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Supplemental Information Related to Risk Assessment for the Off-Site Transportation of Low-Level Waste for the U.S. Department of Energy Waste Management Programmatic Environmental Impact Statement

Environmental Assessment Division
Argonne National Laboratory



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NOTATION

The following is a list of the acronyms, initialisms, and abbreviations (including units of measure) used in this document. Some acronyms used only in tables are defined in those tables.

ACRONYMS, INITIALISMS, AND ABBREVIATIONS

ANL-E	Argonne National Laboratory-East
ANL-W	Argonne National Laboratory-West
BNL	Brookhaven National Laboratory
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
FEMP	Fernald Environmental Management Project
Hanford	Hanford Site
ICRP	International Commission on Radiological Protection
INEL	Idaho National Engineering Laboratory
LANL	Los Alamos National Laboratory
LLNL	Lawrence Livermore National Laboratory
LLW	low-level waste
MEI	maximally exposed individual
NRC	U.S. Nuclear Regulatory Commission
NTS	Nevada Test Site
ORR	Oak Ridge Reservation
Pantex	Pantex Plant
PGDP	Paducah Gaseous Diffusion Plant
PORTS	Portsmouth Gaseous Diffusion Plant
PEIS	Programmatic Environmental Impact Statement
RFETS	Rocky Flats Environmental Technology Site
SMAC	Shipment Mobility/Accountability Collection
SNL-NM	Sandia National Laboratories (New Mexico)
SRS	Savannah River Site
TSD	treatment, storage, and disposal
WM	Waste Management
WVDP	West Valley Demonstration Project

UNITS OF MEASURE

ft	foot (feet)
g	gram(s)
gal	gallon(s)
h	hour(s)
kg	kilogram(s)
km	kilometers(s)
km^2	square kilometer(s)
L	liter(s)

L	liter(s)
lb	pounds(s)
m	meter(s)
mi	mile(s)
mi^2	square mile(s)
mph	mile(s) per hour
mrem	millirem
nCi	nanocurie(s)
rem	roentgen-equivalent man
s	second(s)
yr	year(s)

Supplemental Information Related to Risk Assessment for the Off-Site Transportation of Low-Level Waste for the U.S. Department of Energy Waste Management Programmatic Environmental Impact Statement

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ABSTRACT

This report presents supplemental information to support the human health risk assessment conducted for the transportation of low-level waste (LLW) in support of the U.S Department of Energy Waste Management Programmatic Environmental Impact Statement (WM PEIS). Detailed descriptions of the transportation health risk assessment method and results of the assessment are presented in Appendix E of the WM PEIS and are not repeated in this report. This report presents additional information that is not presented in Appendix E but is necessary to conduct the transportation risk assessment for Waste Management (WM) LLW. Included are definitions of the LLW alternatives considered in the WM PEIS, data related to the inventory and to the physical and radiological characteristics of WM LLW, an overview of the risk assessment method, and detailed results of the assessment for each WM LLW case considered.

1 INTRODUCTION

This report presents supplemental information to support the human health risk assessment conducted for the transportation of low-level waste (LLW) for the U.S. Department of Energy (DOE) Waste Management Programmatic Environmental Impact Statement (WM PEIS) (DOE 1995). Detailed descriptions of the transportation health risk assessment method, major assumptions, and packaging and routing determinations, as well as a summary of the results of the transportation assessment, are presented in Appendix E of the WM PEIS (DOE 1995) and are not repeated in this report. This report presents additional information that is not presented in Appendix E but is necessary to conduct the transportation risk assessment. This report should be read in conjunction with Appendix E to provide a complete description of the transportation risk assessment conducted for LLW. Similar supporting reports have been prepared for the transportation assessments conducted for the WM PEIS alternatives for high-level waste, low-level mixed waste, and transuranic waste (Monette et al. 1995a,b,c).

The WM PEIS assessment of LLW considers LLW generated from WM activities. A description of the LLW inventory, characteristics, and treatment options is presented in Goyette (1995). This report includes definitions of the LLW alternatives considered in the

WM PEIS and presents data related to the inventory and to the physical and radiological characteristics of WM LLW that are used in the transportation assessment (Section 2). An overview of the risk assessment method is provided in Section 3. In addition, supplemental assumptions and parameters for the risk assessment calculations are provided (Section 4), and detailed results of the assessment are presented for each WM LLW case considered (Section 5).

2 LOW-LEVEL WASTE CHARACTERISTICS, ALTERNATIVES, AND ASSESSMENT SCOPE

The risks of transporting LLW have been assessed for 14 WM alternatives in the WM PEIS. The transportation risks for each case depend on the amount of waste transported, the physical form of the waste, and the quantity of radioactivity (curies) in each shipment. This section of the report describes the alternatives considered for WM LLW in the WM PEIS, presents important LLW inventory and characterization data used in the transportation assessment, and defines the scope of the human health risk assessment.

2.1 DEFINITION OF LOW-LEVEL WASTE

Low-level waste is radioactive waste that is not high-level waste, spent nuclear fuel, transuranic waste (greater than 100 nCi/g), or by-product material as defined in Section 11e(2) of the Atomic Energy Act of 1954. Low-level waste is produced in a variety of forms by defense and research activities. The DOE LLW results from daily handling and processing of radioactive materials by DOE defense activities, uranium enrichment operations, the naval nuclear propulsion program, and various research-and-development activities. Low-level waste can contain many different radionuclides in activities ranging from trace quantities to several thousand curies. Low-level waste is present in several physical forms as well, including liquids, wet solids or sludge, and dry solids. Dry solids range from contaminated compactible and combustible materials to contaminated equipment and irradiated hardware. Solid LLW can also consist of soil and sediment and concrete, brick, and rock. Liquid LLW is treated to produce a sludge or solid that may also require packaging before disposal.

2.2 LOW-LEVEL WASTE ALTERNATIVES FOR THE WM PEIS

For the purposes of the WM PEIS, the DOE is considering a range of alternatives for the configuration of new or expanded WM facilities and the potential consolidation of existing facilities. In general, the WM PEIS alternatives reflect decentralized, regionalized, and centralized approaches. For each type of waste, several options, which are referred to as cases, have been defined for each broad alternative. The individual cases differ in the number, location, and types of facilities for treatment, storage, and disposal (TSD) that are being considered.

Transportation risks have been calculated for 14 WM LLW cases. The cases range from decentralized to centralized approaches to TSD. Case 1 represents the No Action Alternative. The number of disposal sites varies from 16 for decentralized disposal to one for centralized disposal. Options for treatment also vary from decentralized to centralized approaches. In general, sites not having the capability for treatment or disposal ship to the

nearest site that has such capability. The cases are summarized in Table 2.1 and are described as follows:

- *No Action (Case 1).* All sites would treat LLW using existing, planned, and approved treatment facilities and dispose of LLW at the six current disposal sites in accordance with current arrangements.

- *Decentralized (Case 2).* All sites would minimally treat LLW, stabilizing fines and liquids, and dispose of LLW at 16 sites (Argonne National Laboratory-East [ANL-E], Brookhaven National Laboratory [BNL], Fernald Environmental Management Project [FEMP], Hanford Site (Hanford), Idaho National Engineering Laboratory [INEL], Lawrence Livermore National Laboratory [LLNL], Los Alamos National Laboratory [LANL], the Nevada Test Site [NTS], Oak Ridge Reservation [ORR], Paducah Gaseous Diffusion Plant [PGDP], Pantex Plant [Pantex], Portsmouth Gaseous Diffusion Plant [PORTS], Rocky Flats Environmental Technology Site [RFETS], Sandia National Laboratory-New Mexico [SNL-NM], Savannah River Site [SRS], and West Valley Demonstration Project [WVDP].

- *Regionalized 1 (Case 3).* All sites would minimally treat LLW, stabilizing fines and liquids, and dispose of LLW at 12 sites (Hanford, INEL, NTS, LANL, ORR, SRS, PORTS, PGDP, FEMP, LLNL, Pantex, and RFETS).

- *Regionalized 2 (Case 9).* Eleven sites (Hanford, INEL, LANL, ORR, SRS, PORTS, PGDP, FEMP, LLNL, Pantex, and RFETS) would incinerate, supercompact, reduce the size of, and grout volume-reducible waste; all sites would minimally treat other waste; disposal would occur at 12 sites (Hanford, INEL, NTS, LANL, ORR, SRS, PORTS, PGDP, FEMP, LLNL, Pantex, and RFETS).

- *Regionalized 3 (Case 4).* All sites would minimally treat LLW, stabilizing fines and liquids, and dispose of LLW at the nearest of six sites (Hanford, INEL, NTS, LANL, ORR, and SRS).

- *Regionalized 4 (Case 12).* Seven sites (Hanford, INEL, LANL, ORR, PORTS, RFETS, and SRS) would incinerate, supercompact, reduce the size of, and grout volume-reducible waste; all sites would minimally treat other waste; disposal would occur at six sites (Hanford, INEL, NTS, LANL, ORR, and SRS).

TABLE 2.1 Summary of WM LLW Cases

Alternative	Description
No Action (Case 1)	All sites use existing and approved treatment facilities and dispose of waste at 6 sites per current arrangements.
Decentralized (Case 2)	All sites minimally treat and stabilize liquids and fines and dispose of waste at 16 sites.
Regionalized 1 (Case 3)	Same as Case 2, except dispose of waste at 12 sites.
Regionalized 2 (Case 9)	Regional treatment of volume-reducible wastes at 11 sites (incineration, supercompaction, and size reduction); all sites minimally treat other wastes and dispose of waste at 12 sites.
Regionalized 3 (Case 4)	Same as Case 2, except dispose of waste at 6 sites.
Regionalized 4 (Case 12)	Regional treatment of volume-reducible wastes at 7 sites; all sites minimally treat other wastes and dispose of waste at 6 sites.
Regionalized 5 (Case 19)	Regional treatment of volume-reducible waste at 4 sites; all sites minimally treat other wastes and dispose of waste at 6 sites.
Regionalized 6 (Case 5)	Same as Case 2, except dispose of waste at 2 sites.
Regionalized 7 (Case 6)	Same as Case 2, except dispose of waste at 2 sites.
Centralized 1 (Case 7)	Same as Case 2, except dispose of waste at 1 site.
Centralized 2 (Case 8)	Same as Case 2, except dispose of waste at 1 site.
Centralized 3 (Case 14)	Same as Case 12, except dispose of waste at 1 site.
Centralized 4 (Case 14a)	Same as Case 12, except dispose of waste at 1 site.
Centralized 5 (Case 21)	One site incinerates, supercompacts, and reduces size of volume-reducible waste; all sites minimally treat other wastes; 1 site disposes of waste.

- *Regionalized 5 (Case 19).* Four sites (Hanford, INEL, ORR, and SRS) would incinerate, supercompact, reduce the size of, and grout volume-reducible waste; all sites would minimally treat other waste; disposal would occur at six sites (Hanford, INEL, NTS, LANL, ORR, and SRS).

- *Regionalized 6 (Case 5).* All sites would minimally treat LLW, stabilizing fines and liquids, and dispose of LLW at the nearer of two sites (Hanford and SRS).

- *Regionalized 7 (Case 6).* All sites would minimally treat LLW, stabilizing fines and liquids, and dispose of LLW at the nearer of two sites (NTS and SRS).

- *Centralized 1 (Case 7).* All sites would minimally treat LLW, stabilizing fines and liquids, and dispose of LLW at one site (Hanford).

- *Centralized 2 (Case 8).* All sites would minimally treat LLW, stabilizing fines and liquids, and dispose of LLW at one site (NTS).

- *Centralized 3 (Case 14).* Seven sites (Hanford, INEL, LANL, ORR, SRS, PORTS, and RFETS) would incinerate, supercompact, reduce the size of, and grout volume-reducible waste; all sites would minimally treat other waste; disposal would occur at one site (Hanford).

- *Centralized 4 (Case 14a).* Seven sites (Hanford, INEL, LANL, ORR, SRS, PORTS, and RFETS) would incinerate, supercompact, reduce the size of, and grout volume-reducible waste; all sites would minimally treat other waste; disposal would occur at one site (NTS).

- *Centralized 5 (Case 21).* One site (Hanford) would incinerate, supercompact, reduce the size of, and grout volume-reducible waste; all sites would minimally treat other waste; disposal would occur at one site (Hanford).

2.3 CHARACTERISTICS OF LOW-LEVEL WASTE

To support the WM PEIS analysis of LLW alternatives, a report has been prepared describing the LLW inventory and characteristics at each DOE site (Goyette 1995). In addition, Goyette (1995) describes the current LLW TSD capabilities of the DOE complex and presents the important assumptions associated with the analysis of LLW alternatives. The information in the report by Goyette (1995) was used as the primary source of information for the transportation assessment.

In the report by Goyette (1995), the current inventories and annual generation rates of LLW are reported for about 30 sites in the DOE complex. For the purposes of assessment,

the WM PEIS considers current inventories plus 20 years of generation for LLW generated from WM activities. For each site, information on inventory is presented in terms of projected waste volumes and masses. In addition, the physical and radiological characteristics of the waste at each site are presented. Information from Goyette (1995) that is important for the transportation assessment is summarized subsequently.

2.3.1 Physical Waste Forms

The LLW at each site is characterized as a function of the potential options for treatment of the various waste forms in the report by Goyette (1995). For WM LLW, 10 different LLW treatability categories were developed for WM PEIS assessment purposes on the basis of the physical characteristics of the waste. Treatability categories for solid waste (both wet and dry) are (1) combustible; (2) noncombustible and noncompactible; (3) noncombustible and compactible; (4) surface-contaminated bulk metal or equipment; (5) activated bulk metal or equipment; (6) sludge or resin; and (7) other (wastes that do not fit into the previous categories). Treatability categories for liquid wastes are (8) dilute or aqueous and (9) organic. Low-level waste can also be remote-handled, although no liquid waste at the installations falls into this category. The 10th LLW treatability category is identified simply as remote-handled, independent of the physical characteristics of the waste. For the WM PEIS, all liquid LLW is assumed to be treated at the site of generation before transportation (Goyette 1995). Residuals are then managed as solid LLW.

For purposes of the transportation assessment, two physical waste forms were defined on the basis of the 10 treatability categories listed previously: (1) heterogeneous solids, and (2) activated metals. The heterogeneous solids include all solid-waste categories with the exception of Category 5, plus the solid residuals of liquid-waste treatment. The activated metals consist of waste in treatability Category 5. Activated metals were treated separately in the transportation assessment because the radioactive contamination is not readily released to the environment in a dispersible form during transportation-related accidents.

2.3.2 Radiological Profiles

The radiological characteristics of LLW at each site are divided into six categories by Goyette (1995): (1) uranium and thorium — waste materials for which the principal hazard results from naturally occurring uranium and thorium isotopes; (2) fission product — waste materials contaminated with beta- or gamma-ray-emitting radionuclides that originate as a result of fission processes (primary examples are cesium-137 and strontium-90); (3) induced activity — waste materials contaminated with beta- or gamma-ray-emitting isotopes that are generated through neutron activation (of major concern is cobalt-60); (4) tritium — waste materials for which the principal hazard results from tritium; (5) alpha — waste material contaminated with low levels (between 10 and 100 nCi/g) of transuranic isotopes, excluding alpha-emitting radionuclides listed under uranium and thorium; and (6) other — mixture or not defined. For each of the six categories, a

representative radionuclide profile is defined that specifies the relative mix of radionuclides in the category (Goyette 1995). These data are combined with activity levels reported by generating sites to determine the activities of individual radionuclides in the LLW at each site.

2.4 QUANTITIES AND CHARACTERISTICS OF TRANSPORTED LOW-LEVEL WASTE BY CASE

The LLW inventory and characterization data described previously are used as the primary input to a computational model called WASTE_MGMT (Kotek et al. 1995). The WASTE_MGMT model has been developed at ANL-E to support analyses of risks and costs for all alternatives for each waste type considered in the WM PEIS (Kotek et al. 1995). Input to the model includes not only data on the waste inventory and characterization, but also data on operations for the TSD facilities used for the wastes, and the definitions of the various alternatives. Specific modeling parameters for the LLW assessment are discussed by Goyette (1995).

One output of the WASTE_MGMT model consists of the annual quantity, physical form, and radiological characteristics of the waste shipped between sites for each case. The output of the model consists of a set of origin-and-destination pairs that represent shipping linkages among generator, treatment, and storage sites. For each origin-and-destination pair, the model computes the annual volume (cubic meters), weight (kilograms), and radioactivity (curies) of the LLW transported. In addition, the radioactivity is computed for each individual radionuclide present in the LLW. The effects of potential waste treatment, such as volume reduction or incineration, are considered in the model and are reflected in changes in waste density and activity concentrations. The WASTE_MGMT output files are used directly as input to the transportation risk assessment.

The WASTE_MGMT transportation summary files generated for the LLW transportation assessment are presented in Appendix A of this report. For each of the 14 WM cases, shipments are summarized separately for heterogeneous solids and for activated metals. The total quantity of shipments for a case can be found by summing the quantities for heterogeneous solids and activated metals. In general, the quantity of activated metals transported is insignificant compared with the quantity of heterogeneous solids for each case.

Note that the WASTE_MGMT files report the quantity of waste shipped on an *annual* basis (cubic meters per year or kilograms per year). As stated previously, the WM PEIS considers a 20-year time frame for WM LLW. For most of the WM alternatives considered in the WM PEIS, the assumption was that shipments would occur uniformly over a 10-year period, which would allow an initial 10-year period to build TSD facilities. Sites would essentially store their own waste for the first 10 years and ship all waste over the subsequent 10 years; however, the assumption was that for the No Action Alternative, shipments would be distributed uniformly over a 20-year period because no new facilities need to be built. Therefore, although the total inventory considered is the same for all

WM cases (current inventories plus 20 years of generation), the annual amounts of waste shipped, as reported in the WASTE_MGMT files in Appendix A, are a function of the assumption concerning the duration of the shipping campaigns for each case.

Because of the differences in the time frames noted previously and uncertainties in the actual timing of future waste shipments, the impacts of transportation for the various cases are best compared by examining the total impacts of transporting a specific inventory of waste, independent of the annual shipping rates. The total amount of LLW transported for each case can be calculated by multiplying the annual shipment quantities (reported in the WASTE_MGMT files in Appendix A) by 20 years for the No Action Alternative and by 10 years for the other WM cases.

2.5 SCOPE OF THE RISK ASSESSMENT

The transportation risk assessment is limited to estimating the human health risks incurred during the actual transportation of LLW by truck or rail. The risks to workers or to the public during the loading, unloading, and handling of waste before or after shipment are considered as part of normal operations of the facility and are not included in the transportation assessment. Similarly, the transportation risk assessment does not address how increased transportation levels may possibly impact local traffic flow, noise levels, logistics, or infrastructure. The impacts that are addressed are discussed subsequently.

2.5.1 Cargo-Related Impacts: Radiological

For radioactive materials, the cargo-related impacts on human health during transportation are caused by exposure to ionizing radiation. For all cases, radiological risks (i.e., risks that result from the radioactive nature of the LLW) are assessed both for routine (normal) transportation and for accidents. The radiological risk associated with routine transportation results from the potential exposure of people to low levels of external radiation in the vicinity of a loaded shipment. The radiological risk from transportation-related accidents lies in the potential release and dispersal of radioactive material into the environment during an accident and the subsequent exposure of people through multiple exposure pathways (i.e., exposure to contaminated ground or air or the ingestion of contaminated food).

All radiologically related impacts are calculated in terms of dose and associated health effects in the exposed populations. The dose of radiation calculated is the total effective dose equivalent as specified in Title 10 of the *Code of Federal Regulations* (10 CFR Part 20), which is the sum of the effective dose equivalent from exposure to external radiation and the 50-year committed effective dose equivalent (International Commission on Radiological Protection [ICRP] 1977) from exposure to internal radiation. Doses of radiation are calculated in units of rem (roentgen-equivalent man) for individuals and in units of person-rem for collective populations.

The potential exposures to the general population from transportation of radioactive materials, whether during routine operations or from postulated accidents, are usually at a low dose, such that the primary adverse health effect is the potential induction of latent cancers (i.e., cancers that occur after a latency period of several years from the time of exposure). The correlation of radiation dose and human health effects for low doses has been traditionally based on what is termed the "linear/no-threshold hypothesis," which has been described by various international authorities on protection against radiation. This hypothesis implies, in part, that even small doses of radiation cause some risk of inducing cancer and that doubling the radiation dose would mean doubling the expected numbers of cancers. The types of cancer induced by radiation are similar to "naturally occurring" cancers and can be expressed later in the lifetimes of the exposed individuals.

On the basis of the analyses conducted for this report, LLW transportation-related operations are not expected to cause acute (short-term) radiation-induced fatalities or to produce immediately observable effects in exposed individuals. Acute radiation-induced fatalities occur at doses well in excess of 100 rem (ICRP 1991), which generally would not occur for a wide range of transportation activities, including routine operations and accidents.[1] For some severe accident scenarios analyzed, doses to individuals possibly would cause short-term effects such as temporary sterility and changes in blood chemistry; however, these effects cannot be readily quantified and therefore have not been assessed in this report.

In this report, the radiological impacts are expressed as health risks in terms of the number of estimated latent-cancer fatalities, the incidence of cancer, and the genetic effects in exposed populations for each alternative. The health risk conversion factors (expected latent health effects per dose absorbed) were derived from ICRP Publication 60 (ICRP 1991).

2.5.2 Vehicle-Related Impacts: Nonradiological

In addition to the radiological risks posed by transportation-related activities, risks are also assessed for vehicle-related causes for the same routes. These risks are independent of the radioactive nature of the cargo and would be incurred for similar shipments of any commodity. The vehicle-related risks are assessed for both routine conditions and accidents. Vehicle-related risks during routine transportation are caused by potential exposure to increased vehicular exhaust emissions. The routine risks are primarily associated with travel in urban environments. The vehicle-related accident risk refers to the potential for transportation-related accidents that result in fatalities due to physical trauma and not related to the cargo in the shipment. State-specific rates for transportation-related fatalities are used in the assessment. Vehicle-related risks are presented in terms of estimated fatalities for each alternative.

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[1] In general, individual acute whole-body doses in the range of 300-500 rem are expected to cause fatality in 50% of the exposed individuals within 30-60 days (ICRP 1991).

2.5.3 Transportation Modes

Although LLW could be transported by a variety of modes, all shipments have been assumed to take place by either truck or rail. For each case, risks have been calculated separately for all truck and all rail options, although the actual shipping campaigns for a selected alternative may involve a combination of the two modes. Rail shipments are assumed to take place by regular freight-train service; the use of special or dedicated rail service was not considered. Shipments by barge, although feasible for some sites, have not been explicitly considered because this mode of transportation is somewhat limited and has not been established as a major programmatic option for the WM PEIS assessment. Similarly, shipments by aircraft and other modes are not considered.

2.5.4 Receptors

In this report, transportation-related risks are calculated and presented separately for workers and members of the general public. The workers considered are truck and rail crew members involved in transporting LLW. The general public includes all persons who could be exposed to a shipment while it is moving or stopped en route. Potential risks are estimated for the collective populations of exposed people, as well as for maximally exposed individuals (MEIs). The collective population risk is a measure of the radiological risk posed to society as a whole by the alternative being considered. As such, the collective population risk is used as the primary means of comparing various alternatives.

3 METHODS FOR CALCULATING TRANSPORTATION-RELATED RISKS

The technical approach for conducting the transportation risk assessment was developed following a thorough and critical review of the literature and existing National Environmental Policy Act documentation for federal actions involving transportation of radioactive materials. Consideration was also given to recent DOE commitments arising from both litigation and public awareness. The approach selected uses several computer models and databases to determine the risks for each case.

The approach for the transportation risk assessment is summarized in Figure 3.1 and is discussed in detail in this section. For each case, risks are assessed for both routine transportation and accidents. For the *routine assessment*, risks are calculated for the collective populations of potentially exposed individuals, as well as for the MEIs. The accident assessment consists of two components: (1) an *accident risk assessment*, which considers the probabilities and consequences of a range of possible transportation-related accidents, including low-probability accidents that have high consequences and high-probability accidents that have low consequences; and (2) an *accident consequence assessment*, which considers only the radiological consequences of the severe transportation-related accidents that are postulated to result in the largest releases of radioactive material.

The RADTRAN 4 computer code (Neuhauser and Kanipe 1993) is used for the routine and accident risk assessments to estimate the impacts to collective populations. RADTRAN 4 was developed by SNL-NM to calculate population risks associated with the transportation of radioactive materials by a variety of modes, including truck, rail, air, ship, and barge. The code has been extensively reviewed, updated, and used for transportation risk assessments since it was issued in the late 1970s.

The RADTRAN 4 calculations of population risk take into account both the consequences and the probabilities of potential exposures. The collective population risk is a measure of the total radiological risk posed to society as a whole by the alternative being considered. As such, the collective population risks are used as the primary means of comparing the various cases.

As a complement to the RADTRAN calculations, the RISKIND computer code (Yuan et al. 1993) is used to estimate scenario-specific doses to MEIs for both routine operation and accidents and to estimate population impacts for the accident consequence assessment. The RISKIND computer code was developed for the DOE Office of Civilian Radioactive Waste Management specifically to analyze radiological consequences to individuals and population subgroups associated with the transportation of spent nuclear fuel. Minor modifications to the code were made for WM PEIS applications to accommodate shipments of all types of radioactive waste.

The RISKIND calculations are conducted for the WM PEIS to supplement the results for collective risk calculated with RADTRAN 4. Whereas the results for collective risk

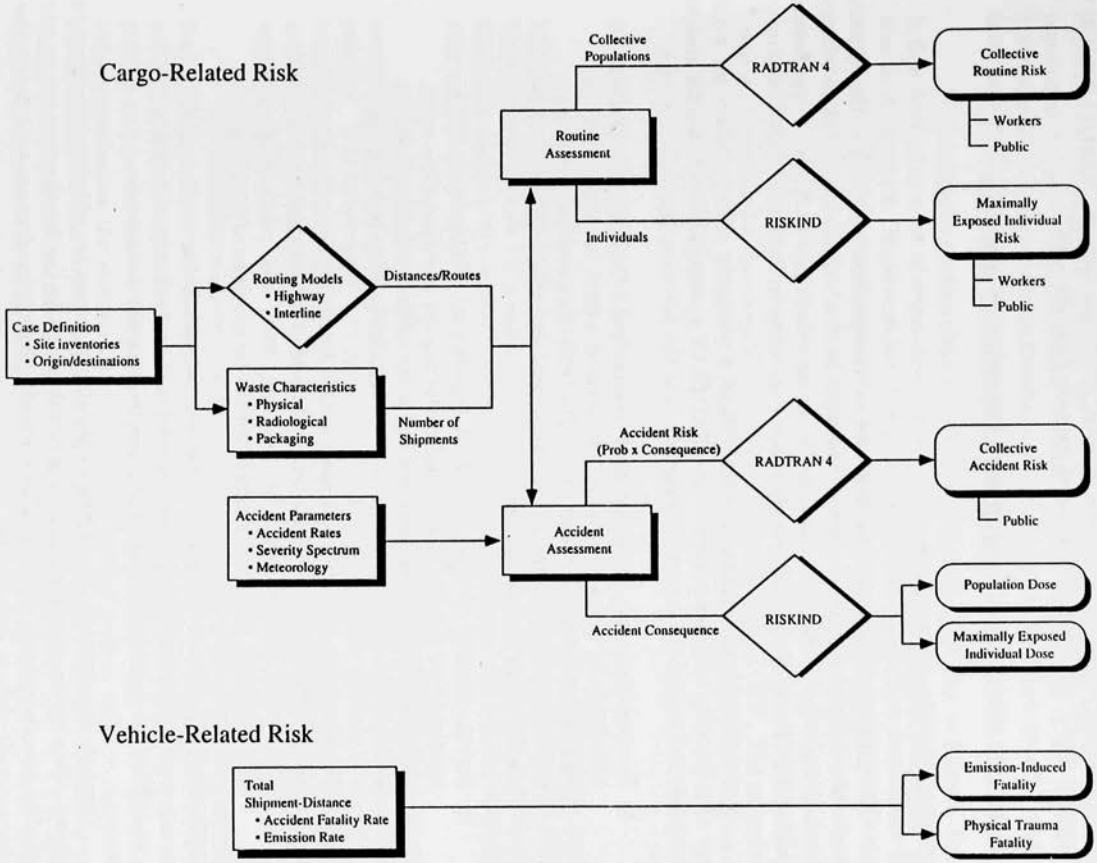


FIGURE 3.1 Technical Approach for the LLW Transportation Radiological Risk Assessment

provide a measure of the overall risks of each case, the RISKIND calculations are meant to address areas of specific concern to individuals and subgroups of population. Essentially, the RISKIND analyses are meant to address "what if" questions, such as, "What if I live next to a site access road?" or "What if an accident happens near my town?"

3.1 ROUTINE (INCIDENT-FREE) RISK ASSESSMENT METHOD

3.1.1 Collective Population Risk

The radiological risk associated with routine transportation results from the potential exposure of people to low-level external radiation in the vicinity of loaded shipments. Because the radiological consequences (dose) occur as a direct result of normal operations, the probability of routine consequences is taken to be unity in the RADTRAN 4 code.

For routine transportation, the RADTRAN 4 computer code considers all major groups of potentially exposed persons. The RADTRAN 4 calculations of risk for routine highway and rail transportation include exposures of the following population groups:

1. *Persons along the Route (Off-Link Population).* Collective doses are calculated for all persons living or working within 0.8 km (0.5 mi) of each side of a transportation route. The total number of persons within the 1.6-km (1-mi) corridor is calculated separately for each route considered in the assessment.

2. *Persons Sharing the Route (On-Link Population).* Collective doses are calculated for persons in all vehicles sharing the transportation route. This group includes persons traveling in the same or opposite directions as the shipment, as well as persons in vehicles passing the shipment.

3. *Persons at Stops.* Collective doses are calculated for people who may be exposed while a shipment is stopped en route. For truck transportation, these stops include stops for refueling, food, and rest. For rail transportation, stops are assumed to occur for purposes of classification.

4. *Crew Members.* Collective doses are calculated for truck and rail transportation crew members involved in the actual shipment of waste. Workers involved in loading or unloading are not considered.

The doses calculated for the first three population groups are added together to yield the collective dose to the general public; the dose calculated for the fourth group represents the collective dose to workers. The RADTRAN 4 models for routine dose are not intended for estimating specific risks to individuals.

The RADTRAN 4 calculations for routine dose are based on generically expressing the dose rate as a function of distance from a point source (Neuhauser and Kanipe 1993).

Associated with the calculation of routine doses for each exposed population group are parameters such as the radiation field strength, source-receptor distance, duration of exposure, vehicular speed, stopping time, traffic density, and route characteristics such as population density. The RADTRAN manual contains derivations of the equations and descriptions of these parameters (Neuhauser and Kanipe 1993). The values for many of the most important parameters are presented in Section 4.

The collective routine risks are calculated for each LLW case as follows. Each case is first defined as a set of origin-destination pairs, as shown in the WASTE_MGMT output files in Appendix A. Representative highway and rail routes are then determined for each unique pair. The number of shipments transported across each linkage is then calculated for both truck and rail modes by dividing the estimated site-specific LLW inventories by the assumed truck and rail shipment capacities. For shipments between each origin-destination pair, RADTRAN 4 is used to calculate the collective risks to workers and the public on the basis of representative radiological and physical properties of the LLW. The collective risks are then summed over the set of origin-destination pairs to estimate the collective routine risks associated with that case.

3.1.2 Maximally Exposed Individual Risk

In addition to the assessment of the routine collective population risk, the risk to MEIs has been estimated for a number of hypothetical exposure scenarios by using RISKIND. The receptors include transportation crew members, departure inspectors, and members of the public exposed during traffic delays, while working at a service station, or while living near a DOE site.

The dose to each MEI considered is calculated with RISKIND for an exposure scenario defined by a given distance, duration, and frequency of exposure specific to that receptor. The distances and durations of exposure are similar to those given in previous transportation risk assessments (DOE 1987b, 1990a) and are presented in Section 4. The scenarios are not meant to be exhaustive but were selected to provide a range of potential exposure situations.

The RISKIND external dose model considers direct external exposure and exposure from radiation scattered from the ground and air. RISKIND is used to calculate the dose as a function of distance (millirem per hour for stationary exposures and millirem per event for moving shipments) from a shipment on the basis of the dimensions of the shipment. The code approximates the shipment as a cylindrical surface source; and the calculated dose includes contributions from secondary radiation scattering from buildup (scattering by waste contents), cloudshine (scattering by the air), and groundshine (scattering by the ground). The dose rates calculated by using RISKIND have been shown to be comparable with output from existing shielding codes for various waste configurations. As a conservative measure, credit for potential shielding between the waste package and the receptor is not considered.

3.1.3 Vehicle-Related (Nonradiological) Routine Risk

Vehicle-related health risks resulting from routine transportation may be associated with the generation of air pollutants by transport vehicles during shipment and are independent of the radioactive nature of the shipment. The health end point assessed under routine transportation conditions is the excess latent mortality due to inhalation of vehicular exhaust emissions. Risk factors for pollutant inhalation in terms of latent mortality have been generated by Rao et al. (1982). These risk factors are 1.0E–07 mortality/km (1.6E–07/mi) and 1.3E–07 mortality/km (2.1E–07/mi) of truck and rail travel in urban areas, respectively. The risk factors are based on regression analyses of the effects of sulfur dioxide and particulate releases from diesel exhaust on mortality rates. Excess latent mortalities are assumed to be equivalent to latent-cancer fatalities. Vehicle-related risks from routine transportation are calculated for each case by multiplying the total distance traveled in urban areas by the appropriate risk factor. Similar data are not available for rural and suburban areas.

Risks are summed over the entire route and over all shipments for each LLW case. This method has been used in several reports to calculate risks from routine transportation of radioactive wastes (DOE 1986, 1987a, 1990a). Lack of information for rural and suburban areas is an obvious data gap, although the risk factors would presumably be lower because of lower total emissions from all sources and lower population densities in rural and suburban areas.

3.2 ACCIDENT ASSESSMENT METHOD

3.2.1 Radiological Accident Risk Assessment

The risk analysis for potential accidents differs fundamentally from the risk analysis for routine transportation because occurrences of accidents are statistical in nature. The accident risk assessment is treated probabilistically in RADTRAN 4. Accident risk is defined as the product of the accident consequence (dose) and the probability of the accident occurring. In this respect, the RADTRAN 4 code estimates the collective accident risk to populations by considering a spectrum of transportation-related accidents. The spectrum of accidents is designed to encompass a range of possible accidents, including low-probability accidents that have high consequences, and high-probability accidents that have low consequences (such as "fender benders"). The results for collective accident risk can be directly compared with the results for routine collective risk because the former results incorporate the probabilities of accident occurrences.

The RADTRAN 4 calculation of collective accident risk employs models that quantify the range of potential accident severities and the responses of transported packages to accidents. The spectrum of accident severity is divided into a number of categories. Each category of severity is assigned a conditional probability of occurrence—that is, the probability that an accident will be of a particular severity if an accident occurs. The more

severe the accident, the more remote the chance of such an accident. Release fractions, defined as the fraction of the material in a package that could be released in an accident, are assigned to each accident severity category on the basis of the physical and chemical form of the waste material. The models take into account the mode of transportation and the type of packaging being considered. The accident rates, the definition of accident severity categories, and the release fractions used in this analysis are discussed further in Section 4.

For accidents involving the release of radioactive material, RADTRAN 4 assumes that the material is dispersed in the environment according to standard Gaussian diffusion models. For the risk assessment, default data for atmospheric dispersion were used, representing an instantaneous ground-level release and a small-diameter source cloud (Neuhauser and Kanipe 1993). The calculation of the collective population dose following the release and dispersal of radioactive material includes the following exposure pathways:

- External exposure to the passing radioactive cloud,
- External exposure to contaminated ground,
- Internal exposure from inhalation of airborne contaminants, and
- Internal exposure from the ingestion of contaminated food.

For the pathway of ingestion, state-specific food transfer factors, which relate the amount of radioactive material ingested to the amount deposited on the ground, were calculated in accordance with the methods described by the U.S. Nuclear Regulatory Commission (NRC) regulatory guide 1.109 (NRC 1977b) and were used as input to the RADTRAN code. Doses of radiation from the ingestion or inhalation of radionuclides are calculated by using standard dose conversion factors (DOE 1988a,b).

The collective accident risk for each case is determined in a manner similar to that described for routine collective risks. Accident risks are first calculated for each unique origin-destination pair and then are summed over all pairs to estimate the total risk for the case. The accident risk assessment uses site-specific and waste-type-specific radiological and physical waste characteristics, as shown in the WASTE_MGMT output files in Appendix A. In addition, the assessment uses route-specific information on population density and accident rates derived for individual states.

3.2.2 Radiological Accident Consequence Assessment

The RISKIND code is used to provide a scenario-specific assessment of radiological consequences of severe transportation-related accidents. Whereas the RADTRAN 4 accident risk assessment considers the entire range of accident severities and their related probabilities, the RISKIND accident consequence assessment focuses on accidents that result in the largest release of radioactive material to the environment.

Accident consequences are presented for a shipment of waste that represents the highest potential radiological risk if an accident occurs. This "worst-case" waste is identified by screening the site-specific radiological waste characteristics (i.e., activity concentrations) developed for the WM PEIS, taking into account the physical forms of waste and the relative hazards of individual radionuclides. For the majority of waste shipments, the consequences of severe accidents would be less than those presented for the "worst-case" waste. The accident consequence assessment is intended to provide an estimate of the maximum potential impacts posed by a severe transportation-related accident.

The severe accidents considered in the consequence assessment are characterized by extreme mechanical and thermal forces. In all cases, these accidents result in a release of radioactive material to the environment. The accidents correspond to those within the highest accident severity category, as described previously. These accidents represent low-probability high-consequence events. The probability of accidents of this magnitude occurring for each case depends on the total shipping distance for the case; however, accidents of this severity are expected to be extremely rare in general.

RISKIND was used for the accident consequence assessment for two reasons. First, the code has the ability to model the complex atmospheric (or site-specific) dispersion present in severe accidents. The atmospheric dispersion is modeled as an instantaneous release by using standard Gaussian puff methods. In addition, because severe accidents routinely involve fires, modeling of the potential radiological consequences takes into account physical phenomena resulting from the fire, such as buoyant plume rise. Second, RISKIND can be used to estimate the dose to MEIs in the vicinity of an accident. The location of the MEIs is determined by RISKIND on the basis of the atmospheric conditions assumed at the time of the accident and the thermal characteristics of the release.

The accident consequences are calculated for both local populations and MEIs. The population dose includes the population within 80 km (50 mi) of the site of the accident. The exposure pathways considered are similar to those discussed previously for the accident risk assessment. Although remedial activities after the accident (e.g., evacuation or ground cleanup) would reduce the consequences of an accident, these activities were not given credit in the consequence assessment.

Because predicting the exact location of a severe transportation-related accident is impossible, separate accident consequences are calculated for accidents occurring in rural, suburban, and urban zones of population density. Moreover, to address the effects of the atmospheric conditions existing at the time of an accident, two different atmospheric conditions are considered. The first case assumes neutral atmospheric conditions, and the second assumes stable conditions. Atmospheric conditions are discussed further in Section 4.

3.2.3 Vehicle-Related (Nonradiological) Accident Risk Assessment

The vehicle-related accident risk refers to the potential for transportation-related accidents that directly result in fatalities that are not related to the cargo in the shipment.

This risk represents fatalities from mechanical causes. State-specific rates for transportation-related fatalities are used in the assessment and are discussed in Section 4. Vehicle-related accident risks are calculated for each case by multiplying the total distance traveled in each state by the appropriate state rate for transportation-related fatalities. In all cases, the vehicle-related accident risks are calculated by using distances for round-trip shipment.

3.3 REPRESENTATIVE ROUTE DETERMINATION METHOD

Representative truck and rail routes were determined for all of the pairs of origin-and-destination sites specified by the case definitions. The routes were selected to be consistent with current routing practices and all applicable routing regulations and guidelines; however, because the routes were determined for the purposes of risk assessment, the routes do not necessarily represent the actual routes that would be used to transport LLW in the future.

The representative truck and rail routes were determined by using the routing models HIGHWAY 3.1 (Johnson et al. 1993a) and INTERLINE 5.0 (Johnson et al. 1993b), respectively. For both truck and rail transportation, the route characteristics that are most important to the radiological risk assessment include the total shipping distance between each origin-destination pair and the fractions of travel in rural, suburban, and urban zones of population density. The route selected determines the total potentially exposed population along a route and the expected frequency of transportation-related accidents. The route distances between major DOE sites are summarized in Tables 3.1 and 3.2 for truck and rail transportation, respectively.

3.3.1 Truck Route Determination

The HIGHWAY 3.1 computer program is used for predicting highway routes for transporting radioactive materials within the United States by truck. The HIGHWAY database is a computerized road atlas that currently describes approximately 386,243 km (240,000 mi) of roads. A complete description of the interstate highway system and of all U.S. highways is included in the database. In addition, most of the principal state highways and a number of local and community highways are also identified. The code is updated periodically to reflect current road conditions and has been benchmarked against reported mileages and observations of commercial trucking firms.

Routes are calculated within the model by minimizing the total impedance between the origin and the destination. The impedance is basically defined as a function of distance and driving time along a particular segment of highway. One of the special features of the HIGHWAY 3.1 model is its ability to calculate routes that maximize the use of interstate highways. This feature allows the user to predict routes for shipment of radioactive materials that conform to the transportation regulations of the U.S. Department of

TABLE 3.1 Truck Route Distances (mi) between Major DOE Sites[a]

	Ames	ANL-E	ANL-W	BCL	Bettis	BNL	Fermi	FEMP	Hanford	INEL	ITRI	KCP	KAPL-S	LBL	LLNL	LANL	Mound	NRF
Ames	0	351	1287	675	894	1206	341	611	1703	1287	1129	234	1163	1844	1853	1136	644	1287
ANL-E	351	0	1582	348	567	874	36	294	1998	1582	1333	520	831	2139	2148	1431	317	1582
ANL-W	1287	1582	0	1906	2125	2437	1572	1842	599	0	1177	1325	2393	963	972	1144	1875	0
BCL	675	348	1906	0	223	653	380	113	2322	1906	1463	650	626	2463	2472	1552	72	1906
Bettis	894	567	2125	223	0	506	599	312	2541	2125	1682	869	543	2682	2691	1771	291	2125
BNL	1206	874	2437	653	506	0	906	760	2853	2437	2113	1299	241	2994	3003	2201	721	2437
Fermi	341	36	1572	380	599	906	0	326	1975	1572	1359	519	863	2129	2138	1421	349	1572
FEMP	611	294	1842	113	312	760	326	0	2258	1842	1399	586	733	2399	2408	1488	49	1842
HS	1703	1998	599	2322	2541	2853	1975	2258	0	599	1593	1741	2809	875	894	1560	2291	599
INEL	1287	1582	0	1906	2125	2437	1572	1842	599	0	1177	1325	2393	963	972	1144	1875	0
ITRI	1129	1333	1177	1463	1682	2113	1359	1399	1593	1177	0	895	2085	1194	1154	111	1432	1177
KCP	234	520	1325	650	869	1299	519	586	1741	1325	895	0	1272	1881	1890	984	619	1325
KAPL-S	1163	831	2393	626	543	241	863	733	2809	2393	2085	1272	0	2950	2959	2174	694	2393
LBL	1844	2139	963	2463	2682	2994	2129	2399	875	963	1194	1881	2950	0	45	1274	2432	963
LLNL	1853	2148	972	2472	2691	3003	2138	2408	894	972	1154	1890	2959	45	0	1233	2441	972
LANL	1136	1431	1144	1552	1771	2201	1421	1488	1560	1144	111	984	2174	1274	1233	0	1521	1144
Mound	644	317	1875	72	291	721	349	49	2291	1875	1432	619	694	2432	2441	1521	0	1875
NRF	1287	1582	0	1906	2125	2437	1572	1842	599	0	1177	1325	2393	963	972	1144	1875	0
NTS	1520	1815	712	2078	2297	2670	1805	2014	1128	712	918	1428	2626	719	678	997	2047	712
ORISE	887	571	2077	399	586	808	603	299	2493	2077	1420	752	872	2592	2551	1509	335	2077
ORR	900	584	2048	412	563	821	616	312	2464	2048	1391	723	885	2563	2523	1480	348	2048
PGDP	629	385	1766	477	696	1115	417	409	2182	1766	1230	441	1099	2322	2327	1319	441	1766
Pantex	834	1038	1468	1168	1387	1817	1064	1104	1884	1468	313	600	1790	1485	1445	402	1137	1468
Pinellas	1481	1204	2617	1065	1252	1329	1236	965	3033	2617	1959	1293	1393	2945	2904	2048	1001	2617
PORTS	755	428	1986	84	265	689	460	173	2402	1986	1543	730	688	2543	2552	1632	152	1986
PPPL	1217	822	2448	546	398	189	854	635	2864	2448	2006	1192	291	3005	3014	2094	614	2448
RMI	751	419	1982	214	175	531	451	321	2398	1982	1673	860	416	2538	2547	1762	282	1982
RFP	722	1017	716	1283	1500	1870	1005	1217	1132	716	483	631	1827	1283	1292	452	1250	716
SNL-NM	1120	1324	1168	1454	1673	2103	1350	1390	1584	1168	9	886	2076	1185	1145	102	1423	1168
SNL-CA	1853	2148	972	2472	2691	3003	2138	2408	894	972	1154	1890	2959	45	0	1233	2441	972
SRS	1175	892	2311	720	656	897	924	620	2727	2311	1653	987	961	2791	2750	1742	656	2311
SLAC	1885	2180	1004	2524	2723	3035	2167	2440	916	1004	1198	1939	2979	47	64	1294	2473	1004
WVDP	909	577	2140	372	257	492	609	479	2556	2140	1832	1018	314	2697	2706	1921	440	2140
WIPP	1301	1505	1759	1625	1813	2192	1531	1526	2175	1759	614	1067	2256	1509	1468	693	1561	1759
YM	1554	1849	746	2112	2331	2704	1839	2048	1162	746	952	1462	2660	753	712	1031	2081	746

TABLE 3.1 (Cont.)

	NTS	ORISE	ORR	PGDP	Pantex	Pinellas	PORTS	PPPL	RMI	RFEIS	SNL-NM	SNL-CA	SRS	SLAC	WVDP	WIPP	YM
Ames	1520	887	900	629	834	1481	755	1217	751	722	1120	1853	1175	1885	909	1301	1554
ANL-E	1815	571	584	385	1038	1204	428	822	419	1017	1324	2148	892	2180	577	1505	1849
ANL-W	712	2077	2048	1766	1468	2617	1986	2448	1982	716	1168	972	2311	1004	2140	1759	746
BCL	2078	399	412	477	1168	1065	84	546	214	1283	1454	2472	720	2524	372	1625	2112
Bettis	2297	586	563	696	1387	1252	265	398	175	1500	1673	2691	656	2723	257	1813	2331
BNL	2670	808	821	1115	1817	1329	689	189	531	1870	2103	3003	897	3035	492	2192	2704
Fermi	1805	603	616	417	1064	1236	460	854	451	1005	1350	2138	924	2167	609	1531	1839
FEMP	2014	299	312	409	1104	965	173	635	321	1217	1390	2408	620	2440	479	1526	2048
Hanford	1128	2493	2464	2182	1884	3033	2402	2864	2398	1132	1584	894	2727	916	2556	2175	1162
INEL	712	2077	2048	1766	1468	2617	1986	2448	1982	716	1168	972	2311	1004	2140	1759	746
ITRI	918	1420	1391	1230	313	1959	1543	2006	1673	483	9	1154	1653	1198	1832	614	952
KCP	1428	752	723	441	600	1293	730	1192	860	631	886	1890	987	1939	1018	1067	1462
KAPL-S	2626	872	885	1099	1790	1393	688	291	416	1827	2076	2959	961	2979	314	2256	2660
LBL	719	2592	2563	2322	1485	2945	2543	3005	2538	1283	1185	45	2791	47	2697	1509	753
LLNL	678	2551	2523	2327	1445	2904	2552	3014	2547	1292	1145	0	2750	64	2706	1468	712
LANL	997	1509	1480	1319	402	2048	1632	2094	1762	452	102	1233	1742	1294	1921	693	1031
Mound	2047	335	348	441	1137	1001	152	614	282	1250	1423	2441	656	2473	440	1561	2081
NRF	712	2077	2048	1766	1468	2617	1986	2448	1982	716	1168	972	2311	1004	2140	1759	746
NTS	0	2180	2151	1864	1209	2720	2158	2620	2214	836	909	678	2414	739	2373	1365	46
ORISE	2180	0	10	333	1125	692	358	702	595	1383	1411	2551	369	2584	753	1410	2214
ORR	2151	10	0	304	1096	685	371	715	608	1354	1382	2523	379	2584	766	1381	2185
PGDP	1864	333	304	0	940	874	0	1009	687	1072	1226	2327	568	2359	845	1258	1903
Pantex	1209	1125	1096	940	0	1664	1248	1710	1378	774	304	1445	1358	1506	1537	308	1243
Pinellas	2720	692	685	874	1664	0	1024	1152	1261	1924	1950	2904	620	2969	1419	1762	2754
PORTS	2158	358	371	0	1248	1024	0	588	276	1361	1534	2552	540	2584	434	1632	2192
PPPL	2620	702	715	1009	1710	1152	588	0	528	1823	1997	3014	767	3046	489	2086	2654
RMI	2214	595	608	687	1378	1261	276	528	0	1415	1664	2547	726	2579	162	1822	2248
RFETS	836	1383	1354	1072	774	1924	1361	1823	1415	0	474	1292	1618	1324	1573	1067	868
SNL-NM	909	1411	1382	1226	304	1950	1534	1997	1664	474	0	1145	1644	1198	1823	605	943
SNL-CA	678	2551	2523	2327	1445	2904	2552	3014	2547	1292	1145	0	2750	64	2706	1468	712
SRS	2414	369	379	568	1358	620	540	767	726	1618	1644	2750	0	2820	1023	1524	2448
SLAC	739	2584	2584	2359	1506	2969	2584	3046	2579	1324	1198	64	2820	0	2738	1529	773
WVDP	2373	753	766	845	1537	1419	434	489	162	1573	1823	2706	1023	2738	0	1980	2407
WIPP	1365	1410	1381	1258	308	1762	1632	2086	1822	1067	605	1468	1524	1529	1980	0	1399
YM	46	2214	2185	1903	1243	2754	2192	2654	2248	868	943	712	2448	773	2407	1399	0

[a] Truck routes generated by using the HIGHWAY 3.1 routing model (Johnson et al. 1993a).

Note: Ames = Ames Laboratory; ANL-E = Argonne National Laboratory-East; ANL-W = Argonne National Laboratory-West; BCL = Battelle Columbus Laboratories; Bettis = Bettis Atomic Power Laboratory; BNL = Brookhaven National Laboratory; Fermi = Fermi National Accelerator Laboratory; FEMP = Fernald Environmental Management Project; Hanford = Hanford Site; INEL = Idaho National Engineering Laboratory; ITRI = Inhalation Toxicology Research Institute; KCP = Kansas City Plant; KAPL-S = Knolls Atomic Power Laboratory (Schenectady); LBL = Lawrence Berkeley National Laboratory; LLNL = Lawrence Livermore National Laboratory; LANL = Los Alamos National Laboratory; Mound = Mound Plant; NRF = Naval Reactor Facility; NTS = Nevada Test Site; ORISE = Oak Ridge Institute for Science and Education; ORR = Oak Ridge Reservation; PGDP = Paducah Gaseous Diffusion Plant; Pantex = Pantex Plant; Pinellas = Pinellas Plant; PORTS = Portsmouth Gaseous Diffusion Plant; PPPL = Princeton Plasma Physics Laboratory; RMI = Reactive Metals, Inc.; RFETS = Rocky Flats Environmental Technology Site; SNL-NM = Sandia National Laboratories (New Mexico); SNL-CA = Sandia National Laboratories (California); SRS = Savannah River Site; SLAC = Stanford Linear Accelerator Center; WVDP = West Valley Demonstration Project; WIPP = Waste Isolation Pilot Plant; and YM = Yucca Mountain.

TABLE 3.2 Rail Route Distances (mi) between Major DOE Sites[a]

	Ames	ANL-E	ANL-W	BCL	Bettis	BNL	Fermi	FEMP	Hanford	INEL	ITRI	KCP	KAPL-S	LBL	LLNL	LANL	Mound	NRF
Ames	0	329	1242	700	823	1365	291	717	1788	1242	1187	275	1126	1873	2018	1124	715	1242
ANL-E	329	0	1655	401	518	1066	49	412	2201	1655	1351	439	827	2549	2506	1288	416	1655
ANL-W	1242	1655	0	1942	2133	2607	1533	1907	658	0	1247	1238	2468	1102	1100	1179	1926	0
BCL	700	401	1942	0	280	855	427	135	2488	1942	1759	753	615	2573	2718	1696	65	1942
Bettis	823	518	2133	280	0	772	543	475	2611	2133	1857	943	533	2696	2840	1794	345	2133
BNL	1365	1066	2607	855	772	0	1088	984	3153	2607	2414	1518	239	3238	3383	2351	920	2607
Fermi	291	49	1533	427	543	1088	0	441	1971	1533	1356	453	853	2343	2341	1405	443	1533
FEMP	717	412	1907	135	475	984	441	0	2505	1907	1751	717	745	2590	2735	1688	69	1907
Hanford	1788	2201	658	2488	2611	3153	1971	2505	0	658	1793	1784	2914	986	973	1725	2472	658
INEL	1242	1655	0	1942	2133	2607	1533	1907	658	0	1247	1238	2468	1102	1100	1179	1926	0
ITRI	1187	1351	1247	1759	1857	2414	1356	1751	1793	1247	0	932	2177	1266	1222	104	1767	1247
KCP	275	439	1238	753	943	1518	453	717	1784	1238	932	0	1250	2016	2013	869	708	1238
KAPL-S	1126	827	2468	615	533	239	853	745	2914	2468	2177	1250	0	2999	3144	2122	680	2468
LBL	1873	2549	1102	2573	2696	3238	2343	2590	986	1102	1266	2016	2999	0	46	1354	2717	1102
LLNL	2018	2506	1100	2718	2840	3383	2341	2735	973	1100	1222	2013	3144	46	0	1326	2695	1100
LANL	1124	1288	1179	1696	1794	2351	1405	1688	1725	1179	104	869	2122	1354	1326	0	1704	1179
Mound	715	416	1926	65	345	920	443	69	2472	1926	1767	708	680	2717	2695	1704	0	1926
NRF	1242	1655	0	1942	2133	2607	1533	1907	658	0	1247	1238	2468	1102	1100	1179	1926	0
NTS	1674	2348	756	2374	2496	3039	1997	2391	1302	756	1065	1670	2800	860	1370	1169	2386	756
ORISE	956	651	2099	366	714	1221	679	331	2644	2099	1989	881	981	2890	2868	1926	301	2099
ORR	954	649	2055	393	903	1152	682	358	2601	2055	1749	838	957	2686	2831	1686	328	2055
PGDP	646	390	1699	581	816	1346	469	468	2245	1699	1539	482	1106	2490	2469	1476	564	1699
Pantex	809	972	1141	1381	1479	2035	977	1373	1686	1141	379	554	1807	1561	1534	483	1396	1141
Pinellas	1623	1319	2721	1151	1293	1585	1344	1116	3267	2721	2079	1503	1390	3278	3491	2183	1086	2721
PORTS	727	422	1975	91	429	921	451	207	2515	1975	1761	758	681	2767	2745	1698	156	1975
PPPL	1197	898	2507	655	400	410	924	938	2985	2507	2248	1289	214	3298	3276	2186	719	2507
RMI	717	418	2060	207	136	648	445	337	2505	2060	1769	842	408	2851	2829	1706	272	2060
RFETS	782	1194	738	1502	1692	2266	1016	1466	1284	738	572	778	2027	1320	1394	504	1485	738
SNL-NM	1187	1351	1247	1759	1857	2414	1356	1751	1793	1247	0	932	2177	1266	1222	104	1767	1247
SNL-CA	2018	2506	1100	2718	2840	3383	2341	2735	973	1100	1222	2013	3144	46	0	1326	2695	1100
SRS	1281	976	2407	740	947	1239	1001	774	2953	2407	2315	1161	1044	3192	3183	2252	744	2407
SLAC	1924	2536	1160	2947	2746	3289	2393	2641	1036	1160	1253	2073	3050	56	60	1357	2930	1160
WVDP	881	579	2123	370	244	549	603	631	2669	2123	1929	1033	309	2773	2898	1866	562	2123
WIPP	1115	1279	1447	1688	1785	2342	1284	1679	1993	1447	477	861	2114	1660	1633	581	1703	1447
YM	1674	2348	756	2374	2496	3039	1997	2391	1302	756	1065	1670	2800	860	1370	1169	2386	756

TABLE 3.2 (Cont.)

	NTS	ORISE	ORR	PGDP	Pantex	Pinellas	PORTS	PPPL	RMI	RFETS	SNL-NM	SNL-CA	SRS	SLAC	WVDP	WIPP	YM
Ames	1674	956	954	646	809	1623	727	1197	717	782	1187	2018	1281	1924	881	1115	1674
ANL-E	2348	651	649	390	972	1319	422	898	418	1194	1351	2506	976	2536	579	1279	2348
ANL-W	756	2099	2055	1699	1141	2721	1975	2507	2060	738	1247	1100	2407	1160	2123	1447	756
BCL	2374	366	393	581	1381	1151	91	655	207	1502	1759	2718	740	2947	370	1688	2374
Bettis	2496	714	903	816	1479	1293	429	400	136	1692	1857	2840	947	2746	244	1785	2496
BNL	3039	1221	1152	1346	2035	1585	921	410	648	2266	2414	3383	1239	3289	549	2342	3039
Fermi	1997	679	682	469	977	1344	451	924	445	1016	1356	2341	1001	2393	603	1284	1997
FEMP	2391	331	358	468	1373	1116	207	938	337	1466	1751	2735	774	2641	631	1679	2391
HS	1302	2644	2601	2245	1686	3267	2515	2985	2505	1284	1793	973	2953	1036	2669	1993	1302
INEL	756	2099	2055	1699	1141	2721	1975	2507	2060	738	1247	1100	2407	1160	2123	1447	756
ITRI	1065	1989	1749	1539	379	2079	1761	2248	1769	572	0	1222	2315	1253	1929	477	1065
KCP	1670	881	838	482	554	1503	758	1289	842	778	932	2013	1161	2073	1033	861	1670
KAPL-S	2800	981	957	1106	1807	1390	681	214	408	2027	2177	3144	1044	3050	309	2114	2800
LBL	860	2890	2686	2490	1561	3278	2767	3298	2851	1320	1266	46	3192	56	2773	1660	860
LLNL	1370	2868	2831	2469	1534	3491	2745	3276	2829	1394	1222	0	3183	60	2898	1633	1370
LANL	1169	1926	1686	1476	483	2183	1698	2186	1706	504	104	1326	2252	1357	1866	581	1169
Mound	2386	301	328	564	1396	1086	156	719	272	1485	1767	2695	744	2930	562	1703	2386
NRF	756	2099	2055	1699	1141	2721	1975	2507	2060	738	1247	1100	2407	1160	2123	1447	756
NTS	0	2530	2487	2131	1376	3153	2401	2871	2391	987	1065	1370	2839	862	2554	1475	0
ORISE	2530	0	40	632	1611	786	392	1176	575	1658	1989	2868	443	3103	889	1918	2530
ORR	2487	40	0	527	1371	797	442	760	600	1586	1749	2831	417	3031	889	1678	2487
PGDP	2131	632	527	0	1103	1056	495	1145	698	1220	1539	2469	714	2597	861	1410	2131
Pantex	1376	1611	1371	1103	0	1825	1382	1867	1387	465	379	1534	1937	1564	1551	307	1376
Pinellas	3153	786	797	1056	1825	0	1106	1207	1361	2280	2079	3491	485	3280	1568	2019	3153
PORTS	2401	392	442	495	1382	1106	0	838	279	1535	1761	2745	655	2651	585	1689	2401
PPPL	2871	1176	760	1145	1867	1207	838	0	511	2066	2248	3276	848	3121	426	2185	2871
RMI	2391	575	600	698	1387	1361	279	511	0	1619	1769	2829	920	2641	163	1705	2391
RFETS	987	1658	1586	1220	465	2280	1535	2066	1619	0	572	1394	1938	1377	1782	769	987
SNL-NM	1065	1989	1749	1539	379	2079	1761	2248	1769	572	0	1222	2315	1253	1929	477	1065
SNL-CA	1370	2868	2831	2469	1534	3491	2745	3276	2829	1394	1222	0	3183	60	2898	1633	1370
SRS	2839	443	417	714	1937	485	655	848	920	1938	2315	3183	0	3194	1223	2243	2839
SLAC	862	3103	3031	2597	1564	3280	2651	3121	2641	1377	1253	60	3194	0	2804	1662	862
WVDP	2554	889	889	861	1551	1568	585	426	163	1782	1929	2898	1223	2804	0	1858	2540
WIPP	1475	1918	1678	1410	307	2019	1689	2185	1705	769	477	1633	2243	1662	1858	0	1475
YM	0	2530	2487	2131	1376	3153	2401	2871	2391	987	1065	1370	2839	862	2540	1475	0

[a] Rail routes generated by using the INTERLINE 5.0 routing model (Johnson et al. 1993b).

Note: Ames = Ames Laboratory; ANL-E = Argonne National Laboratory-East; ANL-W = Argonne National Laboratory-West; BCL = Battelle Columbus Laboratories; Bettis = Bettis Atomic Power Laboratory; BNL = Brookhaven National Laboratory; Fermi = Fermi National Accelerator Laboratory; FEMP = Fernald Environmental Management Project; Hanford = Hanford Site; INEL = Idaho National Engineering Laboratory; ITRI = Inhalation Toxicology Research Institute; KCP = Kansas City Plant; KAPL-S = Knolls Atomic Power Laboratory (Schenectady); LBL = Lawrence Berkeley National Laboratory; LLNL = Lawrence Livermore National Laboratory; LANL = Los Alamos National Laboratory; Mound = Mound Plant; NRF = Naval Reactor Facility; NTS = Nevada Test Site; ORISE = Oak Ridge Institute for Science and Education; ORR = Oak Ridge Reservation; PGDP = Paducah Gaseous Diffusion Plant; Pantex = Pantex Plant; Pinellas = Pinellas Plant; PORTS = Portsmouth Gaseous Diffusion Plant; PPPL = Princeton Plasma Physics Laboratory; RMI = Reactive Metals, Inc.; RFETS = Rocky Flats Environmental Technology Site; SNL-NM = Sandia National Laboratories (New Mexico); SNL-CA = Sandia National Laboratories (California); SRS = Savannah River Site; SLAC = Stanford Linear Accelerator Center; WVDP = West Valley Demonstration Project; WIPP = Waste Isolation Pilot Plant; and YM = Yucca Mountain.

Transportation (DOT), specifically docket HM-164. The population densities along a route are derived from 1990 data from the U.S. Bureau of the Census. Rural, suburban, and urban areas are characterized according to the following breakdown: rural population densities range from 0-54 persons/km^2 (0-139/mi^2); the suburban range is 55-1,284/km^2 (140-3,326/mi^2); and urban is taken to mean all population densities greater than 1,284/km^2 (3,326/mi^2).

3.3.2 Rail Route Determination

The INTERLINE 5.0 computer program is designed to simulate routing of the U.S. rail system. The INTERLINE database consists of 94 separate subnetworks and represents various competing rail companies in the United States. The database used by INTERLINE was originally based on data from the Federal Railroad Administration and reflected the U.S. railroad system in 1974. The database has since been expanded and modified over the past two decades. The code is updated periodically to reflect current track conditions and has been benchmarked against reported mileages and observations of commercial rail firms.

The INTERLINE 5.0 model uses a shortest-route algorithm that finds the path of minimum impedance within an individual subnetwork. A separate routine is used to find paths along the subnetworks. The routes chosen for this study used the standard assumptions in the INTERLINE model that simulate the process of selection that railroads would use to direct shipments of radioactive waste. For sites that do not have direct rail access, the rail siding nearest the site was used for routing purposes. The population densities along a route are derived from 1990 census data. Rural, suburban, and urban areas are characterized according to the following breakdown: rural population densities range from 0-54 persons/km^2 (0-139/mi^2), the suburban range for population density is 55-1,284/km^2 (140-3,326/mi^2), and urban is taken to mean all population densities greater than 1,284/km^2 (3,326/mi^2).

4 RISK ASSESSMENT ASSUMPTIONS AND PARAMETERS

The majority of parameters and assumptions necessary to conduct the LLW transportation risk assessment are described in detail in Appendix E of the WM PEIS (DOE 1995). Supplemental information is provided subsequently for a number of the most important assessment parameters.

4.1 SHIPPING AND PACKAGING ASSUMPTIONS FOR LOW-LEVEL WASTE

Transportation of LLW is assumed to be in certified or certified-equivalent packagings, and exclusive-use vehicles are assumed to be used. Highway transportation is assumed to take place by legal-weight heavy-haul combination (tractor-trailer) trucks. Typically, Type A packages are transported on common flatbed or covered trailers. For transportation via truck, the maximum payload weight has been taken to be 19,958 kg (44,000 lb), on the basis of the DOT highway weight limitations and an average tractor-trailer weight of 16,329 kg (36,000 lb).

Rail transportation is assumed to take place by regular freight-train service. The use of special or dedicated train service was not considered in the analysis. For rail transportation, average payload weights for boxcars range from 45,359 to 68,039 kg (100,000-150,000 lb). A median payload weight of 54,431 kg (120,000 lb) has been assumed for purposes of assessment.

All LLW is assumed to be transported strong and tight or in Type A packaging, such as 208-L (55-gal) drums or standard waste boxes. Suitable Type A packagings are readily available from commercial sources. The number of shipments from a given site is calculated on the basis of projected site-specific information on waste inventory (weight) and on limitations on shipment capacity for each mode of transportation given previously. The effects of potential waste treatment, such as volume reduction or incineration, are reflected in changes in the density of the waste and are reflected in the WASTE-MGMT files in Appendix A. All shipments are assumed to be at the maximum weight limits for truck and rail shipments. On the basis of typical LLW densities, roughly eighty 208-L (55-gal) drums would be shipped per truck and 300 per railcar.

4.2 ACCIDENT RATES

For the calculation of accident risks, rates for vehicular accidents and for fatalities are taken from data provided by Saricks and Kvitek (1994). For each mode of transportation, accident rates are generically defined as the number of accident involvements (or fatalities) in a given year per unit of travel by that mode in that same year. Therefore, the rate is a fractional value, with accident-involvement count as the numerator of the fraction and vehicular activity (total traveled distance) as its denominator. Accident rates are generally determined for a multiyear period. For purposes of assessment, the total number of expected

accidents or fatalities is calculated by multiplying the total shipping distance for a specific case by the appropriate accident or fatality rate.

For truck transportation, the rates presented in Saricks and Kvitek (1994) are specifically for heavy combination trucks involved in interstate commerce. Heavy combination trucks are rigs composed of a separable tractor unit containing the engine and one to three freight trailers connected to each other. Heavy combination trucks are typically used for shipments of radioactive waste. Saricks and Kvitek (1994) base their truck accident rates for each state on statistics compiled by the DOT Office of Motor Carriers for 1986-1988. Saricks and Kvitek (1994) present counts of accident involvement and of fatalities, estimated kilometers of travel by state, and the corresponding average accident involvement, fatality, and injury rates for the three years investigated. Fatalities are deaths (including crew members) that are attributable to the accident and that occurred at any time within 30 days thereafter. The truck accident rates are summarized in Table 4.1.

Rail accident rates are computed and presented similarly to truck accident rates in Saricks and Kvitek (1994); however, the unit of haulage is considered to be the railcar. Saricks and Kvitek (1994) base their state-specific rail accident involvement and fatality rates on statistics compiled by the Federal Railroad Administration for 1985-1988. Rail accident rates include both main-line accidents and those occurring in rail yards. The rail accident rates are summarized in Table 4.2.

4.3 CHARACTERISTICS OF ACCIDENT RELEASES

The transportation accident risk assessment depends on the fraction of material in a package that would be released or spilled to the environment during an accident, commonly referred to as the release fraction. The fraction of material released from a package is a function of the severity of the accident and the waste packaging; for instance, a low-impact accident, such as a "fender-bender," would not be expected to cause any release of material. Conversely, a very severe accident would be expected to release nearly all of the material in a shipment into the environment. The method used to characterize accident severities and the corresponding release fractions are described subsequently.

4.3.1 Accident Severity Categories

A method to characterize the potential severity of transportation-related accidents is described in an NRC report commonly referred to as NUREG-0170 (NRC 1977a). The NRC method divides the spectrum of transportation accident severities into eight categories. Other studies have divided the same accident spectrum into six categories (Wilmot 1981) and into 20 categories (Fischer et al. 1987); however, these studies focused primarily on accidents involving shipments of spent nuclear fuel and thus are not directly applicable to this assessment.

TABLE 4.1 Highway Combination-Truck Accident, Fatality, and Injury Rates by Road Type[a] Based on Reportable Interstate-Carrier Accidents, Reported Fatalities and Injuries, and Estimated Flows, 1986–1988 (10^{-7} accidents and injuries per shipment-kilometer, 10^{-8} fatalities per shipment-kilometer)

	Accident-Involvement Rates					Accident-Fatality Rates					Accident-Injury Rates				
State[b]	FAI-U	FAI-R	FAI	FAP	FAS	FAI-U	FAI-R	FAI	FAP	FAS	FAI-U	FAI-R	FAI	FAP	FAS
AL	4.68	1.26	1.85	5.16	3.96	3.29	1.84	2.09	6.34	7.84	4.66	1.24	1.83	5.62	4.22
AZ	2.71	1.60	1.76	2.12	1.45	3.56	2.13	2.33	4.97	1.20	2.89	1.65	1.82	2.20	2.77
AR	4.82	1.73	2.09	4.69	6.84	6.61	2.28	2.78	8.88	7.10	4.09	1.95	2.20	4.38	5.94
CA	1.92	1.64	1.76	1.15	2.22	1.39	2.56	2.06	1.98	3.81	1.82	1.68	1.74	1.12	2.67
CO	6.28	2.76	3.60	4.11	4.42	3.38	2.45	2.67	6.58	5.83	5.47	2.82	3.45	3.95	3.67
CT	2.67	4.60[c]	3.23	2.56	9.09	1.01	5.11[c]	2.20	1.17	9.09	1.71	4.61[c]	2.55	1.89	7.09
DE	2.56	--	2.56	7.35	4.81	1.66	--	1.66	13.50[c]	7.69	3.46	--	3.46	7.18	3.08
FL	2.25	1.21	1.50	3.73	6.33	1.74	2.62	2.38	5.92	6.12	2.36	1.28	1.58	4.12	7.92
GA	4.87	1.65	2.28	6.15	4.04	2.37	1.86	1.96	8.30	6.74	4.37	1.75	2.26	6.43	3.71
ID	1.73	2.30	2.22	4.93	2.29	0	2.06	1.78	7.46	2.54	1.18	2.12	1.99	3.54	1.69
IL	8.75[c]	1.76	3.53	6.40	1.78	5.33	1.39	2.38	7.84	2.30	8.23[c]	1.49	3.20	6.12	1.55
IN	4.58	1.92	2.43	4.72	2.80	3.51	1.22	1.66	7.66	4.02	4.36	1.81	2.30	4.42	2.32
IA	3.54	1.78	2.02	4.03	1.24	2.68	1.05	1.26	6.14	0.73	3.78	1.46	1.76	3.48	0.88
KS	4.48	2.04	2.56	5.11	1.38	5.52	1.88	2.66	9.35	1.72	3.66	1.91	2.28	4.09	1.12
KY	5.13	1.46	1.99	5.74	8.80	3.22	1.50	1.75	6.60	6.25	5.52	1.33	1.94	5.28	8.12
LA	3.54	1.30	1.88	3.53	2.39	4.90	1.77	2.59	5.73	3.28	4.57	1.32	2.16	4.46	2.85
ME	9.03[c]	2.44	2.93	5.44	2.28	0	2.34	2.16	6.58	2.17	4.52	1.53	1.75	5.00	1.63
MD	3.08	3.95	3.46	3.56	12.40	1.62	4.03	2.69	3.66	8.99	3.41	3.98	3.66[c]	4.32	13.40
MA	1.42	6.47[c]	2.68	3.43	46.10[c]	1.30	6.23[c]	2.53	3.93	52.20[c]	1.13	4.99[c]	2.09	3.02	43.90[c]
MI	3.16	1.59	2.12	2.68	0.81	1.52	1.23	1.33	3.96	1.22	3.04	1.29	1.87	2.61	1.38
MN	2.66	2.06	2.29	4.19	2.16	2.02	1.72	1.83	7.69	7.84	2.08	1.46	1.69	3.28	1.86
MS	2.01	1.19	1.35	4.48	0.65	2.46	1.81	1.93	9.26	1.62	1.85	1.10	1.25	4.55	0.50
MO	5.18	1.78	2.61	5.36	2.49	4.30	1.23	1.99	9.68	3.25	5.53	1.63	2.59	5.06	2.23
MT	10.00[c]	2.52	2.89	5.38	1.02	3.12	1.44	1.52	7.97	2.04	4.69	1.79	1.93	3.95	0.20
NE	6.97	1.77	2.09	3.62	0.99	6.58	1.10	1.43	5.75	0	6.58	1.17	1.50	3.54	0.54
NV	6.33	1.57	1.97	4.35	3.17	8.89[c]	1.14	1.79	10.50	7.94	5.67	1.58	1.93	3.72	2.54
NH	0.22	1.39	1.18	4.36	3.33	0	1.49	1.22	5.77	5.56	0	1.14	0.94	4.17	2.22
NJ	2.77	7.65[c]	4.24[c]	6.80	9.69	1.56	6.56[c]	3.06	4.57	11.50	2.69	8.00[c]	4.28[c]	6.86	11.30
NM	9.64[c]	1.92	2.35	4.77	12.20	9.01[c]	1.93	2.32	6.99	5.56	8.92[c]	1.86	2.25	4.62	10.60
NY	5.69	2.93	3.98[c]	3.16	9.48	2.04	1.38	1.63	4.61	10.30	4.49	2.56	3.28	2.71	10.00
NC	5.92	2.28	2.97	5.17	6.37	5.08	2.92	3.33[c]	6.71	11.00	6.37	2.19	2.99	5.53	6.22
OH	3.16	2.27	2.52	4.42	11.00	1.41	1.32	1.35	6.07	9.88	2.85	2.02	2.25	4.40	1070
OK	3.76	1.47	1.91	3.61	1.73	2.70	2.06	2.18	4.88	0.71	3.34	1.36	1.74	3.05	1.59
OR	3.99	2.20	2.48	4.17	1.63	2.47	1.12	1.33	5.85	4.07	3.82	1.69	2.02	2.94	0.57
PA	3.02	3.60	3.48	7.21	7.92	2.12	2.97	2.79	10.20	9.29	2.68	3.28	3.15	7.28	6.42
RI	2.27	1.98	2.16	1.37	16.70	0.71	3.70	1.80	1.71	66.70[c]	3.12	2.35	2.84	0.86	23.30[c]
SC	3.13	1.83	1.99	6.27	2.27	2.88	2.57	2.61	8.61	3.95	2.65	2.20	2.26	6.96	2.27
SD	8.57[c]	2.09	2.18	3.94	1.49	14.30[c]	0.42	0.62	5.38	2.13	5.71	1.38	1.95	2.94	0
TN	7.97	1.48	2.48	5.56	6.26	5.59	1.63	2.24	6.97	12.10	7.70[c]	1.44	2.41	5.85	4.67

TABLE 4.1 (Cont.)

