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RESOLUTION OF REGULATORY ISSUES FACING THE DOE IN SITU VITRIFICATION PROGRAM

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RESOLUTION OF REGULATORY ISSUES FACING THE DOE IN SITU VITRIFICATION PROGRAM

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ABSTRACT

In situ vitrification (ISV) is being developed by researchers at the Pacific Northwest Laboratory (PNL), Idaho National Engineering Laboratory (INEL), and Oak Ridge National Laboratory (ORNL) as a technology for remediating soils, underground storage tank residuals, and buried materials that have been contaminated with hazardous, radioactive, and mixed wastes (i.e., wastes containing both radioactive and hazardous wastes) at U.S. Department of Energy (DOE) facilities. The goal of the DOE ISV technology development program (i.e., the ISV Integrated Program) is to ensure that ISV is a workable technology for environmental restoration applications for DOE and other agencies.

A DOE complex-wide plan was prepared during Fiscal Year 1991 to coordinate all levels of activities associated with the deployment of ISV. As part of this plan, a programmatic regulatory strategy was developed which focused on the federal environmental, health, safety, and nuclear regulations, including the U.S. Environmental Protection Agency (EPA) and DOE regulations, believed to have the most significant near-term impact on the use of ISV as a remediation technology.

The portion of the programmatic regulatory strategy addressing compliance with the Comprehensive Environmental Response, Compensation and Liability Act, as amended, and the Resource Conservation and Recovery Act, as amended, is presented in this paper.

INTRODUCTION

In situ vitrification (ISV) is being developed by researchers at PNL, INEL, and ORNL as a technology for remediating soils, underground storage tank residuals, and buried materials that have been contaminated with hazardous, radioactive, and mixed wastes (i.e., wastes containing both radioactive and hazardous wastes) at U.S. Department of Energy (DOE) facilities. The ISV process begins when an electric current is passed among four electrodes placed in the ground. Heat from the current melts the soils matrix, transforming them into a stable glass and crystalline material. The goal of the DOE ISV Integrated Program is to ensure that ISV is a workable technology for environmental restoration applications for DOE and other agencies.

To accomplish this goal, the ISV Integrated Program must demonstrate that the technology can be used successfully to remediate contaminated sites. The

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initial focus for remediation is on candidate sites at DOE's Hanford (Richland, WA), Idaho (Idaho Falls, ID) and Oak Ridge (Oak Ridge, TN) facilities. To facilitate the transfer of ISV from the technology developers to the technology users, a DOE complex-wide plan was prepared during Fiscal Year 1991 to coordinate all levels of activities associated with its deployment. An important aspect of this plan is to ensure that ISV can comply with applicable environmental statutes and regulations.

As part of the complex-wide plan, a programmatic regulatory strategy was developed which focused on the federal environmental, health, safety, and nuclear regulations, including the EPA and DOE regulations, believed to have the most significant near-term impact on the use of ISV as a remediation technology. The purpose of the regulatory strategy was to acquaint the researchers with the basic (i.e., federal) regulatory requirements and to provide general guidance on where to direct their research efforts.

While the regulatory strategy recognized the fact that some state and local regulatory requirements must be met when they are more stringent than their federal counterparts, these state and local requirements were not addressed in detail in the regulatory strategy because they, as well as the characteristics of the wastes and the site, will vary from site to site. Thus, it is necessary to address the state/local regulatory requirements on a site-by-site basis. The regulatory strategy recommended that an information management system be developed to facilitate the transfer of regulatory acceptance criteria (including state and local requirements) from one site to another.

For purposes of this presentation, the development of the programmatic regulatory strategy is limited to how ISV, as a remediation technology, must meet the regulatory requirements under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA) (1), and the Resource Conservation and Recovery Act (RCRA), as amended by the Hazardous Solid Waste Amendments (2).

CERCLA RESPONSE AND RCRA CORRECTIVE ACTION REGULATORY REQUIREMENTS

CERCLA Response Actions

CERCLA, as amended by SARA, establishes the process for implementing response actions at uncontrolled or abandoned sites where hazardous substances have been or might have been released into the environment. The National Oil and Hazardous Substances Pollution Contingency Plan, as presented in 40 CFR 300, details procedures and regulatory requirements for Superfund response actions, including the use of innovative technologies, site characterization requirements, and remedy selection procedures and criteria (3).

Prior to evaluating whether a technology or combination of technologies/actions should be considered for CERCLA response actions, remedial action objectives need to be developed for protecting human health and the environment. These objectives should specify contaminants and media of concern, potential exposure pathways, and preliminary goals. The preliminary remediation goals are concentrations of contaminants for each exposure route that are believed to provide adequate protection of human health and the environment based on preliminary site information. These goals are also used to set parameters for evaluating technologies and developing remedial alternatives.

