ACCELERATED CLEAN-UP AT THE HANFORD SITE

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ABSTRACT

Expedited Response Actions are being promoted at the Hanford Site as a means to accelerate the past practice remediation process. These actions are being taken to prevent immediate or potential threats to human health and the environment. This paper describes an expedited response which was initiated at a suspect uranium-contaminated solvent waste disposal trench. The intent was to remove the solvents, still contained in their original containers, to prevent them from leaching into the surrounding soils and possibly into the groundwater. Excavation and removal activities at the site were initiated in February 1991 and completed in May of 1991. Follow-up activities, which include the preparation of an engineering evaluation, waste disposal, and site closure will continue through fiscal year 1992.

INTRODUCTION

The Hanford Site began operations in 1943 as one of the sites for plutonium production associated with the Manhattan Project. It has been used, in part, for nuclear reactor operation, reprocessing of spent fuel, and management of radioactive waste. The Hanford Site covers approximately 1,434 km^2 (560 mi^2) in southeastern Washington State. The subject of this paper, the 618-9 Burial Ground, is located on the Hanford Site approximately 1.6 km (1 mi) west of the Columbia River, and a few miles north of Richland, Washington (Fig. 1).

Throughout Hanford Site history, prior to legislation regarding disposal of chemical waste products, some chemical waste byproducts were disposed via burial in trenches. One such trench was the 618-9 Burial Ground. This burial ground was suspected to contain approximately 19,000 L (5,000 gal) of uranium-contaminated organic solvent, disposed in standard 55-gal (208-L) metal drums. The waste was produced from research and development activities related to fuel reprocessing.

REGULATORY FRAMEWORK

An Agreement in Principle was signed in October 1990 by the U.S. Department of Energy (DOE), the U.S. Environmental Protection Agency (EPA) and the State of Washington Department of Ecology (Ecology) (1). This agreement stated that the 618-9 Burial Ground would be one of a number of candidate sites to be considered for an expedited response action (ERA). An ERA is a provision included in the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980*, as amended (2,3,4). This provision allows for action to be taken at waste sites where early remediation will abate potential threats, or prevent significant or increased degradation if action was delayed until the Record of Decision for the operable unit.

In December 1991, following the review of preliminary planning documentation, DOE was instructed by EPA and Ecology to initiate the actions necessary to implement an ERA at the 618-9 Burial Ground. After review of the project plan for the 618-9 Burial Ground by EPA and Ecology, an Action Memorandum was issued on February 15, 1991 (5) initiating time-critical excavation activities for the 618-9 Burial Ground ERA.

PRELIMINARY INVESTIGATIONS

Prior to implementing removal activities, preliminary investigations were performed. The purpose of these investigations was to gather information that would assist in identification of the contents of the 618-9 Burial Ground and the potential hazards posed. Activities conducted during the preliminary investigation were the following: historical research including oral interviews, a ground-penetrating radar survey, and a soil gas survey.

