ACCELERATED CLEANUP OF MIXED WASTE UNITS ON THE HANFORD SITE, RICHLAND, WASHINGTON

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ABSTRACT

This report provides a basic description of the Expedited Response Action Program currently being implemented at the Hanford Site. Included is reference to the applicable regulations regarding the program's implementation. The first three expedited response actions (a burial ground exhumation and drum removal project, a sediment removal and consolidation project, and a soil vapor extraction and treatment project) are discussed in detail in the form of case studies.

INTRODUCTION

The Hanford Site occupies approximately 1,450 km^3 (560 mi^2) of semiarid land in southeastern Washington. The site was selected by the U.S. Army Corps of Engineers in 1943 as the location for reactor, chemical separation, and related facilities dedicated to the production and purification of plutonium. The mission eventually evolved to include advanced reactor research and development of renewable energy technologies.

As a result of these operations, the Hanford Site presently contains over 1,500 waste management units which include waste disposal sites, accidental releases, and contaminated surface structures. Contamination at these sites consists of radioactive and/or chemical waste constituents.

Current regulations promulgated under the Comprehensive Environmental Response Compensation and Liability Act of 1980 (CERCLA) require the cleanup of wastes sites that pose a potential threat to human health and/or environment. Since the passage of CERCLA, the primary mission at the Hanford Site has been redirected from defense-related production to environmental restoration.

The approach for completing this new mission is documented in "The Hanford Federal Facility Agreement and Consent Order (also referred to as the Tri-Party Agreement) (1). This approach requires completion of remedial investigation (RI) and feasibility study (FS) work plans for operable units or groups of waste sites, extensive characterization of the sites, FS to select a method of remediation, and finally, cleanup. This method is consistent with that provided in CERCLA.

During the implementation of these environmental restoration activities at the Hanford Site, the need became apparent for responses to be taken earlier than allowed for under the standard CERCLA process. The responses may be made to mitigate a threat to the public and/or environment, to make future RI activities safer or more effective by removing or controlling onsite wastes, to demonstrate a promising technology, or where the remedial action to be taken at the site is readily evident.

It was also felt that conducting these early cleanups would improve the public perception of the CERCLA activities at the Hanford Site by accomplishing some level of site cleanup. It is not necessarily the intent of these early actions to reach final cleanup levels at a particular site, but they may often be the final action taken at the site.

Provisions for conducting these expedited actions were included during the development of the Tri-Party Agreement and agreed to by the U.S. Environmental Protection Agency (EPA), the State of Washington Department of Ecology (Ecology) and the U.S. Department of Energy (DOE). Provisions for performing interim or corrective actions are also included in CERCLA and in Resource Conservation and Recovery Act of 1976 (RCRA).

Initially, three proposed expedited response actions (ERA), (the term used to describe all early response actions taken at the Hanford Site), were selected following a limited evaluation of seven candidate sites chosen jointly by the DOE and EPA. In October of 1990, an Agreement in Principle between the DOE, EPA, Ecology was signed. This agreement stated that three candidate projects would be further evaluated for potential ERA.

REGULATORY SETTING

CERCLA provides the regulatory authority for conducting response or removal actions at past practice sites. The implementing regulations for CERCLA are contained within the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) found in 40 CFR 300. It is apparent in the preamble to these implementing regulations that the EPA's intent is to implement a 'bias for action'.

The NCP formed the primary basis for establishing the requirements by which ERA would be performed at the Hanford Site. A summary of the more significant requirement listed in the NCP are provided below.

- 40 CFR 300.415(b)(4) states in part that whenever a planning period of at least 6 mo exists before onsite activities must be initiated, an engineering evaluation/cost assessment (EE/CA) will be completed which analyses removal/remedial alternatives. Sampling and analysis plans must be prepared for EPA approval if environmental samples are needed in support of the action.
- Per 40 CFR 300.415(c), ERA shall, to the extent practicable, contribute to the efficient performance of any anticipated long-term remedial action.
- Per 40 CFR 300.415(j), ERA shall, to the extent practicable considering the emergencies of the situation, attain applicable or relevant and appropriate requirements under federal environmental or state environmental or facility siting laws.

The factors to be considered in determining the appropriateness of conducting ERAs (removal actions) are also provided in the NCP and include:

- Actual or potential exposure to nearby human populations, animals, or the food chain from hazardous substances, pollutants or contaminants

- Hazardous substances, pollutants, or contaminants in drums, barrels, tanks, or other bulk storage containers that may pose a threat of release
- Threat of fire or explosion.

The NCP also provides a list of responses which could be considered appropriate when performing ERAs (40 CFR 300.416(b)). The following list provides some of the response actions described in the NCP.

