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SUPPLEMENT ANALYSIS OF

TRANSURANIC WASTE CHARACTERIZATION AND REPACKAGING ACTIVITIES AT THE IDAHO NATIONAL ENGINEERING LABORATORY IN SUPPORT OF THE WASTE ISOLATION PILOT PLANT TEST PROGRAM

Prepared by

U.S. Department of Energy
Office of Environmental Restoration and Waste Management

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FOREWORD

This supplement analysis has been prepared to describe new information relevant to waste retrieval, handling, and characterization at the Idaho National Engineering Laboratory (INEL) and to evaluate the need for additional documentation to satisfy the National Environmental Policy Act (NEPA)--40 Code of Federal Regulations (CFR) 1502.9--and Section C, Part 2, of the U.S. Department of Energy (DOE) NEPA Guidelines (52 Federal Register [FR] 47662, December 15, 1987).

The INEL proposes to characterize and repackage contact-handled transuranic (CH-TRU) waste to support the Waste Isolation Pilot Plant (WIPP) Test Phase. Waste characterization activities would support WIPP Bin-Scale and Alcove Room Tests, and internal INEL waste characterization efforts. Waste retrieval, handling and processing activities in support of test phase activities at the WIPP were addressed in the Supplemental Environmental Impact Statement (SEIS) for the WIPP. However, the exact location of INEL waste preparation activities was unknown at the time the WIPP SEIS was prepared, and DOE assumed, for analytical purposes, that they would take place entirely at the Radioactive Waste Management Complex (RWMC). Now it is proposed to conduct a portion of these activities at the Hot-Fuel Examination Facility (HFEF) at Argonne National Laboratory-West (ANL-W), with no significant change in the nature of the proposed waste characterization activities.

To ensure that test-phase wastes are properly characterized and packaged, waste containers would be retrieved, nondestructively examined, and transported from the RWMC to the HFEF for headspace gas analysis, visual inspections to verify content code, and waste acceptance criteria compliance, then repackaging into WIPP experimental test bins or returned to drums. Following repackaging the characterized wastes would be returned to the RWMC.

The waste characterization activities conducted at the INEL would help DOE obtain data required to determine WIPP compliance with U.S. Environmental Protection Agency (EPA) regulations governing disposal of transuranic (TRU) waste (40 CFR 191) and hazardous waste (40 CFR 268). Additionally, data gained from this program supports onsite compliance with Resource Conservation and Recovery Act (RCRA) requirements, supports compliance with the terms of the No-Migration Variance at WIPP, and provides data to support future waste shipments to WIPP.

This analysis contains information that would help DOE determine whether there have been substantial changes made to those portions of the proposed action at the INEL, or if there are significant new circumstances or information relevant to environmental concerns that would require preparation of a supplement to the WIPP Final Environmental Impact Statement (FEIS) (DOE, 1980) and SEIS (DOE, 1990a). This analysis is based on current information and includes details not available to the SEIS.

This analysis includes three separate sections based on the activities described above.

Section 1 - "Environmental Analysis of Transuranic Waste Certification and Storage at the Radioactive Waste Management Complex"

Section 2 - "Environmental Analysis of Argonne National Laboratory - West's Waste Isolation Pilot Plant Program at the Hot-Fuel Examination Facilities"

Section 3 - "Environmental Analysis of the Transportation of Contact-Handled Transuranic Waste between the Radioactive Waste Management Complex and the Hot-Fuel Examination Facilities"

General tasks being conducted by the INEL to support preparing packages for the WIPP Test Program are summarized as follows:

- Waste container storage at the RWMC
- Waste drum venting at the Stored Waste Examination Pilot Plant (SWEPP)
- Real time radiography and fissile assay of the selected drums or boxes at SWEPP
- Shipment of the selected drums or boxes to ANL-W's HFEF
- Gas sampling of the drum headspace

- Characterization of the waste (which entails visual inspection, weighing, and sampling of the contents within the inner packages of each drum)

- Repackaging of the waste from drums and boxes to test bins or alcove drums

- Headspace gas sample analysis for inorganics (metals) and NO_x and for volatile organic compounds

- Shipment of the test bins or alcove drums and empty drums and boxes back to RWMC.

The transportation of waste from the INEL to the WIPP is analyzed in the WIPP FEIS and SEIS.

EXECUTIVE SUMMARY

Section 1. Environmental Analysis of Transuranic Waste Certification and Storage at the Radioactive Waste Management Complex

This section specifically addresses impacts associated with waste examination and certification and storage processes at the INEL's RWMC. The examination and certification processes take place at the RWMC's SWEPP and Drum Venting Facility (DVF). Storage facilities for TRU package transporter-II (TRUPACT-II) certified waste are provided within the RWMC's Certified and Segregated Waste Storage Building (C&S). The Air Support Building-2 (ASB-2), located near SWEPP, provides temporary storage facilities for TRU waste containers awaiting venting at the DVF and/or examination at SWEPP. Loading and unloading TRUPACT-II waste shipping containers for transportation of TRU waste off-site is carried out at the TRUPACT-II loading station (TLS).

The WIPP SEIS states, "Measurable exposure to the public or adverse effects on the surrounding environment would not be expected from the extremely small airborne releases experienced during routine operations involving TRU waste at the RWMC."

The analyses presented in Section 1 indicate that the expected impacts of routine waste examination and certification operations at the RWMC and the expected impacts of accident scenarios at SWEPP, DVF, C&S, and the ASB-2 are conservatively bounded by the results and conclusions reported in the SEIS.

Section 2: Environmental Analysis of Argonne National Laboratory - West's Waste Isolation Pilot Plant Program at the Hot-Fuel Examination Facilities

To ensure that test-phase wastes are properly characterized and packaged, waste containers would be transported from the RWMC to the HFEF at the ANL-W complex for headspace gas analysis, visual inspections to verify content code and waste acceptance criteria compliance, and repackaging. Section 2 addresses impacts associated with the characterization and repackaging of wastes at the HFEF.

Radiological doses and nonradiological health risks for routine HFEF operations were evaluated. Projected effective dose equivalents (EDE) for the maximally exposed offsite individual for the initial phase of the proposed action and the WIPP SEIS analysis are 2.67E-08 mrem/yr and 2.6E-08 mrem/yr, respectively.[a] Doses at this level are insignificant and well below applicable standards. Even with a doubling of the throughput (for example, from two bins per week during the decontamination cell/hot repair area phase to four bins per week during the glovebox phase) doses would remain insignificant.

Hazard indices, calculated for noncarcinogenic hazardous chemical health risks, are well below the 1.0 health-based EPA reference level. Cancer risks for hazardous chemical intake are within or below acceptable guidelines.

Radiological and nonradiological health risks associated with the accident scenarios are minor, especially in view of the unlikely nature of the occurrences. The highest dose to a member of the public is 0.5 mrem at the maximum site boundary (MSB) (5,000 m) for Accident No. 1 (Fire in High Bay Storage).

The hazard indices for receptor locations for all accidents are below the 1.0 EPA health-based reference level. Therefore, exposure to workers and the public from postulated accidents would be below health-based reference levels.

This analysis demonstrates that the environmental impacts from the proposed waste characterization and repackaging activities at the HFEF are bounded by the analysis in the WIPP FEIS and SEIS and are very small.

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a. A maximally exposed offsite individual is a member of the public (nonworker) who would receive the highest dose. The EPA NESHAP regulations (40 CFR 61) require the dose to a maximally exposed off-site individual be calculated at the point located at the nearest residence. The WIPP FEIS calculated the maximum dose to an offsite individual at the site boundary, while this analysis calculated dose in accordance with NESHAP regulations. The doses are similar, as shown in Tables 2-3 and 2-4.

Section 3: Environmental Analysis of Transportation of Contact-Handled Transuranic Waste between the Radioactive Waste Management Complex and the Hot-Fuel Examination Facilities

The SWEPP, located at RWMC, was developed to certify WIPP CH-TRU wastes using nondestructive examination techniques. However, these techniques do not identify hazardous materials and waste form concentrations. In order to identify the characteristics of waste and prepare them for use in the WIPP Test Phase Program, the CH-TRU waste would be shipped from the SWEPP located at the RWMC to the HFEF located at ANL-W. After characterization and repackaging, the test bins or alcove drums and empty drums and boxes would be returned to RWMC. Section 3 addresses impacts associated with the potential risks of transporting radioactive and hazardous material between the RWMC and ANL-W facilities.

Transportation risk assessments for shipping inventories of 15 g of fissile material (15 g/cask scenario) and 20 Ci of plutonium (20 Ci/cask scenario) between RWMC and ANL-W were performed using the RADTRAN 4.0 and RSAC-4 computer codes. Both incident free and accident conditions were evaluated for workers and members of the public. Nonradiological transportation accidents were performed for the same inventory scenarios.

For workers, incident free doses of 1.0E-02 person-rem were calculated for both 15 g/cask and 20 Ci/cask scenarios. Incident free doses for members of the public were 8.6E-03 person-rem for both 15 g/cask and 20 Ci/cask scenarios. The incident free dose calculated for both the worker and public were much less than those reported in the FEIS for the INEL to WIPP shipments during the 5-year test phase.

The effects of accidents hypothesized between the RWMC and ANL-W were also evaluated. These analyses show that shipments between RWMC and ANL-W shipments would result in accident doses less than 0.4% of INEL to WIPP accident doses.

Because the RWMC to ANL-W shipments add less than 1% to the INEL to WIPP risks, the overall impacts from transportation are essentially the same as presented in the SEIS.

LOCATION MAP

The INEL is located west of Idaho Falls in southeastern Idaho (figure 1) and covers an area of 2305 km^2 (890 mi^2). The RWMC and ANL-W are located in the southern part of the INEL. The RWMC is located in the southwest corner of the INEL and contains the SWEPP. ANL-W is located in the southeast corner of the INEL and contains the HFEF. The transportation corridor between the RWMC and ANL-W consist of a portion of U.S. Highways 26/20 and 20, which are uncontrolled public highways. No commercial buildings or private dwellings exist along this route within the INEL boundaries. Transportation from each facility to the public highways would be along smaller, controlled access roads.

ARA	Auxiliary Reactor Facility	PREPP	Process Experimental Pilot Plant
ANL-W	Argonne National Laboratory - West	RWMC	Radioactive Waste Management Complex
CFA	Central Facilities Area	STF	Security Training Facility
EBR I	Experimental Breeder Reactor I	TAN	Test Area North
ICPP	Idaho Chemical Processing Plant	TRA	Test Reactor Area
IET	Initial Engineering Test	TREAT	Transient Reactor Test (Facility)
LOFT	Loss-of-Fluid Test (Facility)	WEDF	Waste Experimental Development Facility
MWSF	Mixed Waste Storage Facility	WERF	Waste Experimental Reduction Facility
NRF	Naval Reactor Facility	WRRTF	Water Reactor Research Test Facility
PBF	Power Burst Facility		