State	Accident-Involvement Rates					Accident-Fatality Rates					Accident-Injury Rates				
	FAI-U	FAI-R	FAI	FAP	FAS	FAI-U	FAI-R	FAI	FAP	FAS	FAI-U	FAI-R	FAI	FAP	FAS
TX	2.74	1.56	2.00	2.78	1.09	1.93	1.97	1.95	4.77	1.84	2.53	1.42	1.83	2.53	0.92
VT	0	1.38	1.33	6.30	6.80	0	0.43	0.42	3.36	24.00	0	1.08	1.04	6.13	4.40
VA	2.63	2.54	2.56	4.67	5.03	1.91	1.76	1.80	7.28	7.73	2.49	2.46	2.47	5.39	4.81
WA	1.61	2.50	2.10	2.62	0.73	0.80	1.47	1.17	2.54	0	1.49	2.14	1.85	2.11	0.51
WV	2.95	3.10	3.07	11.70[c]	7.87	1.28	1.67	1.60	17.80[c]	1.70	2.78	2.80	2.79	9.91[c]	7.13
WI	5.29	1.74	2.18	2.80	3.24	0.77	0.66	0.67	3.62	3.68	4.33	1.45	1.81	2.51	3.16
WY	2.98	3.42	3.40	3.41	3.70	0	2.08	2.01	6.22	3.70	0	2.84	2.74	1.86	2.35
USA	3.58	2.03	2.44	3.94	3.48	2.37	1.91	2.03	5.82	4.62	3.36	1.89	2.28	3.82	3.30
σ[d]	2.36	1.25	0.69	1.77	6.98	2.70	1.27	0.63	3.01	11.74	1.99	1.22	0.69	1.79	7.10

[a] FAI = Federally aided interstate

U = Urban

R = Rural

FAP = Federally aided primary

FAS = Federally aided secondary

[b] Includes only the 48 contiguous states, plus the totals for the United States.

[c] Rates are two or more standard deviations greater than the national average rate for that highway category.

[d] σ = standard deviation.

Source: Saricks and Kvitek (1994).

TABLE 4.2 Railroad-Freight-Car Accident Rates, by State, for 1986, 1987, 1988, and 1985–1988 Combined (10^{-8} accidents per railcar-kilometer[a])

	1986		1987		1988		1985-88	
State[b]	Total	Main Only	Total	Main Only	Total	Main Only	Total	Main Only
AL	3.88	2.00	4.80	3.37	4.13	2.52	4.80	2.75
AZ	1.40	1.05	1.30	1.08	1.44	1.18	1.75	1.30
AR	5.05	2.59	4.27	2.32	8.34	3.94	6.78	3.54
CA	5.10	2.64	3.30	1.98	4.32	2.30	5.10	2.51
CO	1.44	1.01	0.86	0.40	2.55	1.51	1.73	1.02
CT	26.47	17.65	16.67	8.34	24.95	0	28.27[c]	10.10
DE	27.44	9.15	25.23	16.82	18.04	18.04	17.71	11.07
DC	0	0	316	316	0	0	117.09[c]	78.06[c]
FL	2.86	2.12	3.90	1.90	4.16	2.38	4.02	2.21
GA	6.44	3.08	6.77	2.81	6.18	2.69	6.44	2.84
ID	5.90	5.25	6.74	4.10	9.03	3.99	7.01	4.14
IL	11.70	3.10	9.97	3.10	9.08	2.45	10.67	2.97
IN	4.18	1.85	3.71	1.48	3.80	1.44	4.64	1.93
IA	17.63	7.15	12.72	6.65	11.95	7.01	14.67	7.16
KS	3.01	1.62	2.97	1.55	4.09	1.98	3.61	1.75
KY	4.78	2.39	3.77	1.98	3.60	1.84	4.48	2.44
LA	12.67	5.98	7.07	2.02	11.94	3.92	12.37	4.28
ME	28.22	16.93	29.40	13.36	52.57	26.29	37.80[c]	18.53[c]
MD	6.07	3.54	5.55	2.44	4.55	1.24	5.62	2.58
MA	12.33	5.87	10.06	3.71	7.31	2.81	11.65	4.97
MI	18.34	8.18	15.10	4.42	15.52	7.45	16.47	7.19
MN	8.63	2.64	6.24	3.30	7.86	3.63	8.48	3.16
MS	15.16	11.20	12.93	9.84	8.47	7.14	11.52	8.51
MO	4.59	2.12	3.60	1.87	5.05	2.87	5.28	2.56
MT	1.35	1.01	1.24	0.81	2.11	1.17	1.73	1.10
NE	4.04	2.11	4.81	2.49	4.46	2.23	4.63	2.56
NV	3.27	1.87	1.29	0.86	3.97	2.65	3.23	2.19
NH	6.60	6.60	17.52	11.68	24.27	16.18	21.45	17.16[c]
NJ	13.86	2.64	9.44	5.31	10.10	4.75	12.38	4.82
NM	0.90	0.52	0.93	0.75	0.86	0.65	0.94	0.66
NY	7.23	3.92	6.80	4.14	7.26	3.36	8.32	4.30
NC	5.40	2.70	5.48	1.62	6.29	2.95	5.70	2.27
ND	2.18	1.48	2.43	1.86	1.49	1.12	2.41	1.80
OH	5.35	2.50	3.55	1.58	4.04	1.92	4.73	2.12
OK	5.25	3.01	3.52	1.90	3.77	1.88	4.66	2.72
OR	11.74	4.96	12.23	6.12	13.64	6.04	12.48	5.77
PA	4.86	3.73	4.22	2.37	3.54	1.95	4.38	2.69
RI	0	0	0	0	0	0	105.33[c]	0
SC	4.64	2.16	4.74	3.62	5.03	3.71	5.11	3.31
SD	8.16	6.27	14.98	14.49	7.27	6.36	10.19	9.09
TN	4.88	1.69	4.67	1.89	7.56	2.02	5.59	1.88
TX	7.03	3.36	5.29	2.50	5.92	2.45	7.12	3.16
UT	3.69	1.34	1.85	0.93	11.19	4.04	5.78	2.31
VT	5.98	2.99	7.86	5.24	24.32	18.24	15.22	11.59
VA	4.27	1.42	4.39	2.31	4.59	2.15	4.35	1.91

TABLE 4.2 (Cont.)

State[b]	1986 Total	1986 Main Only	1987 Total	1987 Main Only	1988 Total	1988 Main Only	1985-88 Total	1985-88 Main Only
WA	3.65	1.38	2.69	1.50	3.57	1.12	3.49	1.44
WV	11.49	9.23	9.97	7.73	6.08	4.67	9.61	7.42
WI	18.79	7.52	16.75	7.75	12.57	7.21	16.53	7.66
WY	2.55	1.37	2.61	1.47	2.88	1.40	3.10	1.97
USA	5.51	2.63	4.70	2.36	5.14	2.43	5.57	2.66
σ[d]	–	–	–	–	–	–	21.48	11.12

[a] Nationwide average fatality rate, using count of fatalities consistent with combination-truck fatality counts, is 6.50×10^{-10} fatalities per railcar-kilometer. Nationwide average injury rate, using count of injuries consistent with combination-truck injury counts, is 7.83×10^{-8} injuries per railcar-kilometer.

[b] Includes the 48 contiguous states, the District of Columbia, and the totals for the United States.

[c] Rates are one or more standard deviations greater than the national average rate for that category (i.e., all accidents on carrier-owned track or accidents on main lines only).

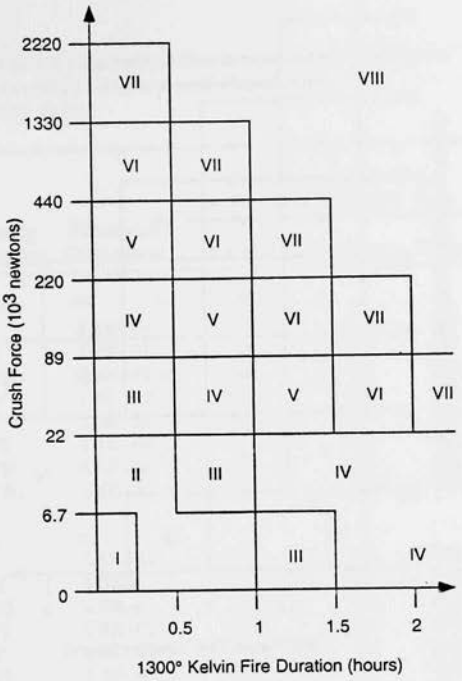
[d] σ = standard deviation.

Source: Saricks and Kvitek (1994).

The NUREG-0170 scheme for accident classification is shown in Figures 4.1 and 4.2 for truck and rail transportation, respectively. Severity is described as a function of the magnitudes of the mechanical forces (impact) and thermal forces (fire) to which a package may be subjected during an accident. Because all accidents can be described in these terms, severity is independent of the specific accident sequence. In other words, any sequence of events that results in an accident in which a package is subjected to forces within a certain range of values is assigned to the accident severity category associated with that range. The scheme for accident severity is designed to take into account all credible transportation-related accidents, including accidents with low probability but high consequences and those with high probability but low consequences.

Each severity category represents a set of accident scenarios defined by a combination of mechanical and thermal forces. A conditional probability of occurrence—that is, the probability that if an accident occurs, it is of a particular severity—is assigned to each category. The fractional occurrences for accidents by the accident severity category and the population density zone are shown in Table 4.3.

Category I accidents are the least severe but the most frequent, whereas Category VIII accidents are very severe but very infrequent. To determine the expected frequency of an accident of a given severity, the conditional probability in the category is

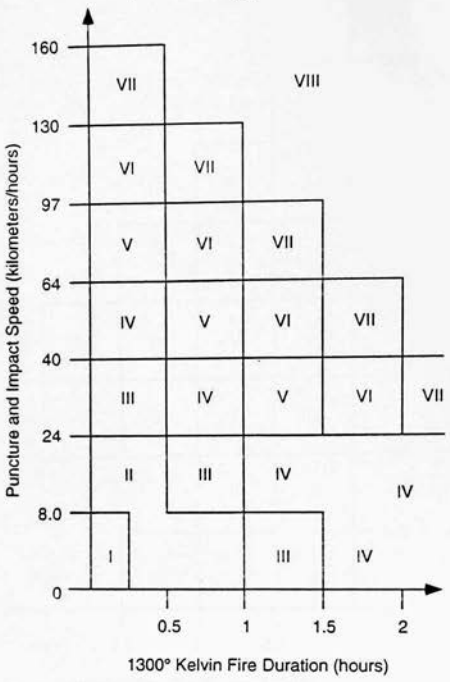


Reference: NRC, 1977.

FIGURE 4.1 Scheme for NUREG-0170 Classification by Accident Severity Category for Truck Accidents (Source: NRC 1977a)

multiplied by the baseline accident rate. Each population density zone has a distinct baseline accident rate and distribution of accident severities related to differences in average vehicular velocity, traffic density, and other factors, including location (rural, suburban, or urban).

For the accident consequence assessment, the doses were assessed for populations and individuals by assuming an accident of severity Category VIII. This accident severity category represents the most severe accident scenarios that can be postulated that would result in the largest release of radioactive material. Accidents of this severity are extremely rare, occurring approximately once in every 70,000 truck or 100,000 rail accidents involving a shipment of radioactive waste. On the basis of national accident statistics (Saricks and Kvitek 1994), for every 1.6 km (1 mi) of loaded shipment, the probability of an accident of this severity is 6E-12 for shipment by truck and 1E-12 for shipment by rail.



Reference: NRC, 1977.

FIGURE 4.2 Scheme for NUREG-0170 Classification by Accident Severity Category for Rail Accidents (Source: NRC 1977a)

4.3.2 Package Release Fractions

Radiological consequences are calculated by assigning package release fractions to each accident severity category. The release fraction is defined as the fraction of the radioactive material in a package that could be released from the package as the result of an accident of a given severity. Release fractions take into account all mechanisms necessary to create release of radioactive material from a damaged package to the environment. Release fractions vary according to the type of package and the physical form of the waste.

Representative waste package release fractions for accidents involving LLW shipments were taken from NUREG-0170 (NRC 1977a). The recommendations in NUREG-0170 are based on best engineering judgments and have been shown to provide conservative estimates of radioactive material releases following accidents. The release fractions used are those reported in NUREG-0170 for NRC Type A packages. Release fractions for accidents of each severity category are given in Table 4.4. As shown in

TABLE 4.3 Fractional Occurrences for Accidents by Severity Category and Population Density Zone

Severity Category	Fractional Occurrence	Fractional Occurrence by Population Density Zone		
		Rural	Suburban	Urban
Truck				
I	5.5E−01	0.1	0.1	0.8
II	3.6E−01	0.1	0.1	0.8
III	7.0E−02	0.3	0.4	0.3
IV	1.6E−02	0.3	0.4	0.3
V	2.8E−03	0.5	0.3	0.2
VI	1.1E−03	0.7	0.2	0.1
VII	8.5E−05	0.8	0.1	0.1
VIII	1.5E−05	0.9	0.05	0.05
Rail				
I	5.0E−01	0.1	0.1	0.8
II	3.0E−01	0.1	0.1	0.8
III	1.8E−01	0.3	0.4	0.3
IV	1.8E−02	0.3	0.4	0.3
V	1.8E−03	0.5	0.3	0.2
VI	1.3E−04	0.7	0.2	0.1
VII	6.0E−05	0.8	0.1	0.1
VIII	1.0E−05	0.9	0.05	0.05

Source: NRC (1977a).

Table 4.4, the amount of material released from the packaging ranges from zero for minor accidents to 100% for the most severe accidents.

Also important for the purposes of risk assessment are the fraction of the released material that can be entrained in an aerosol (part of an airborne radioactive plume) and the fraction of the aerosolized material that is also respirable (of a size that can be inhaled into the lungs). These fractions depend on the physical form of the waste material. As stated previously, the LLW assessment considered two physical waste forms: heterogeneous solids and activated metals. The aerosolized and respirable fractions for these two forms are given in Table 4.5.

4.4 ATMOSPHERIC CONDITIONS DURING ACCIDENTS

Radioactive material released to the atmosphere is transported by the wind. Dispersion or dilution of the radioactive material in the air depends on meteorologic conditions at the time of the accident. Because predicting the specific location of an off-site

transportation-related accident is impossible, generic atmospheric conditions were selected for the accident risk and consequence assessments.

For the accident risk assessment, neutral weather conditions (represented by Pasquill Stability Class D with a wind speed of 4 m/s [9 mph]) were assumed. Because neutral meteorologic conditions constitute the most frequently occurring atmospheric stability conditions in the United States, these conditions are most likely to be present in the event of an accident involving a LLW shipment. On the basis of observations from National Weather Service surface meteorologic stations at over 300 locations in the United States, on an annual average neutral conditions (represented by Pasquill Classes C and D) occur about one-half of the time, while stable (Pasquill Classes E and F) and unstable (Pasquill Classes A and B) conditions occur about one-third and one-sixth of the time, respectively (Doty et al. 1976). The neutral category predominates in all seasons but most frequently in the winter (nearly 60% of the observations). For the accident consequence assessment, doses were assessed under both neutral and stable (Pasquill Stability Class F with a wind speed of 1 m/s [2.2 mph]) atmospheric conditions. The results calculated for neutral conditions represent the most likely consequences, and the results for stable conditions represent a "worst-case" weather situation (i.e., conditions that result in the least amount of dilution and the highest air concentrations of radioactive material).

TABLE 4.4 Estimated Release Fractions for LLW Packages under Various Accident Severity Categories

Severity Category	Release Fraction[a]
Truck	
I	0
II	0.01
III	0.1
IV	1.0
V	1.0
VI	1.0
VII	1.0
VIII	1.0
Rail	
I	0
II	0.01
III	0.1
IV	1.0
V	1.0
VI	1.0
VII	1.0
VIII	1.0

[a] Values are for total material release fraction (the fraction of material in a package released to the environment during an accident).

Source: NRC (1977a).

4.5 EXTERNAL DOSE RATES FROM SHIPMENTS

The dose (and, correspondingly, the risk) to populations during routine transportation is directly proportional to the assumed external dose rate from the shipment. The actual dose rate from the shipment is a complex function of the composition and

TABLE 4.5 Aerosolized and Respirable Material Release Fractions for LLW[a]

Physical Form of Waste	Aerosolized Fraction	Respirable Fraction
Activated metals[b]	1E-06	5E-02
Heterogeneous solids[c]	1E-01	5E-02

[a] The aerosolized fraction is the fraction of the released material that is entrained as an aerosol during an accident. The respirable fraction is the fraction of the aerosolized release that is of a respirable size.

[b] Considered to behave as immobile material.

[c] Considered to behave as a loose powder.

Source: Neuhauser and Kanipe (1993).

configuration of shielding and containment materials used in the waste packaging, the geometry of the loaded shipment, and the characteristics of the waste material itself. Representative shipment dose rates have been developed and used in the WM PEIS LLW transportation analysis. In practice, external dose rates will vary not only from site to site and from waste type to waste type, but also from shipment to shipment at a given site.

For WM LLW shipments, the external dose rates from historical waste shipments were investigated by using the Shipment Mobility/Accountability Collection (SMAC) system (Morris 1993). The SMAC database contains information on unclassified commercial freight shipments made by the DOE and its contractors. The information available in the SMAC database is collected from site shipping and receiving documents. Available information for shipments of radioactive materials includes the types of material shipped, the number of packages in each shipment, shipment weights, external dose rates, and package isotopic inventories. Approximately two-thirds of all DOE unclassified shipments are estimated to be reported to the SMAC system.

Shipment information from the SMAC database was examined for fiscal years 1983-1993 (Morris 1993). Information was provided for three general categories of radioactive material: irradiated fuel, "other" highway route controlled quantities, and LLW. (The material categories chosen were dictated by the format in which data are submitted and entered into the SMAC database and are not consistent with the definitions of waste types used in the WM PEIS.) Of the 15,000 LLW shipments recorded in the SMAC database, approximately 2,500 reported external dose rates. The average dose rate reported was approximately 1 mrem/h measured at 1 m (3.3 ft) from the surface of a shipment. This value was used for future WM LLW shipments for the WM PEIS analysis.

4.6 MAXIMALLY EXPOSED INDIVIDUAL EXPOSURE SCENARIOS

The risk to MEIs has been estimated for a number of hypothetical exposure scenarios for LLW shipments. The receptors include crew members, departure inspectors, and members of the public exposed during traffic obstructions (traffic jam), while working at a service station, or by living near a treatment, storage, or disposal site. The dose and risk to MEIs were calculated for given distances and durations of exposure. The distances and durations of exposure for each receptor are similar to those given in previous transportation assessments (DOE 1987b, 1990a). The scenarios for exposure are not meant to be exhaustive but were selected to provide a range of potential situations for exposure. The assumptions for exposure scenarios are as follows:

- *Crew Members.* Truck and rail crew members are assumed to be occupational radiation workers and would be monitored by a dosimetry program. Therefore, the maximum allowable dose would be 5 rem/yr. As an administrative procedure, the DOE limits doses to DOE workers to 2 rem/yr (DOE 1992).

- *Inspectors (Truck and Rail).* Inspectors are assumed to be either federal or state vehicle inspectors. Inspectors are not assumed to be monitored by a dosimetry program. An average exposure distance of 3 m (10 ft) and an exposure duration of 30 minutes are assumed.

- *Rail-Yard Crew Member.* A rail-yard crew member is not assumed to be monitored by a dosimetry program. An average exposure distance of 10 m (33 ft) and an exposure duration of two hours are assumed.

- *Resident (Truck and Rail).* A resident is assumed to live 30 m (98 ft) from a site entrance route (truck or rail). Shipments pass at an average speed of 24 km/h (15 mph), and the resident is exposed unshielded. Cumulative doses are assessed for each site on the basis of the number of shipments entering or exiting the site, with the assumption that the resident is present for 100% of the shipments.

- *Person in Traffic Obstruction (Truck and Rail).* A person is assumed to be stopped next to a waste shipment (e.g., because of traffic slowdown). The person is assumed to be exposed unshielded at a distance of 1 m (3.3 ft) for a duration of 30 minutes.

- *Person at Truck Service Station.* A person is assumed to be exposed at an average distance of 20 m (66 ft) for a duration of two hours. This receptor could be a worker at a truck stop.

- *Resident Near a Rail Stop.* A resident is assumed to live near a rail classification yard. The resident is assumed to be exposed unshielded at a distance of 200 m (656 ft) for a duration of 20 hours.

The largest uncertainty in predicting the dose to MEIs during transportation involves determining the frequency of occurrence of exposures. This difficulty results from the uncertainties in future shipment schedules and route selection and from the inherent uncertainty in predicting the frequency of random or chance events. For instance, that an individual may be stopped in traffic next to a shipment of radioactive waste is conceivable; however, predicting how often the same individual would experience this event is difficult. Therefore, for the majority of receptors considered, doses are assessed on a per-event basis. To account for possible multiple exposures, ranges of realistic total doses are discussed qualitatively. One exception is the calculation of the dose to a hypothetical resident living near an entrance route to a storage or disposal site. For these residents, total doses are calculated on the basis of the number of shipments entering or exiting each site for each case.

4.7 GENERAL RADTRAN INPUT PARAMETERS

In addition to the specific parameters discussed previously, values for a number of general parameters must be specified within the RADTRAN code. These general parameters define basic characteristics of the shipment and traffic and are specific to the mode of transportation. The user's manual for the RADTRAN code (Neuhauser and Kanipe 1993) contains derivations and descriptions of these parameters. The general RADTRAN input parameters used in the transportation risk assessment are summarized in Table 4.6.

TABLE 4.6 General RADTRAN Input Parameters for the LLW Assessment

Parameter	Truck	Rail
Package type	Type A	Type A
Shipment size (length) (m)	12	16
Shipment capacity (kg)	20,000	55,000
No. of crewmen	2	5
Distance from source to crew (m)	3	152
Average vehicle speed (km/h)		
Rural	88	64
Suburban	40	40
Urban	24	24
Stop time (h/km)	0.011	0.033
No. of people exposed while stopped	25	100
No. of people per vehicle sharing route	2	3
Population densities (persons/km^2)		
Rural	6	6
Suburban	719	719
Urban	3,861	3,861
One-way traffic count (vehicles/h)		
Rural	470	1
Suburban	780	5
Urban	2,800	5
Accident release fractions	[a]	[a]
Accident conditional probabilities	[b]	[b]

[a] See Table 4.4.

[b] See Table 4.3.

Source: Neuhauser and Kanipe (1993).

5 RISK ASSESSMENT RESULTS

The results of the LLW transportation risk assessment are summarized in this section for the 14 WM cases defined in Section 2.2. Although the method for risk assessment and the important assumptions used for the assessment have been presented in detail in previous sections of this report, a brief overview of the risk assessment process is provided to aid the reader in interpreting the results of risk assessment.

The impacts of transportation are calculated in three areas: (1) collective population risks during routine conditions and accidents for each case, (2) risks to MEIs during routine conditions for each case, and (3) consequences to individuals and populations after the most severe accidents involving a release of radioactive material. These three areas are detailed in the following paragraphs:

- *Collective Population Risk.* The collective population risk is a measure of the total risk posed to society as a whole by the case being considered. For the collective population risk assessment, the persons exposed are considered as a group, without specifying individual receptors. The collective population risk is used as the primary means to compare the various cases.

  Collective population risks are calculated from both vehicle- and cargo-related causes for routine transportation and accidents. Vehicle-related risks are independent of the cargo in the shipment and include risks from vehicular exhaust emissions and traffic accidents (fatalities caused by physical trauma). Vehicle-related risks are presented in terms of estimated fatalities for each case.

  For radioactive material, cargo-related risk refers to the risk posed by the radioactive nature of the material. The collective population risks are calculated for each case by using RADTRAN 4. The RADTRAN 4 calculations for population risk take into account both the consequences and the probabilities of potential exposure-causing events (such as accidents). The accident risk values are referred to as "dose risk" because they incorporate the probabilities of a spectrum of accidents. The collective population risks are presented in terms of the total dose (person-rem) to workers and to members of the public for each case. The collective population risks are also presented in terms of the estimated number of fatal latent-cancer cases, the number of latent-cancer cases (incidence), and the number of severe genetic effects by using the health risk conversion factors from ICRP Publication 60 (ICRP 1991).

- *Maximally Exposed Individuals during Routine Conditions.* During the routine transportation of radioactive waste, specific individuals may be exposed to radiation in the vicinity of a shipment. The risk to these

individuals has been estimated for a number of hypothetical exposure-causing events by using RISKIND. The receptors include transportation crew members, inspectors, and members of the public exposed during traffic delays, while working at a service station, or while living near a DOE site. The assumptions about exposure are given in Section 4.6. The scenarios for exposure are not meant to be exhaustive but were selected to provide a range of potential exposures.

For the majority of the individual receptors considered, doses are assessed and presented on a per-event basis—no attempt is made to estimate the frequency of exposure-causing events, although the range of possible exposures is qualitatively discussed. However, one exception is the calculation of the dose to a hypothetical resident living near the entrance route to a treatment, storage, or disposal site. For these residents, cumulative doses are calculated on the basis of the total number of shipments entering or exiting each site for each case.

- *Accident Consequence Assessment.* The RISKIND code is used to provide a detailed assessment of the consequences of the most severe transportation-related accidents involving LLW shipments. Whereas the RADTRAN 4 collective accident risk assessment considers the entire range of accident severities and their related probabilities, the RISKIND accident consequence assessment assumes that an accident of the highest severity category (Category VIII) has occurred. The consequences, in terms of committed dose (rem) and latent-cancer fatalities, are calculated for both exposed populations and individuals in the vicinity of an accident.

5.1 COLLECTIVE POPULATION RISK RESULTS

The results of the collective population risk assessment are summarized in this section. The summarized results present the total transportation impacts that would be incurred across the DOE complex for each case from all LLW shipments associated with that case. The summarized results do not indicate the quantity of waste that would be shipped between specific sites for a given case; however, detailed results of assessment are presented in Appendix B. The detailed results include route information, the estimated number of annual shipments, and "per-shipment" risk factors (an estimate of the risk for a single shipment between two specific sites) for shipments between all origin-destination pairs considered by each case.

The collective risk results for the 14 WM LLW cases are summarized in a series of tables. The collective risk results were calculated with the RADTRAN 4 computer code by using the WASTE_MGMT files provided in Appendix A as the primary input. The summarized results present the total impacts from shipping current inventories plus 20 years of WM LLW generation. As stated previously, the average annual risk (or number of

shipments) can be estimated by dividing the summarized results by the duration of the shipping campaigns. For the No Action Alternative, shipments would be distributed uniformly over a 20-year period; however, for all other cases, shipments would occur uniformly over a 10-year period, with the assumption of a 10-year period to build TSD facilities.

The total number of shipments and shipment mileages are presented for each of the WM LLW cases in Table 5.1. The numbers of shipments were calculated by using the inventory data presented in Appendix A and the assumptions concerning representative shipment sizes presented in Section 4.1. The total incident-free (routine) dose for each case is presented in Table 5.2 in terms of person-rem. The routine doses are presented separately for crew members and for members of the public along the transportation routes; these doses result from exposures to external radiation in the vicinity of a shipment. The total accident dose risk for each case is presented in Table 5.3. The estimates of accident dose risk depend on the specific radionuclides present in each shipment and take into account the probability of accident occurrences and the distribution of accident severities. Finally, impacts are presented in terms of human health risks in Tables 5.4 through 5.6. The health risks are presented for cargo-related (radiological) and vehicle-related (nonradiological) causes. All impacts are presented in two columns, with the first column assuming all truck shipments and the second assuming all rail shipments.

5.2 MAXIMALLY EXPOSED INDIVIDUAL ASSESSMENT

Doses to individuals during routine transportation have been estimated for each of the receptor scenarios described in Section 4.6 for WM LLW shipments. The estimated doses to individuals exposed to WM LLW shipments are presented in Table 5.7. The doses are calculated by assuming an external dose rate of 1 mrem/h at 1 m (3.3 ft) from a shipment and are reported on a per-event basis (rem per event). The total dose for repeated exposures can be estimated by multiplying the per-event dose by the number of exposures.

The potential exists for significant individual exposures if multiple exposure-causing events occur during WM LLW shipments; for instance, the dose to a person stuck in traffic next to a shipment for 30 minutes is estimated to be 0.5 mrem. If the duration of exposure is longer, the dose would rise proportionally. It is conceivable that a person could receive a dose on the order of 2-10 mrem while stopped in traffic next to a WM LLW shipment. In addition, a person working at a truck service station could receive an increased dose if trucks use the same stops repeatedly. If a truck-stop worker is present for 100 shipment stops (at the distance and duration given previously), the estimated dose is on the order of 2 mrem. Administrative controls could be instituted to control the location and duration of truck stops if multiple exposures were to happen routinely. The probability of multiple exposures increases as the amount of waste transportation increases.

The potential cumulative dose to a resident living along a site entrance route has been estimated and is summarized in Table 5.8 for each WM LLW case. The cumulative dose

TABLE 5.1 Total Number of Shipments and One-Way Shipping Distances for the WM LLW Cases[a]

	No. of Shipments[b]		Total Mileage (mi)	
WM LLW Alternative	Truck	Rail	Truck	Rail
No Action (Case 1)	87,360	33,420	1.66E+08	6.99E+07
Decentralized (Case 2)	24,420	9,210	5.57E+06	2.09E+06
Regionalized 1 (Case 3)	25,800	9,740	9.31E+06	3.74E+06
Regionalized 2 (Case 9)	25,880	9,900	9.19E+06	3.78E+06
Regionalized 3 (Case 4)	84,200	31,850	3.81E+07	1.72E+07
Regionalized 4 (Case 12)	87,390	33,460	3.69E+07	1.66E+07
Regionalized 5 (Case 19)	92,200	35,430	6.38E+07	2.53E+07
Regionalized 6 (Case 5)	174,390	66,040	1.24E+08	5.14E+07
Regionalized 7 (Case 6)	188,930	71,480	1.25E+08	5.44E+07
Centralized 1 (Case 7)	242,730	91,440	5.63E+08	2.24E+08
Centralized 2 (Case 8)	257,270	96,880	5.05E+08	2.19E+08
Centralized 3 (Case 14)	250,020	96,710	5.30E+08	2.18E+08
Centralized 4 (Case 14a)	264,060	102,100	4.78E+08	2.12E+08
Centralized 5 (Case 21)	241,540	90,980	5.60E+08	2.23E+08

[a] For each case, impacts are calculated and presented separately assuming exclusive truck *or* exclusive rail shipments. Therefore, the impacts for truck and rail modes should not be added together.

[b] The number of shipments is calculated by assuming that truck and rail shipments consist of 19,958 kg (44,000 lb) and 54,431 kg (120,000 lb) of LLW, respectively.

assumes that a resident is present for every shipment either entering or exiting a site and is unshielded at a distance of 30 m (98 ft) from the roadway. The assessment considers 20 years of shipments for WM LLW. The lifetime risk of fatality due to cancer has been calculated by multiplying the doses by the ICRP health risk conversion factor of 5E–04 fatal cancers per rem for members of the public. The estimated annual dose to a resident would be well below the annual limit of 100 mrem specified for members of the public (DOE 1990b).

5.3 ACCIDENT CONSEQUENCE ASSESSMENT

The RISKIND (Yuan et al. 1993) code is used to provide a detailed assessment of the consequences of the most severe transportation-related accidents for WM LLW shipments. Whereas the RADTRAN 4 accident risk assessment considers the entire range of accident severities and their related probabilities, the RISKIND accident consequence assessment assumes that an accident of the highest credible severity has occurred.

TABLE 5.2 Total Routine (Incident-Free) Dose for the WM LLW Cases[a]

	Dose (person-rem)			
	Truck		Rail	
WM LLW Alternative	Crew[b]	Public[c]	Crew[b]	Public[c]
No Action (Case 1)	4.69E+03	5.62E+03	3.88E+02	8.49E+02
Decentralized (Case 2)	2.25E+02	2.41E+02	3.53E+01	1.04E+02
Regionalized 1 (Case 3)	3.43E+02	3.62E+02	4.37E+01	1.35E+02
Regionalized 2 (Case 9)	3.38E+02	3.57E+02	4.42E+01	1.36E+02
Regionalized 3 (Case 4)	1.21E+03	1.34E+03	1.63E+02	4.08E+02
Regionalized 4 (Case 12)	1.19E+03	1.31E+03	1.66E+02	3.68E+02
Regionalized 5 (Case 19)	1.90E+03	2.18E+03	2.08E+02	4.70E+02
Regionalized 6 (Case 5)	3.87E+03	4.35E+03	4.05E+02	8.20E+02
Regionalized 7 (Case 6)	3.89E+03	4.41E+03	4.33E+02	8.45E+02
Centralized 1 (Case 7)	1.58E+04	1.87E+04	1.19E+03	2.34E+03
Centralized 2 (Case 8)	1.45E+04	1.72E+04	1.19E+03	2.34E+03
Centralized 3 (Case 14)	1.49E+04	1.77E+04	1.19E+03	2.31E+03
Centralized 4 (Case 14a)	1.37E+04	1.63E+04	1.18E+03	2.31E+03
Centralized 5 (Case 21)	1.57E+04	1.87E+04	1.19E+03	2.33E+03

[a] Routine doses result from exposure to external radiation in the vicinity of a loaded shipment. The external dose rate is assumed to be 1 mrem/h at 1 m (3.3 ft) from a WM LLW shipment. For each case, impacts are calculated and presented separately assuming exclusive truck *or* exclusive rail shipments. Therefore, the impacts for truck and rail modes should not be added together.

[b] The crew includes truck drivers, rail crew members, and rail workers in marshaling or classification yards.

[c] Members of the public include persons in vehicles sharing transportation routes, persons living along routes, and persons exposed at shipment stops.

Accident consequences are presented for a shipment of waste that represents the highest potential radiological risk if an accident occurs. This "worst-case" waste is identified by screening the site-specific radiological waste characteristics (i.e., activity concentrations) developed for the WM PEIS, taking into account physical waste forms and the relative hazards of individual radionuclides. For the majority of waste shipments, the consequences of severe accidents would be less than those presented for the "worst-case" waste. The accident consequence assessment is intended to provide an estimate of the maximum potential impacts posed by a severe transportation accident involving a given waste type. The assessment is not meant to be used as a basis for comparison among the different cases.

As stated previously, the accident consequences were calculated for transportation-related accidents that result in the maximum release of radioactive material (accident

TABLE 5.3 Total Accident Dose Risk for the WM LLW Cases[a,b]

WM LLW Alternative	Dose Risk (person-rem) Truck	Rail
No Action (Case 1)	2.45E+00	1.03E+00
Decentralized (Case 2)	1.29E–01	8.41E–02
Regionalized 1 (Case 3)	6.48E–01	1.62E–01
Regionalized 2 (Case 9)	6.48E–01	1.62E–01
Regionalized 3 (Case 4)	1.52E+00	6.26E–01
Regionalized 4 (Case 12)	2.13E+00	8.86E–01
Regionalized 5 (Case 19)	3.44E+02	2.39E+01
Regionalized 6 (Case 5)	2.33E+02	4.40E+01
Regionalized 7 (Case 6)	2.05E+02	2.50E+01
Centralized 1 (Case 7)	5.80E+02	1.14E+02
Centralized 2 (Case 8)	5.63E+02	9.09E+01
Centralized 3 (Case 14)	5.80E+02	1.14E+02
Centralized 4 (Case 14a)	5.67E+02	9.16E+01
Centralized 5 (Case 21)	5.80E+02	1.13E+02

[a] The calculation of accident dose risk takes into account the dose to the public following accidents involving the release of radioactive material to the environment, the probability of accident occurrences, and the distribution of accident severities.

[b] For each case, impacts are calculated and presented separately assuming exclusive truck *or* exclusive rail shipments. Therefore, the impacts for truck and rail modes should not be added together.

severity Category VIII). For these accidents, the assumptions were that all of the material in the shipment would be released from its packaging, that 10% would be entrained as an aerosol, and that 5% of the aerosol would be respirable.

During screening, the WM LLW from the Argonne National Laboratory-West (ANL-W) site was found to result in the highest transportation accident doses. The accident consequence results from RISKIND for WM LLW shipments are presented in Table 5.9. The population doses are for a uniform population density within an 80-km (50-mi) radius of accidents occurring in rural, suburban, and urban population density zones. The location of the MEI after an accident is determined on the basis of atmospheric conditions and the buoyant characteristics of the released plume. The locations of maximum exposure are approximately 160 m (525 ft) and 400 m (1,312 ft) from the accident site for neutral and

TABLE 5.4 Total Estimated Fatalities for the WM LLW Cases[a,b]

WM LLW Alternative	Exposure Group	Fatalities	
		Truck	Rail
No Action (Case 1)	Cargo-related (radiological)		
	Routine crew	1.9E+00	1.5E–01
	Routine public	2.7E+00	4.3E–01
	Accident public	1.2E–03	5.2E–04
	Vehicle-related (nonradiological)		
	Emission	9.5E–01	7.8E–01
	Accident	1.1E+01	1.5E–01
Decentralized (Case 2)	Cargo-related (radiological)		
	Routine crew	9.0E–02	1.4E–02
	Routine public	1.2E–01	5.2E–02
	Accident public	6.4E–05	4.2E–05
	Vehicle-related (nonradiological)		
	Emission	1.2E–01	1.0E–01
	Accident	3.0E–01	4.4E–03
Regionalized 1 (Case 3)	Cargo-related (radiological)		
	Routine crew	1.4E–01	1.8E–02
	Routine public	1.9E–01	6.7E–02
	Accident public	3.3E–04	8.2E–05
	Vehicle-related (nonradiological)		
	Emission	9.9E–02	1.3E–01
	Accident	4.7E–01	7.8E–03
Regionalized 2 (Case 9)	Cargo-related (radiological)		
	Routine crew	1.4E–01	1.8E–02
	Routine public	1.7E–01	6.8E–02
	Accident public	3.3E–04	8.2E–05
	Vehicle–related (nonradiological)		
	Emission	9.6E–02	1.3E–01
	Accident	4.6E–01	7.9E–03

TABLE 5.4 (Cont.)

WM LLW Alternative	Exposure Group	Fatalities	
		Truck	Rail
Regionalized 3 (Case 4)	Cargo-related (radiological)		
	Routine crew	4.9E–01	6.5E–02
	Routine public	6.7E–01	2.1E–01
	Accident public	7.6E–04	3.1E-04
	Vehicle-related (nonradiological)		
	Emission	1.9E–01	3.2E–01
	Accident	2.6E+00	3.6E–02
Regionalized 4 (Case 12)	Cargo–related (radiological)		
	Routine crew	4.8E–01	6.7E–02
	Routine public	6.6E–01	1.8E–01
	Accident public	1.1E–03	4.4E–04
	Vehicle–related (nonradiological)		
	Emission	2.2E–01	2.3E–01
	Accident	2.5E+00	3.5E–02
Regionalized 5 (Case 19)	Cargo-related (radiological)		
	Routine crew	7.6E–01	8.3E–02
	Routine public	1.1E+00	2.3E–01
	Accident public	1.7E–01	1.2E–02
	Vehicle-related (nonradiological)		
	Emission	3.0E–01	3.5E–01
	Accident	4.4E+00	5.3E–02
Regionalized 6 (Case 5)	Cargo-related (radiological)		
	Routine crew	1.5E+00	1.6E–01
	Routine public	2.2E+00	4.1E–01
	Accident public	1.2E–01	2.2E–02
	Vehicle-related (nonradiological)		
	Emission	6.7E–01	4.7E–01
	Accident	8.7E+00	1.1E–01

TABLE 5.4 (Cont.)

WM LLW Alternative	Exposure Group	Fatalities	
		Truck	Rail
Regionalized 7 (Case 6)	Cargo-related (radiological)		
	Routine crew	1.6E+00	1.7E–01
	Routine public	2.2E+00	4.2E–01
	Accident public	1.0E–01	1.2E–02
	Vehicle-related (nonradiological)		
	Emission	8.2E–01	4.7E–01
	Accident	9.0E+00	1.1E–01
Centralized 1 (Case 7)	Cargo-related (radiological)		
	Routine crew	6.3E+00	4.8E–01
	Routine public	9.4E+00	1.2E+00
	Accident public	2.9E–01	5.7E–02
	Vehicle-related (nonradiological)		
	Emission	2.4E+00	1.8E+00
	Accident	3.5E+01	4.7E–01
Centralized 2 (Case 8)	Cargo-related (radiological)		
	Routine crew	5.8E+00	4.7E–01
	Routine public	8.6E+00	1.2E+00
	Accident public	2.8E–01	4.5E–02
	Vehicle-related (nonradiological)		
	Emission	2.9E+00	1.8E+00
	Accident	3.5E+01	4.6E–01
Centralized 3 (Case 14)	Cargo–related (radiological)		
	Routine crew	5.6E+00	4.8E–01
	Routine public	8.8E+00	1.1E+00
	Accident public	2.9E–01	5.7E–02
	Vehicle–related (nonradiological)		
	Emission	2.2E+00	1.7E+00
	Accident	3.3E+01	4.6E–01

TABLE 5.4 (Cont.)

WM LLW Alternative	Exposure Group	Fatalities	
		Truck	Rail
Centralized 4 (Case 14a)	Cargo–related (radiological)		
	Routine crew	5.5E+00	4.7E–01
	Routine public	8.1E+00	1.2E+00
	Accident public	2.8E–01	4.6E–02
	Vehicle–related (nonradiological)		
	Emission	2.8E+00	1.8E+00
	Accident	3.4E+01	4.5E–01
Centralized 5 (Case 21)	Cargo-related (radiological)		
	Routine crew	6.3E+00	4.7E–01
	Routine public	9.3E+00	1.2E+00
	Accident public	2.9E–01	5.7E–02
	Vehicle-related (nonradiological)		
	Emission	2.4E+00	1.8E+00
	Accident	3.5E+01	4.7E–01

[a] Latent-cancer fatalities are calculated by multiplying dose by the ICRP publication 60 (ICRP 1991) health risk conversion factors of 4E–04 and 5E–04 fatal cancers per person-rem for workers and for the public, respectively.

[b] For each case, impacts are calculated and presented separately assuming exclusive truck *or* exclusive rail shipments. Therefore, the impacts for truck and rail modes should not be added together.

stable weather conditions, respectively. The dose to the MEI is independent of the location of the accident. The maximum dose to an individual (approximately 7 rem for a rail accident under unfavorable weather conditions) has a potential lifetime fatal-cancer risk of 4E–03.

The accident consequence results for LLW from ANL-W should be considered extremely conservative for the majority of WM LLW shipments for a number of reasons. First, the LLW from ANL-W represents less than 1% by volume of the total WM LLW generated annually within the DOE. Only about two truck shipments would be required each year to transport ANL-W waste to an off-site facility for treatment, storage, or disposal. Therefore, that a severe LLW accident would involve the LLW from ANL-W is unlikely. Second, the accident dose results for LLW from ANL-W are at least a factor of 10 greater than those for LLW from other sites, primarily because of the large cobalt-60 content of the ANL-W waste. The "average" accident consequences would be much less than those presented here.

TABLE 5.5 Total Estimated Cancer Incidence for the WM LLW Cases[a,b]

WM LLW Alternative	Exposure Group	Cancer Cases	
		Truck	Rail
No Action (Case 1)	Cargo-related (radiological)		
	Routine crew	6.6E+00	5.5E–01
	Routine public	9.5E+00	1.4E+00
	Accident public	4.2E–03	1.8E–03
	Vehicle-related (nonradiological)		
	Emission	9.5E–01	7.8E–01
	Accident	NA[c]	NA
Decentralized (Case 2)	Cargo-related (radiological)		
	Routine crew	3.2E–01	5.0E–02
	Routine public	4.1E–01	1.8E–01
	Accident public	2.2E–04	1.4E–04
	Vehicle-related (nonradiological)		
	Emission	1.2E–01	1.0E–01
	Accident	NA	NA
Regionalized 1 (Case 3)	Cargo-related (radiological)		
	Routine crew	4.8E–01	6.1E–02
	Routine public	6.1E–01	2.3E–01
	Accident public	1.1E–03	2.8E–04
	Vehicle-related (nonradiological)		
	Emission	9.9E–02	1.3E–01
	Accident	NA	NA
Regionalized 2 (Case 9)	Cargo-related (radiological)		
	Routine crew	4.7E-01	6.2E-02
	Routine public	6.0E-01	2.4E-01
	Accident public	1.1E-03	2.8E-04
	Vehicle-related (nonradiological)		
	Emission	9.6E-02	1.3E-01
	Accident	NA	NA

TABLE 5.5 (Cont.)

WM LLW Alternative	Exposure Group	Cancer Cases	
		Truck	Rail
Regionalized 3 (Case 4)	Cargo-related (radiological)		
	Routine crew	1.7E+00	2.3E–01
	Routine public	2.3E+00	6.9E–01
	Accident public	2.6E–03	1.1E–03
	Vehicle-related (nonradiological)		
	Emission	1.9E–01	3.2E–01
	Accident	NA	NA
Regionalized 4 (Case 12)	Cargo-related (radiological)		
	Routine crew	1.6E+00	2.3E-01
	Routine public	2.2E+00	6.3E-01
	Accident public	3.6E-03	1.5E-03
	Vehicle-related (nonradiological)		
	Emission	2.2E-01	2.3E-01
	Accident	NA	NA
Regionalized 5 (Case 19)	Cargo-related (radiological)		
	Routine crew	2.7E+00	2.9E-01
	Routine public	3.8E+00	8.0E-01
	Accident public	5.9E-01	4.1E-02
	Vehicle-related (nonradiological)		
	Emission	3.0E-01	3.5E-01
	Accident	NA	NA
Regionalized 6 (Case 5)	Cargo-related (radiological)		
	Routine crew	5.4E+00	5.6E–01
	Routine public	7.4E+00	1.4E+00
	Accident public	4.0E–01	7.5E–02
	Vehicle-related (nonradiological)		
	Emission	6.7E–01	4.7E–01
	Accident	NA	NA

TABLE 5.5 (Cont.)

WM LLW Alternative	Exposure Group	Cancer Cases	
		Truck	Rail
Regionalized 7 (Case 6)	Cargo-related (radiological)		
	Routine crew	5.4E+00	6.0E–01
	Routine public	7.5E+00	1.5E+00
	Accident public	3.5E–01	4.2E–02
	Vehicle-related (nonradiological)		
	Emission	8.2E–01	4.7E–01
	Accident	NA	NA
Centralized 1 (Case 7)	Cargo-related (radiological)		
	Routine crew	2.2E+01	1.7E+00
	Routine public	3.2E+01	3.9E+00
	Accident public	9.9E–01	1.9E–01
	Vehicle-related (nonradiological)		
	Emission	2.4E+00	1.8E+00
	Accident	NA	NA
Centralized 2 (Case 8)	Cargo-related (radiological)		
	Routine crew	2.0E+01	1.7E+00
	Routine public	2.9E+01	3.9E+00
	Accident public	9.6E–01	1.5E–01
	Vehicle-related (nonradiological)		
	Emission	2.9E+00	1.8E+00
	Accident	NA	NA
Centralized 3 (Case 14)	Cargo-related (radiological)		
	Routine crew	2.1E+01	1.6E+00
	Routine public	3.0E+01	4.0E+00
	Accident public	9.9E-01	1.9E-01
	Vehicle-related (nonradiological)		
	Emission	2.2E+00	1.7+00
	Accident	NA	NA

TABLE 5.5 (Cont.)

WM LLW Alternative	Exposure Group	Cancer Cases	
		Truck	Rail
Centralized 4 (Case 14a)	Cargo-related (radiological)		
	Routine crew	1.9E+01	1.6E+00
	Routine public	2.8E+01	4.0E+00
	Accident public	9.6E-01	1.6E-01
	Vehicle-related (nonradiological)		
	Emission	2.8E+00	1.8E+00
	Accident	NA	NA
Centralized 5 (Case 21)	Cargo-related (radiological)		
	Routine crew	2.2E+01	1.7E+00
	Routine public	3.2E+01	3.9E+00
	Accident public	9.9E-01	1.9E-01
	Vehicle-related (nonradiological)		
	Emission	2.4E+00	1.8E+00
	Accident	NA	NA

[a] Latent-cancer incidences are calculated by multiplying dose by the ICRP Publication 60 (ICRP 1991) health risk conversion factors of 1.4E–03 and 1.7E–03 cancer cases per person-rem for workers and for the public, respectively.

[b] For each case, impacts are calculated and presented separately assuming exclusive truck *or* exclusive rail shipments. Therefore, the impacts for truck and rail modes should not be added together.

[c] NA = not applicable.

TABLE 5.6 Total Estimated Genetic Effects for the WM LLW Cases[a,b]

WM LLW Alternative	Exposure Group	Genetic Effects	
		Truck	Rail
No Action (Case 1)	Cargo-related (radiological)		
	Routine crew	2.7E–01	2.3E–02
	Routine public	5.6E–01	8.6E–02
	Accident public	7.5E–05	2.7E–05
	Vehicle-related (nonradiological)		
	Emission	NA[c]	NA
	Accident	NA	NA
Decentralized (Case 2)	Cargo-related (radiological)		
	Routine crew	1.4E–02	2.1E–03
	Routine public	2.5E–02	1.0E–02
	Accident public	1.2E–05	7.7E–06
	Vehicle-related (nonradiological)		
	Emission	NA	NA
	Accident	NA	NA
Regionalized 1 (Case 3)	Cargo-related (radiological)		
	Routine crew	2.0E–02	2.6E–03
	Routine public	3.6E–02	1.4E–02
	Accident public	3.2E–05	7.1E–06
	Vehicle-related (nonradiological)		
	Emission	NA	NA
	Accident	NA	NA
Regionalized 2 (Case 9)	Cargo-related (radiological)		
	Routine crew	2.0E–02	2.7E–03
	Routine public	3.6E–02	1.4E–02
	Accident public	3.2E–05	7.1E–06
	Vehicle-related (nonradiological)		
	Emission	NA	NA
	Accident	NA	NA

TABLE 5.6 (Cont.)

WM LLW Alternative	Exposure Group	Genetic Effects	
		Truck	Rail
Regionalized 3 (Case 4)	Cargo-related (radiological)		
	Routine crew	7.3E–02	9.8E–03
	Routine public	1.4E–01	4.1E–02
	Accident public	5.8E–05	1.7E–05
	Vehicle-related (nonradiological)		
	Emission	NA	NA
	Accident	NA	NA
Regionalized 4 (Case 12)	Cargo-related (radiological)		
	Routine crew	7.2E–02	9.9E–03
	Routine public	1.3E–01	3.7E–02
	Accident public	7.0E–05	2.1E–05
	Vehicle-related (nonradiological)		
	Emission	NA	NA
	Accident	NA	NA
Regionalized 5 (Case 19)	Cargo-related (radiological)		
	Routine crew	1.2E–01	1.2E–02
	Routine public	2.2E–01	4.7E–02
	Accident public	2.9E–02	1.8E–03
	Vehicle-related (nonradiological)		
	Emission	NA	NA
	Accident	NA	NA
Regionalized 6 (Case 5)	Cargo-related (radiological)		
	Routine crew	2.3E–01	2.4E–02
	Routine public	4.3E–01	8.1E–02
	Accident public	2.0E–02	3.7E–03
	Vehicle-related (nonradiological)		
	Emission	NA	NA
	Accident	NA	NA

TABLE 5.6 (Cont.)

WM LLW Alternative	Exposure Group	Genetic Effects	
		Truck	Rail
Regionalized 7 (Case 6)	Cargo-related (radiological)		
	Routine crew	2.3E–01	2.6E–02
	Routine public	4.4E–01	8.4E–02
	Accident public	1.9E–02	2.2E–03
	Vehicle-related (nonradiological)		
	Emission	NA	NA
	Accident	NA	NA
Centralized 1 (Case 7)	Cargo-related (radiological)		
	Routine crew	9.4E–01	7.2E–02
	Routine public	1.9E+00	2.3E–01
	Accident public	5.3E–02	1.0E–02
	Vehicle-related (nonradiological)		
	Emission	NA	NA
	Accident	NA	NA
Centralized 2 (Case 8)	Cargo-related (radiological)		
	Routine crew	8.7E–01	7.2E–02
	Routine public	1.7E+00	2.3E–01
	Accident public	5.3E–02	8.5E–03
	Vehicle-related (nonradiological)		
	Emission	NA	NA
	Accident	NA	NA
Centralized 3 (Case 14)	Cargo-related (radiological)		
	Routine crew	9.0E–01	7.1E–02
	Routine public	1.8E+00	2.3E–01
	Accident public	5.3E–02	1.0E–02
	Vehicle-related (nonradiological)		
	Emission	NA	NA
	Accident	NA	NA

TABLE 5.6 (Cont.)

WM LLW Alternative	Exposure Group	Genetic Effects	
		Truck	Rail
Centralized 4 (Case 14a)	Cargo-related (radiological)		
	Routine crew	8.2E–01	7.1E–02
	Routine public	1.6E+00	2.3E–01
	Accident public	5.4E–02	8.6E–03
	Vehicle-related (nonradiological)		
	Emission	NA	NA
	Accident	NA	NA
Centralized 5 (Case 21)	Cargo-related (radiological)		
	Routine crew	9.4E–01	7.2E–02
	Routine public	1.8E+00	2.3E–01
	Accident public	5.3E–02	1.0E–02
	Vehicle-related (nonradiological)		
	Emission	NA	NA
	Accident	NA	NA

[a] Genetic effects are calculated by multiplying dose by the ICRP Publication 60 (ICRP 1991) health risk conversion factors of 6E–05 and 1E–04 adverse genetic effects per person-rem for workers and for the public, respectively.

[b] For each case, impacts are calculated and presented separately assuming exclusive truck *or* exclusive rail shipments. Therefore, the impacts for truck and rail modes should not be added together.

[c] NA = not applicable.

TABLE 5.7 Estimated Routine Doses and Lifetime Risk of Fatal Cancer to MEIs from Shipments of WM LLW (per Exposure Event)[a]

Receptor[b]	Dose (rem)		Lifetime Risk[c]	
	Truck	Rail	Truck	Rail
Workers				
Crew member	[d]	[d]	[d]	[d]
Inspector	1.5E–04	1.5E–04	6E–08	6E–08
Rail-yard crew member	NA[e]	7.9E–05	NA	3E–08
Public				
Resident	1.6E–08	1.6E–08	8E–12	8E–12
Person in traffic jam	5.0E–04	5.0E–04	3E–07	3E–07
Person at service station	2.1E–05	NA	1E–08	NA
Resident near rail stop	NA	1.1E–06	NA	6E–10

[a] Dose rate is assumed to be 1 mrem/h at 1 m (3.3 ft) from a WM LLW shipment.

[b] Receptor assumptions are described in Section 4.6.

[c] Lifetime risk of fatal cancer is based on ICRP Publication 60 (ICRP 1991) health risk conversion factors of 4E–04 and 5E–04 fatal cancers per person-rem for workers and for members of the public, respectively.

[d] The DOE administrative control level limits doses to DOE workers to 2 rem/yr. For a representative shipment of 1,609 km (1,000 mi) and an average speed of 80 km/h (50 mph), the dose to a driver would be approximately 40 mrem if the dose rate in the crew compartment were at the regulatory limit of 2 mrem/h. Dose rates are typically much less than 2 mrem/h in the crew compartment.

[e] NA = not applicable.

TABLE 5.8 Cumulative Dose and Lifetime Risk to MEIs Living along a Site Entrance Route for WM LLW Shipments (Current Inventories plus 20 Years of Generation)[a]

Alternative and Site[b]	All Truck			All Rail		
	Total Shipments	Dose (rem)	Risk (Fatal Cancer)[c]	Total Shipments	Dose (rem)	Risk (Fatal Cancer)[c]
No Action (Case 1)						
NTS	69,960	1.1E-03	5.6E-07	26,740	4.3E-04	2.2E-07
PORTS	33,440	5.4E-04	2.7E-07	12,740	2.1E-04	1.0E-07
Hanford	17,340	2.8E-04	1.4E-07	6,640	1.1E-04	5.3E-08
Pantex	13,740	2.2E-04	1.1E-07	5,440	8.8E-05	4.4E-08
RMI	7,300	1.2E-04	5.9E-08	2,740	4.4E-05	2.2E-08
KAPL-S	6,860	1.1E-04	5.5E-08	2,600	4.2E-05	2.1E-08
PGDP	6,420	1.0E-04	5.2E-08	2,400	3.9E-05	1.9E-08
Mound	5,120	8.2E-05	4.1E-08	1,900	3.1E-05	1.5E-08
NRF	4,620	7.4E-05	3.7E-08	1,760	2.8E-05	1.4E-08
Bettis	3,740	6.0E-05	3.0E-08	1,420	2.3E-05	1.1E-08
RFETS	3,200	5.2E-05	2.6E-08	1,200	1.9E-05	9.7E-09
ANL-E	1,060	1.7E-05	8.5E-09	400	6.4E-06	3.2E-09
Fermi	420	6.8E-06	3.4E-09	180	2.9E-06	1.4E-09
SLAC	400	6.4E-06	3.2E-09	160	2.6E-06	1.3E-09
LLNL	320	5.2E-06	2.6E-09	120	1.9E-06	9.7E-10
SNL-NM	240	3.9E-06	1.9E-09	120	1.9E-06	9.7E-10
LBL	200	3.2E-06	1.6E-09	80	1.3E-06	6.4E-10
ITRI	100	1.6E-06	8.1E-10	40	6.4E-07	3.2E-10
SNL-CA	60	9.7E-07	4.8E-10	20	3.2E-07	1.6E-10
SRS	40	6.4E-07	3.2E-10	20	3.2E-07	1.6E-10
Pinellas	40	6.4E-07	3.2E-10	20	3.2E-07	1.6E-10
PPPL	20	3.2E-07	1.6E-10	20	3.2E-07	1.6E-10
ORR	20	3.2E-07	1.6E-10	20	3.2E-07	1.6E-10
ORISE	20	3.2E-07	1.6E-10	20	3.2E-07	1.6E-10
KCP	20	3.2E-07	1.6E-10	20	3.2E-07	1.6E-10
Ames	20	3.2E-07	1.6E-10	20	3.2E-07	1.6E-10
Decentralized (Case 2)						
PORTS	12,800	2.1E-04	1.0E-07	4,770	7.7E-05	3.8E-08
RMI	7,680	1.2E-04	6.2E-08	2,870	4.6E-05	2.3E-08
BNL	6,790	1.1E-04	5.5E-08	2,580	4.2E-05	2.1E-08
KAPL-S	6,780	1.1E-04	5.5E-08	2,570	4.1E-05	2.1E-08
Mound	5,120	8.2E-05	4.1E-08	1,900	3.1E-05	1.5E-08
WVDP	3,730	6.0E-05	3.0E-08	1,410	2.3E-05	1.1E-08
Bettis	3,730	6.0E-05	3.0E-08	1,410	2.3E-05	1.1E-08
LLNL	570	9.2E-06	4.6E-09	230	3.7E-06	1.9E-09
ANL-E	450	7.2E-06	3.6E-09	180	2.9E-06	1.4E-09
Fermi	430	6.9E-06	3.5E-09	170	2.7E-06	1.4E-09
SLAC	390	6.3E-06	3.1E-09	150	2.4E-06	1.2E-09
LBL	180	2.9E-06	1.4E-09	80	1.3E-06	6.4E-10
ORR	50	8.1E-07	4.0E-10	20	3.2E-07	1.6E-10
ORISE	50	8.1E-07	4.0E-10	20	3.2E-07	1.6E-10
SRS	20	3.2E-07	1.6E-10	10	1.6E-07	8.1E-11
Pinellas	20	3.2E-07	1.6E-10	10	1.6E-07	8.1E-11
Ames	20	3.2E-07	1.6E-10	10	1.6E-07	8.1E-11
PPPL	10	1.6E-07	8.1E-11	10	1.6E-07	8.1E-11
PGDP	10	1.6E-07	8.1E-11	10	1.6E-07	8.1E-11
KCP	10	1.6E-07	8.1E-11	10	1.6E-07	8.1E-11

TABLE 5.8 (Cont.)

Alternative and Site[b]	All Truck			All Rail		
	Total Shipments	Dose (rem)	Risk (Fatal Cancer)[c]	Total Shipments	Dose (rem)	Risk (Fatal Cancer)[c]
Regionalized 1 (Case 3)						
PORTS	24,820	4.0E-04	2.0E-07	9,330	1.5E-04	7.5E-08
RMI	7,680	1.2E-04	6.2E-08	2,870	4.6E-05	2.3E-08
KAPL-S	6,780	1.1E-04	5.5E-08	2,570	4.1E-05	2.1E-08
Mound	5,120	8.2E-05	4.1E-08	1,900	3.1E-05	1.5E-08
Bettis	3,730	6.0E-05	3.0E-08	1,410	2.3E-05	1.1E-08
ANL-E	1,050	1.7E-05	8.5E-09	390	6.3E-06	3.1E-09
LLNL	570	9.2E-06	4.6E-09	230	3.7E-06	1.9E-09
Fermi	430	6.9E-06	3.5E-09	170	2.7E-06	1.4E-09
SLAC	390	6.3E-06	3.1E-09	150	2.4E-06	1.2E-09
LANL	330	5.3E-06	2.7E-09	140	2.3E-06	1.1E-09
SNL-NM	230	3.7E-06	1.9E-09	100	1.6E-06	8.1E-10
LBL	180	2.9E-06	1.4E-09	80	1.3E-06	6.4E-10
ITRI	100	1.6E-06	8.1E-10	40	6.4E-07	3.2E-10
ORR	50	8.1E-07	4.0E-10	20	3.2E-07	1.6E-10
ORISE	50	8.1E-07	4.0E-10	20	3.2E-07	1.6E-10
SRS	20	3.2E-07	1.6E-10	10	1.6E-07	8.1E-11
Pinellas	20	3.2E-07	1.6E-10	10	1.6E-07	8.1E-11
Ames	20	3.2E-07	1.6E-10	10	1.6E-07	8.1E-11
PPPL	10	1.6E-07	8.1E-11	10	1.6E-07	8.1E-11
PGDP	10	1.6E-07	8.1E-11	10	1.6E-07	8.1E-11
KCP	10	1.6E-07	8.1E-11	10	1.6E-07	8.1E-11
Regionalized 2 (Case 9)						
PORTS	24,380	3.9E-04	2.0E-07	9,260	1.5E-04	7.5E-08
RMI	7,610	1.2E-04	6.1E-08	2,850	4.6E-05	2.3E-08
KAPL-S	6,670	1.1E-04	5.4E-08	2,560	4.1E-05	2.1E-08
Mound	5,080	8.2E-05	4.1E-08	1,910	3.1E-05	1.5E-08
Bettis	3,660	5.9E-05	2.9E-08	1,400	2.3E-05	1.1E-08
ANL-E	1,050	1.7E-05	8.5E-09	390	6.3E-06	3.1E-09
FEMP	910	1.5E-05	7.3E-09	400	6.4E-06	3.2E-09
LLNL	560	9.0E-06	4.5E-09	230	3.7E-06	1.9E-09
Fermi	420	6.8E-06	3.4E-09	180	2.9E-06	1.4E-09
SLAC	390	6.3E-06	3.1E-09	150	2.4E-06	1.2E-09
LANL	330	5.3E-06	2.7E-09	140	2.3E-06	1.1E-09
SNL-NM	230	3.7E-06	1.9E-09	100	1.6E-06	8.1E-10
LBL	170	2.7E-06	1.4E-09	80	1.3E-06	6.4E-10
ITRI	100	1.6E-06	8.1E-10	40	6.4E-07	3.2E-10
ORR	50	8.1E-07	4.0E-10	20	3.2E-07	1.6E-10
ORISE	50	8.1E-07	4.0E-10	20	3.2E-07	1.6E-10
Ames	30	4.8E-07	2.4E-10	20	3.2E-07	1.6E-10
SRS	20	3.2E-07	1.6E-10	10	1.6E-07	8.1E-11
Pinellas	20	3.2E-07	1.6E-10	10	1.6E-07	8.1E-11
PPPL	10	1.6E-07	8.1E-11	10	1.6E-07	8.1E-11
PGDP	10	1.6E-07	8.1E-11	10	1.6E-07	8.1E-11
KCP	10	1.6E-07	8.1E-11	10	1.6E-07	8.1E-11

TABLE 5.8 (Cont.)

Alternative and Site[b]	All Truck			All Rail		
	Total Shipments	Dose (rem)	Risk (Fatal Cancer)[c]	Total Shipments	Dose (rem)	Risk (Fatal Cancer)[c]
Regionalized 3 (Case 4)						
ORR	64,590	1.0E-03	5.2E-07	24,470	3.9E-04	2.0E-07
PORTS	33,440	5.4E-04	2.7E-07	12,740	2.1E-04	1.0E-07
LANL	18,400	3.0E-04	1.5E-07	6,910	1.1E-04	5.6E-08
Pantex	14,500	2.3E-04	1.2E-07	5,440	8.8E-05	4.4E-08
RMI	7,680	1.2E-04	6.2E-08	2,870	4.6E-05	2.3E-08
KAPL-S	6,780	1.1E-04	5.5E-08	2,570	4.1E-05	2.1E-08
PGDP	6,270	1.0E-04	5.0E-08	2,370	3.8E-05	1.9E-08
Mound	5,120	8.2E-05	4.1E-08	1,900	3.1E-05	1.5E-08
Bettis	3,730	6.0E-05	3.0E-08	1,410	2.3E-05	1.1E-08
RFETS	3,570	5.7E-05	2.9E-08	1,330	2.1E-05	1.1E-08
NTS	1,190	1.9E-05	9.6E-09	460	7.4E-06	3.7E-09
ANL-E	1,050	1.7E-05	8.5E-09	390	6.3E-06	3.1E-09
LLNL	560	9.0E-06	4.5E-09	210	3.4E-06	1.7E-09
Fermi	430	6.9E-06	3.5E-09	170	2.7E-06	1.4E-09
SLAC	390	6.3E-06	3.1E-09	150	2.4E-06	1.2E-09
SNL-NM	230	3.7E-06	1.9E-09	100	1.6E-06	8.1E-10
LBL	180	2.9E-06	1.4E-09	80	1.3E-06	6.4E-10
ITRI	100	1.6E-06	8.1E-10	40	6.4E-07	3.2E-10
SNL-CA	60	9.7E-07	4.8E-10	20	3.2E-07	1.6E-10
ORISE	50	8.1E-07	4.0E-10	20	3.2E-07	1.6E-10
SRS	20	3.2E-07	1.6E-10	10	1.6E-07	8.1E-11
Pinellas	20	3.2E-07	1.6E-10	10	1.6E-07	8.1E-11
Ames	20	3.2E-07	1.6E-10	10	1.6E-07	8.1E-11
PPPL	10	1.6E-07	8.1E-11	10	1.6E-07	8.1E-11
KCP	10	1.6E-07	8.1E-11	10	1.6E-07	8.1E-11
Regionalized 4 (Case 12)						
ORR	58,210	9.4E-04	4.7E-07	22,310	3.6E-04	1.8E-07
PORTS	47,610	7.7E-04	3.8E-07	18,410	3.0E-04	1.5E-07
LANL	17,860	2.9E-04	1.4E-07	6,740	1.1E-04	5.4E-08
Pantex	14,180	2.3E-04	1.1E-07	5,370	8.6E-05	4.3E-08
RMI	7,520	1.2E-04	6.1E-08	2,860	4.6E-05	2.3E-08
KAPL-S	6,670	1.1E-04	5.4E-08	2,560	4.1E-05	2.1E-08
PGDP	6,270	1.0E-04	5.0E-08	2,350	3.8E-05	1.9E-08
Mound	5,080	8.2E-05	4.1E-08	1,910	3.1E-05	1.5E-08
Bettis	3,660	5.9E-05	2.9E-08	1,400	2.3E-05	1.1E-08
RFETS	3,350	5.4E-05	2.7E-08	1,230	2.0E-05	9.9E-09
ANL-E	1,050	1.7E-05	8.5E-09	390	6.3E-06	3.1E-09
NTS	860	1.4E-05	6.9E-09	330	5.3E-06	2.7E-09
LLNL	570	9.2E-06	4.6E-09	220	3.5E-06	1.8E-09
Fermi	420	6.8E-06	3.4E-09	180	2.9E-06	1.4E-09
SLAC	400	6.4E-06	3.2E-09	160	2.6E-06	1.3E-09
Hanford	350	5.6E-06	2.8E-09	160	2.6E-06	1.3E-09
SNL-NM	230	3.7E-06	1.9E-09	100	1.6E-06	8.1E-10
LBL	180	2.9E-06	1.4E-09	80	1.3E-06	6.4E-10
ITRI	100	1.6E-06	8.1E-10	40	6.4E-07	3.2E-10
SNL-CA	60	9.7E-07	4.8E-10	30	4.8E-07	2.4E-10
ORISE	50	8.1E-07	4.0E-10	20	3.2E-07	1.6E-10
Ames	30	4.8E-07	2.4E-10	20	3.2E-07	1.6E-10
PPPL	20	3.2E-07	1.6E-10	20	3.2E-07	1.6E-10
SRS	20	3.2E-07	1.6E-10	10	1.6E-07	8.1E-11
Pinellas	20	3.2E-07	1.6E-10	10	1.6E-07	8.1E-11
KCP	10	1.6E-07	8.1E-11	10	1.6E-07	8.1E-11

TABLE 5.8 (Cont.)

