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SIXTH ANNUAL DOE LLWMP PARTICIPANTS' INFORMATION MEETING

DOE LOW-LEVEL WASTE MANAGEMENT PROGRAM

Denver, Colorado
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Plenary Session I.

Chairman: L. J. Mezga
Oak Ridge National Laboratory

SIXTH ANNUAL DOE LLWMP PARTICIPANTS INFORMATION MEETING WELCOME AND INTRODUCTION

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ABSTRACT

Welcoming investigators, users, management officials and others concerned with LLW to the Sixth Annual DOE LLWMP Participants Information Meeting is a repeated privilege as we describe our accomplishments and plans Let's take advantage of our opportunities to share with each other. DOE Headquarters, Program Participating Contractors, Program Participating Operations Offices, Program Support Contractors, Program Management, Waste Management Operators, Waste Management Lead Offices, Industry, other U. S. Agencies, State, and International contributors. We will examine all aspects of LLW management from generation to long-term disposal. Our focus is upon furnishing, through development and demonstration, the best technology and techniques for use in effective management of all kinds of LLW. We have enlisted a corps of highly qualified speakers and session leaders who are willing, ready, able, and eager, with all of our participation to make this another very beneficial meeting which will be summarized in a proceedings document to be sent to each of us.

Expanding our team approach to this meeting can make it a success; let's move in that direction.

DIRECTIONS AND OBJECTIVES OF DOE LOW-LEVEL WASTE MANAGEMENT: AN OPERATIONAL PERSPECTIVE

J. E. Dieckhoner
U.S. Department of Energy, Headquarters

ABSTRACT

Not available for publication.

OVERVIEW OF EPA'S LOW-LEVEL RADIOACTIVE WASTE STANDARDS DEVELOPMENT PROGRAM, 1984

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ABSTRACT

The USEPA is continuing development of generally applicable environmental standards for the land disposal of low-level radioactive wastes (LLW) under authority of the Atomic Energy Act. This effort includes determining whether some of these wastes contain sufficiently low levels of radioactivity to be "below regulatory concern" (BRC) regarding their radioactive hazard. The Agency has also started a new effort, at the request of the States, to investigate whether certain natural and accelerator-produced radioactive materials (NARM) wastes should also be included under the LLW standards, using the authority of the Resource Conservation and Recovery Act 1976.

This paper describes the current status of the LLW standards program, the technical programs for developing the low-level wastes standards, for identifying a level "below regulatory concern," and for including NARM wastes under the LLW standards. It also gives the revised schedule for promulgating LLW standards.

NRC'S PERSPECTIVE ON LOW-LEVEL WASTE MANAGEMENT NEEDS AND OBJECTIVES

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ABSTRACT

Not available for publication.

DISPOSAL OF LOW-LEVEL WASTE--NUCLEAR PLANT SOURCES AND ECONOMICS

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ABSTRACT

The costs associated with the disposal of low-level radioactive wastes have increased dramatically over the past seven years. With this shift, utilities are seriously pursuing radwaste management programs, seeking to insure that their waste generation is held to a minimum. This paper presents the findings of two recently completed EPRI studies. The first was directed at providing guidance to utilities in efforts to assess their particular plant waste generation experience compared to plants of similar design. The initial work involved a comprehensive survey of waste generation from various plant sources. Over 70% of operating nuclear plants contributed to the assembly of this data base. Correlations explored between plant characteristics, operating modes and the waste volume generated. Finally, volume reduction techniques found to be effective by plants are described.

The second EPRI study provides the methodology for a utility to develop a long range strategy for disposal of LLW from their plant. The work involved the development of a cost data base for the leading 14 waste processing options. Cost information and waste processing volumes are developed for each option, as well as, general arrangement drawings upon which to base installed cost estimates. Finally, a generic economic analysis is described which considered process costs, storage and transportation costs and disposal costs. The work shows through sensitivity analyses that radwaste generation volumes and future burial costs are the key factors in assessing the economic value of volume reduction options.

Further research needs and directions for LLW from a utility perspective are described.

DIRECTIONS AND OBJECTIVES OF THE SIXTH ANNUAL DEPARTMENT OF ENERGY LOW-LEVEL WASTE MANAGEMENT PROGRAM

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ABSTRACT

The Department of Energy's Low-Level Radioactive Waste Management Programs are structured to meet the needs of waste generators and disposal site operators both within and outside the Department. Coordination of activities and the collection of data from a wide range of organizations representative of the various elements of these waste management systems essential to the accomplishment of the Program objectives in a cost effective manner. This paper will present specific concerns for the participants to consider in the course of the meeting.

The annual Low-Level Waste Management Program Participants' Meeting is one of several mechanisms used to provide input for the Program's deliberation. Based on the discussions that take place at this meeting and information gained from the Ad Hoc Waste Operating Contractors Committee, Program Review Committee, other agencies, and visits to the Department's facilities, progress can be determined and future needs can be incorporated into our plans.

Critical to the achievement of each Program objective is the application of technology that has been developed. Program emphasis is shifting from the development of new technology to large scale in-field demonstrations to validate the improved technologies and maximize their utility. Stabilization techniques, improved trench caps, and improved treatment systems resulting in more stable waste forms are a few examples of these technologies.

On the institutional side, states are moving slower to implement their responsibilities under the PL-96-573 for establishing new disposal capacity for low-level waste. Assuming that states continue along the path of establishing new disposal sites, less financial support by the Department will be required in the institutional area. Accordingly, the Department plans to limit its assistance to those tangible activities that contribute toward the management of a stable LLW system over the next two to three years.

Discussions during this meeting should focus on what specific activities are required for the establishment of new low-level waste disposal facilities and how the on-going technology activities are meeting the needs of the users.

Plenary Session II.

INTERNATIONAL LOW-LEVEL WASTE ACTIVITIES

Chairman: L. J. Mezga
Oak Ridge National Laboratory

ONTARIO HYDRO LOW-LEVEL WASTE MANAGEMENT PRACTICES AND PLANS FOR THE FUTURE

T. Carter
Ontario Hydro

ABSTRACT

Not available for publication.

WASTE MANAGEMENT ACTIVITIES AT CHALK RIVER NUCLEAR LABORATORIES

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ABSTRACT

Low-level radioactive waste-management operations at the Chalk River Nuclear Laboratories (CRNL) of Atomic Energy of Canada Limited began in 1946 and currently include waste processing and interim storage in engineered facilities built in unsaturated sandy overburden. In addition, an R&D program has been underway for about ten years directed at preparations for a transition from the current storage mode to one of permanent disposal for the management of about 5000 m^3/a (as-generated volume) of low- and intermediate-level solid wastes generated on the CRNL site or shipped there from the nuclear industry, radioisotope producers and users across Canada.

The first phase of the disposal program was the development and demonstration of selected waste processing methods for the volume reduction and immobilization of solid and liquid low-level wastes. This phase is now nearing completion with the construction, commissioning and operation of the CRNL Waste Treatment Centre. The Centre consists of a controlled-air incinerator for combustible solid and liquid wastes, ultrafiltration, reverse-osmosis, and evaporator systems for aqueous wastes, and wiped-film and ribbon-blender bituminizers for immobilizing the ash and waste concentrates.

The second phase of the program is directed at further advances in waste characterization and processing, and at the development of two disposal concepts potentially suitable for the local geological situation -- intrusion-resistant shallow land burial and excavated rock cavities at shallow depth. Also included is the preparation of safety-assessment methodologies for the two concepts. The intent is to carry one or both disposal concepts through the construction and operation of prototype facilities at CRNL as a qualified component of an evolving integrated disposal strategy for the current inventory and future arisings of wastes to be managed.

SWEDISH PRACTICES IN LOW-LEVEL WASTE MANAGEMENT

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Swedish Nuclear Fuel and Waste Management Company

ABSTRACT

Not available for publication.

Session I.