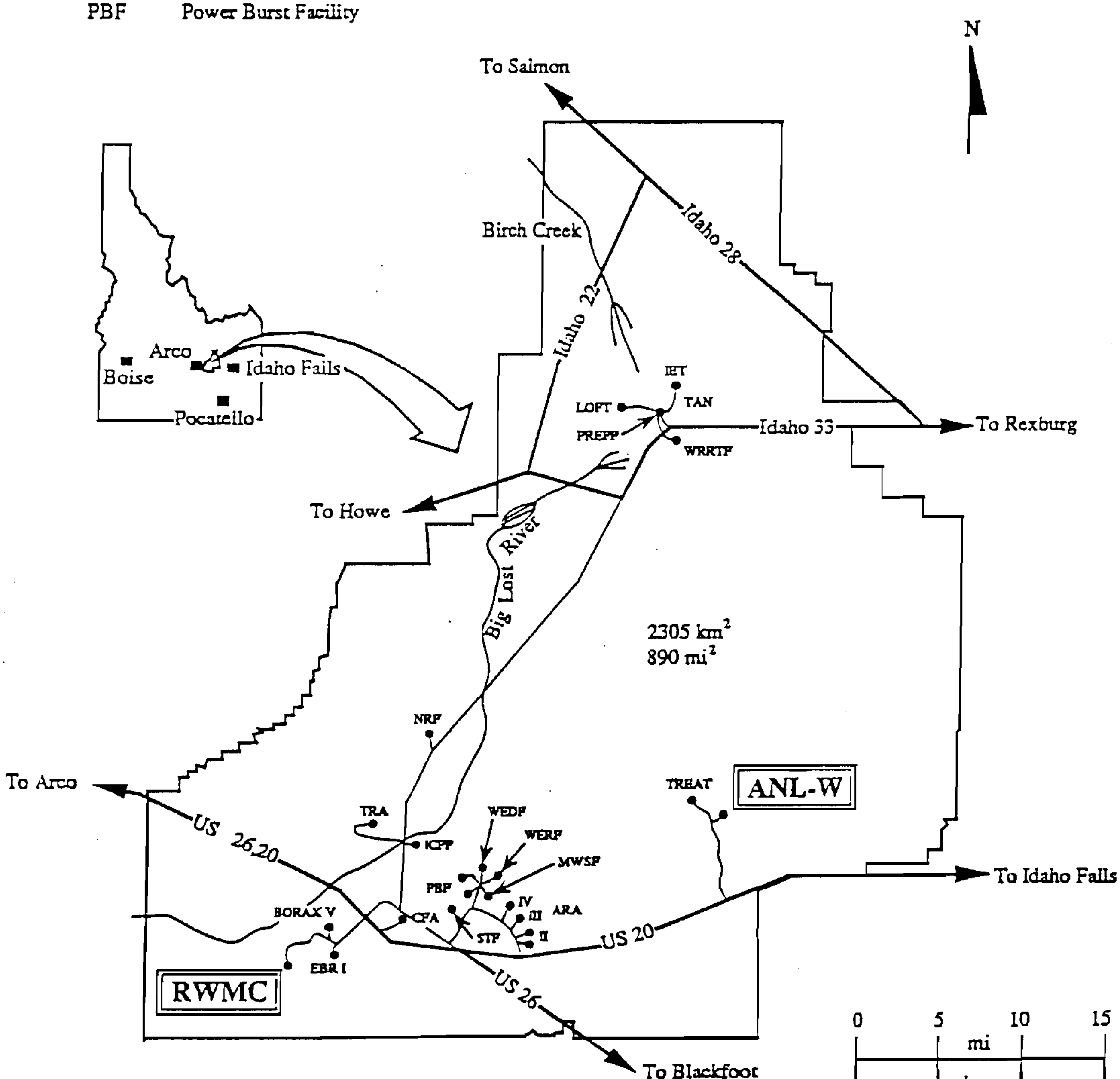

FIGURE 1-1. Location of the Idaho National Engineering Laboratory (INEL).

ACRONYMS AND ABBREVIATIONS

ALARA	As Low As Reasonably Achievable
ANL-W	Argonne National Laboratory - West
ASB-2	Air Support Building-2
C&S	Certified and Segregated Waste Storage Building
CEDE	Committed Effective Dose Equivalent
CH-TRU	Contact-Handled Transuranic
CFR	Code of Federal Regulations
DE	Drum Equivalent
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
DVF	Drum Venting Facility
EBR-I	Experimental Breeder Reactor-I
EDE	Effective Dose Equivalent
EPA	U.S. Environmental Protection Agency
FEIS	Final Environmental Impact Statement
FR	Federal Register
SEIS	Supplemental Environmental Impact Statement
HEPA	High Efficiency Particulate Air
HFEF	Hot-Fuel Examination Facility
HI	Hazard Index
HRA	Hot-Repair Area
ICRP	International Commission on Radiological Protection
IDAPA	Idaho Administrative Procedures Act
IEQD	Idaho Environmental Quality Division
INEL	Idaho National Engineering Laboratory
MSB	Maximum Site Boundary
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NESHAP	National Emission Standards for Hazardous Air Pollutants
NRC	Nuclear Regulatory Commission
RCRA	Resource Conservation and Recovery Act
RTR	Real-time X-ray Radiography
RWMC	Radioactive Waste Management Complex
SB	Site Boundary
SWEPP	Stored Waste Examination Pilot Plant
TI	Transportation Index
TLS	TRUPACT-II Loading Station
TRU	Transuranic
TRUPACT-II	Transuranic Package Transporter-II
TSD	Treatment, Storage, or Disposal
VOC	Volatile Organic Compound
WAC	Waste Acceptance Criteria
WIPP	Waste Isolation Pilot Plant
WMF-613	Waste Management Facility-613

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TABLES

FIGURES

1. ENVIRONMENTAL ANALYSIS OF TRANSURANIC WASTE CERTIFICATION AND STORAGE AT THE RADIOACTIVE WASTE MANAGEMENT COMPLEX

1.1 INTRODUCTION

This section addresses impacts associated with waste certification processes and storage at the Radioactive Waste Management Complex (RWMC).

1.2 DESCRIPTION OF SWEPP AND DVF CERTIFICATION PROCESS AND STORAGE AT C&S AND ASB-2

> As described in the SEIS, "the Stored Waste Examination Pilot Plant (SWEPP) that provides nondestructive examination and assay capabilities to examine TRU [Transuranic] waste. The facility contains a Real-Time X-ray Radiography (RTR) system to examine the contents of both boxes and drums, an assay system to determine fissile and transuranic content, and a container integrity system to assure the waste drums meet DOT [Department of Transportation] metal thickness requirements for Type A containers. In addition, the facility provides capabilities to puncture a drum lid (using a sparkless tool) and install a carbon composite filter to vent any radiolytic-produced gas and provide for pressure equilibrium." (U.S. Department of Energy [DOE], 1990a, p. 5-9).

No modifications to current Stored Waste Examination Pilot Plant (SWEPP) and Drum Venting Facility (DVF) operations are proposed. Waste Isolation Pilot Plant (WIPP)-certified and Transuranic Package Transporter-II (TRUPACT-II)-certified waste storage facilities are provided at the RWMC's Certified Segregated Waste Storage Building (C&S). The Air Support Building-2 (ASB-2), located near SWEPP, would also be involved in the Transuranic (TRU) waste certification/storage process. The ASB-2 provides temporary storage facilities for TRU waste containers awaiting venting at the DVF and/or examination at SWEPP. Loading and unloading TRUPACT-II waste shipping containers for transportation of TRU waste offsite is carried out at the TRUPACT-II Loading Station (TLS); an assessment of the impacts of loading/unloading operations at the TLS has been conducted and an approved Memorandum to File has been issued[a].

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a. U.S. DOE Operations Office, Memorandum-To-File for the WMF 618 TRUPACT II Loading Station (TLS), RWMC 88-07, Revision 1 (approved August 21, 1989).

1.3 ENVIRONMENTAL IMPACTS

The potential impacts of routine operations and potential accident scenarios associated with the SWEPP, DVF, C&S, and ASB-2 are discussed in detail in the following sections and compared to those identified in the Final Supplemental Environmental Impact Statement (SEIS) (DOE, 1990a pp. 5-10 to 5-13).

1.3.1 Routine Operations

1.3.1.1 Radiological Effects. Proposed certification activities to support the WIPP Test Phase would not require modifications to historic or existing SWEPP operational procedures or throughput capacities. Future worker doses are not expected to exceed historic doses. In 1989, 106 RWMC workers with badges received a measured 4.209E+03 mrem (over 12 months) for an average dose equivalent of 3.97E+01 mrem/worker (range 0 to 2.51E+02 mrem). This annual average dose is typical of those received by RWMC workers over the last few years and is bounded by the data provided in the SEIS (DOE, 1990a), as follows:

> "In keeping with ALARA (As Low As Reasonably Achievable) philosophy, the radiological exposures to workers during normal operations are limited by monitoring accumulated personnel dose equivalents and by job preplanning. The maximum radiation exposure on external waste container surfaces is restricted to less than 200 mR/hr. Annual dose equivalents to RWMC personnel including operators, health physics technicians, and supervisors for all RWMC activities, including TRU waste operations, vary from a maximum of 306 mrem to less than 20 mrem. This is well below the established DOE occupational exposure limit of 5 rem per year" . . . "Measurable exposure to the public or adverse effects on the surrounding environment will not be expected from the extremely small airborne releases experienced during routine operations involving TRU waste at the RWMC." (DOE, 1990a, p. 5-10)

This conclusion has not changed and is supported by detailed modeling efforts designed to determine the effects of radiological and nonradiological emissions associated with the SWEPP, DVF, C&S, and ASB-2 facilities. The results of these efforts are provided below.

Release of particulates from C&S- and ASB-2-stored waste containers would not occur during normal operations because of the integrity of the waste containers and because the mechanical filters fitted to the vented waste drums would prevent the passage of particulates under equal pressure conditions. Hence, air emissions of radioactive particulates would not occur as a result of normal operations of the C&S and ASB-2. Air emissions of radioactive or hazardous materials from SWEPP would be negligible because the containers entering SWEPP would also have filtered vents and the SWEPP throughput (about 5000 drum equivalents/yr) would be a small fraction of the maximum storage capacity of the C&S and ASB-2. Thus, combined emissions from these two facilities filled to maximum capacity would bound emissions from all three facilities under normal operating conditions.

Normal air emissions of radionuclides from the DVF were calculated using the U.S. Environmental Protection Agency (EPA) computer code CAP88. Estimated routine radiological emissions from the DVF are provided in Table 1-1. The committed effective dose equivalents (CEDE) for workers and members of the public are shown in Table 1-2.

TABLE 1-1. ANNUAL RADIONUCLIDE AIR EMISSIONS DUE TO NORMAL OPERATIONS OF THE DRUM VENTING FACILITY

Radionuclide	Release (Ci/yr)
Pu-238	7.20E-06
Pu-239	2.10E-06
Pu-240	5.40E-07
Pu-241	1.80E-05
Am-241	7.90E-06

TABLE 1-2. ANNUAL DOSE CONSEQUENCES OF ROUTINE AIR EMISSIONS FROM THE DRUM VENTING FACILITY

Receptor	Committed Effective Dose Equivalent (CEDE)
Worker at 137 m (mrem/yr)	3.39E-03
Member of the Public at EBR-I (2900 m) (mrem/yr)	4.47E-04
Member of the Public at MSB[a] (6000 m) (mrem/yr)	5.73E-07
Population within 80 km (person-rem/yr)	6.60E-04

a Maximum Site Boundary (MSB). This is defined as the point on the site boundary that would yield the maximum dose to an individual.

The CEDE of 5.73E-07 mrem/yr at the MSB from air emissions falls well below the 10 mrem/yr EPA standard. The annual excess number of latent cancer fatalities expected in the exposed population for a dose of 6.60E-04 person-rem would be 6.11E-08 (i.e., none).

1.3.1.2 Nonradiological Effects. Air emissions and resulting air concentrations of hazardous chemicals from DVF, C&S, and ASB-2 were calculated to estimate the impact of routine operations on air quality and human health and safety.

Emissions of metals might result from venting operations at the DVF, but no emissions of metals would occur from the C&S and ASB-2 because of the integrity of the waste containers and because the mechanical filters inserted into vented drums would prevent the passage of particulates under equal pressure conditions. It is therefore assumed that release of particulates from C&S and ASB-2 stored waste containers would not occur during normal operations. The inclusion of metals in the airborne emissions from the DVF is conservative because they are generally in monolithic forms that would be unavailable for airborne particulate release.

To model C&S/ASB-2 volatile organic compound (VOC) annual emissions, it was conservatively assumed that both the C&S and ASB-2 would be filled to maximum capacity with drums fitted with carbon-bonded filters or permeable gaskets (201,632 drums total). Representative VOC air concentrations at the three receptor locations were calculated using dispersion factors (Chi/Q) obtained from the EPA computer code SCREEN (Brodie, 1988) and using a ground-level release of an area source. To model DVF representative particulate and VOC annual air concentrations, dispersion factors obtained from the EPA computer code CAP88 were used.