- Fences, warning signs, or other security or site control pre-cautions where humans or animals have access to the release.
- Drainage controls, for example, run-off or run-on diversion where needed to reduce migration of hazardous substances or pollutants or contaminants offsite.
- Capping of contaminated soils or sludges where needed to reduce migration of hazardous substances or pollutants or contaminants into the soil, ground or surface water, or air.
- Excavation, consolidation, or removal of highly contaminated soils from drainage or to other areas where such actions will reduce the spread of, or direct contact with, the contamination.
- Containment, treatment, disposal, or incineration of hazardous materials where needed to reduce the likelihood of human, animal, or food chain exposure.

Under RCRA, ERA are conducted as interim measures when response is appropriate prior to completion of the RCRA facility investigation/corrective measures study (RFI/CMS). These actions are normally required by an enforcement action or included as a permit condition. The EPA has proposed rules for corrective action for solid waste management units (SWMU) at hazardous waste management facilities (55 FR 30798). These rules express EPA's management philosophy for corrective actions that is consistent with CERCLA and the NCP as stated previously. The following is a pertinent citation from the proposed rule:

> "In managing the corrective action program, the Agency will emphasize early actions and expeditious remedy decisions. One of the Agency's overriding goals in managing the corrective action program will be to expedite cleanup results by requiring sensible early actions to control environmental problems on an interim basis, and using flexible and pragmatic approaches in making final remedy decisions. The EPA believes that in many cases it will be possible to identify early corrective action process actions which can and should be taken to control exposure to contamination, or to stop further environmental degradation from occurring. Such interim measures may be relatively straight forward, such as erecting a fence or removing small numbers of drums, or may involve more elaborate measures such as installing a pump and treat system to prevent further migration of a groundwater contaminant plume. In another example, where it is obvious that the eventual remedy will require excavation and treatment or removal of contaminated 'hotspots', such action should be initiated as an interim measure, rather that deferring it until after final remedy selection."

Hanford Strategy

The U.S. Department of Energy Field Office, Richland, (RL) in conjunction with the EPA and Ecology, have developed a strategy for conducting restoration/remediation activities at the Hanford Site. This strategy provides new concepts for (1) accelerating decision making by maximizing the use of existing data consistent with data quality objectives and (2) under-taking ERA and/or interim remedial measures as appropriate to either remove threats to human health and welfare and the environment or to reduce risk by reducing toxicity, mobility or volume of contaminants (2).

The primary objective of this strategy is to develop a uniform streamlined process to meet statutory requirements and integrate RI/FS and RFI/CMS guidance and ensure the protection of human health and welfare and the environment at the Hanford Site through effective cleanup actions (2).

Under this strategy, ERA must be consistent with both regulatory requirements for conducting removal actions and the Tri-Party Agreement Action Plan (Sections 7.2.3 and 7.2.4) (1). Conditions that might trigger an abatement as an ERA, generally, are the determination of, or suspected, existing or future unacceptable health or environmental risk, and a short time-frame available to mitigate the problem (2).

As data and analyses on specific waste sites are obtained, either through the scoping process, limited field investigations, RI/FS, or RFI/CMS activities, they will be assessed by the project managers for consideration as potential ERA sites. The project managers would then make a recommendation based on this assessment to the EPA, Ecology and RL unit managers. These agencies would ultimately decide whether an ERA is appropriate at the waste site.

The candidate ERA site will be classified into either of two categories: time critical or non-time critical. This classification depends on the severity of the situation and conditions of alternative implementation, as well as availability of resources. Time critical ERA are conducted when a planning period of <6 mo exists before implementation of the response activities must begin. Non-time critical ERA are conducted when immediate response is not necessary and sufficient time (>6 mo) exists before the response actions are initiated.

IMPLEMENTATION PROCESS

The following sections summarize the flowpath (Fig. 1) by which ERA are performed at the Hanford Site. This flowpath is a compilation of the requirements found in both the state and federal regulations as well as the Tri-Party Agreement.

Site Selection/Prioritization

Initially, a site is recommended to the project managers as a candidate site for performing an ERA. This recommendation may come from many sources including DOE, EPA, Ecology, aggregate area/operable unit managers, Hanford Site employees, or the public. The project managers will then collect all readily available information concerning the waste site in question. If the data collected on the site warrant the site for further consideration, an ERA planning proposal will be prepared. This proposal will summarize all the information collected on the waste site, identify the potential response actions, and provide rough cost estimates and implementation