DISPOSAL TECHNOLOGY

A. Improved Shallow Land Burial

Chairman: J. G. Steger
Los Alamos National Laboratory

STATUS OF 10 CFR PART 61 IMPLEMENTATION

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Low-Level Waste and Uranium
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United States Nuclear Regulatory Commission

ABSTRACT

The waste generator requirements for compliance with 10 CFR Part 61 became effective on December 27, 1982. The following provisions were made applicable to persons generating low-level radioactive waste (LLW):

(a) 10 CFR §20.311, transfer for disposal and manifests;
(b) 10 CFR §61.55, waste classification;
(c) 10 CFR §61.56, waste characteristics;
(d) 10 CFR §61.57, labeling.

10 CFR §20.311 requirements provide for a manifest tracking system to supplement existing provisions for transfers and recordkeeping for waste shipments. The waste classification system permits three classes of waste to be routinely disposed of at LLW disposal sites, Class A, B, and C, requiring increasing levels of protection due to concentration and half life of radionuclides. A limited amount of waste (<1%) may exceed Class C concentration limits and must meet specific requirements for disposal at specific sites on a case-by-case basis. LLW must also meet certain characteristics requirements, depending on its class, in order to protect LLW disposal site personnel, to prevent slumping or collapse of the disposal unit and to protect the inadvertent intruder. The labeling requirement provides instructions to the disposal site operator regarding the classification of the waste package.

This paper will discuss Nuclear Regulatory Commission (NRC) initiatives toward implementing Part 61 and NRC/nuclear industry interactions directed toward full implementation.

CHEMICAL CHARACTERISTICS, MIGRATION AND FATE OF RADIONUCLIDES AT SLB SITES

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ABSTRACT

Not available for publication.

UPTAKE OF GAMMA-EMITTING RADIONUCLIDES AFTER AQUATIC BIOTA EXPOSED TO CONTAMINATED WATER BEFORE AND AFTER PASSAGE THROUGH THE GROUND

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ABSTRACT

Three experimental systems were designed to investigate the differential accumulation of radionuclides by biota from low-level aqueous effluents after passage through the ground. One system received river water (control), one received dilute low-level radioactive effluents (trench), and the third received the low-level effluents after it had percolated through about 260 m of porous gravel (springs). Biota studied included filamentous green algae, clams (Corbicula), goldfish (Carassius auratus), carp (Cyprinus carpio), and Veronica.

Trophic level differences in accumulation of the various radionuclides from the diluted trench water were not consistent but generally followed the pattern algae > goldfish > molluscs > carp. Cobalt-60 was assumulated to the highest level of any radionuclide, and accumulation levels at the three sites were directly related to the concentration of ^{60}Co in the water. Manganese-54, ^{59}Fe, and ^{106}Ru were also accumulated to measurable levels in biota at the springs site indicating their bioavailability after passage through the ground.

ORGANIC COMPLEXANT-ENHANCED MOBILITY OF TOXIC ELEMENTS IN LOW-LEVEL WASTES

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ABSTRACT

This paper describes the results obtained during the recent activities of a project whose objective is to determine how and to what extent organic complexants affect the mobility of toxic elements in subsurface groundwaters at commercial low-level waste disposal sites. Generic soil components (e.g., hydrous oxides, silica, clays) are being employed so that the results will be broadly applicable.

Data have been obtained with two radionuclides (^{63}Ni and ^{239}Pu) and one nonradioactive toxic element (Cd). Work with ^{63}Ni has been emphasized; it was studied with five different generic soil components (hydrous ferric oxide, silica, titania, kaolinite, and montmorillonite) and five different complexants (EDTA, NTA, picolinate, citrate, and oxalate). EDTA was the complexant studied most extensively and hydrous ferric oxide, $Fe_2O_3 \cdot xH_2O$, was the most studied soil component.

A wide diversity of effects of organic complexants on toxic elements sorption was observed. The effects vary not only among complexants, but also among toxic elements and among soil components. In some systems the complexant results in increased toxic element sorption (decreased mobility) while in other systems the complexant results in decreased toxic element sorption (increased mobility).

RADIONUCLIDE MIGRATION STUDIES AT THE SAVANNAH RIVER PLANT HUMID SHALLOW LAND BURIAL SITE FOR LOW-LEVEL WASTE*

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ABSTRACT

A program of field, laboratory, and modeling studies for the Savannah River Plant low-level waste burial ground has been conducted for several years. The studies provide generic data on an operating shallow land burial site in a humid region. Recent results from individual studies on subsurface monitoring, lysimeter tests, soil-water chemistry, and transport modeling are reported. Monitoring continues to show little movement of radionuclides except tritium. Long-term lysimeter tests with a variety of defense wastes measure migration under controlled field conditions. One lysimeter was excavated to study radionuclide distribution on the soil column beneath the waste. New soil-water distribution coefficients (K_d) were measured for Co-60, Sr-90, Ru-106, Sb-125, and I-129. Laboratory and field data are integrated by means of the SRL dose-to-man model, to evaluate effects of alternative disposal practices. The model recently has been used to evaluate TRU disposal criteria and to predict migration behavior of tritium, Tc-99, and I-129.

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* The information contained in this article was developed during the course of work under Contract No. DE-AC09-76SR00001 with the U. S. Department of Energy.

** ORAU Postdoctoral Participant

SHALLOW LAND BURIAL TECHNOLOGY - HUMID[1]

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ABSTRACT

Applying engineered modifications to present shallow land burial (SLB) practices is one method of assuring safe operation and improving overall disposal site performance. Two such engineered modifications, trench lining and grouting, are being demonstrated and evaluated at the Oak Ridge National Laboratory (ORNL) Engineered Test Facility (ETF) using nine 28 m^3 experimental trenches containing compacted low-level waste. Though the economic analysis of the two treatments favored Hypalon lining (lining costs were 33% lower at this demonstration scale), results of field experiments examining waste hydrologic isolation favored the cement-bentonite grout treatment. Data from water pump out and water pump in tests described in this paper, combined with observed intratrench water level fluctuations, suggest that the original goal of constructing water-tight liners in three of the nine experimental trenches was not achieved. In addition, trench cover subsidence of approximately 2% of the total trench depth has been measured over two of the three lined trenches, but has not occurred over any of the three grouted or three control (untreated) trenches. The evaluation of the two trench treatments is continuing, however results to date indicate that the cement-bentonite treatment, implemented at a cost of \$160/m^3 of grout, provides a degree of waste isolation not afforded by the lined or control trenches and should be considered for use at SLB sites with water-related problems.

[1]Research sponsored by the Office of Defense Waste and Byproduct Management, U.S. Department of Energy, under Contract No. DE-AC05-840R21400 with Martin Marietta Energy Systems, Inc.

TECHNOLOGY DEVELOPMENT FOR THE DESIGN OF SHALLOW LAND BURIAL FACILITIES AT ARID SITES

J. W. Nyhan, W. V. Abeele, E. J. Cokal, T. E. Hakonson, L. J. Lane, and B. A. Perkins

ABSTRACT

The field research program involving technology development for arid shallow land burial sites is described. Field tests of biointrusion barriers at waste disposal sites and in experimental plots at Los Alamos are reported. Results of completed and on-going experiments with migration barriers for water and contaminant movement are presented. An envelope wick experiment for subsurface water management is described and preliminary field data are reported. An integrated field experiment was designed to test individual SLB component tests related to erosion control, biobarriers, and subsurface capillary and migration barriers, and the progress made in emplacing the experiment is presented. Efforts to utilize the field data collected to validate hydrologic models (CREAMS and TRACR3D) important to waste management strategies are also presented.

ENGINEERED SORBENT BARRIERS FOR LOW-LEVEL WASTE

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ABSTRACT

The purpose of the Engineered Sorbent Barrier program is to evaluate and provide new and cost-effective technology for restricting the migration of radionuclides from low-level waste sites. The primary emphasis is to identify and evaluate sorbent materials as engineered barriers at these sites.