Alternative and Site[b]	All Truck			All Rail		
	Total Shipments	Dose (rem)	Risk (Fatal Cancer)[c]	Total Shipments	Dose (rem)	Risk (Fatal Cancer)[c]
Regionalized 5 (Case 19)						
ORR	63,430	1.0E-03	5.1E-07	24,170	3.9E-04	1.9E-07
PORTS	32,500	5.2E-04	2.6E-07	12,500	2.0E-04	1.0E-07
INEL	25,620	4.1E-04	2.1E-07	10,020	1.6E-04	8.1E-08
Pantex	13,830	2.2E-04	1.1E-07	5,380	8.7E-05	4.3E-08
LANL	11,750	1.9E-04	9.5E-08	4,640	7.5E-05	3.7E-08
RMI	7,610	1.2E-04	6.1E-08	2,850	4.6E-05	2.3E-08
KAPL-S	6,670	1.1E-04	5.4E-08	2,560	4.1E-05	2.1E-08
PGDP	6,270	1.0E-04	5.0E-08	2,350	3.8E-05	1.9E-08
Mound	5,160	8.3E-05	4.2E-08	1,900	3.1E-05	1.5E-08
Bettis	3,660	5.9E-05	2.9E-08	1,400	2.3E-05	1.1E-08
RFETS	3,530	5.7E-05	2.8E-08	1,330	2.1E-05	1.1E-08
ANL-E	1,050	1.7E-05	8.5E-09	390	6.3E-06	3.1E-09
NTS	860	1.4E-05	6.9E-09	330	5.3E-06	2.7E-09
LLNL	570	9.2E-06	4.6E-09	220	3.5E-06	1.8E-09
Fermi	420	6.8E-06	3.4E-09	170	2.7E-06	1.4E-09
SLAC	400	6.4E-06	3.2E-09	160	2.6E-06	1.3E-09
Hanford	350	5.6E-06	2.8E-09	160	2.6E-06	1.3E-09
SNL-NM	240	3.9E-06	1.9E-09	110	1.8E-06	8.9E-10
LBL	180	2.9E-06	1.4E-09	80	1.3E-06	6.4E-10
ITRI	110	1.8E-06	8.9E-10	40	6.4E-07	3.2E-10
SNL-CA	60	9.7E-07	4.8E-10	30	4.8E-07	2.4E-10
ORISE	50	8.1E-07	4.0E-10	20	3.2E-07	1.6E-10
SRS	20	3.2E-07	1.6E-10	10	1.6E-07	8.1E-11
Pinellas	20	3.2E-07	1.6E-10	10	1.6E-07	8.1E-11
Ames	20	3.2E-07	1.6E-10	10	1.6E-07	8.1E-11
PPPL	10	1.6E-07	8.1E-11	10	1.6E-07	8.1E-11
KCP	10	1.6E-07	8.1E-11	10	1.6E-07	8.1E-11
Regionalized 6 (Case 5)						
SRS	130,030	2.1E-03	1.0E-06	49,340	7.9E-04	4.0E-07
ORR	65,420	1.1E-03	5.3E-07	24,860	4.0E-04	2.0E-07
Hanford	44,360	7.1E-04	3.6E-07	16,700	2.7E-04	1.3E-07
PORTS	33,440	5.4E-04	2.7E-07	12,740	2.1E-04	1.0E-07
Pantex	14,500	2.3E-04	1.2E-07	5,440	8.8E-05	4.4E-08
LANL	11,420	1.8E-04	9.2E-08	4,270	6.9E-05	3.4E-08
INEL	8,520	1.4E-04	6.9E-08	3,220	5.2E-05	2.6E-08
RMI	7,680	1.2E-04	6.2E-08	2,870	4.6E-05	2.3E-08
KAPL-S	6,780	1.1E-04	5.5E-08	2,570	4.1E-05	2.1E-08
PGDP	6,270	1.0E-04	5.0E-08	2,370	3.8E-05	1.9E-08
Mound	5,120	8.2E-05	4.1E-08	1,900	3.1E-05	1.5E-08
NRF	4,610	7.4E-05	3.7E-08	1,750	2.8E-05	1.4E-08
Bettis	3,730	6.0E-05	3.0E-08	1,410	2.3E-05	1.1E-08
RFETS	3,570	5.7E-05	2.9E-08	1,330	2.1E-05	1.1E-08
ANL-E	1,050	1.7E-05	8.5E-09	390	6.3E-06	3.1E-09
LLNL	560	9.0E-06	4.5E-09	210	3.4E-06	1.7E-09
Fermi	430	6.9E-06	3.5E-09	170	2.7E-06	1.4E-09
SLAC	390	6.3E-06	3.1E-09	150	2.4E-06	1.2E-09
SNL-NM	230	3.7E-06	1.9E-09	100	1.6E-06	8.1E-10
ANL-W	220	3.5E-06	1.8E-09	90	1.4E-06	7.2E-10
LBL	180	2.9E-06	1.4E-09	80	1.3E-06	6.4E-10
ITRI	100	1.6E-06	8.1E-10	40	6.4E-07	3.2E-10

TABLE 5.8 (Cont.)

Alternative and Site[b]	All Truck			All Rail		
	Total Shipments	Dose (rem)	Risk (Fatal Cancer)[c]	Total Shipments	Dose (rem)	Risk (Fatal Cancer)[c]
SNL-CA	60	9.7E-07	4.8E-10	20	3.2E-07	1.6E-10
ORISE	50	8.1E-07	4.0E-10	20	3.2E-07	1.6E-10
Pinellas	20	3.2E-07	1.6E-10	10	1.6E-07	8.1E-11
Ames	20	3.2E-07	1.6E-10	10	1.6E-07	8.1E-11
PPPL	10	1.6E-07	8.1E-11	10	1.6E-07	8.1E-11
KCP	10	1.6E-07	8.1E-11	10	1.6E-07	8.1E-11
Regionalized 7 (Case 6)						
SRS	130,030	2.1E-03	1.0E-06	49,340	7.9E-04	4.0E-07
ORR	65,420	1.1E-03	5.3E-07	24,860	4.0E-04	2.0E-07
NTS	58,900	9.5E-04	4.7E-07	22,140	3.6E-04	1.8E-07
PORTS	33,440	5.4E-04	2.7E-07	12,740	2.1E-04	1.0E-07
Hanford	14,540	2.3E-04	1.2E-07	5,440	8.8E-05	4.4E-08
Pantex	14,500	2.3E-04	1.2E-07	5,440	8.8E-05	4.4E-08
LANL	11,420	1.8E-04	9.2E-08	4,270	6.9E-05	3.4E-08
INEL	8,520	1.4E-04	6.9E-08	3,220	5.2E-05	2.6E-08
RMI	7,680	1.2E-04	6.2E-08	2,870	4.6E-05	2.3E-08
KAPL-S	6,780	1.1E-04	5.5E-08	2,570	4.1E-05	2.1E-08
PGDP	6,270	1.0E-04	5.0E-08	2,370	3.8E-05	1.9E-08
Mound	5,120	8.2E-05	4.1E-08	1,900	3.1E-05	1.5E-08
NRF	4,610	7.4E-05	3.7E-08	1,750	2.8E-05	1.4E-08
Bettis	3,730	6.0E-05	3.0E-08	1,410	2.3E-05	1.1E-08
RFETS	3,570	5.7E-05	2.9E-08	1,330	2.1E-05	1.1E-08
ANL-E	1,050	1.7E-05	8.5E-09	390	6.3E-06	3.1E-09
LLNL	560	9.0E-06	4.5E-09	210	3.4E-06	1.7E-09
Fermi	430	6.9E-06	3.5E-09	170	2.7E-06	1.4E-09
SLAC	390	6.3E-06	3.1E-09	150	2.4E-06	1.2E-09
SNL-NM	230	3.7E-06	1.9E-09	100	1.6E-06	8.1E-10
ANL-W	220	3.5E-06	1.8E-09	90	1.4E-06	7.2E-10
LBL	180	2.9E-06	1.4E-09	80	1.3E-06	6.4E-10
ITRI	100	1.6E-06	8.1E-10	40	6.4E-07	3.2E-10
SNL-CA	60	9.7E-07	4.8E-10	20	3.2E-07	1.6E-10
ORISE	50	8.1E-07	4.0E-10	20	3.2E-07	1.6E-10
Pinellas	20	3.2E-07	1.6E-10	10	1.6E-07	8.1E-11
Ames	20	3.2E-07	1.6E-10	10	1.6E-07	8.1E-11
PPPL	10	1.6E-07	8.1E-11	10	1.6E-07	8.1E-11
KCP	10	1.6E-07	8.1E-11	10	1.6E-07	8.1E-11
Centralized 1 (Case 7)						
Hanford	242,730	3.9E-03	2.0E-06	91,440	1.5E-03	7.4E-07
SRS	68,340	1.1E-03	5.5E-07	25,400	4.1E-04	2.0E-07
ORR	65,420	1.1E-03	5.3E-07	24,860	4.0E-04	2.0E-07
PORTS	33,440	5.4E-04	2.7E-07	12,740	2.1E-04	1.0E-07
Pantex	14,500	2.3E-04	1.2E-07	5,440	8.8E-05	4.4E-08
LANL	11,420	1.8E-04	9.2E-08	4,270	6.9E-05	3.4E-08
INEL	8,520	1.4E-04	6.9E-08	3,220	5.2E-05	2.6E-08
RMI	7,680	1.2E-04	6.2E-08	2,870	4.6E-05	2.3E-08
KAPL-S	6,780	1.1E-04	5.5E-08	2,570	4.1E-05	2.1E-08
PGDP	6,270	1.0E-04	5.0E-08	2,370	3.8E-05	1.9E-08
Mound	5,120	8.2E-05	4.1E-08	1,900	3.1E-05	1.5E-08
NRF	4,610	7.4E-05	3.7E-08	1,750	2.8E-05	1.4E-08
Bettis	3,730	6.0E-05	3.0E-08	1,410	2.3E-05	1.1E-08
RFETS	3,570	5.7E-05	2.9E-08	1,330	2.1E-05	1.1E-08
ANL-E	1,050	1.7E-05	8.5E-09	390	6.3E-06	3.1E-09

TABLE 5.8 (Cont.)

Alternative and Site[b]	All Truck			All Rail		
	Total Shipments	Dose (rem)	Risk (Fatal Cancer)[c]	Total Shipments	Dose (rem)	Risk (Fatal Cancer)[c]
LLNL	560	9.0E-06	4.5E-09	210	3.4E-06	1.7E-09
Fermi	430	6.9E-06	3.5E-09	170	2.7E-06	1.4E-09
SLAC	390	6.3E-06	3.1E-09	150	2.4E-06	1.2E-09
SNL-NM	230	3.7E-06	1.9E-09	100	1.6E-06	8.1E-10
ANL-W	220	3.5E-06	1.8E-09	90	1.4E-06	7.2E-10
LBL	180	2.9E-06	1.4E-09	80	1.3E-06	6.4E-10
ITRI	100	1.6E-06	8.1E-10	40	6.4E-07	3.2E-10
SNL-CA	60	9.7E-07	4.8E-10	20	3.2E-07	1.6E-10
ORISE	50	8.1E-07	4.0E-10	20	3.2E-07	1.6E-10
Pinellas	20	3.2E-07	1.6E-10	10	1.6E-07	8.1E-11
Ames	20	3.2E-07	1.6E-10	10	1.6E-07	8.1E-11
PPPL	10	1.6E-07	8.1E-11	10	1.6E-07	8.1E-11
KCP	10	1.6E-07	8.1E-11	10	1.6E-07	8.1E-11
Centralized 2 (Case 8)						
NTS	257,270	4.1E-03	2.1E-06	96,880	1.6E-03	7.8E-07
SRS	68,340	1.1E-03	5.5E-07	25,400	4.1E-04	2.0E-07
ORR	65,420	1.1E-03	5.3E-07	24,860	4.0E-04	2.0E-07
PORTS	33,440	5.4E-04	2.7E-07	12,740	2.1E-04	1.0E-07
Hanford	14,540	2.3E-04	1.2E-07	5,440	8.8E-05	4.4E-08
Pantex	14,500	2.3E-04	1.2E-07	5,440	8.8E-05	4.4E-08
LANL	11,420	1.8E-04	9.2E-08	4,270	6.9E-05	3.4E-08
INEL	8,520	1.4E-04	6.9E-08	3,220	5.2E-05	2.6E-08
RMI	7,680	1.2E-04	6.2E-08	2,870	4.6E-05	2.3E-08
KAPL-S	6,780	1.1E-04	5.5E-08	2,570	4.1E-05	2.1E-08
PGDP	6,270	1.0E-04	5.0E-08	2,370	3.8E-05	1.9E-08
Mound	5,120	8.2E-05	4.1E-08	1,900	3.1E-05	1.5E-08
NRF	4,610	7.4E-05	3.7E-08	1,750	2.8E-05	1.4E-08
Bettis	3,730	6.0E-05	3.0E-08	1,410	2.3E-05	1.1E-08
RFETS	3,570	5.7E-05	2.9E-08	1,330	2.1E-05	1.1E-08
ANL-E	1,050	1.7E-05	8.5E-09	390	6.3E-06	3.1E-09
LLNL	560	9.0E-06	4.5E-09	210	3.4E-06	1.7E-09
Fermi	430	6.9E-06	3.5E-09	170	2.7E-06	1.4E-09
SLAC	390	6.3E-06	3.1E-09	150	2.4E-06	1.2E-09
SNL-NM	230	3.7E-06	1.9E-09	100	1.6E-06	8.1E-10
ANL-W	220	3.5E-06	1.8E-09	90	1.4E-06	7.2E-10
LBL	180	2.9E-06	1.4E-09	80	1.3E-06	6.4E-10
ITRI	100	1.6E-06	8.1E-10	40	6.4E-07	3.2E-10
SNL-CA	60	9.7E-07	4.8E-10	20	3.2E-07	1.6E-10
ORISE	50	8.1E-07	4.0E-10	20	3.2E-07	1.6E-10
Pinellas	20	3.2E-07	1.6E-10	10	1.6E-07	8.1E-11
Ames	20	3.2E-07	1.6E-10	10	1.6E-07	8.1E-11
PPPL	10	1.6E-07	8.1E-11	10	1.6E-07	8.1E-11
KCP	10	1.6E-07	8.1E-11	10	1.6E-07	8.1E-11
Centralized 3 (Case 14)						
Hanford	225,660	3.6E-03	1.8E-06	87,240	1.4E-03	7.0E-07
SRS	67,520	1.1E-03	5.4E-07	25,230	4.1E-04	2.0E-07
ORR	61,250	9.9E-04	4.9E-07	24,470	3.9E-04	2.0E-07
PORTS	47,440	7.6E-04	3.8E-07	18,350	3.0E-04	1.5E-07
LANL	36,640	5.9E-04	2.9E-07	14,400	2.3E-04	1.2E-07
Pantex	13,830	2.2E-04	1.1E-07	5,380	8.7E-05	4.3E-08
INEL	11,850	1.9E-04	9.5E-08	4,720	7.6E-05	3.8E-08
RMI	7,520	1.2E-04	6.1E-08	2,860	4.6E-05	2.3E-08

TABLE 5.8 (Cont.)

Alternative and Site[b]	All Truck			All Rail		
	Total Shipments	Dose (rem)	Risk (Fatal Cancer)[c]	Total Shipments	Dose (rem)	Risk (Fatal Cancer)[c]
KAPL-S	6,670	1.1E-04	5.4E-08	2,560	4.1E-05	2.1E-08
PGDP	6,350	1.0E-04	5.1E-08	2,360	3.8E-05	1.9E-08
Mound	5,080	8.2E-05	4.1E-08	1,910	3.1E-05	1.5E-08
Bettis	3,660	5.9E-05	2.9E-08	1,400	2.3E-05	1.1E-08
RFETS	3,350	5.4E-05	2.7E-08	1,230	2.0E-05	9.9E-09
ANL-E	1,050	1.7E-05	8.5E-09	390	6.3E-06	3.1E-09
LLNL	560	9.0E-06	4.5E-09	210	3.4E-06	1.7E-09
Fermi	420	6.8E-06	3.4E-09	180	2.9E-06	1.4E-09
SLAC	390	6.3E-06	3.1E-09	150	2.4E-06	1.2E-09
SNL-NM	240	3.9E-06	1.9E-09	110	1.8E-06	8.9E-10
LBL	170	2.7E-06	1.4E-09	80	1.3E-06	6.4E-10
ITRI	110	1.8E-06	8.9E-10	40	6.4E-07	3.2E-10
ANL-W	100	1.6E-06	8.1E-10	40	6.4E-07	3.2E-10
ORISE	50	8.1E-07	4.0E-10	30	4.8E-07	2.4E-10
SNL-CA	50	8.1E-07	4.0E-10	20	3.2E-07	1.6E-10
Ames	30	4.8E-07	2.4E-10	20	3.2E-07	1.6E-10
PPPL	20	3.2E-07	1.6E-10	20	3.2E-07	1.6E-10
Pinellas	20	3.2E-07	1.6E-10	10	1.6E-07	8.1E-11
KCP	10	1.6E-07	8.1E-11	10	1.6E-07	8.1E-11
Centralized 4 (Case 14a)						
NTS	239,350	3.9E-03	1.9E-06	92,470	1.5E-03	7.4E-07
SRS	67,520	1.1E-03	5.4E-07	25,230	4.1E-04	2.0E-07
ORR	61,250	9.9E-04	4.9E-07	24,470	3.9E-04	2.0E-07
PORTS	47,440	7.6E-04	3.8E-07	18,350	3.0E-04	1.5E-07
LANL	36,640	5.9E-04	2.9E-07	14,400	2.3E-04	1.2E-07
Hanford	14,350	2.3E-04	1.2E-07	5,520	8.9E-05	4.4E-08
Pantex	13,830	2.2E-04	1.1E-07	5,380	8.7E-05	4.3E-08
INEL	11,850	1.9E-04	9.5E-08	4,720	7.6E-05	3.8E-08
RMI	7,520	1.2E-04	6.1E-08	2,860	4.6E-05	2.3E-08
KAPL-S	6,670	1.1E-04	5.4E-08	2,560	4.1E-05	2.1E-08
PGDP	6,350	1.0E-04	5.1E-08	2,360	3.8E-05	1.9E-08
Mound	5,080	8.2E-05	4.1E-08	1,910	3.1E-05	1.5E-08
Bettis	3,660	5.9E-05	2.9E-08	1,400	2.3E-05	1.1E-08
RFETS	3,350	5.4E-05	2.7E-08	1,230	2.0E-05	9.9E-09
ANL-E	1,050	1.7E-05	8.5E-09	390	6.3E-06	3.1E-09
LLNL	570	9.2E-06	4.6E-09	220	3.5E-06	1.8E-09
Fermi	420	6.8E-06	3.4E-09	180	2.9E-06	1.4E-09
SLAC	400	6.4E-06	3.2E-09	160	2.6E-06	1.3E-09
SNL-NM	240	3.9E-06	1.9E-09	110	1.8E-06	8.9E-10
LBL	180	2.9E-06	1.4E-09	80	1.3E-06	6.4E-10
ITRI	110	1.8E-06	8.9E-10	40	6.4E-07	3.2E-10
ANL-W	100	1.6E-06	8.1E-10	40	6.4E-07	3.2E-10
SNL-CA	60	9.7E-07	4.8E-10	30	4.8E-07	2.4E-10
ORISE	50	8.1E-07	4.0E-10	30	4.8E-07	2.4E-10
Ames	30	4.8E-07	2.4E-10	20	3.2E-07	1.6E-10
PPPL	20	3.2E-07	1.6E-10	20	3.2E-07	1.6E-10
Pinellas	20	3.2E-07	1.6E-10	10	1.6E-07	8.1E-11
KCP	10	1.6E-07	8.1E-11	10	1.6E-07	8.1E-11

TABLE 5.8 (Cont.)

Alternative and Site[b]	All Truck			All Rail		
	Total Shipments	Dose (rem)	Risk (Fatal Cancer)[c]	Total Shipments	Dose (rem)	Risk (Fatal Cancer)[c]
Centralized 5 (Case 21)						
Hanford	241,540	3.9E-03	1.9E-06	90,980	1.5E-03	7.3E-07
SRS	68,540	1.1E-03	5.5E-07	25,320	4.1E-04	2.0E-07
ORR	65,840	1.1E-03	5.3E-07	24,890	4.0E-04	2.0E-07
PORTS	32,500	5.2E-04	2.6E-07	12,500	2.0E-04	1.0E-07
Pantex	14,180	2.3E-04	1.1E-07	5,370	8.6E-05	4.3E-08
LANL	11,220	1.8E-04	9.0E-08	4,230	6.8E-05	3.4E-08
INEL	8,570	1.4E-04	6.9E-08	3,200	5.2E-05	2.6E-08
RMI	7,610	1.2E-04	6.1E-08	2,850	4.6E-05	2.3E-08
KAPL-S	6,670	1.1E-04	5.4E-08	2,560	4.1E-05	2.1E-08
PGDP	6,270	1.0E-04	5.0E-08	2,350	3.8E-05	1.9E-08
Mound	5,160	8.3E-05	4.2E-08	1,900	3.1E-05	1.5E-08
NRF	4,500	7.2E-05	3.6E-08	1,780	2.9E-05	1.4E-08
Bettis	3,660	5.9E-05	2.9E-08	1,400	2.3E-05	1.1E-08
RFETS	3,530	5.7E-05	2.8E-08	1,320	2.1E-05	1.1E-08
ANL-E	1,050	1.7E-05	8.5E-09	390	6.3E-06	3.1E-09
LLNL	560	9.0E-06	4.5E-09	210	3.4E-06	1.7E-09
Fermi	420	6.8E-06	3.4E-09	170	2.7E-06	1.4E-09
SLAC	390	6.3E-06	3.1E-09	150	2.4E-06	1.2E-09
SNL-NM	230	3.7E-06	1.9E-09	100	1.6E-06	8.1E-10
ANL -W	210	3.4E-06	1.7E-09	90	1.4E-06	7.2E-10
LBL	170	2.7E-06	1.4E-09	80	1.3E-06	6.4E-10
ITRI	100	1.6E-06	8.1E-10	40	6.4E-07	3.2E-10
SNL-CA	50	8.1E-07	4.0E-10	20	3.2E-07	1.6E-10
ORISE	50	8.1E-07	4.0E-10	20	3.2E-07	1.6E-10
Pinellas	20	3.2E-07	1.6E-10	10	1.6E-07	8.1E-11
Ames	20	3.2E-07	1.6E-10	10	1.6E-07	8.1E-11
PPPL	10	1.6E-07	8.1E-11	10	1.6E-07	8.1E-11
KCP	10	1.6E-07	8.1E-11	10	1.6E-07	8.1E-11

[a] The external dose rate is assumed to be 1 mrem/h at 1 m (3.3 ft) for all shipments. The resident is assumed to be present for all shipments that enter or exit the site. Shipments are assumed to pass at a distance of 30 m (98 ft) and an average speed of 24 km/h (15 mph).

[b] Note: Ames = Ames National Laboratory; ANL-E = Argonne National Laboratory-East; ANL-W = Argonne National Laboratory-West; Bettis = Bettis Atomic Power Laboratory; BNL = Brookhaven National Laboratory; Fermi = Fermi National Accelerator Laboratory; Hanford = Hanford Site; INEL = Idaho National Engineering Laboratory; ITRI = Inhalation Toxicology Research Institute; KCP = Kansas City Plant; KAPL-S = Knolls Atomic Power Laboratory (Schenectady); LBL = Lawrence Berkeley National Laboratory; LLNL = Lawrence Livermore National Laboratory; LANL = Los Alamos National Laboratory; Mound = Mound Plant; NRF = Naval Reactor Facility; NTS = Nevada Test Site; ORISE = Oak Ridge Institute for Science and Education; ORR = Oak Ridge Reservation; PGDP = Paducah Gaseous Diffusion Plant; Pantex = Pantex Plant; Pinellas = Pinellas Plant; PORTS = Portsmouth Gaseous Diffusion Plant; PPPL = Princeton Plasma Physics Laboratory; RMI = Reactive Metals, Inc., RFETS = Rocky Flats Environmental Technology Site; SNL-NM = Sandia National Laboratories (New Mexico); SNL-CA = Sandia National Laboratories (California); SRS = Savannah River Site; SLAC = Stanford Linear Accelerator Center; and WVDP = West Valley Demonstration Project.

[c] The risk of fatal cancer is calculated by using the ICRP Publication 60 (ICRP 1991) health risk conversion factor of 5E-04 fatal cancers per person-rem for members of the public.

TABLE 5.9 Estimated Consequences for the Most Severe Accidents Involving Shipments of WM LLW[a,b]

Mode and Accident Location	Neutral Conditions[c]				Stable Conditions[d]			
	Population[e]		MEI[f]		Population[e]		MEI[f]	
	Dose (person-rem)	Risk (Cancer Fatalities)	Dose (rem)	Risk (Cancer Fatality)	Dose (person-rem)	Risk (Cancer Fatalities)	Dose (rem)	Risk (Cancer Fatality)
Truck								
Urban	8.3E+03	4.2E+00	7.7E-01	3.9E-04	6.7E+04	3.4E+01	2.6E+00	1.3E-03
Suburban	1.6E+03	8.0E-01	7.7E-01	3.9E-04	1.2E+04	6.0E+00	2.6E+00	1.3E-03
Rural	1.5E+01	8.0E-03	7.7E-01	3.9E-04	1.2E+02	6.0E-02	2.6E+00	1.3E-03
Rail								
Urban	2.2E+04	1.1E+01	2.1E+00	1.3E-03	1.8E+05	9.0E+01	7.0E+00	3.5E-03
Suburban	4.2E+03	2.1E+00	2.1E+00	1.3E-03	3.3E+04	1.7E+01	7.0E+00	3.5E-03
Rural	4.1E+01	2.0E-02	2.1E+00	1.3E-03	3.2E+02	1.6E-01	7.0E+00	3.5E-03

[a] The most severe accidents correspond to the highest NUREG-0170 accident severity category (Category VIII) (NRC 1977a). Results are reported for WM LLW from ANL-W, which was found to result in the highest potential accident doses. The assumptions were that 100% of the radioactive material would be released from its packaging in an accident, that 10% of the release would be entrained in an aerosol, and that 5% of the aerosolized release would be respirable.

[b] Buoyant plume rise resulting from fire for a severe accident was included in the exposure model.

[c] Neutral weather conditions result in moderate dispersion and dilution of the released plume. Neutral conditions were taken to be Pasquill Stability Class D with a wind speed of 4 m/s (9 mph). Neutral conditions occur approximately 50% of the time in the United States.

[d] Stable weather conditions result in minimal dispersion and dilution of the released plume and are thus unfavorable. Stable conditions were taken to be Pasquill Stability Class F with a wind speed of 1 m/s (2.2 mph). Stable conditions occur approximately one-third of the time in the United States.

[e] Populations extend at a uniform population density to a radius of 80 km (50 mi) from the accident site. Population exposure pathways include acute inhalation; acute cloudshine; groundshine; resuspended inhalation; resuspended cloudshine; and ingestion of food, including initially contaminated food (rural only). No decontamination or mitigative actions are taken.

[f] The MEI is assumed to be at the location of maximum exposure. The locations of maximum exposure would be 160 m (525 ft) and 400 m (1,312 ft) from the accident site under neutral and stable atmospheric conditions, respectively. Individual exposure pathways include acute inhalation, acute cloudshine, and groundshine during passage of the plume. No ingested dose is considered.

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APPENDIX A:

TRANSPORTED MATERIAL SUMMARY FILES GENERATED BY THE WASTE_MGMT MODEL

APPENDIX A:

TRANSPORTED MATERIAL SUMMARY FILES GENERATED BY THE WASTE_MGMT MODEL

The WASTE_MGMT model has been developed at Argonne National Laboratory to support analyses of risks and costs for all alternatives for each waste type considered in the Waste Management Programmatic Environmental Impact Statement (WM PEIS) (Kotek et al. 1995). One output of the WASTE_MGMT model consists of the annual quantity, physical form, and radiological characteristics of the waste shipped between sites for each case. The WASTE_MGMT output files are used directly as input to the transportation risk assessment.

The WASTE_MGMT transportation summary files generated for the low-level waste (LLW) transportation assessment are presented in this appendix, Appendix A. For each case, shipment summaries are presented separately for heterogeneous solids and activated metals. The total quantity of shipments for a case can be found by summing the quantities for heterogeneous solids and activated metals. In general, the quantity of activated metals transported is insignificant compared with the quantity of heterogeneous solids for each case.

The WASTE_MGMT files report the quantity of waste shipped on an *annual* basis (cubic meters per year or kilograms per year). As stated previously, the WM PEIS considers a 20-year time frame for WM LLW. For most of the WM alternatives considered in the WM PEIS, the assumption was that shipments would occur uniformly over a 10-year period, which would allow an initial 10-year period to build treatment, storage, and disposal facilities. Sites would essentially store their own waste for the first 10 years and ship all waste over the subsequent 10 years; however, the assumption was that for the No Action Alternative shipments would be distributed uniformly over a 20-year period because no new facilities would be required to be built. Therefore, although the total inventory considered is the same for all WM cases (current inventories plus 20 years of generation), the annual amounts of waste shipped, as reported in the WASTE_MGMT files in Appendix A, are a function of the assumption concerning the duration of the shipping campaigns for each case.

Because of the differences in the time frames noted and the uncertainties in the actual timing of future waste shipments, the transportation impacts for the various cases are best compared by examining the total impacts of transporting a specific inventory of waste, independent of the annual shipping rates. The total amount of LLW transported for each case can be calculated by multiplying the annual shipment quantities (reported in the WASTE_MGMT files in Appendix A) by 20 years for the No Action Alternative and by 10 years for the other WM cases.

A.1 WM LLW NO ACTION ALTERNATIVE (CASE 1): HETEROGENEOUS SOLIDS

Transported Material with Radionuclide Profile

Alternative: #1 No Action

Waste Stream: LLW Waste Type: All, excl. Act.Metal

Destination: HANF

Shipping Site: AMES Total Volume (m3/yr) 5.83E+00 Total Mass (kg/yr) 1.49E+04

Radionuclide	Activity (Ci/yr)
Tl-208	2.25E-07
Pb-212	5.96E-07
Bi-212	5.96E-07
Po-212	3.84E-07
Po-216	5.96E-07
Ra-224	5.96E-07
Ra-228	3.56E-06
Ac-228	3.56E-06
Th-228	5.96E-07
Th-231	3.43E-06
Th-232	3.61E-05
Th-234	4.39E-03
Pa-234	4.50E-07
Pa-234m	4.39E-03
U-235	3.41E-06
U-238	4.39E-03
Pu-238	3.47E-04
Pu-239	2.65E-05
Pu-240	9.27E-05
Pu-241	1.27E-02
Am-241	5.30E-07
Cm-242	7.42E-06
Cm-244	2.65E-06

Shipping Site: ANL-E	Total Volume (m3/yr)	3.67E+02	Total Mass (kg/yr)	1.00E+06

Radionuclide	Activity (Ci/yr)
H-3	6.67E+01
C-14	3.95E-02
Cr-51	1.43E+00
Mn-54	7.19E+00
Fe-55	1.02E+01
Fe-59	9.23E-02
Co-58	7.79E+00
Co-60	4.07E+01
Ni-59	1.31E-01
Ni-63	1.88E+01
Sr-90	1.66E+01
Y-90	1.66E+01
Zr-95	1.12E-01
Tc-99	8.11E-02
Ru-106	1.08E+00
Rh-106	1.08E+00
Sb-125	3.10E-01
Te-125m	7.58E-02
Cs-134	1.04E+01
Cs-137	2.37E+01
Ba-137m	2.25E+01
Ce-144	3.62E+00
Pr-144	3.62E+00
Pr-144m	4.35E-02
Pm-147	8.83E+00
Sm-151	8.64E-02
Eu-152	1.31E-03
Eu-154	2.26E-01
Eu-155	1.79E-01
U-238	4.81E-01
Pu-238	2.72E-01
Pu-239	2.63E-03
Pu-240	1.31E-03
Pu-241	3.04E-01
Am-241	3.95E-03

Shipping Site: BAPL	Total Volume (m3/yr)	1.99E+02	Total Mass (kg/yr)	5.43E+05

Radionuclide	Activity (Ci/yr)
H-3	1.25E-03
Co-60	5.98E-03
Ni-63	1.19E-02
Sr-90	1.05E+00
Y-90	1.05E+00
Tc-99	1.88E-04
Ru-106	1.03E-01
Rh-106	1.03E-01
Sb-125	2.96E-02
Te-125m	7.24E-03
Cs-134	1.20E-01
Cs-137	1.10E+00
Ba-137m	1.04E+00
Ce-144	3.45E-01
Pr-144	3.45E-01
Pr-144m	4.15E-03
Pm-147	8.44E-01
Sm-151	8.25E-03
Eu-152	1.25E-04
Eu-154	2.16E-02
Eu-155	1.71E-02
Tl-208	1.90E-06
Pb-212	5.04E-06
Bi-212	5.04E-06
Po-212	3.24E-06
Po-216	5.04E-06
Ra-224	5.04E-06
Ra-228	3.01E-05
Ac-228	3.01E-05
Th-228	5.04E-06
Th-231	2.90E-05
Th-232	3.05E-04
Th-234	3.71E-02
Pa-234	3.80E-06
Pa-234m	3.71E-02
U-235	2.88E-05
U-238	3.71E-02
Pu-238	2.60E-02
Pu-239	2.51E-04
Pu-240	1.25E-04
Pu-241	2.90E-02
Am-241	3.77E-04

Shipping Site: FNAL	Total Volume (m3/yr)	1.15E+01	Total Mass (kg/yr)	1.26E+04

Radionuclide	Activity (Ci/yr)
H-3	9.15E-02
Cr-51	5.58E-03
Mn-54	1.06E-02
Fe-55	3.97E-02
Fe-59	3.58E-04
Co-58	1.42E-02
Co-60	1.11E-01
Ni-59	5.12E-04
Ni-63	7.28E-02
Zr-95	4.35E-04
Tl-208	1.89E-07
Pb-212	5.01E-07
Bi-212	5.01E-07
Po-212	3.23E-07
Po-216	5.01E-07
Ra-224	5.01E-07
Ra-228	2.99E-06
Ac-228	2.99E-06
Th-228	5.01E-07
Th-231	2.88E-06
Th-232	3.04E-05
Th-234	3.69E-03
Pa-234	3.79E-07
Pa-234m	3.69E-03
U-235	2.87E-06
U-238	3.69E-03

Shipping Site: KAPL	Total Volume (m3/yr)	1.23E+02	Total Mass (kg/yr)	2.98E+05

Radionuclide	Activity (Ci/yr)
H-3	5.14E-04
C-14	2.40E-05
Cr-51	2.61E-03
Mn-54	7.67E-03
Fe-55	1.85E-02
Fe-59	1.67E-04
Co-58	9.16E-03
Co-60	5.96E-02
Ni-59	2.39E-04
Ni-63	3.43E-02
Sr-90	2.58E-02
Y-90	2.58E-02
Zr-95	2.03E-04
Tc-99	5.20E-05
Ru-106	2.19E-03
Rh-106	2.19E-03
Sb-125	6.31E-04
Te-125m	1.54E-04
Cs-134	8.14E-03
Cs-137	3.09E-02
Ba-137m	2.92E-02
Ce-144	7.35E-03
Pr-144	7.35E-03
Pr-144m	8.84E-05
Pm-147	1.79E-02
Sm-151	1.75E-04
Eu-152	2.67E-06
Eu-154	4.59E-04
Eu-155	3.64E-04
Tl-208	2.30E-09
Pb-212	6.10E-09
Bi-212	6.10E-09
Po-212	3.90E-09
Po-216	6.10E-09
Ra-224	6.10E-09
Ra-228	3.62E-08
Ac-228	3.62E-08
Th-228	6.10E-09
Th-231	3.48E-08
Th-232	3.66E-07
Th-234	4.46E-05
Pa-234	4.50E-09
Pa-234m	4.46E-05
U-235	3.47E-08
U-238	3.36E-04
Pu-238	5.53E-04
Pu-239	5.35E-06
Pu-240	2.67E-06
Pu-241	6.18E-04
Am-241	8.03E-06

Shipping Site: LBL	Total Volume (m3/yr)	2.12E+01	Total Mass (kg/yr)	3.69E+04

Radionuclide	Activity (Ci/yr)
H-3	7.44E+02
C-14	5.65E-01
Mn-54	6.37E+01
Co-58	5.88E+01
Co-60	1.69E+02
Sr-90	7.99E+01
Y-90	7.99E+01
Tc-99	1.13E+00
Cs-134	1.31E+02
Cs-137	1.73E+02
Ba-137m	1.64E+02
U-238	6.88E+00
Cm-244	5.27E+00

Shipping Site: PPPL	Total Volume (m3/yr)	1.21E+01	Total Mass (kg/yr)	2.48E+03

Radionuclide	Activity (Ci/yr)
H-3	1.00E-01
Cr-51	4.25E-04
Mn-54	8.09E-04
Fe-55	3.02E-03
Fe-59	2.73E-05
Co-58	1.08E-03
Co-60	8.51E-03
Ni-59	3.90E-05
Ni-63	5.54E-03
Zr-95	3.31E-05

Shipping Site: SLAC	Total Volume (m3/yr)	1.36E+02	Total Mass (kg/yr)	3.72E+05

Radionuclide	Activity (Ci/yr)
Cr-51	1.93E-03
Mn-54	3.68E-03
Fe-55	1.37E-02
Fe-59	1.24E-04
Co-58	4.94E-03
Co-60	3.87E-02
Ni-59	1.77E-04
Ni-63	2.52E-02
Zr-95	1.50E-04

Destination: INEL

Shipping Site: ANL-W — Total Volume (m3/yr) 1.30E+02 — Total Mass (kg/yr) 1.07E+05

Radionuclide	Activity (Ci/yr)
H-3	7.64E-04
Cr-51	1.79E+03
Mn-54	3.41E+03
Fe-55	1.27E+04
Fe-59	1.15E+02
Co-58	4.58E+03
Co-60	3.59E+04
Ni-59	1.64E+02
Ni-63	2.33E+04
Sr-90	1.58E-02
Y-90	1.58E-02
Zr-95	1.39E+02
Tc-99	2.83E-06
Ru-106	1.54E-03
Rh-106	1.54E-03
Sb-125	4.44E-04
Te-125m	1.08E-04
Cs-134	1.79E-03
Cs-137	1.66E-02
Ba-137m	1.57E-02
Ce-144	5.18E-03
Pr-144	5.18E-03
Pr-144m	6.22E-05
Pm-147	1.26E-02
Sm-151	1.23E-04
Eu-152	1.88E-06
Eu-154	3.23E-04
Eu-155	2.56E-04
Pu-238	3.90E-04
Pu-239	3.86E-06
Pu-240	2.19E-06
Pu-241	4.78E-04
Am-241	5.66E-06
Cm-242	2.44E-08
Cm-244	8.70E-09

Shipping Site: ITRI — Total Volume (m3/yr) 7.09E+01 — Total Mass (kg/yr) 8.23E+04

Radionuclide	Activity (Ci/yr)
H-3	3.08E+00
C-14	1.51E-01
Mn-54	1.70E+01
Co-58	1.57E+01
Co-60	4.56E+01
Sr-90	2.14E+01
Y-90	2.14E+01
Tc-99	3.03E-01
Cs-134	3.53E+01
Cs-137	4.66E+01
Ba-137m	4.41E+01
U-238	1.84E+00

Shipping Site: KCP — Total Volume (m3/yr) 1.32E+00 — Total Mass (kg/yr) 3.61E+03

Radionuclide	Activity (Ci/yr)
H-3	1.35E-02
C-14	7.23E-05
Mn-54	8.14E-03
Co-58	7.52E-03
Co-60	2.17E-02
Sr-90	1.02E-02
Y-90	1.02E-02
Tc-99	1.44E-04
Cs-134	1.68E-02
Cs-137	2.22E-02
Ba-137m	2.10E-02
U-238	8.80E-04

Shipping Site: LLNL	Total Volume (m3/yr) 1.25E+02	Total Mass (kg/yr) 2.91E+05

Radionuclide	Activity (Ci/yr)
H-3	1.68E+04
C-14	7.76E-04
Mn-54	8.74E-02
Co-58	8.07E-02
Co-60	2.34E-01
Ni-63	2.44E-03
Sr-90	3.27E-01
Y-90	3.27E-01
Tc-99	1.59E-03
Ru-106	2.12E-02
Rh-106	2.12E-02
Sb-125	6.09E-03
Te-125m	1.48E-03
Cs-134	2.05E-01
Cs-137	4.66E-01
Ba-137m	4.41E-01
Ce-144	7.10E-02
Pr-144	7.10E-02
Pr-144m	8.54E-04
Pm-147	1.73E-01
Sm-151	1.69E-03
Eu-152	2.58E-05
Eu-154	4.43E-03
Eu-155	3.51E-03
U-238	9.44E-03
Pu-238	3.92E-02
Pu-239	2.64E-03
Pu-240	9.08E-03
Pu-241	1.25E+00
Am-241	1.29E-04
Cm-242	7.24E-04
Cm-244	2.58E-04

Shipping Site: MOUND	Total Volume (m3/yr) 2.20E+03	Total Mass (kg/yr) 4.83E+06

Radionuclide	Activity (Ci/yr)
H-3	6.70E+03
Pu-238	8.02E-02
Pu-239	6.12E-03
Pu-240	2.14E-02
Pu-241	2.95E+00
Am-241	1.22E-04
Cm-242	1.71E-03
Cm-244	6.12E-04

Shipping Site: PANT	Total Volume (m3/yr) 2.06E+03	Total Mass (kg/yr) 1.44E+07

Radionuclide	Activity (Ci/yr)
H-3	1.17E+02
Tl-208	1.11E-04
Pb-212	2.93E-04
Bi-212	2.93E-04
Po-212	1.89E-04
Po-216	2.93E-04
Ra-224	2.93E-04
Ra-228	1.75E-03
Ac-228	1.75E-03
Th-228	2.93E-04
Th-231	1.69E-03
Th-232	1.78E-02
Th-234	2.16E+00
Pa-234	2.22E-04
Pa-234m	2.16E+00
U-235	1.68E-03
U-238	2.16E+00

Shipping Site: PORTS	Total Volume (m3/yr)	5.35E+03	Total Mass (kg/yr)	3.36E+07

Radionuclide	Activity (Ci/yr)
Tl-208	1.72E-06
Pb-212	4.57E-06
Bi-212	4.57E-06
Po-212	2.94E-06
Po-216	4.57E-06
Ra-224	4.57E-06
Ra-228	2.73E-05
Ac-228	2.73E-05
Th-228	4.57E-06
Th-231	2.63E-05
Th-232	2.77E-04
Th-234	3.37E-02
Pa-234	3.45E-06
Pa-234m	3.37E-02
U-235	2.62E-05
U-238	3.37E-02

Shipping Site: Paducah	Total Volume (m3/yr)	2.76E+03	Total Mass (kg/yr)	6.11E+06

Radionuclide	Activity (Ci/yr)
Tc-99	4.46E-03
Tl-208	1.88E-05
Pb-212	4.97E-05
Bi-212	4.97E-05
Po-212	3.20E-05
Po-216	4.97E-05
Ra-224	4.97E-05
Ra-228	2.97E-04
Ac-228	2.97E-04
Th-228	4.97E-05
Th-231	2.86E-04
Th-232	3.01E-03
Th-234	3.67E-01
Pa-234	3.76E-05
Pa-234m	3.67E-01
U-235	2.85E-04
U-238	3.67E-01
Np-237	3.35E-03
Pu-239	3.35E-03

Shipping Site: RFP	Total Volume (m3/yr)	1.02E+03	Total Mass (kg/yr)	3.08E+06

Radionuclide	Activity (Ci/yr)
Tl-208	1.80E-05
Pb-212	4.77E-05
Bi-212	4.77E-05
Po-212	3.07E-05
Po-216	4.77E-05
Ra-224	4.77E-05
Ra-228	2.85E-04
Ac-228	2.85E-04
Th-228	4.77E-05
Th-231	2.74E-04
Th-232	2.89E-03
Th-234	3.52E-01
Pa-234	3.60E-05
Pa-234m	3.52E-01
U-235	2.73E-04
U-238	3.52E-01
Pu-238	2.78E-01
Pu-239	2.12E-02
Pu-240	7.42E-02
Pu-241	1.02E+01
Am-241	4.24E-04
Cm-242	5.94E-03
Cm-244	2.12E-03

Shipping Site: RMI	Total Volume (m3/yr)	2.70E+03	Total Mass (kg/yr)	7.03E+06

Radionuclide	Activity (Ci/yr)
Tl-208	1.79E-07
Pb-212	4.73E-07
Bi-212	4.73E-07
Po-212	3.05E-07
Po-216	4.73E-07
Ra-224	4.73E-07
Ra-228	2.83E-06
Ac-228	2.83E-06
Th-228	4.73E-07
Th-231	2.72E-06
Th-232	2.87E-05
Th-234	3.49E-03
Pa-234	3.58E-07
Pa-234m	3.49E-03
U-235	2.71E-06
U-238	3.49E-03

Shipping Site: SNLA	Total Volume (m3/yr)	5.97E+01	Total Mass (kg/yr)	1.64E+05

Radionuclide	Activity (Ci/yr)
H-3	1.50E+00
Co-60	1.42E-05
Ni-63	2.83E-05
Sr-90	2.52E-03
Y-90	2.52E-03
Tc-99	4.50E-07
Ru-106	2.46E-04
Rh-106	2.46E-04
Sb-125	7.06E-05
Te-125m	1.72E-05
Cs-134	2.86E-04
Cs-137	2.64E-03
Ba-137m	2.49E-03
Ce-144	8.23E-04
Pr-144	8.23E-04
Pr-144m	9.90E-06
Pm-147	2.01E-03
Sm-151	1.96E-05
Eu-152	3.00E-07
Eu-154	5.14E-05
Eu-155	4.08E-05
Tl-208	2.55E-06
Pb-212	6.75E-06
Bi-212	6.75E-06
Po-212	4.35E-06
Po-216	6.75E-06
Ra-224	6.75E-06
Ra-228	4.03E-05
Ac-228	4.03E-05
Th-228	6.75E-06
Th-231	3.88E-05
Th-232	4.09E-04
Th-234	4.98E-02
Pa-234	5.10E-06
Pa-234m	4.98E-02
U-235	3.87E-05
U-238	4.98E-02
Pu-238	3.93E-02
Pu-239	3.00E-03
Pu-240	1.05E-02
Pu-241	1.44E+00
Am-241	6.09E-05
Cm-242	8.40E-04
Cm-244	3.00E-04

Shipping Site: SNLL	Total Volume (m3/yr)	1.79E+01	Total Mass (kg/yr)	4.68E+04

Radionuclide	Activity (Ci/yr)
H-3	1.41E+04
Fe-55	1.57E-01
Co-60	1.57E-01
Tl-208	3.20E-05
Pb-212	8.47E-05
Bi-212	8.47E-05
Po-212	5.46E-05
Po-216	8.47E-05
Ra-224	8.47E-05
Ra-228	5.06E-04
Ac-228	5.06E-04
Th-228	8.47E-05
Th-231	4.87E-04
Th-232	5.14E-03
Th-234	6.25E-01
Pa-234	6.40E-05
Pa-234m	6.25E-01
U-235	4.85E-04
U-238	6.25E-01

Destination: ORNL

Shipping Site: K-25	Total Volume (m3/yr)	3.43E+03	Total Mass (kg/yr)	2.33E+07

Radionuclide	Activity (Ci/yr)
Tl-208	5.33E-05
Pb-212	1.41E-04
Bi-212	1.41E-04
Po-212	9.10E-05
Po-216	1.41E-04
Ra-224	1.41E-04
Ra-228	8.44E-04
Ac-228	8.44E-04
Th-228	1.41E-04
Th-231	8.13E-04
Th-232	8.57E-03
Th-234	1.04E+00
Pa-234	1.06E-04
Pa-234m	1.04E+00
U-235	8.10E-04
U-238	1.04E+00

Shipping Site: ORISE	Total Volume (m3/yr)	2.59E+01	Total Mass (kg/yr)	1.58E+04

Radionuclide	Activity (Ci/yr)
H-3	1.01E-02
C-14	5.98E-06
Mn-54	6.74E-04
Co-58	6.22E-04
Co-60	1.79E-03
Sr-90	8.46E-04
Y-90	8.46E-04
Tc-99	1.19E-05
Cs-134	1.39E-03
Cs-137	1.84E-03
Ba-137m	1.74E-03
Tl-208	1.69E-07
Pb-212	4.49E-07
Bi-212	4.49E-07
Po-212	2.89E-07
Po-216	4.49E-07
Ra-224	4.49E-07
Ra-228	2.68E-06
Ac-228	2.68E-06
Th-228	4.49E-07
Th-231	2.58E-06
Th-232	2.72E-05
Th-234	3.31E-03
Pa-234	3.39E-07
Pa-234m	3.31E-03
U-235	2.57E-06
U-238	3.38E-03

Shipping Site: Y-12	Total Volume (m3/yr)	7.19E+03	Total Mass (kg/yr)	4.13E+07

Radionuclide	Activity (Ci/yr)
Tl-208	3.40E-05
Pb-212	9.00E-05
Bi-212	9.00E-05
Po-212	5.80E-05
Po-216	9.00E-05
Ra-224	9.00E-05
Ra-228	5.38E-04
Ac-228	5.38E-04
Th-228	9.00E-05
Th-231	5.18E-04
Th-232	5.46E-03
Th-234	6.63E-01
Pa-234	6.80E-05
Pa-234m	6.63E-01
U-235	5.16E-04
U-238	6.63E-01

Destination: SRS

Shipping Site: Pinellas	Total Volume (m3/yr)	7.01E+01	Total Mass (kg/yr)	9.57E+03

Radionuclide	Activity (Ci/yr)
H-3	9.96E+03

A.2 WM LLW NO ACTION ALTERNATIVE (CASE 1): ACTIVATED METALS

Transported Material with Radionuclide Profile

Alternative: #1 No Action

Waste Stream: LLW Waste Type: Activated Metal

Destination: HANF

Shipping Site: BAPL	Total Volume (m3/yr)	4.42E+02	Total Mass (kg/yr)	3.21E+06

Radionuclide	Activity (Ci/yr)
Cr-51	2.37E+03
Mn-54	4.52E+03
Fe-55	1.68E+04
Fe-59	1.52E+02
Co-58	6.07E+03
Co-60	4.76E+04
Ni-59	2.18E+02
Ni-63	3.09E+04
Zr-95	1.85E+02
Tl-208	6.80E-09
Pb-212	1.80E-08
Bi-212	1.80E-08
Po-212	1.16E-08
Po-216	1.80E-08
Ra-224	1.80E-08
Ra-228	1.07E-07
Ac-228	1.07E-07
Th-228	1.80E-08
Th-231	1.03E-07
Th-232	1.09E-06
Th-234	1.32E-04
Pa-234	1.36E-08
Pa-234m	1.32E-04
U-235	1.03E-07
U-238	1.32E-04

Shipping Site: FNAL	Total Volume (m3/yr)	5.59E+01	Total Mass (kg/yr)	4.07E+05

Radionuclide	Activity (Ci/yr)
Cr-51	1.67E-02
Mn-54	3.19E-02
Fe-55	1.19E-01
Fe-59	1.07E-03
Co-58	4.28E-02
Co-60	3.36E-01
Ni-59	1.54E-03
Ni-63	2.18E-01
Zr-95	1.30E-03

Shipping Site: KAPL	Total Volume (m3/yr)	9.14E+02	Total Mass (kg/yr)	6.65E+06

Radionuclide	Activity (Ci/yr)
H-3	2.57E-04
C-14	1.20E-05
Cr-51	5.66E+03
Mn-54	1.07E+04
Fe-55	4.02E+04
Fe-59	3.64E+02
Co-58	1.44E+04
Co-60	1.13E+05
Ni-59	5.20E+02
Ni-63	7.39E+04
Sr-90	1.31E-02
Y-90	1.31E-02
Zr-95	4.42E+02
Tc-99	2.60E-05
Ru-106	1.11E-03
Rh-106	1.11E-03
Sb-125	3.20E-04
Te-125m	7.81E-05
Cs-134	4.09E-03
Cs-137	1.56E-02
Ba-137m	1.48E-02
Ce-144	3.73E-03
Pr-144	3.73E-03
Pr-144m	4.48E-05
Pm-147	9.11E-03
Sm-151	8.90E-05
Eu-152	1.35E-06
Eu-154	2.33E-04
Eu-155	1.84E-04
Tl-208	1.48E-08
Pb-212	3.92E-08
Bi-212	3.92E-08
Po-212	2.53E-08
Po-216	3.92E-08
Ra-224	3.92E-08
Ra-228	2.34E-07
Ac-228	2.34E-07
Th-228	3.92E-08
Th-231	2.25E-07
Th-232	2.37E-06
Th-234	2.88E-04
Pa-234	2.96E-08
Pa-234m	2.88E-04
U-235	2.24E-07
U-238	4.34E-04
Pu-238	2.80E-04
Pu-239	2.71E-06
Pu-240	1.35E-06
Pu-241	3.14E-04
Am-241	4.07E-06

Shipping Site: LBL	Total Volume (m3/yr)	1.97E+01	Total Mass (kg/yr)	1.43E+05

Radionuclide	Activity (Ci/yr)
Cr-51	3.16E-02
Mn-54	6.02E-02
Fe-55	2.24E-01
Fe-59	2.03E-03
Co-58	8.08E-02
Co-60	6.33E-01
Ni-59	2.90E-03
Ni-63	4.12E-01
Zr-95	2.46E-03

Shipping Site: NRF	Total Volume (m3/yr)	6.46E+02	Total Mass (kg/yr)	4.70E+06

Radionuclide	Activity (Ci/yr)
Cr-51	1.15E+03
Mn-54	2.20E+03
Fe-55	8.22E+03
Fe-59	7.43E+01
Co-58	2.95E+03
Co-60	2.31E+04
Ni-59	1.06E+02
Ni-63	1.50E+04
Zr-95	9.02E+01

Destination: INEL

Shipping Site: ANL-W

Total Volume (m3/yr) 1.03E+01 Total Mass (kg/yr) 8.24E+04

Radionuclide	Activity (Ci/yr)
H-3	8.56E-07
Cr-51	6.23E-05
Mn-54	1.18E-04
Fe-55	4.43E-04
Fe-59	4.00E-06
Co-58	1.59E-04
Co-60	1.25E-03
Ni-59	5.71E-06
Ni-63	8.21E-04
Sr-90	7.19E-04
Y-90	7.19E-04
Zr-95	4.86E-06
Tc-99	1.28E-07
Ru-106	7.01E-05
Rh-106	7.01E-05
Sb-125	2.01E-05
Te-125m	4.92E-06
Cs-134	8.16E-05
Cs-137	1.00E-01
Ba-137m	1.00E-01
Ce-144	2.34E-04
Pr-144	2.34E-04
Pr-144m	2.82E-06
Pm-147	5.73E-04
Sm-151	5.60E-06
Eu-152	8.56E-08
Eu-154	1.46E-05
Eu-155	1.16E-05
Pu-238	1.76E-05
Pu-239	1.71E-07
Pu-240	8.56E-08
Pu-241	1.97E-05
Am-241	2.56E-07

Destination: NTS

Shipping Site: SNLA

Total Volume (m3/yr) 7.91E+00 Total Mass (kg/yr) 5.75E+04

Radionuclide	Activity (Ci/yr)
Cr-51	3.27E-04
Mn-54	6.22E-04
Fe-55	2.32E-03
Fe-59	2.10E-05
Co-58	8.35E-04
Co-60	6.55E-03
Ni-59	3.00E-05
Ni-63	4.26E-03
Zr-95	2.55E-05

A.3 WM LLW DECENTRALIZED ALTERNATIVE (CASE 2): HETEROGENEOUS SOLIDS

Transported Material with Radionuclide Profile

Alternative: #2 Decentralized -- 16 Site Disposal

Waste Stream: LLW Waste Type: All, excl. Act.Metal

Destination: ANL-E

Shipping Site: AMES Total Volume (m3/yr) 1.16E+01 Total Mass (kg/yr) 2.99E+04

Radionuclide	Activity (Ci/yr)
Tl-208	4.50E-07
Pb-212	1.19E-06
Bi-212	1.19E-06
Po-212	7.68E-07
Po-216	1.19E-06
Ra-224	1.19E-06
Ra-228	7.12E-06
Ac-228	7.12E-06
Th-228	1.19E-06
Th-231	6.86E-06
Th-232	7.23E-05
Th-234	8.79E-03
Pa-234	9.01E-07
Pa-234m	8.79E-03
U-235	6.83E-06
U-238	8.79E-03
Pu-238	6.94E-04
Pu-239	5.30E-05
Pu-240	1.85E-04
Pu-241	2.55E-02
Am-241	1.06E-06
Cm-242	1.48E-05
Cm-244	5.30E-06

Shipping Site: FNAL Total Volume (m3/yr) 5.19E+01 Total Mass (kg/yr) 5.11E+04

Radionuclide	Activity (Ci/yr)
H-3	1.81E-01
Cr-51	1.11E-02
Mn-54	2.12E-02
Fe-55	7.94E-02
Fe-59	7.17E-04
Co-58	2.85E-02
Co-60	2.23E-01
Ni-59	1.02E-03
Ni-63	1.45E-01
Zr-95	8.71E-04
Tl-208	3.78E-07
Pb-212	1.00E-06
Bi-212	1.00E-06
Po-212	6.46E-07
Po-216	1.00E-06
Ra-224	1.00E-06
Ra-228	5.99E-06
Ac-228	5.99E-06
Th-228	1.00E-06
Th-231	5.77E-06
Th-232	6.08E-05
Th-234	7.39E-03
Pa-234	7.57E-07
Pa-234m	7.39E-03
U-235	5.75E-06
U-238	7.39E-03

Destination: BNL

Shipping Site: KAPL — Total Volume (m3/yr) 2.11E+02 — Total Mass (kg/yr) 5.36E+05

Radionuclide	Activity (Ci/yr)
H-3	5.14E-04
C-14	2.40E-05
Cr-51	5.11E-03
Mn-54	1.24E-02
Fe-55	3.63E-02
Fe-59	3.28E-04
Co-58	1.55E-02
Co-60	1.09E-01
Ni-59	4.69E-04
Ni-63	6.70E-02
Sr-90	2.58E-02
Y-90	2.58E-02
Zr-95	3.99E-04
Tc-99	5.20E-05
Ru-106	2.19E-03
Rh-106	2.19E-03
Sb-125	6.31E-04
Te-125m	1.54E-04
Cs-134	8.14E-03
Cs-137	3.09E-02
Ba-137m	2.92E-02
Ce-144	7.35E-03
Pr-144	7.35E-03
Pr-144m	8.84E-05
Pm-147	1.79E-02
Sm-151	1.75E-04
Eu-152	2.67E-06
Eu-154	4.59E-04
Eu-155	3.64E-04
Tl-208	4.50E-09
Pb-212	1.19E-08
Bi-212	1.19E-08
Po-212	7.60E-09
Po-216	1.19E-08
Ra-224	1.19E-08
Ra-228	7.11E-08
Ac-228	7.11E-08
Th-228	1.19E-08
Th-231	6.84E-08
Th-232	7.21E-07
Th-234	8.77E-05
Pa-234	8.90E-09
Pa-234m	8.77E-05
U-235	6.82E-08
U-238	3.79E-04
Pu-238	5.53E-04
Pu-239	5.35E-06
Pu-240	2.67E-06
Pu-241	6.18E-04
Am-241	8.03E-06

Shipping Site: PPPL — Total Volume (m3/yr) 2.45E+01 — Total Mass (kg/yr) 6.10E+03

Radionuclide	Activity (Ci/yr)
H-3	2.01E-01
Cr-51	8.50E-04
Mn-54	1.61E-03
Fe-55	6.04E-03
Fe-59	5.46E-05
Co-58	2.17E-03
Co-60	1.70E-02
Ni-59	7.80E-05
Ni-63	1.10E-02
Zr-95	6.63E-05

Destination: INEL

Shipping Site: ANL-W	Total Volume (m3/yr) 2.78E+02	Total Mass (kg/yr) 2.12E+05

Radionuclide	Activity (Ci/yr)
H-3	7.83E-04
Cr-51	3.58E+03
Mn-54	6.83E+03
Fe-55	2.54E+04
Fe-59	2.30E+02
Co-58	9.16E+03
Co-60	7.18E+04
Ni-59	3.29E+02
Ni-63	4.67E+04
Sr-90	3.17E-02
Y-90	3.17E-02
Zr-95	2.79E+02
Tc-99	5.66E-06
Ru-106	3.09E-03
Rh-106	3.09E-03
Sb-125	8.89E-04
Te-125m	2.17E-04
Cs-134	3.59E-03
Cs-137	3.32E-02
Ba-137m	3.14E-02
Ce-144	1.03E-02
Pr-144	1.03E-02
Pr-144m	1.24E-04
Pm-147	2.52E-02
Sm-151	2.47E-04
Eu-152	3.77E-06
Eu-154	6.47E-04
Eu-155	5.13E-04
Pu-238	7.81E-04
Pu-239	7.72E-06
Pu-240	4.38E-06
Pu-241	9.56E-04
Am-241	1.13E-05
Cm-242	4.88E-08
Cm-244	1.74E-08

Destination: LLNL

Shipping Site: LBL — Total Volume (m3/yr): 9.20E+01 — Total Mass (kg/yr): 4.51E+04

Radionuclide	Activity (Ci/yr)
H-3	6.35E+02
C-14	1.13E+00
Mn-54	1.27E+02
Co-58	1.17E+02
Co-60	3.39E+02
Sr-90	1.59E+02
Y-90	1.59E+02
Tc-99	2.26E+00
Cs-134	2.63E+02
Cs-137	3.47E+02
Ba-137m	3.28E+02
U-238	1.37E+01
Cm-244	1.05E+01

Shipping Site: SLAC — Total Volume (m3/yr): 2.73E+02 — Total Mass (kg/yr): 7.45E+05

Radionuclide	Activity (Ci/yr)
Cr-51	3.86E-03
Mn-54	7.36E-03
Fe-55	2.74E-02
Fe-59	2.48E-04
Co-58	9.88E-03
Co-60	7.74E-02
Ni-59	3.54E-04
Ni-63	5.04E-02
Zr-95	3.01E-04

Shipping Site: SNLL — Total Volume (m3/yr): 3.68E+01 — Total Mass (kg/yr): 9.73E+04

Radionuclide	Activity (Ci/yr)
H-3	2.78E+04
Fe-55	3.15E-01
Co-60	3.15E-01
Tl-208	6.40E-05
Pb-212	1.69E-04
Bi-212	1.69E-04
Po-212	1.09E-04
Po-216	1.69E-04
Ra-224	1.69E-04
Ra-228	1.01E-03
Ac-228	1.01E-03
Th-228	1.69E-04
Th-231	9.75E-04
Th-232	1.02E-02
Th-234	1.25E+00
Pa-234	1.28E-04
Pa-234m	1.25E+00
U-235	9.71E-04
U-238	1.25E+00

Destination: ORNL

Shipping Site: K-25 — Total Volume (m3/yr) 6.90E+03 — Total Mass (kg/yr) 4.67E+07

Radionuclide	Activity (Ci/yr)
Tl-208	1.06E-04
Pb-212	2.82E-04
Bi-212	2.82E-04
Po-212	1.82E-04
Po-216	2.82E-04
Ra-224	2.82E-04
Ra-228	1.68E-03
Ac-228	1.68E-03
Th-228	2.82E-04
Th-231	1.62E-03
Th-232	1.71E-02
Th-234	2.08E+00
Pa-234	2.13E-04
Pa-234m	2.08E+00
U-235	1.62E-03
U-238	2.08E+00

Shipping Site: ORISE — Total Volume (m3/yr) 6.07E+01 — Total Mass (kg/yr) 7.36E+04

Radionuclide	Activity (Ci/yr)
H-3	2.00E-02
C-14	1.19E-05
Mn-54	1.34E-03
Co-58	1.24E-03
Co-60	3.59E-03
Sr-90	1.69E-03
Y-90	1.69E-03
Tc-99	2.39E-05
Cs-134	2.79E-03
Cs-137	3.68E-03
Ba-137m	3.48E-03
Tl-208	3.39E-07
Pb-212	8.98E-07
Bi-212	8.98E-07
Po-212	5.78E-07
Po-216	8.98E-07
Ra-224	8.98E-07
Ra-228	5.36E-06
Ac-228	5.36E-06
Th-228	8.98E-07
Th-231	5.16E-06
Th-232	5.44E-05
Th-234	6.62E-03
Pa-234	6.78E-07
Pa-234m	6.62E-03
U-235	5.14E-06
U-238	6.77E-03

Shipping Site: Y-12 — Total Volume (m3/yr) 1.46E+04 — Total Mass (kg/yr) 8.27E+07

Radionuclide	Activity (Ci/yr)
Tl-208	6.80E-05
Pb-212	1.80E-04
Bi-212	1.80E-04
Po-212	1.16E-04
Po-216	1.80E-04
Ra-224	1.80E-04
Ra-228	1.07E-03
Ac-228	1.07E-03
Th-228	1.80E-04
Th-231	1.03E-03
Th-232	1.09E-02
Th-234	1.32E+00
Pa-234	1.36E-04
Pa-234m	1.32E+00
U-235	1.03E-03
U-238	1.32E+00

Destination: PORTS

Shipping Site: MOUND	Total Volume (m3/yr)	4.40E+03	Total Mass (kg/yr)	9.67E+06

Radionuclide	Activity (Ci/yr)
H-3	1.34E+04
Pu-238	1.60E-01
Pu-239	1.22E-02
Pu-240	4.28E-02
Pu-241	5.90E+00
Am-241	2.44E-04
Cm-242	3.42E-03
Cm-244	1.22E-03

Shipping Site: RMI	Total Volume (m3/yr)	5.68E+03	Total Mass (kg/yr)	1.47E+07

Radionuclide	Activity (Ci/yr)
Tl-208	3.58E-07
Pb-212	9.47E-07
Bi-212	9.47E-07
Po-212	6.10E-07
Po-216	9.47E-07
Ra-224	9.47E-07
Ra-228	5.66E-06
Ac-228	5.66E-06
Th-228	9.47E-07
Th-231	5.45E-06
Th-232	5.74E-05
Th-234	6.98E-03
Pa-234	7.15E-07
Pa-234m	6.98E-03
U-235	5.43E-06
U-238	6.98E-03

Destination: Paducah

Shipping Site: KCP	Total Volume (m3/yr)	2.65E+00	Total Mass (kg/yr)	7.23E+03

Radionuclide	Activity (Ci/yr)
H-3	2.70E-02
C-14	1.44E-04
Mn-54	1.62E-02
Co-58	1.50E-02
Co-60	4.34E-02
Sr-90	2.04E-02
Y-90	2.04E-02
Tc-99	2.89E-04
Cs-134	3.37E-02
Cs-137	4.44E-02
Ba-137m	4.20E-02
U-238	1.76E-03

Destination: SNLA

Shipping Site: ITRI	Total Volume (m3/yr)	1.41E+02	Total Mass (kg/yr)	1.64E+05

Radionuclide	Activity (Ci/yr)
H-3	6.17E+00
C-14	3.03E-01
Mn-54	3.41E+01
Co-58	3.15E+01
Co-60	9.12E+01
Sr-90	4.28E+01
Y-90	4.28E+01
Tc-99	6.07E-01
Cs-134	7.07E+01
Cs-137	9.33E+01
Ba-137m	8.82E+01
U-238	3.69E+00

Destination: SRS

Shipping Site: Pinellas	Total Volume (m3/yr)	1.40E+02	Total Mass (kg/yr)	1.91E+04

Radionuclide	Activity (Ci/yr)
H-3	1.99E+04

Destination: WVDP

Shipping Site: BAPL	Total Volume (m3/yr)	3.98E+02	Total Mass (kg/yr)	1.08E+06

Radionuclide	Activity (Ci/yr)
H-3	2.51E-03
Co-60	1.19E-02
Ni-63	2.38E-02
Sr-90	2.11E+00
Y-90	2.11E+00
Tc-99	3.77E-04
Ru-106	2.06E-01
Rh-106	2.06E-01
Sb-125	5.93E-02
Te-125m	1.44E-02
Cs-134	2.40E-01
Cs-137	2.21E+00
Ba-137m	2.09E+00
Ce-144	6.91E-01
Pr-144	6.91E-01
Pr-144m	8.31E-03
Pm-147	1.68E+00
Sm-151	1.65E-02
Eu-152	2.51E-04
Eu-154	4.32E-02
Eu-155	3.42E-02
Tl-208	3.80E-06
Pb-212	1.00E-05
Bi-212	1.00E-05
Po-212	6.49E-06
Po-216	1.00E-05
Ra-224	1.00E-05
Ra-228	6.02E-05
Ac-228	6.02E-05
Th-228	1.00E-05
Th-231	5.80E-05
Th-232	6.11E-04
Th-234	7.43E-02
Pa-234	7.61E-06
Pa-234m	7.43E-02
U-235	5.77E-05
U-238	7.43E-02
Pu-238	5.20E-02
Pu-239	5.03E-04
Pu-240	2.51E-04
Pu-241	5.81E-02
Am-241	7.55E-04

A.4 WM LLW DECENTRALIZED ALTERNATIVE (CASE 2): ACTIVATED METALS

Transported Material with Radionuclide Profile

Alternative: #2 Decentralized -- 16 Site Disposal

Waste Stream: LLW Waste Type: Activated Metal

Destination: ANL-E

Shipping Site: FNAL Total Volume (m3/yr) 1.11E+02 Total Mass (kg/yr) 8.14E+05

Radionuclide	Activity (Ci/yr)
Cr-51	3.35E-02
Mn-54	6.39E-02
Fe-55	2.38E-01
Fe-59	2.15E-03
Co-58	8.57E-02
Co-60	6.72E-01
Ni-59	3.08E-03
Ni-63	4.37E-01
Zr-95	2.61E-03

Destination: BNL

Shipping Site: KAPL	Total Volume (m3/yr) 1.82E+03	Total Mass (kg/yr) 1.33E+07

Radionuclide	Activity (Ci/yr)
H-3	5.15E-04
C-14	2.40E-05
Cr-51	1.13E+04
Mn-54	2.15E+04
Fe-55	8.05E+04
Fe-59	7.28E+02
Co-58	2.89E+04
Co-60	2.27E+05
Ni-59	1.04E+03
Ni-63	1.47E+05
Sr-90	2.62E-02
Y-90	2.62E-02
Zr-95	8.84E+02
Tc-99	5.20E-05
Ru-106	2.22E-03
Rh-106	2.22E-03
Sb-125	6.40E-04
Te-125m	1.56E-04
Cs-134	8.18E-03
Cs-137	3.13E-02
Ba-137m	2.96E-02
Ce-144	7.46E-03
Pr-144	7.46E-03
Pr-144m	8.97E-05
Pm-147	1.82E-02
Sm-151	1.78E-04
Eu-152	2.71E-06
Eu-154	4.66E-04
Eu-155	3.69E-04
Tl-208	2.96E-08
Pb-212	7.83E-08
Bi-212	7.83E-08
Po-212	5.05E-08
Po-216	7.83E-08
Ra-224	7.83E-08
Ra-228	4.68E-07
Ac-228	4.68E-07
Th-228	7.83E-08
Th-231	4.50E-07
Th-232	4.75E-06
Th-234	5.77E-04
Pa-234	5.92E-08
Pa-234m	5.77E-04
U-235	4.48E-07
U-238	8.69E-04
Pu-238	5.61E-04
Pu-239	5.43E-06
Pu-240	2.71E-06
Pu-241	6.28E-04
Am-241	8.15E-06

Destination: INEL

Shipping Site: ANL-W	Total Volume (m3/yr)	2.26E+01	Total Mass (kg/yr)	1.64E+05

Radionuclide	Activity (Ci/yr)
H-3	1.71E-06
Cr-51	1.24E-04
Mn-54	2.37E-04
Fe-55	8.86E-04
Fe-59	8.00E-06
Co-58	3.18E-04
Co-60	2.50E-03
Ni-59	1.14E-05
Ni-63	1.64E-03
Sr-90	1.43E-03
Y-90	1.43E-03
Zr-95	9.72E-06
Tc-99	2.56E-07
Ru-106	1.40E-04
Rh-106	1.40E-04
Sb-125	4.03E-05
Te-125m	9.84E-06
Cs-134	1.63E-04
Cs-137	2.00E-01
Ba-137m	2.00E-01
Ce-144	4.69E-04
Pr-144	4.69E-04
Pr-144m	5.64E-06
Pm-147	1.14E-03
Sm-151	1.12E-05
Eu-152	1.71E-07
Eu-154	2.93E-05
Eu-155	2.32E-05
Pu-238	3.53E-05
Pu-239	3.42E-07
Pu-240	1.71E-07
Pu-241	3.95E-05
Am-241	5.13E-07

Shipping Site: NRF	Total Volume (m3/yr)	1.29E+03	Total Mass (kg/yr)	9.40E+06

Radionuclide	Activity (Ci/yr)
Cr-51	2.31E+03
Mn-54	4.40E+03
Fe-55	1.64E+04
Fe-59	1.48E+02
Co-58	5.91E+03
Co-60	4.63E+04
Ni-59	2.12E+02
Ni-63	3.01E+04
Zr-95	1.80E+02

Destination: LLNL

Shipping Site: LBL — Total Volume (m3/yr) 3.95E+01 — Total Mass (kg/yr) 2.87E+05

Radionuclide	Activity (Ci/yr)
Cr-51	6.32E-02
Mn-54	1.20E-01
Fe-55	4.49E-01
Fe-59	4.06E-03
Co-58	1.61E-01
Co-60	1.26E+00
Ni-59	5.80E-03
Ni-63	8.24E-01
Zr-95	4.93E-03

Destination: WVDP

Shipping Site: BAPL — Total Volume (m3/yr) 8.84E+02 — Total Mass (kg/yr) 6.43E+06

Radionuclide	Activity (Ci/yr)
Cr-51	4.75E+03
Mn-54	9.04E+03
Fe-55	3.37E+04
Fe-59	3.05E+02
Co-58	1.21E+04
Co-60	9.52E+04
Ni-59	4.36E+02
Ni-63	6.19E+04
Zr-95	3.70E+02
Tl-208	1.36E-08
Pb-212	3.60E-08
Bi-212	3.60E-08
Po-212	2.32E-08
Po-216	3.60E-08
Ra-224	3.60E-08
Ra-228	2.15E-07
Ac-228	2.15E-07
Th-228	3.60E-08
Th-231	2.07E-07
Th-232	2.18E-06
Th-234	2.65E-04
Pa-234	2.72E-08
Pa-234m	2.65E-04
U-235	2.06E-07
U-238	2.65E-04

A.5 WM LLW REGIONALIZED 1 ALTERNATIVE (CASE 3): HETEROGENEOUS SOLIDS

Transported Material with Radionuclide Profile

Alternative: #3 Minimum Treat -- On-Site -- 12 Site Disposal

Waste Stream: LLW Waste Type: All, excl. Act.Metal

Destination: INEL

Shipping Site: ANL-W

Total Volume (m3/yr) 2.78E+02

Total Mass (kg/yr) 2.12E+05

Radionuclide	Activity (Ci/yr)
H-3	7.83E-04
Cr-51	3.58E+03
Mn-54	6.83E+03
Fe-55	2.54E+04
Fe-59	2.30E+02
Co-58	9.16E+03
Co-60	7.18E+04
Ni-59	3.29E+02
Ni-63	4.67E+04
Sr-90	3.17E-02
Y-90	3.17E-02
Zr-95	2.79E+02
Tc-99	5.66E-06
Ru-106	3.09E-03
Rh-106	3.09E-03
Sb-125	8.89E-04
Te-125m	2.17E-04
Cs-134	3.59E-03
Cs-137	3.32E-02
Ba-137m	3.14E-02
Ce-144	1.03E-02
Pr-144	1.03E-02
Pr-144m	1.24E-04
Pm-147	2.52E-02
Sm-151	2.47E-04
Eu-152	3.77E-06
Eu-154	6.47E-04
Eu-155	5.13E-04
Pu-238	7.81E-04
Pu-239	7.72E-06
Pu-240	4.38E-06
Pu-241	9.56E-04
Am-241	1.13E-05
Cm-242	4.88E-08
Cm-244	1.74E-08