Table 1-3 provides calculated air concentrations of hazardous constituents at three locations because of emissions from the DVF and C&S/ASB-2. Concentrations of applicable hazardous constituents at the Experimental Breeder Reactor-I (EBR-I) and the INEL boundary can be compared with National Ambient Air Quality Standards (NAAQS) and the State of Idaho's ambient air quality standards. For those hazardous materials that have Idaho ambient air

TABLE 1-3. CALCULATED AVERAGE ANNUAL AIR CONCENTRATIONS OF HAZARDOUS CONSTITUENTS ($\mu g/m^3$) DUE TO NORMAL EMISSIONS FROM THE DVF AND C&S/ASB-2 COMBINED AND APPLICABLE NATIONAL AMBIENT AIR QUALITY STANDARDS

Constituent	WMF-613	EBR-I	INEL Boundary	NAAQS[a]
1,1,1-trichloromethane	3.36E-02	3.80E-06	9.21E-07	-
Carbon tetrachloride	4.91E-03	5.56E-07	1.35E-07	-
1,1,2-trichloro-1,2,2-trifluoroethane	3.09E-03	3.50E-07	8.56E-08	-
Trichloroethylene	1.81E-03	2.04E-07	4.96E-08	-
Methylene chloride	1.29E-03	1.46E-07	3.54E-08	-
Total VOC's	4.47E-02	5.06E-06	1.23E-06	2.35E+02[b]
Cadmium	1.21E-16	1.37E-17	3.32E-18	-
Lead	3.32E-13	3.76E-14	9.13E-15	1.50E+00
Beryllium	4.43E-15	5.01E-16	1.23E-16	-
Asbestos	2.76E-14	3.12E-15	7.57E-16	-
Total Particulates	3.64E-13	4.12E-14	1.00E-14	7.50E+00[c]

a. Idaho ambient air quality standards are the same as the NAAQS for applicable hazardous constituents; primary and secondary standards are the same unless otherwise indicated.
b. As ozone.
c. Primary standard; secondary standard is 60 $\mu g/m^3$ annual geometric mean.

quality standards, the standards are the same as the NAAQS. There are no NAAQS or Idaho ambient air quality standards for the other listed constituents. Thus, calculated ambient air concentrations are below applicable federal and state regulatory standards (40 Code of Federal Regulations [CFR] 50; Idaho Administrative Procedures Act [IDAPA] 16.01.1101) and bounded by the qualitative statements made in the SEIS (DOE, 1990a, p. 5-10).

For the purpose of estimating the health impacts of hazardous particulate and VOC emissions from the DVF and VOC emissions from the C&S and ASB-2, noncarcinogenic and carcinogenic health risks were calculated according to EPA methods (1989).

Noncarcinogenic hazard indices (HI), presented in Table 1-4, represent comparisons of human intake to allowable intake based on reference levels. An HI <1E+00 implies that the ambient air concentration of total hazardous materials would not result in a health risk to workers or members of the

TABLE 1-4. NONCARCINOGENIC HAZARD INDICES AND CARCINOGENIC RISKS FOR WORKERS AT WMF-613 AND FOR MEMBERS OF THE PUBLIC AT EBR-I AND THE INEL BOUNDARY

Index/Risk	WMF-613[a]	EBR-I [b]	INEL Boundary
Hazard Index (HI)	2.0E-07	2.0E-06	5.0E-07
Total cancer risk	1.0E-07	2.0E-08	5.0E-09

a. Waste Management Facility-613.
b. Experimental Breeder Reactor-I.

general public at the exposure point (EPA, 1986, 1989). HIs are well below one, thus noncarcinogenic health risks are not expected.

Carcinogenic health risks, also presented in Table 1-4, represent the incremental (above background) probability of an individual developing cancer over a lifetime as a result of exposure to potential carcinogens (EPA, 1989). Both noncarcinogenic and carcinogenic health risks from hazardous chemical emissions are bounded by the description reported in the SEIS (DOE, 1990a, p. 5-10).

1.3.2 Accident Scenarios

The impacts of the following accident scenarios for existing RWMC facilities were evaluated and presented in the SEIS (DOE, 1990a, pp. 5-10 to 5-13):

- Tornado, with an estimated probability of 1E-07 events/yr
- Earthquake, with an estimated probability of 2E-04 events/yr
- Fire in ASB-2/C&S, with an estimated probability of 1E-03 events/yr
- Breached container, with an estimated probability of 6E-04 events/yr
- Explosion, with an estimated probability of 1E-04 events per year
- Lightning strike, with an estimated probability of 4E-06 events/yr.

A summary of the results presented in the SEIS (DOE, 1990a, pp. 5-10 to 5-13) follows. The maximum exposure to an individual member of the public was calculated to be 2E-02 rem committed whole body dose equivalent (maximum annual dose equivalent) during the evaluated tornado accident scenario. The highest population exposure is also associated with the tornado scenario and results in a collective dose equivalent of 1E+00 person-rem. The excess risk to the total exposed population would be 2.8E-04 latent cancer fatalities/person-rem. The highest exposure to the maximally exposed worker was calculated to be 7.0E-01 rem, resulting from a postulated fire in the ASB-2. The highest risk of excess cancer to maximally exposed individuals and average members of the public were calculated for the postulated tornado to be 6E-06 and 2E-09, respectively. The highest calculated risk of excess cancer to maximally exposed workers was 2E-04 for a postulated fire in the ASB-2/C&S.

The results presented in the SEIS (DOE, 1990a, p. 5-10 to 5-13) bound the expected impacts of accident scenarios at SWEPP, DVF, C&S, and ASB-2 because the expected operations and throughput at these facilities has remained the same.

1.4 ENVIRONMENTAL REGULATORY COMPLIANCE

SWEPP and DVF were constructed and began operating during the mid- 1980s. This section summarizes the regulatory requirements and compliance status of SWEPP and the DVF regarding the Clean Air Act, Idaho Air Pollution Control Regulations, and National Emission Standards for Hazardous Air Emissions (NESHAP).

Clean Air Act, as amended (42 USC 7420) - The EPA-delegated authority for regulation of air emissions from SWEPP and DVF (except emissions regulated under NESHAP) to the Idaho Environmental Quality Division (IEQD). The SWEPP facility emits only routine heating and ventilating emissions that do not require IEQD permitting or monitoring. The DVF stack may emit gaseous or filtered particulate constituents from drum venting activities. The INEL is preparing an operating permit application for all INEL-regulated emissions to the atmosphere. The DVF is included in this application. In addition, DVF process, emission, and control system data have been submitted to the IEQD.

EPA has promulgated regulations for radionuclide emission limits and approvals to construct at DOE facilities (NESHAP, 40 CFR 61). SWEPP does not emit radionuclides and is therefore not subject to NESHAP requirements. A NESHAP approval to construct was obtained for the DVF in 1986. This approval is valid for venting WIPP test phase containers. The revised NESHAP regulation promulgated in December 1989 requires an evaluation of DVF emissions to determine stack monitoring requirements. This evaluation is being performed.

Resource Conservation and Recovery Act of 1976, as amended (42 USC 6901 et seq.) and Idaho Hazardous Waste Management Act - The Resource Conservation and Recovery Act (RCRA) regulates hazardous waste by imposing requirements on generators and transporters of hazardous waste, and on owners and operators of treatment, storage, or disposal (TSD) facilities. EPA has authorized the Idaho Department of Health and Welfare to implement most elements of RCRA in Idaho. Little, if any, mixed waste is expected to be generated by SWEPP operations. Waste handling, drum venting, examination, and data management activities within SWEPP and DVF are integrated to the RWMC-Transuranic Storage Area. These activities are covered by the INEL RCRA Part A and Part B permit applications and do not require separate RCRA and Hazardous Waste Management Act permits.

1.5 CONCLUSIONS

The proposed TRU waste certification and storage activities at the RWMC are essentially the same as those discussed in the SEIS. They do not entail changes to the waste inventory, method of operation, throughput rate or capacity and, therefore, should result in no change in impacts from those previously analyzed.

2. ENVIRONMENTAL ANALYSIS OF ARGONNE NATIONAL LABORATORY - WEST'S WASTE ISOLATION PILOT PLANT PROGRAM AT THE HOT-FUEL EXAMINATION FACILITIES

2.1 INTRODUCTION

This section addresses impacts associated with the waste characterization and repackaging program at the Hot-Fue Examination Facility (HFEF) located at Argonne National Laboratory - West (ANL-W), in support of the WIPP Test Phase.

2.2 DESCRIPTION OF ANL-W WASTE CHARACTERIZATION PROGRAM

The purpose of the program is to characterize the waste inventory and repackage the waste for the WIPP Test Phase program. The waste characterization data would also be used for validation of previous certifications (in accordance with the WIPP waste acceptance criteria (WAC) [DOE, 1989]), evaluation of hazardous constituents in support of the No-Migration Variance Petition (DOE, 1990b), verification of process knowledge databases, and documentation of shipping container (TRUPACT-II) payload compliance (Nuclear Packaging, Inc., 1989).

Defense program CH-TRU wastes (primarily generated at the Rocky Flats Plant) are currently stored at the RWMC, operated by EG&G Idaho Idaho, Inc. The waste is present in a variety of forms, including paper, clothing, plastics, glass, metal, rubber, and cemented sludge. Radioactive contaminants in the waste are mostly in the form of TRU particles adhering to other materials. In addition to being radioactive, much of the waste may contain chemically hazardous contaminants regulated by RCRA.

The waste involved in this program is packaged in 55 gal. (0.208 m^3) metal drums and fiberglass-reinforced plywood boxes (7 x 4 x 4 ft). The WIPP Test Phase calls for this waste to be repackaged into metal test bins (4 x 4 x 3 ft) for the Bin Tests or 55 gallon drums for the Alcove Tests.

Waste characterization and repackaging activities would be conducted in the HFEF at ANL-W. Two different operational phases are planned. The first phase would use the decontamination cell and the hot-repair area (Decon Cell/HRA). The second phase would use a glovebox and associated confinement and preparation areas which would be added adjacent to the HRA. The truck lock and the high bay area would be used in both phases. The second phase is being implemented to increase throughput capacity and enhance safety. It is expected to be ready for operation by July 1991. The Decon Cell/HRA would be used only under special circumstances for characterization activities (for example, during maintenance operations in the glovebox) once the glovebox becomes operational.

The current WIPP Test Phase includes characterizing wastes for the Bin-Scale and Alcove Room Tests. Additionally, some characterization of other stored wastes would be performed to support internal INEL requirements. It is anticipated that waste characterization efforts would take place for at least five years, and possible longer.

The maximum throughput that can be accommodated at ANL-W is 24-drum equivalents (DE) per week or 1200 DEs per year.[a] The environmental analysis performed in section 2.3 (see p. 2-2) is based on processing 600 drums per year. This assumes a 50-week operation per year and processing 12 drums per week (2 bins/wk for Bin-Scale Tests or preparing 12 drums/wk for Alcove Room Tests).

2.3 ENVIRONMENTAL IMPACTS

The FEIS for the WIPP employs the critical-organ approach to calculate doses. This approach has since been replaced by the International Commission on Radiological Protection (ICRP) (ICRP, 1977). The new method uses a weighted sum of doses to all irradiated organs and tissues. This sum is called the "effective dose equivalent." This analysis reports doses as effective dose equivalents (EDE)[b].

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a. A bin can hold a maximum of six DEs, and a box is assumed to have a maximum of 15 DEs; one DE equals 55 gal.

b. The effective dose equivalent (EDE) includes the committed EDE from internal deposition of radionuclides, and the effective dose equivalent due to penetrating radiation from sources external to the body (DOE, 1988a).

The WIPP FEIS reports that releases for the repackaging effort (analogous to the proposed action for this analysis) from routine operations would be 2.6 x 10^{-8} mrem/yr (whole body) for the maximally exposed offsite individual[a] and 3.2 x 10^{-7} man-rem/yr for the populations within 50 miles (≈ 80 km) (DOE, 1980, p. 9-17i, Table 9-74). Dose commitments (whole body) and risks from accidents for the repackaging effort would be 2 x 10^{-6} mrem/yr (fire) and 8 x 10^{-6} mrem/yr (explosion) for the maximally exposed worker and 3 x 10^{-6} man-rem (fire) and 2 x 10^{-5} man-rem (explosion) for the population (DOE, 1980).

2.3.1 Routine Operations

2.3.1.1 Radiological Effects to Workers and the Public. The average activity of the waste in the drums to be characterized is listed for a number of isotopes in the WIPP SEIS. The waste would contain more radionuclides than this, but these five isotopes represent 99.7% of the isotopic inventory of the drums (Table 2-1). The throughput rate, as previously discussed, is 600 drums per year. This results in a total annual processing of 1.46E+03 curies (Table 2-1).