Some radionuclides in low-level waste shallow land burial sites have been shown to form complexants induced by the presence of organics, microbial processes, chemical decomposition, or radiation. Complexants can increase radionuclide mobililty and reduce their affinity for the clay minerals in the foundation soil. To reduce or prevent this migration, materials could be designed to sorb radionuclides from the leachate at the base of a burial site. The sorbent materials may be used at low-level waste disposal sites for buried defense low-level wastes requiring remedial action or for commercially generated wastes. The sorbent materials, such as natural or synthetic zeolites or carbon sorbates, would be amended to the foundation soil at these sites to improve the natural effectiveness of the clay or soils.

The paper will describe the concepts that will be investigated over the next two years. Since this program was only recently started, no data is available for inclusion in this paper.

WATER MANAGEMENT OF HUMID AREA SHALLOW LAND BURIAL SITES

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ABSTRACT

During the seasonal year 1983-1984, the first year of a lysimeter based water balance study was carried out at the Maxey Flats low level waste disposal site. The water input to the system, rainfall, and the fate of that water: run-off, deep percolation, and evapotranspiration was measured. About 20% of the water input (rainfall) was disposed of as surface runoff. About one-half of the input water was removed by evapotranspiration. Approximately 30% of the rainfall ended up as deep percolation water. Varying management procedures of the fescue crop and substitution of an alfalfa crop had little effect on deep water percolation. In about one-half of the months (winter-spring), excess water was present in the profile so that deep percolation occurred. As a result, a technique of bio-engineering management was formulated to increase run-off while maintaining evapo-transpiration so as to minimize (or eliminate) deep percolation. Demonstration of that technique is now underway. In other investigations at the Maxey Flats site, the ^{3}H concentration in the transpiration stream of fescue grass grown on trench caps has been measured monthly for the past year and one-half. ^{3}H concentrations in the transpiration stream were up to 1000 times higher in the dry periods compared to winter, although the trench water remained fairly constant at about 15 feet below the surface, indicating plant water uptake from that depth.

THE DESIGN & ECONOMICS OF A SMALL SHALLOW LAND BURIAL FACILITY IN A HUMID CLIMATE

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ABSTRACT

To assess the technical feasibility and cost to generators of disposal of Maine's Low-Level Radioactive Waste (LLRW), the Maine Department of Environmental Protection has designed several general shallow land burial facilities and is performing preliminary costing exercises on each. Trench and facility design were governed by northern New England's humid climate and high ground water table.

Maine's Low-Level Radioactive Waste Siting Commission has been actively discussing with representatives of the States of New Hampshire and Vermont the possibility of a single facility serving all three states. Consequently, our study considered waste volume scenarios to accommodate LLRW from one, two, and three states over a 25 year period. Also provided for were waste volumes from the decommissioning of the two existing commercial power reactors. Costs were estimated for licensing, facility construction, operation, closure, and post closure care. Using DOE's National Low-Level Waste Management Program's economic model, the Maine State Planning Office (SPO) is estimating unit disposal costs to generators. Preliminary findings are presented in this paper.

Evaluation and Design of Drained Low-level Disposal Sites

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ABSTRACT

Most present designs for shallow waste burial trenches assume location in a relatively impermeable medium and rely for protection from invading water on careful design of a trench cap. Actual sites are and, probably will be, located in moderately permeable soil. The project described here took a different approach by assuming that the soil surrounding the waste material would be fairly permeable and that the trench base would deliberately include a drain system. This concept avoids submersion of waste in standing water as well as any bathtub effects, while still permitting decontamination of directed flow downstream from the trench.

Test work has been done on an instrumented lysimeter bed, with sand and soils containing various proportions of clays and silts, to determine drainage rates and minimum residual moisture content. For the materials tested, even in humid climates representative of the Eastern United States, the trench soil would be unsaturated most of the time and leaching of waste would be intermittent and, in any case, occur at a rate well below that assumed for saturated flow. This fact requires reassessment of the calculational models employed to predict waste migration both for deliberately drained trenches and those operated in moderately permeable soils.

APPLICATIONS OF GEOPHYSICS TO LLRW SITES

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ABSTRACT

There are many geophysical techniques which noninvasively acquire information about hazardous waste sites. Waste buried in metal drums can be located using magnetic and electromagnetic methods. Ground penetrating radar can provide detailed cross-sectional imagery of the ground to locate metallic and nonmetallic objects, and to delineate water tables and geologic structure. Complex resistivity can locate clay horizons or clay liners and detect organic reactions that may increase the permeability of the clay. Seismic refraction and reflection techniques can detail hydrology and stratigraphy. Microgravity techniques can find local density anomalies that may indicate voids or future subsidence problems. Radiometric techniques can directly detect near-surface radioisotope migration.

Nothing works all the time, however. Magnetics cannot detect a badly corroded drum. Complex resistivity cannot detect clay-organic reactions if there are no clays. Ground penetrating radar cannot penetrate high conductivity or high clay content soils. Seismic cannot penetrate loose fill. Each technique has advantages and disadvantages inherent to the method and equipment as well as limitations imposed by the geohydrology at the site of application. Examples from both the Radioactive Waste and Hazardous Chemical Waste programs illustrate the advantages and disadvantages of geophysical methods.

GEOPHYSICAL DIFFRACTION TOMOGRAPHY

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ABSTRACT

Geophysical diffraction tomography is a new technique that shows promise as a tool for quantitative subsurface imaging. The approach being used is based upon the filtered backpropagation algorithm[1], which is a mathematical extension of the reconstruction software used in conventional x-ray CAT scanners. The difference between this method and existing methods is that the new algorithm rigorously accounts for diffraction effects through an exact inversion of the wave equation. This refinement is necessary in that it admits the use of acoustic and long-wavelength electromagnetic waves, allowing tomography to be taken from the laboratory to the field.

ORNL's effort in geophysical diffraction tomography involves reducing the filtered backpropagation algorithm to practice. This requires the design and construction of field instrumentation as well as the development of an improved algorithm. The original algorithm requires the imaged region to be illuminated by plane waves. This requirement simplifies the algorithm but complicates its field implementation in that plane waves are difficult to generate. Consequently, ORNL has been working to generalize the filtered backpropagation algorithm to allow a broader range of insonifying wave fields which can more easily be realized in the field. The instrumentation effort involves the selection of appropriate sonic sources and receivers along with the development of a state-of-art, portable, computer-controlled, multichannel data acquisition system.

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[1]A. J. Devaney, "A Filtered Backpropagation Algorithm for Diffraction Tomography," Ultrasonic Imaging 4, 336-350 (1982).

Session I.

DISPOSAL TECHNOLOGY

B. Greater Confinement Disposal

Chairman: G. T. Wright
Savannah River Laboratory

LOW-LEVEL WASTE DISPOSAL SITE SELECTION DEMONSTRATION

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ABSTRACT

This paper discusses the results of recent studies undertaken at EPRI related to low-level waste disposal technology. The initial work provided an overview of the state of the art including an assessment of its influence upon transportation costs and waste form requirements. The paper discusses work done on the overall system design aspects and computer modeling of disposal site performance characteristics. The results of this analysis are presented and provide a relative ranking of the importance of disposal parameters. This allows trade-off evaluations to be made of factors important in the design of a shallow land burial facility.

To help minimize the impact of a shortage of low-level radioactive waste disposal sites, EPRI is closely observing the development of bellweather projects for developing new sites. The purpose of this activity is to provide information about lessons learned in those projects in order to expedite the development of additional disposal facilities. This paper describes most of the major steps in selecting a low-level radioactive waste disposal site in Texas. It shows how the Texas Low-Level Radioactive Waste Disposal Authority started with a wide range of potential siting areas in Texas and narrowed its attention down to a few preferred sites. The parameters used to discriminate between large areas of Texas and, eventually, 50 candidate disposal sites are described, along with the steps in the process. The Texas process is compared to those described in DOE and EPRI handbooks on site selection and to pertinent NRC requirements. The paper also describes how an inventory of low-level waste specific to Texas was developed and applied in preliminary performance assessments of two candidate sites. Finally, generic closure requirements and closure operations for low-level waste facilities in arid regions are given.