Destination: LANL

Shipping Site: ITRI	Total Volume (m3/yr)	1.41E+02	Total Mass (kg/yr)	1.64E+05

Radionuclide	Activity (Ci/yr)
H-3	6.17E+00
C-14	3.03E-01
Mn-54	3.41E+01
Co-58	3.15E+01
Co-60	9.12E+01
Sr-90	4.28E+01
Y-90	4.28E+01
Tc-99	6.07E-01
Cs-134	7.07E+01
Cs-137	9.33E+01
Ba-137m	8.82E+01
U-238	3.69E+00

Shipping Site: SNLA	Total Volume (m3/yr)	1.19E+02	Total Mass (kg/yr)	3.28E+05

Radionuclide	Activity (Ci/yr)
H-3	3.00E+00
Co-60	2.85E-05
Ni-63	5.67E-05
Sr-90	5.04E-03
Y-90	5.04E-03
Tc-99	9.00E-07
Ru-106	4.92E-04
Rh-106	4.92E-04
Sb-125	1.41E-04
Te-125m	3.45E-05
Cs-134	5.72E-04
Cs-137	5.28E-03
Ba-137m	4.99E-03
Ce-144	1.64E-03
Pr-144	1.64E-03
Pr-144m	1.98E-05
Pm-147	4.02E-03
Sm-151	3.93E-05
Eu-152	6.00E-07
Eu-154	1.02E-04
Eu-155	8.16E-05
Tl-208	5.10E-06
Pb-212	1.35E-05
Bi-212	1.35E-05
Po-212	8.70E-06
Po-216	1.35E-05
Ra-224	1.35E-05
Ra-228	8.07E-05
Ac-228	8.07E-05
Th-228	1.35E-05
Th-231	7.77E-05
Th-232	8.19E-04
Th-234	9.96E-02
Pa-234	1.02E-05
Pa-234m	9.96E-02
U-235	7.74E-05
U-238	9.96E-02
Pu-238	7.87E-02
Pu-239	6.00E-03
Pu-240	2.10E-02
Pu-241	2.89E+00
Am-241	1.21E-04
Cm-242	1.68E-03
Cm-244	6.00E-04

Destination: LLNL

Shipping Site: LBL	Total Volume (m3/yr)	9.20E+01	Total Mass (kg/yr)	4.51E+04

Radionuclide	Activity (Ci/yr)
H-3	6.35E+02
C-14	1.13E+00
Mn-54	1.27E+02
Co-58	1.17E+02
Co-60	3.39E+02
Sr-90	1.59E+02
Y-90	1.59E+02
Tc-99	2.26E+00
Cs-134	2.63E+02
Cs-137	3.47E+02
Ba-137m	3.28E+02
U-238	1.37E+01
Cm-244	1.05E+01

Shipping Site: SLAC	Total Volume (m3/yr)	2.73E+02	Total Mass (kg/yr)	7.45E+05

Radionuclide	Activity (Ci/yr)
Cr-51	3.86E-03
Mn-54	7.36E-03
Fe-55	2.74E-02
Fe-59	2.48E-04
Co-58	9.88E-03
Co-60	7.74E-02
Ni-59	3.54E-04
Ni-63	5.04E-02
Zr-95	3.01E-04

Shipping Site: SNLL	Total Volume (m3/yr)	3.68E+01	Total Mass (kg/yr)	9.73E+04

Radionuclide	Activity (Ci/yr)
H-3	2.78E+04
Fe-55	3.15E-01
Co-60	3.15E-01
Tl-208	6.40E-05
Pb-212	1.69E-04
Bi-212	1.69E-04
Po-212	1.09E-04
Po-216	1.69E-04
Ra-224	1.69E-04
Ra-228	1.01E-03
Ac-228	1.01E-03
Th-228	1.69E-04
Th-231	9.75E-04
Th-232	1.02E-02
Th-234	1.25E+00
Pa-234	1.28E-04
Pa-234m	1.25E+00
U-235	9.71E-04
U-238	1.25E+00

Destination: ORNL

Shipping Site: K-25 — Total Volume (m3/yr): 6.90E+03 — Total Mass (kg/yr): 4.67E+07

Radionuclide	Activity (Ci/yr)
Tl-208	1.06E-04
Pb-212	2.82E-04
Bi-212	2.82E-04
Po-212	1.82E-04
Po-216	2.82E-04
Ra-224	2.82E-04
Ra-228	1.68E-03
Ac-228	1.68E-03
Th-228	2.82E-04
Th-231	1.62E-03
Th-232	1.71E-02
Th-234	2.08E+00
Pa-234	2.13E-04
Pa-234m	2.08E+00
U-235	1.62E-03
U-238	2.08E+00

Shipping Site: ORISE — Total Volume (m3/yr): 6.07E+01 — Total Mass (kg/yr): 7.36E+04

Radionuclide	Activity (Ci/yr)
H-3	2.00E-02
C-14	1.19E-05
Mn-54	1.34E-03
Co-58	1.24E-03
Co-60	3.59E-03
Sr-90	1.69E-03
Y-90	1.69E-03
Tc-99	2.39E-05
Cs-134	2.79E-03
Cs-137	3.68E-03
Ba-137m	3.48E-03
Tl-208	3.39E-07
Pb-212	8.98E-07
Bi-212	8.98E-07
Po-212	5.78E-07
Po-216	8.98E-07
Ra-224	8.98E-07
Ra-228	5.36E-06
Ac-228	5.36E-06
Th-228	8.98E-07
Th-231	5.16E-06
Th-232	5.44E-05
Th-234	6.62E-03
Pa-234	6.78E-07
Pa-234m	6.62E-03
U-235	5.14E-06
U-238	6.77E-03

Shipping Site: Y-12 — Total Volume (m3/yr): 1.46E+04 — Total Mass (kg/yr): 8.27E+07

Radionuclide	Activity (Ci/yr)
Tl-208	6.80E-05
Pb-212	1.80E-04
Bi-212	1.80E-04
Po-212	1.16E-04
Po-216	1.80E-04
Ra-224	1.80E-04
Ra-228	1.07E-03
Ac-228	1.07E-03
Th-228	1.80E-04
Th-231	1.03E-03
Th-232	1.09E-02
Th-234	1.32E+00
Pa-234	1.36E-04
Pa-234m	1.32E+00
U-235	1.03E-03
U-238	1.32E+00

Destination: PORTS

Shipping Site: AMES — Total Volume (m3/yr) 1.16E+01 — Total Mass (kg/yr) 2.99E+04

Radionuclide	Activity (Ci/yr)
Tl-208	4.50E-07
Pb-212	1.19E-06
Bi-212	1.19E-06
Po-212	7.68E-07
Po-216	1.19E-06
Ra-224	1.19E-06
Ra-228	7.12E-06
Ac-228	7.12E-06
Th-228	1.19E-06
Th-231	6.86E-06
Th-232	7.23E-05
Th-234	8.79E-03
Pa-234	9.01E-07
Pa-234m	8.79E-03
U-235	6.83E-06
U-238	8.79E-03
Pu-238	6.94E-04
Pu-239	5.30E-05
Pu-240	1.85E-04
Pu-241	2.55E-02
Am-241	1.06E-06
Cm-242	1.48E-05
Cm-244	5.30E-06

Shipping Site: ANL-E — Total Volume (m3/yr) 7.35E+02 — Total Mass (kg/yr) 2.00E+06

Radionuclide	Activity (Ci/yr)
H-3	1.33E+02
C-14	7.91E-02
Cr-51	2.87E+00
Mn-54	1.43E+01
Fe-55	2.04E+01
Fe-59	1.84E-01
Co-58	1.55E+01
Co-60	8.15E+01
Ni-59	2.63E-01
Ni-63	3.77E+01
Sr-90	3.33E+01
Y-90	3.33E+01
Zr-95	2.24E-01
Tc-99	1.62E-01
Ru-106	2.16E+00
Rh-106	2.16E+00
Sb-125	6.21E-01
Te-125m	1.51E-01
Cs-134	2.09E+01
Cs-137	4.75E+01
Ba-137m	4.50E+01
Ce-144	7.24E+00
Pr-144	7.24E+00
Pr-144m	8.70E-02
Pm-147	1.76E+01
Sm-151	1.72E-01
Eu-152	2.63E-03
Eu-154	4.52E-01
Eu-155	3.58E-01
U-238	9.63E-01
Pu-238	5.44E-01
Pu-239	5.27E-03
Pu-240	2.63E-03
Pu-241	6.09E-01
Am-241	7.91E-03

Shipping Site: BAPL	Total Volume (m3/yr)	3.98E+02	Total Mass (kg/yr)	1.08E+06

Radionuclide	Activity (Ci/yr)
H-3	2.51E-03
Co-60	1.19E-02
Ni-63	2.38E-02
Sr-90	2.11E+00
Y-90	2.11E+00
Tc-99	3.77E-04
Ru-106	2.06E-01
Rh-106	2.06E-01
Sb-125	5.93E-02
Te-125m	1.44E-02
Cs-134	2.40E-01
Cs-137	2.21E+00
Ba-137m	2.09E+00
Ce-144	6.91E-01
Pr-144	6.91E-01
Pr-144m	8.31E-03
Pm-147	1.68E+00
Sm-151	1.65E-02
Eu-152	2.51E-04
Eu-154	4.32E-02
Eu-155	3.42E-02
Tl-208	3.80E-06
Pb-212	1.00E-05
Bi-212	1.00E-05
Po-212	6.49E-06
Po-216	1.00E-05
Ra-224	1.00E-05
Ra-228	6.02E-05
Ac-228	6.02E-05
Th-228	1.00E-05
Th-231	5.80E-05
Th-232	6.11E-04
Th-234	7.43E-02
Pa-234	7.61E-06
Pa-234m	7.43E-02
U-235	5.77E-05
U-238	7.43E-02
Pu-238	5.20E-02
Pu-239	5.03E-04
Pu-240	2.51E-04
Pu-241	5.81E-02
Am-241	7.55E-04

Shipping Site: FNAL	Total Volume (m3/yr)	5.19E+01	Total Mass (kg/yr)	5.11E+04

Radionuclide	Activity (Ci/yr)
H-3	1.81E-01
Cr-51	1.11E-02
Mn-54	2.12E-02
Fe-55	7.94E-02
Fe-59	7.17E-04
Co-58	2.85E-02
Co-60	2.23E-01
Ni-59	1.02E-03
Ni-63	1.45E-01
Zr-95	8.71E-04
Tl-208	3.78E-07
Pb-212	1.00E-06
Bi-212	1.00E-06
Po-212	6.46E-07
Po-216	1.00E-06
Ra-224	1.00E-06
Ra-228	5.99E-06
Ac-228	5.99E-06
Th-228	1.00E-06
Th-231	5.77E-06
Th-232	6.08E-05
Th-234	7.39E-03
Pa-234	7.57E-07
Pa-234m	7.39E-03
U-235	5.75E-06
U-238	7.39E-03

Shipping Site: KAPL	Total Volume (m3/yr)	2.11E+02	Total Mass (kg/yr)	5.36E+05

Radionuclide	Activity (Ci/yr)
H-3	5.14E-04
C-14	2.40E-05
Cr-51	5.11E-03
Mn-54	1.24E-02
Fe-55	3.63E-02
Fe-59	3.28E-04
Co-58	1.55E-02
Co-60	1.09E-01
Ni-59	4.69E-04
Ni-63	6.70E-02
Sr-90	2.58E-02
Y-90	2.58E-02
Zr-95	3.99E-04
Tc-99	5.20E-05
Ru-106	2.19E-03
Rh-106	2.19E-03
Sb-125	6.31E-04
Te-125m	1.54E-04
Cs-134	8.14E-03
Cs-137	3.09E-02
Ba-137m	2.92E-02
Ce-144	7.35E-03
Pr-144	7.35E-03
Pr-144m	8.84E-05
Pm-147	1.79E-02
Sm-151	1.75E-04
Eu-152	2.67E-06
Eu-154	4.59E-04
Eu-155	3.64E-04
Tl-208	4.50E-09
Pb-212	1.19E-08
Bi-212	1.19E-08
Po-212	7.60E-09
Po-216	1.19E-08
Ra-224	1.19E-08
Ra-228	7.11E-08
Ac-228	7.11E-08
Th-228	1.19E-08
Th-231	6.84E-08
Th-232	7.21E-07
Th-234	8.77E-05
Pa-234	8.90E-09
Pa-234m	8.77E-05
U-235	6.82E-08
U-238	3.79E-04
Pu-238	5.53E-04
Pu-239	5.35E-06
Pu-240	2.67E-06
Pu-241	6.18E-04
Am-241	8.03E-06

Shipping Site: MOUND	Total Volume (m3/yr)	4.40E+03	Total Mass (kg/yr)	9.67E+06

Radionuclide	Activity (Ci/yr)
H-3	1.34E+04
Pu-238	1.60E-01
Pu-239	1.22E-02
Pu-240	4.28E-02
Pu-241	5.90E+00
Am-241	2.44E-04
Cm-242	3.42E-03
Cm-244	1.22E-03

Shipping Site: PPPL	Total Volume (m3/yr)	2.45E+01	Total Mass (kg/yr)	6.10E+03

Radionuclide	Activity (Ci/yr)
H-3	2.01E-01
Cr-51	8.50E-04
Mn-54	1.61E-03
Fe-55	6.04E-03
Fe-59	5.46E-05
Co-58	2.17E-03
Co-60	1.70E-02
Ni-59	7.80E-05
Ni-63	1.10E-02
Zr-95	6.63E-05

Shipping Site: RMI	Total Volume (m3/yr)	5.68E+03	Total Mass (kg/yr)	1.47E+07

Radionuclide	Activity (Ci/yr)
Tl-208	3.58E-07
Pb-212	9.47E-07
Bi-212	9.47E-07
Po-212	6.10E-07
Po-216	9.47E-07
Ra-224	9.47E-07
Ra-228	5.66E-06
Ac-228	5.66E-06
Th-228	9.47E-07
Th-231	5.45E-06
Th-232	5.74E-05
Th-234	6.98E-03
Pa-234	7.15E-07
Pa-234m	6.98E-03
U-235	5.43E-06
U-238	6.98E-03

Destination: Paducah

Shipping Site: KCP	Total Volume (m3/yr)	2.65E+00	Total Mass (kg/yr)	7.23E+03

Radionuclide	Activity (Ci/yr)
H-3	2.70E-02
C-14	1.44E-04
Mn-54	1.62E-02
Co-58	1.50E-02
Co-60	4.34E-02
Sr-90	2.04E-02
Y-90	2.04E-02
Tc-99	2.89E-04
Cs-134	3.37E-02
Cs-137	4.44E-02
Ba-137m	4.20E-02
U-238	1.76E-03

Destination: SRS

Shipping Site: Pinellas	Total Volume (m3/yr)	1.40E+02	Total Mass (kg/yr)	1.91E+04

Radionuclide	Activity (Ci/yr)
H-3	1.99E+04

A.6 WM LLW REGIONALIZED 1 ALTERNATIVE (CASE 3): ACTIVATED METALS

Destination: INEL

Shipping Site: ANL-W	Total Volume (m3/yr)	2.26E+01	Total Mass (kg/yr)	1.64E+05

Radionuclide	Activity (Ci/yr)
H-3	1.71E-06
Cr-51	1.24E-04
Mn-54	2.37E-04
Fe-55	8.86E-04
Fe-59	8.00E-06
Co-58	3.18E-04
Co-60	2.50E-03
Ni-59	1.14E-05
Ni-63	1.64E-03
Sr-90	1.43E-03
Y-90	1.43E-03
Zr-95	9.72E-06
Tc-99	2.56E-07
Ru-106	1.40E-04
Rh-106	1.40E-04
Sb-125	4.03E-05
Te-125m	9.84E-06
Cs-134	1.63E-04
Cs-137	2.00E-01
Ba-137m	2.00E-01
Ce-144	4.69E-04
Pr-144	4.69E-04
Pr-144m	5.64E-06
Pm-147	1.14E-03
Sm-151	1.12E-05
Eu-152	1.71E-07
Eu-154	2.93E-05
Eu-155	2.32E-05
Pu-238	3.53E-05
Pu-239	3.42E-07
Pu-240	1.71E-07
Pu-241	3.95E-05
Am-241	5.13E-07

Shipping Site: NRF	Total Volume (m3/yr)	1.29E+03	Total Mass (kg/yr)	9.40E+06

Radionuclide	Activity (Ci/yr)
Cr-51	2.31E+03
Mn-54	4.40E+03
Fe-55	1.64E+04
Fe-59	1.48E+02
Co-58	5.91E+03
Co-60	4.63E+04
Ni-59	2.12E+02
Ni-63	3.01E+04
Zr-95	1.80E+02

Destination: LANL

Shipping Site: SNLA — Total Volume (m3/yr): 1.58E+01 — Total Mass (kg/yr): 1.15E+05

Radionuclide	Activity (Ci/yr)
Cr-51	6.54E-04
Mn-54	1.24E-03
Fe-55	4.64E-03
Fe-59	4.20E-05
Co-58	1.67E-03
Co-60	1.31E-02
Ni-59	6.00E-05
Ni-63	8.53E-03
Zr-95	5.10E-05

Destination: LLNL

Shipping Site: LBL — Total Volume (m3/yr): 3.95E+01 — Total Mass (kg/yr): 2.87E+05

Radionuclide	Activity (Ci/yr)
Cr-51	6.32E-02
Mn-54	1.20E-01
Fe-55	4.49E-01
Fe-59	4.06E-03
Co-58	1.61E-01
Co-60	1.26E+00
Ni-59	5.80E-03
Ni-63	8.24E-01
Zr-95	4.93E-03

Destination: PORTS

Shipping Site: BAPL	Total Volume (m3/yr) 8.84E+02	Total Mass (kg/yr) 6.43E+06

Radionuclide	Activity (Ci/yr)
Cr-51	4.75E+03
Mn-54	9.04E+03
Fe-55	3.37E+04
Fe-59	3.05E+02
Co-58	1.21E+04
Co-60	9.52E+04
Ni-59	4.36E+02
Ni-63	6.19E+04
Zr-95	3.70E+02
Tl-208	1.36E-08
Pb-212	3.60E-08
Bi-212	3.60E-08
Po-212	2.32E-08
Po-216	3.60E-08
Ra-224	3.60E-08
Ra-228	2.15E-07
Ac-228	2.15E-07
Th-228	3.60E-08
Th-231	2.07E-07
Th-232	2.18E-06
Th-234	2.65E-04
Pa-234	2.72E-08
Pa-234m	2.65E-04
U-235	2.06E-07
U-238	2.65E-04

Shipping Site: FNAL	Total Volume (m3/yr) 1.11E+02	Total Mass (kg/yr) 8.14E+05

Radionuclide	Activity (Ci/yr)
Cr-51	3.35E-02
Mn-54	6.39E-02
Fe-55	2.38E-01
Fe-59	2.15E-03
Co-58	8.57E-02
Co-60	6.72E-01
Ni-59	3.08E-03
Ni-63	4.37E-01
Zr-95	2.61E-03

Shipping Site: KAPL	Total Volume (m3/yr) 1.82E+03	Total Mass (kg/yr) 1.33E+07

Radionuclide	Activity (Ci/yr)
H-3	5.15E-04
C-14	2.40E-05
Cr-51	1.13E+04
Mn-54	2.15E+04
Fe-55	8.05E+04
Fe-59	7.28E+02
Co-58	2.89E+04
Co-60	2.27E+05
Ni-59	1.04E+03
Ni-63	1.47E+05
Sr-90	2.62E-02
Y-90	2.62E-02
Zr-95	8.84E+02
Tc-99	5.20E-05
Ru-106	2.22E-03
Rh-106	2.22E-03
Sb-125	6.40E-04
Te-125m	1.56E-04
Cs-134	8.18E-03
Cs-137	3.13E-02
Ba-137m	2.96E-02
Ce-144	7.46E-03
Pr-144	7.46E-03
Pr-144m	8.97E-05
Pm-147	1.82E-02
Sm-151	1.78E-04
Eu-152	2.71E-06
Eu-154	4.66E-04
Eu-155	3.69E-04
Tl-208	2.96E-08
Pb-212	7.83E-08
Bi-212	7.83E-08
Po-212	5.05E-08
Po-216	7.83E-08
Ra-224	7.83E-08
Ra-228	4.68E-07
Ac-228	4.68E-07
Th-228	7.83E-08
Th-231	4.50E-07
Th-232	4.75E-06
Th-234	5.77E-04
Pa-234	5.92E-08
Pa-234m	5.77E-04
U-235	4.48E-07
U-238	8.69E-04
Pu-238	5.61E-04
Pu-239	5.43E-06
Pu-240	2.71E-06
Pu-241	6.28E-04
Am-241	8.15E-06

A.7 WM LLW REGIONALIZED 2 ALTERNATIVE (CASE 9): HETEROGENEOUS SOLIDS

Transported Material with Radionuclide Profile

Alternative: #9 Regional Treat -- 11 Site -- 12 Site Disposal

Waste Stream: LLW Waste Type: All, excl. Act.Metal

Destination: FEMP

Shipping Site: AMES Total Volume (m3/yr) 6.66E-01 Total Mass (kg/yr) 1.00E+02

Radionuclide	Activity (Ci/yr)
Tl-208	2.83E-08
Pb-212	7.50E-08
Bi-212	7.50E-08
Po-212	4.83E-08
Po-216	7.50E-08
Ra-224	7.50E-08
Ra-228	4.48E-07
Ac-228	4.48E-07
Th-228	7.50E-08
Th-231	4.31E-07
Th-232	4.55E-06
Th-234	5.53E-04
Pa-234	5.67E-08
Pa-234m	5.53E-04
U-235	4.30E-07
U-238	5.53E-04
Pu-238	4.36E-05
Pu-239	3.33E-06
Pu-240	1.16E-05
Pu-241	1.60E-03
Am-241	6.67E-08
Cm-242	9.33E-07
Cm-244	3.33E-07

Shipping Site: FNAL Total Volume (m3/yr) 6.79E+00 Total Mass (kg/yr) 6.25E+03

Radionuclide	Activity (Ci/yr)
H-3	7.38E-02

Shipping Site: MOUND Total Volume (m3/yr) 7.60E+02 Total Mass (kg/yr) 1.14E+05

Radionuclide	Activity (Ci/yr)
H-3	1.34E+04

Destination: INEL

Shipping Site: ANL-W

Total Volume (m3/yr): 2.59E+02

Total Mass (kg/yr): 2.12E+05

Radionuclide	Activity (Ci/yr)
H-3	7.83E-04
Cr-51	3.58E+03
Mn-54	6.83E+03
Fe-55	2.54E+04
Fe-59	2.30E+02
Co-58	9.16E+03
Co-60	7.18E+04
Ni-59	3.29E+02
Ni-63	4.67E+04
Sr-90	3.17E-02
Y-90	3.17E-02
Zr-95	2.79E+02
Tc-99	5.66E-06
Ru-106	3.09E-03
Rh-106	3.09E-03
Sb-125	8.89E-04
Te-125m	2.17E-04
Cs-134	3.59E-03
Cs-137	3.32E-02
Ba-137m	3.14E-02
Ce-144	1.03E-02
Pr-144	1.03E-02
Pr-144m	1.24E-04
Pm-147	2.52E-02
Sm-151	2.47E-04
Eu-152	3.77E-06
Eu-154	6.47E-04
Eu-155	5.13E-04
Pu-238	7.81E-04
Pu-239	7.72E-06
Pu-240	4.38E-06
Pu-241	9.56E-04
Am-241	1.13E-05
Cm-242	4.88E-08
Cm-244	1.74E-08

Destination: LANL

Shipping Site: ITRI — Total Volume (m3/yr) 1.34E+02 — Total Mass (kg/yr) 1.64E+05

Radionuclide	Activity (Ci/yr)
H-3	6.17E+00
C-14	3.03E-01
Mn-54	3.41E+01
Co-58	3.15E+01
Co-60	9.12E+01
Sr-90	4.28E+01
Y-90	4.28E+01
Tc-99	6.07E-01
Cs-134	7.07E+01
Cs-137	9.33E+01
Ba-137m	8.82E+01
U-238	3.69E+00

Shipping Site: SNLA — Total Volume (m3/yr) 1.19E+02 — Total Mass (kg/yr) 3.28E+05

Radionuclide	Activity (Ci/yr)
H-3	3.00E+00
Co-60	2.85E-05
Ni-63	5.67E-05
Sr-90	5.04E-03
Y-90	5.04E-03
Tc-99	9.00E-07
Ru-106	4.92E-04
Rh-106	4.92E-04
Sb-125	1.41E-04
Te-125m	3.45E-05
Cs-134	5.72E-04
Cs-137	5.28E-03
Ba-137m	4.99E-03
Ce-144	1.64E-03
Pr-144	1.64E-03
Pr-144m	1.98E-05
Pm-147	4.02E-03
Sm-151	3.93E-05
Eu-152	6.00E-07
Eu-154	1.02E-04
Eu-155	8.16E-05
Tl-208	5.10E-06
Pb-212	1.35E-05
Bi-212	1.35E-05
Po-212	8.70E-06
Po-216	1.35E-05
Ra-224	1.35E-05
Ra-228	8.07E-05
Ac-228	8.07E-05
Th-228	1.35E-05
Th-231	7.77E-05
Th-232	8.19E-04
Th-234	9.96E-02
Pa-234	1.02E-05
Pa-234m	9.96E-02
U-235	7.74E-05
U-238	9.96E-02
Pu-238	7.87E-02
Pu-239	6.00E-03
Pu-240	2.10E-02
Pu-241	2.89E+00
Am-241	1.21E-04
Cm-242	1.68E-03
Cm-244	6.00E-04

Destination: LLNL

Shipping Site: LBL — Total Volume (m3/yr) 8.48E+01 — Total Mass (kg/yr) 4.51E+04

Radionuclide	Activity (Ci/yr)
H-3	6.35E+02
C-14	1.13E+00
Mn-54	1.27E+02
Co-58	1.17E+02
Co-60	3.39E+02
Sr-90	1.59E+02
Y-90	1.59E+02
Tc-99	2.26E+00
Cs-134	2.63E+02
Cs-137	3.47E+02
Ba-137m	3.28E+02
U-238	1.37E+01
Cm-244	1.05E+01

Shipping Site: SLAC — Total Volume (m3/yr) 2.73E+02 — Total Mass (kg/yr) 7.45E+05

Radionuclide	Activity (Ci/yr)
Cr-51	3.86E-03
Mn-54	7.36E-03
Fe-55	2.74E-02
Fe-59	2.48E-04
Co-58	9.88E-03
Co-60	7.74E-02
Ni-59	3.54E-04
Ni-63	5.04E-02
Zr-95	3.01E-04

Shipping Site: SNLL — Total Volume (m3/yr) 3.59E+01 — Total Mass (kg/yr) 9.36E+04

Radionuclide	Activity (Ci/yr)
H-3	2.82E+04
Fe-55	3.15E-01
Co-60	3.15E-01
Tl-208	6.40E-05
Pb-212	1.69E-04
Bi-212	1.69E-04
Po-212	1.09E-04
Po-216	1.69E-04
Ra-224	1.69E-04
Ra-228	1.01E-03
Ac-228	1.01E-03
Th-228	1.69E-04
Th-231	9.75E-04
Th-232	1.02E-02
Th-234	1.25E+00
Pa-234	1.28E-04
Pa-234m	1.25E+00
U-235	9.71E-04
U-238	1.25E+00

Destination: ORNL

Shipping Site: K-25	Total Volume (m3/yr)	6.28E+03	Total Mass (kg/yr)	4.67E+07

Radionuclide	Activity (Ci/yr)
Tl-208	1.06E-04
Pb-212	2.82E-04
Bi-212	2.82E-04
Po-212	1.82E-04
Po-216	2.82E-04
Ra-224	2.82E-04
Ra-228	1.68E-03
Ac-228	1.68E-03
Th-228	2.82E-04
Th-231	1.62E-03
Th-232	1.71E-02
Th-234	2.08E+00
Pa-234	2.13E-04
Pa-234m	2.08E+00
U-235	1.62E-03
U-238	2.08E+00

Shipping Site: ORISE	Total Volume (m3/yr)	5.77E+01	Total Mass (kg/yr)	7.36E+04

Radionuclide	Activity (Ci/yr)
H-3	2.00E-02
C-14	1.19E-05
Mn-54	1.34E-03
Co-58	1.24E-03
Co-60	3.59E-03
Sr-90	1.69E-03
Y-90	1.69E-03
Tc-99	2.39E-05
Cs-134	2.79E-03
Cs-137	3.68E-03
Ba-137m	3.48E-03
Tl-208	3.39E-07
Pb-212	8.98E-07
Bi-212	8.98E-07
Po-212	5.78E-07
Po-216	8.98E-07
Ra-224	8.98E-07
Ra-228	5.36E-06
Ac-228	5.36E-06
Th-228	8.98E-07
Th-231	5.16E-06
Th-232	5.44E-05
Th-234	6.62E-03
Pa-234	6.78E-07
Pa-234m	6.62E-03
U-235	5.14E-06
U-238	6.77E-03

Shipping Site: Y-12	Total Volume (m3/yr)	1.33E+04	Total Mass (kg/yr)	8.27E+07

Radionuclide	Activity (Ci/yr)
Tl-208	6.80E-05
Pb-212	1.80E-04
Bi-212	1.80E-04
Po-212	1.16E-04
Po-216	1.80E-04
Ra-224	1.80E-04
Ra-228	1.07E-03
Ac-228	1.07E-03
Th-228	1.80E-04
Th-231	1.03E-03
Th-232	1.09E-02
Th-234	1.32E+00
Pa-234	1.36E-04
Pa-234m	1.32E+00
U-235	1.03E-03
U-238	1.32E+00

Destination: PORTS

Shipping Site: AMES	Total Volume (m3/yr)	1.09E+01	Total Mass (kg/yr)	2.98E+04

Radionuclide	Activity (Ci/yr)
Tl-208	4.22E-07
Pb-212	1.11E-06
Bi-212	1.11E-06
Po-212	7.20E-07
Po-216	1.11E-06
Ra-224	1.11E-06
Ra-228	6.68E-06
Ac-228	6.68E-06
Th-228	1.11E-06
Th-231	6.43E-06
Th-232	6.77E-05
Th-234	8.24E-03
Pa-234	8.44E-07
Pa-234m	8.24E-03
U-235	6.40E-06
U-238	8.24E-03
Pu-238	6.50E-04
Pu-239	4.96E-05
Pu-240	1.73E-04
Pu-241	2.39E-02
Am-241	9.93E-07
Cm-242	1.39E-05
Cm-244	4.96E-06

Shipping Site: ANL-E	Total Volume (m3/yr)	7.35E+02	Total Mass (kg/yr)	2.00E+06

Radionuclide	Activity (Ci/yr)
H-3	1.33E+02
C-14	7.91E-02
Cr-51	2.87E+00
Mn-54	1.43E+01
Fe-55	2.04E+01
Fe-59	1.84E-01
Co-58	1.55E+01
Co-60	8.15E+01
Ni-59	2.63E-01
Ni-63	3.77E+01
Sr-90	3.33E+01
Y-90	3.33E+01
Zr-95	2.24E-01
Tc-99	1.62E-01
Ru-106	2.16E+00
Rh-106	2.16E+00
Sb-125	6.21E-01
Te-125m	1.51E-01
Cs-134	2.09E+01
Cs-137	4.75E+01
Ba-137m	4.50E+01
Ce-144	7.24E+00
Pr-144	7.24E+00
Pr-144m	8.70E-02
Pm-147	1.76E+01
Sm-151	1.72E-01
Eu-152	2.63E-03
Eu-154	4.52E-01
Eu-155	3.58E-01
U-238	9.63E-01
Pu-238	5.44E-01
Pu-239	5.27E-03
Pu-240	2.63E-03
Pu-241	6.09E-01
Am-241	7.91E-03

Shipping Site: BAPL	Total Volume (m3/yr)	3.98E+02	Total Mass (kg/yr)	1.08E+06

Radionuclide	Activity (Ci/yr)
H-3	2.51E-03
Co-60	1.19E-02
Ni-63	2.38E-02
Sr-90	2.11E+00
Y-90	2.11E+00
Tc-99	3.77E-04
Ru-106	2.06E-01
Rh-106	2.06E-01
Sb-125	5.93E-02
Te-125m	1.44E-02
Cs-134	2.40E-01
Cs-137	2.21E+00
Ba-137m	2.09E+00
Ce-144	6.91E-01
Pr-144	6.91E-01
Pr-144m	8.31E-03
Pm-147	1.68E+00
Sm-151	1.65E-02
Eu-152	2.51E-04
Eu-154	4.32E-02
Eu-155	3.42E-02
Tl-208	3.80E-06
Pb-212	1.00E-05
Bi-212	1.00E-05
Po-212	6.49E-06
Po-216	1.00E-05
Ra-224	1.00E-05
Ra-228	6.02E-05
Ac-228	6.02E-05
Th-228	1.00E-05
Th-231	5.80E-05
Th-232	6.11E-04
Th-234	7.43E-02
Pa-234	7.61E-06
Pa-234m	7.43E-02
U-235	5.77E-05
U-238	7.43E-02
Pu-238	5.20E-02
Pu-239	5.03E-04
Pu-240	2.51E-04
Pu-241	5.81E-02
Am-241	7.55E-04

Shipping Site: FEMP	Total Volume (m3/yr)	4.99E+01	Total Mass (kg/yr)	1.30E+05

Radionuclide	Activity (Ci/yr)
H-3	2.24E+02
Tl-208	2.83E-08
Pb-212	7.50E-08
Bi-212	7.50E-08
Po-212	4.83E-08
Po-216	7.50E-08
Ra-224	7.50E-08
Ra-228	4.48E-07
Ac-228	4.48E-07
Th-228	7.50E-08
Th-231	4.31E-07
Th-232	4.54E-06
Th-234	5.53E-04
Pa-234	5.67E-08
Pa-234m	5.53E-04
U-235	4.30E-07
U-238	5.53E-04
Pu-238	4.36E-05
Pu-239	3.33E-06
Pu-240	1.16E-05
Pu-241	1.60E-03
Am-241	6.67E-08
Cm-242	9.33E-07
Cm-244	3.33E-07

Shipping Site: FNAL	Total Volume (m3/yr)	4.22E+01	Total Mass (kg/yr)	3.26E+04

Radionuclide	Activity (Ci/yr)
H-3	1.08E-01
Cr-51	1.11E-02
Mn-54	2.12E-02
Fe-55	7.94E-02
Fe-59	7.17E-04
Co-58	2.85E-02
Co-60	2.23E-01
Ni-59	1.02E-03
Ni-63	1.45E-01
Zr-95	8.71E-04
Tl-208	3.78E-07
Pb-212	1.00E-06
Bi-212	1.00E-06
Po-212	6.46E-07
Po-216	1.00E-06
Ra-224	1.00E-06
Ra-228	5.99E-06
Ac-228	5.99E-06
Th-228	1.00E-06
Th-231	5.77E-06
Th-232	6.08E-05
Th-234	7.39E-03
Pa-234	7.57E-07
Pa-234m	7.39E-03
U-235	5.75E-06
U-238	7.39E-03

Shipping Site: KAPL	Total Volume (m3/yr)	2.11E+02	Total Mass (kg/yr)	5.36E+05

Radionuclide	Activity (Ci/yr)
H-3	5.14E-04
C-14	2.40E-05
Cr-51	5.11E-03
Mn-54	1.24E-02
Fe-55	3.63E-02
Fe-59	3.28E-04
Co-58	1.55E-02
Co-60	1.09E-01
Ni-59	4.69E-04
Ni-63	6.70E-02
Sr-90	2.58E-02
Y-90	2.58E-02
Zr-95	3.99E-04
Tc-99	5.20E-05
Ru-106	2.19E-03
Rh-106	2.19E-03
Sb-125	6.31E-04
Te-125m	1.54E-04
Cs-134	8.14E-03
Cs-137	3.09E-02
Ba-137m	2.92E-02
Ce-144	7.35E-03
Pr-144	7.35E-03
Pr-144m	8.84E-05
Pm-147	1.79E-02
Sm-151	1.75E-04
Eu-152	2.67E-06
Eu-154	4.59E-04
Eu-155	3.64E-04
Tl-208	4.50E-09
Pb-212	1.19E-08
Bi-212	1.19E-08
Po-212	7.60E-09
Po-216	1.19E-08
Ra-224	1.19E-08
Ra-228	7.11E-08
Ac-228	7.11E-08
Th-228	1.19E-08
Th-231	6.84E-08
Th-232	7.21E-07
Th-234	8.77E-05
Pa-234	8.90E-09
Pa-234m	8.77E-05
U-235	6.82E-08
U-238	3.79E-04
Pu-238	5.53E-04
Pu-239	5.35E-06
Pu-240	2.67E-06
Pu-241	6.18E-04
Am-241	8.03E-06

Shipping Site: MOUND	Total Volume (m3/yr)	3.57E+03	Total Mass (kg/yr)	9.56E+06

Radionuclide	Activity (Ci/yr)
H-3	1.59E+00
Pu-238	1.60E-01
Pu-239	1.22E-02
Pu-240	4.28E-02
Pu-241	5.90E+00
Am-241	2.44E-04
Cm-242	3.42E-03
Cm-244	1.22E-03

Shipping Site: PPPL — Total Volume (m3/yr): 2.21E+01 — Total Mass (kg/yr): 4.97E+03

Radionuclide	Activity (Ci/yr)
H-3	2.01E-01
Cr-51	8.50E-04
Mn-54	1.61E-03
Fe-55	6.04E-03
Fe-59	5.46E-05
Co-58	2.17E-03
Co-60	1.70E-02
Ni-59	7.80E-05
Ni-63	1.10E-02
Zr-95	6.63E-05

Shipping Site: RMI — Total Volume (m3/yr): 5.63E+03 — Total Mass (kg/yr): 1.46E+07

Radionuclide	Activity (Ci/yr)
Tl-208	3.58E-07
Pb-212	9.47E-07
Bi-212	9.47E-07
Po-212	6.10E-07
Po-216	9.47E-07
Ra-224	9.47E-07
Ra-228	5.66E-06
Ac-228	5.66E-06
Th-228	9.47E-07
Th-231	5.45E-06
Th-232	5.74E-05
Th-234	6.98E-03
Pa-234	7.15E-07
Pa-234m	6.98E-03
U-235	5.43E-06
U-238	6.98E-03

Destination: Paducah

Shipping Site: KCP — Total Volume (m3/yr): 2.65E+00 — Total Mass (kg/yr): 7.23E+03

Radionuclide	Activity (Ci/yr)
H-3	2.70E-02
C-14	1.44E-04
Mn-54	1.62E-02
Co-58	1.50E-02
Co-60	4.34E-02
Sr-90	2.04E-02
Y-90	2.04E-02
Tc-99	2.89E-04
Cs-134	3.37E-02
Cs-137	4.44E-02
Ba-137m	4.20E-02
U-238	1.76E-03

Destination: SRS

Shipping Site: Pinellas — Total Volume (m3/yr): 1.27E+02 — Total Mass (kg/yr): 1.91E+04

Radionuclide	Activity (Ci/yr)
H-3	1.99E+04

A.8 WM LLW REGIONALIZED 2 ALTERNATIVE (CASE 9): ACTIVATED METALS

Transported Material with Radionuclide Profile

Alternative: #9 Regional Treat -- 11 Site -- 12 Site Disposal

Waste Stream: LLW Waste Type: Activated Metal

Destination: FEMP

Shipping Site: FNAL — Total Volume (m3/yr): 1.01E+02 — Total Mass (kg/yr): 8.14E+05

Radionuclide	Activity (Ci/yr)
Cr-51	3.35E-02
Mn-54	6.39E-02
Fe-55	2.38E-01
Fe-59	2.15E-03
Co-58	8.57E-02
Co-60	6.72E-01
Ni-59	3.08E-03
Ni-63	4.37E-01
Zr-95	2.61E-03

Destination: INEL

Shipping Site: ANL-W — Total Volume (m3/yr): 2.06E+01 — Total Mass (kg/yr): 1.64E+05

Radionuclide	Activity (Ci/yr)
H-3	1.71E-06
Cr-51	1.24E-04
Mn-54	2.37E-04
Fe-55	8.86E-04
Fe-59	8.00E-06
Co-58	3.18E-04
Co-60	2.50E-03
Ni-59	1.14E-05
Ni-63	1.64E-03
Sr-90	1.43E-03
Y-90	1.43E-03
Zr-95	9.72E-06
Tc-99	2.56E-07
Ru-106	1.40E-04
Rh-106	1.40E-04
Sb-125	4.03E-05
Te-125m	9.84E-06
Cs-134	1.63E-04
Cs-137	2.00E-01
Ba-137m	2.00E-01
Ce-144	4.69E-04
Pr-144	4.69E-04
Pr-144m	5.64E-06
Pm-147	1.14E-03
Sm-151	1.12E-05
Eu-152	1.71E-07
Eu-154	2.93E-05
Eu-155	2.32E-05
Pu-238	3.53E-05
Pu-239	3.42E-07
Pu-240	1.71E-07
Pu-241	3.95E-05
Am-241	5.13E-07

Shipping Site: NRF — Total Volume (m3/yr) 1.17E+03 — Total Mass (kg/yr) 9.40E+06

Radionuclide	Activity (Ci/yr)
Cr-51	2.31E+03
Mn-54	4.40E+03
Fe-55	1.64E+04
Fe-59	1.48E+02
Co-58	5.91E+03
Co-60	4.63E+04
Ni-59	2.12E+02
Ni-63	3.01E+04
Zr-95	1.80E+02

Destination: LANL

Shipping Site: SNLA — Total Volume (m3/yr) 1.43E+01 — Total Mass (kg/yr) 1.15E+05

Radionuclide	Activity (Ci/yr)
Cr-51	6.54E-04
Mn-54	1.24E-03
Fe-55	4.64E-03
Fe-59	4.20E-05
Co-58	1.67E-03
Co-60	1.31E-02
Ni-59	6.00E-05
Ni-63	8.53E-03
Zr-95	5.10E-05

Destination: LLNL

Shipping Site: LBL — Total Volume (m3/yr) 3.59E+01 — Total Mass (kg/yr) 2.87E+05

Radionuclide	Activity (Ci/yr)
Cr-51	6.32E-02
Mn-54	1.20E-01
Fe-55	4.49E-01
Fe-59	4.06E-03
Co-58	1.61E-01
Co-60	1.26E+00
Ni-59	5.80E-03
Ni-63	8.24E-01
Zr-95	4.93E-03

Destination: PORTS

Shipping Site: BAPL	Total Volume (m3/yr)	8.03E+02	Total Mass (kg/yr)	6.43E+06

Radionuclide	Activity (Ci/yr)
Cr-51	4.75E+03
Mn-54	9.04E+03
Fe-55	3.37E+04
Fe-59	3.05E+02
Co-58	1.21E+04
Co-60	9.52E+04
Ni-59	4.36E+02
Ni-63	6.19E+04
Zr-95	3.70E+02
Tl-208	1.36E-08
Pb-212	3.60E-08
Bi-212	3.60E-08
Po-212	2.32E-08
Po-216	3.60E-08
Ra-224	3.60E-08
Ra-228	2.15E-07
Ac-228	2.15E-07
Th-228	3.60E-08
Th-231	2.07E-07
Th-232	2.18E-06
Th-234	2.65E-04
Pa-234	2.72E-08
Pa-234m	2.65E-04
U-235	2.06E-07
U-238	2.65E-04

Shipping Site: FEMP	Total Volume (m3/yr)	1.86E+01	Total Mass (kg/yr)	8.14E+05

Radionuclide	Activity (Ci/yr)
Cr-51	3.35E-02
Mn-54	6.39E-02
Fe-55	2.38E-01
Fe-59	2.15E-03
Co-58	8.57E-02
Co-60	6.72E-01
Ni-59	3.08E-03
Ni-63	4.37E-01
Zr-95	2.61E-03

Shipping Site: KAPL	Total Volume (m3/yr) 1.66E+03	Total Mass (kg/yr) 1.33E+07

Radionuclide	Activity (Ci/yr)
H-3	5.15E-04
C-14	2.40E-05
Cr-51	1.13E+04
Mn-54	2.15E+04
Fe-55	8.05E+04
Fe-59	7.28E+02
Co-58	2.89E+04
Co-60	2.27E+05
Ni-59	1.04E+03
Ni-63	1.47E+05
Sr-90	2.62E-02
Y-90	2.62E-02
Zr-95	8.84E+02
Tc-99	5.20E-05
Ru-106	2.22E-03
Rh-106	2.22E-03
Sb-125	6.40E-04
Te-125m	1.56E-04
Cs-134	8.18E-03
Cs-137	3.13E-02
Ba-137m	2.96E-02
Ce-144	7.46E-03
Pr-144	7.46E-03
Pr-144m	8.97E-05
Pm-147	1.82E-02
Sm-151	1.78E-04
Eu-152	2.71E-06
Eu-154	4.66E-04
Eu-155	3.69E-04
Tl-208	2.96E-08
Pb-212	7.83E-08
Bi-212	7.83E-08
Po-212	5.05E-08
Po-216	7.83E-08
Ra-224	7.83E-08
Ra-228	4.68E-07
Ac-228	4.68E-07
Th-228	7.83E-08
Th-231	4.50E-07
Th-232	4.75E-06
Th-234	5.77E-04
Pa-234	5.92E-08
Pa-234m	5.77E-04
U-235	4.48E-07
U-238	8.69E-04
Pu-238	5.61E-04
Pu-239	5.43E-06
Pu-240	2.71E-06
Pu-241	6.28E-04
Am-241	8.15E-06

A.9 WM LLW REGIONALIZED 3 ALTERNATIVE (CASE 4): HETEROGENEOUS SOLIDS

Transported Material with Radionuclide Profile

Alternative: #4 Minimum Treat -- On-Site -- 6 Site Disposal

Waste Stream: LLW Waste Type: All, excl. Act.Metal

Destination: INEL

Shipping Site: ANL-W Total Volume (m3/yr) 2.78E+02 Total Mass (kg/yr) 2.12E+05

Radionuclide	Activity (Ci/yr)
H-3	7.83E-04
Cr-51	3.58E+03
Mn-54	6.83E+03
Fe-55	2.54E+04
Fe-59	2.30E+02
Co-58	9.16E+03
Co-60	7.18E+04
Ni-59	3.29E+02
Ni-63	4.67E+04
Sr-90	3.17E-02
Y-90	3.17E-02
Zr-95	2.79E+02
Tc-99	5.66E-06
Ru-106	3.09E-03
Rh-106	3.09E-03
Sb-125	8.89E-04
Te-125m	2.17E-04
Cs-134	3.59E-03
Cs-137	3.32E-02
Ba-137m	3.14E-02
Ce-144	1.03E-02
Pr-144	1.03E-02
Pr-144m	1.24E-04
Pm-147	2.52E-02
Sm-151	2.47E-04
Eu-152	3.77E-06
Eu-154	6.47E-04
Eu-155	5.13E-04
Pu-238	7.81E-04
Pu-239	7.72E-06
Pu-240	4.38E-06
Pu-241	9.56E-04
Am-241	1.13E-05
Cm-242	4.88E-08
Cm-244	1.74E-08

Destination: LANL

Shipping Site: ITRI — Total Volume (m3/yr) 1.41E+02 — Total Mass (kg/yr) 1.64E+05

Radionuclide	Activity (Ci/yr)
H-3	6.17E+00
C-14	3.03E-01
Mn-54	3.41E+01
Co-58	3.15E+01
Co-60	9.12E+01
Sr-90	4.28E+01
Y-90	4.28E+01
Tc-99	6.07E-01
Cs-134	7.07E+01
Cs-137	9.33E+01
Ba-137m	8.82E+01
U-238	3.69E+00

Shipping Site: PANT — Total Volume (m3/yr) 4.35E+03 — Total Mass (kg/yr) 2.88E+07

Radionuclide	Activity (Ci/yr)
H-3	2.34E+02
Tl-208	2.21E-04
Pb-212	5.86E-04
Bi-212	5.86E-04
Po-212	3.78E-04
Po-216	5.86E-04
Ra-224	5.86E-04
Ra-228	3.50E-03
Ac-228	3.50E-03
Th-228	5.86E-04
Th-231	3.37E-03
Th-232	3.56E-02
Th-234	4.32E+00
Pa-234	4.43E-04
Pa-234m	4.32E+00
U-235	3.36E-03
U-238	4.32E+00

Shipping Site: RFP — Total Volume (m3/yr) 4.56E+03 — Total Mass (kg/yr) 6.49E+06

Radionuclide	Activity (Ci/yr)
Tl-208	3.60E-05
Pb-212	9.55E-05
Bi-212	9.55E-05
Po-212	6.15E-05
Po-216	9.55E-05
Ra-224	9.55E-05
Ra-228	5.70E-04
Ac-228	5.70E-04
Th-228	9.55E-05
Th-231	5.49E-04
Th-232	5.79E-03
Th-234	7.04E-01
Pa-234	7.21E-05
Pa-234m	7.04E-01
U-235	5.47E-04
U-238	7.04E-01
Pu-238	5.56E-01
Pu-239	4.24E-02
Pu-240	1.48E-01
Pu-241	2.04E+01
Am-241	8.48E-04
Cm-242	1.18E-02
Cm-244	4.24E-03

Shipping Site: SNLA	Total Volume (m3/yr)	1.19E+02	Total Mass (kg/yr)	3.28E+05

Radionuclide	Activity (Ci/yr)
H-3	3.00E+00
Co-60	2.85E-05
Ni-63	5.67E-05
Sr-90	5.04E-03
Y-90	5.04E-03
Tc-99	9.00E-07
Ru-106	4.92E-04
Rh-106	4.92E-04
Sb-125	1.41E-04
Te-125m	3.45E-05
Cs-134	5.72E-04
Cs-137	5.28E-03
Ba-137m	4.99E-03
Ce-144	1.64E-03
Pr-144	1.64E-03
Pr-144m	1.98E-05
Pm-147	4.02E-03
Sm-151	3.93E-05
Eu-152	6.00E-07
Eu-154	1.02E-04
Eu-155	8.16E-05
Tl-208	5.10E-06
Pb-212	1.35E-05
Bi-212	1.35E-05
Po-212	8.70E-06
Po-216	1.35E-05
Ra-224	1.35E-05
Ra-228	8.07E-05
Ac-228	8.07E-05
Th-228	1.35E-05
Th-231	7.77E-05
Th-232	8.19E-04
Th-234	9.96E-02
Pa-234	1.02E-05
Pa-234m	9.96E-02
U-235	7.74E-05
U-238	9.96E-02
Pu-238	7.87E-02
Pu-239	6.00E-03
Pu-240	2.10E-02
Pu-241	2.89E+00
Am-241	1.21E-04
Cm-242	1.68E-03
Cm-244	6.00E-04

Destination: NTS

Shipping Site: LBL — Total Volume (m3/yr) 9.20E+01 — Total Mass (kg/yr) 4.51E+04

Radionuclide	Activity (Ci/yr)
H-3	6.35E+02
C-14	1.13E+00
Mn-54	1.27E+02
Co-58	1.17E+02
Co-60	3.39E+02
Sr-90	1.59E+02
Y-90	1.59E+02
Tc-99	2.26E+00
Cs-134	2.63E+02
Cs-137	3.47E+02
Ba-137m	3.28E+02
U-238	1.37E+01
Cm-244	1.05E+01

Shipping Site: LLNL — Total Volume (m3/yr) 4.20E+02 — Total Mass (kg/yr) 1.06E+06

Radionuclide	Activity (Ci/yr)
H-3	3.33E+04
C-14	1.55E-03
Mn-54	1.74E-01
Co-58	1.61E-01
Co-60	4.69E-01
Ni-63	4.89E-03
Sr-90	6.54E-01
Y-90	6.54E-01
Tc-99	3.18E-03
Ru-106	4.24E-02
Rh-106	4.24E-02
Sb-125	1.21E-02
Te-125m	2.97E-03
Cs-134	4.11E-01
Cs-137	9.33E-01
Ba-137m	8.82E-01
Ce-144	1.42E-01
Pr-144	1.42E-01
Pr-144m	1.70E-03
Pm-147	3.46E-01
Sm-151	3.39E-03
Eu-152	5.17E-05
Eu-154	8.87E-03
Eu-155	7.03E-03
U-238	1.88E-02
Pu-238	7.85E-02
Pu-239	5.28E-03
Pu-240	1.81E-02
Pu-241	2.50E+00
Am-241	2.58E-04
Cm-242	1.44E-03
Cm-244	5.17E-04

Shipping Site: SLAC — Total Volume (m3/yr) 2.73E+02 — Total Mass (kg/yr) 7.45E+05

Radionuclide	Activity (Ci/yr)
Cr-51	3.86E-03
Mn-54	7.36E-03
Fe-55	2.74E-02
Fe-59	2.48E-04
Co-58	9.88E-03
Co-60	7.74E-02
Ni-59	3.54E-04
Ni-63	5.04E-02
Zr-95	3.01E-04

Shipping Site: SNLL	Total Volume (m3/yr) 3.68E+01	Total Mass (kg/yr) 9.73E+04

Radionuclide	Activity (Ci/yr)
H-3	2.78E+04
Fe-55	3.15E-01
Co-60	3.15E-01
Tl-208	6.40E-05
Pb-212	1.69E-04
Bi-212	1.69E-04
Po-212	1.09E-04
Po-216	1.69E-04
Ra-224	1.69E-04
Ra-228	1.01E-03
Ac-228	1.01E-03
Th-228	1.69E-04
Th-231	9.75E-04
Th-232	1.02E-02
Th-234	1.25E+00
Pa-234	1.28E-04
Pa-234m	1.25E+00
U-235	9.71E-04
U-238	1.25E+00

Destination: ORNL

Shipping Site: AMES — Total Volume (m3/yr): 1.16E+01 — Total Mass (kg/yr): 2.99E+04

Radionuclide	Activity (Ci/yr)
Tl-208	4.50E-07
Pb-212	1.19E-06
Bi-212	1.19E-06
Po-212	7.68E-07
Po-216	1.19E-06
Ra-224	1.19E-06
Ra-228	7.12E-06
Ac-228	7.12E-06
Th-228	1.19E-06
Th-231	6.86E-06
Th-232	7.23E-05
Th-234	8.79E-03
Pa-234	9.01E-07
Pa-234m	8.79E-03
U-235	6.83E-06
U-238	8.79E-03
Pu-238	6.94E-04
Pu-239	5.30E-05
Pu-240	1.85E-04
Pu-241	2.55E-02
Am-241	1.06E-06
Cm-242	1.48E-05
Cm-244	5.30E-06

Shipping Site: ANL-E — Total Volume (m3/yr): 7.35E+02 — Total Mass (kg/yr): 2.00E+06

Radionuclide	Activity (Ci/yr)
H-3	1.33E+02
C-14	7.91E-02
Cr-51	2.87E+00
Mn-54	1.43E+01
Fe-55	2.04E+01
Fe-59	1.84E-01
Co-58	1.55E+01
Co-60	8.15E+01
Ni-59	2.63E-01
Ni-63	3.77E+01
Sr-90	3.33E+01
Y-90	3.33E+01
Zr-95	2.24E-01
Tc-99	1.62E-01
Ru-106	2.16E+00
Rh-106	2.16E+00
Sb-125	6.21E-01
Te-125m	1.51E-01
Cs-134	2.09E+01
Cs-137	4.75E+01
Ba-137m	4.50E+01
Ce-144	7.24E+00
Pr-144	7.24E+00
Pr-144m	8.70E-02
Pm-147	1.76E+01
Sm-151	1.72E-01
Eu-152	2.63E-03
Eu-154	4.52E-01
Eu-155	3.58E-01
U-238	9.63E-01
Pu-238	5.44E-01
Pu-239	5.27E-03
Pu-240	2.63E-03
Pu-241	6.09E-01
Am-241	7.91E-03

Shipping Site: BAPL	Total Volume (m3/yr)	3.98E+02	Total Mass (kg/yr)	1.08E+06

Radionuclide	Activity (Ci/yr)
H-3	2.51E-03
Co-60	1.19E-02
Ni-63	2.38E-02
Sr-90	2.11E+00
Y-90	2.11E+00
Tc-99	3.77E-04
Ru-106	2.06E-01
Rh-106	2.06E-01
Sb-125	5.93E-02
Te-125m	1.44E-02
Cs-134	2.40E-01
Cs-137	2.21E+00
Ba-137m	2.09E+00
Ce-144	6.91E-01
Pr-144	6.91E-01
Pr-144m	8.31E-03
Pm-147	1.68E+00
Sm-151	1.65E-02
Eu-152	2.51E-04
Eu-154	4.32E-02
Eu-155	3.42E-02
Tl-208	3.80E-06
Pb-212	1.00E-05
Bi-212	1.00E-05
Po-212	6.49E-06
Po-216	1.00E-05
Ra-224	1.00E-05
Ra-228	6.02E-05
Ac-228	6.02E-05
Th-228	1.00E-05
Th-231	5.80E-05
Th-232	6.11E-04
Th-234	7.43E-02
Pa-234	7.61E-06
Pa-234m	7.43E-02
U-235	5.77E-05
U-238	7.43E-02
Pu-238	5.20E-02
Pu-239	5.03E-04
Pu-240	2.51E-04
Pu-241	5.81E-02
Am-241	7.55E-04

Shipping Site: FNAL	Total Volume (m3/yr)	5.19E+01	Total Mass (kg/yr)	5.11E+04

Radionuclide	Activity (Ci/yr)
H-3	1.81E-01
Cr-51	1.11E-02
Mn-54	2.12E-02
Fe-55	7.94E-02
Fe-59	7.17E-04
Co-58	2.85E-02
Co-60	2.23E-01
Ni-59	1.02E-03
Ni-63	1.45E-01
Zr-95	8.71E-04
Tl-208	3.78E-07
Pb-212	1.00E-06
Bi-212	1.00E-06
Po-212	6.46E-07
Po-216	1.00E-06
Ra-224	1.00E-06
Ra-228	5.99E-06
Ac-228	5.99E-06
Th-228	1.00E-06
Th-231	5.77E-06
Th-232	6.08E-05
Th-234	7.39E-03
Pa-234	7.57E-07
Pa-234m	7.39E-03
U-235	5.75E-06
U-238	7.39E-03

Shipping Site: K-25	Total Volume (m3/yr)	6.90E+03	Total Mass (kg/yr)	4.67E+07

Radionuclide	Activity (Ci/yr)
Tl-208	1.06E-04
Pb-212	2.82E-04
Bi-212	2.82E-04
Po-212	1.82E-04
Po-216	2.82E-04
Ra-224	2.82E-04
Ra-228	1.68E-03
Ac-228	1.68E-03
Th-228	2.82E-04
Th-231	1.62E-03
Th-232	1.71E-02
Th-234	2.08E+00
Pa-234	2.13E-04
Pa-234m	2.08E+00
U-235	1.62E-03
U-238	2.08E+00

Shipping Site: KAPL	Total Volume (m3/yr)	2.11E+02	Total Mass (kg/yr)	5.36E+05

Radionuclide	Activity (Ci/yr)
H-3	5.14E-04
C-14	2.40E-05
Cr-51	5.11E-03
Mn-54	1.24E-02
Fe-55	3.63E-02
Fe-59	3.28E-04
Co-58	1.55E-02
Co-60	1.09E-01
Ni-59	4.69E-04
Ni-63	6.70E-02
Sr-90	2.58E-02
Y-90	2.58E-02
Zr-95	3.99E-04
Tc-99	5.20E-05
Ru-106	2.19E-03
Rh-106	2.19E-03
Sb-125	6.31E-04
Te-125m	1.54E-04
Cs-134	8.14E-03
Cs-137	3.09E-02
Ba-137m	2.92E-02
Ce-144	7.35E-03
Pr-144	7.35E-03
Pr-144m	8.84E-05
Pm-147	1.79E-02
Sm-151	1.75E-04
Eu-152	2.67E-06
Eu-154	4.59E-04
Eu-155	3.64E-04
Tl-208	4.50E-09
Pb-212	1.19E-08
Bi-212	1.19E-08
Po-212	7.60E-09
Po-216	1.19E-08
Ra-224	1.19E-08
Ra-228	7.11E-08
Ac-228	7.11E-08
Th-228	1.19E-08
Th-231	6.84E-08
Th-232	7.21E-07
Th-234	8.77E-05
Pa-234	8.90E-09
Pa-234m	8.77E-05
U-235	6.82E-08
U-238	3.79E-04
Pu-238	5.53E-04
Pu-239	5.35E-06
Pu-240	2.67E-06
Pu-241	6.18E-04
Am-241	8.03E-06

Shipping Site: KCP	Total Volume (m3/yr) 2.65E+00	Total Mass (kg/yr) 7.23E+03

Radionuclide	Activity (Ci/yr)
H-3	2.70E-02
C-14	1.44E-04
Mn-54	1.62E-02
Co-58	1.50E-02
Co-60	4.34E-02
Sr-90	2.04E-02
Y-90	2.04E-02
Tc-99	2.89E-04
Cs-134	3.37E-02
Cs-137	4.44E-02
Ba-137m	4.20E-02
U-238	1.76E-03

Shipping Site: MOUND	Total Volume (m3/yr) 4.40E+03	Total Mass (kg/yr) 9.67E+06

Radionuclide	Activity (Ci/yr)
H-3	1.34E+04
Pu-238	1.60E-01
Pu-239	1.22E-02
Pu-240	4.28E-02
Pu-241	5.90E+00
Am-241	2.44E-04
Cm-242	3.42E-03
Cm-244	1.22E-03

Shipping Site: ORISE	Total Volume (m3/yr) 6.07E+01	Total Mass (kg/yr) 7.36E+04

Radionuclide	Activity (Ci/yr)
H-3	2.00E-02
C-14	1.19E-05
Mn-54	1.34E-03
Co-58	1.24E-03
Co-60	3.59E-03
Sr-90	1.69E-03
Y-90	1.69E-03
Tc-99	2.39E-05
Cs-134	2.79E-03
Cs-137	3.68E-03
Ba-137m	3.48E-03
Tl-208	3.39E-07
Pb-212	8.98E-07
Bi-212	8.98E-07
Po-212	5.78E-07
Po-216	8.98E-07
Ra-224	8.98E-07
Ra-228	5.36E-06
Ac-228	5.36E-06
Th-228	8.98E-07
Th-231	5.16E-06
Th-232	5.44E-05
Th-234	6.62E-03
Pa-234	6.78E-07
Pa-234m	6.62E-03
U-235	5.14E-06
U-238	6.77E-03

Shipping Site: PORTS	Total Volume (m3/yr)	1.07E+04	Total Mass (kg/yr)	6.73E+07

Radionuclide	Activity (Ci/yr)
Tl-208	3.45E-06
Pb-212	9.14E-06
Bi-212	9.14E-06
Po-212	5.89E-06
Po-216	9.14E-06
Ra-224	9.14E-06
Ra-228	5.46E-05
Ac-228	5.46E-05
Th-228	9.14E-06
Th-231	5.26E-05
Th-232	5.55E-04
Th-234	6.74E-02
Pa-234	6.91E-06
Pa-234m	6.74E-02
U-235	5.24E-05
U-238	6.74E-02

Shipping Site: PPPL	Total Volume (m3/yr)	2.45E+01	Total Mass (kg/yr)	6.10E+03

Radionuclide	Activity (Ci/yr)
H-3	2.01E-01
Cr-51	8.50E-04
Mn-54	1.61E-03
Fe-55	6.04E-03
Fe-59	5.46E-05
Co-58	2.17E-03
Co-60	1.70E-02
Ni-63	1.10E-02
Zr-95	6.63E-05

Shipping Site: Paducah	Total Volume (m3/yr)	5.39E+03	Total Mass (kg/yr)	1.20E+07

Radionuclide	Activity (Ci/yr)
Tc-99	8.84E-03
Tl-208	3.72E-05
Pb-212	9.84E-05
Bi-212	9.84E-05
Po-212	6.34E-05
Po-216	9.84E-05
Ra-224	9.84E-05
Ra-228	5.88E-04
Ac-228	5.88E-04
Th-228	9.84E-05
Th-231	5.66E-04
Th-232	5.97E-03
Th-234	7.26E-01
Pa-234	7.44E-05
Pa-234m	7.26E-01
U-235	5.64E-04
U-238	7.26E-01
Np-237	6.63E-03
Pu-239	6.63E-03

Shipping Site: RMI	Total Volume (m3/yr)	5.68E+03	Total Mass (kg/yr)	1.47E+07

Radionuclide	Activity (Ci/yr)
Tl-208	3.58E-07
Pb-212	9.47E-07
Bi-212	9.47E-07
Po-212	6.10E-07
Po-216	9.47E-07
Ra-224	9.47E-07
Ra-228	5.66E-06
Ac-228	5.66E-06
Th-228	9.47E-07
Th-231	5.45E-06
Th-232	5.74E-05
Th-234	6.98E-03
Pa-234	7.15E-07
Pa-234m	6.98E-03
U-235	5.43E-06
U-238	6.98E-03

Shipping Site: Y-12	Total Volume (m3/yr)	1.46E+04	Total Mass (kg/yr)	8.27E+07

Radionuclide	Activity (Ci/yr)
Tl-208	6.80E-05
Pb-212	1.80E-04
Bi-212	1.80E-04
Po-212	1.16E-04
Po-216	1.80E-04
Ra-224	1.80E-04
Ra-228	1.07E-03
Ac-228	1.07E-03
Th-228	1.80E-04
Th-231	1.03E-03
Th-232	1.09E-02
Th-234	1.32E+00
Pa-234	1.36E-04
Pa-234m	1.32E+00
U-235	1.03E-03
U-238	1.32E+00

Destination: SRS

Shipping Site: Pinellas	Total Volume (m3/yr)	1.40E+02	Total Mass (kg/yr)	1.91E+04

Radionuclide	Activity (Ci/yr)
H-3	1.99E+04

A.10 WM LLW REGIONALIZED 3 ALTERNATIVE (CASE 4): ACTIVATED METALS

Transported Material with Radionuclide Profile

Alternative: #4 Minimum Treat -- On-Site -- 6 Site Disposal

Waste Stream: LLW Waste Type: Activated Metal

Destination: INEL

Shipping Site: ANL-W Total Volume (m3/yr) 2.26E+01 Total Mass (kg/yr) 1.64E+05

Radionuclide	Activity (Ci/yr)
H-3	1.71E-06
Cr-51	1.24E-04
Mn-54	2.37E-04
Fe-55	8.86E-04
Fe-59	8.00E-06
Co-58	3.18E-04
Co-60	2.50E-03
Ni-59	1.14E-05
Ni-63	1.64E-03
Sr-90	1.43E-03
Y-90	1.43E-03
Zr-95	9.72E-06
Tc-99	2.56E-07
Ru-106	1.40E-04
Rh-106	1.40E-04
Sb-125	4.03E-05
Te-125m	9.84E-06
Cs-134	1.63E-04
Cs-137	2.00E-01
Ba-137m	2.00E-01
Ce-144	4.69E-04
Pr-144	4.69E-04
Pr-144m	5.64E-06
Pm-147	1.14E-03
Sm-151	1.12E-05
Eu-152	1.71E-07
Eu-154	2.93E-05
Eu-155	2.32E-05
Pu-238	3.53E-05
Pu-239	3.42E-07
Pu-240	1.71E-07
Pu-241	3.95E-05
Am-241	5.13E-07

Shipping Site: NRF Total Volume (m3/yr) 1.29E+03 Total Mass (kg/yr) 9.40E+06

Radionuclide	Activity (Ci/yr)
Cr-51	2.31E+03
Mn-54	4.40E+03
Fe-55	1.64E+04
Fe-59	1.48E+02
Co-58	5.91E+03
Co-60	4.63E+04
Ni-59	2.12E+02
Ni-63	3.01E+04
Zr-95	1.80E+02

Destination: LANL

Shipping Site: SNLA	Total Volume (m3/yr) 1.58E+01	Total Mass (kg/yr) 1.15E+05

Radionuclide	Activity (Ci/yr)
Cr-51	6.54E-04
Mn-54	1.24E-03
Fe-55	4.64E-03
Fe-59	4.20E-05
Co-58	1.67E-03
Co-60	1.31E-02
Ni-59	6.00E-05
Ni-63	8.53E-03
Zr-95	5.10E-05

Destination: NTS

Shipping Site: LBL	Total Volume (m3/yr) 3.95E+01	Total Mass (kg/yr) 2.87E+05

Radionuclide	Activity (Ci/yr)
Cr-51	6.32E-02
Mn-54	1.20E-01
Fe-55	4.49E-01
Fe-59	4.06E-03
Co-58	1.61E-01
Co-60	1.26E+00
Ni-59	5.80E-03
Ni-63	8.24E-01
Zr-95	4.93E-03

Destination: ORNL

Shipping Site: BAPL	Total Volume (m3/yr) 8.84E+02	Total Mass (kg/yr) 6.43E+06

Radionuclide	Activity (Ci/yr)
Cr-51	4.75E+03
Mn-54	9.04E+03
Fe-55	3.37E+04
Fe-59	3.05E+02
Co-58	1.21E+04
Co-60	9.52E+04
Ni-59	4.36E+02
Ni-63	6.19E+04
Zr-95	3.70E+02
Tl-208	1.36E-08
Pb-212	3.60E-08
Bi-212	3.60E-08
Po-212	2.32E-08
Po-216	3.60E-08
Ra-224	3.60E-08
Ra-228	2.15E-07
Ac-228	2.15E-07
Th-228	3.60E-08
Th-231	2.07E-07
Th-232	2.18E-06
Th-234	2.65E-04
Pa-234	2.72E-08
Pa-234m	2.65E-04
U-235	2.06E-07
U-238	2.65E-04

Shipping Site: FNAL	Total Volume (m3/yr)	1.11E+02	Total Mass (kg/yr)	8.14E+05

Radionuclide	Activity (Ci/yr)
Cr-51	3.35E-02
Mn-54	6.39E-02
Fe-55	2.38E-01
Fe-59	2.15E-03
Co-58	8.57E-02
Co-60	6.72E-01
Ni-59	3.08E-03
Ni-63	4.37E-01
Zr-95	2.61E-03

Shipping Site: KAPL	Total Volume (m3/yr)	1.82E+03	Total Mass (kg/yr)	1.33E+07

Radionuclide	Activity (Ci/yr)
H-3	5.15E-04
C-14	2.40E-05
Cr-51	1.13E+04
Mn-54	2.15E+04
Fe-55	8.05E+04
Fe-59	7.28E+02
Co-58	2.89E+04
Co-60	2.27E+05
Ni-59	1.04E+03
Ni-63	1.47E+05
Sr-90	2.62E-02
Y-90	2.62E-02
Zr-95	8.84E+02
Tc-99	5.20E-05
Ru-106	2.22E-03
Rh-106	2.22E-03
Sb-125	6.40E-04
Te-125m	1.56E-04
Cs-134	8.18E-03
Cs-137	3.13E-02
Ba-137m	2.96E-02
Ce-144	7.46E-03
Pr-144	7.46E-03
Pr-144m	8.97E-05
Pm-147	1.82E-02
Sm-151	1.78E-04
Eu-152	2.71E-06
Eu-154	4.66E-04
Eu-155	3.69E-04
Tl-208	2.96E-08
Pb-212	7.83E-08
Bi-212	7.83E-08
Po-212	5.05E-08
Po-216	7.83E-08
Ra-224	7.83E-08
Ra-228	4.68E-07
Ac-228	4.68E-07
Th-228	7.83E-08
Th-231	4.50E-07
Th-232	4.75E-06
Th-234	5.77E-04
Pa-234	5.92E-08
Pa-234m	5.77E-04
U-235	4.48E-07
U-238	8.69E-04
Pu-238	5.61E-04
Pu-239	5.43E-06
Pu-240	2.71E-06
Pu-241	6.28E-04
Am-241	8.15E-06

A.11 WM LLW REGIONALIZED 4 ALTERNATIVE (CASE 12): HETEROGENEOUS SOLIDS

Transported Material with Radionuclide Profile

Alternative: #12 Regional Treat -- 7 Site -- 6 Site Disposal

Waste Stream: LLW Waste Type: All, excl. Act.Metal

Destination: HANF

Shipping Site: LBL	Total Volume (m3/yr)	7.21E+01	Total Mass (kg/yr)	1.08E+04

Radionuclide	Activity (Ci/yr)
H-3	1.82E+01
C-14	8.95E-01
Mn-54	1.00E+02
Co-58	9.31E+01
Co-60	2.69E+02
Sr-90	1.26E+02
Y-90	1.26E+02
Tc-99	1.79E+00
Cs-134	2.08E+02
Cs-137	2.75E+02
Ba-137m	2.60E+02
U-238	1.08E+01
Cm-244	1.05E+01

