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CHARACTERIZATION OF MIXED CH-TRU WASTE AT ARGONNE-WEST (A WIPP PROJECT UPDATE)

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ABSTRACT

Argonne National Laboratory is participating in the Department of Energy's Waste Isolation Pilot Plant (WIPP) Experimental Test Program by characterizing and repackaging mixed contact-handled transuranic waste. Argonne's initial activities in the Program were described last year at Waste Management '92. Since then, additional waste has been characterized and repackaged, resulting in six bins ready for shipment to WIPP upon the initiation of the bin tests. Lessons learned from these operations are being factored into the design and installation of a new characterization facility, the Enhanced Waste Characterization Facility (EWCF). The objectives of the WIPP Experimental Test Program have also undergone change since last year, leading to an accelerated effort to factor sludge sampling capability into the EWCF. Consequently, the initiation of non-sludge operations in the waste characterization chamber has been delayed to Summer 1993 while the sludge sampling modifications are incorporated into the facility. Benefits in operational flexibility, effectiveness, and efficiency and reductions in potential facility and personnel contamination and exposure are expected from the enhanced waste characterization facility within the Hot Fuel Examination Facility at Argonne-West.

DISCLAIMER

INTRODUCTION

Argonne National Laboratory (ANL) is participating in the Department of Energy's (DOE) Waste Isolation Pilot Plant (WIPP) Experimental Test Program by characterizing and repackaging mixed contact-handled transuranic waste. Argonne's initial activities in the Program were described last year at Waste Management '92.[1] Since then, additional waste has been characterized and repackaged, resulting in six bins ready for shipment to WIPP upon the initiation of the bin tests. An analysis of actual operational parameters such as time required for visual examination and number of smears taken per drum provided design, procedural, and scheduling input. Lessons learned are being factored into the design and installation of the Enhanced Waste Characterization Facility (EWCF) within the Hot Fuel Examination Facility (HFEF) at Argonne-West. The objectives of the WIPP Experimental Test Program[2] have also undergone change since last year, leading to an accelerated effort to factor sludge sampling capability into the waste characterization chamber. Consequently, the initiation of non-sludge operations in the waste characterization chamber has been delayed to Summer 1993 while the sludge sampling modifications are incorporated into the facility. This paper summarizes results and lessons learned from recent characterization and repackaging efforts and future plans for characterization. It also describes design features and status of the EWCF.

BACKGROUND

Argonne National Laboratory and EG&G Idaho, at the Idaho National Engineering Laboratory, were chosen by the Department of Energy's Office of Environmental Restoration and Waste Management in 1990 to participate in the WIPP Experimental Test Program. The activities include characterization and repackaging of mixed contact-handled transuranic waste for eventual shipment to WIPP. Characterization first entails certification to the WIPP Waste Acceptance Criteria[3] (WAC) via real time radiography, fissile assay, and container integrity inspections which are conducted at EG&G Idaho's Stored Waste Examination Pilot Plant (SWEPP). Then waste is shipped in the TRUPACT-II approximately 20 miles to ANL where it is gas sampled, visually examined, categorized, weighed, and repackaged from 55-gallon metal drums to instrumented test bins, each of which holds up to six drum volume-equivalents of waste. Following these operations at ANL, the loaded bins are shipped back to the SWEPP in the TRUPACT-II where they await shipment to WIPP.

Characterization takes place within the HFEF at ANL. Currently, the hot repair area and the spray chamber within HFEF are being used. A new area within HFEF is being developed which will decrease the potential for alpha contamination spread and greatly increase characterization capabilities and throughput. At the heart of the new area is a waste characterization chamber (WCC), with ancillary areas including the preparation room, transfer room, operating corridor, east and west mezzanines, and health physics room. These together make up the EWCF. Design features and layouts are presented in a later section of this paper.

