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SAND79-1239

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Retrieval of Canistered Experimental Waste at the Waste Isolation Pilot Plant

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SAND79-1239
Unlimited Release
Printed August 1979

Retrieval of Canistered Experimental
Waste at the Waste Isolation Pilot Plant

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Abstract

To assess the suitability of bedded salt for nuclear waste disposal, an extensive experimental program will be implemented at the Waste Isolation Pilot Plant. In order to evaluate experimental results, it will be necessary to recover certain of these experiments for postmortem examination and analysis. This document describes the equipment and procedures used to effect recovery of one category of WIPP experiments.

SOURCE

1. The purpose of this document is to describe the equipment and procedures used to effect recovery of one category of WIPP experiments.

2. The equipment used for the recovery of experiments is described in this document.

3. The procedures used for the recovery of experiments are described in this document.

4. The results of the recovery of experiments are described in this document.

5. The conclusions of the recovery of experiments are described in this document.

Acknowledgment

If the claim "A picture is worth a thousand words" is valid, I owe Dave Humphreys of the library 24,000 words equal to 24,000 words for the excellent information provided in this document.

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I. Introduction

To assess the suitability of casked salt for nuclear waste disposal, an extensive experimental program will be implemented at the Waste Isolation Pilot Plant. In order to evaluate experimental results, it will be necessary to recover certain of these experiments for posttest examination and analysis. This document describes the equipment and procedures used to effect recovery of one category of WIPP experiments.

The equipment and the operational procedures presented in this document are concepts, and it is expected that as the returns from a multitude of contributing experimental, analytical, and test programs are in, these concepts may change.

The methods proposed are specific to the WIPP experimental area and to casked experimental waste; extension of these designs and the outlined procedures to perform retrieval on other waste types, though feasible, is not addressed herein.

II. Design Bases

Certain constraints must be placed on the casked waste experimental system in order to maintain the feasibility of retrieval. Major constraints are:

1. Package sizes regardless of waste type shall not exceed 12.75 inches in diameter by six feet in length. These are maximums. Studies are being carried out to determine if these maximum dimensions can be reduced without jeopardizing experimental goals, e.g., will a six-foot canister compromise the experimental objectives?
2. Depth of burial at the time of emplacement shall not exceed eight feet to top of canister. Only six feet of crushed salt is needed for shielding purposes. Eight feet is used to allow rework of floor, if needed.
3. The total radioactive source dose rate of the waste canister at the time of emplacement shall not exceed that which would result from a canister filled with solidified high-level waste from a representative of ten-year-old spent power reactor fuel (assumed to have a loading of 11,000 mwd MTU).
4. As retrieved waste canisters in their final package configurations must be compatible with the handling systems outside the experimental area. Within the experimental area designs are unconstrained by outside systems; for example, in order to minimize hole depths, overpack can lengths, cask lengths, and room heights; different, lower profile handling appurtenances will be considered for the experimental waste canister.

III. The Retrieval Operation and Equipment

The following step-by-step procedure describes the retrieval operation for canistered experimental waste. The procedure is supported by equipment descriptions, comments on preparations, etc.

Step 1 Relocate Canister and Establish Orientation (Figure 1)

As a prelude to this operation, it may be necessary, due to ground motion induced floor heave, to remachine the drift floor to provide a level, smooth roadway for equipment. In addition to floor work it may be necessary, depending upon the original room size and postmining creep closure, to raise the back of the drift over the retrieval site to provide clearance for equipment.

The "in-the-ballpark" relocation of a canister will be accomplished by conventional survey techniques, which are sufficient to reestablish the original canister location. When the original location is pinpointed, the actual location and orientation of the canister will be determined by use of ground penetrating radar. (Note: Trial tests conducted with a ground-penetrating radar system prove that this is a workable technique.)

Step 2 Install Retrieval Manifold (Figure 2)

The retrieval manifold and its relationship to the retrieval system is shown in Figure 3; it is shown in greater detail in

RELOCATE CANISTER AND
ESTABLISH ORIENTATION

FIGURE 1

RETRIEVAL MANIFOLD, INSTALL CONCENTRIC
AND PERPENDICULAR TO CANISTER CENTER-
LINE. GROUT AND BOLT IN PLACE.

INSTALL RETRIEVAL MANIFOLD

FIGURE 2

FIGURE 3

Figures 4, 5, and 6. It serves three basic functions in the retrieval operation. These are:

- a. It provides a rigid, well-fitted containment structure for the retrieval cask;
- b. It serves as a collector for the radioactive dust settling; and
- c. It provides a shielded radiation zone for the operator and equipment throughout the retrieval operation.

This item must be installed concentric with the pipe, aligned to the centerline of the cask connector. When it is correctly aligned, it must be grouted and bolted on that alignment which is indicated.

Step 2 - Position retrieval cask on retrieval machine and connect dustings collector (Figure 7).