Shipping Site: LLNL	Total Volume (m3/yr)	1.11E+02	Total Mass (kg/yr)	3.25E+05

Radionuclide	Activity (Ci/yr)
H-3	1.16E+04
C-14	5.38E-04
Mn-54	6.07E-02
Co-58	5.60E-02
Co-60	1.62E-01
Ni-63	1.69E-03
Sr-90	2.27E-01
Y-90	2.27E-01
Tc-99	1.10E-03
Ru-106	1.47E-02
Rh-106	1.47E-02
Sb-125	4.22E-03
Te-125m	1.03E-03
Cs-134	1.42E-01
Cs-137	3.23E-01
Ba-137m	3.06E-01
Ce-144	4.92E-02
Pr-144	4.92E-02
Pr-144m	5.92E-04
Pm-147	1.20E-01
Sm-151	1.17E-03
Eu-152	1.79E-05
Eu-154	3.07E-03
Eu-155	2.44E-03
U-238	6.55E-03
Pu-238	2.72E-02
Pu-239	1.83E-03
Pu-240	6.30E-03
Pu-241	8.69E-01
Am-241	8.97E-05
Cm-242	5.02E-04
Cm-244	1.79E-04

Shipping Site: SLAC	Total Volume (m3/yr)	1.35E-02	Total Mass (kg/yr)	1.24E+01

Radionuclide	Activity (Ci/yr)
Cr-51	2.10E-07
Mn-54	4.00E-07
Fe-55	1.49E-06
Fe-59	1.35E-08
Co-58	5.38E-07
Co-60	4.21E-06
Ni-59	1.93E-08
Ni-63	2.74E-06
Zr-95	1.64E-08

Shipping Site: SNLL	Total Volume (m3/yr)	2.28E+00	Total Mass (kg/yr)	1.92E+03

Radionuclide	Activity (Ci/yr)
H-3	2.82E+04
Fe-55	3.15E-01
Co-60	3.15E-01
Tl-208	5.35E-06
Pb-212	1.41E-05
Bi-212	1.41E-05
Po-212	9.13E-06
Po-216	1.41E-05
Ra-224	1.41E-05
Ra-228	8.47E-05
Ac-228	8.47E-05
Th-228	1.41E-05
Th-231	8.15E-05
Th-232	8.59E-04
Th-234	1.04E-01
Pa-234	1.07E-05
Pa-234m	1.04E-01
U-235	8.12E-05
U-238	1.04E-01

Destination: INEL

Shipping Site: ANL-W

Total Volume (m3/yr)	2.59E+02	Total Mass (kg/yr)	2.12E+05

Radionuclide	Activity (Ci/yr)
H-3	7.83E-04
Cr-51	3.58E+03
Mn-54	6.83E+03
Fe-55	2.54E+04
Fe-59	2.30E+02
Co-58	9.16E+03
Co-60	7.18E+04
Ni-59	3.29E+02
Ni-63	4.67E+04
Sr-90	3.17E-02
Y-90	3.17E-02
Zr-95	2.79E+02
Tc-99	5.66E-06
Ru-106	3.09E-03
Rh-106	3.09E-03
Sb-125	8.89E-04
Te-125m	2.17E-04
Cs-134	3.59E-03
Cs-137	3.32E-02
Ba-137m	3.14E-02
Ce-144	1.03E-02
Pr-144	1.03E-02
Pr-144m	1.24E-04
Pm-147	2.52E-02
Sm-151	2.47E-04
Eu-152	3.77E-06
Eu-154	6.47E-04
Eu-155	5.13E-04
Pu-238	7.81E-04
Pu-239	7.72E-06
Pu-240	4.38E-06
Pu-241	9.56E-04
Am-241	1.13E-05
Cm-242	4.88E-08
Cm-244	1.74E-08

Destination: LANL

Shipping Site: ITRI

Total Volume (m3/yr)	1.34E+02	Total Mass (kg/yr)	1.64E+05

Radionuclide	Activity (Ci/yr)
H-3	6.17E+00
C-14	3.03E-01
Mn-54	3.41E+01
Co-58	3.15E+01
Co-60	9.12E+01
Sr-90	4.28E+01
Y-90	4.28E+01
Tc-99	6.07E-01
Cs-134	7.07E+01
Cs-137	9.33E+01
Ba-137m	8.82E+01
U-238	3.69E+00

Shipping Site: PANT	Total Volume (m3/yr)	3.97E+03	Total Mass (kg/yr)	2.88E+07

Radionuclide	Activity (Ci/yr)
H-3	2.34E+02
Tl-208	2.21E-04
Pb-212	5.86E-04
Bi-212	5.86E-04
Po-212	3.78E-04
Po-216	5.86E-04
Ra-224	5.86E-04
Ra-228	3.50E-03
Ac-228	3.50E-03
Th-228	5.86E-04
Th-231	3.37E-03
Th-232	3.56E-02
Th-234	4.32E+00
Pa-234	4.43E-04
Pa-234m	4.32E+00
U-235	3.36E-03
U-238	4.32E+00

Shipping Site: RFP	Total Volume (m3/yr)	1.27E+03	Total Mass (kg/yr)	6.52E+06

Radionuclide	Activity (Ci/yr)
Tl-208	3.60E-05
Pb-212	9.55E-05
Bi-212	9.55E-05
Po-212	6.15E-05
Po-216	9.55E-05
Ra-224	9.55E-05
Ra-228	5.70E-04
Ac-228	5.70E-04
Th-228	9.55E-05
Th-231	5.49E-04
Th-232	5.79E-03
Th-234	7.04E-01
Pa-234	7.21E-05
Pa-234m	7.04E-01
U-235	5.47E-04
U-238	7.04E-01
Pu-238	5.56E-01
Pu-239	4.24E-02
Pu-240	1.48E-01
Pu-241	2.04E+01
Am-241	8.48E-04
Cm-242	1.18E-02
Cm-244	4.24E-03

Shipping Site: SNLA	Total Volume (m3/yr)	1.19E+02	Total Mass (kg/yr)	3.28E+05

Radionuclide	Activity (Ci/yr)
H-3	3.00E+00
Co-60	2.85E-05
Ni-63	5.67E-05
Sr-90	5.04E-03
Y-90	5.04E-03
Tc-99	9.00E-07
Ru-106	4.92E-04
Rh-106	4.92E-04
Sb-125	1.41E-04
Te-125m	3.45E-05
Cs-134	5.72E-04
Cs-137	5.28E-03
Ba-137m	4.99E-03
Ce-144	1.64E-03
Pr-144	1.64E-03
Pr-144m	1.98E-05
Pm-147	4.02E-03
Sm-151	3.93E-05
Eu-152	6.00E-07
Eu-154	1.02E-04
Eu-155	8.16E-05
Tl-208	5.10E-06
Pb-212	1.35E-05
Bi-212	1.35E-05
Po-212	8.70E-06
Po-216	1.35E-05
Ra-224	1.35E-05
Ra-228	8.07E-05
Ac-228	8.07E-05
Th-228	1.35E-05
Th-231	7.77E-05
Th-232	8.19E-04
Th-234	9.96E-02
Pa-234	1.02E-05
Pa-234m	9.96E-02
U-235	7.74E-05
U-238	9.96E-02
Pu-238	7.87E-02
Pu-239	6.00E-03
Pu-240	2.10E-02
Pu-241	2.89E+00
Am-241	1.21E-04
Cm-242	1.68E-03
Cm-244	6.00E-04

Destination: NTS

Shipping Site: LBL — Total Volume (m3/yr) 1.26E+01 — Total Mass (kg/yr) 3.43E+04

Radionuclide	Activity (Ci/yr)
H-3	6.17E+02
C-14	2.35E-01
Mn-54	2.65E+01
Co-58	2.45E+01
Co-60	7.08E+01
Sr-90	3.33E+01
Y-90	3.33E+01
Tc-99	4.71E-01
Cs-134	5.49E+01
Cs-137	7.25E+01
Ba-137m	6.85E+01
U-238	2.86E+00

Shipping Site: LLNL — Total Volume (m3/yr) 2.98E+02 — Total Mass (kg/yr) 7.42E+05

Radionuclide	Activity (Ci/yr)
H-3	2.16E+04
C-14	1.01E-03
Mn-54	1.14E-01
Co-58	1.05E-01
Co-60	3.06E-01
Ni-63	3.19E-03
Sr-90	4.27E-01
Y-90	4.27E-01
Tc-99	2.07E-03
Ru-106	2.77E-02
Rh-106	2.77E-02
Sb-125	7.96E-03
Te-125m	1.94E-03
Cs-134	2.68E-01
Cs-137	6.09E-01
Ba-137m	5.76E-01
Ce-144	9.27E-02
Pr-144	9.27E-02
Pr-144m	1.11E-03
Pm-147	2.26E-01
Sm-151	2.21E-03
Eu-152	3.38E-05
Eu-154	5.79E-03
Eu-155	4.59E-03
U-238	1.23E-02
Pu-238	5.12E-02
Pu-239	3.44E-03
Pu-240	1.18E-02
Pu-241	1.63E+00
Am-241	1.69E-04
Cm-242	9.46E-04
Cm-244	3.38E-04

Shipping Site: SLAC — Total Volume (m3/yr) 2.73E+02 — Total Mass (kg/yr) 7.45E+05

Radionuclide	Activity (Ci/yr)
Cr-51	3.86E-03
Mn-54	7.36E-03
Fe-55	2.74E-02
Fe-59	2.48E-04
Co-58	9.88E-03
Co-60	7.74E-02
Ni-59	3.54E-04
Ni-63	5.04E-02
Zr-95	3.01E-04

Shipping Site: SNLL	Total Volume (m3/yr)	3.36E+01	Total Mass (kg/yr)	9.17E+04

Radionuclide	Activity (Ci/yr)
H-3	1.38E+01
Tl-208	5.86E-05
Pb-212	1.55E-04
Bi-212	1.55E-04
Po-212	1.00E-04
Po-216	1.55E-04
Ra-224	1.55E-04
Ra-228	9.28E-04
Ac-228	9.28E-04
Th-228	1.55E-04
Th-231	8.93E-04
Th-232	9.42E-03
Th-234	1.14E+00
Pa-234	1.17E-04
Pa-234m	1.14E+00
U-235	8.90E-04
U-238	1.14E+00

Destination: ORNL

Shipping Site: AMES — Total Volume (m3/yr): 1.09E+01 — Total Mass (kg/yr): 2.98E+04

Radionuclide	Activity (Ci/yr)
Tl-208	4.22E-07
Pb-212	1.11E-06
Bi-212	1.11E-06
Po-212	7.20E-07
Po-216	1.11E-06
Ra-224	1.11E-06
Ra-228	6.68E-06
Ac-228	6.68E-06
Th-228	1.11E-06
Th-231	6.43E-06
Th-232	6.77E-05
Th-234	8.24E-03
Pa-234	8.44E-07
Pa-234m	8.24E-03
U-235	6.40E-06
U-238	8.24E-03
Pu-238	6.50E-04
Pu-239	4.96E-05
Pu-240	1.73E-04
Pu-241	2.39E-02
Am-241	9.93E-07
Cm-242	1.39E-05
Cm-244	4.96E-06

Shipping Site: ANL-E — Total Volume (m3/yr): 7.35E+02 — Total Mass (kg/yr): 2.00E+06

Radionuclide	Activity (Ci/yr)
H-3	1.33E+02
C-14	7.91E-02
Cr-51	2.87E+00
Mn-54	1.43E+01
Fe-55	2.04E+01
Fe-59	1.84E-01
Co-58	1.55E+01
Co-60	8.15E+01
Ni-59	2.63E-01
Ni-63	3.77E+01
Sr-90	3.33E+01
Y-90	3.33E+01
Zr-95	2.24E-01
Tc-99	1.62E-01
Ru-106	2.16E+00
Rh-106	2.16E+00
Sb-125	6.21E-01
Te-125m	1.51E-01
Cs-134	2.09E+01
Cs-137	4.75E+01
Ba-137m	4.50E+01
Ce-144	7.24E+00
Pr-144	7.24E+00
Pr-144m	8.70E-02
Pm-147	1.76E+01
Sm-151	1.72E-01
Eu-152	2.63E-03
Eu-154	4.52E-01
Eu-155	3.58E-01
U-238	9.63E-01
Pu-238	5.44E-01
Pu-239	5.27E-03
Pu-240	2.63E-03
Pu-241	6.09E-01
Am-241	7.91E-03

Shipping Site: BAPL	Total Volume (m3/yr) 3.98E+02	Total Mass (kg/yr) 1.08E+06

Radionuclide	Activity (Ci/yr)
H-3	2.51E-03
Co-60	1.19E-02
Ni-63	2.38E-02
Sr-90	2.11E+00
Y-90	2.11E+00
Tc-99	3.77E-04
Ru-106	2.06E-01
Rh-106	2.06E-01
Sb-125	5.93E-02
Te-125m	1.44E-02
Cs-134	2.40E-01
Cs-137	2.21E+00
Ba-137m	2.09E+00
Ce-144	6.91E-01
Pr-144	6.91E-01
Pr-144m	8.31E-03
Pm-147	1.68E+00
Sm-151	1.65E-02
Eu-152	2.51E-04
Eu-154	4.32E-02
Eu-155	3.42E-02
Tl-208	3.80E-06
Pb-212	1.00E-05
Bi-212	1.00E-05
Po-212	6.49E-06
Po-216	1.00E-05
Ra-224	1.00E-05
Ra-228	6.02E-05
Ac-228	6.02E-05
Th-228	1.00E-05
Th-231	5.80E-05
Th-232	6.11E-04
Th-234	7.43E-02
Pa-234	7.61E-06
Pa-234m	7.43E-02
U-235	5.77E-05
U-238	7.43E-02
Pu-238	5.20E-02
Pu-239	5.03E-04
Pu-240	2.51E-04
Pu-241	5.81E-02
Am-241	7.55E-04

Shipping Site: FNAL	Total Volume (m3/yr) 1.11E+01	Total Mass (kg/yr) 2.84E+04

Radionuclide	Activity (Ci/yr)
H-3	2.45E-02
Cr-51	2.53E-03
Mn-54	4.82E-03
Fe-55	1.80E-02
Fe-59	1.62E-04
Co-58	6.48E-03
Co-60	5.08E-02
Ni-59	2.32E-04
Ni-63	3.30E-02
Zr-95	1.97E-04
Tl-208	8.60E-08
Pb-212	2.27E-07
Bi-212	2.27E-07
Po-212	1.46E-07
Po-216	2.27E-07
Ra-224	2.27E-07
Ra-228	1.36E-06
Ac-228	1.36E-06
Th-228	2.27E-07
Th-231	1.31E-06
Th-232	1.38E-05
Th-234	1.67E-03
Pa-234	1.72E-07
Pa-234m	1.67E-03
U-235	1.30E-06
U-238	1.67E-03

Shipping Site: K-25	Total Volume (m3/yr)	6.28E+03	Total Mass (kg/yr)	4.67E+07

Radionuclide	Activity (Ci/yr)
Tl-208	1.06E-04
Pb-212	2.82E-04
Bi-212	2.82E-04
Po-212	1.82E-04
Po-216	2.82E-04
Ra-224	2.82E-04
Ra-228	1.68E-03
Ac-228	1.68E-03
Th-228	2.82E-04
Th-231	1.62E-03
Th-232	1.71E-02
Th-234	2.08E+00
Pa-234	2.13E-04
Pa-234m	2.08E+00
U-235	1.62E-03
U-238	2.08E+00

Shipping Site: KAPL	Total Volume (m3/yr)	2.11E+02	Total Mass (kg/yr)	5.36E+05

Radionuclide	Activity (Ci/yr)
H-3	5.14E-04
C-14	2.40E-05
Cr-51	5.11E-03
Mn-54	1.24E-02
Fe-55	3.63E-02
Fe-59	3.28E-04
Co-58	1.55E-02
Co-60	1.09E-01
Ni-59	4.69E-04
Ni-63	6.70E-02
Sr-90	2.58E-02
Y-90	2.58E-02
Zr-95	3.99E-04
Tc-99	5.20E-05
Ru-106	2.19E-03
Rh-106	2.19E-03
Sb-125	6.31E-04
Te-125m	1.54E-04
Cs-134	8.14E-03
Cs-137	3.09E-02
Ba-137m	2.92E-02
Ce-144	7.35E-03
Pr-144	7.35E-03
Pr-144m	8.84E-05
Pm-147	1.79E-02
Sm-151	1.75E-04
Eu-152	2.67E-06
Eu-154	4.59E-04
Eu-155	3.64E-04
Tl-208	4.50E-09
Pb-212	1.19E-08
Bi-212	1.19E-08
Po-212	7.60E-09
Po-216	1.19E-08
Ra-224	1.19E-08
Ra-228	7.11E-08
Ac-228	7.11E-08
Th-228	1.19E-08
Th-231	6.84E-08
Th-232	7.21E-07
Th-234	8.77E-05
Pa-234	8.90E-09
Pa-234m	8.77E-05
U-235	6.82E-08
U-238	3.79E-04
Pu-238	5.53E-04
Pu-239	5.35E-06
Pu-240	2.67E-06
Pu-241	6.18E-04
Am-241	8.03E-06

Shipping Site: KCP	Total Volume (m3/yr)	2.65E+00	Total Mass (kg/yr)	7.23E+03

Radionuclide	Activity (Ci/yr)
H-3	2.70E-02
C-14	1.44E-04
Mn-54	1.62E-02
Co-58	1.50E-02
Co-60	4.34E-02
Sr-90	2.04E-02
Y-90	2.04E-02
Tc-99	2.89E-04
Cs-134	3.37E-02
Cs-137	4.44E-02
Ba-137m	4.20E-02
U-238	1.76E-03

Shipping Site: MOUND	Total Volume (m3/yr)	3.57E+03	Total Mass (kg/yr)	9.56E+06

Radionuclide	Activity (Ci/yr)
H-3	1.59E+00
Pu-238	1.60E-01
Pu-239	1.22E-02
Pu-240	4.28E-02
Pu-241	5.90E+00
Am-241	2.44E-04
Cm-242	3.42E-03
Cm-244	1.22E-03

Shipping Site: ORISE	Total Volume (m3/yr)	5.77E+01	Total Mass (kg/yr)	7.36E+04

Radionuclide	Activity (Ci/yr)
H-3	2.00E-02
C-14	1.19E-05
Mn-54	1.34E-03
Co-58	1.24E-03
Co-60	3.59E-03
Sr-90	1.69E-03
Y-90	1.69E-03
Tc-99	2.39E-05
Cs-134	2.79E-03
Cs-137	3.68E-03
Ba-137m	3.48E-03
Tl-208	3.39E-07
Pb-212	8.98E-07
Bi-212	8.98E-07
Po-212	5.78E-07
Po-216	8.98E-07
Ra-224	8.98E-07
Ra-228	5.36E-06
Ac-228	5.36E-06
Th-228	8.98E-07
Th-231	5.16E-06
Th-232	5.44E-05
Th-234	6.62E-03
Pa-234	6.78E-07
Pa-234m	6.62E-03
U-235	5.14E-06
U-238	6.77E-03

Shipping Site: PORTS	Total Volume (m3/yr)	1.78E+03	Total Mass (kg/yr)	6.77E+07

Radionuclide	Activity (Ci/yr)
H-3	2.24E+02
Cr-51	8.63E-03
Mn-54	1.64E-02
Fe-55	6.13E-02
Fe-59	5.54E-04
Co-58	2.20E-02
Co-60	1.73E-01
Ni-59	7.92E-04
Ni-63	1.12E-01
Zr-95	6.73E-04
Tl-208	3.79E-06
Pb-212	1.00E-05
Bi-212	1.00E-05
Po-212	6.47E-06
Po-216	1.00E-05
Ra-224	1.00E-05
Ra-228	6.00E-05
Ac-228	6.00E-05
Th-228	1.00E-05
Th-231	5.78E-05
Th-232	6.09E-04
Th-234	7.41E-02
Pa-234	7.59E-06
Pa-234m	7.41E-02
U-235	5.76E-05
U-238	7.41E-02
Pu-238	4.36E-05
Pu-239	3.33E-06
Pu-240	1.16E-05
Pu-241	1.60E-03
Am-241	6.67E-08
Cm-242	9.33E-07
Cm-244	3.33E-07

Shipping Site: PPPL	Total Volume (m3/yr)	4.51E-01	Total Mass (kg/yr)	1.23E+03

Radionuclide	Activity (Ci/yr)
H-3	3.74E-03
Cr-51	8.50E-04
Mn-54	1.61E-03
Fe-55	6.04E-03
Fe-59	5.46E-05
Co-58	2.17E-03
Co-60	1.70E-02
Ni-59	7.80E-05
Ni-63	1.10E-02
Zr-95	6.63E-05

Shipping Site: Paducah	Total Volume (m3/yr)	5.26E+03	Total Mass (kg/yr)	1.19E+07

Radionuclide	Activity (Ci/yr)
Tc-99	8.84E-03
Tl-208	3.72E-05
Pb-212	9.84E-05
Bi-212	9.84E-05
Po-212	6.34E-05
Po-216	9.84E-05
Ra-224	9.84E-05
Ra-228	5.88E-04
Ac-228	5.88E-04
Th-228	9.84E-05
Th-231	5.66E-04
Th-232	5.97E-03
Th-234	7.26E-01
Pa-234	7.44E-05
Pa-234m	7.26E-01
U-235	5.64E-04
U-238	7.26E-01
Np-237	6.63E-03
Pu-239	6.63E-03

Shipping Site: RMI	Total Volume (m3/yr)	5.36E+03	Total Mass (kg/yr)	1.45E+07

Radionuclide	Activity (Ci/yr)
Tl-208	3.38E-07
Pb-212	8.96E-07
Bi-212	8.96E-07
Po-212	5.77E-07
Po-216	8.96E-07
Ra-224	8.96E-07
Ra-228	5.35E-06
Ac-228	5.35E-06
Th-228	8.96E-07
Th-231	5.15E-06
Th-232	5.43E-05
Th-234	6.61E-03
Pa-234	6.77E-07
Pa-234m	6.61E-03
U-235	5.13E-06
U-238	6.61E-03

Shipping Site: Y-12	Total Volume (m3/yr)	1.33E+04	Total Mass (kg/yr)	8.27E+07

Radionuclide	Activity (Ci/yr)
Tl-208	6.80E-05
Pb-212	1.80E-04
Bi-212	1.80E-04
Po-212	1.16E-04
Po-216	1.80E-04
Ra-224	1.80E-04
Ra-228	1.07E-03
Ac-228	1.07E-03
Th-228	1.80E-04
Th-231	1.03E-03
Th-232	1.09E-02
Th-234	1.32E+00
Pa-234	1.36E-04
Pa-234m	1.32E+00
U-235	1.03E-03
U-238	1.32E+00

Destination: PORTS

Shipping Site: AMES — Total Volume (m3/yr): 6.66E-01 — Total Mass (kg/yr): 1.00E+02

Radionuclide	Activity (Ci/yr)
Tl-208	2.83E-08
Pb-212	7.50E-08
Bi-212	7.50E-08
Po-212	4.83E-08
Po-216	7.50E-08
Ra-224	7.50E-08
Ra-228	4.48E-07
Ac-228	4.48E-07
Th-228	7.50E-08
Th-231	4.31E-07
Th-232	4.55E-06
Th-234	5.53E-04
Pa-234	5.67E-08
Pa-234m	5.53E-04
U-235	4.30E-07
U-238	5.53E-04
Pu-238	4.36E-05
Pu-239	3.33E-06
Pu-240	1.16E-05
Pu-241	1.60E-03
Am-241	6.67E-08
Cm-242	9.33E-07
Cm-244	3.33E-07

Shipping Site: FNAL — Total Volume (m3/yr): 3.50E+01 — Total Mass (kg/yr): 1.04E+04

Radionuclide	Activity (Ci/yr)
H-3	1.58E-01
Cr-51	8.63E-03
Mn-54	1.64E-02
Fe-55	6.13E-02
Fe-59	5.54E-04
Co-58	2.20E-02
Co-60	1.73E-01
Ni-59	7.92E-04
Ni-63	1.12E-01
Zr-95	6.73E-04
Tl-208	2.92E-07
Pb-212	7.75E-07
Bi-212	7.75E-07
Po-212	4.99E-07
Po-216	7.75E-07
Ra-224	7.75E-07
Ra-228	4.63E-06
Ac-228	4.63E-06
Th-228	7.75E-07
Th-231	4.46E-06
Th-232	4.70E-05
Th-234	5.71E-03
Pa-234	5.85E-07
Pa-234m	5.71E-03
U-235	4.44E-06
U-238	5.71E-03

Shipping Site: MOUND — Total Volume (m3/yr): 7.60E+02 — Total Mass (kg/yr): 1.14E+05

Radionuclide	Activity (Ci/yr)
H-3	1.34E+04

Shipping Site: PPPL	Total Volume (m3/yr)	2.16E+01	Total Mass (kg/yr)	3.73E+03

Radionuclide	Activity (Ci/yr)
H-3	1.97E-01

Shipping Site: RMI	Total Volume (m3/yr)	2.74E+02	Total Mass (kg/yr)	9.49E+04

Radionuclide	Activity (Ci/yr)
Tl-208	1.94E-08
Pb-212	5.13E-08
Bi-212	5.13E-08
Po-212	3.30E-08
Po-216	5.13E-08
Ra-224	5.13E-08
Ra-228	3.06E-07
Ac-228	3.06E-07
Th-228	5.13E-08
Th-231	2.95E-07
Th-232	3.11E-06
Th-234	3.78E-04
Pa-234	3.87E-08
Pa-234m	3.78E-04
U-235	2.93E-07
U-238	3.78E-04

Destination: SRS

Shipping Site: Pinellas	Total Volume (m3/yr)	1.27E+02	Total Mass (kg/yr)	1.91E+04

Radionuclide	Activity (Ci/yr)
H-3	1.99E+04

A.12 WM LLW REGIONALIZED 4 ALTERNATIVE (CASE 12): ACTIVATED METALS

Transported Material with Radionuclide Profile

Alternative: #12 Regional Treat -- 7 Site -- 6 Site Disposal

Waste Stream: LLW Waste Type: Activated Metal

Destination: HANF

Shipping Site: LBL Total Volume (m3/yr) 3.59E+01 Total Mass (kg/yr) 2.87E+05

Radionuclide	Activity (Ci/yr)
Cr-51	6.32E-02
Mn-54	1.20E-01
Fe-55	4.49E-01
Fe-59	4.06E-03
Co-58	1.61E-01
Co-60	1.26E+00
Ni-59	5.80E-03
Ni-63	8.24E-01
Zr-95	4.93E-03

Destination: INEL

Shipping Site: ANL-W Total Volume (m3/yr) 2.06E+01 Total Mass (kg/yr) 1.64E+05

Radionuclide	Activity (Ci/yr)
H-3	1.71E-06
Cr-51	1.24E-04
Mn-54	2.37E-04
Fe-55	8.86E-04
Fe-59	8.00E-06
Co-58	3.18E-04
Co-60	2.50E-03
Ni-59	1.14E-05
Ni-63	1.64E-03
Sr-90	1.43E-03
Y-90	1.43E-03
Zr-95	9.72E-06
Tc-99	2.56E-07
Ru-106	1.40E-04
Rh-106	1.40E-04
Sb-125	4.03E-05
Te-125m	9.84E-06
Cs-134	1.63E-04
Cs-137	2.00E-01
Ba-137m	2.00E-01
Ce-144	4.69E-04
Pr-144	4.69E-04
Pr-144m	5.64E-06
Pm-147	1.14E-03
Sm-151	1.12E-05
Eu-152	1.71E-07
Eu-154	2.93E-05
Eu-155	2.32E-05
Pu-238	3.53E-05
Pu-239	3.42E-07
Pu-240	1.71E-07
Pu-241	3.95E-05
Am-241	5.13E-07

Shipping Site: NRF	Total Volume (m3/yr)	1.17E+03	Total Mass (kg/yr)	9.40E+06

Radionuclide	Activity (Ci/yr)
Cr-51	2.31E+03
Mn-54	4.40E+03
Fe-55	1.64E+04
Fe-59	1.48E+02
Co-58	5.91E+03
Co-60	4.63E+04
Ni-59	2.12E+02
Ni-63	3.01E+04
Zr-95	1.80E+02

Destination: LANL

Shipping Site: SNLA	Total Volume (m3/yr)	1.43E+01	Total Mass (kg/yr)	1.15E+05

Radionuclide	Activity (Ci/yr)
Cr-51	6.54E-04
Mn-54	1.24E-03
Fe-55	4.64E-03
Fe-59	4.20E-05
Co-58	1.67E-03
Co-60	1.31E-02
Ni-59	6.00E-05
Ni-63	8.53E-03
Zr-95	5.10E-05

Destination: ORNL

Shipping Site: PORTS

Total Volume (m3/yr): 4.71E+02

Total Mass (kg/yr): 2.05E+07

Radionuclide	Activity (Ci/yr)
H-3	5.15E-04
C-14	2.40E-05
Cr-51	1.60E+04
Mn-54	3.06E+04
Fe-55	1.14E+05
Fe-59	1.03E+03
Co-58	4.11E+04
Co-60	3.22E+05
Ni-59	1.47E+03
Ni-63	2.09E+05
Sr-90	2.62E-02
Y-90	2.62E-02
Zr-95	1.25E+03
Tc-99	5.20E-05
Ru-106	2.22E-03
Rh-106	2.22E-03
Sb-125	6.40E-04
Te-125m	1.56E-04
Cs-134	8.18E-03
Cs-137	3.13E-02
Ba-137m	2.96E-02
Ce-144	7.46E-03
Pr-144	7.46E-03
Pr-144m	8.97E-05
Pm-147	1.82E-02
Sm-151	1.78E-04
Eu-152	2.71E-06
Eu-154	4.66E-04
Eu-155	3.69E-04
Tl-208	4.32E-08
Pb-212	1.14E-07
Bi-212	1.14E-07
Po-212	7.37E-08
Po-216	1.14E-07
Ra-224	1.14E-07
Ra-228	6.83E-07
Ac-228	6.83E-07
Th-228	1.14E-07
Th-231	6.57E-07
Th-232	6.93E-06
Th-234	8.43E-04
Pa-234	8.64E-08
Pa-234m	8.43E-04
U-235	6.55E-07
U-238	1.13E-03
Pu-238	5.61E-04
Pu-239	5.43E-06
Pu-240	2.71E-06
Pu-241	6.28E-04
Am-241	8.15E-06

Destination: PORTS

Shipping Site: BAPL	Total Volume (m3/yr)	8.03E+02	Total Mass (kg/yr)	6.43E+06

Radionuclide	Activity (Ci/yr)
Cr-51	4.75E+03
Mn-54	9.04E+03
Fe-55	3.37E+04
Fe-59	3.05E+02
Co-58	1.21E+04
Co-60	9.52E+04
Ni-59	4.36E+02
Ni-63	6.19E+04
Zr-95	3.70E+02
Tl-208	1.36E-08
Pb-212	3.60E-08
Bi-212	3.60E-08
Po-212	2.32E-08
Po-216	3.60E-08
Ra-224	3.60E-08
Ra-228	2.15E-07
Ac-228	2.15E-07
Th-228	3.60E-08
Th-231	2.07E-07
Th-232	2.18E-06
Th-234	2.65E-04
Pa-234	2.72E-08
Pa-234m	2.65E-04
U-235	2.06E-07
U-238	2.65E-04

Shipping Site: FNAL	Total Volume (m3/yr)	1.01E+02	Total Mass (kg/yr)	8.14E+05

Radionuclide	Activity (Ci/yr)
Cr-51	3.35E-02
Mn-54	6.39E-02
Fe-55	2.38E-01
Fe-59	2.15E-03
Co-58	8.57E-02
Co-60	6.72E-01
Ni-59	3.08E-03
Ni-63	4.37E-01
Zr-95	2.61E-03

Shipping Site: KAPL	Total Volume (m3/yr) 1.66E+03	Total Mass (kg/yr) 1.33E+07

Radionuclide	Activity (Ci/yr)
H-3	5.15E-04
C-14	2.40E-05
Cr-51	1.13E+04
Mn-54	2.15E+04
Fe-55	8.05E+04
Fe-59	7.28E+02
Co-58	2.89E+04
Co-60	2.27E+05
Ni-59	1.04E+03
Ni-63	1.47E+05
Sr-90	2.62E-02
Y-90	2.62E-02
Zr-95	8.84E+02
Tc-99	5.20E-05
Ru-106	2.22E-03
Rh-106	2.22E-03
Sb-125	6.40E-04
Te-125m	1.56E-04
Cs-134	8.18E-03
Cs-137	3.13E-02
Ba-137m	2.96E-02
Ce-144	7.46E-03
Pr-144	7.46E-03
Pr-144m	8.97E-05
Pm-147	1.82E-02
Sm-151	1.78E-04
Eu-152	2.71E-06
Eu-154	4.66E-04
Eu-155	3.69E-04
Tl-208	2.96E-08
Pb-212	7.83E-08
Bi-212	7.83E-08
Po-212	5.05E-08
Po-216	7.83E-08
Ra-224	7.83E-08
Ra-228	4.68E-07
Ac-228	4.68E-07
Th-228	7.83E-08
Th-231	4.50E-07
Th-232	4.75E-06
Th-234	5.77E-04
Pa-234	5.92E-08
Pa-234m	5.77E-04
U-235	4.48E-07
U-238	8.69E-04
Pu-238	5.61E-04
Pu-239	5.43E-06
Pu-240	2.71E-06
Pu-241	6.28E-04
Am-241	8.15E-06

A.13 WM LLW REGIONALIZED 5 ALTERNATIVE (CASE 19): HETEROGENEOUS SOLIDS

Transported Material with Radionuclide Profile

Alternative: #19 Regional Treat -- 4 Site -- 6 Site Disposal

Waste Stream: LLW Waste Type: All, excl. Act.Metal

Destination: HANF

Shipping Site: LBL	Total Volume (m3/yr)	7.21E+01	Total Mass (kg/yr)	1.08E+04

Radionuclide	Activity (Ci/yr)
H-3	1.82E+01
C-14	8.95E-01
Mn-54	1.00E+02
Co-58	9.31E+01
Co-60	2.69E+02
Sr-90	1.26E+02
Y-90	1.26E+02
Tc-99	1.79E+00
Cs-134	2.08E+02
Cs-137	2.75E+02
Ba-137m	2.60E+02
U-238	1.08E+01
Cm-244	1.05E+01

Shipping Site: LLNL	Total Volume (m3/yr)	1.11E+02	Total Mass (kg/yr)	3.25E+05

Radionuclide	Activity (Ci/yr)
H-3	1.16E+04
C-14	5.38E-04
Mn-54	6.07E-02
Co-58	5.60E-02
Co-60	1.62E-01
Ni-63	1.69E-03
Sr-90	2.27E-01
Y-90	2.27E-01
Tc-99	1.10E-03
Ru-106	1.47E-02
Rh-106	1.47E-02
Sb-125	4.22E-03
Te-125m	1.03E-03
Cs-134	1.42E-01
Cs-137	3.23E-01
Ba-137m	3.06E-01
Ce-144	4.92E-02
Pr-144	4.92E-02
Pr-144m	5.92E-04
Pm-147	1.20E-01
Sm-151	1.17E-03
Eu-152	1.79E-05
Eu-154	3.07E-03
Eu-155	2.44E-03
U-238	6.55E-03
Pu-238	2.72E-02
Pu-239	1.83E-03
Pu-240	6.30E-03
Pu-241	8.69E-01
Am-241	8.97E-05
Cm-242	5.02E-04
Cm-244	1.79E-04

Shipping Site: SLAC	Total Volume (m3/yr)	1.35E-02	Total Mass (kg/yr)	1.24E+01

Radionuclide	Activity (Ci/yr)
Cr-51	2.10E-07
Mn-54	4.00E-07
Fe-55	1.49E-06
Fe-59	1.35E-08
Co-58	5.38E-07
Co-60	4.21E-06
Ni-59	1.93E-08
Ni-63	2.74E-06
Zr-95	1.64E-08

Shipping Site: SNLL	Total Volume (m3/yr)	2.28E+00	Total Mass (kg/yr)	1.92E+03

Radionuclide	Activity (Ci/yr)
H-3	2.82E+04
Fe-55	3.15E-01
Co-60	3.15E-01
Tl-208	5.35E-06
Pb-212	1.41E-05
Bi-212	1.41E-05
Po-212	9.13E-06
Po-216	1.41E-05
Ra-224	1.41E-05
Ra-228	8.47E-05
Ac-228	8.47E-05
Th-228	1.41E-05
Th-231	8.15E-05
Th-232	8.59E-04
Th-234	1.04E-01
Pa-234	1.07E-05
Pa-234m	1.04E-01
U-235	8.12E-05
U-238	1.04E-01

Destination: INEL

Shipping Site: ANL-W	Total Volume (m3/yr)	2.59E+02	Total Mass (kg/yr)	2.12E+05

Radionuclide	Activity (Ci/yr)
H-3	7.83E-04
Cr-51	3.58E+03
Mn-54	6.83E+03
Fe-55	2.54E+04
Fe-59	2.30E+02
Co-58	9.16E+03
Co-60	7.18E+04
Ni-59	3.29E+02
Ni-63	4.67E+04
Sr-90	3.17E-02
Y-90	3.17E-02
Zr-95	2.79E+02
Tc-99	5.66E-06
Ru-106	3.09E-03
Rh-106	3.09E-03
Sb-125	8.89E-04
Te-125m	2.17E-04
Cs-134	3.59E-03
Cs-137	3.32E-02
Ba-137m	3.14E-02
Ce-144	1.03E-02
Pr-144	1.03E-02
Pr-144m	1.24E-04
Pm-147	2.52E-02
Sm-151	2.47E-04
Eu-152	3.77E-06
Eu-154	6.47E-04
Eu-155	5.13E-04
Pu-238	7.81E-04
Pu-239	7.72E-06
Pu-240	4.38E-06
Pu-241	9.56E-04
Am-241	1.13E-05
Cm-242	4.88E-08
Cm-244	1.74E-08

Shipping Site: ITRI	Total Volume (m3/yr)	7.80E+01	Total Mass (kg/yr)	1.17E+04

Radionuclide	Activity (Ci/yr)
H-3	3.73E+00
C-14	1.83E-01
Mn-54	2.06E+01
Co-58	1.90E+01
Co-60	5.51E+01
Sr-90	2.59E+01
Y-90	2.59E+01
Tc-99	3.67E-01
Cs-134	4.27E+01
Cs-137	5.64E+01
Ba-137m	5.33E+01
U-238	2.23E+00

Shipping Site: LANL	Total Volume (m3/yr) 1.03E+04	Total Mass (kg/yr) 1.55E+06

Radionuclide	Activity (Ci/yr)
H-3	3.84E+05
Cr-51	4.64E-03
Mn-54	8.83E-03
Fe-55	3.29E-02
Fe-59	2.98E-04
Co-58	1.18E-02
Co-60	3.65E+02
Ni-59	4.26E-04
Ni-63	7.27E+02
Sr-90	6.46E+04
Y-90	6.46E+04
Zr-95	3.62E-04
Tc-99	1.15E+01
Ru-106	6.31E+03
Rh-106	6.31E+03
Sb-125	1.81E+03
Te-125m	4.42E+02
Cs-134	7.34E+03
Cs-137	6.77E+04
Ba-137m	6.41E+04
Ce-144	2.11E+04
Pr-144	2.11E+04
Pr-144m	2.54E+02
Pm-147	5.16E+04
Sm-151	5.04E+02
Eu-152	7.70E+00
Eu-154	1.32E+03
Eu-155	1.04E+03
Tl-208	1.66E-02
Pb-212	4.41E-02
Bi-212	4.41E-02
Po-212	2.84E-02
Po-216	4.41E-02
Ra-224	4.41E-02
Ra-228	2.64E-01
Ac-228	2.64E-01
Th-228	4.41E-02
Th-231	2.54E-01
Th-232	2.68E+00
Th-234	3.25E+02
Pa-234	3.33E-02
Pa-234m	3.25E+02
U-235	2.53E-01
U-238	3.25E+02
Pu-238	1.59E+03
Pu-239	1.57E+01
Pu-240	8.93E+00
Pu-241	1.94E+03
Am-241	2.31E+01
Cm-242	9.84E-02
Cm-244	3.51E-02

Shipping Site: PANT	Total Volume (m3/yr) 3.80E+03	Total Mass (kg/yr) 2.84E+07

Radionuclide	Activity (Ci/yr)
H-3	2.25E+02
Tl-208	2.12E-04
Pb-212	5.63E-04
Bi-212	5.63E-04
Po-212	3.62E-04
Po-216	5.63E-04
Ra-224	5.63E-04
Ra-228	3.36E-03
Ac-228	3.36E-03
Th-228	5.63E-04
Th-231	3.24E-03
Th-232	3.41E-02
Th-234	4.15E+00
Pa-234	4.25E-04
Pa-234m	4.15E+00
U-235	3.22E-03
U-238	4.15E+00

Shipping Site: RFP	Total Volume (m3/yr)	3.22E+03	Total Mass (kg/yr)	3.76E+06

Radionuclide	Activity (Ci/yr)
Tl-208	2.83E-05
Pb-212	7.49E-05
Bi-212	7.49E-05
Po-212	4.83E-05
Po-216	7.49E-05
Ra-224	7.49E-05
Ra-228	4.48E-04
Ac-228	4.48E-04
Th-228	7.49E-05
Th-231	4.31E-04
Th-232	4.54E-03
Th-234	5.53E-01
Pa-234	5.66E-05
Pa-234m	5.53E-01
U-235	4.29E-04
U-238	5.53E-01
Pu-238	4.36E-01
Pu-239	3.33E-02
Pu-240	1.16E-01
Pu-241	1.60E+01
Am-241	6.66E-04
Cm-242	9.33E-03
Cm-244	3.33E-03

Shipping Site: SNLA	Total Volume (m3/yr)	5.39E-01	Total Mass (kg/yr)	4.31E+03

Radionuclide	Activity (Ci/yr)
Tl-208	5.10E-06
Pb-212	1.35E-05
Bi-212	1.35E-05
Po-212	8.70E-06
Po-216	1.35E-05
Ra-224	1.35E-05
Ra-228	8.07E-05
Ac-228	8.07E-05
Th-228	1.35E-05
Th-231	7.77E-05
Th-232	8.19E-04
Th-234	9.96E-02
Pa-234	1.02E-05
Pa-234m	9.96E-02
U-235	7.74E-05
U-238	9.96E-02

Destination: LANL

Shipping Site: INEL — Total Volume (m3/yr): 8.97E+02 — Total Mass (kg/yr): 1.66E+06

Radionuclide	Activity (Ci/yr)
H-3	3.83E+05
Cr-51	4.64E-03
Mn-54	8.83E-03
Fe-55	3.29E-02
Fe-59	2.98E-04
Co-58	1.18E-02
Co-60	3.65E+02
Ni-59	4.25E-04
Ni-63	7.27E+02
Sr-90	6.46E+04
Y-90	6.46E+04
Zr-95	3.62E-04
Tc-99	1.15E+01
Ru-106	6.31E+03
Rh-106	6.31E+03
Sb-125	1.81E+03
Te-125m	4.42E+02
Cs-134	7.34E+03
Cs-137	6.77E+04
Ba-137m	6.41E+04
Ce-144	2.11E+04
Pr-144	2.11E+04
Pr-144m	2.54E+02
Pm-147	5.16E+04
Sm-151	5.04E+02
Eu-152	7.70E+00
Eu-154	1.32E+03
Eu-155	1.04E+03
Tl-208	1.66E-02
Pb-212	4.41E-02
Bi-212	4.41E-02
Po-212	2.84E-02
Po-216	4.41E-02
Ra-224	4.41E-02
Ra-228	2.64E-01
Ac-228	2.64E-01
Th-228	4.41E-02
Th-231	2.54E-01
Th-232	2.68E+00
Th-234	3.25E+02
Pa-234	3.33E-02
Pa-234m	3.25E+02
U-235	2.53E-01
U-238	3.25E+02
Pu-238	1.59E+03
Pu-239	1.57E+01
Pu-240	8.93E+00
Pu-241	1.94E+03
Am-241	2.31E+01
Cm-242	9.84E-02
Cm-244	3.51E-02

Shipping Site: ITRI — Total Volume (m3/yr): 5.61E+01 — Total Mass (kg/yr): 1.53E+05

Radionuclide	Activity (Ci/yr)
H-3	2.44E+00
C-14	1.20E-01
Mn-54	1.35E+01
Co-58	1.24E+01
Co-60	3.60E+01
Sr-90	1.69E+01
Y-90	1.69E+01
Tc-99	2.40E-01
Cs-134	2.79E+01
Cs-137	3.69E+01
Ba-137m	3.49E+01
U-238	1.46E+00

Shipping Site: PANT	Total Volume (m3/yr)	1.70E+02	Total Mass (kg/yr)	4.66E+05

Radionuclide	Activity (Ci/yr)
H-3	9.18E+00
Tl-208	8.99E-06
Pb-212	2.38E-05
Bi-212	2.38E-05
Po-212	1.53E-05
Po-216	2.38E-05
Ra-224	2.38E-05
Ra-228	1.42E-04
Ac-228	1.42E-04
Th-228	2.38E-05
Th-231	1.37E-04
Th-232	1.44E-03
Th-234	1.75E-01
Pa-234	1.79E-05
Pa-234m	1.75E-01
U-235	1.36E-04
U-238	1.75E-01

Shipping Site: RFP	Total Volume (m3/yr)	1.01E+03	Total Mass (kg/yr)	2.72E+06

Radionuclide	Activity (Ci/yr)
Tl-208	7.75E-06
Pb-212	2.05E-05
Bi-212	2.05E-05
Po-212	1.32E-05
Po-216	2.05E-05
Ra-224	2.05E-05
Ra-228	1.22E-04
Ac-228	1.22E-04
Th-228	2.05E-05
Th-231	1.18E-04
Th-232	1.24E-03
Th-234	1.51E-01
Pa-234	1.55E-05
Pa-234m	1.51E-01
U-235	1.17E-04
U-238	1.51E-01
Pu-238	1.19E-01
Pu-239	9.11E-03
Pu-240	3.19E-02
Pu-241	4.39E+00
Am-241	1.82E-04
Cm-242	2.55E-03
Cm-244	9.11E-04

Shipping Site: SNLA	Total Volume (m3/yr) 1.18E+02	Total Mass (kg/yr) 3.24E+05

Radionuclide	Activity (Ci/yr)
H-3	3.00E+00
Co-60	2.85E-05
Ni-63	5.67E-05
Sr-90	5.04E-03
Y-90	5.04E-03
Tc-99	9.00E-07
Ru-106	4.92E-04
Rh-106	4.92E-04
Sb-125	1.41E-04
Te-125m	3.45E-05
Cs-134	5.72E-04
Cs-137	5.28E-03
Ba-137m	4.99E-03
Ce-144	1.64E-03
Pr-144	1.64E-03
Pr-144m	1.98E-05
Pm-147	4.02E-03
Sm-151	3.93E-05
Eu-152	6.00E-07
Eu-154	1.02E-04
Eu-155	8.16E-05
Pu-238	7.87E-02
Pu-239	6.00E-03
Pu-240	2.10E-02
Pu-241	2.89E+00
Am-241	1.21E-04
Cm-242	1.68E-03
Cm-244	6.00E-04

Destination: NTS

Shipping Site: LBL — Total Volume (m3/yr) 1.26E+01 — Total Mass (kg/yr) 3.43E+04

Radionuclide	Activity (Ci/yr)
H-3	6.17E+02
C-14	2.35E-01
Mn-54	2.65E+01
Co-58	2.45E+01
Co-60	7.08E+01
Sr-90	3.33E+01
Y-90	3.33E+01
Tc-99	4.71E-01
Cs-134	5.49E+01
Cs-137	7.25E+01
Ba-137m	6.85E+01
U-238	2.86E+00

Shipping Site: LLNL — Total Volume (m3/yr) 2.98E+02 — Total Mass (kg/yr) 7.42E+05

Radionuclide	Activity (Ci/yr)
H-3	2.16E+04
C-14	1.01E-03
Mn-54	1.14E-01
Co-58	1.05E-01
Co-60	3.06E-01
Ni-63	3.19E-03
Sr-90	4.27E-01
Y-90	4.27E-01
Tc-99	2.07E-03
Ru-106	2.77E-02
Rh-106	2.77E-02
Sb-125	7.96E-03
Te-125m	1.94E-03
Cs-134	2.68E-01
Cs-137	6.09E-01
Ba-137m	5.76E-01
Ce-144	9.27E-02
Pr-144	9.27E-02
Pr-144m	1.11E-03
Pm-147	2.26E-01
Sm-151	2.21E-03
Eu-152	3.38E-05
Eu-154	5.79E-03
Eu-155	4.59E-03
U-238	1.23E-02
Pu-238	5.12E-02
Pu-239	3.44E-03
Pu-240	1.18E-02
Pu-241	1.63E+00
Am-241	1.69E-04
Cm-242	9.46E-04
Cm-244	3.38E-04

Shipping Site: SLAC — Total Volume (m3/yr) 2.73E+02 — Total Mass (kg/yr) 7.45E+05

Radionuclide	Activity (Ci/yr)
Cr-51	3.86E-03
Mn-54	7.36E-03
Fe-55	2.74E-02
Fe-59	2.48E-04
Co-58	9.88E-03
Co-60	7.74E-02
Ni-59	3.54E-04
Ni-63	5.04E-02
Zr-95	3.01E-04

Shipping Site: SNLL	Total Volume (m3/yr)	3.36E+01	Total Mass (kg/yr)	9.17E+04

Radionuclide	Activity (Ci/yr)
H-3	1.38E+01
Tl-208	5.86E-05
Pb-212	1.55E-04
Bi-212	1.55E-04
Po-212	1.00E-04
Po-216	1.55E-04
Ra-224	1.55E-04
Ra-228	9.28E-04
Ac-228	9.28E-04
Th-228	1.55E-04
Th-231	8.93E-04
Th-232	9.42E-03
Th-234	1.14E+00
Pa-234	1.17E-04
Pa-234m	1.14E+00
U-235	8.90E-04
U-238	1.14E+00

Destination: ORNL

Shipping Site: AMES — Total Volume (m3/yr) 1.15E+01 — Total Mass (kg/yr) 2.99E+04

Radionuclide	Activity (Ci/yr)
Tl-208	4.50E-07
Pb-212	1.19E-06
Bi-212	1.19E-06
Po-212	7.68E-07
Po-216	1.19E-06
Ra-224	1.19E-06
Ra-228	7.12E-06
Ac-228	7.12E-06
Th-228	1.19E-06
Th-231	6.86E-06
Th-232	7.23E-05
Th-234	8.79E-03
Pa-234	9.01E-07
Pa-234m	8.79E-03
U-235	6.83E-06
U-238	8.79E-03
Pu-238	6.94E-04
Pu-239	5.30E-05
Pu-240	1.85E-04
Pu-241	2.55E-02
Am-241	1.06E-06
Cm-242	1.48E-05
Cm-244	5.30E-06

Shipping Site: ANL-E — Total Volume (m3/yr) 7.35E+02 — Total Mass (kg/yr) 2.00E+06

Radionuclide	Activity (Ci/yr)
H-3	1.33E+02
C-14	7.91E-02
Cr-51	2.87E+00
Mn-54	1.43E+01
Fe-55	2.04E+01
Fe-59	1.84E-01
Co-58	1.55E+01
Co-60	8.15E+01
Ni-59	2.63E-01
Ni-63	3.77E+01
Sr-90	3.33E+01
Y-90	3.33E+01
Zr-95	2.24E-01
Tc-99	1.62E-01
Ru-106	2.16E+00
Rh-106	2.16E+00
Sb-125	6.21E-01
Te-125m	1.51E-01
Cs-134	2.09E+01
Cs-137	4.75E+01
Ba-137m	4.50E+01
Ce-144	7.24E+00
Pr-144	7.24E+00
Pr-144m	8.70E-02
Pm-147	1.76E+01
Sm-151	1.72E-01
Eu-152	2.63E-03
Eu-154	4.52E-01
Eu-155	3.58E-01
U-238	9.63E-01
Pu-238	5.44E-01
Pu-239	5.27E-03
Pu-240	2.63E-03
Pu-241	6.09E-01
Am-241	7.91E-03

Shipping Site: BAPL	Total Volume (m3/yr)	3.98E+02	Total Mass (kg/yr)	1.08E+06

Radionuclide	Activity (Ci/yr)
H-3	2.51E-03
Co-60	1.19E-02
Ni-63	2.38E-02
Sr-90	2.11E+00
Y-90	2.11E+00
Tc-99	3.77E-04
Ru-106	2.06E-01
Rh-106	2.06E-01
Sb-125	5.93E-02
Te-125m	1.44E-02
Cs-134	2.40E-01
Cs-137	2.21E+00
Ba-137m	2.09E+00
Ce-144	6.91E-01
Pr-144	6.91E-01
Pr-144m	8.31E-03
Pm-147	1.68E+00
Sm-151	1.65E-02
Eu-152	2.51E-04
Eu-154	4.32E-02
Eu-155	3.42E-02
Tl-208	3.80E-06
Pb-212	1.00E-05
Bi-212	1.00E-05
Po-212	6.49E-06
Po-216	1.00E-05
Ra-224	1.00E-05
Ra-228	6.02E-05
Ac-228	6.02E-05
Th-228	1.00E-05
Th-231	5.80E-05
Th-232	6.11E-04
Th-234	7.43E-02
Pa-234	7.61E-06
Pa-234m	7.43E-02
U-235	5.77E-05
U-238	7.43E-02
Pu-238	5.20E-02
Pu-239	5.03E-04
Pu-240	2.51E-04
Pu-241	5.81E-02
Am-241	7.55E-04

Shipping Site: FNAL	Total Volume (m3/yr)	4.90E+01	Total Mass (kg/yr)	3.89E+04

Radionuclide	Activity (Ci/yr)
H-3	1.82E-01
Cr-51	1.11E-02
Mn-54	2.12E-02
Fe-55	7.94E-02
Fe-59	7.17E-04
Co-58	2.85E-02
Co-60	2.23E-01
Ni-59	1.02E-03
Ni-63	1.45E-01
Zr-95	8.71E-04
Tl-208	3.78E-07
Pb-212	1.00E-06
Bi-212	1.00E-06
Po-212	6.46E-07
Po-216	1.00E-06
Ra-224	1.00E-06
Ra-228	5.99E-06
Ac-228	5.99E-06
Th-228	1.00E-06
Th-231	5.77E-06
Th-232	6.08E-05
Th-234	7.39E-03
Pa-234	7.57E-07
Pa-234m	7.39E-03
U-235	5.75E-06
U-238	7.39E-03

Shipping Site: K-25	Total Volume (m3/yr)	6.28E+03	Total Mass (kg/yr)	4.67E+07

Radionuclide	Activity (Ci/yr)
Tl-208	1.06E-04
Pb-212	2.82E-04
Bi-212	2.82E-04
Po-212	1.82E-04
Po-216	2.82E-04
Ra-224	2.82E-04
Ra-228	1.68E-03
Ac-228	1.68E-03
Th-228	2.82E-04
Th-231	1.62E-03
Th-232	1.71E-02
Th-234	2.08E+00
Pa-234	2.13E-04
Pa-234m	2.08E+00
U-235	1.62E-03
U-238	2.08E+00

Shipping Site: KAPL	Total Volume (m3/yr)	2.11E+02	Total Mass (kg/yr)	5.36E+05

Radionuclide	Activity (Ci/yr)
H-3	5.14E-04
C-14	2.40E-05
Cr-51	5.11E-03
Mn-54	1.24E-02
Fe-55	3.63E-02
Fe-59	3.28E-04
Co-58	1.55E-02
Co-60	1.09E-01
Ni-59	4.69E-04
Ni-63	6.70E-02
Sr-90	2.58E-02
Y-90	2.58E-02
Zr-95	3.99E-04
Tc-99	5.20E-05
Ru-106	2.19E-03
Rh-106	2.19E-03
Sb-125	6.31E-04
Te-125m	1.54E-04
Cs-134	8.14E-03
Cs-137	3.09E-02
Ba-137m	2.92E-02
Ce-144	7.35E-03
Pr-144	7.35E-03
Pr-144m	8.84E-05
Pm-147	1.79E-02
Sm-151	1.75E-04
Eu-152	2.67E-06
Eu-154	4.59E-04
Eu-155	3.64E-04
Tl-208	4.50E-09
Pb-212	1.19E-08
Bi-212	1.19E-08
Po-212	7.60E-09
Po-216	1.19E-08
Ra-224	1.19E-08
Ra-228	7.11E-08
Ac-228	7.11E-08
Th-228	1.19E-08
Th-231	6.84E-08
Th-232	7.21E-07
Th-234	8.77E-05
Pa-234	8.90E-09
Pa-234m	8.77E-05
U-235	6.82E-08
U-238	3.79E-04
Pu-238	5.53E-04
Pu-239	5.35E-06
Pu-240	2.67E-06
Pu-241	6.18E-04
Am-241	8.03E-06

Shipping Site: KCP	Total Volume (m3/yr)	2.65E+00	Total Mass (kg/yr)	7.23E+03

Radionuclide	Activity (Ci/yr)
H-3	2.70E-02
C-14	1.44E-04
Mn-54	1.62E-02
Co-58	1.50E-02
Co-60	4.34E-02
Sr-90	2.04E-02
Y-90	2.04E-02
Tc-99	2.89E-04
Cs-134	3.37E-02
Cs-137	4.44E-02
Ba-137m	4.20E-02
U-238	1.76E-03

Shipping Site: MOUND	Total Volume (m3/yr)	4.33E+03	Total Mass (kg/yr)	9.67E+06

Radionuclide	Activity (Ci/yr)
H-3	1.34E+04
Pu-238	1.60E-01
Pu-239	1.22E-02
Pu-240	4.28E-02
Pu-241	5.90E+00
Am-241	2.44E-04
Cm-242	3.42E-03
Cm-244	1.22E-03

Shipping Site: ORISE	Total Volume (m3/yr)	5.77E+01	Total Mass (kg/yr)	7.36E+04

Radionuclide	Activity (Ci/yr)
H-3	2.00E-02
C-14	1.19E-05
Mn-54	1.34E-03
Co-58	1.24E-03
Co-60	3.59E-03
Sr-90	1.69E-03
Y-90	1.69E-03
Tc-99	2.39E-05
Cs-134	2.79E-03
Cs-137	3.68E-03
Ba-137m	3.48E-03
Tl-208	3.39E-07
Pb-212	8.98E-07
Bi-212	8.98E-07
Po-212	5.78E-07
Po-216	8.98E-07
Ra-224	8.98E-07
Ra-228	5.36E-06
Ac-228	5.36E-06
Th-228	8.98E-07
Th-231	5.16E-06
Th-232	5.44E-05
Th-234	6.62E-03
Pa-234	6.78E-07
Pa-234m	6.62E-03
U-235	5.14E-06
U-238	6.77E-03

Shipping Site: PORTS	Total Volume (m3/yr) 9.75E+03	Total Mass (kg/yr) 6.74E+07

Radionuclide	Activity (Ci/yr)
Tl-208	3.45E-06
Pb-212	9.14E-06
Bi-212	9.14E-06
Po-212	5.89E-06
Po-216	9.14E-06
Ra-224	9.14E-06
Ra-228	5.46E-05
Ac-228	5.46E-05
Th-228	9.14E-06
Th-231	5.26E-05
Th-232	5.55E-04
Th-234	6.74E-02
Pa-234	6.91E-06
Pa-234m	6.74E-02
U-235	5.24E-05
U-238	6.74E-02

Shipping Site: PPPL	Total Volume (m3/yr) 2.21E+01	Total Mass (kg/yr) 4.97E+03

Radionuclide	Activity (Ci/yr)
H-3	2.01E-01
Cr-51	8.50E-04
Mn-54	1.61E-03
Fe-55	6.04E-03
Fe-59	5.46E-05
Co-58	2.17E-03
Co-60	1.70E-02
Ni-59	7.80E-05
Ni-63	1.10E-02
Zr-95	6.63E-05

Shipping Site: Paducah	Total Volume (m3/yr) 5.26E+03	Total Mass (kg/yr) 1.19E+07

Radionuclide	Activity (Ci/yr)
Tc-99	8.84E-03
Tl-208	3.72E-05
Pb-212	9.84E-05
Bi-212	9.84E-05
Po-212	6.34E-05
Po-216	9.84E-05
Ra-224	9.84E-05
Ra-228	5.88E-04
Ac-228	5.88E-04
Th-228	9.84E-05
Th-231	5.66E-04
Th-232	5.97E-03
Th-234	7.26E-01
Pa-234	7.44E-05
Pa-234m	7.26E-01
U-235	5.64E-04
U-238	7.26E-01
Np-237	6.63E-03
Pu-239	6.63E-03

Shipping Site: RMI	Total Volume (m3/yr)	5.63E+03	Total Mass (kg/yr)	1.46E+07

Radionuclide	Activity (Ci/yr)
Tl-208	3.58E-07
Pb-212	9.47E-07
Bi-212	9.47E-07
Po-212	6.10E-07
Po-216	9.47E-07
Ra-224	9.47E-07
Ra-228	5.66E-06
Ac-228	5.66E-06
Th-228	9.47E-07
Th-231	5.45E-06
Th-232	5.74E-05
Th-234	6.98E-03
Pa-234	7.15E-07
Pa-234m	6.98E-03
U-235	5.43E-06
U-238	6.98E-03

Shipping Site: Y-12	Total Volume (m3/yr)	1.33E+04	Total Mass (kg/yr)	8.27E+07

Radionuclide	Activity (Ci/yr)
Tl-208	6.80E-05
Pb-212	1.80E-04
Bi-212	1.80E-04
Po-212	1.16E-04
Po-216	1.80E-04
Ra-224	1.80E-04
Ra-228	1.07E-03
Ac-228	1.07E-03
Th-228	1.80E-04
Th-231	1.03E-03
Th-232	1.09E-02
Th-234	1.32E+00
Pa-234	1.36E-04
Pa-234m	1.32E+00
U-235	1.03E-03
U-238	1.32E+00

Destination: SRS

Shipping Site: Pinellas	Total Volume (m3/yr)	1.27E+02	Total Mass (kg/yr)	1.91E+04

Radionuclide	Activity (Ci/yr)
H-3	1.99E+04

A.14 WM LLW REGIONALIZED 5 ALTERNATIVE (CASE 19): ACTIVATED METALS

Transported Material with Radionuclide Profile

Alternative: #19 Regional Treat -- 4 Site -- 6 Site Disposal

Waste Stream: LLW Waste Type: Activated Metal

Destination: HANF

Shipping Site: LBL — Total Volume (m3/yr): 3.59E+01 — Total Mass (kg/yr): 2.87E+05

Radionuclide	Activity (Ci/yr)
Cr-51	6.32E-02
Mn-54	1.20E-01
Fe-55	4.49E-01
Fe-59	4.06E-03
Co-58	1.61E-01
Co-60	1.26E+00
Ni-59	5.80E-03
Ni-63	8.24E-01
Zr-95	4.93E-03

Destination: INEL

Shipping Site: ANL-W — Total Volume (m3/yr): 2.06E+01 — Total Mass (kg/yr): 1.64E+05

Radionuclide	Activity (Ci/yr)
H-3	1.71E-06
Cr-51	1.24E-04
Mn-54	2.37E-04
Fe-55	8.86E-04
Fe-59	8.00E-06
Co-58	3.18E-04
Co-60	2.50E-03
Ni-59	1.14E-05
Ni-63	1.64E-03
Sr-90	1.43E-03
Y-90	1.43E-03
Zr-95	9.72E-06
Tc-99	2.56E-07
Ru-106	1.40E-04
Rh-106	1.40E-04
Sb-125	4.03E-05
Te-125m	9.84E-06
Cs-134	1.63E-04
Cs-137	2.00E-01
Ba-137m	2.00E-01
Ce-144	4.69E-04
Pr-144	4.69E-04
Pr-144m	5.64E-06
Pm-147	1.14E-03
Sm-151	1.12E-05
Eu-152	1.71E-07
Eu-154	2.93E-05
Eu-155	2.32E-05
Pu-238	3.53E-05
Pu-239	3.42E-07
Pu-240	1.71E-07
Pu-241	3.95E-05
Am-241	5.13E-07

Shipping Site: LANL — Total Volume (m3/yr) 1.07E+03 — Total Mass (kg/yr) 8.57E+06

Radionuclide	Activity (Ci/yr)
Cr-51	2.42E+01
Mn-54	4.62E+01
Fe-55	1.72E+02
Fe-59	1.55E+00
Co-58	6.20E+01
Co-60	4.86E+02
Ni-59	2.22E+00
Ni-63	3.16E+02
Zr-95	1.89E+00

Shipping Site: NRF — Total Volume (m3/yr) 1.17E+03 — Total Mass (kg/yr) 9.40E+06

Radionuclide	Activity (Ci/yr)
Cr-51	2.31E+03
Mn-54	4.40E+03
Fe-55	1.64E+04
Fe-59	1.48E+02
Co-58	5.91E+03
Co-60	4.63E+04
Ni-59	2.12E+02
Ni-63	3.01E+04
Zr-95	1.80E+02

Shipping Site: SNLA — Total Volume (m3/yr) 1.43E+01 — Total Mass (kg/yr) 1.15E+05

Radionuclide	Activity (Ci/yr)
Cr-51	6.54E-04
Mn-54	1.24E-03
Fe-55	4.64E-03
Fe-59	4.20E-05
Co-58	1.67E-03
Co-60	1.31E-02
Ni-59	6.00E-05
Ni-63	8.53E-03
Zr-95	5.10E-05

Destination: LANL

Shipping Site: INEL — Total Volume (m3/yr) 1.96E+02 — Total Mass (kg/yr) 8.57E+06

Radionuclide	Activity (Ci/yr)
Cr-51	2.42E+01
Mn-54	4.62E+01
Fe-55	1.72E+02
Fe-59	1.55E+00
Co-58	6.20E+01
Co-60	4.86E+02
Ni-59	2.22E+00
Ni-63	3.16E+02
Zr-95	1.89E+00

Destination: ORNL

Shipping Site: BAPL	Total Volume (m3/yr)	8.03E+02	Total Mass (kg/yr)	6.43E+06

Radionuclide	Activity (Ci/yr)
Cr-51	4.75E+03
Mn-54	9.04E+03
Fe-55	3.37E+04
Fe-59	3.05E+02
Co-58	1.21E+04
Co-60	9.52E+04
Ni-59	4.36E+02
Ni-63	6.19E+04
Zr-95	3.70E+02
Tl-208	1.36E-08
Pb-212	3.60E-08
Bi-212	3.60E-08
Po-212	2.32E-08
Po-216	3.60E-08
Ra-224	3.60E-08
Ra-228	2.15E-07
Ac-228	2.15E-07
Th-228	3.60E-08
Th-231	2.07E-07
Th-232	2.18E-06
Th-234	2.65E-04
Pa-234	2.72E-08
Pa-234m	2.65E-04
U-235	2.06E-07
U-238	2.65E-04

Shipping Site: FNAL	Total Volume (m3/yr)	1.01E+02	Total Mass (kg/yr)	8.14E+05

Radionuclide	Activity (Ci/yr)
Cr-51	3.35E-02
Mn-54	6.39E-02
Fe-55	2.38E-01
Fe-59	2.15E-03
Co-58	8.57E-02
Co-60	6.72E-01
Ni-59	3.08E-03
Ni-63	4.37E-01
Zr-95	2.61E-03

Shipping Site: KAPL	Total Volume (m3/yr)	1.66E+03	Total Mass (kg/yr)	1.33E+07

Radionuclide	Activity (Ci/yr)
H-3	5.15E-04
C-14	2.40E-05
Cr-51	1.13E+04
Mn-54	2.15E+04
Fe-55	8.05E+04
Fe-59	7.28E+02
Co-58	2.89E+04
Co-60	2.27E+05
Ni-59	1.04E+03
Ni-63	1.47E+05
Sr-90	2.62E-02
Y-90	2.62E-02
Zr-95	8.84E+02
Tc-99	5.20E-05
Ru-106	2.22E-03
Rh-106	2.22E-03
Sb-125	6.40E-04
Te-125m	1.56E-04
Cs-134	8.18E-03
Cs-137	3.13E-02
Ba-137m	2.96E-02
Ce-144	7.46E-03
Pr-144	7.46E-03
Pr-144m	8.97E-05
Pm-147	1.82E-02
Sm-151	1.78E-04
Eu-152	2.71E-06
Eu-154	4.66E-04
Eu-155	3.69E-04
Tl-208	2.96E-08
Pb-212	7.83E-08
Bi-212	7.83E-08
Po-212	5.05E-08
Po-216	7.83E-08
Ra-224	7.83E-08
Ra-228	4.68E-07
Ac-228	4.68E-07
Th-228	7.83E-08
Th-231	4.50E-07
Th-232	4.75E-06
Th-234	5.77E-04
Pa-234	5.92E-08
Pa-234m	5.77E-04
U-235	4.48E-07
U-238	8.69E-04
Pu-238	5.61E-04
Pu-239	5.43E-06
Pu-240	2.71E-06
Pu-241	6.28E-04
Am-241	8.15E-06

A.15 WM LLW REGIONALIZED 6 ALTERNATIVE (CASE 5): HETEROGENEOUS SOLIDS

Transported Material with Radionuclide Profile

Alternative: #5 Minimum Treat -- On-Site -- 2 Site (SRS,HANF) Disposal

Waste Stream: LLW Waste Type: All, excl. Act.Metal

Destination: HANF

Shipping Site: ANL-W

Total Volume (m3/yr) 2.78E+02

Total Mass (kg/yr) 2.12E+05

Radionuclide	Activity (Ci/yr)
H-3	7.83E-04
Cr-51	3.58E+03
Mn-54	6.83E+03
Fe-55	2.54E+04
Fe-59	2.30E+02
Co-58	9.16E+03
Co-60	7.18E+04
Ni-59	3.29E+02
Ni-63	4.67E+04
Sr-90	3.17E-02
Y-90	3.17E-02
Zr-95	2.79E+02
Tc-99	5.66E-06
Ru-106	3.09E-03
Rh-106	3.09E-03
Sb-125	8.89E-04
Te-125m	2.17E-04
Cs-134	3.59E-03
Cs-137	3.32E-02
Ba-137m	3.14E-02
Ce-144	1.03E-02
Pr-144	1.03E-02
Pr-144m	1.24E-04
Pm-147	2.52E-02
Sm-151	2.47E-04
Eu-152	3.77E-06
Eu-154	6.47E-04
Eu-155	5.13E-04
Pu-238	7.81E-04
Pu-239	7.72E-06
Pu-240	4.38E-06
Pu-241	9.56E-04
Am-241	1.13E-05
Cm-242	4.88E-08
Cm-244	1.74E-08

Shipping Site: INEL	Total Volume (m3/yr)	6.81E+03	Total Mass (kg/yr)	1.64E+07

Radionuclide	Activity (Ci/yr)
H-3	1.56E+00
Cr-51	1.02E+02
Mn-54	1.94E+02
Fe-55	7.24E+02
Fe-59	6.55E+00
Co-58	2.60E+02
Co-60	2.04E+03
Ni-59	9.35E+00
Ni-63	1.33E+03
Sr-90	5.01E+01
Y-90	5.01E+01
Zr-95	7.95E+00
Tc-99	8.95E-03
Ru-106	4.89E+00
Rh-106	4.89E+00
Sb-125	1.40E+00
Te-125m	3.43E-01
Cs-134	5.69E+00
Cs-137	5.25E+01
Ba-137m	4.97E+01
Ce-144	1.63E+01
Pr-144	1.63E+01
Pr-144m	1.97E-01
Pm-147	4.00E+01
Sm-151	3.91E-01
Eu-152	5.97E-03
Eu-154	1.02E+00
Eu-155	8.12E-01
Pu-238	1.23E+00
Pu-239	1.19E-02
Pu-240	5.97E-03
Pu-241	1.37E+00
Am-241	1.79E-02

Shipping Site: ITRI	Total Volume (m3/yr)	1.41E+02	Total Mass (kg/yr)	1.64E+05

Radionuclide	Activity (Ci/yr)
H-3	6.17E+00
C-14	3.03E-01
Mn-54	3.41E+01
Co-58	3.15E+01
Co-60	9.12E+01
Sr-90	4.28E+01
Y-90	4.28E+01
Tc-99	6.07E-01
Cs-134	7.07E+01
Cs-137	9.33E+01
Ba-137m	8.82E+01
U-238	3.69E+00

Shipping Site: LANL	Total Volume (m3/yr)	1.52E+04	Total Mass (kg/yr)	1.22E+07

Radionuclide	Activity (Ci/yr)
H-3	3.84E+05
Cr-51	5.93E+00
Mn-54	1.12E+01
Fe-55	4.21E+01
Fe-59	3.81E-01
Co-58	1.51E+01
Co-60	4.85E+02
Ni-59	5.44E-01
Ni-63	8.05E+02
Sr-90	6.47E+04
Y-90	6.47E+04
Zr-95	4.62E-01
Tc-99	1.15E+01
Ru-106	6.32E+03
Rh-106	6.32E+03
Sb-125	1.81E+03
Te-125m	4.43E+02
Cs-134	7.35E+03
Cs-137	6.78E+04
Ba-137m	6.42E+04
Ce-144	2.11E+04
Pr-144	2.11E+04
Pr-144m	2.54E+02
Pm-147	5.16E+04
Sm-151	5.04E+02
Eu-152	7.70E+00
Eu-154	1.32E+03
Eu-155	1.04E+03
Tl-208	1.66E-02
Pb-212	4.41E-02
Bi-212	4.41E-02
Po-212	2.84E-02
Po-216	4.41E-02
Ra-224	4.41E-02
Ra-228	2.64E-01
Ac-228	2.64E-01
Th-228	4.41E-02
Th-231	2.54E-01
Th-232	2.68E+00
Th-234	3.26E+02
Pa-234	3.33E-02
Pa-234m	3.26E+02
U-235	2.53E-01
U-238	3.26E+02
Pu-238	1.59E+03
Pu-239	1.57E+01
Pu-240	8.94E+00
Pu-241	1.95E+03
Am-241	2.31E+01
Cm-242	9.84E-02
Cm-244	3.51E-02