RESULTS AND LESSONS LEARNED

Six bins of waste have been loaded to date in the HFEF spray chamber, and a seventh is underway. Table I summarizes pertinent information for the six loaded bins, including waste description, fissile quantities, dose rates, waste category weights, characterization time, number of gas samples collected, and concentrations of target analytes. Bin 7 will be loaded with the same types of waste as Bin 6. Through bin 6, waste from five different TRUCON [4] codes was handled. For the drums handled to date, none have come close to the WIPP WAC limits for fissile loading or surface dose of 200 grams or 200 mrem/hr, respectively, as seen from the data in Table I. Characterization times ranged from fifteen to fifty-one working days. Numerous inner packages within a drum, high alpha contamination levels, and the inherent cumbersome nature of master-slave operations associated with the spray chamber (deliberately undertaken in order to begin characterization in the shortest possible time) account for the longer characterization periods. An analysis of actual operational parameters in the characterization process was compiled to aid in improving equipment and procedures to be be used in the EWCF and in estimating long-term characterization schedules. Table II summarizes the data obtained from the analysis.

{ INSERT TABLES I AND II HERE }

Note from Table II the large number of smears taken during the bin loading process. Contamination control is a key factor in container handling and characterization activities at HFEF. This topic is specifically addressed in another Waste Management '93 paper, "Radiological Control Aspects of WIPP Waste Characterization Operations at ANL-W." [5] Much of the visual examination time span is consumed with the transfer of smears out of the spray chamber to the counting area in HFEF and the smear counting time. Therefore, efficiencies in this area are being factored into the EWCF, addressed in the next section.

ENHANCED WASTE CHARACTERIZATION FACILITY

The EWCF is being installed in the HFEF to replace current characterization operations taking place in the hot repair area and spray chamber. Figures 1 and 2 are isometric and plan views, respectfully, of the EWCF. At the heart of the EWCF is the WCC; it is constructed of one and two thicknesses of 0.475cm (7 guage) stainless steel sheet metal welded to a square structural steel frame, measuring approximately 4.9m x 2.4m x 2.4m. The footprint of the EWCF is approximately 157 m^2. Four large viewing windows made of safety and leaded glass laminated with Lexan™ are located on the front face of the WCC. Each of the viewing windows contains two gloveports. Heavy lifting and material transfers between the drums and bins will be accomplished with two Schilling robotic arms. Each arm has a lifting capacity of 113 kg. For heavier items, an internal jib crane (680-kg capacity) will be used. These features can be seen in Figure 3, a photo of the operating side of the WCC. Master slave manipulators are also being considered for the WCC due to their versatility in delicate operations. The floor of the WCC has two drum ports and one bin port. Primary confinement between the waste containers and the WCC will be maintained during waste transfers via polyethylene bags. When containers are ready to be disconnected from the WCC, the plastic bags are sealed using a radio-frequency heat sealer. The back face of the WCC has windows through which large video monitors

are mounted. Several high-resolution video cameras are mounted inside and on top of the WCC, providing viewing from all angles. The WCC is HEPA-filtered on both the inlet and outlet ventilation streams. Charcoal absorption is also provided for volatile organic compounds on the outlet stream. A gas sampling system is similar to the one used currently in the hot repair area, however, the WCC gas sampling system will decrease sampling times and be more automated. A smear counting station is will be located inside the WCC. By not having to transfer smears outside the WCC for counting, a great deal of time will be saved making the characterization operations more efficient.

