (Item 18 from file: 669)

0012867
Land Disposal Restrictions
Vol. 53, No. 100
Tuesday, May 24, 1988

2/3/35 (Item 19 from file: 669)

0008680
Land Disposal Restrictions for Restrictions for First Third of Scheduled Wastes
Vol. 53, No. 68
Friday, April 8, 1988

2/3/36 (Item 20 from file: 669)

0007974
Oil and Gas and Sulphur Operations in the Outer Continental Shelf; Outer Continental Shelf Minerals and Rights-of-Way Management, General; and

Outer Continental Shelf Orders for All Regions of the Outer Continental Shelf
Vol. 53, No. 63
Friday, April 1, 1988
?bt 2/5/1-7 from 6

2/5/37 (Item 1 from file: 6)
1480775 DE90012188/XAB
Stabilization/solidification of wastes containing volatile organic compounds in commercial cementitious waste forms
Spence, R. D. ; Gilliam, T. M. ; Morgan, I. L. ; Osborne, S. G.
Oak Ridge National Lab., TN.
Corp. Source Codes: 021310000; 4832000
Sponsor: Department of Energy, Washington, DC.
Report No.: CONF-900525-2
1990 36p
Languages: English Document Type: Conference proceeding
Journal Announcement: GRAI9022; NSA1500
International symposium on stabilization/solidification of hazardous, radioactive and mixed waste (2nd), Williamsburg, VA (USA), 29 May - 1 Jun 1990. Sponsored by Department of Energy, Washington, DC.
Portions of this document are illegible in microfiche products.
NTIS Prices: PC A03/MF A01
Country of Publication: United States
Contract No.: AC05-84OR21400

Stabilization/solidification (S/S) is one of the most widely used techniques for the treatment and ultimate disposal of both radioactive and chemically hazardous wastes. But does not have regulatory approval for treating organics. Application with volatile organic compounds (VOC) is particularly controversial since it was believed that the necessary mechanical mixing and exothermic cementitious reactions would vaporize the VOC. The objective of this study was to establish whether S/S is a viable alternative for a sludge heavily contaminated (about 1%) with relatively immobile metals, but lightly contaminated (<0.04%) with VOC that was contaminating the groundwater. The mass balance indicated that >50% of the VOC was retained in the laboratory preparation of cementitious samples cured for 28 d. The performance tests indicated the commercial products could attain leachability indexes from 7 to >9 for the eight VOC studies and distribution coefficients of >10 could be attained for all eight and >100 for some compounds. 6 refs., 9 tabs. (ERA citation 15:034110)

Descriptors: *Acetone; *Benzene; *Chloroform; *Metals; *Organic Chlorine Compounds; *Organic Compounds; *Waste Forms; Cements; Leaching; Mass Transfer; Radioactive Wastes; Sludges; Solidification; Stability; Underground; Waste Disposal; Wastes; Meetings

Identifiers: EDB/052000; *Stabilization; *Hazardous materials; Volatile organic compounds; NTISDE

Section Headings: 68C (Environmental Pollution and Control--Solid Wastes Pollution and Control); 68F (Environmental Pollution and Control--Radiation Pollution and Control); 77G (Nuclear Science and Technology--Radioactive Wastes and Radioactivity)

2/5/38 (Item 2 from file: 6)
1434733 DE88010333/XAB
Glass Furnace Processing of Rocky Flats Plant Wastes: An Evaluation
Klingler, L. M. ; Abellera, P. L.
Monsanto Research Corp., Miamisburg, OH. Mound.
Corp. Source Codes: 013512003; 9515000
Sponsor: Department of Energy, Washington, DC.
Report No.: MLM-3493

29 Apr 88 58p
Languages: English
Journal Announcement: GRAI9007; NSA1300
Portions of this document are illegible in microfiche products.
NTIS Prices: PC A04/MF A01
Country of Publication: United States
Contract No.: AC04-76DP00053

This report evaluates the use of a joule-heated glass furnace to treat four Rocky Flats Plant waste streams. These streams are extremely large, are primarily water soluble inorganic salts, and can be contaminated with hazardous organic material, toxics, and/or radioactivity. It runs closely simulating actual process type runs, the glass furnace effectively treated these wastes by degrading the salts to oxides that can be incorporated along with radioactivity and toxic metals into a highly stable glass matrix. Most of the gaseous by-products of the waste treatment can be handled by a wet offgas scrubbing system. Two major exceptions are NOx and volatile organics. This study has provided additional evidence that NOx can be adequately controlled by means of the adding NH3 to the gases in the furnace chamber. To prepare glass with optimum characteristics, batch compositions were computer selected for this study. The quantities of glass-making chemical additives required to prepare glass to this formulation effectively eliminated any process volume reduction potential for some of the wastes. 1 ref., 17 figs., 20 tabs. (ERA citation 13:035828)

