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Technology Status Report Transuranic Contamination Control at INEL

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EG&G Idaho

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TECHNOLOGY STATUS REPORT
TRANSURANIC CONTAMINATION CONTROL AT INEL

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ABSTRACT

This report summarizes proposed FY-92 work at the Idaho National Engineering Laboratory (INEL) in the field of contamination control during transuranic waste handling operations. The proposed work is both applied research and demonstration testing. The INEL needs for contamination control applied research and demonstration testing are listed along with a description of past accomplishments. The INEL proposal is compared to other proposals for contamination control work that are under consideration for funding by the Department of Energy. Benefits of this work and impacts of not sponsoring this work are also given.

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INTRODUCTION

This report provides an executive summary of proposed Idaho National Engineering Laboratory (INEL) work in the field of contamination control during transuranic waste-handling operations. The proposed work is to be performed during FY-92 and is a logical extension of four years of buried waste retrieval research into dust control using misting systems, dust suppressants and moisture retentive fixatives, rapid transuranic monitoring, decontamination, and electrostatic curtains. The research was initiated at INEL because contamination control of transuranic material is mandatory due to the extremely small amounts of allowable ingestion. This report first lists the needs of the Environmental Restoration Program and Waste Management Operations at INEL as conducted by the Buried Waste Integrated Demonstration Program. Next, accomplishments of the contamination control program are discussed. Finally, the proposed activities are summarized and put in perspective with other efforts in the field of contamination control.

BURIED WASTE INTEGRATED DEMONSTRATION NEEDS

Since the INEL has identified retrieval of buried transuranic waste as an integral part of a final remedial action at INEL, research into retrieval technologies, such as contamination control for the entire Department of Energy (DOE) system, has centered at INEL. Other DOE Sites including Hanford, Oak Ridge, and Savannah River look to the INEL as the source of information on contamination control during waste retrieval. There have been many studies and experimental retrieval programs performed at INEL, including the Initial Drum Retrieval Program[1] and The Early Waste Retrieval Program.[2] The need for contamination control was emphasized in these programs.

The main difficulty with transuranic contaminants is that uptake of extremely small (tenths of microgram) quantities of the material can result in life-time body burdens. Therefore, contamination control of plutonium/americium particles during retrieval and handling operations involving transuranic waste is mandatory to reduce the potential of personnel uptake. Additionally, to assess the degree of control, rapid and accurate monitoring of loose surface contamination and airborne contamination is imperative.

The INEL has two million cubic feet of transuranic waste buried in shallow land burial (co-mingled with approximately nine million cubic feet of soil). Another two million cubic feet of transuranic waste is stored above ground but under earthen cover [Transuranic Storage Area (TSA)]. Retrieval and disposal of this waste is one of the options being considered. Handling defense-related transuranic waste during retrieval operations requires aggressive contamination control techniques, primarily due to the highly mobile nature of the contaminants. Plutonium/americium particles readily attach to respirable soil particles which are easily aerosolized during handling. Regulatory uptake of plutonium/americium is limited to extremely small amounts so contamination control is mandatory. Rapid monitoring of this waste is also mandatory to allow on-line tracking of the trend of contamination levels so that operational and safety limits are not exceeded. With current monitoring schemes, on-line monitoring in a high radon and thorium daughter background is not possible.