{ INSERT FIGURE 1 HERE }
FIGURE 1
PLAN VIEW OF ENHANCED WASTE CHARACTERIZATION FACILITY

{ INSERT FIGURE 2 HERE }
FIGURE 2
ISOMETRIC VIEW OF ENHANCED WASTE CHARACTERIZATION FACILITY

{ INSERT FIGURE 3 HERE }
FIGURE 3
PHOTO OF WASTE CHARACTERIZATION CHAMBER

Another important feature of the EWCF is the sampling scheme for sludge waste, defined as solidified organic waste, solidified inorganic waste, and waste water treatment sludge. The sampling scheme utilizes a coring machine located on the roof of the hot repair area. The drill string will protrude vertically down into the WCC directly over one of the drum ports. Core samples will be collected from the drum connected to the sampling port. Augers, split spoons, and/or shelby tubes may be used on the drill string. The core samples will then be decoupled from the drill string and prepared to send to the analytical laboratory which will perform the sludge analyses. Sample preparation will be done in a glovebox adjacent to the WCC, located probably on the east mezzanine. The design for this glovebox is still underway; desirable features include the ability to transfer samples directly into the transfer room. Another feature still under consideration is maintenance of manipulators--both the robotic arms and master-slave manipulators if they are added. Due to the hydraulic fluids used with the robotic arms, it is desirable to perform repairs when necessary in an atmosphere separate from the WCC and sample preparation glovebox to avoid cross contamination of volatile organic compounds. Therefore, a separate repair glovebox is being designed which will probably be located on the hot repair area roof adjacent the the coring machine. The repair glovebox will have a direct transfer path from the WCC to minimize transfer of contaminated equipment throughout HFEF. Some advanced features, such as package real-time radiography and on-line gas sample analyses will be considered next year for incorporation into the EWCF.

Besides the WCC, the EWCF contains a preparation room, transfer room, and operations room. The preparation room is designed to store empty and loaded drums and bins both before and after characterization. It is equipped with a jib crane to facilitate container movement. A complete TRUPACT-II payload can be assembled and disassembled in the preparation room. Drums and bins are placed on transfer

carts in the preparation room and then guided on the carts to the transfer room. The transfer room is designed as part of the WCC secondary confinement zone, where waste containers are interfaced via a bagging scheme to the WCC. A small crane is located in the transfer room to facilitate bin lid placement. The gas sampling system equipment is also located in the transfer room. Characterization operations will be performed from the operations room located adjacent to the WCC on the north side. The operations room houses the controls for the robotic arms, gas sampling system, sludge coring machine, and video and data acquisition system. The east and west mezzanines are also part of the operations area. The EWCF also includes areas for health physics instrumentation,and personnel decontamination, step-down, and change areas. Figures 1 and 2 depict these features.

The transfer room and WCC are licensed as one unit of HFEF's Resource and Conservation Recovery Act (RCRA) storage facility; the preparation room is licensed as another unit. The design features in these areas include provisions for RCRA compliance, such as secondary containment of waste containers. The EWCF in general is designed to DOE's General Design Criteria for Radioactive Solid Waste Storage Facilities, DOE Order 6430.1A, Section 1324.

FUTURE PLANS

The current WIPP program schedule calls for completion of the WCC and readiness for startup of operations by the Summer of 1993. Characterization will continue in the hot repair area and spray chamber until the WCC becomes operational. The revised scope of the test program calls for one more bin to be loaded before sludge waste is characterized. Other activities being conducted by Sandia National Laboratories, Westinghouse-Waste Isolation Division, and Los Alamos National Laboratory, such as design of new bin hardware to accommodate sludge waste and development of analytical methods for sludge analysis, constrain the start of sludge characterization. Therefore, sludge sampling at Argonne may not commence until 1994. Until then, the WCC will be used to characterize non-sludge waste. The characterization activities at ANL have confirmed process knowledge and non-destructive examinations conducted at the SWEPP. Six bins are currently loaded and ready for shipment to WIPP whenever the facility can be opened to initiate its test phase.

ACKNOWLEDGEMENT

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REFERENCES

1. C. C. Dwight, G. C. McClellan, K. P. Guay, J. C. Courtney, and M. J. Duff, "Characterization of Mixed CH-TRU Waste for the WIPP Experimental Test Program Conducted at ANL," Proceedings of the Symposium on Waste Management, "Waste Management '92," Volume 2,Tucson, AZ (March 1-5, 1992).