PLANNING FOR GREATER CONFINEMENT DISPOSAL

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ABSTRACT

This contribution is a progress report on preparation of a planning document that will summarize the procedures and technical information needed to plan for and implement greater-confinement disposal (GCD) of low-level radioactive waste. Planning activities leading to selection of a site and a facility design (phase 1), and planning activities for construction, operation, and extended care (phase 2) will be covered in the document. This progress report is limited to phase 1. Co-location with a shallow-land burial facility is chosen as the baseline case, with a separate facility as a possible alternative. Phase 1 planning covers three topics: determination of the need for GCD (based on a preliminary characterization of expected waste streams, facility performance, and regulatory requirements); design alternatives; and selection of a site and facility design. Alternative designs considered include augered shafts, deep trenches, engineered structures, hydrofracture, and improved waste form. Design considerations and specifications, performance elements, cost elements, and comparative advantages and disadvantages of the different designs are covered. Discussion of site and design selection procedures includes screening criteria, benefit-cost-risk evaluation procedures, performance assessment, and National Environmental Policy Act (NEPA) planning.

GREATER CONFINEMENT DISPOSAL ACTIVITIES AT THE SAVANNAH RIVER PLANT*

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ABSTRACT

The first facility to demonstrate Greater Confinement Disposal (GCD) of low-level solid radioactive waste in a humid environment in the United States has been built and is operating at the Savannah River Plant. GCD practices used in the demonstration are: waste segregation into high and low activity concentrations, emplacement below the root zone, waste stabilization, and capping. Activity concentrations to select wastes for GCD are based on the activity/volume distribution of low-level solid wastes as obtained from SRP burial records, and are equal to or less than those for Class B waste in 10CFR61. The first disposal units constructed are twenty 9-foot-diameter, 30-foot-deep boreholes to dispose of wastes from the production reactors, tritiated waste, and selected wastes from offsite. In 1984, construction will begin on an engineered trench for disposal of boxed waste and large bulky items that meet the activity concentration criteria for GCD.

Other programs are underway to develop a stabilization/disposal system for decontaminated aqueous waste. A cement based wasteform, "saltstone," has been designed for disposal of this waste in engineered trenches. Wasteform properties and landfill design have been developed to assure that the concentration of salts and radionuclides will meet state and federal water quality standards at the perimeter of the disposal site. Scaled lysimeter experiments, including a 1/10th scale lysimeter, are in progress to ascertain performance of the disposal system.

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* The information contained in this article was developed during the course of work under Contract No. DE-AC09-76SR00001 with the U. S. Department of Energy.

** On loan from Rockwell Hanford Operations

GREATER CONFINEMENT DISPOSAL TEST AND OPERATIONAL PLANS

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ABSTRACT

The Greater Confinement Disposal Test (GCDT) at the Nevada Test Site is a demonstration of greater confinement disposal using large-diameter boreholes. During the past year the operational aspects of GCDT were completed with the transfer and disposal of over 1,000,000 curies of high-specific-activity low-level wastes. A specially-designed remote waste handling system was used to unload and free-air transfer wastes from shielded shipping casks. Although many of these sources had very high external radiation levels, personnel did not receive any recordable doses.

As part of the National Low-Level Waste Management Program's technology transfer process a GCD Operational Technology Report was prepared. This report was primarily written for low-level waste site managers and radiation safety personnel. The report also addresses the economics of facility design, loading efficiency, and waste handling to assist planners in performing cost analyses.

This paper will present the accomplishments to date of the GCDT and will summarize the Operational Technology Report.

Session I.

DISPOSAL TECHNOLOGY

C. Corrective Measures

Chairman: S. J. Phillips
Rockwell Hanford Operations

DEVELOPMENT OF CORRECTIVE MEASURES TECHNOLOGY FOR SHALLOW LAND BURIAL FACILITIES AT ARID SITES

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ABSTRACT

The field research program involving corrective measure technologies for arid shallow land burial sites is described. Soil erosion and infiltration of water into a simulated trench cap with various surface treatments was measured and compared with similar data from agricultural systems across the United States. Field testing of biointrusion barriers at closed-out waste disposal sites at Los Alamos and in the experimental clusters are reported. The final results of an experiment designed to measure the extent of contaminant transport to the surface of a SLB facility, and the influence of plants on this relationship, are presented. An experiment designed to determine the effects of subsidence on the performance of a cobble-gravel biobarrier system is described and current field data are presented.

CORRECTIVE MEASURES TECHNOLOGY FOR HUMID SITES - 1984[1]

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ABSTRACT

The corrective measures technology task for humid sites consists of two subtasks. The first has the objective of demonstrating that caustic soda/soda ash injection into a closed trench's backfill can achieve a fixation of radiostrontium from further contamination of surrounding ground waters. Monitoring of ground water in and around a demonstration trench, first treated in 1980, has indicated a continued fixation of radiostrontium as a coprecipitate with calcium carbonate; soil samples taken in 1984 showed comparable amounts of ^{90}Sr-$CaCO_3$ coprecipitate to those found in samples from 1981. A chemical equilibria model of the leachability of ^{90}Sr from soil in response to inputs of caustic was formulated; the model includes the pertinent processes of cation exchange, acid-base buffering, and dissolution and precipitation of calcite and calcium and magnesium hydroxides. Model predictions of ^{90}Sr leachability were compared to tests with soil samples collected from the trench.

The second subtask has the objective of demonstrating the feasibility of detecting ^{90}Sr in ground water via in situ Cerenkov radiation measurement. A prototype Cerenkov detector was fabricated of a photomultiplier tube optically coupled to a free-draining, light-sealed sample chamber for lowering into a well. The device was tested on ground waters from a group of monitoring wells within an ORNL solid waste storage area. The estimates of ^{90}Sr concentrations were compared to those found by the standard radiochemical method. A second prototype detector is being constructed to employ dual photomultiplier tubes in a coincident counting mode to lower background counting rates.

[1]Research sponsored by the Office of Defense Waste and Byproduct Management, U.S. Department of Energy, under Contract No. DE-AC05-84OR21400 with Martin Marietta Energy Systems, Inc.

DYNAMIC CONSOLIDATION ALTERNATIVES TESTS FOR LOW-LEVEL WASTE DISPOSAL SITE CORRECTIVE MEASURES

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ABSTRACT

Alternative techniques to control geomechanical subsidence of materials disposed at low-level waste disposal sites have been evaluated at a test facility containing simulated waste materials. Alternatives tested include: (1) accelerating mass impact; (2) vibratory hammer/extractor rod and cylinder injection-withdrawal; and (3) pile driver-hammer rod and cylinder injection. Each alternative performed adequately to; densify burial matrix materials (soils), compact buried waste materials, and significantly reduce waste package and total void volume of disposed materials. No detectable simulated respirable contaminants introduced into the test site at the time of construction were ejected or otherwise brought to the surface as a result of alternatives testing.

IN SITU GROUTING DEMONSTRATION AT THE MAXEY FLATS NUCLEAR WASTE DISPOSAL SITE, FLEMING COUNTY, KENTUCKY

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Commonwealth of Kentucky
Department of Environmental Protection

ABSTRACT

Abstract not available for publication.