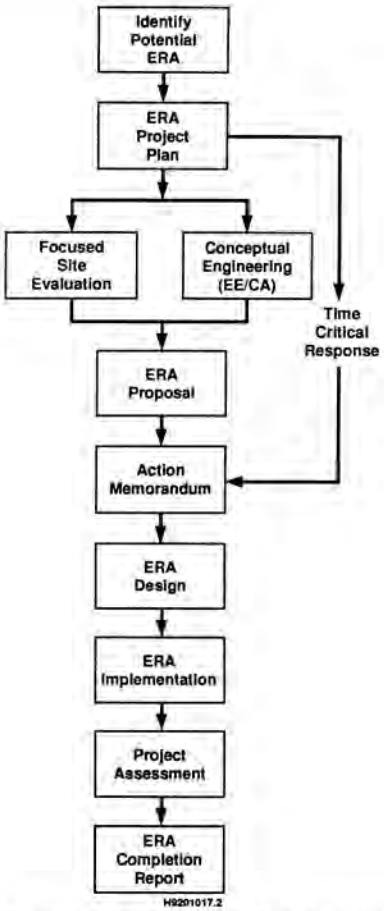

Fig. 1. Expedited response action process.

schedule based on the preliminary determination of the most promising response action identified.

The preliminary proposal is submitted to the EPA, Ecology, and RL. They review the proposal and jointly decide if the site warrants further consideration as an ERA activity. These parties will then prioritize the sites depending on the imminency of the situation, cost and schedule of implementation, and the availability of resources for conducting the activity.

Project Plan/Site Characterization

Once a site is selected as a candidate for conducting an ERA and approval to proceed is obtained, a project plan is prepared describing each of the tasks needed to complete the ERA Proposal. Information provided in the project plan includes:

- A brief description of site characteristics
- Identification and preliminary screening of response alternatives
- Identification of any focused characterization tasks needed in selecting the appropriate response alternative
- Sampling and analysis plans
- Tasks necessary in evaluating and selecting the appropriate response alternative
- A project schedule for implementing these activities.

ERA Proposal/Action Memorandum

An ERA Proposal is prepared based on the information obtained as a result of the site characterization activities. This plan contains an EE/CA which recommends the preferred response alternative to be taken at the waste site in question. This alternative could include the no-action alternative if the evaluation indicated that no significant benefit would result from performing the ERA. The proposal also contains information on implementing the preferred alternative, including design of process systems and development of implementing procedures as well as the schedule for implementing the preferred alternative and project costs.

The ERA proposal is submitted to the EPA, Ecology, and RL for their review and comments. Once all comments are resolved, the ERA proposal will be submitted for public review and comment. Once this comment period is concluded and all comments received have been resolved, the EPA will issue an action memorandum authorizing the initiation of the cleanup activities.

Design/Implementation/Monitoring

After the Action Memorandum has been issued, the project design and implementation phase is begun. This phase of the ERA includes system designs and/or development of operational work plans and procedures, safety analysis, and monitoring plans for assessing the effectiveness of the actions taken. During this phase, the required equipment is procured, installed, and tested as necessary. The ERA is then initiated in conjunction with the appropriate monitoring to ensure optimum efficiency of the actions taken. Information obtained during the monitoring activities may result in design changes as well as termination of activities if necessary or prudent.

EXPEDITED RESPONSE ACTIONS INITIATED AT HANFORD

As indicated in the introduction, three ERA have been initiated to date on the Hanford Site. These types of activities were new to the Hanford Site and as a result, innovative technical and management solutions to problems had to be pioneered. By providing the project engineer for each of these ERA with the authority and autonomy to build a successful project team, make critical decisions, and develop new and innovative approached for complying with existing orders and procedures, the projects proceeded on schedule and at significantly reduced costs.

In addition, all environmental cleanup activities have an intrinsic element of the unknown. Many cleanup projects evolve as site conditions change. To this end, it is essential that highly qualified individuals be placed in charge of the field activities and be given the authority to make real-time decisions to avoid delays, improve job efficiencies, and maintain the entire operation in a safe and environmentally secure manner. The following sections provide a brief summary of each of the ERA activities conducted to date.

618-9 Burial Grounds ERA

The 618-9 Burial Ground ERA was conducted as a time critical response action and, consequently, was initiated in February 1991. The response action involved the retrieval of organic solvents potentially contaminated with uranium disposed of in 55-gal drums during the 1950's. Since the solvent had not been detected in the groundwater and there was no

significant subsidence on the ground surface, it was felt that at least a portion of the drums were still intact. It was the intent of the ERA to retrieve the solvent before it was released into the environment.

The retrieval process consisted of excavating the soil around the intact drums, puncturing the drums with a non-sparking opener, and pumping the material into new containers. As a result, over 1,600 gal of the organic solvent was retrieved. Figure 2 illustrates the excavation activities that were performed. This waste was then shipped offsite to a licensed and permitted incinerator for treatment. A comprehensive soil sampling program was conducted to determine the extent of contamination resulting from the release of solvent from the portion of the drums which were not intact.