ACCOMPLISHMENTS OF THE CONTAMINATION CONTROL RESEARCH PROJECT

Contamination control research relating to buried transuranic waste retrieval has been ongoing at INEL since 1988. Fields of study include dust control, ventilation, bubble suit decontamination, electrostatic curtains, and rapid monitoring. For dust control, initial studies included glove-box-scale characterization of plutonium movement with dust and identification of dust control products.[3-5] In engineering scale experiments, dust control products were tested in digging, dumping, and vehicle traffic experiments with INEL soil types.[6] Field-scale experiments are ongoing during FY-91. The major finding is that dust control products must be tested with the exact soil types expected and that these products have a wide variety of responses, such as cure time and application efficiency. For ventilation studies, laminar flow ventilation was examined for reverse migration of plutonium-contaminated dust and clearing of dust clouds.[7] The major finding was that a laminar flow of about 40 ft/min resulted in no reverse migration. In bubble suit decontamination experiments, it was shown that shower-based decontamination stalls could remove 99.8% of the activity of the plutonium contaminated dust thus allowing safe doffing.[8] In rapid monitoring experiments, techniques were examined to measure essentially on-line both airborne and loose surface contamination.[9-11] The major finding is that Pu-239 can be measured at the pCi/g level in hours rather than days. In electrostatic curtain experiments, curtain materials were shown to attract plutonium-contaminated dust.[12] The major finding is that plutonium is attached to both positive and negative charged material. Present work includes identifying materials for use in a ventilation system and an inner enclosure for use during buried waste retrieval.

These research results have been published in meeting proceedings[13-16] and a patent has been applied for covering a system to control contamination spread.[17]

PROPOSED FY-92 WORK ON CONTAMINATION CONTROL

Proposed work for FY-92 is divided into three main areas including the following:

- Completion of NEPA delayed FY-91 work

- Demonstration testing which is comprised of (a) a field deployable contamination control unit, (b) a field deployable rapid transuranic monitoring unit, and (c) an electrostatic curtain inner enclosure for use on the Buried Waste Integrated Demonstration's (BWID) retrieval project at the cold test pit

- Research and development efforts including a tracer study to obtain a stand-in for plutonium and an advanced dust measurement system which uses lasers correlated with alpha cams.

The completion of the FY-91 research and development-related contamination control work is important information that will feed directly into the FY-92 proposed work. The two field deployable contamination control units will be developed for field use at INEL on the Pad-A Retrieval project and during BWID cold pit tests. These field units also have application in the Transuranic Storage Area-Retrieval Enclosure (TSA-RE) project. The electrostatic curtain will be demonstrated first in the cold test pit retrieval followed by hot test pit retrievals. The tracer study is mandatory for understanding the movement of tracers relative to the movement of plutonium during retrieval because the cold test pit contains tracers which will be used to assess the effectiveness of contamination control schemes. Finally, the laser dust study could result in a truly on-line technique to measure the spread of contaminants during retrieval.

Completion of FY-91 Work

The background research on contamination control during FY-91 was delayed by increased NEPA documentation and approval requirements. As a result, much of the work requires funding in FY-92 to complete the final reports and in some cases the experiments. Completion of this work is mandatory to developing the field-deployable contamination control unit and the rapid monitoring unit, as well as the electrostatic curtain enclosure. Specifically, the work involves (a) evaluation of the Merlin Gerin alpha cam in actual contaminated dust conditions, (b) development of a large area direct counting alpha spectrometer and development of a rapid Uranium L-shell x-ray detection system, (c) development of electrostatic curtain material for use in an inner enclosure building and materials for use in a ventilation system, and (d) dust control studies involving air flow for dust control during dumping of retrieved waste into a funnel and fixant spray performance tests on actual INEL soils.

Demonstration Testing

Field Deployable Contamination Control Unit

A Dust Suppression Unit will provide a contamination control dust suppression system based on FY-91 work. This unit will be mobile and supply misting, fixants, and dust suppressants at the site of retrieval for projects such as the cold test pit, Pad-A, transuranic pits and trenches, and the Waste Management TSA-RE project. A mobile contamination control unit can provide protection from fugitive dust at a handling operation which will reduce down-time for decontamination requirements.

Field Deployable Rapid Monitoring Unit

A Rapid Monitoring Unit will be a field deployable analysis trailer for processing soils, fallout coupons and filter samples for plutonium content (rapid transuranic monitoring). This unit will also have the space for evaluating remote alpha continuous air monitors within the retrieval area. Rapid turnaround of soil samples, smears, filters, and air samples with cams will greatly expedite any plutonium handling operation. With the low levels of detectability and rapid turnaround, larger statistical volumes of samples can be accommodated reducing the magnitude of the number of samples required. The system will reduce cost and improve schedules. A requested journal article summarizing the rapid monitoring work will also be written as part of this project. A related task is to provide contamination control monitoring during all phases of the cold test pit Buried Waste Integrated Demonstrations. The system would also be applicable to operations in Pad A in FY-93 through FY-94 and TRU-contaminated pits and trenches in FY-95 through FY-97.