GROUNDWATER SUPPRESSION AND DIVERSION STRUCTURES APPLIED TO CLOSED SHALLOW LAND BURIAL TRENCHES[1]

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ABSTRACT

Shallow depth to groundwater, surface drainage, and subsurface flow during storm events are major environmental concerns of low-level radioactive waste management operations in humid regions. At two waste disposal sites within the Oak Ridge National Laboratory (ORNL), groups of closed trenches have experienced these problems and have been shown to collect and hold intratrench water with seasonal fluctuations ranging from 1 to 2 m. In an attempt to correct these water-related problems, the older of the two sites, Solid Waste Storage Area Four (SWSA-4), was equipped in September 1975 with asphalt-lined drainage ways designed to prevent reinfiltration of storm drainage from the 13.8 ha upslope catchment. At the second site (49-Trench Area of SWSA-6), the entire 0.44 ha trench area was capped with a bentonite clay cover in 1976. These early attempts at hydrologic isolation have not corrected the water problems, and have suggested the need for further remedial action. In September 1983, two similarly designed engineered drainage projects were initiated at the disposal sites. The SWSA-4 project was designed to divert surface runoff around the trench area and drain a portion of the shallow subsurface flow which originates upslope of the site. The second project, a passive French drain constructed in SWSA-6, was aimed strictly at suppressing the site water table thus preventing its intersection with the bottoms of disposal trenches. The cost of the two projects was $153,000 (SWSA-6) and $229,000 (SWSA-4), with onsite construction requiring 40 and 60 days, respectively. Post-construction monitoring for performance evaluation has shown that the water table in the 49-trench area has been suppressed to a depth >4.9 m below the ground surface over 50% of the site with a maximum drawdown of 4 m at the drains deepest point. The SWSA-4 project evaluation is just being completed and data show that 56±15% of the Winter-Spring 1984 runoff was diverted around SWSA 4. As a result, a 44% reduction in ^{90}Sr flux was calculated from observed discharges and a previously established relation between flow rate and ^{90}Sr concentration.

[1]Research sponsored by the Office of Defense Waste and Byproduct Management, U.S. Department of Energy, under Contract No. DE-AC05-840R21400 with Martin Marietta Energy Systems, Inc.

LOW-LEVEL RADIOACTIVE WASTE DISPOSAL SITE TRANSFER PROGRAM

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ABSTRACT

The Nuclear Waste Policy Act of 1982 (Section 151) authorizes the Secretary of the Department of Energy (DOE) to accept title and custody of low-level radioactive waste and the land on which such waste is disposed of, as well as certain special disposal sites if the waste resulted from licensed activities to recover zirconium, hafnium, and rare earths from source materials. The DOE is developing its program to implement Section 151 of this law through an analysis of the technical, administrative and institutional issues involved in the transfer of a closed waste disposal site to the federal government in order to protect the public health and safety and the environment. As part of the development activities, a DOE task force is conducting a test-case review of an actual disposal site for the purpose of determining the adequacy of its procedures and information needs. The background and frame work of this new program and the process for establishing procedures that will support an efficient review of a proposed transfer to the DOE is described.

Session II.

CHARACTERISTICS AND TREATMENT OF LOW-LEVEL WASTE

Chairman: R. K. Blauvelt
Mound Laboratories

WASTE CLASSIFICATION--A MANAGEMENT APPROACH

C. Smith
Science Applications, Inc.

ABSTRACT

Not available for publication.

APPROACH TO DOE THRESHOLD LIMITS

R. D. Shuman
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ABSTRACT

Not available for publication.

A COMMERCIAL REGIONAL INCINERATOR FACILITY FOR TREATMENT OF LOW-LEVEL RADIOACTIVE WASTE

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ABSTRACT

In 1981, US Ecology, Inc. began studies on the feasibility of constructing and operating a regional radioactive waste incinerator facility.

In December, 1982, US Ecology requested turnkey quotations from several vendors for engineering, procurement, and construction of the new facility. After technical and commercial evaluations, a contract was awarded to Associated Technologies, Inc. of Charlotte, N.C. in June, 1983.

In June, 1984, US Ecology made a public announcement that they were studying two sites in North Carolina for location of the facility. This same month, they submitted their permit application for a radioactive material license to the North Carolina Department of Human Resources.

The facility will accept wastes from power reactors, medical and research institutions and other industrial users, and will incinerate dry solid waste, pathological waste, scintillation fluids, and turbine oils.

The incinerator will be a dual chamber controlled air design, rated at 600 lbs/Hr, with a venturi scrubber, packed column, HEPA, and charcoal filters for pollution control. The stack will have a continuous monitor.

CLASSIFICATION OF LOW-LEVEL RADIOACTIVE WASTES FROM NUCLEAR POWER PLANTS

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ABSTRACT

The NRC regulation, 10 CFR Part 61, establishes three classes of wastes designated A, B, and C based on listed concentrations of specific nuclides. The NRC Branch Technical Position (BTP) relative to the required compliance program focused on extensive waste stream sampling and analysis as a means of compliance but did not preclude other approaches that could be shown to "ensure a realistic representation of the distribution of radionuclides within waste" and "to classify waste in a consistent manner".

To meet the above regulatory requirements, an engineering analysis approach for quantifying the concentrations and amounts of radionuclides of classification concern was developed as an alternative to an extensive and difficult waste sampling and analysis program. Essentially this methodology involves a material balance of radionuclides which for the most part originate in the reactor core and are transported to the waste streams by reactor coolants and whose concentration in the coolant is primarily a function of fuel performance. The use of scaling factors between readily measured key radionuclides and others required for classification have been published in Report AIF/NESP-027 entitled, "Methodologies for Classification of Low-Level Radioactive Wastes from Nuclear Power Plants".

Since then data from about 1000 samples on nuclide concentrations in various reactor waste streams from 65 units at 40 sites was collated, analyzed and evaluated to confirm the calculational methodology in AIF/NESP-027. In summary, the approach and results of the engineering analysis methodology were validated.

THE DISPOSAL OF SLIGHTLY CONTAMINATED WASTE OIL

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ABSTRACT

Currently, the disposal of essentially all low-level waste is subject to the requirements of 10 CFR Part 61. This regulation requires, among other things, waste classification by radionuclide concentration, compliance with waste form, packaging and shipping manifest provisions and disposal facility requirements. Much of this waste, however -- including quantities of waste lubricating oil from nuclear power plants -- contains radionuclide concentrations so low that disposal by less restrictive methods would pose an insignificant risk to the environment and public health and safety. Thus, expenditure of resources to ensure that Part 61 requirements are met with respect to this waste cannot be justified.

Last month the Utility Nuclear Waste Management Group, in conjunction with the Edison Electric Institute, petitioned the Nuclear Regulatory Commission for the issuance of a regulation governing the disposal of low-level radioactively contaminated waste oil from nuclear power plants. Essentially, the petition requests that a regulation be issued setting forth radionuclide concentrations below regulatory concern (BRC) -- such that waste oil with radionuclide concentrations less then said levels could be disposed of without regard to the radioactive material content of the waste. Adoption of such a rule would provide for the more efficient disposal of slightly contaminated waste oil while, at the same time, provide adequate protection for both the environment and public health and safety.

TREATMENT METHODS FOR MIXED WASTES: Y-12 EXPERIENCE

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Y-12 Plant

ABSTRACT

Not available for publication.

LEACHING MECHANISMS

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ABSTRACT

Sufficient data are lacking to provide a basis for adequately assessing the long term leaching behavior of solidified low-level radioactive waste forms in their disposal environment. Although the release of radioactivity from a waste form to an aqueous environment is recognized to be due to one or more mechanisms such as diffusion, dissolution, corrosion or ion exchange, the leaching mechanisms and the factors which control the leaching behavior of waste forms is not fully understood. This study will determine the prevailing mechanisms for a variety of selected LLW solidification agents which are being considered for use by defense and commercial generators and which will cover the broadest possible number of mechanisms. The investigation will proceed by the postulation of mathematical models representative of the prevailing mechanism(s) and the use of statistically designed experiments to test the actual leaching behavior of laboratory samples against the postulated representations. Maximum use of existing leach data in the literature will be made by incorporating literature results into a computerized data base along with the experimental results generated in this task.

PERFORMANCE OF SPECIAL WASTEFORM LYSIMETERS AT A HUMID SITE

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ABSTRACT

The special wasteform lysimeters at the Savannah River Laboratory are designed to measure the migration of radionuclides from commercial power reactor wasteforms under unsaturated conditions in a humid site. Operation of the lysimeters under field conditions allows prediction of the behavior of solid low-level wasteforms (concrete and polymer) in actual burial trenches. Analysis of the percolate water from the lysimeters has been performed regularly since emplacement of the waste in March 1982. Co-60 and Sr-90 have migrated through the soil to the sumps. Cs-137 has been detected only in water collected from the soil column and has not yet migrated to the sumps. The results of this unsaturated leaching can be compared to the performance of identical wasteforms in saturated leach tests.