2. US DOE, "Gas Generation and Source-Term Programs: Technical Needs Assessment for the WIPP Test Phase," DOE/WPIO/001-92, Revision 0, (December 1992).

3. Westinghouse Electric Corporation, "Waste Acceptance Criteria for the WIPP," US DOE, WIPP/DOE-069, Rev. 4 (December 1991).

4. US DOE, "TRUPACT-II Content Codes (TRUCON)," Rev. 3, DOE/WIPP 89-004, Waste Isolation Pilot Plant, Carlsbad, NM (July 1989).

5. J. C. Courtney, K. P. Guay, and C. C. Dwight, "Radiological Control Aspects of WIPP Waste Characterization Operations at ANL-W," Waste Management '93, Tucson, AZ (February 28 - March 4, 1993).

TABLE I
CHARACTERIZATION SUMMARY

BIN NO.	1	2	3	4	5	6
TRUCON Code(s)	218	218	218	217	217	216 219 223
Waste Description	Raschig Rings	Glass Labware	Raschig Rings and Glass Labware	Metals	Metals	Combustibles Filters Leaded Rub.
Highest Drum Fissile Loading (g)	4.2	52.7	4.0	4.3	9.2	2.5
Total Bin Fissile Loading (g)	10.6	73.5	10.0	9.5	14.0	9.3
Highest Drum Surface Dose Rate (mrem/hr)	0.7	12	0.5	1.5	3	1.5
No. of Drums in Bin	5	4	4	5	5	5
Approximate Waste Weight (kg)						
Plastics	10	31	18	21	23	Data undergoing validation.
Inorganic Solids	250	220	132	8	7	
Cellulosics	7	3	6	1	6	
Corroding Metals	14	5	11	136	191	
Non-corroding Metals	0	0	0	8	39	
Other	0	0	0	4	9	
TOTAL	281	259	167	179	281	
Characterization Time (working days)	16	43	15	36	51	59
Number of Gas Samples Taken (Excluding Bin Headspace at RWMC)	47	34	46	47	50	53
Highest Gas Sample Concentration for Bin (Volume %)						
Carbon Tetrachloride	1.32E-04	1.10E-04	0.0002	8.20E-5	0.0020	Data undergoing validation.
Methylene Chloride	0.0045	0.0038	0.0058	0.0045	0.0041	
1,1,1-Trichloroethane	0.0594	0.0185	0.1190	0.0650	0.0061	
Trichloroethylene	2.20E-04	0.0016	0.0048	7.70E-4	0.0429	
1,1,2-Trichloro-1,2,2-Trifluoroethane	1.53E-04	1.30E-4	0.0003	2.30E-4	0.0015	
Hydrogen	0.0330	0.1050	<0.0150*	0.1310	0.1160	
Methane	0.1080	0.1030	<0.0150*	0.0990	0.1010	

* Minimum Detection Limit

TABLE II
OPERATIONAL PARAMETERS SUMMARY

PARAMETER	5-BIN AVERAGE
Number of drums/bin	4.6
Number of gas samples/bin	46
Number of inner containers/bin	99
Avg. number of inner containers/drum	22
Characterization Time Span (working days from start of gas sampling through completion of visual examination)	32
Characterization Time Span Breakdown (working days)	
Gas Sampling	2.4
Visual Examination	29.4
Visual Examination Time Span Breakdown (% of working days)	
Actual characterization of waste	62%
Facility/equipment decontamination	20%
Technique/tool development and equipment repair	18%
Total Smears Analyzed per Bin Cycle	507
Transfers into facility	22%
Characterization and decontamination during visual exam time span	59%
Transfers out of facility and decontamination after visual exam time span	19%
Percentage of Visual Examination Time Span During Which Smears Were Taken	82%

