MANAGING PREVIOUSLY DISPOSED WASTE TO TODAY'S STANDARDS THE IDAHO BURIED WASTE PROGRAM

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ABSTRACT

A Radioactive Waste Management Complex (RWMC) was established at the Idaho National Engineering Laboratory (INEL) in 1952 for controlled disposal of radioactive waste generated at the INEL. Between 1954 and 1970 waste characterized by long lived, alpha emitting radionuclides (later defined as transuranic waste) from the Rocky Flats Plant was also buried at this site. Migration of radionuclides and other hazardous substances from the buried waste has recently been detected. A Buried Waste Program (BWP) was established to manage cleanup of the buried waste. This program has four objectives: (1) determine contaminant sources, (2) determine extent of contamination, (3) mitigate migration, and (4) recommend an alternative for long term management of the waste. Activities designed to meet these objectives have been under way since the inception of the program. The regulatory environment governing these activities is evolving. Pursuant to permitting activities under the Resource Conservation and Recovery Act (RCRA), the Department of Energy (DOE) and the Environmental Protection Agency (EPA) entered into a Consent Order Compliance Agreement (COCA) for cleanup of past practice disposal units at the INEL. Subsequent to identification of the RWMC as a release site, cleanup activities proceeded under dual regulatory coverage of RCRA and the Atomic Energy Act. DOE, EPA, and the State of Idaho are negotiating a RCRA/Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Interagency Agreement (IAG) for management of waste disposal sites at the INEL as a result of the November 1989 listing of the INEL on the National Priority List (NPL). Decision making for selection of cleanup technology will be conducted under the CERCLA process supplemented as required to meet the requirements of the National Environmental Policy Act (NEPA).

BURIED WASTE PROGRAM HISTORY AND BACKGROUND

The Radioactive Waste Management Complex (RWMC) was established in 1952 by the Atomic Energy Commission (AEC) and located, based on a siting study by the United States Geological Survey (USGS), in the southwestern part of the National Reactor Testing Station, now known as the Idaho National Engineering Laboratory (INEL) (Fig. 1). The RWMC was designated a controlled area for disposal of low level radioactive waste generated at the INEL. Disposal occurred in pits and trenches in what is now designated as the Subsurface Disposal Area (SDA) (Fig. 2).

In 1954, the AEC directed that the RWMC begin receiving and burying waste generated by the Rocky Flats Plant near Golden, Colorado. This waste is characterized by long lived, alpha emitting radionuclides. Rocky Flats waste continued to be received and buried until 1970, when the AEC gave definition to such waste as transuranic (TRU) waste and directed that these wastes be stored in aboveground sites. This post-1970 TRU waste is stored in above grade berms in the Transuranic Storage Area (TSA) of the RWMC (Fig. 3). In addition to INEL and Rocky Flats wastes, the RWMC also served as a burial ground from 1960 to 1963 for other off-site AEC licensees, such as universities and hospitals.

These wastes were generally commingled in the pits and trenches mentioned above. Wastes were packaged in cardboard boxes, plywood boxes, and 55-gallon steel drums; some large items were disposed without any packaging. The total volume of TRU waste and TRU-contaminated low level waste (LLW) and surrounding soil is approximately 8 million cubic feet. From 1954 to 1963, waste containers were stacked in an orderly fashion (Fig. 4); however, disposal by random dumping was conducted from 1963 to 1969. This method of disposal was adopted to comply with as low as reasonably achievable (ALARA) radiation exposure principles.

Rapid snow melt on frozen ground within an enclosed topographic basin, brought on by winter thaws in 1962 and 1969, resulted in flooding of open pits and trenches. The estimated cumulative volume of water in the disposal pits and trenches was in excess of 20 million gallons. Most of this water percolated through the waste and entered the Snake River Plain Aquifer.