Shipping Site: LBL	Total Volume (m3/yr)	9.20E+01	Total Mass (kg/yr)	4.51E+04

Radionuclide	Activity (Ci/yr)
H-3	6.35E+02
C-14	1.13E+00
Mn-54	1.27E+02
Co-58	1.17E+02
Co-60	3.39E+02
Sr-90	1.59E+02
Y-90	1.59E+02
Tc-99	2.26E+00
Cs-134	2.63E+02
Cs-137	3.47E+02
Ba-137m	3.28E+02
U-238	1.37E+01
Cm-244	1.05E+01

Shipping Site: LLNL	Total Volume (m3/yr)	4.20E+02	Total Mass (kg/yr)	1.06E+06

Radionuclide	Activity (Ci/yr)
H-3	3.33E+04
C-14	1.55E-03
Mn-54	1.74E-01
Co-58	1.61E-01
Co-60	4.69E-01
Ni-63	4.89E-03
Sr-90	6.54E-01
Y-90	6.54E-01
Tc-99	3.18E-03
Ru-106	4.24E-02
Rh-106	4.24E-02
Sb-125	1.21E-02
Te-125m	2.97E-03
Cs-134	4.11E-01
Cs-137	9.33E-01
Ba-137m	8.82E-01
Ce-144	1.42E-01
Pr-144	1.42E-01
Pr-144m	1.70E-03
Pm-147	3.46E-01
Sm-151	3.39E-03
Eu-152	5.17E-05
Eu-154	8.87E-03
Eu-155	7.03E-03
U-238	1.88E-02
Pu-238	7.85E-02
Pu-239	5.28E-03
Pu-240	1.81E-02
Pu-241	2.50E+00
Am-241	2.58E-04
Cm-242	1.44E-03
Cm-244	5.17E-04

Shipping Site: PANT	Total Volume (m3/yr)	4.35E+03	Total Mass (kg/yr)	2.88E+07

Radionuclide	Activity (Ci/yr)
H-3	2.34E+02
Tl-208	2.21E-04
Pb-212	5.86E-04
Bi-212	5.86E-04
Po-212	3.78E-04
Po-216	5.86E-04
Ra-224	5.86E-04
Ra-228	3.50E-03
Ac-228	3.50E-03
Th-228	5.86E-04
Th-231	3.37E-03
Th-232	3.56E-02
Th-234	4.32E+00
Pa-234	4.43E-04
Pa-234m	4.32E+00
U-235	3.36E-03
U-238	4.32E+00

Shipping Site: RFP	Total Volume (m3/yr)	4.56E+03	Total Mass (kg/yr)	6.49E+06

Radionuclide	Activity (Ci/yr)
Tl-208	3.60E-05
Pb-212	9.55E-05
Bi-212	9.55E-05
Po-212	6.15E-05
Po-216	9.55E-05
Ra-224	9.55E-05
Ra-228	5.70E-04
Ac-228	5.70E-04
Th-228	9.55E-05
Th-231	5.49E-04
Th-232	5.79E-03
Th-234	7.04E-01
Pa-234	7.21E-05
Pa-234m	7.04E-01
U-235	5.47E-04
U-238	7.04E-01
Pu-238	5.56E-01
Pu-239	4.24E-02
Pu-240	1.48E-01
Pu-241	2.04E+01
Am-241	8.48E-04
Cm-242	1.18E-02
Cm-244	4.24E-03

Shipping Site: SLAC	Total Volume (m3/yr)	2.73E+02	Total Mass (kg/yr)	7.45E+05

Radionuclide	Activity (Ci/yr)
Cr-51	3.86E-03
Mn-54	7.36E-03
Fe-55	2.74E-02
Fe-59	2.48E-04
Co-58	9.88E-03
Co-60	7.74E-02
Ni-59	3.54E-04
Ni-63	5.04E-02
Zr-95	3.01E-04

Shipping Site: SNLA	Total Volume (m3/yr) 1.19E+02	Total Mass (kg/yr) 3.28E+05

Radionuclide	Activity (Ci/yr)
H-3	3.00E+00
Co-60	2.85E-05
Ni-63	5.67E-05
Sr-90	5.04E-03
Y-90	5.04E-03
Tc-99	9.00E-07
Ru-106	4.92E-04
Rh-106	4.92E-04
Sb-125	1.41E-04
Te-125m	3.45E-05
Cs-134	5.72E-04
Cs-137	5.28E-03
Ba-137m	4.99E-03
Ce-144	1.64E-03
Pr-144	1.64E-03
Pr-144m	1.98E-05
Pm-147	4.02E-03
Sm-151	3.93E-05
Eu-152	6.00E-07
Eu-154	1.02E-04
Eu-155	8.16E-05
Tl-208	5.10E-06
Pb-212	1.35E-05
Bi-212	1.35E-05
Po-212	8.70E-06
Po-216	1.35E-05
Ra-224	1.35E-05
Ra-228	8.07E-05
Ac-228	8.07E-05
Th-228	1.35E-05
Th-231	7.77E-05
Th-232	8.19E-04
Th-234	9.96E-02
Pa-234	1.02E-05
Pa-234m	9.96E-02
U-235	7.74E-05
U-238	9.96E-02
Pu-238	7.87E-02
Pu-239	6.00E-03
Pu-240	2.10E-02
Pu-241	2.89E+00
Am-241	1.21E-04
Cm-242	1.68E-03
Cm-244	6.00E-04

Shipping Site: SNLL	Total Volume (m3/yr) 3.68E+01	Total Mass (kg/yr) 9.73E+04

Radionuclide	Activity (Ci/yr)
H-3	2.78E+04
Fe-55	3.15E-01
Co-60	3.15E-01
Tl-208	6.40E-05
Pb-212	1.69E-04
Bi-212	1.69E-04
Po-212	1.09E-04
Po-216	1.69E-04
Ra-224	1.69E-04
Ra-228	1.01E-03
Ac-228	1.01E-03
Th-228	1.69E-04
Th-231	9.75E-04
Th-232	1.02E-02
Th-234	1.25E+00
Pa-234	1.28E-04
Pa-234m	1.25E+00
U-235	9.71E-04
U-238	1.25E+00

Destination: SRS

Shipping Site: AMES	Total Volume (m3/yr) 1.16E+01	Total Mass (kg/yr) 2.99E+04

Radionuclide	Activity (Ci/yr)
Tl-208	4.50E-07
Pb-212	1.19E-06
Bi-212	1.19E-06
Po-212	7.68E-07
Po-216	1.19E-06
Ra-224	1.19E-06
Ra-228	7.12E-06
Ac-228	7.12E-06
Th-228	1.19E-06
Th-231	6.86E-06
Th-232	7.23E-05
Th-234	8.79E-03
Pa-234	9.01E-07
Pa-234m	8.79E-03
U-235	6.83E-06
U-238	8.79E-03
Pu-238	6.94E-04
Pu-239	5.30E-05
Pu-240	1.85E-04
Pu-241	2.55E-02
Am-241	1.06E-06
Cm-242	1.48E-05
Cm-244	5.30E-06

Shipping Site: ANL-E	Total Volume (m3/yr) 7.35E+02	Total Mass (kg/yr) 2.00E+06

Radionuclide	Activity (Ci/yr)
H-3	1.33E+02
C-14	7.91E-02
Cr-51	2.87E+00
Mn-54	1.43E+01
Fe-55	2.04E+01
Fe-59	1.84E-01
Co-58	1.55E+01
Co-60	8.15E+01
Ni-59	2.63E-01
Ni-63	3.77E+01
Sr-90	3.33E+01
Y-90	3.33E+01
Zr-95	2.24E-01
Tc-99	1.62E-01
Ru-106	2.16E+00
Rh-106	2.16E+00
Sb-125	6.21E-01
Te-125m	1.51E-01
Cs-134	2.09E+01
Cs-137	4.75E+01
Ba-137m	4.50E+01
Ce-144	7.24E+00
Pr-144	7.24E+00
Pr-144m	8.70E-02
Pm-147	1.76E+01
Sm-151	1.72E-01
Eu-152	2.63E-03
Eu-154	4.52E-01
Eu-155	3.58E-01
U-238	9.63E-01
Pu-238	5.44E-01
Pu-239	5.27E-03
Pu-240	2.63E-03
Pu-241	6.09E-01
Am-241	7.91E-03

Shipping Site: BAPL	Total Volume (m3/yr) 3.98E+02	Total Mass (kg/yr) 1.08E+06

Radionuclide	Activity (Ci/yr)
H-3	2.51E-03
Co-60	1.19E-02
Ni-63	2.38E-02
Sr-90	2.11E+00
Y-90	2.11E+00
Tc-99	3.77E-04
Ru-106	2.06E-01
Rh-106	2.06E-01
Sb-125	5.93E-02
Te-125m	1.44E-02
Cs-134	2.40E-01
Cs-137	2.21E+00
Ba-137m	2.09E+00
Ce-144	6.91E-01
Pr-144	6.91E-01
Pr-144m	8.31E-03
Pm-147	1.68E+00
Sm-151	1.65E-02
Eu-152	2.51E-04
Eu-154	4.32E-02
Eu-155	3.42E-02
Tl-208	3.80E-06
Pb-212	1.00E-05
Bi-212	1.00E-05
Po-212	6.49E-06
Po-216	1.00E-05
Ra-224	1.00E-05
Ra-228	6.02E-05
Ac-228	6.02E-05
Th-228	1.00E-05
Th-231	5.80E-05
Th-232	6.11E-04
Th-234	7.43E-02
Pa-234	7.61E-06
Pa-234m	7.43E-02
U-235	5.77E-05
U-238	7.43E-02
Pu-238	5.20E-02
Pu-239	5.03E-04
Pu-240	2.51E-04
Pu-241	5.81E-02
Am-241	7.55E-04

Shipping Site: FNAL	Total Volume (m3/yr) 5.19E+01	Total Mass (kg/yr) 5.11E+04

Radionuclide	Activity (Ci/yr)
H-3	1.81E-01
Cr-51	1.11E-02
Mn-54	2.12E-02
Fe-55	7.94E-02
Fe-59	7.17E-04
Co-58	2.85E-02
Co-60	2.23E-01
Ni-59	1.02E-03
Ni-63	1.45E-01
Zr-95	8.71E-04
Tl-208	3.78E-07
Pb-212	1.00E-06
Bi-212	1.00E-06
Po-212	6.46E-07
Po-216	1.00E-06
Ra-224	1.00E-06
Ra-228	5.99E-06
Ac-228	5.99E-06
Th-228	1.00E-06
Th-231	5.77E-06
Th-232	6.08E-05
Th-234	7.39E-03
Pa-234	7.57E-07
Pa-234m	7.39E-03
U-235	5.75E-06
U-238	7.39E-03

Shipping Site: K-25	Total Volume (m3/yr) 6.90E+03	Total Mass (kg/yr) 4.67E+07

Radionuclide	Activity (Ci/yr)
Tl-208	1.06E-04
Pb-212	2.82E-04
Bi-212	2.82E-04
Po-212	1.82E-04
Po-216	2.82E-04
Ra-224	2.82E-04
Ra-228	1.68E-03
Ac-228	1.68E-03
Th-228	2.82E-04
Th-231	1.62E-03
Th-232	1.71E-02
Th-234	2.08E+00
Pa-234	2.13E-04
Pa-234m	2.08E+00
U-235	1.62E-03
U-238	2.08E+00

Shipping Site: KAPL	Total Volume (m3/yr) 2.11E+02	Total Mass (kg/yr) 5.36E+05

Radionuclide	Activity (Ci/yr)
H-3	5.14E-04
C-14	2.40E-05
Cr-51	5.11E-03
Mn-54	1.24E-02
Fe-55	3.63E-02
Fe-59	3.28E-04
Co-58	1.55E-02
Co-60	1.09E-01
Ni-59	4.69E-04
Ni-63	6.70E-02
Sr-90	2.58E-02
Y-90	2.58E-02
Zr-95	3.99E-04
Tc-99	5.20E-05
Ru-106	2.19E-03
Rh-106	2.19E-03
Sb-125	6.31E-04
Te-125m	1.54E-04
Cs-134	8.14E-03
Cs-137	3.09E-02
Ba-137m	2.92E-02
Ce-144	7.35E-03
Pr-144	7.35E-03
Pr-144m	8.84E-05
Pm-147	1.79E-02
Sm-151	1.75E-04
Eu-152	2.67E-06
Eu-154	4.59E-04
Eu-155	3.64E-04
Tl-208	4.50E-09
Pb-212	1.19E-08
Bi-212	1.19E-08
Po-212	7.60E-09
Po-216	1.19E-08
Ra-224	1.19E-08
Ra-228	7.11E-08
Ac-228	7.11E-08
Th-228	1.19E-08
Th-231	6.84E-08
Th-232	7.21E-07
Th-234	8.77E-05
Pa-234	8.90E-09
Pa-234m	8.77E-05
U-235	6.82E-08
U-238	3.79E-04
Pu-238	5.53E-04
Pu-239	5.35E-06
Pu-240	2.67E-06
Pu-241	6.18E-04
Am-241	8.03E-06

Shipping Site: KCP	Total Volume (m3/yr)	2.65E+00	Total Mass (kg/yr)	7.23E+03

Radionuclide	Activity (Ci/yr)
H-3	2.70E-02
C-14	1.44E-04
Mn-54	1.62E-02
Co-58	1.50E-02
Co-60	4.34E-02
Sr-90	2.04E-02
Y-90	2.04E-02
Tc-99	2.89E-04
Cs-134	3.37E-02
Cs-137	4.44E-02
Ba-137m	4.20E-02
U-238	1.76E-03

Shipping Site: MOUND	Total Volume (m3/yr)	4.40E+03	Total Mass (kg/yr)	9.67E+06

Radionuclide	Activity (Ci/yr)
H-3	1.34E+04
Pu-238	1.60E-01
Pu-239	1.22E-02
Pu-240	4.28E-02
Pu-241	5.90E+00
Am-241	2.44E-04
Cm-242	3.42E-03
Cm-244	1.22E-03

Shipping Site: ORISE	Total Volume (m3/yr)	6.07E+01	Total Mass (kg/yr)	7.36E+04

Radionuclide	Activity (Ci/yr)
H-3	2.00E-02
C-14	1.19E-05
Mn-54	1.34E-03
Co-58	1.24E-03
Co-60	3.59E-03
Sr-90	1.69E-03
Y-90	1.69E-03
Tc-99	2.39E-05
Cs-134	2.79E-03
Cs-137	3.68E-03
Ba-137m	3.48E-03
Tl-208	3.39E-07
Pb-212	8.98E-07
Bi-212	8.98E-07
Po-212	5.78E-07
Po-216	8.98E-07
Ra-224	8.98E-07
Ra-228	5.36E-06
Ac-228	5.36E-06
Th-228	8.98E-07
Th-231	5.16E-06
Th-232	5.44E-05
Th-234	6.62E-03
Pa-234	6.78E-07
Pa-234m	6.62E-03
U-235	5.14E-06
U-238	6.77E-03

Shipping Site: ORNL	Total Volume (m3/yr) 2.82E+03	Total Mass (kg/yr) 3.30E+06

Radionuclide	Activity (Ci/yr)
H-3	1.17E+00
C-14	4.44E-03
Cr-51	1.01E+01
Mn-54	1.97E+01
Fe-55	7.20E+01
Fe-59	6.51E-01
Co-58	2.63E+01
Co-60	2.09E+02
Ni-59	9.30E-01
Ni-63	1.42E+02
Sr-90	9.15E+02
Y-90	9.15E+02
Zr-95	7.90E-01
Tc-99	1.72E-01
Ru-106	8.91E+01
Rh-106	8.91E+01
Sb-125	2.56E+01
Te-125m	6.25E+00
Cs-134	1.04E+02
Cs-137	9.58E+02
Ba-137m	9.07E+02
Ce-144	2.98E+02
Pr-144	2.98E+02
Pr-144m	3.58E+00
Pm-147	7.28E+02
Sm-151	7.12E+00
Eu-152	1.08E-01
Eu-154	1.86E+01
Eu-155	1.47E+01
Tl-208	1.70E-06
Pb-212	4.50E-06
Bi-212	4.50E-06
Po-212	2.90E-06
Po-216	4.50E-06
Ra-224	4.50E-06
Ra-228	2.69E-05
Ac-228	2.69E-05
Th-228	4.50E-06
Th-231	2.59E-05
Th-232	2.73E-04
Th-234	3.31E-02
Pa-234	3.40E-06
Pa-234m	3.31E-02
U-235	2.58E-05
U-238	8.72E-02
Pu-238	2.24E+01
Pu-239	2.17E-01
Pu-240	1.09E-01
Pu-241	2.52E+01
Am-241	3.26E-01
Cm-242	5.60E-05
Cm-244	2.00E-05

Shipping Site: PORTS	Total Volume (m3/yr) 1.07E+04	Total Mass (kg/yr) 6.73E+07

Radionuclide	Activity (Ci/yr)
Tl-208	3.45E-06
Pb-212	9.14E-06
Bi-212	9.14E-06
Po-212	5.89E-06
Po-216	9.14E-06
Ra-224	9.14E-06
Ra-228	5.46E-05
Ac-228	5.46E-05
Th-228	9.14E-06
Th-231	5.26E-05
Th-232	5.55E-04
Th-234	6.74E-02
Pa-234	6.91E-06
Pa-234m	6.74E-02
U-235	5.24E-05
U-238	6.74E-02

Shipping Site: PPPL	Total Volume (m3/yr)	2.45E+01	Total Mass (kg/yr)	6.10E+03

Radionuclide	Activity (Ci/yr)
H-3	2.01E-01
Cr-51	8.50E-04
Mn-54	1.61E-03
Fe-55	6.04E-03
Fe-59	5.46E-05
Co-58	2.17E-03
Co-60	1.70E-02
Ni-59	7.80E-05
Ni-63	1.10E-02
Zr-95	6.63E-05

Shipping Site: Paducah	Total Volume (m3/yr)	5.39E+03	Total Mass (kg/yr)	1.20E+07

Radionuclide	Activity (Ci/yr)
Tc-99	8.84E-03
Tl-208	3.72E-05
Pb-212	9.84E-05
Bi-212	9.84E-05
Po-212	6.34E-05
Po-216	9.84E-05
Ra-224	9.84E-05
Ra-228	5.88E-04
Ac-228	5.88E-04
Th-228	9.84E-05
Th-231	5.66E-04
Th-232	5.97E-03
Th-234	7.26E-01
Pa-234	7.44E-05
Pa-234m	7.26E-01
U-235	5.64E-04
U-238	7.26E-01
Np-237	6.63E-03
Pu-239	6.63E-03

Shipping Site: Pinellas	Total Volume (m3/yr)	1.40E+02	Total Mass (kg/yr)	1.91E+04

Radionuclide	Activity (Ci/yr)
H-3	1.99E+04

Shipping Site: RMI	Total Volume (m3/yr)	5.68E+03	Total Mass (kg/yr)	1.47E+07

Radionuclide	Activity (Ci/yr)
Tl-208	3.58E-07
Pb-212	9.47E-07
Bi-212	9.47E-07
Po-212	6.10E-07
Po-216	9.47E-07
Ra-224	9.47E-07
Ra-228	5.66E-06
Ac-228	5.66E-06
Th-228	9.47E-07
Th-231	5.45E-06
Th-232	5.74E-05
Th-234	6.98E-03
Pa-234	7.15E-07
Pa-234m	6.98E-03
U-235	5.43E-06
U-238	6.98E-03

Shipping Site: Y-12	Total Volume (m3/yr) 1.46E+04	Total Mass (kg/yr) 8.27E+07

Radionuclide	Activity (Ci/yr)
Tl-208	6.80E-05
Pb-212	1.80E-04
Bi-212	1.80E-04
Po-212	1.16E-04
Po-216	1.80E-04
Ra-224	1.80E-04
Ra-228	1.07E-03
Ac-228	1.07E-03
Th-228	1.80E-04
Th-231	1.03E-03
Th-232	1.09E-02
Th-234	1.32E+00
Pa-234	1.36E-04
Pa-234m	1.32E+00
U-235	1.03E-03
U-238	1.32E+00

A.16 WM LLW REGIONALIZED 6 ALTERNATIVE (CASE 5): ACTIVATED METALS

Transported Material with Radionuclide Profile

Alternative: #5 Minimum Treat -- On-Site -- 2 Site (SRS,HANF) Disposal

Waste Stream: LLW Waste Type: Activated Metal

Destination: HANF

Shipping Site: ANL-W Total Volume (m3/yr) 2.26E+01 Total Mass (kg/yr) 1.64E+05

Radionuclide	Activity (Ci/yr)
H-3	1.71E-06
Cr-51	1.24E-04
Mn-54	2.37E-04
Fe-55	8.86E-04
Fe-59	8.00E-06
Co-58	3.18E-04
Co-60	2.50E-03
Ni-59	1.14E-05
Ni-63	1.64E-03
Sr-90	1.43E-03
Y-90	1.43E-03
Zr-95	9.72E-06
Tc-99	2.56E-07
Ru-106	1.40E-04
Rh-106	1.40E-04
Sb-125	4.03E-05
Te-125m	9.84E-06
Cs-134	1.63E-04
Cs-137	2.00E-01
Ba-137m	2.00E-01
Ce-144	4.69E-04
Pr-144	4.69E-04
Pr-144m	5.64E-06
Pm-147	1.14E-03
Sm-151	1.12E-05
Eu-152	1.71E-07
Eu-154	2.93E-05
Eu-155	2.32E-05
Pu-238	3.53E-05
Pu-239	3.42E-07
Pu-240	1.71E-07
Pu-241	3.95E-05
Am-241	5.13E-07

Shipping Site: LANL Total Volume (m3/yr) 1.17E+03 Total Mass (kg/yr) 8.57E+06

Radionuclide	Activity (Ci/yr)
Cr-51	2.42E+01
Mn-54	4.62E+01
Fe-55	1.72E+02
Fe-59	1.55E+00
Co-58	6.20E+01
Co-60	4.86E+02
Ni-59	2.22E+00
Ni-63	3.16E+02
Zr-95	1.89E+00

Shipping Site: LBL	Total Volume (m3/yr)	3.95E+01	Total Mass (kg/yr)	2.87E+05

Radionuclide	Activity (Ci/yr)
Cr-51	6.32E-02
Mn-54	1.20E-01
Fe-55	4.49E-01
Fe-59	4.06E-03
Co-58	1.61E-01
Co-60	1.26E+00
Ni-59	5.80E-03
Ni-63	8.24E-01
Zr-95	4.93E-03

Shipping Site: NRF	Total Volume (m3/yr)	1.29E+03	Total Mass (kg/yr)	9.40E+06

Radionuclide	Activity (Ci/yr)
Cr-51	2.31E+03
Mn-54	4.40E+03
Fe-55	1.64E+04
Fe-59	1.48E+02
Co-58	5.91E+03
Co-60	4.63E+04
Ni-59	2.12E+02
Ni-63	3.01E+04
Zr-95	1.80E+02

Shipping Site: SNLA	Total Volume (m3/yr)	1.58E+01	Total Mass (kg/yr)	1.15E+05

Radionuclide	Activity (Ci/yr)
Cr-51	6.54E-04
Mn-54	1.24E-03
Fe-55	4.64E-03
Fe-59	4.20E-05
Co-58	1.67E-03
Co-60	1.31E-02
Ni-59	6.00E-05
Ni-63	8.53E-03
Zr-95	5.10E-05

Destination: SRS

Shipping Site: BAPL	Total Volume (m3/yr)	8.84E+02	Total Mass (kg/yr)	6.43E+06

Radionuclide	Activity (Ci/yr)
Cr-51	4.75E+03
Mn-54	9.04E+03
Fe-55	3.37E+04
Fe-59	3.05E+02
Co-58	1.21E+04
Co-60	9.52E+04
Ni-59	4.36E+02
Ni-63	6.19E+04
Zr-95	3.70E+02
Tl-208	1.36E-08
Pb-212	3.60E-08
Bi-212	3.60E-08
Po-212	2.32E-08
Po-216	3.60E-08
Ra-224	3.60E-08
Ra-228	2.15E-07
Ac-228	2.15E-07
Th-228	3.60E-08
Th-231	2.07E-07
Th-232	2.18E-06
Th-234	2.65E-04
Pa-234	2.72E-08
Pa-234m	2.65E-04
U-235	2.06E-07
U-238	2.65E-04

Shipping Site: FNAL	Total Volume (m3/yr)	1.11E+02	Total Mass (kg/yr)	8.14E+05

Radionuclide	Activity (Ci/yr)
Cr-51	3.35E-02
Mn-54	6.39E-02
Fe-55	2.38E-01
Fe-59	2.15E-03
Co-58	8.57E-02
Co-60	6.72E-01
Ni-59	3.08E-03
Ni-63	4.37E-01
Zr-95	2.61E-03

Shipping Site: KAPL	Total Volume (m3/yr) 1.82E+03	Total Mass (kg/yr) 1.33E+07

Radionuclide	Activity (Ci/yr)
H-3	5.15E-04
C-14	2.40E-05
Cr-51	1.13E+04
Mn-54	2.15E+04
Fe-55	8.05E+04
Fe-59	7.28E+02
Co-58	2.89E+04
Co-60	2.27E+05
Ni-59	1.04E+03
Ni-63	1.47E+05
Sr-90	2.62E-02
Y-90	2.62E-02
Zr-95	8.84E+02
Tc-99	5.20E-05
Ru-106	2.22E-03
Rh-106	2.22E-03
Sb-125	6.40E-04
Te-125m	1.56E-04
Cs-134	8.18E-03
Cs-137	3.13E-02
Ba-137m	2.96E-02
Ce-144	7.46E-03
Pr-144	7.46E-03
Pr-144m	8.97E-05
Pm-147	1.82E-02
Sm-151	1.78E-04
Eu-152	2.71E-06
Eu-154	4.66E-04
Eu-155	3.69E-04
Tl-208	2.96E-08
Pb-212	7.83E-08
Bi-212	7.83E-08
Po-212	5.05E-08
Po-216	7.83E-08
Ra-224	7.83E-08
Ra-228	4.68E-07
Ac-228	4.68E-07
Th-228	7.83E-08
Th-231	4.50E-07
Th-232	4.75E-06
Th-234	5.77E-04
Pa-234	5.92E-08
Pa-234m	5.77E-04
U-235	4.48E-07
U-238	8.69E-04
Pu-238	5.61E-04
Pu-239	5.43E-06
Pu-240	2.71E-06
Pu-241	6.28E-04
Am-241	8.15E-06

A.17 WM LLW REGIONALIZED 7 ALTERNATIVE (CASE 6): HETEROGENEOUS SOLIDS

Transported Material with Radionuclide Profile

Alternative: #6 Minimum Treat -- On-Site -- 2 Site (SRS,NTS) Disposal

Waste Stream: LLW Waste Type: All, excl. Act.Metal

Destination: NTS

Shipping Site: ANL-W Total Volume (m3/yr) 2.78E+02 Total Mass (kg/yr) 2.12E+05

Radionuclide	Activity (Ci/yr)
H-3	7.83E-04
Cr-51	3.58E+03
Mn-54	6.83E+03
Fe-55	2.54E+04
Fe-59	2.30E+02
Co-58	9.16E+03
Co-60	7.18E+04
Ni-59	3.29E+02
Ni-63	4.67E+04
Sr-90	3.17E-02
Y-90	3.17E-02
Zr-95	2.79E+02
Tc-99	5.66E-06
Ru-106	3.09E-03
Rh-106	3.09E-03
Sb-125	8.89E-04
Te-125m	2.17E-04
Cs-134	3.59E-03
Cs-137	3.32E-02
Ba-137m	3.14E-02
Ce-144	1.03E-02
Pr-144	1.03E-02
Pr-144m	1.24E-04
Pm-147	2.52E-02
Sm-151	2.47E-04
Eu-152	3.77E-06
Eu-154	6.47E-04
Eu-155	5.13E-04
Pu-238	7.81E-04
Pu-239	7.72E-06
Pu-240	4.38E-06
Pu-241	9.56E-04
Am-241	1.13E-05
Cm-242	4.88E-08
Cm-244	1.74E-08

Shipping Site: HANF	Total Volume (m3/yr)	9.66E+03	Total Mass (kg/yr)	2.75E+07

Radionuclide	Activity (Ci/yr)
H-3	2.22E+01
Cr-51	5.66E+01
Mn-54	1.07E+02
Fe-55	4.02E+02
Fe-59	3.63E+00
Co-58	1.44E+02
Co-60	1.14E+03
Ni-59	5.19E+00
Ni-63	7.60E+02
Sr-90	1.93E+03
Y-90	1.93E+03
Zr-95	4.41E+00
Tc-99	3.44E-01
Ru-106	1.88E+02
Rh-106	1.88E+02
Sb-125	5.41E+01
Te-125m	1.32E+01
Cs-134	2.19E+02
Cs-137	2.02E+03
Ba-137m	1.91E+03
Ce-144	6.31E+02
Pr-144	6.31E+02
Pr-144m	7.58E+00
Pm-147	1.54E+03
Sm-151	1.50E+01
Eu-152	2.29E-01
Eu-154	3.94E+01
Eu-155	3.12E+01
Tl-208	2.70E-04
Pb-212	7.16E-04
Bi-212	7.16E-04
Po-212	4.61E-04
Po-216	7.16E-04
Ra-224	7.16E-04
Ra-228	4.28E-03
Ac-228	4.28E-03
Th-228	7.16E-04
Th-231	4.12E-03
Th-232	4.34E-02
Th-234	5.28E+00
Pa-234	5.41E-04
Pa-234m	5.28E+00
U-235	4.10E-03
U-238	5.28E+00
Pu-238	4.74E+01
Pu-239	4.59E-01
Pu-240	2.29E-01
Pu-241	5.31E+01
Am-241	6.89E-01

Shipping Site: INEL	Total Volume (m3/yr)	6.81E+03	Total Mass (kg/yr)	1.64E+07

Radionuclide	Activity (Ci/yr)
H-3	1.56E+00
Cr-51	1.02E+02
Mn-54	1.94E+02
Fe-55	7.24E+02
Fe-59	6.55E+00
Co-58	2.60E+02
Co-60	2.04E+03
Ni-59	9.35E+00
Ni-63	1.33E+03
Sr-90	5.01E+01
Y-90	5.01E+01
Zr-95	7.95E+00
Tc-99	8.95E-03
Ru-106	4.89E+00
Rh-106	4.89E+00
Sb-125	1.40E+00
Te-125m	3.43E-01
Cs-134	5.69E+00
Cs-137	5.25E+01
Ba-137m	4.97E+01
Ce-144	1.63E+01
Pr-144	1.63E+01
Pr-144m	1.97E-01
Pm-147	4.00E+01
Sm-151	3.91E-01
Eu-152	5.97E-03
Eu-154	1.02E+00
Eu-155	8.12E-01
Pu-238	1.23E+00
Pu-239	1.19E-02
Pu-240	5.97E-03
Pu-241	1.37E+00
Am-241	1.79E-02

Shipping Site: ITRI	Total Volume (m3/yr)	1.41E+02	Total Mass (kg/yr)	1.64E+05

Radionuclide	Activity (Ci/yr)
H-3	6.17E+00
C-14	3.03E-01
Mn-54	3.41E+01
Co-58	3.15E+01
Co-60	9.12E+01
Sr-90	4.28E+01
Y-90	4.28E+01
Tc-99	6.07E-01
Cs-134	7.07E+01
Cs-137	9.33E+01
Ba-137m	8.82E+01
U-238	3.69E+00

Shipping Site: LANL	Total Volume (m3/yr) 1.52E+04	Total Mass (kg/yr) 1.22E+07

Radionuclide	Activity (Ci/yr)
H-3	3.84E+05
Cr-51	5.93E+00
Mn-54	1.12E+01
Fe-55	4.21E+01
Fe-59	3.81E-01
Co-58	1.51E+01
Co-60	4.85E+02
Ni-59	5.44E-01
Ni-63	8.05E+02
Sr-90	6.47E+04
Y-90	6.47E+04
Zr-95	4.62E-01
Tc-99	1.15E+01
Ru-106	6.32E+03
Rh-106	6.32E+03
Sb-125	1.81E+03
Te-125m	4.43E+02
Cs-134	7.35E+03
Cs-137	6.78E+04
Ba-137m	6.42E+04
Ce-144	2.11E+04
Pr-144	2.11E+04
Pr-144m	2.54E+02
Pm-147	5.16E+04
Sm-151	5.04E+02
Eu-152	7.70E+00
Eu-154	1.32E+03
Eu-155	1.04E+03
Tl-208	1.66E-02
Pb-212	4.41E-02
Bi-212	4.41E-02
Po-212	2.84E-02
Po-216	4.41E-02
Ra-224	4.41E-02
Ra-228	2.64E-01
Ac-228	2.64E-01
Th-228	4.41E-02
Th-231	2.54E-01
Th-232	2.68E+00
Th-234	3.26E+02
Pa-234	3.33E-02
Pa-234m	3.26E+02
U-235	2.53E-01
U-238	3.26E+02
Pu-238	1.59E+03
Pu-239	1.57E+01
Pu-240	8.94E+00
Pu-241	1.95E+03
Am-241	2.31E+01
Cm-242	9.84E-02
Cm-244	3.51E-02

Shipping Site: LBL	Total Volume (m3/yr) 9.20E+01	Total Mass (kg/yr) 4.51E+04

Radionuclide	Activity (Ci/yr)
H-3	6.35E+02
C-14	1.13E+00
Mn-54	1.27E+02
Co-58	1.17E+02
Co-60	3.39E+02
Sr-90	1.59E+02
Y-90	1.59E+02
Tc-99	2.26E+00
Cs-134	2.63E+02
Cs-137	3.47E+02
Ba-137m	3.28E+02
U-238	1.37E+01
Cm-244	1.05E+01

Shipping Site: LLNL	Total Volume (m3/yr)	4.20E+02	Total Mass (kg/yr)	1.06E+06

Radionuclide	Activity (Ci/yr)
H-3	3.33E+04
C-14	1.55E-03
Mn-54	1.74E-01
Co-58	1.61E-01
Co-60	4.69E-01
Ni-63	4.89E-03
Sr-90	6.54E-01
Y-90	6.54E-01
Tc-99	3.18E-03
Ru-106	4.24E-02
Rh-106	4.24E-02
Sb-125	1.21E-02
Te-125m	2.97E-03
Cs-134	4.11E-01
Cs-137	9.33E-01
Ba-137m	8.82E-01
Ce-144	1.42E-01
Pr-144	1.42E-01
Pr-144m	1.70E-03
Pm-147	3.46E-01
Sm-151	3.39E-03
Eu-152	5.17E-05
Eu-154	8.87E-03
Eu-155	7.03E-03
U-238	1.88E-02
Pu-238	7.85E-02
Pu-239	5.28E-03
Pu-240	1.81E-02
Pu-241	2.50E+00
Am-241	2.58E-04
Cm-242	1.44E-03
Cm-244	5.17E-04

Shipping Site: PANT	Total Volume (m3/yr)	4.35E+03	Total Mass (kg/yr)	2.88E+07

Radionuclide	Activity (Ci/yr)
H-3	2.34E+02
Tl-208	2.21E-04
Pb-212	5.86E-04
Bi-212	5.86E-04
Po-212	3.78E-04
Po-216	5.86E-04
Ra-224	5.86E-04
Ra-228	3.50E-03
Ac-228	3.50E-03
Th-228	5.86E-04
Th-231	3.37E-03
Th-232	3.56E-02
Th-234	4.32E+00
Pa-234	4.43E-04
Pa-234m	4.32E+00
U-235	3.36E-03
U-238	4.32E+00

Shipping Site: RFP	Total Volume (m3/yr)	4.56E+03	Total Mass (kg/yr)	6.49E+06

Radionuclide	Activity (Ci/yr)
Tl-208	3.60E-05
Pb-212	9.55E-05
Bi-212	9.55E-05
Po-212	6.15E-05
Po-216	9.55E-05
Ra-224	9.55E-05
Ra-228	5.70E-04
Ac-228	5.70E-04
Th-228	9.55E-05
Th-231	5.49E-04
Th-232	5.79E-03
Th-234	7.04E-01
Pa-234	7.21E-05
Pa-234m	7.04E-01
U-235	5.47E-04
U-238	7.04E-01
Pu-238	5.56E-01
Pu-239	4.24E-02
Pu-240	1.48E-01
Pu-241	2.04E+01
Am-241	8.48E-04
Cm-242	1.18E-02
Cm-244	4.24E-03

Shipping Site: SLAC	Total Volume (m3/yr)	2.73E+02	Total Mass (kg/yr)	7.45E+05

Radionuclide	Activity (Ci/yr)
Cr-51	3.86E-03
Mn-54	7.36E-03
Fe-55	2.74E-02
Fe-59	2.48E-04
Co-58	9.88E-03
Co-60	7.74E-02
Ni-59	3.54E-04
Ni-63	5.04E-02
Zr-95	3.01E-04

Shipping Site: SNLA	Total Volume (m3/yr)	1.19E+02	Total Mass (kg/yr)	3.28E+05

Radionuclide	Activity (Ci/yr)
H-3	3.00E+00
Co-60	2.85E-05
Ni-63	5.67E-05
Sr-90	5.04E-03
Y-90	5.04E-03
Tc-99	9.00E-07
Ru-106	4.92E-04
Rh-106	4.92E-04
Sb-125	1.41E-04
Te-125m	3.45E-05
Cs-134	5.72E-04
Cs-137	5.28E-03
Ba-137m	4.99E-03
Ce-144	1.64E-03
Pr-144	1.64E-03
Pr-144m	1.98E-05
Pm-147	4.02E-03
Sm-151	3.93E-05
Eu-152	6.00E-07
Eu-154	1.02E-04
Eu-155	8.16E-05
Tl-208	5.10E-06
Pb-212	1.35E-05
Bi-212	1.35E-05
Po-212	8.70E-06
Po-216	1.35E-05
Ra-224	1.35E-05
Ra-228	8.07E-05
Ac-228	8.07E-05
Th-228	1.35E-05
Th-231	7.77E-05
Th-232	8.19E-04
Th-234	9.96E-02
Pa-234	1.02E-05
Pa-234m	9.96E-02
U-235	7.74E-05
U-238	9.96E-02
Pu-238	7.87E-02
Pu-239	6.00E-03
Pu-240	2.10E-02
Pu-241	2.89E+00
Am-241	1.21E-04
Cm-242	1.68E-03
Cm-244	6.00E-04

Shipping Site: SNLL	Total Volume (m3/yr)	3.68E+01	Total Mass (kg/yr)	9.73E+04

Radionuclide	Activity (Ci/yr)
H-3	2.78E+04
Fe-55	3.15E-01
Co-60	3.15E-01
Tl-208	6.40E-05
Pb-212	1.69E-04
Bi-212	1.69E-04
Po-212	1.09E-04
Po-216	1.69E-04
Ra-224	1.69E-04
Ra-228	1.01E-03
Ac-228	1.01E-03
Th-228	1.69E-04
Th-231	9.75E-04
Th-232	1.02E-02
Th-234	1.25E+00
Pa-234	1.28E-04
Pa-234m	1.25E+00
U-235	9.71E-04
U-238	1.25E+00

Destination: SRS

Shipping Site: AMES	Total Volume (m3/yr) 1.16E+01	Total Mass (kg/yr) 2.99E+04

Radionuclide	Activity (Ci/yr)
Tl-208	4.50E-07
Pb-212	1.19E-06
Bi-212	1.19E-06
Po-212	7.68E-07
Po-216	1.19E-06
Ra-224	1.19E-06
Ra-228	7.12E-06
Ac-228	7.12E-06
Th-228	1.19E-06
Th-231	6.86E-06
Th-232	7.23E-05
Th-234	8.79E-03
Pa-234	9.01E-07
Pa-234m	8.79E-03
U-235	6.83E-06
U-238	8.79E-03
Pu-238	6.94E-04
Pu-239	5.30E-05
Pu-240	1.85E-04
Pu-241	2.55E-02
Am-241	1.06E-06
Cm-242	1.48E-05
Cm-244	5.30E-06

Shipping Site: ANL-E	Total Volume (m3/yr) 7.35E+02	Total Mass (kg/yr) 2.00E+06

Radionuclide	Activity (Ci/yr)
H-3	1.33E+02
C-14	7.91E-02
Cr-51	2.87E+00
Mn-54	1.43E+01
Fe-55	2.04E+01
Fe-59	1.84E-01
Co-58	1.55E+01
Co-60	8.15E+01
Ni-59	2.63E-01
Ni-63	3.77E+01
Sr-90	3.33E+01
Y-90	3.33E+01
Zr-95	2.24E-01
Tc-99	1.62E-01
Ru-106	2.16E+00
Rh-106	2.16E+00
Sb-125	6.21E-01
Te-125m	1.51E-01
Cs-134	2.09E+01
Cs-137	4.75E+01
Ba-137m	4.50E+01
Ce-144	7.24E+00
Pr-144	7.24E+00
Pr-144m	8.70E-02
Pm-147	1.76E+01
Sm-151	1.72E-01
Eu-152	2.63E-03
Eu-154	4.52E-01
Eu-155	3.58E-01
U-238	9.63E-01
Pu-238	5.44E-01
Pu-239	5.27E-03
Pu-240	2.63E-03
Pu-241	6.09E-01
Am-241	7.91E-03

Shipping Site: BAPL	Total Volume (m3/yr)	3.98E+02	Total Mass (kg/yr)	1.08E+06

Radionuclide	Activity (Ci/yr)
H-3	2.51E-03
Co-60	1.19E-02
Ni-63	2.38E-02
Sr-90	2.11E+00
Y-90	2.11E+00
Tc-99	3.77E-04
Ru-106	2.06E-01
Rh-106	2.06E-01
Sb-125	5.93E-02
Te-125m	1.44E-02
Cs-134	2.40E-01
Cs-137	2.21E+00
Ba-137m	2.09E+00
Ce-144	6.91E-01
Pr-144	6.91E-01
Pr-144m	8.31E-03
Pm-147	1.68E+00
Sm-151	1.65E-02
Eu-152	2.51E-04
Eu-154	4.32E-02
Eu-155	3.42E-02
Tl-208	3.80E-06
Pb-212	1.00E-05
Bi-212	1.00E-05
Po-212	6.49E-06
Po-216	1.00E-05
Ra-224	1.00E-05
Ra-228	6.02E-05
Ac-228	6.02E-05
Th-228	1.00E-05
Th-231	5.80E-05
Th-232	6.11E-04
Th-234	7.43E-02
Pa-234	7.61E-06
Pa-234m	7.43E-02
U-235	5.77E-05
U-238	7.43E-02
Pu-238	5.20E-02
Pu-239	5.03E-04
Pu-240	2.51E-04
Pu-241	5.81E-02
Am-241	7.55E-04

Shipping Site: FNAL	Total Volume (m3/yr)	5.19E+01	Total Mass (kg/yr)	5.11E+04

Radionuclide	Activity (Ci/yr)
H-3	1.81E-01
Cr-51	1.11E-02
Mn-54	2.12E-02
Fe-55	7.94E-02
Fe-59	7.17E-04
Co-58	2.85E-02
Co-60	2.23E-01
Ni-59	1.02E-03
Ni-63	1.45E-01
Zr-95	8.71E-04
Tl-208	3.78E-07
Pb-212	1.00E-06
Bi-212	1.00E-06
Po-212	6.46E-07
Po-216	1.00E-06
Ra-224	1.00E-06
Ra-228	5.99E-06
Ac-228	5.99E-06
Th-228	1.00E-06
Th-231	5.77E-06
Th-232	6.08E-05
Th-234	7.39E-03
Pa-234	7.57E-07
Pa-234m	7.39E-03
U-235	5.75E-06
U-238	7.39E-03

Shipping Site: K-25	Total Volume (m3/yr)	6.90E+03	Total Mass (kg/yr)	4.67E+07

Radionuclide	Activity (Ci/yr)
Tl-208	1.06E-04
Pb-212	2.82E-04
Bi-212	2.82E-04
Po-212	1.82E-04
Po-216	2.82E-04
Ra-224	2.82E-04
Ra-228	1.68E-03
Ac-228	1.68E-03
Th-228	2.82E-04
Th-231	1.62E-03
Th-232	1.71E-02
Th-234	2.08E+00
Pa-234	2.13E-04
Pa-234m	2.08E+00
U-235	1.62E-03
U-238	2.08E+00

Shipping Site: KAPL	Total Volume (m3/yr)	2.11E+02	Total Mass (kg/yr)	5.36E+05

Radionuclide	Activity (Ci/yr)
H-3	5.14E-04
C-14	2.40E-05
Cr-51	5.11E-03
Mn-54	1.24E-02
Fe-55	3.63E-02
Fe-59	3.28E-04
Co-58	1.55E-02
Co-60	1.09E-01
Ni-59	4.69E-04
Ni-63	6.70E-02
Sr-90	2.58E-02
Y-90	2.58E-02
Zr-95	3.99E-04
Tc-99	5.20E-05
Ru-106	2.19E-03
Rh-106	2.19E-03
Sb-125	6.31E-04
Te-125m	1.54E-04
Cs-134	8.14E-03
Cs-137	3.09E-02
Ba-137m	2.92E-02
Ce-144	7.35E-03
Pr-144	7.35E-03
Pr-144m	8.84E-05
Pm-147	1.79E-02
Sm-151	1.75E-04
Eu-152	2.67E-06
Eu-154	4.59E-04
Eu-155	3.64E-04
Tl-208	4.50E-09
Pb-212	1.19E-08
Bi-212	1.19E-08
Po-212	7.60E-09
Po-216	1.19E-08
Ra-224	1.19E-08
Ra-228	7.11E-08
Ac-228	7.11E-08
Th-228	1.19E-08
Th-231	6.84E-08
Th-232	7.21E-07
Th-234	8.77E-05
Pa-234	8.90E-09
Pa-234m	8.77E-05
U-235	6.82E-08
U-238	3.79E-04
Pu-238	5.53E-04
Pu-239	5.35E-06
Pu-240	2.67E-06
Pu-241	6.18E-04
Am-241	8.03E-06

Shipping Site: KCP	Total Volume (m3/yr)	2.65E+00	Total Mass (kg/yr)	7.23E+03

Radionuclide	Activity (Ci/yr)
H-3	2.70E-02
C-14	1.44E-04
Mn-54	1.62E-02
Co-58	1.50E-02
Co-60	4.34E-02
Sr-90	2.04E-02
Y-90	2.04E-02
Tc-99	2.89E-04
Cs-134	3.37E-02
Cs-137	4.44E-02
Ba-137m	4.20E-02
U-238	1.76E-03

Shipping Site: MOUND	Total Volume (m3/yr)	4.40E+03	Total Mass (kg/yr)	9.67E+06

Radionuclide	Activity (Ci/yr)
H-3	1.34E+04
Pu-238	1.60E-01
Pu-239	1.22E-02
Pu-240	4.28E-02
Pu-241	5.90E+00
Am-241	2.44E-04
Cm-242	3.42E-03
Cm-244	1.22E-03

Shipping Site: ORISE	Total Volume (m3/yr)	6.07E+01	Total Mass (kg/yr)	7.36E+04

Radionuclide	Activity (Ci/yr)
H-3	2.00E-02
C-14	1.19E-05
Mn-54	1.34E-03
Co-58	1.24E-03
Co-60	3.59E-03
Sr-90	1.69E-03
Y-90	1.69E-03
Tc-99	2.39E-05
Cs-134	2.79E-03
Cs-137	3.68E-03
Ba-137m	3.48E-03
Tl-208	3.39E-07
Pb-212	8.98E-07
Bi-212	8.98E-07
Po-212	5.78E-07
Po-216	8.98E-07
Ra-224	8.98E-07
Ra-228	5.36E-06
Ac-228	5.36E-06
Th-228	8.98E-07
Th-231	5.16E-06
Th-232	5.44E-05
Th-234	6.62E-03
Pa-234	6.78E-07
Pa-234m	6.62E-03
U-235	5.14E-06
U-238	6.77E-03

Shipping Site: ORNL	Total Volume (m3/yr) 2.82E+03	Total Mass (kg/yr) 3.30E+06

Radionuclide	Activity (Ci/yr)
H-3	1.17E+00
C-14	4.44E-03
Cr-51	1.01E+01
Mn-54	1.97E+01
Fe-55	7.20E+01
Fe-59	6.51E-01
Co-58	2.63E+01
Co-60	2.09E+02
Ni-59	9.30E-01
Ni-63	1.42E+02
Sr-90	9.15E+02
Y-90	9.15E+02
Zr-95	7.90E-01
Tc-99	1.72E-01
Ru-106	8.91E+01
Rh-106	8.91E+01
Sb-125	2.56E+01
Te-125m	6.25E+00
Cs-134	1.04E+02
Cs-137	9.58E+02
Ba-137m	9.07E+02
Ce-144	2.98E+02
Pr-144	2.98E+02
Pr-144m	3.58E+00
Pm-147	7.28E+02
Sm-151	7.12E+00
Eu-152	1.08E-01
Eu-154	1.86E+01
Eu-155	1.47E+01
Tl-208	1.70E-06
Pb-212	4.50E-06
Bi-212	4.50E-06
Po-212	2.90E-06
Po-216	4.50E-06
Ra-224	4.50E-06
Ra-228	2.69E-05
Ac-228	2.69E-05
Th-228	4.50E-06
Th-231	2.59E-05
Th-232	2.73E-04
Th-234	3.31E-02
Pa-234	3.40E-06
Pa-234m	3.31E-02
U-235	2.58E-05
U-238	8.72E-02
Pu-238	2.24E+01
Pu-239	2.17E-01
Pu-240	1.09E-01
Pu-241	2.52E+01
Am-241	3.26E-01
Cm-242	5.60E-05
Cm-244	2.00E-05

Shipping Site: PORTS	Total Volume (m3/yr) 1.07E+04	Total Mass (kg/yr) 6.73E+07

Radionuclide	Activity (Ci/yr)
Tl-208	3.45E-06
Pb-212	9.14E-06
Bi-212	9.14E-06
Po-212	5.89E-06
Po-216	9.14E-06
Ra-224	9.14E-06
Ra-228	5.46E-05
Ac-228	5.46E-05
Th-228	9.14E-06
Th-231	5.26E-05
Th-232	5.55E-04
Th-234	6.74E-02
Pa-234	6.91E-06
Pa-234m	6.74E-02
U-235	5.24E-05
U-238	6.74E-02

Shipping Site: PPPL	Total Volume (m3/yr)	2.45E+01	Total Mass (kg/yr)	6.10E+03

Radionuclide	Activity (Ci/yr)
H-3	2.01E-01
Cr-51	8.50E-04
Mn-54	1.61E-03
Fe-55	6.04E-03
Fe-59	5.46E-05
Co-58	2.17E-03
Co-60	1.70E-02
Ni-59	7.80E-05
Ni-63	1.10E-02
Zr-95	6.63E-05

Shipping Site: Paducah	Total Volume (m3/yr)	5.39E+03	Total Mass (kg/yr)	1.20E+07

Radionuclide	Activity (Ci/yr)
Tc-99	8.84E-03
Tl-208	3.72E-05
Pb-212	9.84E-05
Bi-212	9.84E-05
Po-212	6.34E-05
Po-216	9.84E-05
Ra-224	9.84E-05
Ra-228	5.88E-04
Ac-228	5.88E-04
Th-228	9.84E-05
Th-231	5.66E-04
Th-232	5.97E-03
Th-234	7.26E-01
Pa-234	7.44E-05
Pa-234m	7.26E-01
U-235	5.64E-04
U-238	7.26E-01
Np-237	6.63E-03
Pu-239	6.63E-03

Shipping Site: Pinellas	Total Volume (m3/yr)	1.40E+02	Total Mass (kg/yr)	1.91E+04

Radionuclide	Activity (Ci/yr)
H-3	1.99E+04

Shipping Site: RMI	Total Volume (m3/yr)	5.68E+03	Total Mass (kg/yr)	1.47E+07

Radionuclide	Activity (Ci/yr)
Tl-208	3.58E-07
Pb-212	9.47E-07
Bi-212	9.47E-07
Po-212	6.10E-07
Po-216	9.47E-07
Ra-224	9.47E-07
Ra-228	5.66E-06
Ac-228	5.66E-06
Th-228	9.47E-07
Th-231	5.45E-06
Th-232	5.74E-05
Th-234	6.98E-03
Pa-234	7.15E-07
Pa-234m	6.98E-03
U-235	5.43E-06
U-238	6.98E-03

Shipping Site: Y-12	Total Volume (m3/yr)	1.46E+04	Total Mass (kg/yr)	8.27E+07

Radionuclide	Activity (Ci/yr)
Tl-208	6.80E-05
Pb-212	1.80E-04
Bi-212	1.80E-04
Po-212	1.16E-04
Po-216	1.80E-04
Ra-224	1.80E-04
Ra-228	1.07E-03
Ac-228	1.07E-03
Th-228	1.80E-04
Th-231	1.03E-03
Th-232	1.09E-02
Th-234	1.32E+00
Pa-234	1.36E-04
Pa-234m	1.32E+00
U-235	1.03E-03
U-238	1.32E+00

A.18 WM LLW REGIONALIZED 7 ALTERNATIVE (CASE 6): ACTIVATED METALS

Transported Material with Radionuclide Profile

Alternative: #6 Minimum Treat -- On-Site -- 2 Site (SRS,NTS) Disposal

Waste Stream: LLW Waste Type: Activated Metal

Destination: NTS

Shipping Site: ANL-W Total Volume (m3/yr) 2.26E+01 Total Mass (kg/yr) 1.64E+05

Radionuclide	Activity (Ci/yr)
H-3	1.71E-06
Cr-51	1.24E-04
Mn-54	2.37E-04
Fe-55	8.86E-04
Fe-59	8.00E-06
Co-58	3.18E-04
Co-60	2.50E-03
Ni-59	1.14E-05
Ni-63	1.64E-03
Sr-90	1.43E-03
Y-90	1.43E-03
Zr-95	9.72E-06
Tc-99	2.56E-07
Ru-106	1.40E-04
Rh-106	1.40E-04
Sb-125	4.03E-05
Te-125m	9.84E-06
Cs-134	1.63E-04
Cs-137	2.00E-01
Ba-137m	2.00E-01
Ce-144	4.69E-04
Pr-144	4.69E-04
Pr-144m	5.64E-06
Pm-147	1.14E-03
Sm-151	1.12E-05
Eu-152	1.71E-07
Eu-154	2.93E-05
Eu-155	2.32E-05
Pu-238	3.53E-05
Pu-239	3.42E-07
Pu-240	1.71E-07
Pu-241	3.95E-05
Am-241	5.13E-07

Shipping Site: HANF Total Volume (m3/yr) 9.20E+01 Total Mass (kg/yr) 6.69E+05

Radionuclide	Activity (Ci/yr)
Cr-51	2.99E+01
Mn-54	5.71E+01
Fe-55	2.13E+02
Fe-59	1.92E+00
Co-58	7.66E+01
Co-60	6.00E+02
Ni-63	3.91E+02
Zr-95	2.33E+00

Shipping Site: LANL	Total Volume (m3/yr)	1.17E+03	Total Mass (kg/yr)	8.57E+06

Radionuclide	Activity (Ci/yr)
Cr-51	2.42E+01
Mn-54	4.62E+01
Fe-55	1.72E+02
Fe-59	1.55E+00
Co-58	6.20E+01
Co-60	4.86E+02
Ni-59	2.22E+00
Ni-63	3.16E+02
Zr-95	1.89E+00

Shipping Site: LBL	Total Volume (m3/yr)	3.95E+01	Total Mass (kg/yr)	2.87E+05

Radionuclide	Activity (Ci/yr)
Cr-51	6.32E-02
Mn-54	1.20E-01
Fe-55	4.49E-01
Fe-59	4.06E-03
Co-58	1.61E-01
Co-60	1.26E+00
Ni-59	5.80E-03
Ni-63	8.24E-01
Zr-95	4.93E-03

Shipping Site: NRF	Total Volume (m3/yr)	1.29E+03	Total Mass (kg/yr)	9.40E+06

Radionuclide	Activity (Ci/yr)
Cr-51	2.31E+03
Mn-54	4.40E+03
Fe-55	1.64E+04
Fe-59	1.48E+02
Co-58	5.91E+03
Co-60	4.63E+04
Ni-59	2.12E+02
Ni-63	3.01E+04
Zr-95	1.80E+02

Shipping Site: SNLA	Total Volume (m3/yr)	1.58E+01	Total Mass (kg/yr)	1.15E+05

Radionuclide	Activity (Ci/yr)
Cr-51	6.54E-04
Mn-54	1.24E-03
Fe-55	4.64E-03
Fe-59	4.20E-05
Co-58	1.67E-03
Co-60	1.31E-02
Ni-59	6.00E-05
Ni-63	8.53E-03
Zr-95	5.10E-05

Destination: SRS

Shipping Site: BAPL — Total Volume (m3/yr): 8.84E+02 — Total Mass (kg/yr): 6.43E+06

Radionuclide	Activity (Ci/yr)
Cr-51	4.75E+03
Mn-54	9.04E+03
Fe-55	3.37E+04
Fe-59	3.05E+02
Co-58	1.21E+04
Co-60	9.52E+04
Ni-59	4.36E+02
Ni-63	6.19E+04
Zr-95	3.70E+02
Tl-208	1.36E-08
Pb-212	3.60E-08
Bi-212	3.60E-08
Po-212	2.32E-08
Po-216	3.60E-08
Ra-224	3.60E-08
Ra-228	2.15E-07
Ac-228	2.15E-07
Th-228	3.60E-08
Th-231	2.07E-07
Th-232	2.18E-06
Th-234	2.65E-04
Pa-234	2.72E-08
Pa-234m	2.65E-04
U-235	2.06E-07
U-238	2.65E-04

Shipping Site: FNAL — Total Volume (m3/yr): 1.11E+02 — Total Mass (kg/yr): 8.14E+05

Radionuclide	Activity (Ci/yr)
Cr-51	3.35E-02
Mn-54	6.39E-02
Fe-55	2.38E-01
Fe-59	2.15E-03
Co-58	8.57E-02
Co-60	6.72E-01
Ni-59	3.08E-03
Ni-63	4.37E-01
Zr-95	2.61E-03

Shipping Site: KAPL	Total Volume (m3/yr)	1.82E+03	Total Mass (kg/yr)	1.33E+07

Radionuclide	Activity (Ci/yr)
H-3	5.15E-04
C-14	2.40E-05
Cr-51	1.13E+04
Mn-54	2.15E+04
Fe-55	8.05E+04
Fe-59	7.28E+02
Co-58	2.89E+04
Co-60	2.27E+05
Ni-59	1.04E+03
Ni-63	1.47E+05
Sr-90	2.62E-02
Y-90	2.62E-02
Zr-95	8.84E+02
Tc-99	5.20E-05
Ru-106	2.22E-03
Rh-106	2.22E-03
Sb-125	6.40E-04
Te-125m	1.56E-04
Cs-134	8.18E-03
Cs-137	3.13E-02
Ba-137m	2.96E-02
Ce-144	7.46E-03
Pr-144	7.46E-03
Pr-144m	8.97E-05
Pm-147	1.82E-02
Sm-151	1.78E-04
Eu-152	2.71E-06
Eu-154	4.66E-04
Eu-155	3.69E-04
Tl-208	2.96E-08
Pb-212	7.83E-08
Bi-212	7.83E-08
Po-212	5.05E-08
Po-216	7.83E-08
Ra-224	7.83E-08
Ra-228	4.68E-07
Ac-228	4.68E-07
Th-228	7.83E-08
Th-231	4.50E-07
Th-232	4.75E-06
Th-234	5.77E-04
Pa-234	5.92E-08
Pa-234m	5.77E-04
U-235	4.48E-07
U-238	8.69E-04
Pu-238	5.61E-04
Pu-239	5.43E-06
Pu-240	2.71E-06
Pu-241	6.28E-04
Am-241	8.15E-06

A.19 WM LLW CENTRALIZED 1 ALTERNATIVE (CASE 7): HETEROGENEOUS SOLIDS

Transported Material with Radionuclide Profile

Alternative: #7 Minimum Treat -- On-Site -- 1 Site (HANF) Disposal

Waste Stream: LLW Waste Type: All, excl. Act.Metal

Destination: HANF

Shipping Site: AMES Total Volume (m3/yr) 1.16E+01 Total Mass (kg/yr) 2.99E+04

Radionuclide	Activity (Ci/yr)
Tl-208	4.50E-07
Pb-212	1.19E-06
Bi-212	1.19E-06
Po-212	7.68E-07
Po-216	1.19E-06
Ra-224	1.19E-06
Ra-228	7.12E-06
Ac-228	7.12E-06
Th-228	1.19E-06
Th-231	6.86E-06
Th-232	7.23E-05
Th-234	8.79E-03
Pa-234	9.01E-07
Pa-234m	8.79E-03
U-235	6.83E-06
U-238	8.79E-03
Pu-238	6.94E-04
Pu-239	5.30E-05
Pu-240	1.85E-04
Pu-241	2.55E-02
Am-241	1.06E-06
Cm-242	1.48E-05
Cm-244	5.30E-06

Shipping Site: ANL-E	Total Volume (m3/yr)	7.35E+02	Total Mass (kg/yr)	2.00E+06

Radionuclide	Activity (Ci/yr)
H-3	1.33E+02
C-14	7.91E-02
Cr-51	2.87E+00
Mn-54	1.43E+01
Fe-55	2.04E+01
Fe-59	1.84E-01
Co-58	1.55E+01
Co-60	8.15E+01
Ni-59	2.63E-01
Ni-63	3.77E+01
Sr-90	3.33E+01
Y-90	3.33E+01
Zr-95	2.24E-01
Tc-99	1.62E-01
Ru-106	2.16E+00
Rh-106	2.16E+00
Sb-125	6.21E-01
Te-125m	1.51E-01
Cs-134	2.09E+01
Cs-137	4.75E+01
Ba-137m	4.50E+01
Ce-144	7.24E+00
Pr-144	7.24E+00
Pr-144m	8.70E-02
Pm-147	1.76E+01
Sm-151	1.72E-01
Eu-152	2.63E-03
Eu-154	4.52E-01
Eu-155	3.58E-01
U-238	9.63E-01
Pu-238	5.44E-01
Pu-239	5.27E-03
Pu-240	2.63E-03
Pu-241	6.09E-01
Am-241	7.91E-03

Shipping Site: ANL-W	Total Volume (m3/yr)	2.78E+02	Total Mass (kg/yr)	2.12E+05

Radionuclide	Activity (Ci/yr)
H-3	7.83E-04
Cr-51	3.58E+03
Mn-54	6.83E+03
Fe-55	2.54E+04
Fe-59	2.30E+02
Co-58	9.16E+03
Co-60	7.18E+04
Ni-59	3.29E+02
Ni-63	4.67E+04
Sr-90	3.17E-02
Y-90	3.17E-02
Zr-95	2.79E+02
Tc-99	5.66E-06
Ru-106	3.09E-03
Rh-106	3.09E-03
Sb-125	8.89E-04
Te-125m	2.17E-04
Cs-134	3.59E-03
Cs-137	3.32E-02
Ba-137m	3.14E-02
Ce-144	1.03E-02
Pr-144	1.03E-02
Pr-144m	1.24E-04
Pm-147	2.52E-02
Sm-151	2.47E-04
Eu-152	3.77E-06
Eu-154	6.47E-04
Eu-155	5.13E-04
Pu-238	7.81E-04
Pu-239	7.72E-06
Pu-240	4.38E-06
Pu-241	9.56E-04
Am-241	1.13E-05
Cm-242	4.88E-08
Cm-244	1.74E-08

Shipping Site: BAPL	Total Volume (m3/yr) 3.98E+02	Total Mass (kg/yr) 1.08E+06

Radionuclide	Activity (Ci/yr)
H-3	2.51E-03
Co-60	1.19E-02
Ni-63	2.38E-02
Sr-90	2.11E+00
Y-90	2.11E+00
Tc-99	3.77E-04
Ru-106	2.06E-01
Rh-106	2.06E-01
Sb-125	5.93E-02
Te-125m	1.44E-02
Cs-134	2.40E-01
Cs-137	2.21E+00
Ba-137m	2.09E+00
Ce-144	6.91E-01
Pr-144	6.91E-01
Pr-144m	8.31E-03
Pm-147	1.68E+00
Sm-151	1.65E-02
Eu-152	2.51E-04
Eu-154	4.32E-02
Eu-155	3.42E-02
Tl-208	3.80E-06
Pb-212	1.00E-05
Bi-212	1.00E-05
Po-212	6.49E-06
Po-216	1.00E-05
Ra-224	1.00E-05
Ra-228	6.02E-05
Ac-228	6.02E-05
Th-228	1.00E-05
Th-231	5.80E-05
Th-232	6.11E-04
Th-234	7.43E-02
Pa-234	7.61E-06
Pa-234m	7.43E-02
U-235	5.77E-05
U-238	7.43E-02
Pu-238	5.20E-02
Pu-239	5.03E-04
Pu-240	2.51E-04
Pu-241	5.81E-02
Am-241	7.55E-04

Shipping Site: FNAL	Total Volume (m3/yr) 5.19E+01	Total Mass (kg/yr) 5.11E+04

Radionuclide	Activity (Ci/yr)
H-3	1.81E-01
Cr-51	1.11E-02
Mn-54	2.12E-02
Fe-55	7.94E-02
Fe-59	7.17E-04
Co-58	2.85E-02
Co-60	2.23E-01
Ni-59	1.02E-03
Ni-63	1.45E-01
Zr-95	8.71E-04
Tl-208	3.78E-07
Pb-212	1.00E-06
Bi-212	1.00E-06
Po-212	6.46E-07
Po-216	1.00E-06
Ra-224	1.00E-06
Ra-228	5.99E-06
Ac-228	5.99E-06
Th-228	1.00E-06
Th-231	5.77E-06
Th-232	6.08E-05
Th-234	7.39E-03
Pa-234	7.57E-07
Pa-234m	7.39E-03
U-235	5.75E-06
U-238	7.39E-03

Shipping Site: INEL	Total Volume (m3/yr)	6.81E+03	Total Mass (kg/yr)	1.64E+07

Radionuclide	Activity (Ci/yr)
H-3	1.56E+00
Cr-51	1.02E+02
Mn-54	1.94E+02
Fe-55	7.24E+02
Fe-59	6.55E+00
Co-58	2.60E+02
Co-60	2.04E+03
Ni-59	9.35E+00
Ni-63	1.33E+03
Sr-90	5.01E+01
Y-90	5.01E+01
Zr-95	7.95E+00
Tc-99	8.95E-03
Ru-106	4.89E+00
Rh-106	4.89E+00
Sb-125	1.40E+00
Te-125m	3.43E-01
Cs-134	5.69E+00
Cs-137	5.25E+01
Ba-137m	4.97E+01
Ce-144	1.63E+01
Pr-144	1.63E+01
Pr-144m	1.97E-01
Pm-147	4.00E+01
Sm-151	3.91E-01
Eu-152	5.97E-03
Eu-154	1.02E+00
Eu-155	8.12E-01
Pu-238	1.23E+00
Pu-239	1.19E-02
Pu-240	5.97E-03
Pu-241	1.37E+00
Am-241	1.79E-02

Shipping Site: ITRI	Total Volume (m3/yr)	1.41E+02	Total Mass (kg/yr)	1.64E+05

Radionuclide	Activity (Ci/yr)
H-3	6.17E+00
C-14	3.03E-01
Mn-54	3.41E+01
Co-58	3.15E+01
Co-60	9.12E+01
Sr-90	4.28E+01
Y-90	4.28E+01
Tc-99	6.07E-01
Cs-134	7.07E+01
Cs-137	9.33E+01
Ba-137m	8.82E+01
U-238	3.69E+00

Shipping Site: K-25	Total Volume (m3/yr)	6.90E+03	Total Mass (kg/yr)	4.67E+07

Radionuclide	Activity (Ci/yr)
Tl-208	1.06E-04
Pb-212	2.82E-04
Bi-212	2.82E-04
Po-212	1.82E-04
Po-216	2.82E-04
Ra-224	2.82E-04
Ra-228	1.68E-03
Ac-228	1.68E-03
Th-228	2.82E-04
Th-231	1.62E-03
Th-232	1.71E-02
Th-234	2.08E+00
Pa-234	2.13E-04
Pa-234m	2.08E+00
U-235	1.62E-03
U-238	2.08E+00

Shipping Site: KAPL	Total Volume (m3/yr)	2.11E+02	Total Mass (kg/yr)	5.36E+05

Radionuclide	Activity (Ci/yr)
H-3	5.14E-04
C-14	2.40E-05
Cr-51	5.11E-03
Mn-54	1.24E-02
Fe-55	3.63E-02
Fe-59	3.28E-04
Co-58	1.55E-02
Co-60	1.09E-01
Ni-59	4.69E-04
Ni-63	6.70E-02
Sr-90	2.58E-02
Y-90	2.58E-02
Zr-95	3.99E-04
Tc-99	5.20E-05
Ru-106	2.19E-03
Rh-106	2.19E-03
Sb-125	6.31E-04
Te-125m	1.54E-04
Cs-134	8.14E-03
Cs-137	3.09E-02
Ba-137m	2.92E-02
Ce-144	7.35E-03
Pr-144	7.35E-03
Pr-144m	8.84E-05
Pm-147	1.79E-02
Sm-151	1.75E-04
Eu-152	2.67E-06
Eu-154	4.59E-04
Eu-155	3.64E-04
Tl-208	4.50E-09
Pb-212	1.19E-08
Bi-212	1.19E-08
Po-212	7.60E-09
Po-216	1.19E-08
Ra-224	1.19E-08
Ra-228	7.11E-08
Ac-228	7.11E-08
Th-228	1.19E-08
Th-231	6.84E-08
Th-232	7.21E-07
Th-234	8.77E-05
Pa-234	8.90E-09
Pa-234m	8.77E-05
U-235	6.82E-08
U-238	3.79E-04
Pu-238	5.53E-04
Pu-239	5.35E-06
Pu-240	2.67E-06
Pu-241	6.18E-04
Am-241	8.03E-06

Shipping Site: KCP	Total Volume (m3/yr)	2.65E+00	Total Mass (kg/yr)	7.23E+03

Radionuclide	Activity (Ci/yr)
H-3	2.70E-02
C-14	1.44E-04
Mn-54	1.62E-02
Co-58	1.50E-02
Co-60	4.34E-02
Sr-90	2.04E-02
Y-90	2.04E-02
Tc-99	2.89E-04
Cs-134	3.37E-02
Cs-137	4.44E-02
Ba-137m	4.20E-02
U-238	1.76E-03

Shipping Site: LANL	Total Volume (m3/yr) 1.52E+04	Total Mass (kg/yr) 1.22E+07

Radionuclide	Activity (Ci/yr)
H-3	3.84E+05
Cr-51	5.93E+00
Mn-54	1.12E+01
Fe-55	4.21E+01
Fe-59	3.81E-01
Co-58	1.51E+01
Co-60	4.85E+02
Ni-59	5.44E-01
Ni-63	8.05E+02
Sr-90	6.47E+04
Y-90	6.47E+04
Zr-95	4.62E-01
Tc-99	1.15E+01
Ru-106	6.32E+03
Rh-106	6.32E+03
Sb-125	1.81E+03
Te-125m	4.43E+02
Cs-134	7.35E+03
Cs-137	6.78E+04
Ba-137m	6.42E+04
Ce-144	2.11E+04
Pr-144	2.11E+04
Pr-144m	2.54E+02
Pm-147	5.16E+04
Sm-151	5.04E+02
Eu-152	7.70E+00
Eu-154	1.32E+03
Eu-155	1.04E+03
Tl-208	1.66E-02
Pb-212	4.41E-02
Bi-212	4.41E-02
Po-212	2.84E-02
Po-216	4.41E-02
Ra-224	4.41E-02
Ra-228	2.64E-01
Ac-228	2.64E-01
Th-228	4.41E-02
Th-231	2.54E-01
Th-232	2.68E+00
Th-234	3.26E+02
Pa-234	3.33E-02
Pa-234m	3.26E+02
U-235	2.53E-01
U-238	3.26E+02
Pu-238	1.59E+03
Pu-239	1.57E+01
Pu-240	8.94E+00
Pu-241	1.95E+03
Am-241	2.31E+01
Cm-242	9.84E-02
Cm-244	3.51E-02

Shipping Site: LBL	Total Volume (m3/yr) 9.20E+01	Total Mass (kg/yr) 4.51E+04

Radionuclide	Activity (Ci/yr)
H-3	6.35E+02
C-14	1.13E+00
Mn-54	1.27E+02
Co-58	1.17E+02
Co-60	3.39E+02
Sr-90	1.59E+02
Y-90	1.59E+02
Tc-99	2.26E+00
Cs-134	2.63E+02
Cs-137	3.47E+02
Ba-137m	3.28E+02
U-238	1.37E+01
Cm-244	1.05E+01

Shipping Site: LLNL	Total Volume (m3/yr)	4.20E+02	Total Mass (kg/yr)	1.06E+06

Radionuclide	Activity (Ci/yr)
H-3	3.33E+04
C-14	1.55E-03
Mn-54	1.74E-01
Co-58	1.61E-01
Co-60	4.69E-01
Ni-63	4.89E-03
Sr-90	6.54E-01
Y-90	6.54E-01
Tc-99	3.18E-03
Ru-106	4.24E-02
Rh-106	4.24E-02
Sb-125	1.21E-02
Te-125m	2.97E-03
Cs-134	4.11E-01
Cs-137	9.33E-01
Ba-137m	8.82E-01
Ce-144	1.42E-01
Pr-144	1.42E-01
Pr-144m	1.70E-03
Pm-147	3.46E-01
Sm-151	3.39E-03
Eu-152	5.17E-05
Eu-154	8.87E-03
Eu-155	7.03E-03
U-238	1.88E-02
Pu-238	7.85E-02
Pu-239	5.28E-03
Pu-240	1.81E-02
Pu-241	2.50E+00
Am-241	2.58E-04
Cm-242	1.44E-03
Cm-244	5.17E-04