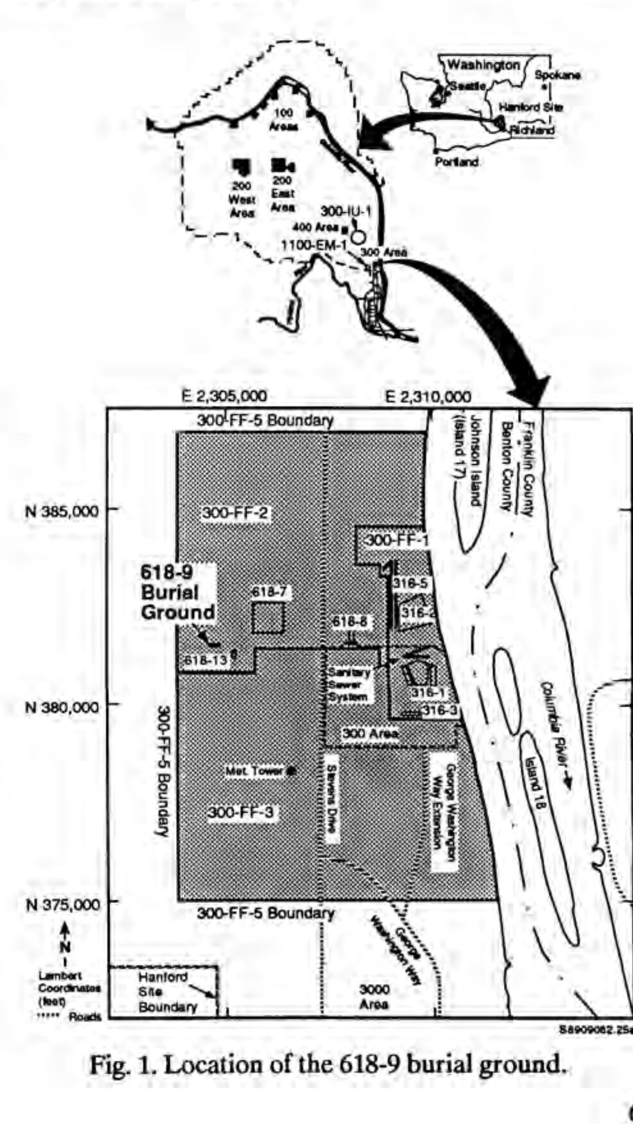

Fig. 1. Location of the 618-9 burial ground.

Historical records indicated that the facility was operational in the early 1950's, and received 19,000 L (5,000 gal) of uranium-contaminated solvent used in laboratory experiments. The solvent was suspected to be Methyl Isobutyl Ketone (MIBK), commonly referred to as hexone. The solvent was believed to have been contained in 55-gal (208-L) steel drums; however, the number of drums buried was not documented. Interviews with personnel employed at the facility during the 1950's provided conflicting information regarding the items disposed in the burial trench. It was suggested that chemicals other than hexone were buried, and that tanks and other debris was disposed therein. In reference to uranium in the solvents, it was suggested that the solvents would have been distilled for uranium recovery before disposal, and that the uranium would not have been discarded as waste.

The ground-penetrating radar survey was conducted to define burial ground boundaries and to identify the depth of buried objects. The exact location of the 618-9 Burial Ground was not known since the burial ground markers did not coincide with subsidence at the site. Results of the survey indicated anomalies occurring at approximately 1.2 m (4 ft) below ground, and delineated the trench boundary.

A soil gas survey was conducted to determine if hexone and other volatile organic carbons (VOC) were migrating through the soil at the 618-9 Burial Ground. Positive detection of unidentified VOCs at low concentrations indicated that some of the buried drums may already be leaking.

DOCUMENTATION

Prior to the initiation of field activities, preliminary investigation results were used to fulfill regulatory and internal requirements regarding national environmental policy, health and safety documentation and work controlling procedures. The National Environmental Policy Act (6) documentation was fulfilled under the categorical exclusion for removal actions.

Two health and safety documents, one to fulfill DOE facility safety requirements, and one to fulfill Occupational Safety and Health Administration requirements (7,8) were prepared. Both documents are intended to protect onsite and offsite personnel during the course of activities at the site. While the Facilities Safety Document discusses the maximum potential accident at the site, the other document is a procedural document outlining site activities, personnel protective equipment, and emergency procedures.

Existing information could not clarify conflicts to define the hazards which would be encountered during excavation of the trench. The work procedures were prepared according to the worst-case scenarios, with contingencies for changing field conditions. Since the procedure was written based on unconfirmed assumptions, field changes were required a few times during excavation when unexpected conditions appeared. Skilled personnel with the ability to quickly evaluate field conditions were critical to continued operations.

EXCAVATION ACTIVITIES

Excavation of the 618-9 Burial Ground commenced on February 28, 1991. Digging originated at the center of the trench, over areas showing anomalies in the geophysical survey. To avoid breaching the drums, soil was machine excavated, leaving approximately .6 m (1 to 2 ft) of overburden. Hand digging (using nonsparking equipment) was performed on the remaining soil to uncover buried items. Although extreme caution was observed throughout excavation activities, one drum was breached, causing a leak of approximately 4 to 7 L (1 to 2 gal) of a kerosene-like material. The spill was cleaned up and the contaminated soil was contained for disposal.

Initially, the excavation revealed a variety of debris covered by 1.2 m (4 ft) of backfill. The debris included such items as, empty waste drums, a wheel barrow, construction debris (corrugated siding), breached bags of ammonium nitrate fertilizer, unidentified white powders, and several lead bricks. Since the historical information stated that there was 1.2 m (4 ft) of backfill over the drums, and did not mention a large volume of debris, it was assumed that the anomalies seen in the ground-penetrating radar data were drums, not debris. The large volume of debris found was unexpected. The drums were found on either side of the debris, with a minimum of 2.4 m (8 ft) of backfill. Figure 2 shows a side view of the drums found in the bottom of the west end of the trench, and how they were approached. Note that the center drums did not contain solvents. Over the years, the tops had collapsed and filled with the overlying sand.