The stratigraphy of the RWMC subsurface is comprised of a sequence of basaltic lava flows and two significant sedimentary interbeds. The lava flows are highly fractured, number about 15, and range from 10 to 30 feet

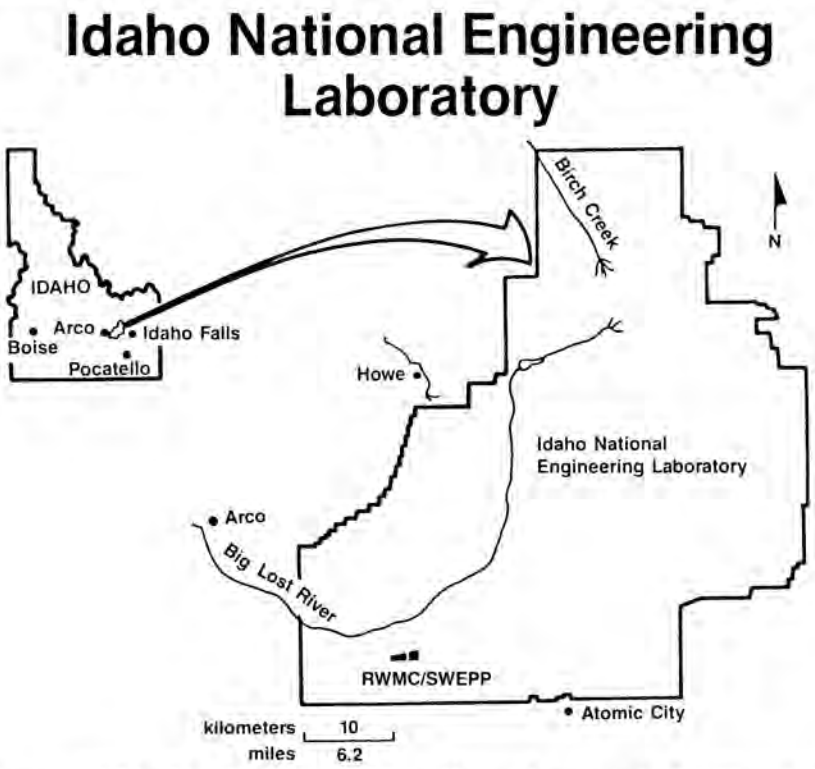

Fig. 1. The RWMC was established in 1952 by the AEC and located as a result of a siting study by the USGS in the southwestern part of the National Reactor Testing Station, now known as the INEL.