Once the remediation goals are established, potentially suitable technologies, including innovative technologies, are identified, evaluated, and assembled into alternative remedial actions. Alternatives will undergo an initial screening based on the ability of the alternatives to meet three criteria (e.g., effectiveness, implementability, and cost). The alternatives that remain after the initial screening must then undergo a detailed analysis against nine evaluation criteria. These criteria are:

- Overall protection of human health and the environment;
- Compliance with applicable or relevant and appropriate requirements (ARARs);
- Long-term effectiveness and permanence;
- Reduction of toxicity, mobility, or volume;
- Short-term effectiveness;
- Implementability;
- Cost;
- State acceptance; and
- Community acceptance.

A preferred remedy is proposed following the detailed analysis of alternatives against these nine criteria. There is a preference for remedies that reduce the volume, toxicity, and mobility of the hazardous substances, particularly those that are considered permanent and use innovative technologies, to the extent practicable. The final remedy is selected after considering the public's comments (including state comments) on the preferred alternative.

RCRA Corrective Actions

Under RCRA, EPA may require corrective actions (e.g., cleanup actions) for releases from operating hazardous waste management facilities, regardless of permit status. The implementing regulations for corrective actions at RCRA-permitted facilities are currently in the proposal stage and are similar to the CERCLA process (4). Corrective actions at RCRA-permitted facilities will be implemented by modifying the existing permits. Corrective actions at interim-status facilities (i.e., not fully permitted under RCRA) are implemented on a case-by-case basis via RCRA 3008(h) corrective action orders (i.e., consent orders). (EPA expects the proposed regulations for corrective action at permitted facilities to be used as guidance for 3008(h) orders).

The proposed corrective action regulations include general standards for selecting remedies. These standards are:

- Be protective of human health and the environment.
- Attain media cleanup standards specified in the corrective action regulations.
- Control the sources of releases so as to reduce or eliminate, to the extent practicable, further releases that may pose a threat to human health and the environment.
- Comply with standards for the management of hazardous wastes.

Proposed remedies must meet, at a minimum, these four standards. The proposed remedies will then be evaluated against five decision factors. These factors are:

- Long-term reliability and effectiveness;
- Reduction of toxicity, mobility or volume of wastes;
- Short-term effectiveness;
- Implementability; and
- Cost.

For permitted facilities, a major permit modification will be developed to specify the selected remedy and impose a schedule of compliance for implementing the remedy.

Elements Common to CERCLA Response and RCRA Corrective Actions

Under both remediation programs, the recommended remedy is presented to the public. Under CERCLA, the preferred alternative (i.e., remedy) is submitted for public comment, including state comment, in a proposed plan. Under the proposed RCRA corrective action regulations, the proposed remedy is issued for public comment via the major permit modification process under 40 CFR 270. Based on consideration of the public's comments, the final selection is made.

Also under both remediation programs, EPA expects to consider using innovative technologies (i.e., not yet widely available) when such technology offers the potential for comparable or significant advantages over currently available technologies. To re-emphasize this expectation, EPA Headquarters has recently issued a memorandum encouraging EPA Regional Offices and other affected parties (i.e., Federal facilities, potentially responsible parties, technology vendors, etc.) to undertake studies on the potential use of innovative treatment technologies for CERCLA response actions and RCRA corrective actions (5).

For example, the Superfund Innovative Technology Evaluation (SITE) program has been established by the EPA to promote innovative technology development for cleanup activities at EPA-lead cleanup sites. ISV has been chosen for the remediation of several non-federal CERCLA hazardous waste sites throughout the nation; the progress of implementing ISV at these sites is being tracked by EPA under the SITE program.

HAZARDOUS WASTE MANAGEMENT REGULATIONS

General

Hazardous waste management is regulated at the federal level primarily by the EPA pursuant to the RCRA. RCRA will also apply to the hazardous portion of a mixed waste, wastes that contain both hazardous and radioactive wastes (2,6). Additionally, most states are authorized to implement RCRA within their boundaries, except for RCRA corrective action at this time. (The states will have to apply for authorization to implement RCRA corrective actions.)

Subtitle C of RCRA establishes standards for generators, transporters, and owners/operators of hazardous waste treatment, storage, and disposal facilities (i.e., hazardous waste management units). A hazardous waste management unit is defined, in part, as a contiguous area of land on or in which hazardous waste is placed (RCRA). Examples of hazardous waste management units include landfills, land treatment units, waste piles, underground storage tanks, and miscellaneous units.