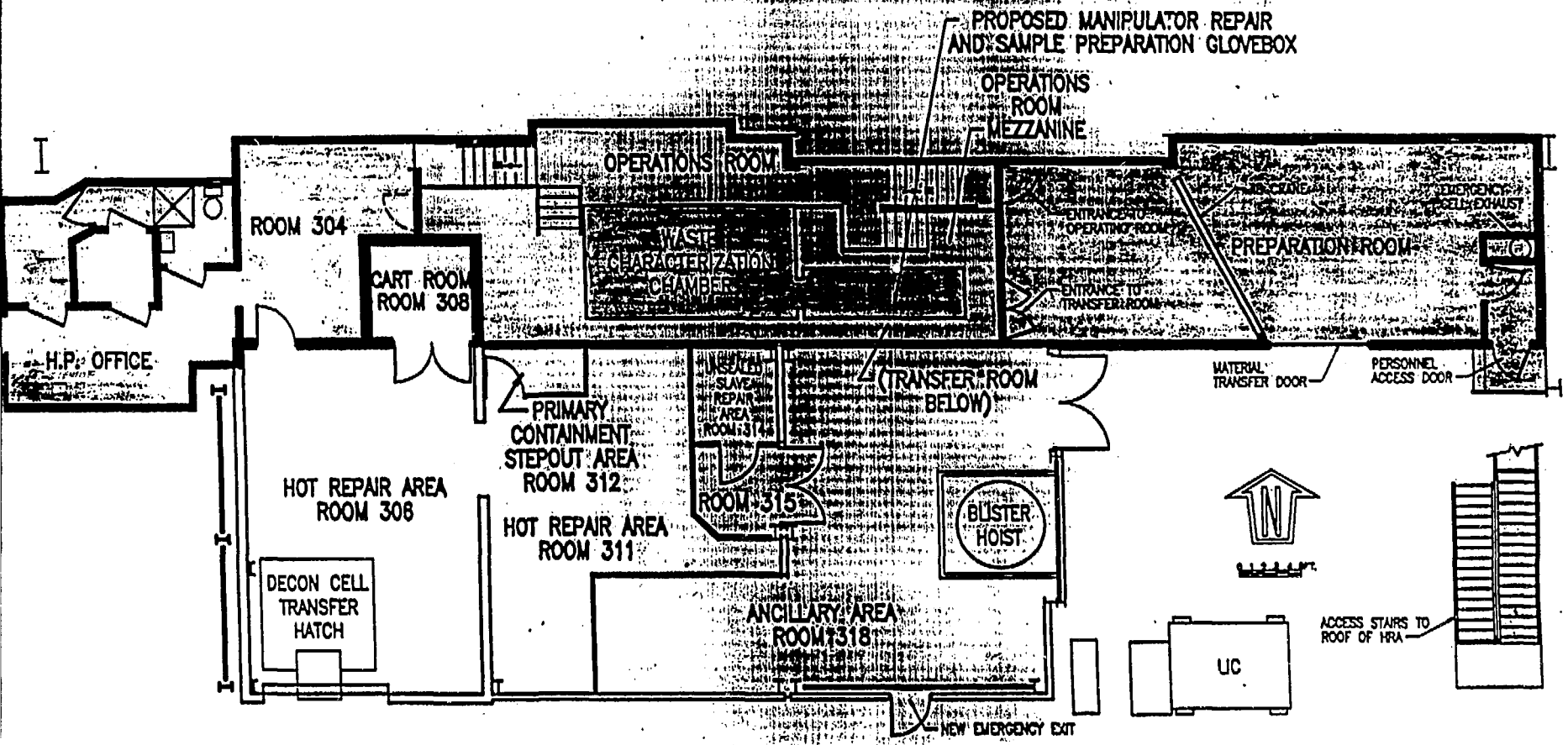

FIG. 1

PLAN VIEW OF WIPP WCC AND ANCILLARY