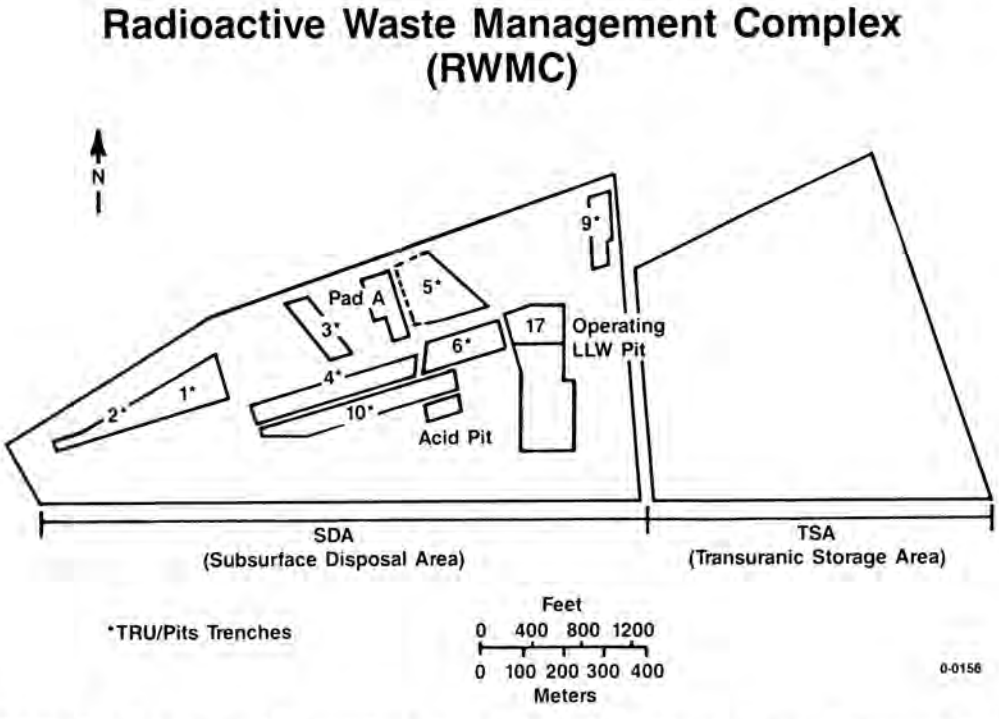

Fig. 2. The RWMC was designated a controlled area for disposal of radioactive waste generated at the INEL. This waste, primarily low level with minor volumes of transuranic (TRU) waste, was disposed in pits and trenches in what is now designated as the (SDA).

Fig. 3. Post-1970 TRU waste is stroed in above grade berms in the Transuranic Storage Area (TSA) of the RWMC.

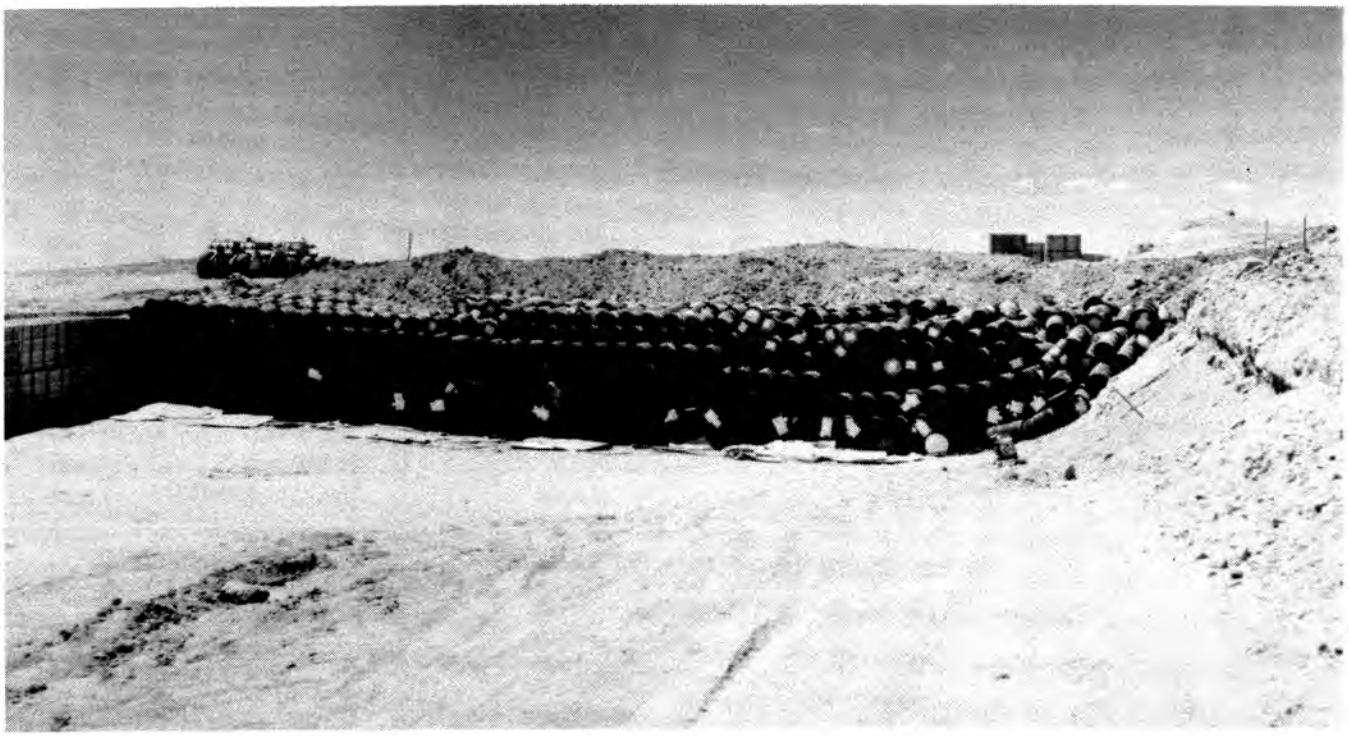

Fig. 4. From 1954 to 1963, waste containers were stacked in an orderly fashion.

thick. The Snake River Plain Aquifer is approximately 600 feet beneath the RWMC (Fig. 5).