The information contained in this article was developed during the course of work under Contract No. DE-AC09-76SR00001 with the U. S. Department of Energy.

EVALUATION OF THE PERFORMANCE OF SOLIDIFIED COMMERCIAL LOW-LEVEL WASTES IN AN ARID CLIMATE

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ABSTRACT

Shallow land burial is being used as a disposal method for commercial low-level waste at waste disposal sites in arid (Hanford, Washington) and humid (Barnwell, South Carolina) climatic regions. A field lysimeter facility has been established at Hanford in which to conduct waste-form leaching tests. The primary objective of this research is to determine typical source terms generated by commercial solidified low-level wastes. The field lysimeter facility consists of 10, 3 M deep by 1.8 M diameter, closed-bottomed lysimeters around a central 4 M deep by 4 M diameter instrument caisson. Commercial cement and dow polymer waste samples were removed from 210 L drums and placed in the 1.8 M diameter lysimeters. Two bitumen samples are planned to be emplaced in the facility this year. The central caisson provides access to the instrumentation in the individual lysimeters and allows selective sampling of the soil and waste forms. Suction candles (ceramic cups) placed around the waste will be used to periodically collect soil water samples for chemical analysis. Meteorological data, moisture content, and soil temperature are being automatically monitored at the facility. Characterization of the soils and waste forms have been partially completed. These data consist of moisture release characteristics, particle size distribution, concentrations and distributions of radionuclides in the waste streams, and concentrations of hydrophilic organic species in one of the waste streams.

WASTE FORM DEVELOPMENT/TEST

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Low-density polyethylene and a modified sulfur cement have been selected for further study as new potential solidification agents for LLW streams including dry evaporator concentrates, incinerator ash and ion exchange resins. These binder materials are thermoplastic and are processed by use of a screw-type extruder or an air-powered dual action mixer. The studies have utilized "bench scale" systems with sufficient capacity to enable reliable determination of the effects of processing parameters such as temperature requirements, feed rates, mixing methods, waste pretreatment and solidification kinetics. Maximum waste loadings have been obtained for polyethylene by use of the screw extruder under controlled conditions. The modified sulfur cement system is processed more effectively by the dual action mixer due to its very low melt viscosity. Simulated waste forms produced using acceptable formulations, are being tested to develop a data base of relevant waste form properties. Several tests underway include immersion, leaching, compressive strength and thermal stability.

PROPERTIES OF RADIOACTIVE WASTES AND WASTE CONTAINERS*

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ABSTRACT

Major tasks in this NRC sponsored program include (1) an evaluation of the acceptability of low-level solidified wastes with respect to minimizing radionuclide releases after burial, and (2) an assessment of the influence of pertinent environmental stresses on the performance of high-integrity radwaste container (HIC) materials.

The waste form performance task studies have been performed on small-scale laboratory specimens to predict and extrapolate: (1) leachability for extended time periods; (2) leach behavior of full-size forms; (3) performance of waste forms under realistic leach conditions; and (4) leachability of solidified reactor wastes. The results show that leach data derived from testing of small-scale specimens can be extrapolated to estimate leachability of a full-scale specimen and that radionuclide release data derived from testing of simulants can be employed to predict the release behavior of reactor wastes. Leaching under partially saturated conditions exhibits lower releases of radionuclides than those observed under the conventional IAEA-type or ANS 16.1 leach tests.

The HIC assessment task includes the characterization of mechanical properties of Marlex CL-100, a candidate radwaste high density polyethylene material. Tensile strength and creep rupture tests have been carried out to determine the influence of specific waste constituents as well as gamma irradiation on material performance. Emphasis in on-going tests is being placed on studying creep rupture while the specimens are in contact with a variety of chemicals including radiolytic by-products of irradiated resin wastes.

*Work carried out under the auspices of the U. S. Nuclear Regulatory Commission.

EVALUATION OF A JOULE-HEATED GLASS FURNACE FOR WASTE PROCESSING FINAL REPORT

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ABSTRACT

The experimental phase of the evaluation of a joule-heated glass furnace has been completed. This evaluation focused on the major concerns of the nuclear power industry in order to determine the feasibility of using this system for the complete handling of low-level power plant wastes. Areas singled out as critical concerns for waste management include thermal processing capabilities, radioisotope capture and containment, final product acceptability, material and component performance, and economics. The final conclusion of this study is that, although the glass furnace can handle an extremely wide variety of wastetypes, its optimum use would be for waste streams with high percentages of contaminated sludges, wet resins, and other aqueous wastes.

LOW-LEVEL NITRATE WASTE PROCESS DEVELOPMENT

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A. J. Johnson

Program Manager: J. J. Blakeslee

Rockwell International
Energy Systems Group
Rocky Flats Plant

ABSTRACT

Thermal and chemical methods for denitrification of nitrate wastes were investigated. Experiments were conducted using a high temperature fluid wall reactor to determine the nitrate/nitrite destruction efficiency on simulated Rocky Flats Plant and Savannah River Plant waste streams. These streams included nitrate contaminated soils and surrogate fission product containing feeds. Various additives were tested to enhance nitrate destruction, reduce NO_x off-gas generation, and produce an acceptable final waste form. In addition, testing was completed with actual Rocky Flats Plant nitrate wastes on an aqueous process consisting of formic and sulfuric acid reflux, followed by evaporation of the liquid to dryness. Experimental results are discussed and conclusions are presented on both the thermal and the aqueous processes. An update of an earlier survey on nitrate waste generation and inventories at DOE facilities is also provided.

ANAEROBIC DIGESTION OF CELLULOSIC WASTES

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ABSTRACT

Anaerobic digestion is a potentially attractive technology for volume reduction of cellulosic wastes. A substantial fraction of the waste is converted to off-gas (carbon dioxide and methane) and a relatively small volume of biologically stabilized sludge is produced. Process development work is underway using a 75-L digester to verify rates and conversions obtained previously at the bench scale, to develop start-up and operating procedures, and to generate effluent for characterization and disposal studies.

Three runs using batch and batch-fed conditions have been made using simulated wastes. Solids solubilization and gas production rates and total solids destruction have met or exceeded the target values of 0.6 g cellulose per L of reactor per day, 0.5 L off-gas per L of reactor per day, and 80% destruction of solids, respectively. Successful start-up procedures have been developed, and preliminary effluent characterization and disposal studies have been done. A simple dynamic process model has been constructed to aid in further process development and for use in process monitoring and control of a large-scale digester.

BIOLOGICAL DENITRIFICATION OF NITRATE WASTES

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Waste Management Technology Department
Development Division
Oak Ridge Y-12 Plant*
Martin Marietta Energy Systems, Inc.

ABSTRACT

Enriched uranium wastes are purified in the Y-12 Plant, and the uranium product is recycled. One purification method involves dissolving the waste in nitric acid followed by solvent extraction to recover uranium. The process generates nitrate waste solutions which must be discarded. For many years, these wastes were stored in unlined ponds. In 1976 a recycle process was installed, and about half of the wastes were recovered and reused. A biological process (stirred tank) was installed, and the remaining nitrate wastes were biologically decomposed to produce nitrogen gas. Some additional nitrate wastes, generated in other parts of the plant, continued to be placed in the open ponds which must now be decommissioned. In 1983 an in-situ biological process was developed and tested whereby the open ponds were successfully biologically treated. This paper describes the results of the stirred tank and the in-situ pond treatment processes used in the plant to decompose nitrate ions.

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* Operated for the U. S. Department of Energy by Martin Marietta Energy Systems, Inc., under Contract Number DE-AC05-84OR21400.