The results of the soil sampling effort were subsequently evaluated and a risk assessment was completed. The risk assessment determined that no additional controls or cleanup activities are needed as the site. Another significant result of the sampling effort was the removal of the underground radiological controls imposed on the burial ground.

316-5 Process Trenches ERA

The 316-5 Process Trench ERA was conducted as a non-time critical ERA. The action consisted of excavating and consolidating sediments contaminated with uranium as well as heavy metals from the bottom of the trenches. The consolidated sediments were placed in a portion of the trenches farthest away from the outfall structures where the discharge water is released into the trenches. The water currently being discharged is not considered to be hazardous but may drive the contaminants further through the soil column and into the groundwater. Due to the reduced volume of water being discharged and the installation of clean fill dikes, the waste water will not enter the portions of the trench containing the consolidated sediments.

An ERA proposal was submitted to the regulatory agencies who approved of the action and prepared the required Action Memorandum. Field activities were initiated in July 1991 and were completed in September 1991. Figure 3 illustrates the field activities. Field screening measurements indicated that the majority of the contaminants have been removed from the bottom of the trenches. Analytical results from a comprehensive sampling effort will be used to verify the field screening results.

200 West Area Carbon Tetrachloride Plume ERA

The 200 West Area carbon tetrachloride plume ERA is also being conducted as a non-time-critical ERA. Radioactively contaminated acidic aqueous wastes and organic liquids were discharged to the soil column at three disposal sites on the Hanford Site from 1955 to 1973. These actions resulted in carbon tetrachloride contamination of $> 10\ km^2$ of the underlying groundwater and both organic and radiological contamination of the underlying unsaturated soils.

The ERA was initiated to remove carbon tetrachloride from the unsaturated soils. The concept of the ERA is to perform an early action which would reduce the mobility, toxicity, and/or volume of carbon tetrachloride in unsaturated soils beneath the disposal sites mitigating the further spread of the organic to the groundwater.

Based on the contaminant nature and distribution, site physical characteristics, and technology pilot tests, soil vapor extraction was chosen as the preferred remedial technology for the ERA. Figure 4 provides a view of the extraction equipment. During the initial phase of the ERA, carbon tetra-chloride is extracted from the soils using existing perforated wells and collected on granular-activated carbons, which are then sent offsite for regeneration.

Further testing of innovative treatment and extraction enhancement technologies is being conducted in support of the ERA in conjunction with the integrated demonstration for cleanup of volatile organic compounds (VOC) at arid sites and the International Technology Exchange Program. Results of testing will lead to implementation of onsite treatment/

Fig. 2. Hexone transfer operations during the 618-9 burial ground ERA.

Fig. 3. Excavation and sampling of sediments during the 316-5 process trenches ERA.

destruction of the carbon tetrachloride and a new well field design, to be implemented in the second phase of the ERA.

FUTURE ACTIVITIES

As RI activities proceed, more waste sites warranting ERA will be identified. As these sites are identified, a preliminary proposal for each will be produced and submitted to the regulatory agencies for their decision on whether conducting

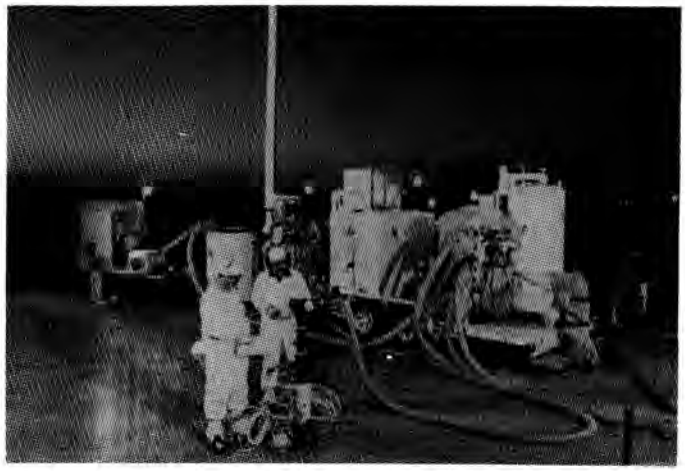

Fig. 4. Pilot scale vapor extraction testing conducted as part of the carbon tetrachloride ERA.

an ERA at that particular site is appropriate. These agencies will also prioritize the sites warranting ERA to ensure the most critical or promising ones take precedence over those less critical or promising.

The endeavor of conducting ERA has proven to be a rewarding experience for those involved with the restoration of the Hanford Site while also improving the public perception of the Restoration Program as a whole. With the unprecedented success of the three initial ERA, additional sites are already being proposed. It is anticipated that many more will follow. As a result, ERA will undoubtedly play a key role in the restoration of the Hanford Site.

REFERENCES

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