Generally, all facilities that treat, store, or dispose of hazardous or mixed wastes are required to obtain a RCRA permit. These permits include administrative and technical performance standards that hazardous waste management units must meet. The process of obtaining a permit can take two to five years (7). Groundwater monitoring is required when land disposal units are used or have been used to manage hazardous wastes. For all hazardous waste management units that received hazardous wastes on or after November 19, 1980, closure and post-closure care requirements exist to address how the units will be closed (via written closure plans). Any release of hazardous wastes resulting from the management of such wastes will require corrective action to address the release.

Permitting Requirements

Where wastes meeting the RCRA definition of "hazardous" are treated, stored, or disposed of during RCRA corrective action, EPA is proposing that they are subject to the standards of 40 CFR 262, 264, and 268, except for the procedural requirements for closure of hazardous waste management units (4). (EPA believes that the remedy selection process is equivalent to and equally effective at ensuring the closure technical requirements will be met.) However, the general technical performance standard for closure and unit-specific standards would not be waived during the remedy and will apply to new hazardous waste management units created to manage corrective action wastes.

EPA has also stated that it believes, for remediating existing contamination problems under RCRA, it will "often be unnecessary and counterproductive to strictly apply to cleanup activities standards that were designed to prevent future risks at operating facilities that will continue to receive and manage hazardous waste"(4). There is a potential for conflict between this belief and the requirement that all hazardous wastes managed during corrective actions are subject to the existing hazardous waste management standards.

Under CERCLA, other laws must be investigated for applicability, relevancy and appropriateness to the CERCLA cleanup activities. While administrative requirements of other laws deemed to be applicable or relevant and appropriate (i.e., permitting requirements) are not required for onsite CERCLA response actions, compliance with the substantive requirements of the laws is required. For using ISV under CERCLA, RCRA will likely be used as an ARAR.

There is some uncertainty as to what type of permitting requirements ISV will need to meet. ISV thermally destroys organic constituents and immobilizes inorganic and radioactive constituents of contaminants. ISV's intended use is to treat contaminated materials that have already been disposed to land rather than as an ongoing waste management unit. Thus, it is highly likely the regulating community will view ISV as a remediation technology involving land disposal. A case in point is the recent request for comments by EPA on whether ISV, as an innovative technology, is a potential regulatory disposal option that can effectively and safely manage polychlorinated biphenyls (8).

Since ISV involves land disposal, it might be subjected to meeting the landfill requirements under RCRA. (A landfill is defined as a disposal facility where hazardous waste is placed in or on land, and which is not a waste pile, a

land treatment facility, a surface impoundment, and underground injection well, a salt dome or salt bed formation, an underground mine, or a cave.) In this case, ISV would have to demonstrate that it could meet the double liner requirement, as well as the other technical standards which apply to landfills under RCRA.

Several options exist for meeting the RCRA landfill requirements. These include:

- Using the alternative design option under the landfill requirements.
- Using the delisting option for listed RCRA wastes. (See discussion on delisting under Land Disposal Requirements.)
- Using the no-migration petitioning option. (See discussion on no-migration petitions under Land Disposal Requirements.)

Land Disposal Requirements

RCRA includes specific provisions restricting the land disposal (i.e., placement on land) of RCRA hazardous wastes. Land disposal restrictions (LDRs) require that RCRA hazardous wastes must be treated to certain levels prior to land disposal (9). The LDRs apply to the hazardous components of mixed wastes, unless the wastes are managed in land disposal units that have been granted a no-migration petition. The LDRs apply to residues resulting from types of management other than treatment (e.g., contaminated soil or leachate).

There are three types of treatment standards based on the Best Demonstrated Available Technology (BDAT) identified for a particular RCRA-restricted waste including: 1) a concentration level to be achieved prior to disposal; 2) a specified technology to be used prior to disposal; and 3) a "no land disposal" designation when the waste is no longer generated, is totally recycled, is not currently being land disposed, or no residuals are produced from treatment. The most common type of treatment standards are those based on concentration levels. When a BDAT has been designated to achieve a concentration level treatment standard, it is not necessary to use the designated BDAT as long as the alternative technology can achieve the treatment standard. (Alternate technology demonstrations must be submitted to EPA for approval.)

EPA recognizes that treatment of wastes to the LDR treatment standards will not always be possible or appropriate. In addition, EPA does not want the LDRs to be unnecessarily restrictive to the development and use of alternative and innovative treatment technologies for remediating hazardous waste sites. Thus, there are four options available for demonstrating compliance with the LDR treatment standards: 1) treatability variances; 2) equivalent treatment method petition; 3) no migration petition; and 4) delisting.