Electrostatic Curtain Enclosure

As an advanced contamination control demonstration, an electrostatic enclosure will be developed for use on the Buried Waste Integrated Demonstration's retrieval demonstration projects cold test pit. This enclosure will include a ventilation system which utilizes the principles learned from the FY-91 work. The experience gained in the cold test pit for the electrostatic inner enclosure will be applied to hot pit demonstrations in out-years. An electrostatic curtain enclosure and ventilation system provides an in-depth control of contaminants from escaping the retrieval building thus reducing health and environmental risks.

RESEARCH AND DEVELOPMENT TESTING

Tracer Study

Rare-earth oxides and cerium oxide will be investigated as possible stand-ins for plutonium during dust-migration studies. These studies will be performed in the glove-box scale and will be related to future cold test pit retrieval studies. Movement of actual plutonium-contaminated soils will be compared to movement of soils spiked with rare-earth tracers and cerium oxide tracers.

Laser Dust Study

Laser Doppler measurements of dust concentrations will be correlated with known state-of-the-art alpha cam techniques to measure plutonium content in air. The laser allows a true on-line measurement capability of particle size distribution and density in air, and with proper correlation with an alpha cam air quality can be continuously followed.

As part of all these efforts, NEPA requirements will involve submittal of environmental checklists and Environmental Assessments.

RELATION OF PROPOSED INEL WORK TO OTHER TTP PROPOSALS

This technology status report is required to evaluate the funding for a variety of technical task plans that have been submitted to DOE.[18-21] Reference 18 is the subject TTP from INEL and the other TTPs (References 19, 20, and 21) are either unrelated to transuranic-contamination control or have already been covered in the scope of work performed at INEL. Reference 19 involves a organic gas monitor. On-line monitoring of the organic gas content during retrieval is unnecessary. This is because manned entry is by bubble suit (because of the transuranics) and, therefore, is not limited by gas levels. In addition, retrieval designs involve a glove-box technique of room volume changes of air which will eliminate the explosive hazards. This TTP might be better applied to a facility design for a stack monitor. References 20 and 21 have had considerable research effort already at INEL and are explained in References 10, 11, and 12. A total of five state-of-the-art alpha cams have been evaluated in a plutonium-contaminated dusty environment. Research on electrostatic curtains for use as enclosures and in ventilation systems is in the final stages of research and is ready for a field application. In summary, INEL has already performed many of the required research efforts in these fields and is ready to proceed to the demonstration arena.

SUMMARY

Continuation of the contamination control project allows a logical progression from the research and development efforts to demonstration tests and evaluations. The field deployable units and the electrostatic enclosure can be demonstrated on the cold test pit, as well as retrieval efforts in actual transuranic wastes in the TSA-RE project and the Pad-A project. The systems developed by INEL scientists and engineers can potentially be transferred to the private sector to support INEL's Subsurface Disposal Area remediation efforts. A recent example is a possible technical transfer of the contamination control patent application (see Reference 17) to the successful bidder for the pit-9 removal project.

The major impact of not continuing the contamination control work is that health and safety concerns during retrieval could demand actions such as massive decontamination efforts that could jeopardize the entire retrieval option. The immediate impact of not funding the FY-91 completion task is to have spent over $900K in research funding without reporting the results.

A benefit of continuing the contamination control studies is to develop a knowledge-base upon which reasonable cost estimates for the various retrieval options can be determined. If retrieval operations cannot be safely performed using contamination control techniques, then other more costly options, such as robotics maintenance, may become mandatory.

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18. TTP ID0605DT-Contamination Control.

19. TTP ALPROP14-Gas Contamination.

20. TTP ALPROP15-Realtime Monitoring.

21. TTP AL920039-Electrostatic Sampler.

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