Shipping Site: MOUND	Total Volume (m3/yr)	4.40E+03	Total Mass (kg/yr)	9.67E+06

Radionuclide	Activity (Ci/yr)
H-3	1.34E+04
Pu-238	1.60E-01
Pu-239	1.22E-02
Pu-240	4.28E-02
Pu-241	5.90E+00
Am-241	2.44E-04
Cm-242	3.42E-03
Cm-244	1.22E-03

Shipping Site: ORISE	Total Volume (m3/yr)	6.07E+01	Total Mass (kg/yr)	7.36E+04

Radionuclide	Activity (Ci/yr)
H-3	2.00E-02
C-14	1.19E-05
Mn-54	1.34E-03
Co-58	1.24E-03
Co-60	3.59E-03
Sr-90	1.69E-03
Y-90	1.69E-03
Tc-99	2.39E-05
Cs-134	2.79E-03
Cs-137	3.68E-03
Ba-137m	3.48E-03
Tl-208	3.39E-07
Pb-212	8.98E-07
Bi-212	8.98E-07
Po-212	5.78E-07
Po-216	8.98E-07
Ra-224	8.98E-07
Ra-228	5.36E-06
Ac-228	5.36E-06
Th-228	8.98E-07
Th-231	5.16E-06
Th-232	5.44E-05
Th-234	6.62E-03
Pa-234	6.78E-07
Pa-234m	6.62E-03
U-235	5.14E-06
U-238	6.77E-03

Shipping Site: ORNL	Total Volume (m3/yr) 2.82E+03	Total Mass (kg/yr) 3.30E+06

Radionuclide	Activity (Ci/yr)
H-3	1.17E+00
C-14	4.44E-03
Cr-51	1.01E+01
Mn-54	1.97E+01
Fe-55	7.20E+01
Fe-59	6.51E-01
Co-58	2.63E+01
Co-60	2.09E+02
Ni-59	9.30E-01
Ni-63	1.42E+02
Sr-90	9.15E+02
Y-90	9.15E+02
Zr-95	7.90E-01
Tc-99	1.72E-01
Ru-106	8.91E+01
Rh-106	8.91E+01
Sb-125	2.56E+01
Te-125m	6.25E+00
Cs-134	1.04E+02
Cs-137	9.58E+02
Ba-137m	9.07E+02
Ce-144	2.98E+02
Pr-144	2.98E+02
Pr-144m	3.58E+00
Pm-147	7.28E+02
Sm-151	7.12E+00
Eu-152	1.08E-01
Eu-154	1.86E+01
Eu-155	1.47E+01
Tl-208	1.70E-06
Pb-212	4.50E-06
Bi-212	4.50E-06
Po-212	2.90E-06
Po-216	4.50E-06
Ra-224	4.50E-06
Ra-228	2.69E-05
Ac-228	2.69E-05
Th-228	4.50E-06
Th-231	2.59E-05
Th-232	2.73E-04
Th-234	3.31E-02
Pa-234	3.40E-06
Pa-234m	3.31E-02
U-235	2.58E-05
U-238	8.72E-02
Pu-238	2.24E+01
Pu-239	2.17E-01
Pu-240	1.09E-01
Pu-241	2.52E+01
Am-241	3.26E-01
Cm-242	5.60E-05
Cm-244	2.00E-05

Shipping Site: PANT	Total Volume (m3/yr)	4.35E+03	Total Mass (kg/yr)	2.88E+07

Radionuclide	Activity (Ci/yr)
H-3	2.34E+02
Tl-208	2.21E-04
Pb-212	5.86E-04
Bi-212	5.86E-04
Po-212	3.78E-04
Po-216	5.86E-04
Ra-224	5.86E-04
Ra-228	3.50E-03
Ac-228	3.50E-03
Th-228	5.86E-04
Th-231	3.37E-03
Th-232	3.56E-02
Th-234	4.32E+00
Pa-234	4.43E-04
Pa-234m	4.32E+00
U-235	3.36E-03
U-238	4.32E+00

Shipping Site: PORTS	Total Volume (m3/yr)	1.07E+04	Total Mass (kg/yr)	6.73E+07

Radionuclide	Activity (Ci/yr)
Tl-208	3.45E-06
Pb-212	9.14E-06
Bi-212	9.14E-06
Po-212	5.89E-06
Po-216	9.14E-06
Ra-224	9.14E-06
Ra-228	5.46E-05
Ac-228	5.46E-05
Th-228	9.14E-06
Th-231	5.26E-05
Th-232	5.55E-04
Th-234	6.74E-02
Pa-234	6.91E-06
Pa-234m	6.74E-02
U-235	5.24E-05
U-238	6.74E-02

Shipping Site: PPPL	Total Volume (m3/yr)	2.45E+01	Total Mass (kg/yr)	6.10E+03

Radionuclide	Activity (Ci/yr)
H-3	2.01E-01
Cr-51	8.50E-04
Mn-54	1.61E-03
Fe-55	6.04E-03
Fe-59	5.46E-05
Co-58	2.17E-03
Co-60	1.70E-02
Ni-59	7.80E-05
Ni-63	1.10E-02
Zr-95	6.63E-05

Shipping Site: Paducah	Total Volume (m3/yr)	5.39E+03	Total Mass (kg/yr)	1.20E+07

Radionuclide	Activity (Ci/yr)
Tc-99	8.84E-03
Tl-208	3.72E-05
Pb-212	9.84E-05
Bi-212	9.84E-05
Po-212	6.34E-05
Po-216	9.84E-05
Ra-224	9.84E-05
Ra-228	5.88E-04
Ac-228	5.88E-04
Th-228	9.84E-05
Th-231	5.66E-04
Th-232	5.97E-03
Th-234	7.26E-01
Pa-234	7.44E-05
Pa-234m	7.26E-01
U-235	5.64E-04
U-238	7.26E-01
Np-237	6.63E-03
Pu-239	6.63E-03

Shipping Site: Pinellas	Total Volume (m3/yr)	1.40E+02	Total Mass (kg/yr)	1.91E+04

Radionuclide	Activity (Ci/yr)
H-3	1.99E+04

Shipping Site: RFP	Total Volume (m3/yr)	4.56E+03	Total Mass (kg/yr)	6.49E+06

Radionuclide	Activity (Ci/yr)
Tl-208	3.60E-05
Pb-212	9.55E-05
Bi-212	9.55E-05
Po-212	6.15E-05
Po-216	9.55E-05
Ra-224	9.55E-05
Ra-228	5.70E-04
Ac-228	5.70E-04
Th-228	9.55E-05
Th-231	5.49E-04
Th-232	5.79E-03
Th-234	7.04E-01
Pa-234	7.21E-05
Pa-234m	7.04E-01
U-235	5.47E-04
U-238	7.04E-01
Pu-238	5.56E-01
Pu-239	4.24E-02
Pu-240	1.48E-01
Pu-241	2.04E+01
Am-241	8.48E-04
Cm-242	1.18E-02
Cm-244	4.24E-03

Shipping Site: RMI	Total Volume (m3/yr)	5.68E+03	Total Mass (kg/yr)	1.47E+07

Radionuclide	Activity (Ci/yr)
Tl-208	3.58E-07
Pb-212	9.47E-07
Bi-212	9.47E-07
Po-212	6.10E-07
Po-216	9.47E-07
Ra-224	9.47E-07
Ra-228	5.66E-06
Ac-228	5.66E-06
Th-228	9.47E-07
Th-231	5.45E-06
Th-232	5.74E-05
Th-234	6.98E-03
Pa-234	7.15E-07
Pa-234m	6.98E-03
U-235	5.43E-06
U-238	6.98E-03

Shipping Site: SLAC	Total Volume (m3/yr)	2.73E+02	Total Mass (kg/yr)	7.45E+05

Radionuclide	Activity (Ci/yr)
Cr-51	3.86E-03
Mn-54	7.36E-03
Fe-55	2.74E-02
Fe-59	2.48E-04
Co-58	9.88E-03
Co-60	7.74E-02
Ni-59	3.54E-04
Ni-63	5.04E-02
Zr-95	3.01E-04

Shipping Site: SNLA	Total Volume (m3/yr)	1.19E+02	Total Mass (kg/yr)	3.28E+05

Radionuclide	Activity (Ci/yr)
H-3	3.00E+00
Co-60	2.85E-05
Ni-63	5.67E-05
Sr-90	5.04E-03
Y-90	5.04E-03
Tc-99	9.00E-07
Ru-106	4.92E-04
Rh-106	4.92E-04
Sb-125	1.41E-04
Te-125m	3.45E-05
Cs-134	5.72E-04
Cs-137	5.28E-03
Ba-137m	4.99E-03
Ce-144	1.64E-03
Pr-144	1.64E-03
Pr-144m	1.98E-05
Pm-147	4.02E-03
Sm-151	3.93E-05
Eu-152	6.00E-07
Eu-154	1.02E-04
Eu-155	8.16E-05
Tl-208	5.10E-06
Pb-212	1.35E-05
Bi-212	1.35E-05
Po-212	8.70E-06
Po-216	1.35E-05
Ra-224	1.35E-05
Ra-228	8.07E-05
Ac-228	8.07E-05
Th-228	1.35E-05
Th-231	7.77E-05
Th-232	8.19E-04
Th-234	9.96E-02
Pa-234	1.02E-05
Pa-234m	9.96E-02
U-235	7.74E-05
U-238	9.96E-02
Pu-238	7.87E-02
Pu-239	6.00E-03
Pu-240	2.10E-02
Pu-241	2.89E+00
Am-241	1.21E-04
Cm-242	1.68E-03
Cm-244	6.00E-04

Shipping Site: SNLL	Total Volume (m3/yr)	3.68E+01	Total Mass (kg/yr)	9.73E+04

Radionuclide	Activity (Ci/yr)
H-3	2.78E+04
Fe-55	3.15E-01
Co-60	3.15E-01
Tl-208	6.40E-05
Pb-212	1.69E-04
Bi-212	1.69E-04
Po-212	1.09E-04
Po-216	1.69E-04
Ra-224	1.69E-04
Ra-228	1.01E-03
Ac-228	1.01E-03
Th-228	1.69E-04
Th-231	9.75E-04
Th-232	1.02E-02
Th-234	1.25E+00
Pa-234	1.28E-04
Pa-234m	1.25E+00
U-235	9.71E-04
U-238	1.25E+00

Shipping Site: SRS	Total Volume (m3/yr) 5.74E+04	Total Mass (kg/yr) 1.29E+08

Radionuclide	Activity (Ci/yr)
H-3	4.77E+04
C-14	1.08E+00
Cr-51	1.95E+03
Mn-54	3.84E+03
Fe-55	1.38E+04
Fe-59	1.25E+02
Co-58	5.10E+03
Co-60	3.94E+04
Ni-59	1.79E+02
Ni-63	2.55E+04
Sr-90	3.56E+03
Y-90	3.56E+03
Zr-95	1.52E+02
Tc-99	2.78E+00
Ru-106	3.32E+02
Rh-106	3.32E+02
Sb-125	9.56E+01
Te-125m	2.33E+01
Cs-134	6.40E+02
Cs-137	3.90E+03
Ba-137m	3.69E+03
Ce-144	1.11E+03
Pr-144	1.11E+03
Pr-144m	1.33E+01
Pm-147	2.72E+03
Sm-151	2.65E+01
Eu-152	4.05E-01
Eu-154	6.96E+01
Eu-155	5.52E+01
Tl-208	8.54E-04
Pb-212	2.26E-03
Bi-212	2.26E-03
Po-212	1.45E-03
Po-216	2.26E-03
Ra-224	2.26E-03
Ra-228	1.35E-02
Ac-228	1.35E-02
Th-228	2.26E-03
Th-231	1.30E-02
Th-232	1.37E-01
Th-234	1.66E+01
Pa-234	1.70E-03
Pa-234m	1.66E+01
U-235	1.29E-02
U-238	2.99E+01
Pu-238	8.45E+01
Pu-239	8.64E-01
Pu-240	5.89E-01
Pu-241	1.19E+02
Am-241	1.21E+00
Cm-242	1.46E-02
Cm-244	5.24E-03

Shipping Site: Y-12	Total Volume (m3/yr)	1.46E+04	Total Mass (kg/yr)	8.27E+07

Radionuclide	Activity (Ci/yr)
Tl-208	6.80E-05
Pb-212	1.80E-04
Bi-212	1.80E-04
Po-212	1.16E-04
Po-216	1.80E-04
Ra-224	1.80E-04
Ra-228	1.07E-03
Ac-228	1.07E-03
Th-228	1.80E-04
Th-231	1.03E-03
Th-232	1.09E-02
Th-234	1.32E+00
Pa-234	1.36E-04
Pa-234m	1.32E+00
U-235	1.03E-03
U-238	1.32E+00

A.20 WM LLW CENTRALIZED 1 ALTERNATIVE (CASE 7): ACTIVATED METALS

Transported Material with Radionuclide Profile

Alternative: #7 Minimum Treat -- On-Site -- 1 Site (HANF) Disposal

Waste Stream: LLW Waste Type: Activated Metal

Destination: HANF

Shipping Site: ANL-W Total Volume (m3/yr) 2.26E+01 Total Mass (kg/yr) 1.64E+05

Radionuclide	Activity (Ci/yr)
H-3	1.71E-06
Cr-51	1.24E-04
Mn-54	2.37E-04
Fe-55	8.86E-04
Fe-59	8.00E-06
Co-58	3.18E-04
Co-60	2.50E-03
Ni-59	1.14E-05
Ni-63	1.64E-03
Sr-90	1.43E-03
Y-90	1.43E-03
Zr-95	9.72E-06
Tc-99	2.56E-07
Ru-106	1.40E-04
Rh-106	1.40E-04
Sb-125	4.03E-05
Te-125m	9.84E-06
Cs-134	1.63E-04
Cs-137	2.00E-01
Ba-137m	2.00E-01
Ce-144	4.69E-04
Pr-144	4.69E-04
Pr-144m	5.64E-06
Pm-147	1.14E-03
Sm-151	1.12E-05
Eu-152	1.71E-07
Eu-154	2.93E-05
Eu-155	2.32E-05
Pu-238	3.53E-05
Pu-239	3.42E-07
Pu-240	1.71E-07
Pu-241	3.95E-05
Am-241	5.13E-07

Shipping Site: BAPL	Total Volume (m3/yr)	8.84E+02	Total Mass (kg/yr)	6.43E+06

Radionuclide	Activity (Ci/yr)
Cr-51	4.75E+03
Mn-54	9.04E+03
Fe-55	3.37E+04
Fe-59	3.05E+02
Co-58	1.21E+04
Co-60	9.52E+04
Ni-59	4.36E+02
Ni-63	6.19E+04
Zr-95	3.70E+02
Tl-208	1.36E-08
Pb-212	3.60E-08
Bi-212	3.60E-08
Po-212	2.32E-08
Po-216	3.60E-08
Ra-224	3.60E-08
Ra-228	2.15E-07
Ac-228	2.15E-07
Th-228	3.60E-08
Th-231	2.07E-07
Th-232	2.18E-06
Th-234	2.65E-04
Pa-234	2.72E-08
Pa-234m	2.65E-04
U-235	2.06E-07
U-238	2.65E-04

Shipping Site: FNAL	Total Volume (m3/yr)	1.11E+02	Total Mass (kg/yr)	8.14E+05

Radionuclide	Activity (Ci/yr)
Cr-51	3.35E-02
Mn-54	6.39E-02
Fe-55	2.38E-01
Fe-59	2.15E-03
Co-58	8.57E-02
Co-60	6.72E-01
Ni-59	3.08E-03
Ni-63	4.37E-01
Zr-95	2.61E-03

Shipping Site: KAPL	Total Volume (m3/yr)	1.82E+03	Total Mass (kg/yr)	1.33E+07

Radionuclide	Activity (Ci/yr)
H-3	5.15E-04
C-14	2.40E-05
Cr-51	1.13E+04
Mn-54	2.15E+04
Fe-55	8.05E+04
Fe-59	7.28E+02
Co-58	2.89E+04
Co-60	2.27E+05
Ni-59	1.04E+03
Ni-63	1.47E+05
Sr-90	2.62E-02
Y-90	2.62E-02
Zr-95	8.84E+02
Tc-99	5.20E-05
Ru-106	2.22E-03
Rh-106	2.22E-03
Sb-125	6.40E-04
Te-125m	1.56E-04
Cs-134	8.18E-03
Cs-137	3.13E-02
Ba-137m	2.96E-02
Ce-144	7.46E-03
Pr-144	7.46E-03
Pr-144m	8.97E-05
Pm-147	1.82E-02
Sm-151	1.78E-04
Eu-152	2.71E-06
Eu-154	4.66E-04
Eu-155	3.69E-04
Tl-208	2.96E-08
Pb-212	7.83E-08
Bi-212	7.83E-08
Po-212	5.05E-08
Po-216	7.83E-08
Ra-224	7.83E-08
Ra-228	4.68E-07
Ac-228	4.68E-07
Th-228	7.83E-08
Th-231	4.50E-07
Th-232	4.75E-06
Th-234	5.77E-04
Pa-234	5.92E-08
Pa-234m	5.77E-04
U-235	4.48E-07
U-238	8.69E-04
Pu-238	5.61E-04
Pu-239	5.43E-06
Pu-240	2.71E-06
Pu-241	6.28E-04
Am-241	8.15E-06

Shipping Site: LANL	Total Volume (m3/yr)	1.17E+03	Total Mass (kg/yr)	8.57E+06

Radionuclide	Activity (Ci/yr)
Cr-51	2.42E+01
Mn-54	4.62E+01
Fe-55	1.72E+02
Fe-59	1.55E+00
Co-58	6.20E+01
Co-60	4.86E+02
Ni-59	2.22E+00
Ni-63	3.16E+02
Zr-95	1.89E+00

Shipping Site: LBL	Total Volume (m3/yr) 3.95E+01	Total Mass (kg/yr) 2.87E+05

Radionuclide	Activity (Ci/yr)
Cr-51	6.32E-02
Mn-54	1.20E-01
Fe-55	4.49E-01
Fe-59	4.06E-03
Co-58	1.61E-01
Co-60	1.26E+00
Ni-59	5.80E-03
Ni-63	8.24E-01
Zr-95	4.93E-03

Shipping Site: NRF	Total Volume (m3/yr) 1.29E+03	Total Mass (kg/yr) 9.40E+06

Radionuclide	Activity (Ci/yr)
Cr-51	2.31E+03
Mn-54	4.40E+03
Fe-55	1.64E+04
Fe-59	1.48E+02
Co-58	5.91E+03
Co-60	4.63E+04
Ni-59	2.12E+02
Ni-63	3.01E+04
Zr-95	1.80E+02

Shipping Site: SNLA	Total Volume (m3/yr) 1.58E+01	Total Mass (kg/yr) 1.15E+05

Radionuclide	Activity (Ci/yr)
Cr-51	6.54E-04
Mn-54	1.24E-03
Fe-55	4.64E-03
Fe-59	4.20E-05
Co-58	1.67E-03
Co-60	1.31E-02
Ni-59	6.00E-05
Ni-63	8.53E-03
Zr-95	5.10E-05

A.21 WM LLW CENTRALIZED 2 ALTERNATIVE (CASE 8): HETEROGENEOUS SOLIDS

Transported Material with Radionuclide Profile

Alternative: #8 Minimum Treat -- On-Site -- 1 Site (NTS) Disposal

Waste Stream: LLW Waste Type: All, excl. Act.Metal

Destination: NTS

Shipping Site: AMES Total Volume (m3/yr) 1.16E+01 Total Mass (kg/yr) 2.99E+04

Radionuclide	Activity (Ci/yr)
Tl-208	4.50E-07
Pb-212	1.19E-06
Bi-212	1.19E-06
Po-212	7.68E-07
Po-216	1.19E-06
Ra-224	1.19E-06
Ra-228	7.12E-06
Ac-228	7.12E-06
Th-228	1.19E-06
Th-231	6.86E-06
Th-232	7.23E-05
Th-234	8.79E-03
Pa-234	9.01E-07
Pa-234m	8.79E-03
U-235	6.83E-06
U-238	8.79E-03
Pu-238	6.94E-04
Pu-239	5.30E-05
Pu-240	1.85E-04
Pu-241	2.55E-02
Am-241	1.06E-06
Cm-242	1.48E-05
Cm-244	5.30E-06

Shipping Site: ANL-E	Total Volume (m3/yr) 7.35E+02	Total Mass (kg/yr) 2.00E+06

Radionuclide	Activity (Ci/yr)
H-3	1.33E+02
C-14	7.91E-02
Cr-51	2.87E+00
Mn-54	1.43E+01
Fe-55	2.04E+01
Fe-59	1.84E-01
Co-58	1.55E+01
Co-60	8.15E+01
Ni-59	2.63E-01
Ni-63	3.77E+01
Sr-90	3.33E+01
Y-90	3.33E+01
Zr-95	2.24E-01
Tc-99	1.62E-01
Ru-106	2.16E+00
Rh-106	2.16E+00
Sb-125	6.21E-01
Te-125m	1.51E-01
Cs-134	2.09E+01
Cs-137	4.75E+01
Ba-137m	4.50E+01
Ce-144	7.24E+00
Pr-144	7.24E+00
Pr-144m	8.70E-02
Pm-147	1.76E+01
Sm-151	1.72E-01
Eu-152	2.63E-03
Eu-154	4.52E-01
Eu-155	3.58E-01
U-238	9.63E-01
Pu-238	5.44E-01
Pu-239	5.27E-03
Pu-240	2.63E-03
Pu-241	6.09E-01
Am-241	7.91E-03

Shipping Site: ANL-W	Total Volume (m3/yr)	2.78E+02	Total Mass (kg/yr)	2.12E+05

Radionuclide	Activity (Ci/yr)
H-3	7.83E-04
Cr-51	3.58E+03
Mn-54	6.83E+03
Fe-55	2.54E+04
Fe-59	2.30E+02
Co-58	9.16E+03
Co-60	7.18E+04
Ni-59	3.29E+02
Ni-63	4.67E+04
Sr-90	3.17E-02
Y-90	3.17E-02
Zr-95	2.79E+02
Tc-99	5.66E-06
Ru-106	3.09E-03
Rh-106	3.09E-03
Sb-125	8.89E-04
Te-125m	2.17E-04
Cs-134	3.59E-03
Cs-137	3.32E-02
Ba-137m	3.14E-02
Ce-144	1.03E-02
Pr-144	1.03E-02
Pr-144m	1.24E-04
Pm-147	2.52E-02
Sm-151	2.47E-04
Eu-152	3.77E-06
Eu-154	6.47E-04
Eu-155	5.13E-04
Pu-238	7.81E-04
Pu-239	7.72E-06
Pu-240	4.38E-06
Pu-241	9.56E-04
Am-241	1.13E-05
Cm-242	4.88E-08
Cm-244	1.74E-08

Shipping Site: BAPL	Total Volume (m3/yr)	3.98E+02	Total Mass (kg/yr)	1.08E+06

Radionuclide	Activity (Ci/yr)
H-3	2.51E-03
Co-60	1.19E-02
Ni-63	2.38E-02
Sr-90	2.11E+00
Y-90	2.11E+00
Tc-99	3.77E-04
Ru-106	2.06E-01
Rh-106	2.06E-01
Sb-125	5.93E-02
Te-125m	1.44E-02
Cs-134	2.40E-01
Cs-137	2.21E+00
Ba-137m	2.09E+00
Ce-144	6.91E-01
Pr-144	6.91E-01
Pr-144m	8.31E-03
Pm-147	1.68E+00
Sm-151	1.65E-02
Eu-152	2.51E-04
Eu-154	4.32E-02
Eu-155	3.42E-02
Tl-208	3.80E-06
Pb-212	1.00E-05
Bi-212	1.00E-05
Po-212	6.49E-06
Po-216	1.00E-05
Ra-224	1.00E-05
Ra-228	6.02E-05
Ac-228	6.02E-05
Th-228	1.00E-05
Th-231	5.80E-05
Th-232	6.11E-04
Th-234	7.43E-02
Pa-234	7.61E-06
Pa-234m	7.43E-02
U-235	5.77E-05
U-238	7.43E-02
Pu-238	5.20E-02
Pu-239	5.03E-04
Pu-240	2.51E-04
Pu-241	5.81E-02
Am-241	7.55E-04

Shipping Site: FNAL	Total Volume (m3/yr)	5.19E+01	Total Mass (kg/yr)	5.11E+04

Radionuclide	Activity (Ci/yr)
H-3	1.81E-01
Cr-51	1.11E-02
Mn-54	2.12E-02
Fe-55	7.94E-02
Fe-59	7.17E-04
Co-58	2.85E-02
Co-60	2.23E-01
Ni-59	1.02E-03
Ni-63	1.45E-01
Zr-95	8.71E-04
Tl-208	3.78E-07
Pb-212	1.00E-06
Bi-212	1.00E-06
Po-212	6.46E-07
Po-216	1.00E-06
Ra-224	1.00E-06
Ra-228	5.99E-06
Ac-228	5.99E-06
Th-228	1.00E-06
Th-231	5.77E-06
Th-232	6.08E-05
Th-234	7.39E-03
Pa-234	7.57E-07
Pa-234m	7.39E-03
U-235	5.75E-06
U-238	7.39E-03

Shipping Site: HANF	Total Volume (m3/yr) 9.66E+03	Total Mass (kg/yr) 2.75E+07

Radionuclide	Activity (Ci/yr)
H-3	2.22E+01
Cr-51	5.66E+01
Mn-54	1.07E+02
Fe-55	4.02E+02
Fe-59	3.63E+00
Co-58	1.44E+02
Co-60	1.14E+03
Ni-59	5.19E+00
Ni-63	7.60E+02
Sr-90	1.93E+03
Y-90	1.93E+03
Zr-95	4.41E+00
Tc-99	3.44E-01
Ru-106	1.88E+02
Rh-106	1.88E+02
Sb-125	5.41E+01
Te-125m	1.32E+01
Cs-134	2.19E+02
Cs-137	2.02E+03
Ba-137m	1.91E+03
Ce-144	6.31E+02
Pr-144	6.31E+02
Pr-144m	7.58E+00
Pm-147	1.54E+03
Sm-151	1.50E+01
Eu-152	2.29E-01
Eu-154	3.94E+01
Eu-155	3.12E+01
Tl-208	2.70E-04
Pb-212	7.16E-04
Bi-212	7.16E-04
Po-212	4.61E-04
Po-216	7.16E-04
Ra-224	7.16E-04
Ra-228	4.28E-03
Ac-228	4.28E-03
Th-228	7.16E-04
Th-231	4.12E-03
Th-232	4.34E-02
Th-234	5.28E+00
Pa-234	5.41E-04
Pa-234m	5.28E+00
U-235	4.10E-03
U-238	5.28E+00
Pu-238	4.74E+01
Pu-239	4.59E-01
Pu-240	2.29E-01
Pu-241	5.31E+01
Am-241	6.89E-01

Shipping Site: INEL	Total Volume (m3/yr)	6.81E+03	Total Mass (kg/yr)	1.64E+07

Radionuclide	Activity (Ci/yr)
H-3	1.56E+00
Cr-51	1.02E+02
Mn-54	1.94E+02
Fe-55	7.24E+02
Fe-59	6.55E+00
Co-58	2.60E+02
Co-60	2.04E+03
Ni-59	9.35E+00
Ni-63	1.33E+03
Sr-90	5.01E+01
Y-90	5.01E+01
Zr-95	7.95E+00
Tc-99	8.95E-03
Ru-106	4.89E+00
Rh-106	4.89E+00
Sb-125	1.40E+00
Te-125m	3.43E-01
Cs-134	5.69E+00
Cs-137	5.25E+01
Ba-137m	4.97E+01
Ce-144	1.63E+01
Pr-144	1.63E+01
Pr-144m	1.97E-01
Pm-147	4.00E+01
Sm-151	3.91E-01
Eu-152	5.97E-03
Eu-154	1.02E+00
Eu-155	8.12E-01
Pu-238	1.23E+00
Pu-239	1.19E-02
Pu-240	5.97E-03
Pu-241	1.37E+00
Am-241	1.79E-02

Shipping Site: ITRI	Total Volume (m3/yr)	1.41E+02	Total Mass (kg/yr)	1.64E+05

Radionuclide	Activity (Ci/yr)
H-3	6.17E+00
C-14	3.03E-01
Mn-54	3.41E+01
Co-58	3.15E+01
Co-60	9.12E+01
Sr-90	4.28E+01
Y-90	4.28E+01
Tc-99	6.07E-01
Cs-134	7.07E+01
Cs-137	9.33E+01
Ba-137m	8.82E+01
U-238	3.69E+00

Shipping Site: K-25	Total Volume (m3/yr) 6.90E+03	Total Mass (kg/yr) 4.67E+07

Radionuclide	Activity (Ci/yr)
Tl-208	1.06E-04
Pb-212	2.82E-04
Bi-212	2.82E-04
Po-212	1.82E-04
Po-216	2.82E-04
Ra-224	2.82E-04
Ra-228	1.68E-03
Ac-228	1.68E-03
Th-228	2.82E-04
Th-231	1.62E-03
Th-232	1.71E-02
Th-234	2.08E+00
Pa-234	2.13E-04
Pa-234m	2.08E+00
U-235	1.62E-03
U-238	2.08E+00

Shipping Site: KAPL	Total Volume (m3/yr) 2.11E+02	Total Mass (kg/yr) 5.36E+05

Radionuclide	Activity (Ci/yr)
H-3	5.14E-04
C-14	2.40E-05
Cr-51	5.11E-03
Mn-54	1.24E-02
Fe-55	3.63E-02
Fe-59	3.28E-04
Co-58	1.55E-02
Co-60	1.09E-01
Ni-59	4.69E-04
Ni-63	6.70E-02
Sr-90	2.58E-02
Y-90	2.58E-02
Zr-95	3.99E-04
Tc-99	5.20E-05
Ru-106	2.19E-03
Rh-106	2.19E-03
Sb-125	6.31E-04
Te-125m	1.54E-04
Cs-134	8.14E-03
Cs-137	3.09E-02
Ba-137m	2.92E-02
Ce-144	7.35E-03
Pr-144	7.35E-03
Pr-144m	8.84E-05
Pm-147	1.79E-02
Sm-151	1.75E-04
Eu-152	2.67E-06
Eu-154	4.59E-04
Eu-155	3.64E-04
Tl-208	4.50E-09
Pb-212	1.19E-08
Bi-212	1.19E-08
Po-212	7.60E-09
Po-216	1.19E-08
Ra-224	1.19E-08
Ra-228	7.11E-08
Ac-228	7.11E-08
Th-228	1.19E-08
Th-231	6.84E-08
Th-232	7.21E-07
Th-234	8.77E-05
Pa-234	8.90E-09
Pa-234m	8.77E-05
U-235	6.82E-08
U-238	3.79E-04
Pu-238	5.53E-04
Pu-239	5.35E-06
Pu-240	2.67E-06
Pu-241	6.18E-04
Am-241	8.03E-06

Shipping Site: KCP	Total Volume (m3/yr)	2.65E+00	Total Mass (kg/yr)	7.23E+03

Radionuclide	Activity (Ci/yr)
H-3	2.70E-02
C-14	1.44E-04
Mn-54	1.62E-02
Co-58	1.50E-02
Co-60	4.34E-02
Sr-90	2.04E-02
Y-90	2.04E-02
Tc-99	2.89E-04
Cs-134	3.37E-02
Cs-137	4.44E-02
Ba-137m	4.20E-02
U-238	1.76E-03

Shipping Site: LANL	Total Volume (m3/yr)	1.52E+04	Total Mass (kg/yr)	1.22E+07

Radionuclide	Activity (Ci/yr)
H-3	3.84E+05
Cr-51	5.93E+00
Mn-54	1.12E+01
Fe-55	4.21E+01
Fe-59	3.81E-01
Co-58	1.51E+01
Co-60	4.85E+02
Ni-59	5.44E-01
Ni-63	8.05E+02
Sr-90	6.47E+04
Y-90	6.47E+04
Zr-95	4.62E-01
Tc-99	1.15E+01
Ru-106	6.32E+03
Rh-106	6.32E+03
Sb-125	1.81E+03
Te-125m	4.43E+02
Cs-134	7.35E+03
Cs-137	6.78E+04
Ba-137m	6.42E+04
Ce-144	2.11E+04
Pr-144	2.11E+04
Pr-144m	2.54E+02
Pm-147	5.16E+04
Sm-151	5.04E+02
Eu-152	7.70E+00
Eu-154	1.32E+03
Eu-155	1.04E+03
Tl-208	1.66E-02
Pb-212	4.41E-02
Bi-212	4.41E-02
Po-212	2.84E-02
Po-216	4.41E-02
Ra-224	4.41E-02
Ra-228	2.64E-01
Ac-228	2.64E-01
Th-228	4.41E-02
Th-231	2.54E-01
Th-232	2.68E+00
Th-234	3.26E+02
Pa-234	3.33E-02
Pa-234m	3.26E+02
U-235	2.53E-01
U-238	3.26E+02
Pu-238	1.59E+03
Pu-239	1.57E+01
Pu-240	8.94E+00
Pu-241	1.95E+03
Am-241	2.31E+01
Cm-242	9.84E-02
Cm-244	3.51E-02

Shipping Site: LBL	Total Volume (m3/yr)	9.20E+01	Total Mass (kg/yr)	4.51E+04

Radionuclide	Activity (Ci/yr)
H-3	6.35E+02
C-14	1.13E+00
Mn-54	1.27E+02
Co-58	1.17E+02
Co-60	3.39E+02
Sr-90	1.59E+02
Y-90	1.59E+02
Tc-99	2.26E+00
Cs-134	2.63E+02
Cs-137	3.47E+02
Ba-137m	3.28E+02
U-238	1.37E+01
Cm-244	1.05E+01

Shipping Site: LLNL	Total Volume (m3/yr)	4.20E+02	Total Mass (kg/yr)	1.06E+06

Radionuclide	Activity (Ci/yr)
H-3	3.33E+04
C-14	1.55E-03
Mn-54	1.74E-01
Co-58	1.61E-01
Co-60	4.69E-01
Ni-63	4.89E-03
Sr-90	6.54E-01
Y-90	6.54E-01
Tc-99	3.18E-03
Ru-106	4.24E-02
Rh-106	4.24E-02
Sb-125	1.21E-02
Te-125m	2.97E-03
Cs-134	4.11E-01
Cs-137	9.33E-01
Ba-137m	8.82E-01
Ce-144	1.42E-01
Pr-144	1.42E-01
Pr-144m	1.70E-03
Pm-147	3.46E-01
Sm-151	3.39E-03
Eu-152	5.17E-05
Eu-154	8.87E-03
Eu-155	7.03E-03
U-238	1.88E-02
Pu-238	7.85E-02
Pu-239	5.28E-03
Pu-240	1.81E-02
Pu-241	2.50E+00
Am-241	2.58E-04
Cm-242	1.44E-03
Cm-244	5.17E-04

Shipping Site: MOUND	Total Volume (m3/yr)	4.40E+03	Total Mass (kg/yr)	9.67E+06

Radionuclide	Activity (Ci/yr)
H-3	1.34E+04
Pu-238	1.60E-01
Pu-239	1.22E-02
Pu-240	4.28E-02
Pu-241	5.90E+00
Am-241	2.44E-04
Cm-242	3.42E-03
Cm-244	1.22E-03

Shipping Site: ORISE	Total Volume (m3/yr)	6.07E+01	Total Mass (kg/yr)	7.36E+04

Radionuclide	Activity (Ci/yr)
H-3	2.00E-02
C-14	1.19E-05
Mn-54	1.34E-03
Co-58	1.24E-03
Co-60	3.59E-03
Sr-90	1.69E-03
Y-90	1.69E-03
Tc-99	2.39E-05
Cs-134	2.79E-03
Cs-137	3.68E-03
Ba-137m	3.48E-03
Tl-208	3.39E-07
Pb-212	8.98E-07
Bi-212	8.98E-07
Po-212	5.78E-07
Po-216	8.98E-07
Ra-224	8.98E-07
Ra-228	5.36E-06
Ac-228	5.36E-06
Th-228	8.98E-07
Th-231	5.16E-06
Th-232	5.44E-05
Th-234	6.62E-03
Pa-234	6.78E-07
Pa-234m	6.62E-03
U-235	5.14E-06
U-238	6.77E-03

Shipping Site: ORNL	Total Volume (m3/yr) 2.82E+03	Total Mass (kg/yr) 3.30E+06

Radionuclide	Activity (Ci/yr)
H-3	1.17E+00
C-14	4.44E-03
Cr-51	1.01E+01
Mn-54	1.97E+01
Fe-55	7.20E+01
Fe-59	6.51E-01
Co-58	2.63E+01
Co-60	2.09E+02
Ni-59	9.30E-01
Ni-63	1.42E+02
Sr-90	9.15E+02
Y-90	9.15E+02
Zr-95	7.90E-01
Tc-99	1.72E-01
Ru-106	8.91E+01
Rh-106	8.91E+01
Sb-125	2.56E+01
Te-125m	6.25E+00
Cs-134	1.04E+02
Cs-137	9.58E+02
Ba-137m	9.07E+02
Ce-144	2.98E+02
Pr-144	2.98E+02
Pr-144m	3.58E+00
Pm-147	7.28E+02
Sm-151	7.12E+00
Eu-152	1.08E-01
Eu-154	1.86E+01
Eu-155	1.47E+01
Tl-208	1.70E-06
Pb-212	4.50E-06
Bi-212	4.50E-06
Po-212	2.90E-06
Po-216	4.50E-06
Ra-224	4.50E-06
Ra-228	2.69E-05
Ac-228	2.69E-05
Th-228	4.50E-06
Th-231	2.59E-05
Th-232	2.73E-04
Th-234	3.31E-02
Pa-234	3.40E-06
Pa-234m	3.31E-02
U-235	2.58E-05
U-238	8.72E-02
Pu-238	2.24E+01
Pu-239	2.17E-01
Pu-240	1.09E-01
Pu-241	2.52E+01
Am-241	3.26E-01
Cm-242	5.60E-05
Cm-244	2.00E-05

Shipping Site: PANT	Total Volume (m3/yr)	4.35E+03	Total Mass (kg/yr)	2.88E+07

Radionuclide	Activity (Ci/yr)
H-3	2.34E+02
Tl-208	2.21E-04
Pb-212	5.86E-04
Bi-212	5.86E-04
Po-212	3.78E-04
Po-216	5.86E-04
Ra-224	5.86E-04
Ra-228	3.50E-03
Ac-228	3.50E-03
Th-228	5.86E-04
Th-231	3.37E-03
Th-232	3.56E-02
Th-234	4.32E+00
Pa-234	4.43E-04
Pa-234m	4.32E+00
U-235	3.36E-03
U-238	4.32E+00

Shipping Site: PORTS	Total Volume (m3/yr)	1.07E+04	Total Mass (kg/yr)	6.73E+07

Radionuclide	Activity (Ci/yr)
Tl-208	3.45E-06
Pb-212	9.14E-06
Bi-212	9.14E-06
Po-212	5.89E-06
Po-216	9.14E-06
Ra-224	9.14E-06
Ra-228	5.46E-05
Ac-228	5.46E-05
Th-228	9.14E-06
Th-231	5.26E-05
Th-232	5.55E-04
Th-234	6.74E-02
Pa-234	6.91E-06
Pa-234m	6.74E-02
U-235	5.24E-05
U-238	6.74E-02

Shipping Site: PPPL	Total Volume (m3/yr)	2.45E+01	Total Mass (kg/yr)	6.10E+03

Radionuclide	Activity (Ci/yr)
H-3	2.01E-01
Cr-51	8.50E-04
Mn-54	1.61E-03
Fe-55	6.04E-03
Fe-59	5.46E-05
Co-58	2.17E-03
Co-60	1.70E-02
Ni-59	7.80E-05
Ni-63	1.10E-02
Zr-95	6.63E-05

Shipping Site: Paducah	Total Volume (m3/yr)	5.39E+03	Total Mass (kg/yr)	1.20E+07

Radionuclide	Activity (Ci/yr)
Tc-99	8.84E-03
Tl-208	3.72E-05
Pb-212	9.84E-05
Bi-212	9.84E-05
Po-212	6.34E-05
Po-216	9.84E-05
Ra-224	9.84E-05
Ra-228	5.88E-04
Ac-228	5.88E-04
Th-228	9.84E-05
Th-231	5.66E-04
Th-232	5.97E-03
Th-234	7.26E-01
Pa-234	7.44E-05
Pa-234m	7.26E-01
U-235	5.64E-04
U-238	7.26E-01
Np-237	6.63E-03
Pu-239	6.63E-03

Shipping Site: Pinellas	Total Volume (m3/yr)	1.40E+02	Total Mass (kg/yr)	1.91E+04

Radionuclide	Activity (Ci/yr)
H-3	1.99E+04

Shipping Site: RFP	Total Volume (m3/yr)	4.56E+03	Total Mass (kg/yr)	6.49E+06

Radionuclide	Activity (Ci/yr)
Tl-208	3.60E-05
Pb-212	9.55E-05
Bi-212	9.55E-05
Po-212	6.15E-05
Po-216	9.55E-05
Ra-224	9.55E-05
Ra-228	5.70E-04
Ac-228	5.70E-04
Th-228	9.55E-05
Th-231	5.49E-04
Th-232	5.79E-03
Th-234	7.04E-01
Pa-234	7.21E-05
Pa-234m	7.04E-01
U-235	5.47E-04
U-238	7.04E-01
Pu-238	5.56E-01
Pu-239	4.24E-02
Pu-240	1.48E-01
Pu-241	2.04E+01
Am-241	8.48E-04
Cm-242	1.18E-02
Cm-244	4.24E-03

Shipping Site: RMI	Total Volume (m3/yr)	5.68E+03	Total Mass (kg/yr)	1.47E+07

Radionuclide	Activity (Ci/yr)
Tl-208	3.58E-07
Pb-212	9.47E-07
Bi-212	9.47E-07
Po-212	6.10E-07
Po-216	9.47E-07
Ra-224	9.47E-07
Ra-228	5.66E-06
Ac-228	5.66E-06
Th-228	9.47E-07
Th-231	5.45E-06
Th-232	5.74E-05
Th-234	6.98E-03
Pa-234	7.15E-07
Pa-234m	6.98E-03
U-235	5.43E-06
U-238	6.98E-03

Shipping Site: SLAC	Total Volume (m3/yr)	2.73E+02	Total Mass (kg/yr)	7.45E+05

Radionuclide	Activity (Ci/yr)
Cr-51	3.86E-03
Mn-54	7.36E-03
Fe-55	2.74E-02
Fe-59	2.48E-04
Co-58	9.88E-03
Co-60	7.74E-02
Ni-59	3.54E-04
Ni-63	5.04E-02
Zr-95	3.01E-04

Shipping Site: SNLA	Total Volume (m3/yr) 1.19E+02	Total Mass (kg/yr) 3.28E+05

Radionuclide	Activity (Ci/yr)
H-3	3.00E+00
Co-60	2.85E-05
Ni-63	5.67E-05
Sr-90	5.04E-03
Y-90	5.04E-03
Tc-99	9.00E-07
Ru-106	4.92E-04
Rh-106	4.92E-04
Sb-125	1.41E-04
Te-125m	3.45E-05
Cs-134	5.72E-04
Cs-137	5.28E-03
Ba-137m	4.99E-03
Ce-144	1.64E-03
Pr-144	1.64E-03
Pr-144m	1.98E-05
Pm-147	4.02E-03
Sm-151	3.93E-05
Eu-152	6.00E-07
Eu-154	1.02E-04
Eu-155	8.16E-05
Tl-208	5.10E-06
Pb-212	1.35E-05
Bi-212	1.35E-05
Po-212	8.70E-06
Po-216	1.35E-05
Ra-224	1.35E-05
Ra-228	8.07E-05
Ac-228	8.07E-05
Th-228	1.35E-05
Th-231	7.77E-05
Th-232	8.19E-04
Th-234	9.96E-02
Pa-234	1.02E-05
Pa-234m	9.96E-02
U-235	7.74E-05
U-238	9.96E-02
Pu-238	7.87E-02
Pu-239	6.00E-03
Pu-240	2.10E-02
Pu-241	2.89E+00
Am-241	1.21E-04
Cm-242	1.68E-03
Cm-244	6.00E-04

Shipping Site: SNLL	Total Volume (m3/yr) 3.68E+01	Total Mass (kg/yr) 9.73E+04

Radionuclide	Activity (Ci/yr)
H-3	2.78E+04
Fe-55	3.15E-01
Co-60	3.15E-01
Tl-208	6.40E-05
Pb-212	1.69E-04
Bi-212	1.69E-04
Po-212	1.09E-04
Po-216	1.69E-04
Ra-224	1.69E-04
Ra-228	1.01E-03
Ac-228	1.01E-03
Th-228	1.69E-04
Th-231	9.75E-04
Th-232	1.02E-02
Th-234	1.25E+00
Pa-234	1.28E-04
Pa-234m	1.25E+00
U-235	9.71E-04
U-238	1.25E+00

Shipping Site: SRS	Total Volume (m3/yr)	5.74E+04	Total Mass (kg/yr)	1.29E+08

Radionuclide	Activity (Ci/yr)
H-3	4.77E+04
C-14	1.08E+00
Cr-51	1.95E+03
Mn-54	3.84E+03
Fe-55	1.38E+04
Fe-59	1.25E+02
Co-58	5.10E+03
Co-60	3.94E+04
Ni-59	1.79E+02
Ni-63	2.55E+04
Sr-90	3.56E+03
Y-90	3.56E+03
Zr-95	1.52E+02
Tc-99	2.78E+00
Ru-106	3.32E+02
Rh-106	3.32E+02
Sb-125	9.56E+01
Te-125m	2.33E+01
Cs-134	6.40E+02
Cs-137	3.90E+03
Ba-137m	3.69E+03
Ce-144	1.11E+03
Pr-144	1.11E+03
Pr-144m	1.33E+01
Pm-147	2.72E+03
Sm-151	2.65E+01
Eu-152	4.05E-01
Eu-154	6.96E+01
Eu-155	5.52E+01
Tl-208	8.54E-04
Pb-212	2.26E-03
Bi-212	2.26E-03
Po-212	1.45E-03
Po-216	2.26E-03
Ra-224	2.26E-03
Ra-228	1.35E-02
Ac-228	1.35E-02
Th-228	2.26E-03
Th-231	1.30E-02
Th-232	1.37E-01
Th-234	1.66E+01
Pa-234	1.70E-03
Pa-234m	1.66E+01
U-235	1.29E-02
U-238	2.99E+01
Pu-238	8.45E+01
Pu-239	8.64E-01
Pu-240	5.89E-01
Pu-241	1.19E+02
Am-241	1.21E+00
Cm-242	1.46E-02
Cm-244	5.24E-03

Shipping Site: Y-12	Total Volume (m3/yr)	1.46E+04	Total Mass (kg/yr)	8.27E+07

Radionuclide	Activity (Ci/yr)
Tl-208	6.80E-05
Pb-212	1.80E-04
Bi-212	1.80E-04
Po-212	1.16E-04
Po-216	1.80E-04
Ra-224	1.80E-04
Ra-228	1.07E-03
Ac-228	1.07E-03
Th-228	1.80E-04
Th-231	1.03E-03
Th-232	1.09E-02
Th-234	1.32E+00
Pa-234	1.36E-04
Pa-234m	1.32E+00
U-235	1.03E-03
U-238	1.32E+00

A.22 WM LLW CENTRALIZED 2 ALTERNATIVE (CASE 8): ACTIVATED METALS

Transported Material with Radionuclide Profile

Alternative: #8 Minimum Treat -- On-Site -- 1 Site (NTS) Disposal

Waste Stream: LLW Waste Type: Activated Metal

Destination: NTS

Shipping Site: ANL-W Total Volume (m3/yr) 2.26E+01 Total Mass (kg/yr) 1.64E+05

Radionuclide	Activity (Ci/yr)
H-3	1.71E-06
Cr-51	1.24E-04
Mn-54	2.37E-04
Fe-55	8.86E-04
Fe-59	8.00E-06
Co-58	3.18E-04
Co-60	2.50E-03
Ni-59	1.14E-05
Ni-63	1.64E-03
Sr-90	1.43E-03
Y-90	1.43E-03
Zr-95	9.72E-06
Tc-99	2.56E-07
Ru-106	1.40E-04
Rh-106	1.40E-04
Sb-125	4.03E-05
Te-125m	9.84E-06
Cs-134	1.63E-04
Cs-137	2.00E-01
Ba-137m	2.00E-01
Ce-144	4.69E-04
Pr-144	4.69E-04
Pr-144m	5.64E-06
Pm-147	1.14E-03
Sm-151	1.12E-05
Eu-152	1.71E-07
Eu-154	2.93E-05
Eu-155	2.32E-05
Pu-238	3.53E-05
Pu-239	3.42E-07
Pu-240	1.71E-07
Pu-241	3.95E-05
Am-241	5.13E-07

Shipping Site: BAPL	Total Volume (m3/yr)	8.84E+02	Total Mass (kg/yr)	6.43E+06

Radionuclide	Activity (Ci/yr)
Cr-51	4.75E+03
Mn-54	9.04E+03
Fe-55	3.37E+04
Fe-59	3.05E+02
Co-58	1.21E+04
Co-60	9.52E+04
Ni-59	4.36E+02
Ni-63	6.19E+04
Zr-95	3.70E+02
Tl-208	1.36E-08
Pb-212	3.60E-08
Bi-212	3.60E-08
Po-212	2.32E-08
Po-216	3.60E-08
Ra-224	3.60E-08
Ra-228	2.15E-07
Ac-228	2.15E-07
Th-228	3.60E-08
Th-231	2.07E-07
Th-232	2.18E-06
Th-234	2.65E-04
Pa-234	2.72E-08
Pa-234m	2.65E-04
U-235	2.06E-07
U-238	2.65E-04

Shipping Site: FNAL	Total Volume (m3/yr)	1.11E+02	Total Mass (kg/yr)	8.14E+05

Radionuclide	Activity (Ci/yr)
Cr-51	3.35E-02
Mn-54	6.39E-02
Fe-55	2.38E-01
Fe-59	2.15E-03
Co-58	8.57E-02
Co-60	6.72E-01
Ni-59	3.08E-03
Ni-63	4.37E-01
Zr-95	2.61E-03

Shipping Site: HANF	Total Volume (m3/yr)	9.20E+01	Total Mass (kg/yr)	6.69E+05

Radionuclide	Activity (Ci/yr)
Cr-51	2.99E+01
Mn-54	5.71E+01
Fe-55	2.13E+02
Fe-59	1.92E+00
Co-58	7.66E+01
Co-60	6.00E+02
Ni-59	2.75E+00
Ni-63	3.91E+02
Zr-95	2.33E+00

Shipping Site: KAPL	Total Volume (m3/yr)	1.82E+03	Total Mass (kg/yr)	1.33E+07

Radionuclide	Activity (Ci/yr)
H-3	5.15E-04
C-14	2.40E-05
Cr-51	1.13E+04
Mn-54	2.15E+04
Fe-55	8.05E+04
Fe-59	7.28E+02
Co-58	2.89E+04
Co-60	2.27E+05
Ni-59	1.04E+03
Ni-63	1.47E+05
Sr-90	2.62E-02
Y-90	2.62E-02
Zr-95	8.84E+02
Tc-99	5.20E-05
Ru-106	2.22E-03
Rh-106	2.22E-03
Sb-125	6.40E-04
Te-125m	1.56E-04
Cs-134	8.18E-03
Cs-137	3.13E-02
Ba-137m	2.96E-02
Ce-144	7.46E-03
Pr-144	7.46E-03
Pr-144m	8.97E-05
Pm-147	1.82E-02
Sm-151	1.78E-04
Eu-152	2.71E-06
Eu-154	4.66E-04
Eu-155	3.69E-04
Tl-208	2.96E-08
Pb-212	7.83E-08
Bi-212	7.83E-08
Po-212	5.05E-08
Po-216	7.83E-08
Ra-224	7.83E-08
Ra-228	4.68E-07
Ac-228	4.68E-07
Th-228	7.83E-08
Th-231	4.50E-07
Th-232	4.75E-06
Th-234	5.77E-04
Pa-234	5.92E-08
Pa-234m	5.77E-04
U-235	4.48E-07
U-238	8.69E-04
Pu-238	5.61E-04
Pu-239	5.43E-06
Pu-240	2.71E-06
Pu-241	6.28E-04
Am-241	8.15E-06

Shipping Site: LANL	Total Volume (m3/yr)	1.17E+03	Total Mass (kg/yr)	8.57E+06

Radionuclide	Activity (Ci/yr)
Cr-51	2.42E+01
Mn-54	4.62E+01
Fe-55	1.72E+02
Fe-59	1.55E+00
Co-58	6.20E+01
Co-60	4.86E+02
Ni-59	2.22E+00
Ni-63	3.16E+02
Zr-95	1.89E+00

Shipping Site: LBL	Total Volume (m3/yr)	3.95E+01	Total Mass (kg/yr)	2.87E+05

Radionuclide	Activity (Ci/yr)
Cr-51	6.32E-02
Mn-54	1.20E-01
Fe-55	4.49E-01
Fe-59	4.06E-03
Co-58	1.61E-01
Co-60	1.26E+00
Ni-59	5.80E-03
Ni-63	8.24E-01
Zr-95	4.93E-03

Shipping Site: NRF	Total Volume (m3/yr)	1.29E+03	Total Mass (kg/yr)	9.40E+06

Radionuclide	Activity (Ci/yr)
Cr-51	2.31E+03
Mn-54	4.40E+03
Fe-55	1.64E+04
Fe-59	1.48E+02
Co-58	5.91E+03
Co-60	4.63E+04
Ni-59	2.12E+02
Ni-63	3.01E+04
Zr-95	1.80E+02

Shipping Site: SNLA	Total Volume (m3/yr)	1.58E+01	Total Mass (kg/yr)	1.15E+05

Radionuclide	Activity (Ci/yr)
Cr-51	6.54E-04
Mn-54	1.24E-03
Fe-55	4.64E-03
Fe-59	4.20E-05
Co-58	1.67E-03
Co-60	1.31E-02
Ni-59	6.00E-05
Ni-63	8.53E-03
Zr-95	5.10E-05

A.23 WM LLW CENTRALIZED 3 ALTERNATIVE (CASE 14): HETEROGENEOUS SOLIDS

Transported Material with Radionuclide Profile

Alternative: #14 Regional Treat -- 7 Site -- 1 Site Disposal

Waste Stream: LLW Waste Type: All, excl. Act.Metal

Destination: HANF

Shipping Site: AMES Total Volume (m3/yr) 1.09E+01 Total Mass (kg/yr) 2.98E+04

Radionuclide	Activity (Ci/yr)
Tl-208	4.22E-07
Pb-212	1.11E-06
Bi-212	1.11E-06
Po-212	7.20E-07
Po-216	1.11E-06
Ra-224	1.11E-06
Ra-228	6.68E-06
Ac-228	6.68E-06
Th-228	1.11E-06
Th-231	6.43E-06
Th-232	6.77E-05
Th-234	8.24E-03
Pa-234	8.44E-07
Pa-234m	8.24E-03
U-235	6.40E-06
U-238	8.24E-03
Pu-238	6.50E-04
Pu-239	4.96E-05
Pu-240	1.73E-04
Pu-241	2.39E-02
Am-241	9.93E-07
Cm-242	1.39E-05
Cm-244	4.96E-06

Shipping Site: ANL-E	Total Volume (m3/yr)	7.35E+02	Total Mass (kg/yr)	2.00E+06

Radionuclide	Activity (Ci/yr)
H-3	1.33E+02
C-14	7.91E-02
Cr-51	2.87E+00
Mn-54	1.43E+01
Fe-55	2.04E+01
Fe-59	1.84E-01
Co-58	1.55E+01
Co-60	8.15E+01
Ni-59	2.63E-01
Ni-63	3.77E+01
Sr-90	3.33E+01
Y-90	3.33E+01
Zr-95	2.24E-01
Tc-99	1.62E-01
Ru-106	2.16E+00
Rh-106	2.16E+00
Sb-125	6.21E-01
Te-125m	1.51E-01
Cs-134	2.09E+01
Cs-137	4.75E+01
Ba-137m	4.50E+01
Ce-144	7.24E+00
Pr-144	7.24E+00
Pr-144m	8.70E-02
Pm-147	1.76E+01
Sm-151	1.72E-01
Eu-152	2.63E-03
Eu-154	4.52E-01
Eu-155	3.58E-01
U-238	9.63E-01
Pu-238	5.44E-01
Pu-239	5.27E-03
Pu-240	2.63E-03
Pu-241	6.09E-01
Am-241	7.91E-03

Shipping Site: ANL-W	Total Volume (m3/yr)	6.74E+01	Total Mass (kg/yr)	1.83E+05

Radionuclide	Activity (Ci/yr)
H-3	7.45E-04
Cr-51	3.58E+03
Mn-54	6.83E+03
Fe-55	2.54E+04
Fe-59	2.30E+02
Co-58	9.16E+03
Co-60	7.18E+04
Ni-59	3.29E+02
Ni-63	4.67E+04
Zr-95	2.79E+02

Shipping Site: BAPL	Total Volume (m3/yr)	3.98E+02	Total Mass (kg/yr)	1.08E+06

Radionuclide	Activity (Ci/yr)
H-3	2.51E-03
Co-60	1.19E-02
Ni-63	2.38E-02
Sr-90	2.11E+00
Y-90	2.11E+00
Tc-99	3.77E-04
Ru-106	2.06E-01
Rh-106	2.06E-01
Sb-125	5.93E-02
Te-125m	1.44E-02
Cs-134	2.40E-01
Cs-137	2.21E+00
Ba-137m	2.09E+00
Ce-144	6.91E-01
Pr-144	6.91E-01
Pr-144m	8.31E-03
Pm-147	1.68E+00
Sm-151	1.65E-02
Eu-152	2.51E-04
Eu-154	4.32E-02
Eu-155	3.42E-02
Tl-208	3.80E-06
Pb-212	1.00E-05
Bi-212	1.00E-05
Po-212	6.49E-06
Po-216	1.00E-05
Ra-224	1.00E-05
Ra-228	6.02E-05
Ac-228	6.02E-05
Th-228	1.00E-05
Th-231	5.80E-05
Th-232	6.11E-04
Th-234	7.43E-02
Pa-234	7.61E-06
Pa-234m	7.43E-02
U-235	5.77E-05
U-238	7.43E-02
Pu-238	5.20E-02
Pu-239	5.03E-04
Pu-240	2.51E-04
Pu-241	5.81E-02
Am-241	7.55E-04

Shipping Site: FNAL	Total Volume (m3/yr)	4.22E+01	Total Mass (kg/yr)	3.26E+04

Radionuclide	Activity (Ci/yr)
H-3	1.08E-01
Cr-51	1.11E-02
Mn-54	2.12E-02
Fe-55	7.94E-02
Fe-59	7.17E-04
Co-58	2.85E-02
Co-60	2.23E-01
Ni-59	1.02E-03
Ni-63	1.45E-01
Zr-95	8.71E-04
Tl-208	3.78E-07
Pb-212	1.00E-06
Bi-212	1.00E-06
Po-212	6.46E-07
Po-216	1.00E-06
Ra-224	1.00E-06
Ra-228	5.99E-06
Ac-228	5.99E-06
Th-228	1.00E-06
Th-231	5.77E-06
Th-232	6.08E-05
Th-234	7.39E-03
Pa-234	7.57E-07
Pa-234m	7.39E-03
U-235	5.75E-06
U-238	7.39E-03

Shipping Site: INEL	Total Volume (m3/yr)	3.77E+03	Total Mass (kg/yr)	1.64E+07

Radionuclide	Activity (Ci/yr)
H-3	1.56E+00
Cr-51	1.02E+02
Mn-54	1.94E+02
Fe-55	7.24E+02
Fe-59	6.55E+00
Co-58	2.60E+02
Co-60	2.04E+03
Ni-59	9.35E+00
Ni-63	1.33E+03
Sr-90	5.01E+01
Y-90	5.01E+01
Zr-95	7.95E+00
Tc-99	8.96E-03
Ru-106	4.90E+00
Rh-106	4.90E+00
Sb-125	1.40E+00
Te-125m	3.43E-01
Cs-134	5.69E+00
Cs-137	5.25E+01
Ba-137m	4.97E+01
Ce-144	1.64E+01
Pr-144	1.64E+01
Pr-144m	1.97E-01
Pm-147	4.00E+01
Sm-151	3.91E-01
Eu-152	5.97E-03
Eu-154	1.02E+00
Eu-155	8.12E-01
Pu-238	1.23E+00
Pu-239	1.19E-02
Pu-240	5.97E-03
Pu-241	1.38E+00
Am-241	1.79E-02
Cm-242	4.88E-08
Cm-244	1.74E-08

Shipping Site: ITRI	Total Volume (m3/yr)	5.61E+01	Total Mass (kg/yr)	1.53E+05

Radionuclide	Activity (Ci/yr)
H-3	2.44E+00
C-14	1.20E-01
Mn-54	1.35E+01
Co-58	1.24E+01
Co-60	3.60E+01
Sr-90	1.69E+01
Y-90	1.69E+01
Tc-99	2.40E-01
Cs-134	2.79E+01
Cs-137	3.69E+01
Ba-137m	3.49E+01
U-238	1.46E+00

Shipping Site: K-25	Total Volume (m3/yr)	8.16E+01	Total Mass (kg/yr)	2.22E+05

Radionuclide	Activity (Ci/yr)
Tl-208	1.26E-06
Pb-212	3.34E-06
Bi-212	3.34E-06
Po-212	2.15E-06
Po-216	3.34E-06
Ra-224	3.34E-06
Ra-228	1.99E-05
Ac-228	1.99E-05
Th-228	3.34E-06
Th-231	1.92E-05
Th-232	2.02E-04
Th-234	2.46E-02
Pa-234	2.52E-06
Pa-234m	2.46E-02
U-235	1.91E-05
U-238	2.46E-02

Shipping Site: KAPL	Total Volume (m3/yr)	2.11E+02	Total Mass (kg/yr)	5.36E+05

Radionuclide	Activity (Ci/yr)
H-3	5.14E-04
C-14	2.40E-05
Cr-51	5.11E-03
Mn-54	1.24E-02
Fe-55	3.63E-02
Fe-59	3.28E-04
Co-58	1.55E-02
Co-60	1.09E-01
Ni-59	4.69E-04
Ni-63	6.70E-02
Sr-90	2.58E-02
Y-90	2.58E-02
Zr-95	3.99E-04
Tc-99	5.20E-05
Ru-106	2.19E-03
Rh-106	2.19E-03
Sb-125	6.31E-04
Te-125m	1.54E-04
Cs-134	8.14E-03
Cs-137	3.09E-02
Ba-137m	2.92E-02
Ce-144	7.35E-03
Pr-144	7.35E-03
Pr-144m	8.84E-05
Pm-147	1.79E-02
Sm-151	1.75E-04
Eu-152	2.67E-06
Eu-154	4.59E-04
Eu-155	3.64E-04
Tl-208	4.50E-09
Pb-212	1.19E-08
Bi-212	1.19E-08
Po-212	7.60E-09
Po-216	1.19E-08
Ra-224	1.19E-08
Ra-228	7.11E-08
Ac-228	7.11E-08
Th-228	1.19E-08
Th-231	6.84E-08
Th-232	7.21E-07
Th-234	8.77E-05
Pa-234	8.90E-09
Pa-234m	8.77E-05
U-235	6.82E-08
U-238	3.79E-04
Pu-238	5.53E-04
Pu-239	5.35E-06
Pu-240	2.67E-06
Pu-241	6.18E-04
Am-241	8.03E-06

Shipping Site: KCP	Total Volume (m3/yr)	2.65E+00	Total Mass (kg/yr)	7.23E+03

Radionuclide	Activity (Ci/yr)
H-3	2.70E-02
C-14	1.44E-04
Mn-54	1.62E-02
Co-58	1.50E-02
Co-60	4.34E-02
Sr-90	2.04E-02
Y-90	2.04E-02
Tc-99	2.89E-04
Cs-134	3.37E-02
Cs-137	4.44E-02
Ba-137m	4.20E-02
U-238	1.76E-03

Shipping Site: LANL	Total Volume (m3/yr)	5.50E+03	Total Mass (kg/yr)	4.07E+07

Radionuclide	Activity (Ci/yr)
H-3	3.84E+05
C-14	1.83E-01
Cr-51	5.93E+00
Mn-54	3.19E+01
Fe-55	4.21E+01
Fe-59	3.81E-01
Co-58	3.42E+01
Co-60	5.40E+02
Ni-59	5.44E-01
Ni-63	8.05E+02
Sr-90	6.47E+04
Y-90	6.47E+04
Zr-95	4.62E-01
Tc-99	1.19E+01
Ru-106	6.32E+03
Rh-106	6.32E+03
Sb-125	1.81E+03
Te-125m	4.43E+02
Cs-134	7.39E+03
Cs-137	6.79E+04
Ba-137m	6.42E+04
Ce-144	2.11E+04
Pr-144	2.11E+04
Pr-144m	2.54E+02
Pm-147	5.16E+04
Sm-151	5.04E+02
Eu-152	7.70E+00
Eu-154	1.32E+03
Eu-155	1.04E+03
Tl-208	1.69E-02
Pb-212	4.47E-02
Bi-212	4.47E-02
Po-212	2.88E-02
Po-216	4.47E-02
Ra-224	4.47E-02
Ra-228	2.67E-01
Ac-228	2.67E-01
Th-228	4.47E-02
Th-231	2.57E-01
Th-232	2.71E+00
Th-234	3.30E+02
Pa-234	3.38E-02
Pa-234m	3.30E+02
U-235	2.56E-01
U-238	3.32E+02
Pu-238	1.59E+03
Pu-239	1.57E+01
Pu-240	8.94E+00
Pu-241	1.95E+03
Am-241	2.31E+01

Destination: HANF

Shipping Site: LANL — Total Volume (m3/yr) 5.50E+03 — Total Mass (kg/yr) 4.07E+07

Radionuclide	Activity (Ci/yr)
Cm-242	9.84E-02
Cm-244	3.51E-02

Shipping Site: LBL — Total Volume (m3/yr) 8.48E+01 — Total Mass (kg/yr) 4.51E+04

Radionuclide	Activity (Ci/yr)
H-3	6.35E+02
C-14	1.13E+00
Mn-54	1.27E+02
Co-58	1.17E+02
Co-60	3.39E+02
Sr-90	1.59E+02
Y-90	1.59E+02
Tc-99	2.26E+00
Cs-134	2.63E+02
Cs-137	3.47E+02
Ba-137m	3.28E+02
U-238	1.37E+01
Cm-244	1.05E+01

Shipping Site: LLNL — Total Volume (m3/yr) 4.09E+02 — Total Mass (kg/yr) 1.06E+06

Radionuclide	Activity (Ci/yr)
H-3	3.33E+04
C-14	1.55E-03
Mn-54	1.74E-01
Co-58	1.61E-01
Co-60	4.69E-01
Ni-63	4.89E-03
Sr-90	6.54E-01
Y-90	6.54E-01
Tc-99	3.18E-03
Ru-106	4.24E-02
Rh-106	4.24E-02
Sb-125	1.21E-02
Te-125m	2.97E-03
Cs-134	4.11E-01
Cs-137	9.33E-01
Ba-137m	8.82E-01
Ce-144	1.42E-01
Pr-144	1.42E-01
Pr-144m	1.70E-03
Pm-147	3.46E-01
Sm-151	3.39E-03
Eu-152	5.17E-05
Eu-154	8.87E-03
Eu-155	7.03E-03
U-238	1.88E-02
Pu-238	7.85E-02
Pu-239	5.28E-03
Pu-240	1.81E-02
Pu-241	2.50E+00
Am-241	2.58E-04
Cm-242	1.44E-03
Cm-244	5.17E-04

Shipping Site: MOUND	Total Volume (m3/yr)	3.57E+03	Total Mass (kg/yr)	9.56E+06

Radionuclide	Activity (Ci/yr)
H-3	1.59E+00
Pu-238	1.60E-01
Pu-239	1.22E-02
Pu-240	4.28E-02
Pu-241	5.90E+00
Am-241	2.44E-04
Cm-242	3.42E-03
Cm-244	1.22E-03

Shipping Site: ORISE	Total Volume (m3/yr)	2.76E+01	Total Mass (kg/yr)	6.91E+04

Radionuclide	Activity (Ci/yr)
H-3	7.88E-03
C-14	4.74E-06
Mn-54	5.34E-04
Co-58	4.92E-04
Co-60	1.42E-03
Sr-90	6.69E-04
Y-90	6.69E-04
Tc-99	9.48E-06
Cs-134	1.10E-03
Cs-137	1.45E-03
Ba-137m	1.37E-03
Tl-208	1.34E-07
Pb-212	3.55E-07
Bi-212	3.55E-07
Po-212	2.29E-07
Po-216	3.55E-07
Ra-224	3.55E-07
Ra-228	2.12E-06
Ac-228	2.12E-06
Th-228	3.55E-07
Th-231	2.04E-06
Th-232	2.15E-05
Th-234	2.62E-03
Pa-234	2.68E-07
Pa-234m	2.62E-03
U-235	2.03E-06
U-238	2.68E-03

Shipping Site: ORNL	Total Volume (m3/yr)	4.78E+03	Total Mass (kg/yr)	1.32E+08

Radionuclide	Activity (Ci/yr)
H-3	1.10E+00
C-14	1.14E-05
Cr-51	1.01E+01
Mn-54	1.98E+01
Fe-55	7.20E+01
Fe-59	6.51E-01
Co-58	2.63E+01
Co-60	2.09E+02
Ni-59	9.30E-01
Ni-63	1.42E+02
Sr-90	9.15E+02
Y-90	9.15E+02
Zr-95	7.90E-01
Tc-99	1.74E-01
Ru-106	8.91E+01
Rh-106	8.91E+01
Sb-125	2.56E+01
Te-125m	6.25E+00
Cs-134	1.04E+02
Cs-137	9.58E+02
Ba-137m	9.07E+02
Ce-144	2.98E+02
Pr-144	2.98E+02
Pr-144m	3.58E+00
Pm-147	7.28E+02
Sm-151	7.12E+00
Eu-152	1.08E-01
Eu-154	1.86E+01
Eu-155	1.47E+01
Tl-208	1.81E-04
Pb-212	4.81E-04
Bi-212	4.81E-04
Po-212	3.10E-04
Po-216	4.81E-04
Ra-224	4.81E-04
Ra-228	2.87E-03
Ac-228	2.87E-03
Th-228	4.81E-04
Th-231	2.77E-03
Th-232	2.92E-02
Th-234	3.55E+00
Pa-234	3.63E-04
Pa-234m	3.55E+00
U-235	2.76E-03
U-238	3.60E+00
Np-237	1.63E-03
Pu-238	2.24E+01
Pu-239	2.19E-01
Pu-240	1.09E-01
Pu-241	2.52E+01
Am-241	3.26E-01
Cm-242	5.60E-05
Cm-244	2.00E-05

Shipping Site: PANT	Total Volume (m3/yr)	1.70E+02	Total Mass (kg/yr)	4.66E+05

Radionuclide	Activity (Ci/yr)
H-3	9.18E+00
Tl-208	8.99E-06
Pb-212	2.38E-05
Bi-212	2.38E-05
Po-212	1.53E-05
Po-216	2.38E-05
Ra-224	2.38E-05
Ra-228	1.42E-04
Ac-228	1.42E-04
Th-228	2.38E-05
Th-231	1.37E-04
Th-232	1.44E-03
Th-234	1.75E-01
Pa-234	1.79E-05
Pa-234m	1.75E-01
U-235	1.36E-04
U-238	1.75E-01

Shipping Site: PORTS	Total Volume (m3/yr)	1.77E+03	Total Mass (kg/yr)	6.77E+07

Radionuclide	Activity (Ci/yr)
H-3	2.24E+02
Tl-208	3.50E-06
Pb-212	9.27E-06
Bi-212	9.27E-06
Po-212	5.97E-06
Po-216	9.27E-06
Ra-224	9.27E-06
Ra-228	5.54E-05
Ac-228	5.54E-05
Th-228	9.27E-06
Th-231	5.33E-05
Th-232	5.62E-04
Th-234	6.84E-02
Pa-234	7.00E-06
Pa-234m	6.84E-02
U-235	5.31E-05
U-238	6.84E-02
Pu-238	4.36E-05
Pu-239	3.33E-06
Pu-240	1.16E-05
Pu-241	1.60E-03
Am-241	6.67E-08
Cm-242	9.33E-07
Cm-244	3.33E-07

Shipping Site: PPPL	Total Volume (m3/yr)	4.51E-01	Total Mass (kg/yr)	1.23E+03

Radionuclide	Activity (Ci/yr)
H-3	3.74E-03
Cr-51	8.50E-04
Mn-54	1.61E-03
Fe-55	6.04E-03
Fe-59	5.46E-05
Co-58	2.17E-03
Co-60	1.70E-02
Ni-59	7.80E-05
Ni-63	1.10E-02
Zr-95	6.63E-05

Shipping Site: Paducah	Total Volume (m3/yr)	4.04E+03	Total Mass (kg/yr)	1.10E+07

Radionuclide	Activity (Ci/yr)
Tc-99	6.66E-03
Tl-208	2.80E-05
Pb-212	7.41E-05
Bi-212	7.41E-05
Po-212	4.78E-05
Po-216	7.41E-05
Ra-224	7.41E-05
Ra-228	4.43E-04
Ac-228	4.43E-04
Th-228	7.41E-05
Th-231	4.27E-04
Th-232	4.50E-03
Th-234	5.47E-01
Pa-234	5.60E-05
Pa-234m	5.47E-01
U-235	4.25E-04
U-238	5.47E-01
Np-237	4.99E-03
Pu-239	4.99E-03