Table 2-1. THE AVERAGE ACTIVITY OF WASTE DRUMS FOR IMPORTANT ISOTOPES AND ANNUAL PROCESSING QUANTITIES BASED ON WASTE CHARACTERIZATION PROPOSED AT HFEF

Isotope	Fraction	Average drum (Ci)	Average bin (Ci)	Annual[a] (Ci)
Pu-238	1.054E-01	2.57E-01	1.54E+00	1.54E+02
Pu-239	5.744E-02	1.40E-01	8.40E-01	8.40E+01
Pu-240	1.407E-02	3.43E-02	2.06E-01	2.06E+01
Pu-241	4.431E-01	1.08E+00	6.48E+00	6.48E+02
Am-241	3.799E-01	9.26E-01	5.56E+00	5.56E+02
Totals	1.000E+00	2.44E+00	1.462E+01	1.46E+03

a Annual (Ci) at 2 bins/week.

a. A maximally exposed off-site individual is a member of the public (non-worker) that would receive the highest dose. The EPA NESHAP regulations (40 CFR61) require the dose to a maximally exposed off-site individual be calculated at the point located at the nearest residence. The WIPP FEIS calculated the maximum dose to an off-site individual at the site boundary, while this analysis calculated dose in accordance with NESHAP regulations. The doses are similar, as shown in Tables 2-3 and 2-4.

In the process of opening and examining bags taken from drums, 5% of the waste is assumed to be particulate (DOE, 1990a) and 0.1% of that is assumed to become airborne (Elder et al., 1986). This fraction is decreased by the two banks of high efficiency particulate air (HEPA) filters. This approach results in a projected total annual release of 6.59E-09 curies (Table 2-2).

Radiological effects to the worker and public for routine operation during the Decon Cell/HRA Phase are presented in Table 2-3. The total EDEs for the onsite worker and maximally exposed offsite individual at the nearest residence during the Decon cell/HRA Phase are 3.06E-05 and 2.67E-08 mrem/yr. During the glovebox phase the throughput and dose is expected to double (Table 2-4). These estimated doses are extremely small, as were comparable estimates in the FEIS.

2.3.1.2 Nonradiological Effects to Workers and the Public. Air concentrations of hazardous chemicals as a result of emissions from the Decon Cell/HRA and the glovebox area operations were calculated to estimate the impact of routine operations on air quality.

Table 2-2. CALCULATED CURIES RELEASED/YR AND USED AS INPUT INTO CAP88[a]

Isotope	Source Ci/yr	Airborne[b] Ci/yr	Released Ci/yr
Pu-238	1.54E+02	7.70E-03	6.94E-10
Pu-239	8.40E+01	4.20E-03	3.78E-10
Pu-240	2.06E+01	1.03E-03	9.28E-11
Pu-241	6.48E+02	3.24E-02	2.92E-09
Am-241	5.56E+02	2.78E-02	2.50E-09
Total	1.46E+03	7.31E-02	6.59E-09

a Assumes 2 bins/week.
b 5×10^{-2} respirable; 10^{-3} resuspended.

TABLE 2-3. THE EDE[a] TO THE MAXIMALLY EXPOSED INDIVIDUAL DUE TO ROUTINE RELEASES FROM WASTE CHARACTERIZATION AND REPACKAGING DURING THE DECON CELL/HRA PHASE

Isotope/Pathway	Worker[b] On-site (mrem/yr)	Public[c] SB (mrem/yr)	Atomic City (mrem/yr)	Nearest Residence (mrem/yr)	Population (man-rem)[d]
	Decontamination Cell/Hot Repair Phase[e]				
Isotope					
Pu-238	3.78E-06	9.50E-09	1.87E-09	3.36E-09	3.25E-08
Pu-239	2.27E-06	5.57E-09	1.10E-09	1.97E-09	1.90E-08
Pu-240	5.56E-07	1.36E-09	2.69E-10	4.83E-10	4.67E-09
Pu-241	2.96E-07	6.56E-10	1.29E-10	2.32E-10	2.24E-09
Am-241	2.37E-05	5.83E-08	1.15E-08	2.06E-08	1.99E-07
Total	3.06E-05	7.54E-08	1.49E-08	2.67E-08	2.58E-07
Pathway					
Inhalation	3.06E-05[f]	7.48E-08	1.47E-08	2.65E-08	2.56E-07
Ingestion	-	5.52E-10	1.09E-10	1.95E-10	1.89E-09
Air Immersion	-	1.21E-15	2.39E-16	4.29E-16	4.14E-15
Ground Surface	-	1.40E-11	2.77E-12	4.97E-12	4.80E-11
Total	3.06E-05	7.54E-08	1.49E-08	2.67E-08	2.58E-07

Note: Minor discrepancies due to rounding errors.

a. Effective Dose Equivalent (EDE).
b. The dose to the worker (inhalation) located 100 m SSW from the HFEF. One hundred meters was chosen because it is the lower limitation of the code used to model dispersion and calculations <100 m are not accurate because of variability in wind currents. The distance is within the ANL-W site perimeter.
c. The dose to the maximally exposed individual located at the Site Boundary (SB), 5,000 m SSE; Atomic City, 21,500 m SW; Nearest Residence, 7,800 m SE; and for the population out to 80 km.
d. Population units are person-rem/yr.
e. The doses during the Decon Cell/HRA phase are based on a throughput of 2 bins/week; doses during the Glovebox phase are based on 4 bins/week.
f. Inhalation accounts for 99% of the exposure. Ingestion, air immersion, and ground surface contribute insignificant amounts.

To model emissions of VOCs present in the waste, it was conservatively assumed that 100% of the VOCs (Gratson, 1990a) would be released within the HFEF facility during characterization operations. For annual particulate emissions, it was assumed that 5% (DOE, 1990a) of the material in the waste was in particulate form and 0.1% of that (Elder et al., 1986) would become airborne within the facility during characterization operations. These are

TABLE 2-4. THE EDE[a] TO THE MAXIMALLY EXPOSED INDIVIDUAL DUE TO ROUTINE RELEASES FROM WASTE CHARACTERIZATION AND REPACKAGING DURING THE GLOVEBOX AREA PHASE

	Worker[b]	Public[c]			
Isotope/Pathway	On-site (mrem/yr)	SB (mrem/yr)	Atomic City (mrem/yr)	Nearest Residence (mrem/yr)	Population (man-rem)[d]
		Glovebox Phase[e]			
Isotope					
Pu-238	7.56E-06	1.90E-08	3.74E-09	6.72E-09	6.50E-08
Pu-239	4.54E-06	1.11E-08	2.20E-09	3.94E-09	3.80E-08
Pu-240	1.11E-06	2.72E-09	5.38E-10	9.66E-10	9.34E-09
Pu-241	5.92E-07	1.31E-09	2.58E-10	4.64E-10	4.48E-09
Am-241	4.74E-05	1.17E-07	2.30E-08	4.12E-08	3.98E-07
Total	6.12E-05	1.51E-07	2.98E-08	5.33E-08	5.16E-07
Pathway					
Inhalation	6.12E-05[f]	1.50E-07	2.94E-08	5.30E-08	5.12E-07
Ingestion	-	1.10E-09	2.18E-10	3.90E-10	3.78E-09
Air Immersion	-	2.42E-15	4.78E-16	8.58E-16	8.28E-15
Ground Surface	-	2.80E-11	5.54E-12	9.94E-12	9.60E-11
Total	6.12E-05	1.51E-07	2.98E-08	5.33E-08	5.16E-07

Note: Minor discrepancies due to rounding errors.

a. Effective Dose Equivalent (EDE).
b. The dose to the worker (inhalation) located 100 m SSW from the HFEF. One hundred meters was chosen because it is the lower limitation of the code used to model dispersion and calculations <100 m are not accurate because of variability in wind currents. The distance is within the ANL-W site perimeter.
c. The dose to the maximally exposed individual located at the Site Boundary (SB), 5,000 m SSE; Atomic City, 21,500 m SW; Nearest Residence, 7,800 m SE; and for the population out to 80 km.
d. Population units are person-rem/yr.
e. The doses during the Decon Cell/HRA phase are based on a throughput of 2 bins/week; doses during the Glovebox phase are based on 4 bins/week.
f. Inhalation accounts for 99% of the exposure. Ingestion, air immersion, and ground surface contribute insignificant amounts.

conservative assumptions because: (1) the fraction of waste in particulate form is typically much less than 0.01 (Clements and Kudera, 1985), (2) the WIPP WAC limits the amount of particulate <10 microns in size in a drum to ≤1%. Nitric acid and nitrates are non-volatile and thus are treated as particulates. Calculations of normal emissions from the Decon Cell/HRA operations assume a throughput of 600 DEs per year (1 DE = 0.208 m^3 or 7.35

ft^3) and filtration through two HEPA filters, each with an efficiency of 99.97%. Calculations of normal emissions from the glovebox area operations assume a throughput of 1200 DE/yr, filtered by two HEPA filters, and 90% efficiency activated charcoal filter (Gratson, 1990b). Air concentrations of hazardous chemicals at the site boundary (SB) and the nearby town of Atomic City were calculated using dispersion factors (Chi/Q) obtained from the EPA computer code CAP88 (Gratson, 1990b). Air concentrations of hazardous chemicals at the receptor locations were calculated by dividing the emission rates by the volume of air in the area where workers were assumed to be located (Gratson, 1990b).

Calculated concentrations of applicable hazardous materials at the site boundary, the nearest residence, and Atomic City are compared with NAAQS and to the State of Idaho's ambient air quality standards (Table 2-5). For those hazardous materials that have Idaho ambient air quality standards, the standards are the same as the NAAQS. Standards apply to the following: (1) total VOC's (as ozone), (2) particulate matter, and (3) lead (Table 2-5). The standard for nitrogen dioxide is $100 \mu g/m^3$ annual arithmetic mean, but this is not applicable because nitric acid would not become volatilized and result in NO_2 emissions. There are no NAAQS or Idaho ambient air quality standards for the other listed hazardous materials. Thus, calculated ambient air concentrations are below applicable federal and state regulatory standards (40 CFR 50; IDAPA 16.01.1101).

For the purpose of estimating the health and safety impacts of hazardous particulate and VOC emissions from HFEF operations, noncarcinogenic and carcinogenic health risks were calculated according to EPA methods (EPA, 1989).

Noncarcinogenic hazard indices (HIs) represent comparisons of human intake to health-based reference levels. An HI <1E+00 implies that the ambient concentration of total hazardous materials would not result in a health risk to workers or members of the general public at the exposure point (EPA, 1986, 1989). HIs are well below one; thus noncarcinogenic health risks are not expected (Table 2-6).

TABLE 2-5. CALCULATED AVERAGE AIR CONCENTRATIONS OF HAZARDOUS MATERIALS FOR WORKERS AND THE PUBLIC DURING WASTE CHARACTERIZATION AND NATIONAL AMBIENT AIR QUALITY STANDARDS

	Worker[a]	Public[b]			
Constituent	On-site μg/m³	SB μg/m³	Nearest Residence μg/m³	Atomic City μg/m³	NAAQS[c] μg/m³
Decontamination Cell/Hot Repair Phase					
1,1,1-trichloroethane	1.60E+00	5.84E-03	2.07E-03	1.15E-03	-
Carbon tetrachloride	1.72E+00	6.30E-03	2.23E-03	1.24E-03	-
1,1,2-trichloro-1,2,2-trifluoroethane	1.02E+00	3.73E-03	1.32E-03	7.36E-04	-
Trichloroethylene	1.08E+00	3.94E-03	1.40E-03	7.78E-04	-
Methylene chloride	1.10E-01	4.02E-04	1.42E-04	7.94E-05	-
Methyl alcohol	2.20E-03	8.04E-06	2.85E-06	1.59E-06	-
Butyl alcohol	8.24E-04	3.01E-06	1.07E-06	5.96E-07	-
Xylene	5.49E-03	2.01E-05	7.12E-06	3.97E-06	-
Total VOC's	5.53E+00	2.02E-02	7.17E-03	3.99E-03	2.35E+02[d]
Nitric acid	2.35E-12	8.59E-15	3.04E-15	1.70E-15	[e]
Nitrates	4.57E-13	1.67E-15	5.93E-16	3.31E-16	-
Cadmium	3.71E-15	1.36E-17	4.81E-18	2.68E-18	-
Lead	1.02E-11	3.73E-14	1.32E-14	7.38E-15	1.50E+00
Mercury	4.38E-12	1.60E-14	5.67E-15	3.16E-15	-
Beryllium	1.36E-13	4.97E-16	1.76E-16	9.83E-17	-
Asbestos	3.39E-12	1.24E-14	4.39E-15	2.45E-15	-
Lithium	2.19E-12	8.00E-15	2.84E-15	1.58E-15	-
Total Particulate	2.31E-11	8.45E-14	3.00E-14	1.67E-14	7.50E+01[f]
Glovebox Phase					
1,1,1-trichloroethane	3.19E-01	1.17E-03	4.14E-04	2.31E-04	-
Carbon tetrachloride	3.44E-01	1.26E-03	4.47E-04	2.49E-04	-
1,1,2-trichloro-1,2,2-trifluoroethane	2.04E-01	7.45E-04	2.64E-04	1.47E-04	-
Trichloroethylene	2.15E-01	7.88E-04	2.79E-04	7.56E-04	-
Methylene chloride	2.20E-02	8.04E-05	2.85E-05	1.59E-05	-
Methyl alcohol	4.39E-04	1.61E-06	5.70E-07	3.18E-07	-
Butyl alcohol	1.65E-04	6.03E-07	2.14E-07	1.19E-07	-
Xylene	1.10E-03	4.02E-06	1.42E-06	7.94E-07	-
Total VOC's	1.11E+00	4.05E-03	1.43E-03	8.00E-04	2.35E+02[d]