PROCESSING AND PACKAGING OF MOUND'S TRITIUM CONTAMINATED WASTE

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ABSTRACT

The origin, type, contamination level and packaging of tritium-containing waste generated at Mound are described. The waste originates in a wide variety of laboratory operations, process systems and effluent reduction systems. Three major packaging systems are used for three broad classifications of waste based on the tritium content. Mound's waste ranges from 1 mCi to 25,000 Ci per 55-gallon drum. These packages are described along with the procedures used to load and check the containers.

Development efforts related to tritium waste management are briefly described. These include volume reduction by incineration and a technique to decontaminate aqueous waste with recovery of the tritium.

Session III.

ENVIRONMENTAL ASPECTS AND PERFORMANCE PREDICTION

Chairman: J. N. Fischer
U.S. Geological Survey

TRANSPORT ASSESSMENT - ARID: MEASUREMENT AND PREDICTION OF WATER MOVEMENT BELOW THE ROOT ZONE

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ABSTRACT

The amount of water transported below the root-zone and available for drainage (recharge) must be known in order to quantify the potential for leaching at low-level waste sites. Under arid site conditions, we quantified drainage by using weighing lysimeters containing sandy soil and measured 6 and 11 cm of drainage for a 1-yr period (June 1983-May 1984) from grass-covered and bare-soil surfaces, respectively. Precipitation during this period at our test site in Richland, Washington, was 25 cm. Similar drainage values were estimated from neutron probe measurements of water content profile changes in an adjacent grass-covered site. These data suggest that significant amounts of drainage can occur at arid sites when soils are coarse textured and precipitation occurs during fall and winter months. Model simulations predicted drainage values comparable to those measured with our weighing lysimeters. Long-term, 500- to 1000-yr predictions of leaching are possible with our model simulations. However, additional studies are needed to evaluate the effect of soil variability and stochastic rainfall inputs on drainage estimates, particularly for arid sites.

This work was supported by the U.S. Department of Energy under contract DE-AC06-76RLO 1830. The Pacific Northwest Laboratory is operated for the U.S. Department of Energy by Battelle Memorial Institute.

INSTALLATION AND INSTRUMENTATION OF A TEST-TRENCH FACILITY IN THE UNSATURATED ZONE AT THE IDAHO NATIONAL ENGINEERING LABORATORY

Barney D. Lewis
U.S. Geological Survey

ABSTRACT

Two simulated waste trenches have been constructed just north of the Radioactive Waste Management Complex (RWMC) at the Idaho National Engineering Laboratory. Sections of culvert occupy part of these trenches and are accessible through vertical caissons. These structures therefore allow personnel access for installing instrumentation, maintenance, and observation. Instrumented simulated waste containers will occupy the remainder of the trenches, in order that soil-moisture migration may be observed in relation to waste container forms.

The installation will be used to determine, under actual and simulated conditions at a shallow land-burial site in an arid environment, typical soil-moisture content, unsaturated hydraulic conductivity, matric potential, soil-moisture flux, and soil-moisture velocity. The information will be collected using instrumentation located in disturbed and undisturbed soils, simulated waste containers, and the underlying basalt layer. Therefore, data collected from the facility will (a) help characterize the hydrogeologic and geochemical properties of the surficial sediments, (b) contribute to understanding the hydrogeologic phenomena associated with buried waste (including leachate formation and radionuclide migration), (c) provide information on water and solute movement at the sediment/basalt interface, and (d) be used in a radionuclide migration model.

RUNOFF, SEDIMENT TRANSPORT, AND LANDFORM MODIFICATIONS NEAR SHEFFIELD, ILLINOIS

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ABSTRACT

Relations among precipitation, runoff, sediment transport, and landform modifications are being evaluated at an 8.1-hectare, low-level radioactive-waste disposal site near Sheffield, Ill. Rainfall, runoff, and sediment discharge are measured in three basins comprising two-thirds of the site area and in a 1.10-hectare basin in undisturbed terrain 0.5 kilometer south of the site. The effects of slope, land use, and the physical characteristics of surficial material on runoff and sediment transport are evaluated at four 0.001-hectare plots--two on site and two on the undisturbed watershed. Preliminary results indicate that 890 millimeters of precipitation from July 1, 1982, through June 30, 1983, produced 230 millimeters of runoff from the site, compared to 50 millimeters of runoff from the undisturbed basin. Storm-sediment yields from the site consistently exceed yields from the undisturbed area. Runoff and sediment yields from burial-trench covers are consistently lower than yields from the site. Over 110 collapse holes were documented at the site from December 1978 through December 1982. More than 70 percent of these collapses formed along the periphery of trenches.

AN UPDATE ON STATUS OF EPA'S PRESTO METHODOLOGY FOR ESTIMATING RISKS FROM DISPOSAL OF LLW AND BRC WASTES

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Cheng Y. Hung and Philip A. Cuny, EPA
Fidel Parraga, ISI

ABSTRACT

EPA developed the PRESTO methodology and computer codes to estimate health impacts to general populations and critical population groups from disposal of low-level and below regulatory concern wastes. These codes determine radionuclides released and their transport through multiple air and water pathways to the environment. Thereafter, they calculate potential health effects and genetic effects from these releases.

This paper describes subsequent modifications to the PRESTO codes including leaching, groundwater migration for unsaturated and arid conditions, modification of the calculation of basin residual effects, nuclide decay during operations, and waste container failure as a function of time. It also briefly describes the four authorized versions of the PRESTO code: PRESTO-POP for general population effects from shallow disposal options, PRESTO-DEEP for general population effects from deep disposal options, PRESTO-CPG for critical population group annual dose effects, and PRESTO-BRC for general effects from certain disposal alternatives for below regulatory concern wastes. Representative calculations from each version are presented.

RADIOACTIVE GROUND-WATER CONTAMINATION FROM A COLD SCRAP RECOVERY OPERATION, WOOD RIVER JUNCTION, RHODE ISLAND

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U. S. Geological Survey, Water Resources Division

ABSTRACT

Liquid wastes from a uranium-bearing cold scrap recovery plant in southern Rhode Island were discharged to the environment through evaporation ponds from 1966-1980. Leakage from the polyethylene- and polyvinylchloride-lined ponds resulted in a plume of contaminated ground water that extends from the ponds to the Pawcatuck River through a highly permeable sand and gravel aquifer.

Water quality data from more than 100 observation wells indicate that the plume of contamination is approximately 2300 feet long, 300 feet wide, and is confined to the upper 80 feet of saturated thickness. Piezometric-head and water quality data from wells screened at multiple depths on both sides of the river indicate that contaminants discharge both to the river and to a swampy area at the west edge of the river. Dilution precludes detection of contaminants once they have entered the river.

Strontium 90, technetium 99, boron, nitrate, and potassium exceed background concentrations by an order of magnitude in much of the plume. Concentrations of gross beta emitters range from 5 to 500 picoCuries per liter. No gamma emitters above detection levels have been found. Laboratory tests of exchangeable cations indicate little capacity for uptake on the course sediments. In the swamp, however, reducing conditions may promote observable solute interaction with sediments or organic material.

METHODS FOR DETERMINING THE TRANSPORT OF RADIOACTIVE GASES IN THE UNSATURATED ZONE

By R. G. Striegl
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ABSTRACT

Data are being collected at the low-level radioactive-waste disposal site near Sheffield, Illinois, to define mechanisms that control the transport of radioactive gases in the unsaturated zone. Spatial and temporal changes in concentrations of carbon-14 dioxide, tritiated water vapor, radon-222, and major component gases in the unsaturated-zone atmosphere are determined by analyses of samples collected from a network of gas piezometers located in undisturbed deposits adjacent to waste-disposal trenches.

Temperature and pneumatic pressure are automatically recorded at the land surface and at selected gas piezometers; soil-moisture data are recorded nearby. A two-dimensional finite-difference model of molecular diffusion through porous media is used to simulate movement of the gases.

COLORADO'S AUTOMATED MONITORING SYSTEM

L. Sloski
State of Colorado
Governor's Office Science Advisor

ABSTRACT

Not available for publication.