A **treatability variance** is available when the waste differs significantly from the waste used to set the standard and the concentration level or the BDAT technology is inappropriate for that waste; an alternate treatment standard is established based on data from actual treatment of soil, or best management practices for debris. The **equivalent treatment method petition** is available when EPA has set a treatment standard that is a specified technology. RCRA-restricted wastes may be treated by a different technology only if the technology can achieve a measure of performance equivalent to that of the specified technology. The **no migration petition** enables the land disposal of wastes that do not meet

the LDR requirements if it can be demonstrated that there will be no migration of hazardous constituents above health-based levels from the disposal unit or injection zone for as long as the waste remains hazardous. A "listed" RCRA waste (i.e., a waste that is listed under 40 CFR 261 as being hazardous) may be **delisted** if it is demonstrated that the waste does not meet any of the criteria which made the waste listed as hazardous, and other factors (including additional constituents) do not cause the waste to be hazardous.

Due to the complex nature of many soil and debris matrices relative to those on which the LDR treatment standards have been based, it may not be possible or appropriate to treat restricted soil and debris wastes to the LDR treatment standards. For this reason, EPA is considering developing treatment standards for contaminated soils and debris at CERCLA response and RCRA corrective action sites. In the meantime, the restricted soil and debris wastes still must be treated to a certain level on a site-by-site basis. Typically, a treatability variance is used to seek compliance with the LDR treatment standards (10)

Importantly, EPA has decided for response actions undertaken pursuant to CERCLA that placement does not occur when wastes are left in place or moved within a single area of contamination. Thus, the LDRs will not apply (11). However, placement is considered to occur when the wastes (e.g., soil and debris contaminated with restricted RCRA wastes or RCRA wastes that have undergone some form of treatment) are moved from one area of contamination into another area of contamination. Thus, the LDRs will be triggered. EPA has proposed the same concepts for corrective actions at RCRA-permitted units.

FINDINGS

Based on the regulatory analysis, the following findings can be made.

- Technologies, as part of proposed alternatives/remedies, will be screened in detail against nine criteria under CERCLA and against five criteria under RCRA.

- EPA emphasizes using innovative technologies to address contamination problems under both CERCLA and RCRA. ISV has been selected as the remedial response at several non-federal sites contaminated with hazardous wastes.

- It is EPA's policy under CERCLA that <u>in situ</u> remediation techniques do not trigger the land disposal restrictions under the RCRA. EPA has proposed the same concept for corrective actions at RCRA-permitted facilities.

- There appears to be an inconsistency between the proposed requirement that RCRA wastes at facilities undergoing RCRA corrective action must be managed in accordance with RCRA, including the procedural and technical performance standards for hazardous waste management units, and EPA's belief that it may be unnecessary and counterproductive to strictly apply these standards to cleanup operations under RCRA.

- Uncertainties exist regarding the level and type of permitting requirements ISV will have to meet under RCRA.

CERCLA offers an incentive to use innovative technologies for cleanup projects. However, there is still a need for resolution of certain regulatory issues (e.g., uncertainties associated with RCRA permitting requirements). Thus, the following programmatic regulatory strategy has been developed to provide general guidance to the ISV developers (federal).

PROGRAMMATIC REGULATORY STRATEGY

ISV will first be applied to DOE facilities containing relatively non-complex contaminated sites[a] under CERCLA, thereby establishing a baseline for gaining regulatory acceptance. Three reasons exist for this approach. First, EPA's policy encourages use of innovative technologies for remediation, and the commercial application of ISV is currently being tracked under EPA's SITE program. Second, the majority of cleanup activities at DOE facilities are expected to occur under the authority of CERCLA via interagency agreements. Third, it will not be necessary to obtain operating permits under RCRA when a technology is applied at CERCLA sites; thus, a time can be saved.

Further research is needed to resolve the permitting requirements that ISV will likely face for RCRA corrective actions, as well as an ARAR for CERCLA response actions.

As noted in the introduction, state and local requirements will be addressed on a site-by-site basis, because they, as well as characteristics of the waste and the sites, will vary from site to site. An information management system should be developed to facilitate the transfer of regulatory acceptance criteria, including state and local requirements, from one site to another. This information can also track the regulatory acceptance of ISV on commercial applications.

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a. The term "relatively non-complex contaminated sites" means soils contaminated with hazardous, low-level radioactive wastes, or mixed low-level radioactive wastes. It is based on the regulatory analysis--used to develop the overall programmatic regulatory strategy--that there is less uncertainty associated with the applicable environmental, health, safety, and nuclear regulations than with other type of wastes (e.g., high-level radioactive wastes).

REFERENCES

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