Drums in the western end of the trench were fairly well preserved, and approximately 6,050 L (1,600 gal) of solvents were recovered. Drums in the eastern end of the trench were severely corroded and only parts of the drums remained. Figure 3 depicts the three sections of the trench (this figure is not to scale).

A nonsparking bronze spike, welded to the backhoe bucket, was used to remotely punch a hole through each drum. If liquid was found, it was tested with a field test kit and subsequently pumped into a new drum. Preliminary sampling using the Haztech Hazcat kit (a trademark of Sensidyne) provided an initial designation of the chemical compound and its compatibility with other materials found in the trench. This information was used to develop an estimate of the volume of hexone and/or kerosene in the trench, to calculate a conservative estimate of the volume which could have leaked, and to assist in waste segregation. From this sampling, it was estimated that 2,650 L (700 gal) of hexone (ketone) and 3,400 L (900 gal) of kerosene* were recovered from the trench.

Environmental and personal air monitoring for radiological and organic constituents was conducted throughout implementation of the excavation. Organic contaminants were collected on an activated charcoal media at flowrates between 10 and 200 ml/min, depending on personnel and site conditions. Radioactive monitoring was conducted via continuous air monitors. Samples were collected on high-efficiency glass filters at a flowrate of 2.6 m^3/h. Results of both the chemical and radiological air sampling indicated that levels of air

* The term kerosene, as used, is actually a purified derivative of kerosene, containing straight chain hydrocarbons in the range of $C_{10}H_{22}$ through $C_{18}H_{38}$. Another term for this compound is normal paraffin hydrocarbons (NPH).

Fig. 2. Side view of drums as found in the trench.

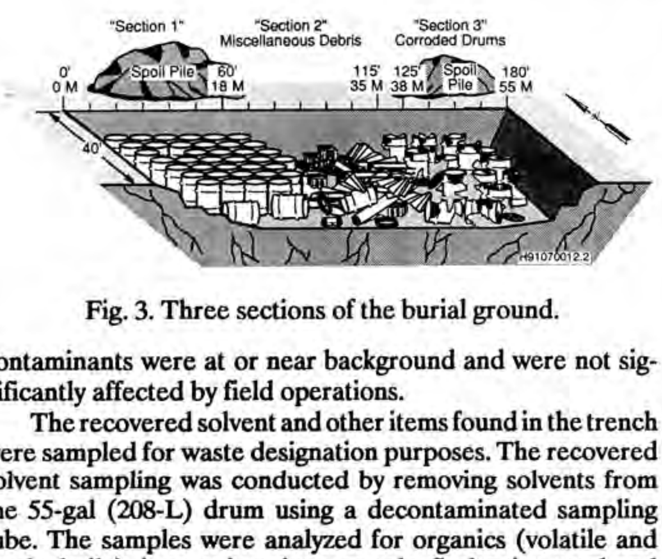

Fig. 3. Three sections of the burial ground.

contaminants were at or near background and were not significantly affected by field operations.

The recovered solvent and other items found in the trench were sampled for waste designation purposes. The recovered solvent sampling was conducted by removing solvents from the 55-gal (208-L) drum using a decontaminated sampling tube. The samples were analyzed for organics (volatile and semivolatile), inorganic anions, metals, flashpoint, total and isotopic uranium, gamma scan, total alpha, and total beta. Samples of the waste items were collected by driving a decontaminated metal tube through the material to obtain a representative sample. These samples were analyzed for the suspected constituents of concern.

The results of the solvent sampling effort revealed that the solvents were mixed organics, but were predominantly hexone and kerosene. Metal contamination existed at low levels, primarily from the rusting of the drums in the trench. Trace levels of uranium were found in less than one half the drums sampled. No other radioisotopes were detected. The flashpoint varied from -5°C (22°F) to over 38°C (100°F).

Soil samples were taken from the three different trench sections and the spoil piles. Analyses were selected to detect constituents of concern in the trench. These constituents were chosen from the historical information, interviews, and from the items discovered during excavations. The results of the soil sampling indicate no hexone with trace amounts of kerosene remaining in the soil. The results have been summarized in Table I, along with a list of the constituents of concern.