TABLE 2-5. CONTINUED

Constituent	Worker[a] On-site µg/m³	Public[b] SB µg/m³	Nearest Residence µg/m³	Atomic City µg/m³	NAAQS[c] µg/m³
Nitric acid	4.70E-12	1.72E-14	6.09E-15	3.39E-15	e
Nitrates	9.15E-13	3.35E-15	1.19E-15	6.61E-16	-
Cadmium	7.42E-15	2.71E-17	9.62E-18	5.36E-18	-
Lead	2.04E-11	7.47E-14	2.65E-14	1.48E-14	1.50E+00
Mercury	8.75E-12	3.20E-14	1.13E-14	6.32E-15	-
Beryllium	2.72E-13	9.95E-16	3.53E-16	1.97E-16	-
Asbestos	6.77E-12	2.48E-14	8.78E-15	4.90E-15	-
Lithium	4.38E-12	1.60E-14	5.67E-15	3.16E-15	-
Total Particulates	4.62E-11	1.69E-13	5.99E-14	3.34E-14	7.50E+01[f]

a. Worker located 100 m SSW of HFEF. One hundred meters was chose because it is the lower limitation of the code used to model dispersion and calculations <100 m are not accurate because of variability in wind currents. This distance is within the ANL-W perimeter.
b. Member of the public located at the Site Boundary (SB), 5,000 m SSE; at the Nearest Residence, 7,800 m, SE; and at Atomic City, 21,500 m SW.
c. Applicable Idaho ambient air quality standards are the same as the NAAQS; primary and secondary standards are the same unless otherwise indicated.
d. As ozone.
e. Not applicable, Nitric acid would not become volatilized and lead to NO_2 emissions.
f. Primary standard; secondary standard is 60 $\mu g/m^3$ annual geometric mean.

Carcinogenic health risks represent the incremental (above background) probability of an individual developing cancer over a lifetime as a result of exposure to potential carcinogens (EPA, 1989). The carcinogenic health risks for a maximally exposed worker and a maximally exposed member of the public at the site boundary, the nearest residence, and Atomic City are listed in Table 2-6. The carcinogenic health risks for the public at the site boundary are very small, 3E-07 and 5E-08 for the Decon Cell/HRA and glovebox areas, respectively.

2.3.2 Accident Scenarios

The RSAC-4 code (Wenzel, 1990) was used to predict radiological doses and dispersion coefficients for nonradiological calculation (air emissions and concentrations) to the worker (onsite) and public (site boundary and Atomic City) for the following accident scenarios:

TABLE 2-6. NONCARCINOGENIC HAZARD INDICES AND CARCINOGENIC RISKS FOR WORKERS AND THE PUBLIC DURING WASTE CHARACTERIZATION OPERATIONS

	Worker[a]	Public[b]		
Index / Risk	On-site	SB	Nearest Residence	Atomic City
Decontamination Cell/Hot Repair Phase				
Hazard Index (HI)[c]	6E-05	2E-05	8E-06	4E-06
Total Cancer Risk[d]	4E-05	3E-07	9E-08	5E-08
Glovebox Phase				
Hazard Index (HI)[c]	1E-05	4E-06	2E-06	8E-07
Total Cancer Risk[d]	7E-06	5E-08	2E-08	1E-08

a. Worker located 100 m SSW of HFEF. One hundred meters was chose because it is the lower limitation of the code used to model dispersion and calculations <100 m are not accurate because of variability in wind currents. This distance is within the ANL-W perimeter.
b. Member of the public located at the Site Boundary (SB), 5,000 m SSE; at the Nearest Residence, 7,800 m, SE; and at Atomic City, 21,500 m SW.
c. An HI <1.0E+00 implies that the ambient concentration of total hazardous materials would not result in a health risk to workers or members of the general public at the exposure point (EPA, 1986).
d. Chance that the maximally exposed individual will die of cancer resulting from the exposure.

1. Fire in high bay storage area
2. Dropped waste bin onto high bay floor
3. Fire and explosion when drum is opened
4. Dropped waste bin in truck lock
5. Fire in WIPP waste bin located in the spray chamber
6. Fire in a WIPP waste bin located in the glovebox
7. Partial collapse of HRA facility due to seismic event
8. Loss of exhaust blowers and decontamination cell exhaust

These accident scenarios were developed to calculate doses to the worker in the vicinity of HFEF and the general public at the site boundary, the nearest residence, and Atomic City. According to Elder et al. (1986) the quantity of material that might become airborne in an explosion and fire is

1%. For this analysis, 1% airborne material was assumed for accidents involving an explosion and fire. A value of 0.1% was used for resuspension from a drop accident. A basic assumption for all accidents was the HEPA filter efficiencies of 99% and 99.9%.

A more detailed description of assumptions and probabilities for each accident scenario is provided in Appendix A. Radiological and nonradiological effects were calculated for the first six accident scenarios. Consequences of the seismic event accident scenario (No. 7) are identical to accident No. 2, dropped waste bin in the high bay. The loss of exhaust blowers accident scenario (No. 8) is a zero-consequence event. Thermal convection following complete loss of ventilation fan power would most likely move air in the normal direction through the HEPA filters. In this case, the consequence of the power failure is a continuation of routine releases.

The scenario of a drum explosion caused by the ignition of hydrogen was also considered. Such an accident has a probability in the 10^{-6} to 10^{-8} range. The consequences of such a scenario are the same as for a fire in the high bay storage area. This is because the source terms are assumed the same in both scenarios. The probability of criticality was also investigated. Tilbrook (1991) states that there is no potential for an occurrence with catastrophic consequences with a probability greater than 10^{-8} (see Appendix A, section A.2, p. A-5).

2.3.2.1 Radiological Effects on Workers and the Public. The radiation doses estimated for accident scenarios are given in Table 2-7 and are quite small, especially in view of the low probabilities of the scenarios.

2.3.2.2 Nonradiological Effects on Workers and the Public. Air emissions and air concentrations of hazardous chemicals resulting from six accident scenarios (see section 2.3.2) were calculated and compared to health-based reference levels. The source term used for CH-TRU waste drums was developed by Gratson (1990a) and is summarized in Table 2-8. Dispersion coefficients used to calculate air concentrations at receptor locations were the same as used for radiological accident impacts and were calculated using the RSAC-4 code (Wenzel, 1990). The assumptions for calculating air concentrations for

Table 2-7. CALCULATED CEDE,[a] BY ISOTOPE, FOR ACCIDENT SCENARIOS 1-6 LISTED IN THE APPENDIX[b]

Isotope	Worker[c] On-site (mrem)	Public[d] SB (mrem)	Public[d] Nearest Residence (mrem)	Public[d] Atomic City (mrem)
No. 1 - Fire in the High Bay Storage Area (10^{-2} to 10^{-4} Probability)[e]				
Pu-238	1.05E+00	6.81E-02	4.59E-02	1.97E-02
Pu-239	6.26E-01	4.06E-02	2.74E-02	1.17E-02
Pu-240	1.54E-01	9.98E-03	6.73E-03	2.88E-03
Pu-241	8.35E-02	5.41E-03	3.65E-03	1.56E-03
Am-241	6.54E+00	4.24E-01	2.86E-01	1.23E-01
Total	8.45E+00	5.48E-01	3.70E-01	1.58E-01
No. 2 - Dropped Waste Bin onto High Bay Floor (10^{-4} to 10^{-6} Probability)[e]				
Pu-238	3.14E-01	2.04E-02	1.37E-02	5.88E-03
Pu-239	1.88E-01	1.22E-02	8.21E-03	3.52E-03
Pu-240	4.63E-02	2.99E-03	2.02E-03	8.65E-04
Pu-241	2.51E-02	1.62E-03	1.09E-03	4.69E-04
Am-241	1.96E+00	1.27E-01	8.57E-02	3.67E-02
Total	2.53E+00	1.64E-01	1.11E-01	4.75E-02
No. 3 - Fire and Explosion when Drum is Opened (10^{-2} to 10^{-4} Probability)[e]				
Pu-238	2.10E-05	1.36E-06	9.19E-07	3.94E-07
Pu-239	1.26E-05	8.14E-07	5.48E-07	2.35E-07
Pu-240	3.08E-06	2.00E-07	1.35E-07	5.78E-08
Pu-241	1.68E-06	1.08E-07	7.31E-08	3.13E-08
Am-241	1.30E-04	8.48E-06	5.72E-06	2.45E-06
Total	1.69E-04	1.10E-05	7.39E-06	3.17E-06
No. 4 - Dropped Waste Bin in Truck Lock (10^{-4} to 10^{-6} Probability)[e]				
Pu-238	1.30E+00	3.06E-02	2.07E-02	8.84E-03
Pu-239	7.78E-01	1.83E-02	1.23E-02	5.29E-03
Pu-240	1.91E-01	4.50E-03	3.03E-03	1.30E-03
Pu-241	1.04E-01	2.44E-03	1.65E-03	7.05E-04
Am-241	8.12E+00	1.91E-01	1.29E-01	5.52E-02
Total	1.05E+01	2.47E-01	1.66E-01	7.14E-02

Table 2-7. (continued).

Isotope	Worker[c] On-site (mrem)	Public[d] SB (mrem)	Nearest Residence (mrem)	Atomic City (mrem)
No. 5 - Fire in the WIPP Waste Bin located in the Spray Chamber (10^{-2} to 10^{-4} Probability)[e]				
Pu-238	1.52E-04	2.72E-06	1.83E-06	7.85E-07
Pu-239	9.13E-05	1.63E-06	1.10E-06	4.71E-07
Pu-240	2.24E-05	3.99E-07	2.69E-07	1.15E-07
Pu-241	1.22E-05	2.17E-07	1.46E-07	6.27E-08
Am-241	9.50E-04	1.70E-05	1.14E-05	4.90E-06
Total	1.23E-03	2.19E-05	1.48E-05	6.33E-06
No. 6 - Fire in the WIPP Waste Bin located in the Glove-Box (10^{-2} to 10^{-4} Probability)[e]				
Pu-238	9.88E-05	1.76E-06	1.19E-06	5.09E-07
Pu-239	5.92E-05	1.06E-06	7.12E-07	3.05E-07
Pu-240	1.45E-05	2.59E-07	1.75E-07	7.48E-08
Pu-241	7.87E-06	1.40E-07	9.46E-08	4.06E-08
Am-241	6.15E-04	1.10E-05	7.40E-06	3.17E-06
Total	7.96E-04	1.42E-05	9.57E-06	4.10E-06

a. Committed Effective Dose Equivalent (CEDE).
b. Doses were not calculated for accident scenarios 7, 8 and 9 (see text).
c. The dose to worker (inhalation) located downwind distance of 280 m from the HFEF, SSW.
d. Public (inhalation) doses located at the Site Boundary (SB), 5,000 m SSE; the Nearest Residence, 7,800 m, SE; and Atomic City, 21,500 m SW.
e. Probabilities were derived by ANL-E, see Tilbrook, 1990.

each accident scenario are discussed in Appendix A. Detailed methodology for calculations are presented in Staley (1990).