In June 1987, Department of Energy (DOE) environmental monitoring activities detected migrated TRU radionuclides in a sedimentary interbed approximately 100 feet beneath the RWMC. In addition, hazardous constituents in the form of volatile organic compounds (VOCs) were detected in the underlying aquifer. A Buried Waste Program (BWP) was established to manage the buried waste cleanup within the constraints of the applicable regulatory statutes.

Pre-Buried Waste Program Regulatory Environment

In August of 1980, pursuant to the requirements of the Resource Conservation and Recovery Act (RCRA), DOE submitted a Notice of Hazardous Waste Activity to the Environmental Protection Agency (EPA). The notice identified DOE as the owner and operator of a treatment, storage and/or disposal (TSD) facility for hazardous wastes located at the INEL. DOE and EPA entered into a Memorandum of Agreement in July 1986 covering INEL compliance with RCRA. In August 1986, DOE submitted a revised Part A permit identifying TSD units at the INEL requiring permitting under RCRA. EPA then issued a corrective action order under Section 3008(h) of RCRA for cleanup of past practice disposal units at the INEL. To facilitate coordination of various activities of DOE and EPA in these cleanups, EPA and DOE entered into a Consent Order Compliance Agreement (COCA) designating policy, procedures, and schedules for cleanup activities. The agreement was signed in July 1987 but was considered to be effective as of November 1, 1986. For the purposes of coordinating its activities in support of both DOE and EPA, the USGS was also a signatory to the agreement. Although the State of Idaho was not a signatory to the COCA, EPA in recognition of pending authorization of the State to administer RCRA, has made the State a full participant in review of documentation and decision making relative to the COCA. At this time there were no known hazardous wastes in the SDA, and the Transuranic Storage Area (TSA) was under interim status as a TSD facility. Therefore, the existing regulatory environment at the onset of the program was RCRA controlled and directed toward remediation of hazardous wastes. It did not include radiological components, which are regulated by the Atomic Energy Act (AEA).

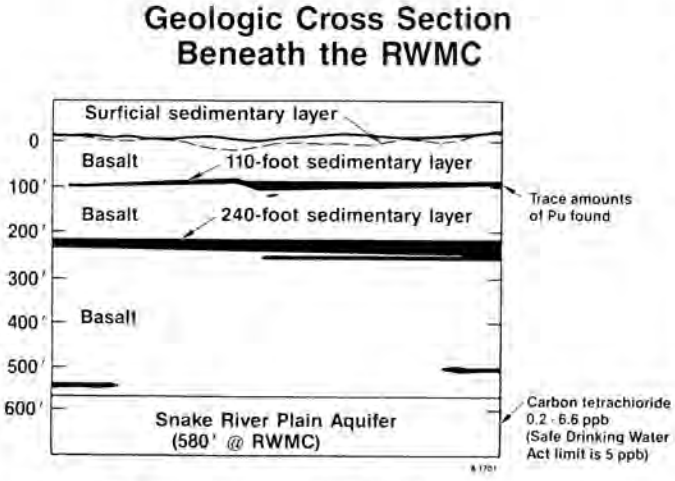

Fig. 5. The stratigraphy of the RWMC subsurface is comprised of a sequence of basaltic lava flows and two significant sedimentary interbeds.

Management of the INEL Buried Waste

As previously discussed, the BWP was established in response to the detection of migrated waste. In August of 1987, a Buried Waste Program "Action Plan" was developed outlining the objectives of the program and how the waste would be managed. Program objectives are (1) determine contaminant sources, (2) characterize extent of migration, (3) mitigate further migration, and (4) recommend a long term alternative for waste management.