This step involves a number of hardware items, namely:

The Cask Transporter - The transporter, shown on Figures 8 and 9 is built on the chassis of a commercially available forklift. The significant modifications necessary to adapt the forklift to this task are the addition of: 1) a cask yaw positioning bearing load carriage, 2) a shielded cab, 3) a cab environmental control and

RETRIEVAL MANIFOLD

FIGURE 4

FIGURE 5

FIGURE 6

POSITION RETRIEVAL CASK* ON RETRIEVAL
MANIFOLD THEN CONNECT CUTTINGS COLLECTOR

FIGURE 7

FIGURE 8

CASK TRANSPORTER

CASK TRANSPORTER

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FIGURE 9

The following is a summary of the information received from the
 following sources: (1) the results of the experiments
 conducted at the University of California, San Diego, and
 (2) the results of the experiments conducted at the University
 of California, Los Angeles. The results of the experiments
 conducted at the University of California, San Diego, are
 summarized in the following table:

The "Universal Drill" is the "Universal Drill" shown on Figure 1 and 2 with a seat on the top end of the vertical shaft. This drill provides the driving torque and the thrust required for all vertical associated drilling operations. The drill is hydraulically driven and is fed by the auxiliary hydraulic power source on the derrick transporter.

The Uncontaminated Cuttings Collector - Figure 11 shows this device. It is simply a dust and cuttings collector designed to

RETRIEVAL DRILL

FIGURE 10

FIGURE 11

UNCONTAMINATED CUTTINGS COLLECTOR

collect the cuttings generated by all experimental area drilling operations which do not involve radioactive material.

Prior to placing the retrieval cask onto the retrieval manifold, a small diameter core hole will be drilled concentric with the center centerline. This hole will extend to desired depth and will provide information to establish the location when radioactive material will be encountered above the cask. This small core hole will be drilled using a remotely operated experimental sampling tool, not described in this document.

Step 4: Drill to within four inches of the bottom (Figure 12).

For this operation the retrieval drill, equipped with a full-sized reaming bit, will be used. The bit size will expand when it exits the lower end of the retrieval cask so that the hole size will be of sufficient diameter to clear the overcore barrel used in the next step.

Step 5: Reconfigure drill system to overcore canister, perform overcoring operation (Figure 13).

This step involves the following additional items of equipment.

An Overcore Barrel - This item is shown in its relationship to the remainder of the retrieval system on Figure 3. Additional details of the overcore barrel are shown on Figures 14, 15, 16, and 17.

DRILL TO WITHIN 4 INCHES OF TOP OF CANISTER

FIGURE 12

RETRACT FULL FACE DRILL. CLOSE SHIELD VALVE ON RETRIEVAL MANIFOLD. RAISE CASK. ROTATE AND RETOOL WITH OVERCORE DRILL. REPLACE CASK ON RETRIEVAL MANIFOLD AND RECONNECT THE CONTAMINATED CUTTINGS COLLECTOR. COMMENCE OVERCORING OPERATION.

FIGURE 13

FIGURE 14

DETAIL 1

DETAIL 2

DETAIL 3

A Contaminated Cuttings Collector - The contaminated cuttings collector is shown on Figure 18. The collector is comprised of three types of air cleaners in series. The first cleaner is a centrifugal separator which will remove the bulk of the dust and cuttings generated by the milling operation. Following the centrifugal separator will be a bag-type filter. Behind the bag-type filter will be a second series of medium through high efficiency paper filters. The dust generated by the centrifugal separator is collected in a paper sack which is an integral part of the collection.

The overcoring operation is next explained by examining in sequential detail the function of the overcore barrel as overcoring is accomplished. The overcoring initially proceeds as a common coring operation until a depth slightly beyond the bottom of the canister is reached (see Figure 19). At this point, the special features of the overcore barrel come into play. First, the advance of the overcore barrel is halted but rotation is continued. Activation pressure (125 psig) is applied through the center conductor of the coaxial drill stem to the head end of the sleeve portion of the overcore barrel. The actuation pressure forces the sleeve to advance. As the sleeve advances, its cutting tips are deflected inward by the radius on the inside surface of the barrel cutting head. This results in the sleeve end cutters undercutting the canister. Figure 20 and 21 reflect the results of the operation described to this point. After undercutting is complete, the sleeve

CONTAMINATED CUTTINGS COLLECTOR

FIGURE 19

CORE TO POINT BEYOND CANISTER BASE

FIGURE 19

STOP BARREL ADVANCE, CONTINUE TURNING,
APPLY ACTUATION PRESSURE
TO ADVANCE SLEEVE

FIGURE 20

AFTER SLEEVE HAS ADVANCED TO POINT
SHOWN, RELEASE ACTUATION PRESSURE

FIGURE 21

RETRACT SLEEVE INTO BARREL

FIGURE 22

SECTION A-A

FIGURE 23

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