HIs for the three receptor locations for all accidents are summarized in Table 2-9. All HIs are below 1, indicating that exposures of workers and the public from postulated accidents to all nonradiological (including carcinogens), hazardous constituents would be below health-based reference levels. Estimating carcinogenic risks at these low exposures is not possible. However, carcinogenics are included in this analysis.

TABLE 2-8. ESTIMATED FRACTION AND TOTAL MASS OF HAZARDOUS, NONRADIOACTIVE MATERIALS IN ONE TYPICAL DRUM OF CH-TRU WASTE (Gratson, 1990a)

Constituent	Fraction	Material in one Drum (mg)
Volatile Organic Compounds		
1,1,1-trichloroethane	5.81E-03	8.39E+05
Carbon tetrachloride	6.27E-03	9.05E+05
1,1,2-trichloro-1,2,2-trifluoroethane	3.71E-03	5.36E+05
Trichloroethylene	3.92E-03	5.66E+05
Methylene Chloride	4.00E-04	5.77E+04
Methyl alcohol	8.00E-06	1.15E+03
Butyl alcohol	3.00E-06	4.33E+02
Xylene	2.00E-05	2.89E+03
Particulates		
Cadmium	3.00E-06	4.33E+02
Lead	8.26E-03	1.19E+06
Mercury	3.54E-03	5.11E+05
Beryllium	1.10E-04	1.59E+04
Asbestos	2.74E-03	3.96E+05
Lithium	1.77E-03	2.56E+05
Other		
Nitric acid	1.90E-03	2.74E+05
Nitrates	3.70E-04	5.34E+04

2.4 ENVIRONMENTAL REGULATORY COMPLIANCE

The HFEF was constructed and began operating during the mid-1970's. Major regulatory requirements affecting continued operation of these facilities include the Clean Air Act, Idaho Air Pollution Control Regulations, NESHAP, and RCRA. This section summarizes the regulatory compliance status of HFEF.

Clean Air Act, as amended (42 USC 7420) - The EPA delegated authority for regulation of air emissions (except emissions regulated under NESHAP) to the Idaho Environmental Quality Department (IEQD). The HFEF facility started operations prior to development of IEQD permitting or monitoring requirements.

TABLE 2-9. HAZARD INDICES[a] FOR NONRADIOLOGICAL, HAZARDOUS CONSTITUENTS CALCULATED FOR ACCIDENTS DURING WASTE CHARACTERIZATION ACTIVITIES AT HFEF

	Worker[b]	Public[c]		
Accident	On-site	SB	Nearest Residence	Atomic City
1	7E-03	2E-02	8E-03	5E-03
2	3E-02	1E-01	3E-02	2E-02
3	2E-02	5E-02	2E-02	1E-02
4	4E-02	1E-01	4E-02	3E-02
5	3E-02	1E-01	3E-02	2E-02
6	4E-02	2E-01	5E-02	3E-02

a. An HI <1.0E+00 implies that the ambient concentration of total hazardous materials would not result in a health risk to workers or members of the general public at the exposure point[4].
b. Worker dose located downwind 280 m from the HFEF, SSW.
c. Public doses located at the Site Boundary (SB), 5,000 m SSE; at the Nearest Residence, 7,800 m, SE; and at Atomic City, 21,500 m SW.

The INEL is preparing an operating permit application for all INEL-regulated emissions to the atmosphere. The HFEF-N is included in this application. Specific issues of the WIPP Project emissions from HFEF have been discussed with the IEQD.

EPA has promulgated regulations for radionuclide emission limits at DOE facilities (NESHAP, 40 CFR 61). An analysis has been performed per 40 CFR 61 for the HFEF WIPP emissions. Because neither new construction nor a modification to the HFEF is proposed, approval to construct or modify is not required. However, stack monitoring is required per 40 CPR 61.93. Per agreements between EPA Region X and DOE-ID, the INEL has until December, 1991 to comply with the stack monitoring requirements. The HFEF stack monitoring system would be upgraded to comply by December 1991.

Resource Conservation and Recovery Act of 1976, as amended (42 USC 6901 et. seq.) and Idaho Hazardous Waste Management Act - RCRA regulates hazardous waste by imposing requirements on generators and transporters of hazardous waste, and on owners and operators of TSD facilities. The EPA has authorized the Idaho Department of Health and Welfare to implement most elements of RCRA in Idaho. Five RCRA storage units have been identified within HFEF to accommodate the WIPP project. These units are covered by the INEL RCRA Part B permit applications and do not require separate RCRA and Hazardous Waste Management Act permits. Interim status of these units has been approved by the State of Idaho.

2.5 CONCLUSIONS

To aid in ensuring that test phase wastes are properly characterized and packaged, waste containers would be transported from the RWMC to the HFEF at the ANL-W complex for headspace gas analysis, visual inspections to verify content code and WAC compliance, and repackaging.

The current analysis and the WIPP FEIS analysis shows that the radiological dose for the maximally exposed offsite individual is less than 10^{-7} mrem/yr for normal operations. HIs, calculated for noncarcinogenic hazardous chemical health risks, are well below the 1.0 level stipulated by EPA.

Radiological and nonradiological (including carcinogenic) health risks associated with accident scenarios are minor.

The environmental impacts from the proposed waste characterization and repackaging activities at the HFEF are not significantly different from those presented in the WIPP FEIS and SEIS.

3. ENVIRONMENTAL ANALYSIS OF TRANSPORTATION OF CONTACT-HANDLED TRANSURANIC WASTE DRUMS BETWEEN THE RADIOACTIVE WASTE MANAGEMENT COMPLEX AND THE HOT-FUEL EXAMINATION FACILITIES

3.1 INTRODUCTION

This section addresses impacts associated with INEL onsite transportation activities that support the waste characterization program. The environmental impacts of transporting CH-TRU waste between SWEPP, located at the RWMC, and HFEF, located at ANL-W, are assessed in this section. The shipments would be conducted within the INEL's boundaries along a 42 km (26 mi) route that includes a portion of U.S. Highway 26/20 and controlled access roads from the highway to the facilities (see location map in the Executive Summary, p. xi). The report, *Shipping Plan For Movement of Characterization Waste Between SWEPP and ANL-W*, (Tyacke et al., 1990) describes in detail the following:

- Waste containers, transporter, and shipping casks
- Criteria compliance
- Material content
- Sequence of transport operations
- Administrative controls.

3.2 DESCRIPTION OF TRANSPORTATION ACTIVITY

The waste would be transported between SWEPP and ANL-W using an open transporter (e.g., flatbed truck or trailer) and Nuclear Regulatory Commission (NRC)-certified Type B shipping casks. The waste would be in Department of Transportation (DOT) type A drums and boxes of various sizes. Two drum and two box sizes have been identified for shipping waste material. The drums are (1) DOT Specification 17C steel 55-gal drum and (2) DOT 83-gal steel drum used as an overpack for the 55-gal drum. The boxes are (1) TRUPACT-II standard waste boxes and (2) SWEPP TX4 overpack container to be used as overpacks for the DOT Specification 7A fiber glass reinforced box. Detailed specifications for these drums and boxes are found in MLM-3245 (DOT 7A Type A Certification Document).

All containers transported on an open transporter would meet DOT Specifications for Type A, A_2 values for radionuclide packaging and would meet contact-handling criteria. Those containers transported in the Type B shipping cask would meet NRC Certificate of Compliance requirements. A decision flow chart for identifying the appropriate mode of transport and shipping requirements is shown in Figure 3-1.

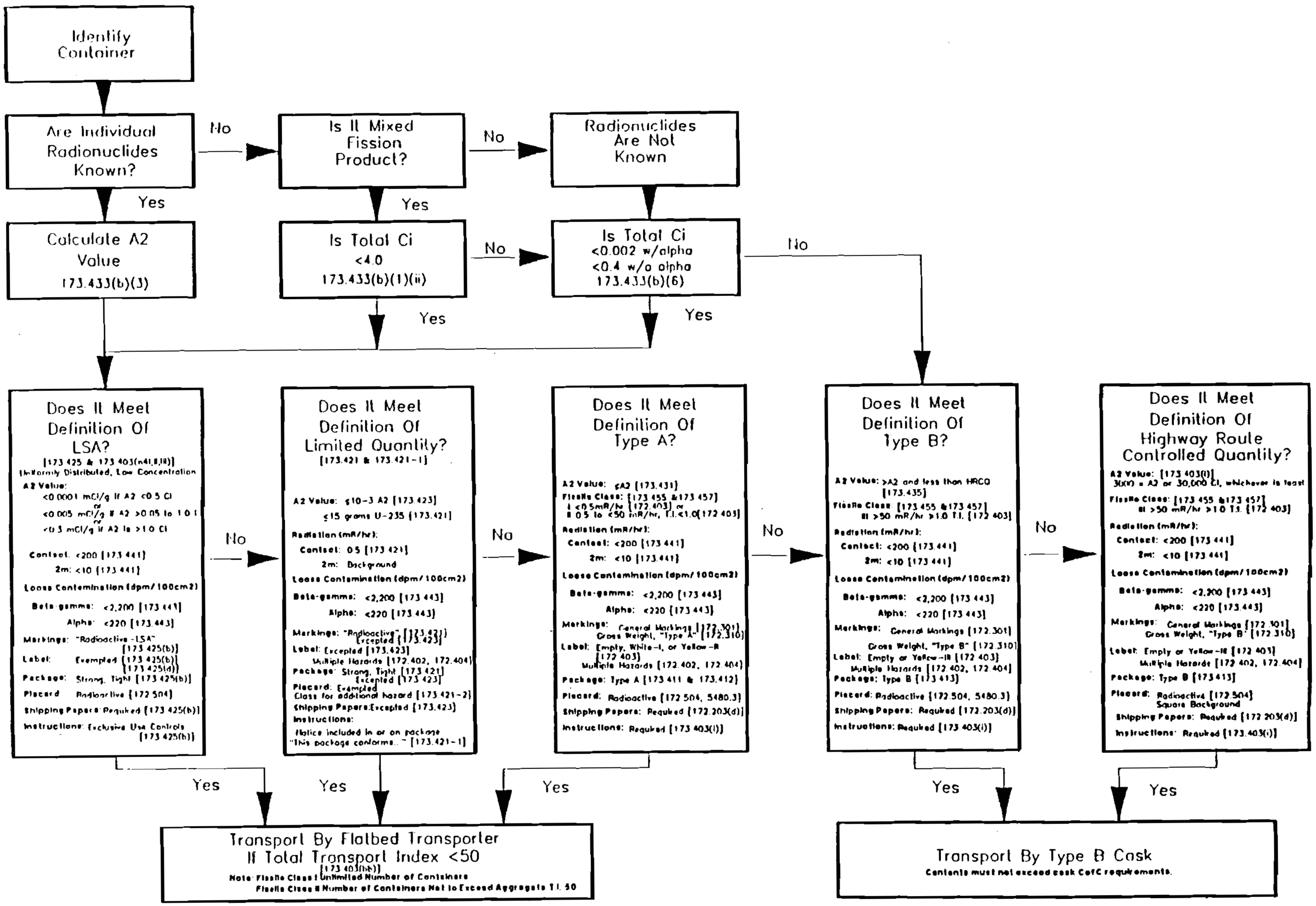
The open transporter would be an 8-ft wide trailer or flatbed truck that would meet DOT maintenance requirements for radioactive shipments. Pallets and boxes would be placed on and removed from the transporter with a forklift that has a minimum safe working load of greater than 6000 lbs. The pallets would carry four drums banded or shrink-wrapped together and banded to the pallet, or the TRUPACT-II standard waste box banded to the pallet.

A pallet could be made up of empty or full drums banded together as previously described. Packaging specified in DOT CFR 173.25 or Type A packaging specified in CFR 173.435 would be used to contain the waste for transport.

Casks with NRC approved Certificates of Compliance, or authorized by the DOT for Type B shipments, would be used for radioactive shipments in excess of Type A quantity of radionuclides. The Type B shipping casks used for this campaign would be NRC certified or would have an approved exemption from the DOT, NRC, or DOE. The shipments would be manifested in compliance with 40 CFR 262 and documented by an offsite Radioactive Material Shipment Record (ID-F-5480.1A). The containers loaded in the cask would meet the stipulations in the Certificate of Compliance or exemption. Loading and unloading operations would be performed in accordance with the procedure specified in the Safety Analysis Report for the package.