Descriptors: *Chemical Effluents; *Low-Level Radioactive Wastes; *Radioactive Effluents; Evaluation; *Glass; Liquid Wastes; Nitrogen Oxides; *Off-Gas Systems; Potassium Compounds; Radioactive Waste Management; Radioactive Waste Processing; Rocky Flats Plant; Sodium Nitrates; Solidification; Vitrification; Waste Forms

Identifiers: ERDA/052001; ERDA/053000; Ammonia; NTISDE

Section Headings: 77G (Nuclear Science and Technology--Radioactive Wastes and Radioactivity); 68F (Environmental Pollution and Control--Radiation Pollution and Control); 71D (Materials Sciences--Ceramics, Refractories, and Glass)

2/5/39 (Item 3 from file: 6)
1408243 PB89-206031/XAB
Applications Analysis Report: HAZCON Solidification Process, Douglassville, Pennsylvania
Sawyer, S.
Foster Wheeler Enviresponse, Inc., Livingston, NJ.
Corp. Source Codes: 094973000;
Sponsor: HAZCON, Inc., Katy, TX.; Environmental Protection Agency, Cincinnati, OH. Risk Reduction Engineering Lab.
Report No.: EPA/540/A5-89/001
May 89 64p
Languages: English
Journal Announcement: GRAI8920

Also available from Supt. of Docs. See also PB89-158810. Prepared in cooperation with HAZCON, Inc., Katy, TX. Sponsored by Environmental Protection Agency, Cincinnati, OH. Risk Reduction Engineering Lab.

NTIS Prices: PC A04/MF A01
Country of Publication: United States
Contract No.: EPA-68-03-3255

The document is an evaluation of the HAZCON solidification technology and its applicability as an on-site treatment method for waste site cleanup. A Demonstration was held at the Douglassville, Pennsylvania Superfund site in the fall of 1987. Operational data and sampling and analysis information were carefully monitored and controlled to establish a database against which other available data and the vendor's claims for the technology could be compared and evaluated. Conclusions were reached concerning the technology's suitability for use in clean up of the types of materials found at the test site, and extrapolations were made to cleanups of other materials.

Descriptors: *Hazardous materials; *Cost analysis; *Solidification; *Encapsulating; Performance evaluation; Substitutes; Cements; Soil analysis ; Permeability; Equipment; Soil stabilization; Leaching; Leakage; Sampling

Identifiers: *Superfund project; *SITE program; *Oil pollution; Environmental transport; Volatile organic compounds; Heavy metals; Land pollution; NTISGPO

Section Headings: 68C (Environmental Pollution and Control--Solid Wastes Pollution and Control); 97R (Energy--Environmental Studies); 97K (Energy--Fuels)

2/5/40 (Item 4 from file: 6)
1383389 PB89-158828/XAB
Technology Evaluation Report SITE Program Demonstration Test, HAZCON Solidification, Douglassville, Pennsylvania. Volume 2
(Rept. for Apr 87-Aug 88)
Sawyer, S.
Enviresponse, Inc., Livingston, NJ.
Corp. Source Codes: 087097000
Sponsor: Environmental Protection Agency, Cincinnati, OH. Risk Reduction Engineering Lab.
Report No.: EPA/540/5-89/001B
Feb 89 326p
Languages: English
Journal Announcement: GRAI8912
See also PB89-158810. Sponsored by Environmental Protection Agency, Cincinnati, OH. Risk Reduction Engineering Lab.
NTIS Prices: PC A15/MF A01
Country of Publication: United States
Contract No.: EPA-68-03-3255

The major objectives of the HAZCON Solidification SITE Program Demonstration Test were to develop reliable performance and cost information. The HAZCON process mixes the hazardous waste material with cement, a proprietary additive called Chloranan and water. The Chloranan is claimed to neutralize the inhibiting effect that organics normally have on the hydration of cement. The technical criteria used to evaluate the effectiveness of the HAZCON process were contaminant mobility, based on leaching and permeability tests; and potential integrity of solidified soils, based on measurements of physical and microstructural properties. Extensive sampling and analyses were performed showing the concentration of the organics were the same in the leachates of the untreated and treated soils, heavy metals reductions were achieved, and structural properties of the solidified cores were found to indicate good long-term stability. The volume contains data collected during the project.