DOUBLE SAMPLING AS A COST-EFFECTIVE METHOD TO ESTIMATE MEAN OR TOTAL AMOUNTS OF RADIOACTIVITY

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ABSTRACT

In many field studies to determine the quantities of radioactivity at commercial low-level radioactive waste sites, preliminary appraisals are made with field radiation detectors, or other relatively inaccurate devices. More accurate determinations are subsequently made with procedures requiring chemical separations or other expensive analyses. Costs of these laboratory determinations are often large, so that adequate sampling may not be achieved due to budget limitations. In this paper, we propose double sampling as a way to combine the two approaches and to substantially reduce overall costs. The underlying theory was developed for human and agricultural surveys and is based on assumptions that are not appropriate for low level waste sites. Thus, extensive computer simulations were conducted to determine whether the results can be applied in circumstances of importance in managing commercial low-level radioactive waste sites. This paper gives a few simulation details, and concludes that the principal equations will be valid in some waste site applications. A few points will require further research, using actual low-level radioactive waste site data.

TREES AS INDICATORS OF SUBTERRANEAN MIGRATION OF TRITIUM FROM A SHALLOWLAND RADIOACTIVE WASTE DISPOSAL SITE

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Pacific Northwest Laboratory

ABSTRACT

Tritium analyses were made in water taken from the leaves and sap of deciduous trees growing around the Maxey Flats waste disposal site in eastern Kentucky. Tritium concentrations were measured in leaf water as great as 27,000,000 picocuries per liter and as low as 500 picocuries. A sample size of 90 trees indicated that only two trees had tritium concentrations of greater than 10,000,000 picocuries per liter in leaf water. These trees were located outside the boundaries of the exclusion zone but still within the boundaries of the waste disposal property. The source of elevated levels of tritium is subterranean water movement from waste disposal trenches located upslope from the trees.

VADOSE-ZONE INSTRUMENTATION IN COARSE ALLUVIAL DEPOSITS OF THE AMARGOSA DESERT NEAR BEATTY, NEVADA

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ABSTRACT

A vadose-zone monitoring shaft near Beatty, Nev., is 1.52 m in diameter and penetrates nearly 14 m of unsaturated fluvial sediments. These sediments are comprised of silty sand, coarse sandy gravel, and poorly cemented sand, with gravel and occasional cobbles and boulders. Thirty-three lateral ports at 11 levels between 3 and 13 m deep allow access to undisturbed sediments outside the vertical shaft. The prefabricated metal shaft was emplaced in a 2.44-m-diameter hole excavated by using a crane drill with bucket and flight augers.

Laboratory-calibrated thermocouple-psychrometers are being used to measure soil-matrix potential. A method of installing the psychrometers was developed which will allow their retrieval, after extended periods in the soil, for cleaning, recalibration, and reinstallation. Primary access holes 2.5 cm in diameter are drilled laterally outward from the monitoring shaft to a distance of approximately 4 m. The psychrometer is then inserted into the primary access hole and sealed into a smaller diameter boring in the undisturbed material at the outer end of the primary access hole.

Data are collected and stored by a programmable measurement-control and data-logger system powered by photovoltaic cells. Magnetic-tape data storage is used to back up daily data retrieval via telecommunication with the project headquarters in Carson City, Nev., 520 km north of the study site.

Workshop A.

PREDICTING SOURCE TERMS FOR LOW-LEVEL WASTE

Chairman: R. A. Shaw
Electric Power Research Institute

STATUS OF WASTE FORM TESTING

Harry Lawroski
Utility Nuclear Waste Management Group
Edison Electric Institute

ABSTRACT

The promulgation of the amendment of 10 CFR Part 61 by the Nuclear Regulatory Commission on December 27, 1982 by Federal Register Notice with an effective date of December 27, 1983 established the criteria for licensing requirements for new shallow land burial sites. Part of the new requirements, paragraph 60.56, contained the description to provide adequate stability of the site through the use of suitable waste forms. In May, 1983, the NRC published a final Branch Technical Position (BTP) paper on waste form. The position taken by the BTP was considerably more severe than indicated in 10 CFR Part 61. An extensive and expensive testing program was started in 1983. As an interim measure, the presently utilized solidification processes such as cement, Dow binder, Envirostone and bitumen, and the presently qualified High Integrity containers (HICs) were considered acceptable with the caveat that acceptable process control programs were being utilized. The NRC requested that topical reports for licenses be submitted. The topical reports were to contain test results to substantiate the acceptability of the waste forms. The test results to date show that the volume of wastes will have to increase to meet the position taken by the NRC in the BTP. This position will cause more waste to be generated which is contrary to the emphasis by states and others to reduce the volume of waste. The details of testing will be discussed in the paper to be presented.

NUCLIDE CORRELATION LIMITS

M. D. Naughton
Electric Power Research Institute

ABSTRACT

Not available for publication.

Workshop B.

PERFORMANCE ASSESSMENT FOR LOW-LEVEL DISPOSAL FACILITIES

Chairman: J. N. Fischer
U.S. Geological Survey

APPLICATION OF PATHWAYS ANALYSES FOR SITE PERFORMANCE PREDICTION FOR THE GAS CENTRIFUGE ENRICHMENT PLANT AND OAK RIDGE CENTRAL WASTE DISPOSAL FACILITY

Francois G. Pin
Oak Ridge National Laboratory

ABSTRACT

The suitability of two sites for shallow land burial of low-level radioactive waste is evaluated using pathways analyses. The analyses rely on conservative scenarios to describe the generation and migration of contamination and the potential human exposure to the waste. Conceptual and numerical models are developed using data from comprehensive laboratory and field investigations and are used to simulate the long-term transport of contamination to man. Conservatism is built into the analyses when assumptions concerning future events have to be made or when uncertainties concerning site or waste characteristics exist. Maximum potential doses to man are calculated and compared to the appropriate standards. The sites are found to provide adequate buffer to persons outside the DOE reservations. Conclusions concerning site capacity and site acceptability are drawn. In reaching these conclusions, some consideration is given to the uncertainties and conservatisms involved in the analyses. Analytical methods to quantitatively assess the sensitivity of the results to data uncertainty may prove useful in relaxing some of the conservatism built into the analyses. The applicability of such methods to pathways analyses is briefly discussed.

Workshop C.

APPROACHES TO LOW-LEVEL DISPOSAL FACILITY SITING AND CHARACTERIZATION

Chairman: E. A. Jennrich
EG&G Idaho

LOW-LEVEL SITING, EDGEMONT, SOUTH DAKOTA

Lloyd J. Andrews
Vice Chairman and Director, Chem-Nuclear Systems, Inc.

ABSTRACT

The siting of a low-level radwaste disposal facility and characterization activities to date, Edgemont, South Dakota. Using past and present experience setting forth the major problem as viewed by the author, the social and political considerations, community acceptance, media and public officials' attitudes, criteria for acceptance and significance of countywide vote in support of facility.

Characterization activities, site selection planning and criteria, above-grade and below-grade technical evaluation, NRC interface, 10 CFR Part 61 related to technical work, as well as community acceptance and license application. The paper deals with specific problems, solutions and ongoing activities.

CHARACTERIZATION PLAN FOR A LOW-LEVEL RADIOACTIVE WASTE DISPOSAL SITE IN TEXAS

Ruben A. Alvarado, P.E.
Texas Low-Level Radioactive Waste Disposal Authority

ABSTRACT

Since September 1982, the Texas Low-Level Radioactive Waste Disposal Authority has been aggressively pursuing a site for the shallow land burial of low-level radioactive wastes. In February 1983, the Authority started a site selection process which is intended to produce one suitable site. Following site selection, a three-phase site characterization program will commence. The first phase will evaluate techniques and procedures to quantify the parameters which must be evaluated. In Phase II, the techniques selected in Phase I will be used in an actual on-site characterization of the site. In the final phase, the results of the on-site work will be thoroughly analyzed. A report on the efficacy of the selected techniques will be prepared.

This program is being conducted in cooperation with the U.S. Department of Energy.