A Buried Waste Program Management Plan (PMP) was developed for implementation of the Action Plan. Normal DOE project documentation, Configuration Management Plan, Quality Assurance Plan (to the requirements of NQA-1), Safety Plan, etc. were also developed in conjunction with the PMP. In addition, a BWP requirements document was developed. This document was done in a "Fault Tree" format, with a Record of Decision for selecting the ultimate remedial action for cleanup of the SDA being the top box on the tree and activities required to support this decision shown as subtier boxes. The National Environmental Policy Act (NEPA) was shown as the decision making process for determining the Record of Decision.

Initial program activities were directed to site characterization. By January 1988, it was verified, via review of shipping manifests and a soil gas survey, that hazardous waste was present in the waste pits and that it had contaminated surrounding soils. Analysis of a perched water table beneath the RWMC confirmed downward migration of VOCs. DOE notified the EPA that the RWMC was a hazardous waste release site. The RWMC came under COCA oversight and in August 1988 a RCRA Facility Investigation (RFI) Workplan was generated by DOE and approved by the EPA. From the inception of the Program, peer reviews by private industry and universities have been conducted on Program content and planning. The results of these peer reviews were incorporated in the RFI Workplan. This Workplan constituted the official, comprehensive, documented agreement between EPA and DOE covering work to be performed at the SDA. This work was consolidated into fourteen tasks designed to meet the objectives

of the program and satisfy EPA site characterization requirements.

These tasks cover identification of contaminant sources, extent of migration, and mitigation of further migration. The tasks can be grouped in the following general areas:

1. Site Characterization/Contaminant Sources:

   Site characterization is an important aspect of the program. DOE is continuing to perform in-depth characterization activities in an effort to identify contaminant sources. Continuing investigations of waste inventories include interviews, shipping manifest reviews, and actual sampling below waste pits. These efforts indicate that hazardous wastes (VOCs and machining oils) were disposed with TRU and LLW. The estimated combined total volume of TRU waste, TRU contaminated LLW, and contaminated surrounding soil is 8 million cubic feet.

2. Site Characterization/Extent of Migration:

   Well drilling and soil sampling are being performed in an effort to determine the extent of migration. Even though the RFI Workplan is directed toward hazardous waste, DOE's ongoing site characterization studies also address radionuclides. Drilling results confirm TRU radionuclides at a depth of approximately 100 feet and the presence of VOCs in the upper 240 feet of the RWMC subsurface. Environmental monitoring, which was initiated in the early 1970s, remains a significant effort at the INEL. The environmental monitoring program samples and analyzes air, soil, and surface water for contaminants. The USGS performs aquifer monitoring.

3. Mitigation of Further Migration:

   DOE is investigating technologies to remove VOCs from the vadose zone and prevent further contamination to the aquifer. One method, Vapor Vacuum Extraction (VVE), is being tested. This technology applies a vacuum to the subsurface geology from a well head. VOCs are drawn into the well through the porous fractured basalts and brought to the surface where they are captured in carbon beds (Fig. 6). In situ vitrification (ISV) is another technology being studied for the mitigation of migration. The ISV process heats waste and soil until molten by introducing electrical energy into a waste pit. When allowed to cool, the melt is converted into a glass-like product encapsulating heavy metals and radionuclides; VOCs are destroyed by pyrolosis (Fig. 7). An intermediate scale ISV test using simulated waste and a VVE demonstration are currently under way at the INEL. In addition to these mitigation technologies, the SDA grounds have been renovated to minimize the amount of water coming in contact with the waste. Overburden soils have been contoured so snowmelt or rain is diverted to the perimeter of the SDA, where ditches direct water out of the burial area. This water is sampled for contaminants. Also, a dike has been constructed around the SDA to keep water from entering the grounds.