Several shipping casks, including TRUPACT-1, TRUPACT-II, B-2, and Super Tiger casks, are being considered for shipment of CH-TRU waste between RWMC and ANL-W.[a] The B-2 cask would be used initially to transport waste to the

a. Other transportation containers may be identified at a later date. Additional appropriate NEPA reviews will be performed as these containers are identified.



Assumptions: A. Dedicated Transporters will be used.
B. All waste is Regular Form, A2, not Special Form, A1

Figure 3-1. Decision flow chart for identifying appropriate mode of transport and shipping requirements.

characterization facility. The initial shipments would be limited to ≤15 g of fissile material in compliance with 10 CFR 71.53 requirements. Subsequent shipments may use other single containment casks (in compliance with appropriate Certificates of Compliance or exemptions) allowing up to 20 Ci of plutonium. The TRUPACT-II container would be used for any shipments containing more than 20 Ci of plutonium. The analyses presented in the next section examine the transportation risks for incident-free transport and accidents using type B containers with radionuclide inventories of 15 g and 20 Cis.

Waste transport between RWMC and ANL-W using TRUPACT-II containers is not evaluated here because it would represent only a 0.5% increase in the total transport distance evaluated in the WIPP SEIS. This small increase would not significantly change the risks presented in the SEIS.

3.3 ENVIRONMENTAL IMPACT ANALYSIS

Transportation risk assessments for shipment inventories of 15 g of fissile material (15 g/cask scenario) and 20 Ci of Plutonium (20 Ci/cask scenario) between RWMC and ANL-W were performed using the RADTRAN 4.0 computer code (Neuhauser and Reardon, 1989). Both incident free and accident conditions were evaluated for workers and members of the public. Nonradiological transportation accidents were performed for the same shipment scenarios. The radiological inventory for shipments with 15 grams of fissile material/cask and 20 Ci plutonium/cask are given in Table 3-1. These values were based on the source term provided in the WIPP SEIS.

The assessment of transportation risk was based on 600 round-trip shipments occurring between RWMC and ANL-W (1200 shipments total). The 1200 shipments provide a maximum estimate of the number of shipments that would occur to support WIPP Bin-Scale Test, Alcove Room Test, and any additional sampling that may be performed to support internal INEL waste characterization.

TABLE 3-1. RADIOLOGICAL INVENTORY FOR SHIPMENTS CONTAINING 15 GRAMS OF FISSILE MATERIAL/CASK AND 20 Ci PLUTONIUM/CASK[a]

	Inventory Scenario	
Radionuclide	15 g Fissile Material[b] (Ci)	20 Ci Plutonium[c] (Ci)
Pu-238	1.7E+00	3.4E+00
Pu-239	9.2E-01	1.8E+00
Pu-240	2.2E-01	4.4E-01
Pu-241	7.2E+00	1.4E+01
Am-241	6.1E+00	1.2E+01
Total	1.6E+01	3.2E+01

a. Values based on source term provided in WIPP FSEIS.
b. 15 g fissile material/cask applies to Pu-238, Pu-239, and Pu-241.
c. 20 Ci plutonium/cask applies to Pu-238, Pu-239, and Pu-240.

3.3.1 Radiological Consequences of Transportation

3.3.1.1 Incident Free Analysis. Radiological dose during normal, incident-free transport results from exposure to the external radiation field surrounding the cask. The dose is a function of the number of people exposed, their proximity to the cask, their length of time of exposure, and the radiation field surrounding the cask.

Radiological impacts, for the total shipment campaign, were determined for two groups during normal operations: 1) workers, and 2) members of the public sharing the transport link. The workers were assumed to be the drivers of the shipment vehicle. No off-link exposures to members of the public were postulated because their are no residents along the route from RWMC to ANL-W.

The computer code RADTRAN 4.0 (Neuhauser and Reardon, 1989) was used to determine the risk from incident-free transportation. The magnitude of the incident-free risk depends mainly on the transport index (TI) of the shipment. Because the waste to be transported between the RWMC and ANL-W is CH-TRU and has a low external exposure rate, a TI of 0.15 was used for the incident-free analyses. This TI is consistent with the TI for TRU waste used in the Special Isotope Separation Environmental Impact Statement (DOE, 1988b).

For workers, doses of 1.0E-2 person-rem were calculated for both 15 g and 20 Ci inventories. For members of the public (sharing the transport link with the radioactive shipments) incident free doses of 8.6E-03 person-rem were calculated for both 15 g/cask and 20 Ci/cask scenarios (Table 3-2). This additional dose is less than 0.25% of the occupational dose of 4.0 person-rem and less than 0.54% of dose to members of the public (1.6 person-rem) calculated for INEL to WIPP shipments during the five-year test phase (DOE, 1990a, Table 5.10, p. 5-29). Therefore, it can be seen that the shipments RWMC and ANL-W add an insignificant amount to the total cumulative dose for the five-year test phase.

3.3.1.2 Accident-Analysis. Radiological consequences of accidents were calculated by assigning release fractions to each category for each chemically and physically distinct type of radionuclides. The release fraction is defined as that fraction of the radionuclide group in the container that could be released in a given severity of accident. Release fractions vary by container type. Most solid materials are relatively nondispersible and would be difficult to release in particulate form. Values for the aerosolized and

TABLE 3-2. INCIDENT-FREE DOSES FOR THE TOTAL SHIPMENT CAMPAIGN FOR THE 15 GRAM/CASK AND 20 Ci/CASK SCENARIO

Scenario	On-Site Worker (Person-rem)	Public (on-link)[a] (Person-rem)
15 g/cask	1.0E-02	8.6E-03
20 Ci/cask	1.0E-02	8.6E-03

a. Since no residences occur along transportation route we assume no off-link dose to members of public.

respirable fractions of the released radioactive material are assigned for each Accident Severity Category (see Table 3-3). Distinct aerosolized and respirable fractions are assigned by material dispersibility category; these categories describe the physical form of the material (e.g., gas, liquid, solid in powder form, monolithic or nondispersible solid). The accident evaluated in this analysis is of Accident Severity Category V (see Madsen et al., 1986 for Accident Severity Category definitions). An Accident Severity Category V accident has a probability of about 10^{-6}. This value has been used in the past for design basis accidents.

Material released in aerosol form is assumed to travel away from the immediate vicinity of an accident in a particulate plume. For this analysis, INEL 95% meteorological conditions (Class F stability, 2 m/s wind speed) were used.

To calculate consequences and health effects, three exposure pathways are considered:

- Inhalation of respirable aerosols in the passing plume
- Cloudshine, defined as exposure to penetrating radiation (e.g., gamma radiation) from the passing plume
- Groundshine, defined as exposure to penetrating radiation from radioactive material that is deposited on the ground from the plume.

Cloudshine and inhalation of respirable aerosols occur only while persons are exposed to the plume. It was assumed that a worker or individual was exposed to the plume for its entire duration. No ingestion doses were postulated for transportation accidents due to the interdiction of foodstuffs mandated by INEL emergency plans. Groundshine was assumed to extend for a period of one year. Consequences were calculated for two exposure groups, an onsite worker who was assumed to be 100 m from the location of the accident and the maximally exposed individual (an offsite member of the public) assumed to be located at 5000 m from ANL-W, at the INEL site boundary. The inventories released by the accident are shown in Table 3-4.

TABLE 3-3. ACCIDENT TRANSPORTATION PARAMETERS

Parameter	Value
Transport mode	Exclusive use truck
Number of shipments	
RWMC to ANL-W	600
ANL-W to RWMC	600
Distance per shipment	42 km
Accident rate	1.4E-07 accidents/km
Accident Severity Category	Probability
Class I	0.58
Class II	0.38
Class III	0.028
Class IV	0.0064
Class V	7.4E-4
Class VI	1.5E-4
Class VII	1.1E-5
Class VIII	9.9E-7

Probability of an Accident:

1.4E-7 accidents/km x 600 x 42 km x 7.4E-04 = 2.6E-06

Accident Severity Category	Release Fraction	Aerosolized Fraction	Respirable Fraction
Class I	0	0.1	0.05
Class II	0	0.1	0.05
Class III	0.01	0.1	0.05
Class IV	0.1	0.1	0.05
Class V	1.0	0.1	0.05
Class VI	1.0	0.1	0.05
Class VII	1.0	0.1	0.05
Class VIII	1.0	0.1	0.05

a. For the maximally exposed individual at the site boundary, the accident was assumed to be Class V (Probability = 7.4E-04), which yields a probability of 2.6E-06.

TABLE 3-4. CURIES RELEASED DURING TRANSPORTATION ACCIDENTS FOR THE 15 GRAM/CASK AND 20 Ci/CASK SCENARIO[a]

Radionuclide	15g/Drum Release[b]	20 Ci/Drum Release[c]
Pu-238	8.5E-03	1.7E-02
Pu-239	4.6E-03	9.1E-03
Pu-240	1.1E-03	2.2E-03
Pu-241	3.6E-02	7.2E-02
Am-241	3.1E-02	6.1E-02
Total	8.1E-02	1.6E-01

a. Assuming a 5.0E-03 release fraction.
b. 15 g/cask applies to Pu-238, Pu-239, and Pu-241;
c. 20 Ci/cask applies to Pu-238, Pu-239, Pu-240, and Pu-241.

At the location of the onsite worker (100 m), an atmospheric dispersion factor (Chi/Q) of 1.8E-3 s/m^3 was calculated using 95% INEL dispersion conditions. At the location of the maximum individual at the site boundary (5000 m), a Chi/Q of 2.1E-5 s/m^3 was calculated using the same meteorological conditions. The EDE was calculated using a breathing rate of 3.3E-4 m^3/s and all EDEs represent 50-year dose commitments. Well over 99% of the EDE from the accident resulted from inhalation exposures. Groundshine and cloudshine made relatively small contributions to the total EDE.

The transportation accident was evaluated using two radionuclide inventories: (1) a type B cask containing 15 g of fissile material and (2) a type B cask containing 20 Ci of Plutonium. The accident scenario has a probability of 2.6E-06 (Table 3-3). Radiological doses for postulated transportation accidents were calculated using the RSAC-4 computer code (Wenzel, 1990). To calculate the probability of a transportation accident for a given Accident Severity Category, the baseline accident rate (units of accidents/km) is multiplied by the total shipment distance (over all shipments, units of km) and the probability of an accident being of a given Accident Severity Category.

The onsite worker would receive about 100 times greater dose (1.3E+01 rem and 2.5E+01 rem) than the maximally exposed offsite individual (1.2E-01 and 2.3E-01) for inventory scenarios of 15 g/cask and 20 Ci/cask, respectively (Table 3-5). This is due to the closeness of the worker to the accident. The inhalation of Am-241 was the greatest contributor to the dose, with Pu-238 and Pu-239 also making substantial contributions.

The 20 Ci/cask scenario would result in the highest consequences, 2.5E+01 rem, 2.3E-01 rem, and 2.5E-04 person-rem for the onsite worker, maximally exposed offsite individual and public, respectively (Table 3-5). The corresponding individual risk for the worker and maximally exposed offsite individual in the 20 Ci/cask scenario are 1.0E-02 and 9.2E-05, respectively; 10^{-7} deaths (that is, no deaths would be expected for the exposed public). This corresponds to risks (frequency x consequence) to the worker, maximally exposed individual, public of 2.6E-08, 2.4E-10, and 2.6E-13 fatalities/total population for the 20 Ci/cask scenario, respectively. Both inventory scenarios would have very minor consequences.

For accidents, a collective dose of 1.3E-04 and 2.5E-04 person-rem was calculated for the 15 g/cask and 20 Ci/cask scenario (Table 3-5). These accident doses are less than 0.40% of the accident dose of 6.4E-2 person-rem calculated in the WIPP SEIS for shipments between the INEL and WIPP. The RWMC to ANL-W and the ANL-W to RWMC shipments result in far smaller doses to all exposed groups than INEL to WIPP shipments. For example, occupational doses are expected to be 0.25% of the INEL to WIPP occupational doses. Doses to members of the public are expected to be 0.54% of the INEL to WIPP doses. Accident doses are expected to be 0.40% of the INEL to WIPP accident doses. Therefore, the additional radiological effect for transportation between RWMC and ANL-W would be an insignificant increase over what was presented in the SEIS for transportation between INEL and WIPP. These findings stem from the small number of shipments, short distance, and sparsely populated area between RWMC and ANL-W.