AREAS IN HFEF

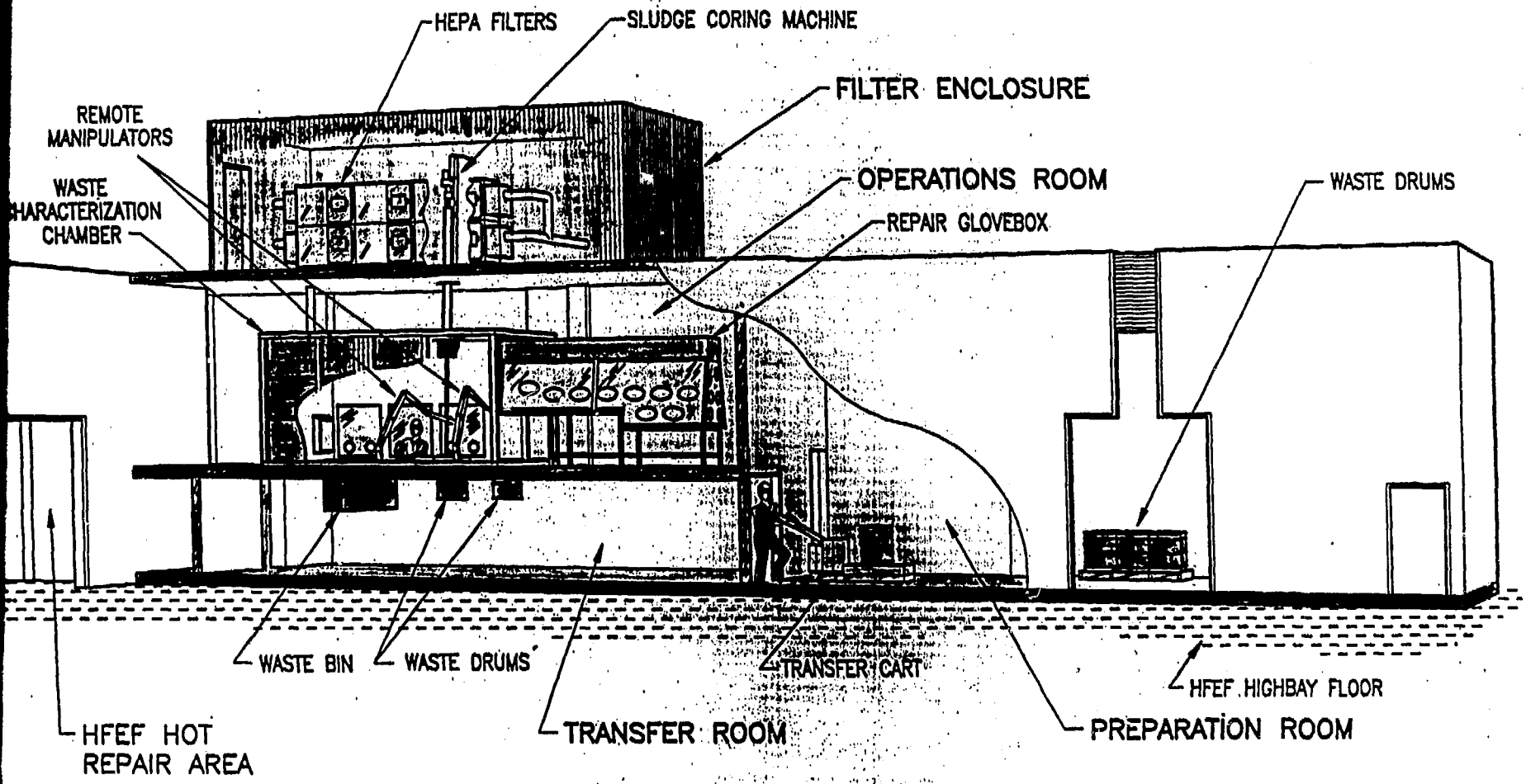

FIG. 2

WIPP WASTE CHARACTERIZATION