4. Selection of the Long Term Management Alternatives:

   The selection of a long term management alternative has its origin in a DOE document entitled, "Defense Waste Management Plan for Buried Transuranic Contaminated Waste, Transuranic Contaminated Soil, and Difficult-to-Certify Transuranic Waste" (June 1987). This document identified three possible alternatives for these wastes: (1) leave in place and monitor, (2) leave in place and stabilize, and (3) retrieve and place in a TRU repository. Because migration of waste has been confirmed, emphasis has been placed on development of stabilization and retrieval technologies. In addition to migration mitigation, ISV could provide stabilization of waste for either permanent remediation or treatment prior to retrieval. In situ grouting has also been tested, but results proved unsatisfactory. Actual retrieval of buried waste is being studied. If waste retrieval becomes the selected remediation, it is not known whether it would be applied to the entire volume of waste or only to selected areas. Production retrieval of the waste would be conducted by remotely operated equipment and could require 20 years. Technology demonstrations of large scale ISV and retrieval, using actual waste, are being designed and may be performed as part of remedy selection.

In addition to the above activities, DOE has developed a comprehensive Community Relations Plan providing outreach for public involvement in the BWP. DOE conducts bimonthly meetings with EPA and the State to assure effective communications on BWP and other INEL activities. It is DOE's intent to continue to develop a cooperative relationship with EPA and the State.

The National Academy of Sciences, at the request of DOE, is providing continuing peer review of the BWP.

In November 1989, the INEL was placed on the National Priority List (NPL). As a consequence of this designation, negotiations are considering incorporation of the RCRA based COCA into the NPL required CERCLA process.

In anticipation of the NPL listing, DOE-Idaho Operations Office (ID) established an Environmental Compliance Office (ECO) "Tiger Team" to lead activities required to establish and maintain compliance with State

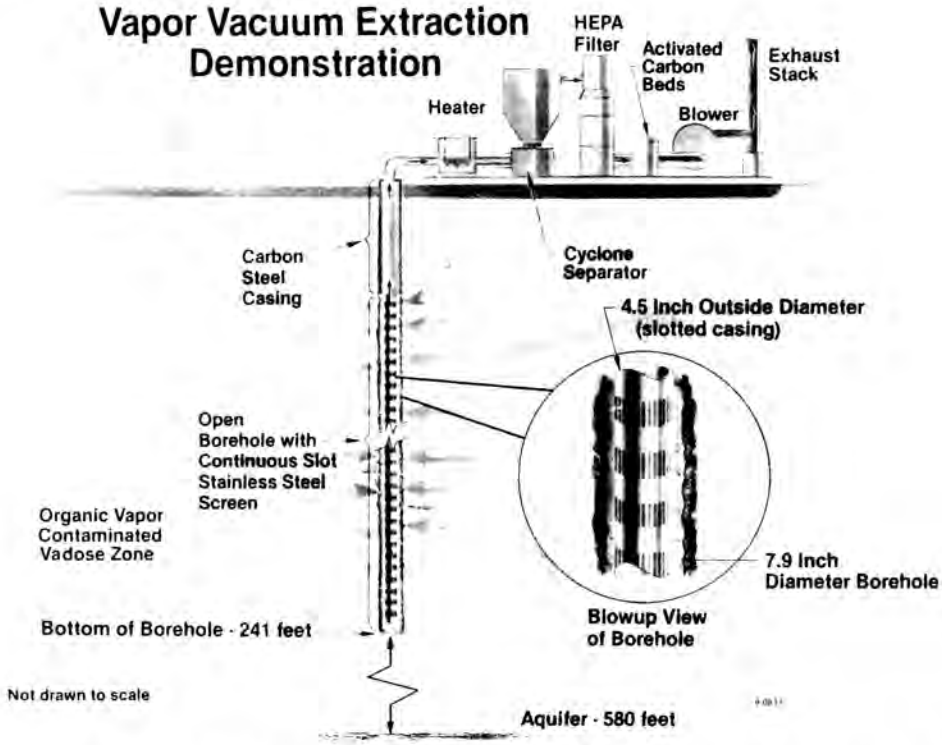

Fig. 6. Volatile Organic Compounds (VOCs) are drawn into the well through porous fractured basalts and brought to the surface where they are captured in carbon beds.