TABLE 3-5. TRANSPORTATION ACCIDENT DOSES (EDE)[a] AND HEALTH EFFECTS (LCF)[b] TO THE ON-SITE WORKER, MAXIMUM INDIVIDUAL, AND POPULATION FOR THE SHIPMENT OF CH-TRU WASTE BETWEEN SWEPP AND HFEF

	EDE		
Inventory Scenario	On-site Worker[c] (rem)	Maximum Individual[d] (rem)	Public[e] (Person-rem)
15 g/cask	1.3E+01	1.2E-01	1.3E-04
20 Ci/cask	2.5E+01	2.3E-01	2.5E-04

	Health Effects		
Inventory Scenario	On-site Worker[c] (LCF)	Maximum Individual[d] (LCF)	Public[e] (LCF)
15 g/cask	5.2E-03	4.8E-05	5.2E-08
20 Ci/cask	1.0E-02	9.2E-05	1.0E-07

a. EDE (effective dose equivalent) is the sum of the CEDE (committed dose equivalent) from internal exposures and the EDE from external exposures.
b. Health effects are defined as latent cancer fatalities. A conversion factor of 400 cancer fatalities/10^6 person-rem (EPA 1989) was used for this analysis.
c. On-site worker at a distance of 100 m.
d. Maximum individual at a distance of 5,000 m.
e. Collective dose to the public (person-rem).

3.3.2 Nonradiological Consequences of Transportation

Nonradiological transportation accidents consist of traffic accidents that do not release waste material and accidents that release waste constituents. The impacts of non-release accidents are the same as those resulting from transporting nonnuclear materials, and are not characteristic of the container that is shipped or its contents, but are representative of accidents observed on the interstate or state highway systems. Unit risk factors have been developed for truck transport based on truck accident data and describe the number of fatalities per unit distance traveled (Cashwell et al. 1986). The impacts of these accidents are calculated based on two population groups, occupational (workers) and nonoccupational (members of the public). Also, the consequences of these accidents are not dependent on whether the Type B cask is full or empty.

Table 3-6 indicates that less than 1 fatality (6.8E-03) would be expected to occur during the transport between RWMC and ANL-W (1200 shipments assumed for conservatism). Further, it would take about 176,000 shipments for one fatality to occur.

A "bounding case" accident scenario involving hazardous chemical releases is evaluated in the SEIS (DOE, 1990a, Section 5.2.2.2). The evaluation is based on INEL stored waste and conservatively assumes that the transport casks and all (42) drums are breached during an accident, and the entire releasable

TABLE 3-6. NONRADIOLOGICAL TRANSPORTATION SHIPMENT RISKS FOR THE TRANSPORT OF HFEF TRU WASTE BETWEEN RWMC AND ANL-W.

Population Group	Unit Risk Factor (fatalities/km)[a]	Total Trip Distance (km)[b]	Fatalities
RWMC to ANL-W			
Occupational	1.5E-08	25,200	7.6E-04
Nonoccupational	5.3E-08	25,200	2.7E-03
Total			3.4E-03
ANL-W to RWMC			
Occupational	1.5E-08	25,200	7.6E-04
Nonoccupational	5.3E-08	25,200	2.7E-03
Total			3.4E-03
		Project Total	6.8E-03

a. Reference: Cashwell et al. 1986
b. Total round trip distance for all shipments between RWMC and ANL-W. Based on 600 shipments from RWMC to ANL-W and 600 shipments from ANL-W to RWMC.

fraction of hazardous chemicals in the waste is expelled. Risks are evaluated for an exposed receptor located 50m (164 ft) from the accident in the pathway of the contaminant plume. HIs for the exposed receptor range from 6.9E-06 for 1,1,2-trichloro-1,2,2-trifluoroethane to 5.3E-03 for carbon tetrachloride. All exposures to hazardous chemicals were below health-based reference levels.

The chemical risk assessment for transportation in the SEIS is based on the maximum waste inventory (42 drums) in a TRUPACT-II and representative chemical composition of INEL waste. This scenario bounds all transportation configurations under consideration for transport between RWMC and ANL-W.

3.4 ENVIRONMENTAL REGULATORY COMPLIANCE

Waste shipment between RWMC and ANL-W would comply with applicable DOT and

RCRA requirements for transporting hazardous materials. Specifically, DOT requirements for labelling, placarding, shipping manifests, and so forth (49 CFR 171-173) would be met. Additionally, a Uniform Hazardous Waste Manifest (40 CFR 262) and applicable Land Disposal Restriction notifications (40 CFR 268) would be provided to ensure compliance with RCRA.

3.5 CONCLUSIONS

Potential environmental impacts of the incident-free waste transportation scenarios (15 g/cask and 20 Ci/cask) between RWMC and ANL-W were evaluated using the RADTRAN 4.0 computer code. For workers, incident-free doses of 1.0E-02 person-rem were calculated for both 15 g/cask and 20 Ci/cask scenarios. Incident-free doses for members of the public (off-link) were 8.6E-03 person-rem for both 15 g/cask and 20 Ci/cask scenarios. The incident-free dose calculated for both the worker and public were less than 1% of those reported for the INEL to WIPP shipments during the five-year test phase (DOE, 1990a, Table 5.10, p. 5-29).

The effects of postulated accidents between the RWMC and ANL-W were also evaluated. These analyses show that shipments from RWMC to ANL-W result in accident doses less than 0.4% of INEL to WIPP accident doses. In addition, the dose to a hypothetical maximally exposed individual is well within the recommended dose guideline of 0.5 to 25 rem (see Elder et al, 1986). The risks (frequency x consequence) are also extremely low, in the size of 1E-12 to 1E-13, well below levels that the public typically views as acceptable.

Because the shipments from RWMC to ANL-W add less than 1% to the INEL to WIPP risks, from transportation are essentially the same as the incremental impacts presented in the SEIS (DOE, 1990a).

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APPENDIX A

Accident Descriptions, Probabilities and Assumptions

APPENDIX A
ACCIDENT DESCRIPTIONS, PROBABILITIES AND ASSUMPTIONS

A.1 Accident Descriptions AT HFEF

These accident scenarios were used to calculate doses to the worker in the vicinity of HFEF and the general public at the site boundary, the nearest residence, and Atomic City. According to Elder et al., (1986) the quantity of material that would become airborne in an explosion and fire is 1%. For this analysis, 1% airborne material was used for accidents involving an explosion and fire. A value of 0.1% was used for resuspension from a drop accident.

1. Fire in High Bay Storage Area: Accident scenario - One drum gets hot enough to reach the flash point of the enclosed volatiles causing the drum to explode. The burning contents of the drum are scattered over the floor. Assumptions include:

   - Sprinkler system limits the spread and intensity of the fire
   - Five percent of nonvolatile, hazardous wastes is assumed to be in particulate form; 1% of that 5% is assumed to become airborne when fire is involved (Elder et al., 1986)
   - Half of the airborne particulates released into the high bay "plate out", (adhere to surfaces) in the high bay and are thus unavailable for release
   - Exhaust fan in high bay exhausts entire contaminated volume in: 1.54E-04 x 10^4 m^3 (high bay volume)/2.12 x 10^2 m^3/min (fan capacity) = 72.5 minutes.

2. Dropped Waste Bin Onto High Bay Floor: A full waste bin, containing six DE is dropped to the high bay floor, spilling 50% of its contents (three DEs). Assumptions include:

   - Same as for fire in high bay storage area (No. 1), except the resuspension fraction is assumed to be 0.1.

3. Fire and Explosion When Drum Opened: Similar to the fire in the high bay, except the accident occurs in HRA or Preparation Room. Assumptions include:

- No immediate fire extinguishing intervention. Fire fighters arrive at HFEF in five minutes, but are delayed five minutes before entering the HRA (or Prep room). Fire burns for 10 minutes.

- Effluent from fire is filtered (particulates only) by two stages of HEPA filters, one with an efficiency of 99.9%, and the second with 99.0% efficiency for a combined decontamination factor equal to 1.0×10^{-5}.

- One DE VOCs and 5×10^{-4} DE particulates are released and dispersed in HRA volume of 658 m^3.

- Ventilation system exhausts that volume in 658 m^3/68 m^3/min (HVAC capacity) = 9.7 minutes. This time is added to the fire fighter response time of 10 minutes, for a total release time of 20 minutes. The preparation room would take slightly less time (about two minutes less) to exhaust its air volume; the difference in release rate is small and therefore a prep room fire was not modeled separately.

4. Waste Bin Dropped Into Truck Lock: A loaded waste bin is dropped in the truck lock, spilling 50% of its contents (three DEs). Assumptions include:

   - The spilled inventory mixes in the truck lock air; half of that inventory leaks out into the high bay, while the remainder in the truck lock is exhausted to the atmosphere (no filtration).

   - For particulates, half the airborne particulate DE plate out in the high bay and are unavailable for release. The remaining particulates are exhausted in 72.5 minutes.

   - For VOCs, one and one-half DEs each are exhausted from the high bay and truck lock.

   - The one and one-half DEs in the truck lock are exhausted by its ventilation system in 1235 m^3 (volume)/67 m^3/min (ventilation rate) = 18.6 min.

5. Fire Involving WIPP Waste Bin in Spray Chamber: Fire occurs in the spray chamber, and lasts 20 min before being extinguished. Wastes on the sorting table and in the bin are involved in the fire. Assumptions include:

   - Five DEs are loaded in bin; one DE is on sorting table

   - All of the one DE on table is on fire

- Fire penetrates 0.5 ft into bin contents, involving 4 x 4 x 0.5 ft = 8 ft^3, or about one DE. Therefore, total DEs involved equal two

- Effluent from fire is filtered (particulates only) by two stages of HEPA filters, with a combined decontamination factor equal to 1.0×10^{-5}

- Release time from spray chamber equals 23.6 m^3/34 m^3/min = 0.695 minute. Total release time is 0.695 minute + 20 minutes burn time = 21 minutes.

6. Fire Involving WIPP Waste Bin in Glovebox: Accident similar to fire in the spray chamber (No. 5). However, fire occurs in the glovebox and is extinguished in five minutes by the CO_2 fire suppression system. Wastes on the sorting table and in the bin are involved in the fire. Assumptions include:

   - One DE on sorting table is involved in fire

   - Fire burns 1.5 in. into bin; volume burned equals 4 x 4 x (1.5 in./12 in./ft) = 2.00 ft^3 and 2.00 ft^3/7.33 ft^3/drum ≈ 0.3 DE. Therefore, total DE equals 1 + 0.3 = 1.3 DE involved in fire

   - Clearance time for glovebox area equals 27 m^3 (glovebox volume)/11 m^3/min (ventilation rate) = 2.4 min. Total release time equals 5 + 2.4 ≈ 8 minutes

   - For this analysis, no removal of VOCs by carbon filter beds is assumed. This is because calculating removal by carbon beds is complex; if results of analysis without credit for carbon beds show VOC concentrations below levels of concern, no further analysis is necessary.

7. Partial Collapse of HRA Facility Due to Seismic Event: This is identical to a dropped waste bin in high bay (No. 2) because it releases the same amount of material to the high bay.

8. Loss of Exhaust Blowers, Decon Cell/HRA Exhaust: This accident appears to be a zero-consequence event. Discussions with ventilation and facilities personnel at ANL-W indicate that, should thermal convection take place following a complete loss of ventilation fan power, convective flow is most likely to proceed in the normal direction through the HEPA

filters. In this case, the consequence of the power failure is a continuation of routine releases.

A.2 Accident Probabilities

Accident scenarios were evaluated and assigned probabilities by Tilbrook (1990; 1991) and Gratson (1990c). Radiological doses from accidents were evaluated using guidance from Elder et al., (1986)..

Accident No.	Description	Probability
1	Fire in high bay storage area	10^{-2} to 10^{-4}
2	Dropped waste bin onto high bay floor	10^{-4} to 10^{-6}
3	Fire and explosion when drum is opened	10^{-2} to 10^{-4}
4	Dropped waste bin in truck lock	10^{-4} to 10^{-6}
5	Fire in WIPP waste bin located in spray chamber	10^{-4} to 10^{-2}
6	Fire in WIPP waste bin located in glovebox area	10^{-4} to 10^{-2}
7	Partial collapse of HRA facility due to seismic event	10^{-4} to 10^{-2}
8	Loss of exhaust blowers and decontamination cell exhaust	10^{-4} to 10^{-2}
9	Hydrogen explosion	$<10^{-6}$
10	Criticality	$<10^{-8}$