FACILITY

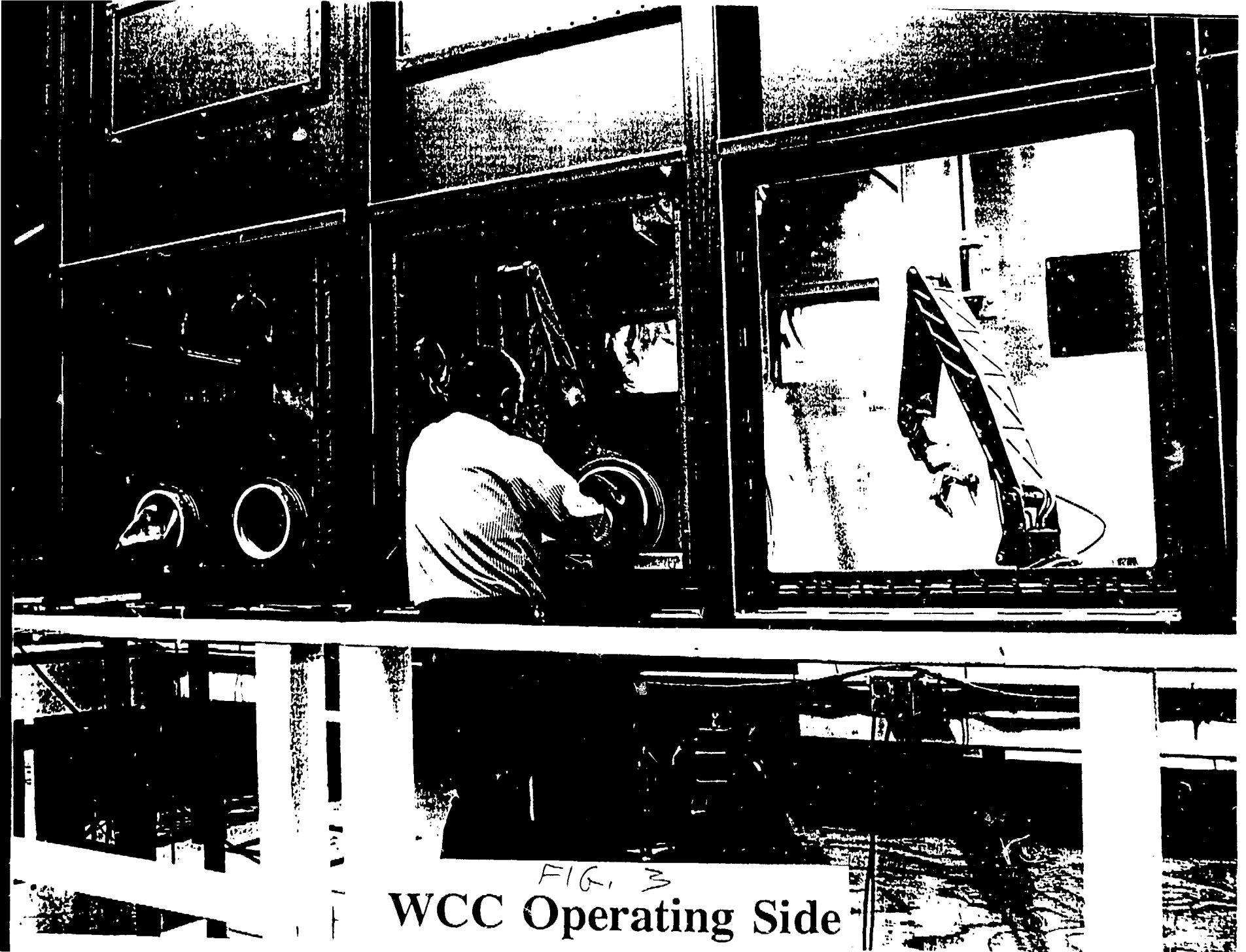

FIG. 3

WCC Operating Side