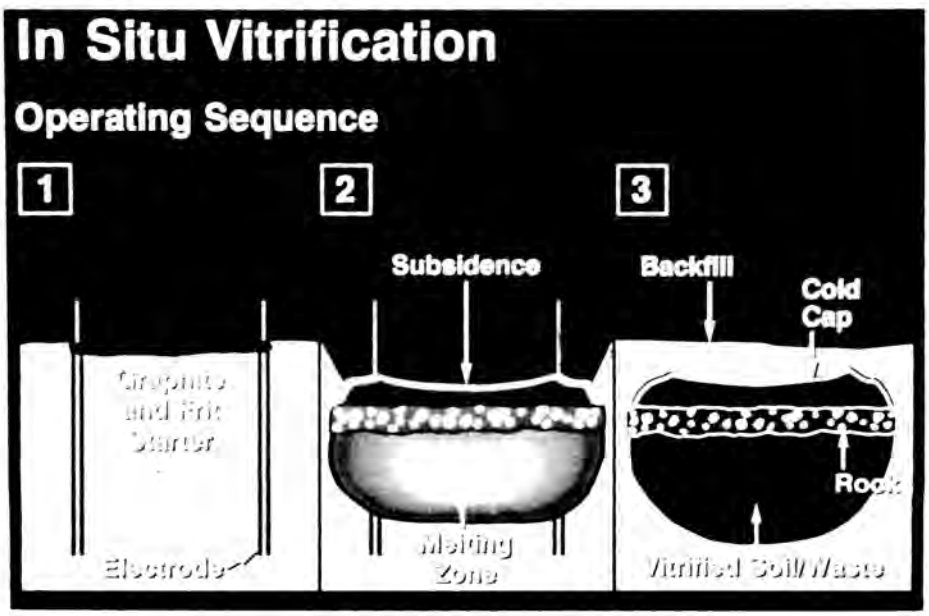

Fig. 7. The ISV process destroys VOCs by pyrolosis.

and Federal environmental regulations. Teams were established within the ECO in several areas of emphasis, including

- CERCLA Section 120 Interagency Agreement (IAG) Negotiation
- Permits
- Audit of Performance to the Requirements of the COCA
- Audit of Performance to the Requirements of NEPA.

The IAG Team is negotiating a comprehensive, legally enforceable agreement with the EPA and State that will (1) incorporate the provisions of the COCA, (2) provide for compliance (and equivalency of actions) to both RCRA and CERCLA (which includes radionuclides), (3) provide for RCRA and other permitting of facilities and activities at the INEL, and (4) define a schedule of activities for accomplishment of the provisions of the agreement.

The State and EPA have informally agreed that the State will have lead regulatory authority, under pending RCRA authorization, for remedial activities at the RWMC. Draft IAG documentation specifies that provisions of the COCA will be incorporated into the IAG. Therefore, tasks spelled out in the current RFI Workplan for management of hazardous waste at the SDA will be retained and expanded to include radionuclides. This work will be planned and conducted under combined RCRA/CERCLA documentation. IAG negotiations were started in February 1990. Results of the negotiations will define future regulatory requirements.

There is an overall INEL strategy for compliance with the NEPA. This strategy covers activities to be conducted by the BWP. In accordance with DOE Orders, the NEPA process will be combined with the CERCLA process if the IAG defines CERCLA as the preferred decision making mechanism.

SUMMARY

The BWP has transitioned from an environment of AEA/DOE regulated activities through a RCRA/COCA period and is moving into a RCRA/CERCLA IAG driven program. As this evolution has occurred, activities have been conducted to achieve program objectives of contaminant source identification, migration extent determination, migration mitigation, and remedial alternative selection. The DOE will continue to strive for public outreach and a cooperative relationship with regulatory agencies and hold cleanup of the buried waste as the primary objective of the program.