Descriptors: *Hazardous materials; *Cost analysis; *Encapsulating; *Oil wastes; *Solidification; Performance evaluation; Substitutes; Cements; Soil analysis; Soil stabilization; Concentration(Composition); Leaching; Leakage ; Drums(Containers); Sampling; Tables(Data)

Identifiers: *Superfund project; *SITE program; *HAZCON solidification process; *Oil pollution; Chloranan; Environmental transport; Polychlorinated biphenyls; Volatile organic compounds; Heavy metals; Land pollution; NTISEPAORD

Section Headings: 68C (Environmental Pollution and Control--Solid Wastes Pollution and Control); 97R (Energy--Environmental Studies); 97K (Energy--Fuels)

2/5/41 (Item 5 from file: 6)
1383388 PB89-158810/XAB

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  Technology  Evaluation  Report  SITE  Program  Demonstration Test, HAZCON
Solidification, Douglassville, Pennsylvania. Volume 1
  (Rept. for Apr 87-Aug 88)
  Sawyer, S.
  Enviresponse, Inc., Livingston, NJ.
  Corp. Source Codes: 087097000
  Sponsor:  Environmental  Protection  Agency,  Cincinnati,  OH.  Office of
Research and Development.
  Report No.: EPA/540/5-89/101A
  Feb 89   131p
  Languages: English
  Journal Announcement: GRAI8912
  See  also  PB89-158828.  Sponsored  by  Environmental  Protection Agency,
Cincinnati, OH. Office of Research and Development.
  NTIS Prices: PC A07/MF A01
  Country of Publication: United States
  Contract No.: EPA-68-03-3255
  The   major   objectives   of  the  HAZCON  Solidification  SITE  Program
Demonstration   Test   were   to  develop  reliable  performance  and  cost
information.  The  HAZCON  process  mixes the hazardous waste material with
cement, a proprietary additive called Chloranan and water. The Chloranan is
claimed  to neutralize the inhibiting effect that organics normally have on
the  hydration  of  cement.  The  technical  criteria  used to evaluate the
effectiveness  of  the  HAZCON  process were contaminant mobility, based on
leaching  and  permeability  tests;  and  potential integrity of solidified
soils,  based  on  measurements of physical and microstructural properties.
Extensive sampling and analyses were performed showing the concentration of
the  organics  were  the same in the leachates of the untreated and treated
soils,  heavy metals reductions were achieved, and structural properties of
the solidified cores were found to indicate good long-term stability.
  Descriptors:  *Hazardous  materials; *Cost analysis; *Encapsulating; *Oil
wastes; *Solidification; Performance evaluation; Substitutes; Cements; Soil
analysis;   Soil   stabilization;   Leaching;  Leakage;  Drums(Containers);
Sampling
  Identifiers:  *Superfund  project;  *SITE program; *HAZCON solidification
process;   *Oil   pollution;   Chloranan;   Environmental   transport;
Polychlorinated  biphenyls;  Volatile organic compounds; Heavy metals; Land
pollution; NTISEPAORD
  Section  Headings: 68C (Environmental Pollution and Control--Solid Wastes
Pollution   and   Control);   97R   (Energy--Environmental   Studies);  97K
(Energy--Fuels)
?t 2/5/1-3 from 340


 2/5/42     (Item 1 from file: 340)
0239163    6505498
C/   NON-SETTLING NEOPRENE-MODIFIED PHENOLIC RESIN ADHESIVES
Inventors: GARRETT ROBERT ROTH (N/A)
Assignee: DU PONT DE NEMOURS, E I & CO   Assignee Codes: 25048
Document Type: UTILITY
               Patent       Issue
               Number        Date
              ----------    ------
Patent:       US 3185658    650525
    (Cited in 005 later patents)
Equivalent Patents: DE 1243310; FR 1355168; GB 1031768
Claim:
  1. A NON-SETTLING ADHESIVE CEMENT COMPOSITION COMPRISING (A) 100 PARTS BY
WEIGHT  OF POLYCHLOROPRENE DISSOLVED IN VOLATILE ORGANIC SOLVENT, (B) 45 TO
50  PARTS BY WEIGHT OF A MAGNESIUM SALT OF A RESIN MADE BY REACTING, IN THE
```

PRESSURE OF AN ALKALINE CATALYST, FROM 1 TO 2 MOLES OF FORMALDEHYDE WITH 1 MOLE OF A PARA SUBSTITUTED PHENOL IN WHICH THE SUBSTITUENT IS A HYDROCARBON RADICAL SELECTED FROM THE GROUP CONSISTING OF ARYL RADICALS AND ALKYL RADICALS CONTAINING FROM 3 TO 6 CARBON ATOMS, (C) 1 TO 40 PARTS BY WEIGHT OF AN ORGANIC CARBOXYLIC ACID CONTAINING AT LEAST ONE CARBOXYL GROUP, AND (D) A MINOR PROPORTION OF STABILIZING INGREDIENTS.

CA Ref: 62004178
Class: 524432000
Cross Ref: 524284000; 524287000; 524300000; 524433000; 525139000; 525506000
?b 411

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