An engineering evaluation (9) of the actions at the site was prepared to present the results of the soil sampling and to determine the extent of future activities required at the site. The document concludes that no further remedial actions need to be taken at the site. These conclusions are based on a risk assessment conducted using the data obtained from soil sampling. The risk assessment indicated a cancer risk no greater than 2.5e-7, much lower than the EPA recommended 10e-6 levels. Metals and radionuclides were all within background range.

All waste recovered from the site was disposed according to the applicable state and federal requirements. Figure 4 shows the site prior to beginning excavation. Figure 5 shows the site as excavation work was being completed.

SUMMARY AND CONCLUSIONS

The excavation and removal activities safely and successfully removed over 6,050 L (1,600 gal) of solvent and a large volume of debris from the 618-9 Burial Ground without negative impacts to the environment.

TABLE I

Constituents of Concern, Soil

Constituent of Concern	Reason	Detected Average Concentration in Soil
MIBK (hexone)	known buried solvent	NO
Kerosene/tributyl phosphate	known buried solvent	YES NPH-129 ppm YES TBP-236 ppm
Ammonium nitrate	breached bags found in trench	YES (as nitrate, 131 ppm)
Metals	from debris in trench	NO (all levels within background range)
Uranium	solvents suspected to have been contaminated with uranium	NO (all levels within background range)

Removal of the trench debris facilitated further action at the past practice unit by: 1) identifying items buried in the trench, thereby exposing constituents of concern, 2) removal of potential hazards, and 3) exposing the trench bottom for soil sampling.

Fig. 4. Burial ground prior to excavation.

Fig. 5. Burial ground near completion of excavation.

Conducting ERAs to facilitate remedial actions at past practice hazardous wastes sites is an option that should be exercised more often at past practice sites. The benefit from learning the actual conditions, instead of continued speculation, will provide a means for remediating in a more expedient and economical manner.

While the conduct of ERAs provides great benefit to the public and to successful remediation of a past practice unit, uncertainties can create obstacles in the preparation for safe field operations. Consequently, procedures should allow the field team leader and the site safety officer flexibility in implementing work plans and processing required documentation for those changes.

To continue to accomplish these accelerated cleanups, it will be necessary to work with the regulators and the DOE in developing documentation to ensure work is done safely, yet provides more flexibility in the field, and less redundancy. The ability for key qualified field personnel to make real time decisions is critical to completing actions on schedule and in a safe manner.

REFERENCES

1. DOE, EPA, and Ecology, 1990, *Agreement in Principle between the U.S. Department of Energy, the U.S. Environmental Protection Agency and the State of Washington*, October 1990, U.S. Department of Energy, U.S. Environmental Protection Agency, Washington State Department of Ecology, Olympia, Washington.
2. *Comprehensive Environmental Response, Compensation, and Liability Act of 1980*, 42 USC 9601 et seq.
3. EPA, 1988, *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA*, Interim Final, EPA/540/G-89/004, U.S. Environmental Protection Agency, Washington, D.C.
4. EPA, 1990, *National Oil and Hazardous Substances Pollution Contingency Plan*, Final Rule, Federal Register Volume 55, Number 46:8665-8865, U.S. Environmental Protection Agency, Washington, D.C.
5. EPA and Ecology, 1991, *Expedited Action Approval for 618-9 Burial Ground*, Action Memorandum to J. Wagoner from D. Rasmussen, EPA, and C. Gregoire, Ecology, February 15, 1991, U.S. Environmental Protection

Agency, Washington State Department of Ecology, Olympia, Washington.

6. *National Environmental Policy Act of 1969*, 42 USC 4321 et seq.
7. OSHA, 1988, "Occupational Health and Safety Standards," Title 29, *Code of Federal Regulations*, Part 1910, as amended, Occupational Health and Safety Administration, Washington, D.C.
8. DOE-RL, 1983, *Safety Analysis and Review System*, DOE-RL Order 5481.1, as amended, U.S. Department of Energy Richland Field Office, Richland, Washington.
9. DOE-RL, 1991, *Engineering Evaluation of the 618-9 Burial Ground Expedited Response Action*, DOE/RL-91-38, U.S. Department of Energy Richland Field Office, Richland, Washington.