Shipping Site: RFP	Total Volume (m3/yr)	1.27E+03	Total Mass (kg/yr)	6.52E+06

Radionuclide	Activity (Ci/yr)
Tl-208	3.60E-05
Pb-212	9.55E-05
Bi-212	9.55E-05
Po-212	6.15E-05
Po-216	9.55E-05
Ra-224	9.55E-05
Ra-228	5.70E-04
Ac-228	5.70E-04
Th-228	9.55E-05
Th-231	5.49E-04
Th-232	5.79E-03
Th-234	7.04E-01
Pa-234	7.21E-05
Pa-234m	7.04E-01
U-235	5.47E-04
U-238	7.04E-01
Pu-238	5.56E-01
Pu-239	4.24E-02
Pu-240	1.48E-01
Pu-241	2.04E+01
Am-241	8.48E-04
Cm-242	1.18E-02
Cm-244	4.24E-03

Shipping Site: RMI	Total Volume (m3/yr)	5.36E+03	Total Mass (kg/yr)	1.45E+07

Radionuclide	Activity (Ci/yr)
Tl-208	3.38E-07
Pb-212	8.96E-07
Bi-212	8.96E-07
Po-212	5.77E-07
Po-216	8.96E-07
Ra-224	8.96E-07
Ra-228	5.35E-06
Ac-228	5.35E-06
Th-228	8.96E-07
Th-231	5.15E-06
Th-232	5.43E-05
Th-234	6.61E-03
Pa-234	6.77E-07
Pa-234m	6.61E-03
U-235	5.13E-06
U-238	6.61E-03

Shipping Site: SLAC	Total Volume (m3/yr) 2.73E+02	Total Mass (kg/yr) 7.45E+05

Radionuclide	Activity (Ci/yr)
Cr-51	3.86E-03
Mn-54	7.36E-03
Fe-55	2.74E-02
Fe-59	2.48E-04
Co-58	9.88E-03
Co-60	7.74E-02
Ni-59	3.54E-04
Ni-63	5.04E-02
Zr-95	3.01E-04

Shipping Site: SNLA	Total Volume (m3/yr) 1.18E+02	Total Mass (kg/yr) 3.24E+05

Radionuclide	Activity (Ci/yr)
H-3	3.00E+00
Co-60	2.85E-05
Ni-63	5.67E-05
Sr-90	5.04E-03
Y-90	5.04E-03
Tc-99	9.00E-07
Ru-106	4.92E-04
Rh-106	4.92E-04
Sb-125	1.41E-04
Te-125m	3.45E-05
Cs-134	5.72E-04
Cs-137	5.28E-03
Ba-137m	4.99E-03
Ce-144	1.64E-03
Pr-144	1.64E-03
Pr-144m	1.98E-05
Pm-147	4.02E-03
Sm-151	3.93E-05
Eu-152	6.00E-07
Eu-154	1.02E-04
Eu-155	8.16E-05
Pu-238	7.87E-02
Pu-239	6.00E-03
Pu-240	2.10E-02
Pu-241	2.89E+00
Am-241	1.21E-04
Cm-242	1.68E-03
Cm-244	6.00E-04

Shipping Site: SNLL	Total Volume (m3/yr) 3.59E+01	Total Mass (kg/yr) 9.36E+04

Radionuclide	Activity (Ci/yr)
H-3	2.82E+04
Fe-55	3.15E-01
Co-60	3.15E-01
Tl-208	6.40E-05
Pb-212	1.69E-04
Bi-212	1.69E-04
Po-212	1.09E-04
Po-216	1.69E-04
Ra-224	1.69E-04
Ra-228	1.01E-03
Ac-228	1.01E-03
Th-228	1.69E-04
Th-231	9.75E-04
Th-232	1.02E-02
Th-234	1.25E+00
Pa-234	1.28E-04
Pa-234m	1.25E+00
U-235	9.71E-04
U-238	1.25E+00

Shipping Site: SRS	Total Volume (m3/yr) 4.59E+04	Total Mass (kg/yr) 1.30E+08

Radionuclide	Activity (Ci/yr)
H-3	6.72E+04
C-14	1.08E+00
Cr-51	1.95E+03
Mn-54	3.84E+03
Fe-55	1.38E+04
Fe-59	1.25E+02
Co-58	5.10E+03
Co-60	3.94E+04
Ni-59	1.79E+02
Ni-63	2.55E+04
Sr-90	3.56E+03
Y-90	3.56E+03
Zr-95	1.52E+02
Tc-99	2.78E+00
Ru-106	3.32E+02
Rh-106	3.32E+02
Sb-125	9.56E+01
Te-125m	2.33E+01
Cs-134	6.40E+02
Cs-137	3.90E+03
Ba-137m	3.69E+03
Ce-144	1.11E+03
Pr-144	1.11E+03
Pr-144m	1.33E+01
Pm-147	2.72E+03
Sm-151	2.65E+01
Eu-152	4.05E-01
Eu-154	6.96E+01
Eu-155	5.52E+01
Tl-208	8.54E-04
Pb-212	2.26E-03
Bi-212	2.26E-03
Po-212	1.45E-03
Po-216	2.26E-03
Ra-224	2.26E-03
Ra-228	1.35E-02
Ac-228	1.35E-02
Th-228	2.26E-03
Th-231	1.30E-02
Th-232	1.37E-01
Th-234	1.66E+01
Pa-234	1.70E-03
Pa-234m	1.66E+01
U-235	1.29E-02
U-238	2.99E+01
Pu-238	8.45E+01
Pu-239	8.64E-01
Pu-240	5.89E-01
Pu-241	1.19E+02
Am-241	1.21E+00
Cm-242	1.46E-02
Cm-244	5.24E-03

Shipping Site: Y-12	Total Volume (m3/yr) 5.57E+02	Total Mass (kg/yr) 1.51E+06

Radionuclide	Activity (Ci/yr)
Tl-208	2.58E-06
Pb-212	6.84E-06
Bi-212	6.84E-06
Po-212	4.40E-06
Po-216	6.84E-06
Ra-224	6.84E-06
Ra-228	4.08E-05
Ac-228	4.08E-05
Th-228	6.84E-06
Th-231	3.93E-05
Th-232	4.14E-04
Th-234	5.04E-02
Pa-234	5.16E-06
Pa-234m	5.04E-02
U-235	3.92E-05
U-238	5.04E-02

Destination: INEL

Shipping Site: ANL-W	Total Volume (m3/yr) 1.92E+02	Total Mass (kg/yr) 2.88E+04

Radionuclide	Activity (Ci/yr)
H-3	3.77E-05
Cr-51	3.85E-03
Mn-54	7.34E-03
Fe-55	2.74E-02
Fe-59	2.47E-04
Co-58	9.85E-03
Co-60	7.74E-02
Ni-59	3.53E-04
Ni-63	5.06E-02
Sr-90	3.17E-02
Y-90	3.17E-02
Zr-95	3.00E-04
Tc-99	5.66E-06
Ru-106	3.09E-03
Rh-106	3.09E-03
Sb-125	8.89E-04
Te-125m	2.17E-04
Cs-134	3.59E-03
Cs-137	3.32E-02
Ba-137m	3.14E-02
Ce-144	1.03E-02
Pr-144	1.03E-02
Pr-144m	1.24E-04
Pm-147	2.52E-02
Sm-151	2.47E-04
Eu-152	3.77E-06
Eu-154	6.47E-04
Eu-155	5.13E-04
Pu-238	7.81E-04
Pu-239	7.72E-06
Pu-240	4.38E-06
Pu-241	9.56E-04
Am-241	1.13E-05
Cm-242	4.88E-08
Cm-244	1.74E-08

Destination: LANL

Shipping Site: ITRI	Total Volume (m3/yr)	7.80E+01	Total Mass (kg/yr)	1.17E+04

Radionuclide	Activity (Ci/yr)
H-3	3.73E+00
C-14	1.83E-01
Mn-54	2.06E+01
Co-58	1.90E+01
Co-60	5.51E+01
Sr-90	2.59E+01
Y-90	2.59E+01
Tc-99	3.67E-01
Cs-134	4.27E+01
Cs-137	5.64E+01
Ba-137m	5.33E+01
U-238	2.23E+00

Shipping Site: PANT	Total Volume (m3/yr)	3.80E+03	Total Mass (kg/yr)	2.84E+07

Radionuclide	Activity (Ci/yr)
H-3	2.25E+02
Tl-208	2.12E-04
Pb-212	5.63E-04
Bi-212	5.63E-04
Po-212	3.62E-04
Po-216	5.63E-04
Ra-224	5.63E-04
Ra-228	3.36E-03
Ac-228	3.36E-03
Th-228	5.63E-04
Th-231	3.24E-03
Th-232	3.41E-02
Th-234	4.15E+00
Pa-234	4.25E-04
Pa-234m	4.15E+00
U-235	3.22E-03
U-238	4.15E+00

Shipping Site: SNLA	Total Volume (m3/yr)	5.39E-01	Total Mass (kg/yr)	4.31E+03

Radionuclide	Activity (Ci/yr)
Tl-208	5.10E-06
Pb-212	1.35E-05
Bi-212	1.35E-05
Po-212	8.70E-06
Po-216	1.35E-05
Ra-224	1.35E-05
Ra-228	8.07E-05
Ac-228	8.07E-05
Th-228	1.35E-05
Th-231	7.77E-05
Th-232	8.19E-04
Th-234	9.96E-02
Pa-234	1.02E-05
Pa-234m	9.96E-02
U-235	7.74E-05
U-238	9.96E-02

Destination: ORNL

Shipping Site: K-25	Total Volume (m3/yr)	6.20E+03	Total Mass (kg/yr)	4.65E+07

Radionuclide	Activity (Ci/yr)
Tl-208	1.05E-04
Pb-212	2.79E-04
Bi-212	2.79E-04
Po-212	1.79E-04
Po-216	2.79E-04
Ra-224	2.79E-04
Ra-228	1.66E-03
Ac-228	1.66E-03
Th-228	2.79E-04
Th-231	1.60E-03
Th-232	1.69E-02
Th-234	2.05E+00
Pa-234	2.10E-04
Pa-234m	2.05E+00
U-235	1.60E-03
U-238	2.05E+00

Shipping Site: ORISE	Total Volume (m3/yr)	3.01E+01	Total Mass (kg/yr)	4.52E+03

Radionuclide	Activity (Ci/yr)
H-3	1.22E-02
C-14	7.23E-06
Mn-54	8.15E-04
Co-58	7.52E-04
Co-60	2.17E-03
Sr-90	1.02E-03
Y-90	1.02E-03
Tc-99	1.44E-05
Cs-134	1.68E-03
Cs-137	2.22E-03
Ba-137m	2.10E-03
Tl-208	2.05E-07
Pb-212	5.42E-07
Bi-212	5.42E-07
Po-212	3.49E-07
Po-216	5.42E-07
Ra-224	5.42E-07
Ra-228	3.24E-06
Ac-228	3.24E-06
Th-228	5.42E-07
Th-231	3.12E-06
Th-232	3.29E-05
Th-234	4.00E-03
Pa-234	4.10E-07
Pa-234m	4.00E-03
U-235	3.11E-06
U-238	4.09E-03

Shipping Site: Paducah	Total Volume (m3/yr)	1.21E+03	Total Mass (kg/yr)	9.48E+05

Radionuclide	Activity (Ci/yr)
Tc-99	2.17E-03
Tl-208	9.17E-06
Pb-212	2.42E-05
Bi-212	2.42E-05
Po-212	1.56E-05
Po-216	2.42E-05
Ra-224	2.42E-05
Ra-228	1.45E-04
Ac-228	1.45E-04
Th-228	2.42E-05
Th-231	1.39E-04
Th-232	1.47E-03
Th-234	1.79E-01
Pa-234	1.83E-05
Pa-234m	1.79E-01
U-235	1.39E-04
U-238	1.79E-01
Np-237	1.63E-03
Pu-239	1.63E-03

Shipping Site: Y-12	Total Volume (m3/yr)	1.28E+04	Total Mass (kg/yr)	8.12E+07

Radionuclide	Activity (Ci/yr)
Tl-208	6.54E-05
Pb-212	1.73E-04
Bi-212	1.73E-04
Po-212	1.11E-04
Po-216	1.73E-04
Ra-224	1.73E-04
Ra-228	1.03E-03
Ac-228	1.03E-03
Th-228	1.73E-04
Th-231	9.96E-04
Th-232	1.05E-02
Th-234	1.27E+00
Pa-234	1.30E-04
Pa-234m	1.27E+00
U-235	9.92E-04
U-238	1.27E+00

Destination: PORTS

Shipping Site: AMES	Total Volume (m3/yr) 6.66E-01	Total Mass (kg/yr) 1.00E+02

Radionuclide	Activity (Ci/yr)
Tl-208	2.83E-08
Pb-212	7.50E-08
Bi-212	7.50E-08
Po-212	4.83E-08
Po-216	7.50E-08
Ra-224	7.50E-08
Ra-228	4.48E-07
Ac-228	4.48E-07
Th-228	7.50E-08
Th-231	4.31E-07
Th-232	4.55E-06
Th-234	5.53E-04
Pa-234	5.67E-08
Pa-234m	5.53E-04
U-235	4.30E-07
U-238	5.53E-04
Pu-238	4.36E-05
Pu-239	3.33E-06
Pu-240	1.16E-05
Pu-241	1.60E-03
Am-241	6.67E-08
Cm-242	9.33E-07
Cm-244	3.33E-07

Shipping Site: FNAL	Total Volume (m3/yr) 6.79E+00	Total Mass (kg/yr) 6.25E+03

Radionuclide	Activity (Ci/yr)
H-3	7.38E-02

Shipping Site: MOUND	Total Volume (m3/yr) 7.60E+02	Total Mass (kg/yr) 1.14E+05

Radionuclide	Activity (Ci/yr)
H-3	1.34E+04

Shipping Site: PPPL	Total Volume (m3/yr)	2.16E+01	Total Mass (kg/yr)	3.73E+03

Radionuclide	Activity (Ci/yr)
H-3	1.97E-01

Shipping Site: RMI	Total Volume (m3/yr)	2.74E+02	Total Mass (kg/yr)	9.49E+04

Radionuclide	Activity (Ci/yr)
Tl-208	1.94E-08
Pb-212	5.13E-08
Bi-212	5.13E-08
Po-212	3.30E-08
Po-216	5.13E-08
Ra-224	5.13E-08
Ra-228	3.06E-07
Ac-228	3.06E-07
Th-228	5.13E-08
Th-231	2.95E-07
Th-232	3.11E-06
Th-234	3.78E-04
Pa-234	3.87E-08
Pa-234m	3.78E-04
U-235	2.93E-07
U-238	3.78E-04

Destination: SRS

Shipping Site: Pinellas	Total Volume (m3/yr)	1.27E+02	Total Mass (kg/yr)	1.91E+04

Radionuclide	Activity (Ci/yr)
H-3	1.99E+04

A.24 WM LLW CENTRALIZED 3 ALTERNATIVE (CASE 14): ACTIVATED METALS

Transported Material with Radionuclide Profile

Alternative: #14 Regional Treat -- 7 Site -- 1 Site Disposal

Waste Stream: LLW Waste Type: Activated Metal

Destination: HANF

Shipping Site: INEL Total Volume (m3/yr) 2.19E+02 Total Mass (kg/yr) 9.57E+06

Radionuclide	Activity (Ci/yr)
H-3	1.71E-06
Cr-51	2.31E+03
Mn-54	4.40E+03
Fe-55	1.64E+04
Fe-59	1.48E+02
Co-58	5.91E+03
Co-60	4.63E+04
Ni-59	2.12E+02
Ni-63	3.01E+04
Sr-90	1.43E-03
Y-90	1.43E-03
Zr-95	1.80E+02
Tc-99	2.56E-07
Ru-106	1.40E-04
Rh-106	1.40E-04
Sb-125	4.03E-05
Te-125m	9.84E-06
Cs-134	1.63E-04
Cs-137	2.00E-01
Ba-137m	2.00E-01
Ce-144	4.69E-04
Pr-144	4.69E-04
Pr-144m	5.64E-06
Pm-147	1.14E-03
Sm-151	1.12E-05
Eu-152	1.71E-07
Eu-154	2.93E-05
Eu-155	2.32E-05
Pu-238	3.53E-05
Pu-239	3.42E-07
Pu-240	1.71E-07
Pu-241	3.95E-05
Am-241	5.13E-07

Shipping Site: LANL Total Volume (m3/yr) 1.99E+02 Total Mass (kg/yr) 8.69E+06

Radionuclide	Activity (Ci/yr)
Cr-51	2.42E+01
Mn-54	4.62E+01
Fe-55	1.72E+02
Fe-59	1.55E+00
Co-58	6.20E+01
Co-60	4.86E+02
Ni-59	2.22E+00
Ni-63	3.16E+02
Zr-95	1.89E+00

Shipping Site: LBL	Total Volume (m3/yr) 3.59E+01	Total Mass (kg/yr) 2.87E+05

Radionuclide	Activity (Ci/yr)
Cr-51	6.32E-02
Mn-54	1.20E-01
Fe-55	4.49E-01
Fe-59	4.06E-03
Co-58	1.61E-01
Co-60	1.26E+00
Ni-59	5.80E-03
Ni-63	8.24E-01
Zr-95	4.93E-03

Shipping Site: PORTS	Total Volume (m3/yr) 4.71E+02	Total Mass (kg/yr) 2.05E+07

Radionuclide	Activity (Ci/yr)
H-3	5.15E-04
C-14	2.40E-05
Cr-51	1.60E+04
Mn-54	3.06E+04
Fe-55	1.14E+05
Fe-59	1.03E+03
Co-58	4.11E+04
Co-60	3.22E+05
Ni-59	1.47E+03
Ni-63	2.09E+05
Sr-90	2.62E-02
Y-90	2.62E-02
Zr-95	1.25E+03
Tc-99	5.20E-05
Ru-106	2.22E-03
Rh-106	2.22E-03
Sb-125	6.40E-04
Te-125m	1.56E-04
Cs-134	8.18E-03
Cs-137	3.13E-02
Ba-137m	2.96E-02
Ce-144	7.46E-03
Pr-144	7.46E-03
Pr-144m	8.97E-05
Pm-147	1.82E-02
Sm-151	1.78E-04
Eu-152	2.71E-06
Eu-154	4.66E-04
Eu-155	3.69E-04
Tl-208	4.32E-08
Pb-212	1.14E-07
Bi-212	1.14E-07
Po-212	7.37E-08
Po-216	1.14E-07
Ra-224	1.14E-07
Ra-228	6.83E-07
Ac-228	6.83E-07
Th-228	1.14E-07
Th-231	6.57E-07
Th-232	6.93E-06
Th-234	8.43E-04
Pa-234	8.64E-08
Pa-234m	8.43E-04
U-235	6.55E-07
U-238	1.13E-03
Pu-238	5.61E-04
Pu-239	5.43E-06
Pu-240	2.71E-06
Pu-241	6.28E-04
Am-241	8.15E-06

Destination: INEL

Shipping Site: ANL-W — Total Volume (m3/yr) 2.06E+01 — Total Mass (kg/yr) 1.64E+05

Radionuclide	Activity (Ci/yr)
H-3	1.71E-06
Cr-51	1.24E-04
Mn-54	2.37E-04
Fe-55	8.86E-04
Fe-59	8.00E-06
Co-58	3.18E-04
Co-60	2.50E-03
Ni-59	1.14E-05
Ni-63	1.64E-03
Sr-90	1.43E-03
Y-90	1.43E-03
Zr-95	9.72E-06
Tc-99	2.56E-07
Ru-106	1.40E-04
Rh-106	1.40E-04
Sb-125	4.03E-05
Te-125m	9.84E-06
Cs-134	1.63E-04
Cs-137	2.00E-01
Ba-137m	2.00E-01
Ce-144	4.69E-04
Pr-144	4.69E-04
Pr-144m	5.64E-06
Pm-147	1.14E-03
Sm-151	1.12E-05
Eu-152	1.71E-07
Eu-154	2.93E-05
Eu-155	2.32E-05
Pu-238	3.53E-05
Pu-239	3.42E-07
Pu-240	1.71E-07
Pu-241	3.95E-05
Am-241	5.13E-07

Shipping Site: NRF — Total Volume (m3/yr) 1.17E+03 — Total Mass (kg/yr) 9.40E+06

Radionuclide	Activity (Ci/yr)
Cr-51	2.31E+03
Mn-54	4.40E+03
Fe-55	1.64E+04
Fe-59	1.48E+02
Co-58	5.91E+03
Co-60	4.63E+04
Ni-59	2.12E+02
Ni-63	3.01E+04
Zr-95	1.80E+02

Destination: LANL

Shipping Site: SNLA — Total Volume (m3/yr) 1.43E+01 — Total Mass (kg/yr) 1.15E+05

Radionuclide	Activity (Ci/yr)
Cr-51	6.54E-04
Mn-54	1.24E-03
Fe-55	4.64E-03
Fe-59	4.20E-05
Co-58	1.67E-03
Co-60	1.31E-02
Ni-59	6.00E-05
Ni-63	8.53E-03
Zr-95	5.10E-05

Destination: PORTS

Shipping Site: BAPL — Total Volume (m3/yr) 8.03E+02 — Total Mass (kg/yr) 6.43E+06

Radionuclide	Activity (Ci/yr)
Cr-51	4.75E+03
Mn-54	9.04E+03
Fe-55	3.37E+04
Fe-59	3.05E+02
Co-58	1.21E+04
Co-60	9.52E+04
Ni-59	4.36E+02
Ni-63	6.19E+04
Zr-95	3.70E+02
Tl-208	1.36E-08
Pb-212	3.60E-08
Bi-212	3.60E-08
Po-212	2.32E-08
Po-216	3.60E-08
Ra-224	3.60E-08
Ra-228	2.15E-07
Ac-228	2.15E-07
Th-228	3.60E-08
Th-231	2.07E-07
Th-232	2.18E-06
Th-234	2.65E-04
Pa-234	2.72E-08
Pa-234m	2.65E-04
U-235	2.06E-07
U-238	2.65E-04

Shipping Site: FNAL — Total Volume (m3/yr) 1.01E+02 — Total Mass (kg/yr) 8.14E+05

Radionuclide	Activity (Ci/yr)
Cr-51	3.35E-02
Mn-54	6.39E-02
Fe-55	2.38E-01
Fe-59	2.15E-03
Co-58	8.57E-02
Co-60	6.72E-01
Ni-59	3.08E-03
Ni-63	4.37E-01
Zr-95	2.61E-03

Shipping Site: KAPL	Total Volume (m3/yr)	1.66E+03	Total Mass (kg/yr)	1.33E+07

Radionuclide	Activity (Ci/yr)
H-3	5.15E-04
C-14	2.40E-05
Cr-51	1.13E+04
Mn-54	2.15E+04
Fe-55	8.05E+04
Fe-59	7.28E+02
Co-58	2.89E+04
Co-60	2.27E+05
Ni-59	1.04E+03
Ni-63	1.47E+05
Sr-90	2.62E-02
Y-90	2.62E-02
Zr-95	8.84E+02
Tc-99	5.20E-05
Ru-106	2.22E-03
Rh-106	2.22E-03
Sb-125	6.40E-04
Te-125m	1.56E-04
Cs-134	8.18E-03
Cs-137	3.13E-02
Ba-137m	2.96E-02
Ce-144	7.46E-03
Pr-144	7.46E-03
Pr-144m	8.97E-05
Pm-147	1.82E-02
Sm-151	1.78E-04
Eu-152	2.71E-06
Eu-154	4.66E-04
Eu-155	3.69E-04
Tl-208	2.96E-08
Pb-212	7.83E-08
Bi-212	7.83E-08
Po-212	5.05E-08
Po-216	7.83E-08
Ra-224	7.83E-08
Ra-228	4.68E-07
Ac-228	4.68E-07
Th-228	7.83E-08
Th-231	4.50E-07
Th-232	4.75E-06
Th-234	5.77E-04
Pa-234	5.92E-08
Pa-234m	5.77E-04
U-235	4.48E-07
U-238	8.69E-04
Pu-238	5.61E-04
Pu-239	5.43E-06
Pu-240	2.71E-06
Pu-241	6.28E-04
Am-241	8.15E-06

A.25 WM LLW CENTRALIZED 4 ALTERNATIVE (CASE 14A): HETEROGENEOUS SOLIDS

Transported Material with Radionuclide Profile

Alternative: #14a Regional Treat -- 7 Site -- 1 Site Disposal (NTS)

Waste Stream: LLW Waste Type: All, excl. Act.Metal

Destination: HANF

Shipping Site: LBL Total Volume (m3/yr) 7.21E+01 Total Mass (kg/yr) 1.08E+04

Radionuclide	Activity (Ci/yr)
H-3	1.82E+01
C-14	8.95E-01
Mn-54	1.00E+02
Co-58	9.31E+01
Co-60	2.69E+02
Sr-90	1.26E+02
Y-90	1.26E+02
Tc-99	1.79E+00
Cs-134	2.08E+02
Cs-137	2.75E+02
Ba-137m	2.60E+02
U-238	1.08E+01
Cm-244	1.05E+01

Shipping Site: LLNL Total Volume (m3/yr) 1.11E+02 Total Mass (kg/yr) 3.25E+05

Radionuclide	Activity (Ci/yr)
H-3	1.16E+04
C-14	5.38E-04
Mn-54	6.07E-02
Co-58	5.60E-02
Co-60	1.62E-01
Ni-63	1.69E-03
Sr-90	2.27E-01
Y-90	2.27E-01
Tc-99	1.10E-03
Ru-106	1.47E-02
Rh-106	1.47E-02
Sb-125	4.22E-03
Te-125m	1.03E-03
Cs-134	1.42E-01
Cs-137	3.23E-01
Ba-137m	3.06E-01
Ce-144	4.92E-02
Pr-144	4.92E-02
Pr-144m	5.92E-04
Pm-147	1.20E-01
Sm-151	1.17E-03
Eu-152	1.79E-05
Eu-154	3.07E-03
Eu-155	2.44E-03
U-238	6.55E-03
Pu-238	2.72E-02
Pu-239	1.83E-03
Pu-240	6.30E-03
Pu-241	8.69E-01
Am-241	8.97E-05
Cm-242	5.02E-04
Cm-244	1.79E-04

Shipping Site: SLAC	Total Volume (m3/yr)	1.35E-02	Total Mass (kg/yr)	1.24E+01

Radionuclide	Activity (Ci/yr)
Cr-51	2.10E-07
Mn-54	4.00E-07
Fe-55	1.49E-06
Fe-59	1.35E-08
Co-58	5.38E-07
Co-60	4.21E-06
Ni-59	1.93E-08
Ni-63	2.74E-06
Zr-95	1.64E-08

Shipping Site: SNLL	Total Volume (m3/yr)	2.28E+00	Total Mass (kg/yr)	1.92E+03

Radionuclide	Activity (Ci/yr)
H-3	2.82E+04
Fe-55	3.15E-01
Co-60	3.15E-01
Tl-208	5.35E-06
Pb-212	1.41E-05
Bi-212	1.41E-05
Po-212	9.13E-06
Po-216	1.41E-05
Ra-224	1.41E-05
Ra-228	8.47E-05
Ac-228	8.47E-05
Th-228	1.41E-05
Th-231	8.15E-05
Th-232	8.59E-04
Th-234	1.04E-01
Pa-234	1.07E-05
Pa-234m	1.04E-01
U-235	8.12E-05
U-238	1.04E-01

Destination: INEL

Shipping Site: ANL-W

Total Volume (m3/yr): 1.92E+02

Total Mass (kg/yr): 2.88E+04

Radionuclide	Activity (Ci/yr)
H-3	3.77E-05
Cr-51	3.85E-03
Mn-54	7.34E-03
Fe-55	2.74E-02
Fe-59	2.47E-04
Co-58	9.85E-03
Co-60	7.74E-02
Ni-59	3.53E-04
Ni-63	5.06E-02
Sr-90	3.17E-02
Y-90	3.17E-02
Zr-95	3.00E-04
Tc-99	5.66E-06
Ru-106	3.09E-03
Rh-106	3.09E-03
Sb-125	8.89E-04
Te-125m	2.17E-04
Cs-134	3.59E-03
Cs-137	3.32E-02
Ba-137m	3.14E-02
Ce-144	1.03E-02
Pr-144	1.03E-02
Pr-144m	1.24E-04
Pm-147	2.52E-02
Sm-151	2.47E-04
Eu-152	3.77E-06
Eu-154	6.47E-04
Eu-155	5.13E-04
Pu-238	7.81E-04
Pu-239	7.72E-06
Pu-240	4.38E-06
Pu-241	9.56E-04
Am-241	1.13E-05
Cm-242	4.88E-08
Cm-244	1.74E-08

Destination: LANL

Shipping Site: ITRI	Total Volume (m3/yr)	7.80E+01	Total Mass (kg/yr)	1.17E+04

Radionuclide	Activity (Ci/yr)
H-3	3.73E+00
C-14	1.83E-01
Mn-54	2.06E+01
Co-58	1.90E+01
Co-60	5.51E+01
Sr-90	2.59E+01
Y-90	2.59E+01
Tc-99	3.67E-01
Cs-134	4.27E+01
Cs-137	5.64E+01
Ba-137m	5.33E+01
U-238	2.23E+00

Shipping Site: PANT	Total Volume (m3/yr)	3.80E+03	Total Mass (kg/yr)	2.84E+07

Radionuclide	Activity (Ci/yr)
H-3	2.25E+02
Tl-208	2.12E-04
Pb-212	5.63E-04
Bi-212	5.63E-04
Po-212	3.62E-04
Po-216	5.63E-04
Ra-224	5.63E-04
Ra-228	3.36E-03
Ac-228	3.36E-03
Th-228	5.63E-04
Th-231	3.24E-03
Th-232	3.41E-02
Th-234	4.15E+00
Pa-234	4.25E-04
Pa-234m	4.15E+00
U-235	3.22E-03
U-238	4.15E+00

Shipping Site: SNLA	Total Volume (m3/yr)	5.39E-01	Total Mass (kg/yr)	4.31E+03

Radionuclide	Activity (Ci/yr)
Tl-208	5.10E-06
Pb-212	1.35E-05
Bi-212	1.35E-05
Po-212	8.70E-06
Po-216	1.35E-05
Ra-224	1.35E-05
Ra-228	8.07E-05
Ac-228	8.07E-05
Th-228	1.35E-05
Th-231	7.77E-05
Th-232	8.19E-04
Th-234	9.96E-02
Pa-234	1.02E-05
Pa-234m	9.96E-02
U-235	7.74E-05
U-238	9.96E-02

Destination: NTS

Shipping Site: AMES	Total Volume (m3/yr)	1.09E+01	Total Mass (kg/yr)	2.98E+04

Radionuclide	Activity (Ci/yr)
Tl-208	4.22E-07
Pb-212	1.11E-06
Bi-212	1.11E-06
Po-212	7.20E-07
Po-216	1.11E-06
Ra-224	1.11E-06
Ra-228	6.68E-06
Ac-228	6.68E-06
Th-228	1.11E-06
Th-231	6.43E-06
Th-232	6.77E-05
Th-234	8.24E-03
Pa-234	8.44E-07
Pa-234m	8.24E-03
U-235	6.40E-06
U-238	8.24E-03
Pu-238	6.50E-04
Pu-239	4.96E-05
Pu-240	1.73E-04
Pu-241	2.39E-02
Am-241	9.93E-07
Cm-242	1.39E-05
Cm-244	4.96E-06

Shipping Site: ANL-E	Total Volume (m3/yr)	7.35E+02	Total Mass (kg/yr)	2.00E+06

Radionuclide	Activity (Ci/yr)
H-3	1.33E+02
C-14	7.91E-02
Cr-51	2.87E+00
Mn-54	1.43E+01
Fe-55	2.04E+01
Fe-59	1.84E-01
Co-58	1.55E+01
Co-60	8.15E+01
Ni-59	2.63E-01
Ni-63	3.77E+01
Sr-90	3.33E+01
Y-90	3.33E+01
Zr-95	2.24E-01
Tc-99	1.62E-01
Ru-106	2.16E+00
Rh-106	2.16E+00
Sb-125	6.21E-01
Te-125m	1.51E-01
Cs-134	2.09E+01
Cs-137	4.75E+01
Ba-137m	4.50E+01
Ce-144	7.24E+00
Pr-144	7.24E+00
Pr-144m	8.70E-02
Pm-147	1.76E+01
Sm-151	1.72E-01
Eu-152	2.63E-03
Eu-154	4.52E-01
Eu-155	3.58E-01
U-238	9.63E-01
Pu-238	5.44E-01
Pu-239	5.27E-03
Pu-240	2.63E-03
Pu-241	6.09E-01
Am-241	7.91E-03

Shipping Site: ANL-W	Total Volume (m3/yr) 6.74E+01	Total Mass (kg/yr) 1.83E+05

Radionuclide	Activity (Ci/yr)
H-3	7.45E-04
Cr-51	3.58E+03
Mn-54	6.83E+03
Fe-55	2.54E+04
Fe-59	2.30E+02
Co-58	9.16E+03
Co-60	7.18E+04
Ni-59	3.29E+02
Ni-63	4.67E+04
Zr-95	2.79E+02

Shipping Site: BAPL	Total Volume (m3/yr) 3.98E+02	Total Mass (kg/yr) 1.08E+06

Radionuclide	Activity (Ci/yr)
H-3	2.51E-03
Co-60	1.19E-02
Ni-63	2.38E-02
Sr-90	2.11E+00
Y-90	2.11E+00
Tc-99	3.77E-04
Ru-106	2.06E-01
Rh-106	2.06E-01
Sb-125	5.93E-02
Te-125m	1.44E-02
Cs-134	2.40E-01
Cs-137	2.21E+00
Ba-137m	2.09E+00
Ce-144	6.91E-01
Pr-144	6.91E-01
Pr-144m	8.31E-03
Pm-147	1.68E+00
Sm-151	1.65E-02
Eu-152	2.51E-04
Eu-154	4.32E-02
Eu-155	3.42E-02
Tl-208	3.80E-06
Pb-212	1.00E-05
Bi-212	1.00E-05
Po-212	6.49E-06
Po-216	1.00E-05
Ra-224	1.00E-05
Ra-228	6.02E-05
Ac-228	6.02E-05
Th-228	1.00E-05
Th-231	5.80E-05
Th-232	6.11E-04
Th-234	7.43E-02
Pa-234	7.61E-06
Pa-234m	7.43E-02
U-235	5.77E-05
U-238	7.43E-02
Pu-238	5.20E-02
Pu-239	5.03E-04
Pu-240	2.51E-04
Pu-241	5.81E-02
Am-241	7.55E-04

Shipping Site: FNAL	Total Volume (m3/yr)	4.22E+01	Total Mass (kg/yr)	3.26E+04

Radionuclide	Activity (Ci/yr)
H-3	1.08E-01
Cr-51	1.11E-02
Mn-54	2.12E-02
Fe-55	7.94E-02
Fe-59	7.17E-04
Co-58	2.85E-02
Co-60	2.23E-01
Ni-59	1.02E-03
Ni-63	1.45E-01
Zr-95	8.71E-04
Tl-208	3.78E-07
Pb-212	1.00E-06
Bi-212	1.00E-06
Po-212	6.46E-07
Po-216	1.00E-06
Ra-224	1.00E-06
Ra-228	5.99E-06
Ac-228	5.99E-06
Th-228	1.00E-06
Th-231	5.77E-06
Th-232	6.08E-05
Th-234	7.39E-03
Pa-234	7.57E-07
Pa-234m	7.39E-03
U-235	5.75E-06
U-238	7.39E-03

Shipping Site: HANF	Total Volume (m3/yr)	2.18E+03	Total Mass (kg/yr)	2.79E+07

Radionuclide	Activity (Ci/yr)
H-3	1.17E+04
C-14	6.33E-01
Cr-51	5.66E+01
Mn-54	2.08E+02
Fe-55	4.02E+02
Fe-59	3.63E+00
Co-58	2.37E+02
Co-60	1.41E+03
Ni-59	5.19E+00
Ni-63	7.60E+02
Sr-90	2.05E+03
Y-90	2.05E+03
Zr-95	4.41E+00
Tc-99	2.13E+00
Ru-106	1.88E+02
Rh-106	1.88E+02
Sb-125	5.41E+01
Te-125m	1.32E+01
Cs-134	4.27E+02
Cs-137	2.29E+03

Destination: NTS

Shipping Site: HANF	Total Volume (m3/yr) 2.18E+03	Total Mass (kg/yr) 2.79E+07

Radionuclide	Activity (Ci/yr)
Ba-137m	2.17E+03
Ce-144	6.31E+02
Pr-144	6.31E+02
Pr-144m	7.58E+00
Pm-147	1.54E+03
Sm-151	1.50E+01
Eu-152	2.29E-01
Eu-154	3.94E+01
Eu-155	3.12E+01
Tl-208	2.76E-04
Pb-212	7.30E-04
Bi-212	7.30E-04
Po-212	4.70E-04
Po-216	7.30E-04
Ra-224	7.30E-04
Ra-228	4.36E-03
Ac-228	4.36E-03
Th-228	7.30E-04
Th-231	4.20E-03
Th-232	4.43E-02
Th-234	5.39E+00
Pa-234	5.52E-04
Pa-234m	5.39E+00
U-235	4.18E-03
U-238	1.62E+01
Pu-238	4.74E+01
Pu-239	4.61E-01
Pu-240	2.36E-01
Pu-241	5.39E+01
Am-241	6.89E-01
Cm-242	5.02E-04
Cm-244	1.05E+01

Shipping Site: INEL	Total Volume (m3/yr) 3.77E+03	Total Mass (kg/yr) 1.64E+07

Radionuclide	Activity (Ci/yr)
H-3	1.56E+00
Cr-51	1.02E+02
Mn-54	1.94E+02
Fe-55	7.24E+02
Fe-59	6.55E+00
Co-58	2.60E+02
Co-60	2.04E+03
Ni-59	9.35E+00
Ni-63	1.33E+03
Sr-90	5.01E+01
Y-90	5.01E+01
Zr-95	7.95E+00
Tc-99	8.96E-03
Ru-106	4.90E+00
Rh-106	4.90E+00
Sb-125	1.40E+00
Te-125m	3.43E-01
Cs-134	5.69E+00
Cs-137	5.25E+01
Ba-137m	4.97E+01
Ce-144	1.64E+01
Pr-144	1.64E+01
Pr-144m	1.97E-01
Pm-147	4.00E+01
Sm-151	3.91E-01
Eu-152	5.97E-03
Eu-154	1.02E+00
Eu-155	8.12E-01
Pu-238	1.23E+00
Pu-239	1.19E-02
Pu-240	5.97E-03
Pu-241	1.38E+00
Am-241	1.79E-02
Cm-242	4.88E-08
Cm-244	1.74E-08

Shipping Site: ITRI	Total Volume (m3/yr)	5.61E+01	Total Mass (kg/yr)	1.53E+05

Radionuclide	Activity (Ci/yr)
H-3	2.44E+00
C-14	1.20E-01
Mn-54	1.35E+01
Co-58	1.24E+01
Co-60	3.60E+01
Sr-90	1.69E+01
Y-90	1.69E+01
Tc-99	2.40E-01
Cs-134	2.79E+01
Cs-137	3.69E+01
Ba-137m	3.49E+01
U-238	1.46E+00

Destination: NTS

Shipping Site: K-25	Total Volume (m3/yr)	8.16E+01	Total Mass (kg/yr)	2.22E+05

Radionuclide	Activity (Ci/yr)
Tl-208	1.26E-06
Pb-212	3.34E-06
Bi-212	3.34E-06
Po-212	2.15E-06
Po-216	3.34E-06
Ra-224	3.34E-06
Ra-228	1.99E-05
Ac-228	1.99E-05
Th-228	3.34E-06
Th-231	1.92E-05
Th-232	2.02E-04
Th-234	2.46E-02
Pa-234	2.52E-06
Pa-234m	2.46E-02
U-235	1.91E-05
U-238	2.46E-02

Shipping Site: KAPL	Total Volume (m3/yr)	2.11E+02	Total Mass (kg/yr)	5.36E+05

Radionuclide	Activity (Ci/yr)
H-3	5.14E-04
C-14	2.40E-05
Cr-51	5.11E-03
Mn-54	1.24E-02
Fe-55	3.63E-02
Fe-59	3.28E-04
Co-58	1.55E-02
Co-60	1.09E-01
Ni-59	4.69E-04
Ni-63	6.70E-02
Sr-90	2.58E-02
Y-90	2.58E-02
Zr-95	3.99E-04
Tc-99	5.20E-05
Ru-106	2.19E-03
Rh-106	2.19E-03
Sb-125	6.31E-04
Te-125m	1.54E-04
Cs-134	8.14E-03
Cs-137	3.09E-02
Ba-137m	2.92E-02
Ce-144	7.35E-03
Pr-144	7.35E-03
Pr-144m	8.84E-05
Pm-147	1.79E-02
Sm-151	1.75E-04
Eu-152	2.67E-06
Eu-154	4.59E-04
Eu-155	3.64E-04
Tl-208	4.50E-09
Pb-212	1.19E-08
Bi-212	1.19E-08
Po-212	7.60E-09
Po-216	1.19E-08
Ra-224	1.19E-08
Ra-228	7.11E-08
Ac-228	7.11E-08
Th-228	1.19E-08
Th-231	6.84E-08
Th-232	7.21E-07
Th-234	8.77E-05
Pa-234	8.90E-09
Pa-234m	8.77E-05
U-235	6.82E-08
U-238	3.79E-04
Pu-238	5.53E-04
Pu-239	5.35E-06
Pu-240	2.67E-06
Pu-241	6.18E-04
Am-241	8.03E-06

Shipping Site: KCP	Total Volume (m3/yr)	2.65E+00	Total Mass (kg/yr)	7.23E+03

Radionuclide	Activity (Ci/yr)
H-3	2.70E-02
C-14	1.44E-04
Mn-54	1.62E-02
Co-58	1.50E-02
Co-60	4.34E-02
Sr-90	2.04E-02
Y-90	2.04E-02
Tc-99	2.89E-04
Cs-134	3.37E-02
Cs-137	4.44E-02
Ba-137m	4.20E-02
U-238	1.76E-03

Shipping Site: LANL	Total Volume (m3/yr)	5.50E+03	Total Mass (kg/yr)	4.07E+07

Radionuclide	Activity (Ci/yr)
H-3	3.84E+05
C-14	1.83E-01
Cr-51	5.93E+00
Mn-54	3.19E+01
Fe-55	4.21E+01
Fe-59	3.81E-01
Co-58	3.42E+01
Co-60	5.40E+02
Ni-59	5.44E-01
Ni-63	8.05E+02
Sr-90	6.47E+04
Y-90	6.47E+04
Zr-95	4.62E-01
Tc-99	1.19E+01
Ru-106	6.32E+03
Rh-106	6.32E+03
Sb-125	1.81E+03
Te-125m	4.43E+02
Cs-134	7.39E+03
Cs-137	6.79E+04
Ba-137m	6.42E+04
Ce-144	2.11E+04
Pr-144	2.11E+04
Pr-144m	2.54E+02
Pm-147	5.16E+04
Sm-151	5.04E+02
Eu-152	7.70E+00
Eu-154	1.32E+03
Eu-155	1.04E+03
Tl-208	1.69E-02
Pb-212	4.47E-02
Bi-212	4.47E-02
Po-212	2.88E-02
Po-216	4.47E-02
Ra-224	4.47E-02
Ra-228	2.67E-01
Ac-228	2.67E-01
Th-228	4.47E-02
Th-231	2.57E-01
Th-232	2.71E+00
Th-234	3.30E+02
Pa-234	3.38E-02
Pa-234m	3.30E+02
U-235	2.56E-01
U-238	3.32E+02
Pu-238	1.59E+03
Pu-239	1.57E+01
Pu-240	8.94E+00
Pu-241	1.95E+03
Am-241	2.31E+01
Cm-242	9.84E-02
Cm-244	3.51E-02

Shipping Site: LBL	Total Volume (m3/yr)	1.26E+01	Total Mass (kg/yr)	3.43E+04

Radionuclide	Activity (Ci/yr)
H-3	6.17E+02
C-14	2.35E-01
Mn-54	2.65E+01
Co-58	2.45E+01
Co-60	7.08E+01
Sr-90	3.33E+01
Y-90	3.33E+01
Tc-99	4.71E-01
Cs-134	5.49E+01
Cs-137	7.25E+01
Ba-137m	6.85E+01
U-238	2.86E+00

Shipping Site: LLNL	Total Volume (m3/yr)	2.98E+02	Total Mass (kg/yr)	7.42E+05

Radionuclide	Activity (Ci/yr)
H-3	2.16E+04
C-14	1.01E-03
Mn-54	1.14E-01
Co-58	1.05E-01
Co-60	3.06E-01
Ni-63	3.19E-03
Sr-90	4.27E-01
Y-90	4.27E-01
Tc-99	2.07E-03
Ru-106	2.77E-02
Rh-106	2.77E-02
Sb-125	7.96E-03
Te-125m	1.94E-03
Cs-134	2.68E-01
Cs-137	6.09E-01
Ba-137m	5.76E-01
Ce-144	9.27E-02
Pr-144	9.27E-02
Pr-144m	1.11E-03
Pm-147	2.26E-01
Sm-151	2.21E-03
Eu-152	3.38E-05
Eu-154	5.79E-03
Eu-155	4.59E-03
U-238	1.23E-02
Pu-238	5.12E-02
Pu-239	3.44E-03
Pu-240	1.18E-02
Pu-241	1.63E+00
Am-241	1.69E-04
Cm-242	9.46E-04
Cm-244	3.38E-04

Shipping Site: MOUND	Total Volume (m3/yr)	3.57E+03	Total Mass (kg/yr)	9.56E+06

Radionuclide	Activity (Ci/yr)
H-3	1.59E+00
Pu-238	1.60E-01
Pu-239	1.22E-02
Pu-240	4.28E-02
Pu-241	5.90E+00
Am-241	2.44E-04
Cm-242	3.42E-03
Cm-244	1.22E-03

Shipping Site: ORISE	Total Volume (m3/yr) 2.76E+01	Total Mass (kg/yr) 6.91E+04

Radionuclide	Activity (Ci/yr)
H-3	7.88E-03
C-14	4.74E-06
Mn-54	5.34E-04
Co-58	4.92E-04
Co-60	1.42E-03
Sr-90	6.69E-04
Y-90	6.69E-04
Tc-99	9.48E-06
Cs-134	1.10E-03
Cs-137	1.45E-03
Ba-137m	1.37E-03
Tl-208	1.34E-07
Pb-212	3.55E-07
Bi-212	3.55E-07
Po-212	2.29E-07
Po-216	3.55E-07
Ra-224	3.55E-07
Ra-228	2.12E-06
Ac-228	2.12E-06
Th-228	3.55E-07
Th-231	2.04E-06
Th-232	2.15E-05
Th-234	2.62E-03
Pa-234	2.68E-07
Pa-234m	2.62E-03
U-235	2.03E-06
U-238	2.68E-03

Shipping Site: ORNL	Total Volume (m3/yr) 4.78E+03	Total Mass (kg/yr) 1.32E+08

Radionuclide	Activity (Ci/yr)
H-3	1.10E+00
C-14	1.14E-05
Cr-51	1.01E+01
Mn-54	1.98E+01
Fe-55	7.20E+01
Fe-59	6.51E-01
Co-58	2.63E+01
Co-60	2.09E+02
Ni-59	9.30E-01
Ni-63	1.42E+02
Sr-90	9.15E+02
Y-90	9.15E+02
Zr-95	7.90E-01
Tc-99	1.74E-01
Ru-106	8.91E+01
Rh-106	8.91E+01
Sb-125	2.56E+01
Te-125m	6.25E+00
Cs-134	1.04E+02
Cs-137	9.58E+02
Ba-137m	9.07E+02
Ce-144	2.98E+02
Pr-144	2.98E+02
Pr-144m	3.58E+00
Pm-147	7.28E+02
Sm-151	7.12E+00
Eu-152	1.08E-01
Eu-154	1.86E+01
Eu-155	1.47E+01
Tl-208	1.81E-04
Pb-212	4.81E-04
Bi-212	4.81E-04
Po-212	3.10E-04
Po-216	4.81E-04
Ra-224	4.81E-04
Ra-228	2.87E-03
Ac-228	2.87E-03
Th-228	4.81E-04
Th-231	2.77E-03
Th-232	2.92E-02
Th-234	3.55E+00
Pa-234	3.63E-04
Pa-234m	3.55E+00
U-235	2.76E-03
U-238	3.60E+00
Np-237	1.63E-03
Pu-238	2.24E+01
Pu-239	2.19E-01
Pu-240	1.09E-01
Pu-241	2.52E+01
Am-241	3.26E-01
Cm-242	5.60E-05
Cm-244	2.00E-05

Shipping Site: PANT	Total Volume (m3/yr)	1.70E+02	Total Mass (kg/yr)	4.66E+05

Radionuclide	Activity (Ci/yr)
H-3	9.18E+00
Tl-208	8.99E-06
Pb-212	2.38E-05
Bi-212	2.38E-05
Po-212	1.53E-05
Po-216	2.38E-05
Ra-224	2.38E-05
Ra-228	1.42E-04
Ac-228	1.42E-04
Th-228	2.38E-05
Th-231	1.37E-04
Th-232	1.44E-03
Th-234	1.75E-01
Pa-234	1.79E-05
Pa-234m	1.75E-01
U-235	1.36E-04
U-238	1.75E-01

Shipping Site: PORTS	Total Volume (m3/yr)	1.77E+03	Total Mass (kg/yr)	6.77E+07

Radionuclide	Activity (Ci/yr)
H-3	2.24E+02
Tl-208	3.50E-06
Pb-212	9.27E-06
Bi-212	9.27E-06
Po-212	5.97E-06
Po-216	9.27E-06
Ra-224	9.27E-06
Ra-228	5.54E-05
Ac-228	5.54E-05
Th-228	9.27E-06
Th-231	5.33E-05
Th-232	5.62E-04
Th-234	6.84E-02
Pa-234	7.00E-06
Pa-234m	6.84E-02
U-235	5.31E-05
U-238	6.84E-02
Pu-238	4.36E-05
Pu-239	3.33E-06
Pu-240	1.16E-05
Pu-241	1.60E-03
Am-241	6.67E-08
Cm-242	9.33E-07
Cm-244	3.33E-07

Shipping Site: PPPL	Total Volume (m3/yr)	4.51E-01	Total Mass (kg/yr)	1.23E+03

Radionuclide	Activity (Ci/yr)
H-3	3.74E-03
Cr-51	8.50E-04
Mn-54	1.61E-03
Fe-55	6.04E-03
Fe-59	5.46E-05
Co-58	2.17E-03
Co-60	1.70E-02
Ni-59	7.80E-05
Ni-63	1.10E-02
Zr-95	6.63E-05

Shipping Site: Paducah	Total Volume (m3/yr)	4.04E+03	Total Mass (kg/yr)	1.10E+07

Radionuclide	Activity (Ci/yr)
Tc-99	6.66E-03
Tl-208	2.80E-05
Pb-212	7.41E-05
Bi-212	7.41E-05
Po-212	4.78E-05
Po-216	7.41E-05
Ra-224	7.41E-05
Ra-228	4.43E-04
Ac-228	4.43E-04
Th-228	7.41E-05
Th-231	4.27E-04
Th-232	4.50E-03
Th-234	5.47E-01
Pa-234	5.60E-05
Pa-234m	5.47E-01
U-235	4.25E-04
U-238	5.47E-01
Np-237	4.99E-03
Pu-239	4.99E-03

Shipping Site: RFP	Total Volume (m3/yr)	1.27E+03	Total Mass (kg/yr)	6.52E+06

Radionuclide	Activity (Ci/yr)
Tl-208	3.60E-05
Pb-212	9.55E-05
Bi-212	9.55E-05
Po-212	6.15E-05
Po-216	9.55E-05
Ra-224	9.55E-05
Ra-228	5.70E-04
Ac-228	5.70E-04
Th-228	9.55E-05
Th-231	5.49E-04
Th-232	5.79E-03
Th-234	7.04E-01
Pa-234	7.21E-05
Pa-234m	7.04E-01
U-235	5.47E-04
U-238	7.04E-01
Pu-238	5.56E-01
Pu-239	4.24E-02
Pu-240	1.48E-01
Pu-241	2.04E+01
Am-241	8.48E-04
Cm-242	1.18E-02
Cm-244	4.24E-03

Shipping Site: RMI	Total Volume (m3/yr)	5.36E+03	Total Mass (kg/yr)	1.45E+07

Radionuclide	Activity (Ci/yr)
Tl-208	3.38E-07
Pb-212	8.96E-07
Bi-212	8.96E-07
Po-212	5.77E-07
Po-216	8.96E-07
Ra-224	8.96E-07
Ra-228	5.35E-06
Ac-228	5.35E-06
Th-228	8.96E-07
Th-231	5.15E-06
Th-232	5.43E-05
Th-234	6.61E-03
Pa-234	6.77E-07
Pa-234m	6.61E-03
U-235	5.13E-06
U-238	6.61E-03

Shipping Site: SLAC	Total Volume (m3/yr)	2.73E+02	Total Mass (kg/yr)	7.45E+05

Radionuclide	Activity (Ci/yr)
Cr-51	3.86E-03
Mn-54	7.36E-03
Fe-55	2.74E-02
Fe-59	2.48E-04
Co-58	9.88E-03
Co-60	7.74E-02
Ni-59	3.54E-04
Ni-63	5.04E-02
Zr-95	3.01E-04

Shipping Site: SNLA	Total Volume (m3/yr)	1.18E+02	Total Mass (kg/yr)	3.24E+05

Radionuclide	Activity (Ci/yr)
H-3	3.00E+00
Co-60	2.85E-05
Ni-63	5.67E-05
Sr-90	5.04E-03
Y-90	5.04E-03
Tc-99	9.00E-07
Ru-106	4.92E-04
Rh-106	4.92E-04
Sb-125	1.41E-04
Te-125m	3.45E-05
Cs-134	5.72E-04
Cs-137	5.28E-03
Ba-137m	4.99E-03
Ce-144	1.64E-03
Pr-144	1.64E-03
Pr-144m	1.98E-05
Pm-147	4.02E-03
Sm-151	3.93E-05
Eu-152	6.00E-07
Eu-154	1.02E-04
Eu-155	8.16E-05
Pu-238	7.87E-02
Pu-239	6.00E-03
Pu-240	2.10E-02
Pu-241	2.89E+00
Am-241	1.21E-04
Cm-242	1.68E-03
Cm-244	6.00E-04

Shipping Site: SNLL	Total Volume (m3/yr)	3.36E+01	Total Mass (kg/yr)	9.17E+04

Radionuclide	Activity (Ci/yr)
H-3	1.38E+01
Tl-208	5.86E-05
Pb-212	1.55E-04
Bi-212	1.55E-04
Po-212	1.00E-04
Po-216	1.55E-04
Ra-224	1.55E-04
Ra-228	9.28E-04
Ac-228	9.28E-04
Th-228	1.55E-04
Th-231	8.93E-04
Th-232	9.42E-03
Th-234	1.14E+00
Pa-234	1.17E-04
Pa-234m	1.14E+00
U-235	8.90E-04
U-238	1.14E+00

Shipping Site: SRS	Total Volume (m3/yr)	4.59E+04	Total Mass (kg/yr)	1.30E+08

Radionuclide	Activity (Ci/yr)
H-3	6.72E+04
C-14	1.08E+00
Cr-51	1.95E+03
Mn-54	3.84E+03
Fe-55	1.38E+04
Fe-59	1.25E+02
Co-58	5.10E+03
Co-60	3.94E+04
Ni-59	1.79E+02
Ni-63	2.55E+04
Sr-90	3.56E+03
Y-90	3.56E+03
Zr-95	1.52E+02
Tc-99	2.78E+00
Ru-106	3.32E+02
Rh-106	3.32E+02
Sb-125	9.56E+01
Te-125m	2.33E+01
Cs-134	6.40E+02
Cs-137	3.90E+03
Ba-137m	3.69E+03
Ce-144	1.11E+03
Pr-144	1.11E+03
Pr-144m	1.33E+01
Pm-147	2.72E+03
Sm-151	2.65E+01
Eu-152	4.05E-01
Eu-154	6.96E+01
Eu-155	5.52E+01
Tl-208	8.54E-04
Pb-212	2.26E-03
Bi-212	2.26E-03
Po-212	1.45E-03
Po-216	2.26E-03
Ra-224	2.26E-03
Ra-228	1.35E-02
Ac-228	1.35E-02
Th-228	2.26E-03
Th-231	1.30E-02
Th-232	1.37E-01
Th-234	1.66E+01
Pa-234	1.70E-03
Pa-234m	1.66E+01
U-235	1.29E-02
U-238	2.99E+01
Pu-238	8.45E+01
Pu-239	8.64E-01
Pu-240	5.89E-01
Pu-241	1.19E+02
Am-241	1.21E+00
Cm-242	1.46E-02
Cm-244	5.24E-03

Shipping Site: Y-12	Total Volume (m3/yr)	5.57E+02	Total Mass (kg/yr)	1.51E+06

Radionuclide	Activity (Ci/yr)
Tl-208	2.58E-06
Pb-212	6.84E-06
Bi-212	6.84E-06
Po-212	4.40E-06
Po-216	6.84E-06
Ra-224	6.84E-06
Ra-228	4.08E-05
Ac-228	4.08E-05
Th-228	6.84E-06
Th-231	3.93E-05
Th-232	4.14E-04
Th-234	5.04E-02
Pa-234	5.16E-06
Pa-234m	5.04E-02
U-235	3.92E-05
U-238	5.04E-02

Destination: ORNL

Shipping Site: K-25	Total Volume (m3/yr)	6.20E+03	Total Mass (kg/yr)	4.65E+07

Radionuclide	Activity (Ci/yr)
Tl-208	1.05E-04
Pb-212	2.79E-04
Bi-212	2.79E-04
Po-212	1.79E-04
Po-216	2.79E-04
Ra-224	2.79E-04
Ra-228	1.66E-03
Ac-228	1.66E-03
Th-228	2.79E-04
Th-231	1.60E-03
Th-232	1.69E-02
Th-234	2.05E+00
Pa-234	2.10E-04
Pa-234m	2.05E+00
U-235	1.60E-03
U-238	2.05E+00

Shipping Site: ORISE	Total Volume (m3/yr)	3.01E+01	Total Mass (kg/yr)	4.52E+03

Radionuclide	Activity (Ci/yr)
H-3	1.22E-02
C-14	7.23E-06
Mn-54	8.15E-04
Co-58	7.52E-04
Co-60	2.17E-03
Sr-90	1.02E-03
Y-90	1.02E-03
Tc-99	1.44E-05
Cs-134	1.68E-03
Cs-137	2.22E-03
Ba-137m	2.10E-03
Tl-208	2.05E-07
Pb-212	5.42E-07
Bi-212	5.42E-07
Po-212	3.49E-07
Po-216	5.42E-07
Ra-224	5.42E-07
Ra-228	3.24E-06
Ac-228	3.24E-06
Th-228	5.42E-07
Th-231	3.12E-06
Th-232	3.29E-05
Th-234	4.00E-03
Pa-234	4.10E-07
Pa-234m	4.00E-03
U-235	3.11E-06
U-238	4.09E-03

Shipping Site: Paducah	Total Volume (m3/yr)	1.21E+03	Total Mass (kg/yr)	9.48E+05

Radionuclide	Activity (Ci/yr)
Tc-99	2.17E-03
Tl-208	9.17E-06
Pb-212	2.42E-05
Bi-212	2.42E-05
Po-212	1.56E-05
Po-216	2.42E-05
Ra-224	2.42E-05
Ra-228	1.45E-04
Ac-228	1.45E-04
Th-228	2.42E-05
Th-231	1.39E-04
Th-232	1.47E-03
Th-234	1.79E-01
Pa-234	1.83E-05
Pa-234m	1.79E-01
U-235	1.39E-04
U-238	1.79E-01
Np-237	1.63E-03
Pu-239	1.63E-03

Shipping Site: Y-12	Total Volume (m3/yr)	1.28E+04	Total Mass (kg/yr)	8.12E+07

Radionuclide	Activity (Ci/yr)
Tl-208	6.54E-05
Pb-212	1.73E-04
Bi-212	1.73E-04
Po-212	1.11E-04
Po-216	1.73E-04
Ra-224	1.73E-04
Ra-228	1.03E-03
Ac-228	1.03E-03
Th-228	1.73E-04
Th-231	9.96E-04
Th-232	1.05E-02
Th-234	1.27E+00
Pa-234	1.30E-04
Pa-234m	1.27E+00
U-235	9.92E-04
U-238	1.27E+00

Destination: PORTS

Shipping Site: AMES — Total Volume (m3/yr) 6.66E-01 — Total Mass (kg/yr) 1.00E+02

Radionuclide	Activity (Ci/yr)
Tl-208	2.83E-08
Pb-212	7.50E-08
Bi-212	7.50E-08
Po-212	4.83E-08
Po-216	7.50E-08
Ra-224	7.50E-08
Ra-228	4.48E-07
Ac-228	4.48E-07
Th-228	7.50E-08
Th-231	4.31E-07
Th-232	4.55E-06
Th-234	5.53E-04
Pa-234	5.67E-08
Pa-234m	5.53E-04
U-235	4.30E-07
U-238	5.53E-04
Pu-238	4.36E-05
Pu-239	3.33E-06
Pu-240	1.16E-05
Pu-241	1.60E-03
Am-241	6.67E-08
Cm-242	9.33E-07
Cm-244	3.33E-07

Shipping Site: FNAL — Total Volume (m3/yr) 6.79E+00 — Total Mass (kg/yr) 6.25E+03

Radionuclide	Activity (Ci/yr)
H-3	7.38E-02

Shipping Site: MOUND — Total Volume (m3/yr) 7.60E+02 — Total Mass (kg/yr) 1.14E+05

Radionuclide	Activity (Ci/yr)
H-3	1.34E+04

Shipping Site: PPPL — Total Volume (m3/yr) 2.16E+01 — Total Mass (kg/yr) 3.73E+03

Radionuclide	Activity (Ci/yr)
H-3	1.97E-01

Shipping Site: RMI — Total Volume (m3/yr) 2.74E+02 — Total Mass (kg/yr) 9.49E+04

Radionuclide	Activity (Ci/yr)
Tl-208	1.94E-08
Pb-212	5.13E-08
Bi-212	5.13E-08
Po-212	3.30E-08
Po-216	5.13E-08
Ra-224	5.13E-08
Ra-228	3.06E-07
Ac-228	3.06E-07
Th-228	5.13E-08
Th-231	2.95E-07
Th-232	3.11E-06
Th-234	3.78E-04
Pa-234	3.87E-08
Pa-234m	3.78E-04
U-235	2.93E-07
U-238	3.78E-04

Destination: SRS

Shipping Site: Pinellas	Total Volume (m3/yr)	1.27E+02	Total Mass (kg/yr)	1.91E+04

Radionuclide	Activity (Ci/yr)
H-3	1.99E+04

A.26 WM LLW CENTRALIZED 4 ALTERNATIVE (CASE 14A): ACTIVATED METALS

Transported Material with Radionuclide Profile

Alternative: #14a Regional Treat -- 7 Site -- 1 Site Disposal (NTS)

Waste Stream: LLW Waste Type: Activated Metal

Destination: HANF

Shipping Site: LBL Total Volume (m3/yr) 3.59E+01 Total Mass (kg/yr) 2.87E+05

Radionuclide	Activity (Ci/yr)
Cr-51	6.32E-02
Mn-54	1.20E-01
Fe-55	4.49E-01
Fe-59	4.06E-03
Co-58	1.61E-01
Co-60	1.26E+00
Ni-59	5.80E-03
Ni-63	8.24E-01
Zr-95	4.93E-03

Destination: INEL

Shipping Site: ANL-W Total Volume (m3/yr) 2.06E+01 Total Mass (kg/yr) 1.64E+05

Radionuclide	Activity (Ci/yr)
H-3	1.71E-06
Cr-51	1.24E-04
Mn-54	2.37E-04
Fe-55	8.86E-04
Fe-59	8.00E-06
Co-58	3.18E-04
Co-60	2.50E-03
Ni-59	1.14E-05
Ni-63	1.64E-03
Sr-90	1.43E-03
Y-90	1.43E-03
Zr-95	9.72E-06
Tc-99	2.56E-07
Ru-106	1.40E-04
Rh-106	1.40E-04
Sb-125	4.03E-05
Te-125m	9.84E-06
Cs-134	1.63E-04
Cs-137	2.00E-01
Ba-137m	2.00E-01
Ce-144	4.69E-04
Pr-144	4.69E-04
Pr-144m	5.64E-06
Pm-147	1.14E-03
Sm-151	1.12E-05
Eu-152	1.71E-07
Eu-154	2.93E-05
Eu-155	2.32E-05
Pu-238	3.53E-05
Pu-239	3.42E-07
Pu-240	1.71E-07
Pu-241	3.95E-05
Am-241	5.13E-07

Shipping Site: NRF	Total Volume (m3/yr)	1.17E+03	Total Mass (kg/yr)	9.40E+06

Radionuclide	Activity (Ci/yr)
Cr-51	2.31E+03
Mn-54	4.40E+03
Fe-55	1.64E+04
Fe-59	1.48E+02
Co-58	5.91E+03
Co-60	4.63E+04
Ni-59	2.12E+02
Ni-63	3.01E+04
Zr-95	1.80E+02

Destination: LANL

Shipping Site: SNLA	Total Volume (m3/yr)	1.43E+01	Total Mass (kg/yr)	1.15E+05

Radionuclide	Activity (Ci/yr)
Cr-51	6.54E-04
Mn-54	1.24E-03
Fe-55	4.64E-03
Fe-59	4.20E-05
Co-58	1.67E-03
Co-60	1.31E-02
Ni-59	6.00E-05
Ni-63	8.53E-03
Zr-95	5.10E-05

Destination: NTS

Shipping Site: HANF	Total Volume (m3/yr)	2.19E+01	Total Mass (kg/yr)	9.57E+05

Radionuclide	Activity (Ci/yr)
Cr-51	3.00E+01
Mn-54	5.72E+01
Fe-55	2.13E+02
Fe-59	1.93E+00
Co-58	7.68E+01
Co-60	6.02E+02
Ni-59	2.75E+00
Ni-63	3.92E+02
Zr-95	2.34E+00

Shipping Site: INEL	Total Volume (m3/yr)	2.19E+02	Total Mass (kg/yr)	9.57E+06

Radionuclide	Activity (Ci/yr)
H-3	1.71E-06
Cr-51	2.31E+03
Mn-54	4.40E+03
Fe-55	1.64E+04
Fe-59	1.48E+02
Co-58	5.91E+03
Co-60	4.63E+04
Ni-59	2.12E+02
Ni-63	3.01E+04
Sr-90	1.43E-03
Y-90	1.43E-03
Zr-95	1.80E+02
Tc-99	2.56E-07
Ru-106	1.40E-04
Rh-106	1.40E-04
Sb-125	4.03E-05
Te-125m	9.84E-06
Cs-134	1.63E-04
Cs-137	2.00E-01
Ba-137m	2.00E-01
Ce-144	4.69E-04
Pr-144	4.69E-04
Pr-144m	5.64E-06
Pm-147	1.14E-03
Sm-151	1.12E-05
Eu-152	1.71E-07
Eu-154	2.93E-05
Eu-155	2.32E-05
Pu-238	3.53E-05
Pu-239	3.42E-07
Pu-240	1.71E-07
Pu-241	3.95E-05
Am-241	5.13E-07

Shipping Site: LANL	Total Volume (m3/yr)	1.99E+02	Total Mass (kg/yr)	8.69E+06

Radionuclide	Activity (Ci/yr)
Cr-51	2.42E+01
Mn-54	4.62E+01
Fe-55	1.72E+02
Fe-59	1.55E+00
Co-58	6.20E+01
Co-60	4.86E+02
Ni-59	2.22E+00
Ni-63	3.16E+02
Zr-95	1.89E+00

Shipping Site: PORTS	Total Volume (m3/yr) 4.71E+02	Total Mass (kg/yr) 2.05E+07

Radionuclide	Activity (Ci/yr)
H-3	5.15E-04
C-14	2.40E-05
Cr-51	1.60E+04
Mn-54	3.06E+04
Fe-55	1.14E+05
Fe-59	1.03E+03
Co-58	4.11E+04
Co-60	3.22E+05
Ni-59	1.47E+03
Ni-63	2.09E+05
Sr-90	2.62E-02
Y-90	2.62E-02
Zr-95	1.25E+03
Tc-99	5.20E-05
Ru-106	2.22E-03
Rh-106	2.22E-03
Sb-125	6.40E-04
Te-125m	1.56E-04
Cs-134	8.18E-03
Cs-137	3.13E-02
Ba-137m	2.96E-02
Ce-144	7.46E-03
Pr-144	7.46E-03
Pr-144m	8.97E-05
Pm-147	1.82E-02
Sm-151	1.78E-04
Eu-152	2.71E-06
Eu-154	4.66E-04
Eu-155	3.69E-04
Tl-208	4.32E-08
Pb-212	1.14E-07
Bi-212	1.14E-07
Po-212	7.37E-08
Po-216	1.14E-07
Ra-224	1.14E-07
Ra-228	6.83E-07
Ac-228	6.83E-07
Th-228	1.14E-07
Th-231	6.57E-07
Th-232	6.93E-06
Th-234	8.43E-04
Pa-234	8.64E-08
Pa-234m	8.43E-04
U-235	6.55E-07
U-238	1.13E-03
Pu-238	5.61E-04
Pu-239	5.43E-06
Pu-240	2.71E-06
Pu-241	6.28E-04
Am-241	8.15E-06

Destination: PORTS

Shipping Site: BAPL	Total Volume (m3/yr)	8.03E+02	Total Mass (kg/yr)	6.43E+06

Radionuclide	Activity (Ci/yr)
Cr-51	4.75E+03
Mn-54	9.04E+03
Fe-55	3.37E+04
Fe-59	3.05E+02
Co-58	1.21E+04
Co-60	9.52E+04
Ni-59	4.36E+02
Ni-63	6.19E+04
Zr-95	3.70E+02
Tl-208	1.36E-08
Pb-212	3.60E-08
Bi-212	3.60E-08
Po-212	2.32E-08
Po-216	3.60E-08
Ra-224	3.60E-08
Ra-228	2.15E-07
Ac-228	2.15E-07
Th-228	3.60E-08
Th-231	2.07E-07
Th-232	2.18E-06
Th-234	2.65E-04
Pa-234	2.72E-08
Pa-234m	2.65E-04
U-235	2.06E-07
U-238	2.65E-04

Shipping Site: FNAL	Total Volume (m3/yr)	1.01E+02	Total Mass (kg/yr)	8.14E+05

Radionuclide	Activity (Ci/yr)
Cr-51	3.35E-02
Mn-54	6.39E-02
Fe-55	2.38E-01
Fe-59	2.15E-03
Co-58	8.57E-02
Co-60	6.72E-01
Ni-59	3.08E-03
Ni-63	4.37E-01
Zr-95	2.61E-03

Shipping Site: KAPL	Total Volume (m3/yr) 1.66E+03	Total Mass (kg/yr) 1.33E+07

Radionuclide	Activity (Ci/yr)
H-3	5.15E-04
C-14	2.40E-05
Cr-51	1.13E+04
Mn-54	2.15E+04
Fe-55	8.05E+04
Fe-59	7.28E+02
Co-58	2.89E+04
Co-60	2.27E+05
Ni-59	1.04E+03
Ni-63	1.47E+05
Sr-90	2.62E-02
Y-90	2.62E-02
Zr-95	8.84E+02
Tc-99	5.20E-05
Ru-106	2.22E-03
Rh-106	2.22E-03
Sb-125	6.40E-04
Te-125m	1.56E-04
Cs-134	8.18E-03
Cs-137	3.13E-02
Ba-137m	2.96E-02
Ce-144	7.46E-03
Pr-144	7.46E-03
Pr-144m	8.97E-05
Pm-147	1.82E-02
Sm-151	1.78E-04
Eu-152	2.71E-06
Eu-154	4.66E-04
Eu-155	3.69E-04
Tl-208	2.96E-08
Pb-212	7.83E-08
Bi-212	7.83E-08
Po-212	5.05E-08
Po-216	7.83E-08
Ra-224	7.83E-08
Ra-228	4.68E-07
Ac-228	4.68E-07
Th-228	7.83E-08
Th-231	4.50E-07
Th-232	4.75E-06
Th-234	5.77E-04
Pa-234	5.92E-08
Pa-234m	5.77E-04
U-235	4.48E-07
U-238	8.69E-04
Pu-238	5.61E-04
Pu-239	5.43E-06
Pu-240	2.71E-06
Pu-241	6.28E-04
Am-241	8.15E-06

A.27 WM LLW CENTRALIZED 5 ALTERNATIVE (CASE 21): HETEROGENEOUS SOLIDS

Transported Material with Radionuclide Profile

Alternative: #21 Centralized Treat -- 1 Site -- 1 Site Disposal

Waste Stream: LLW Waste Type: All, excl. Act.Metal

Destination: HANF

Shipping Site: AMES Total Volume (m3/yr) 1.15E+01 Total Mass (kg/yr) 2.99E+04

Radionuclide	Activity (Ci/yr)
Tl-208	4.50E-07
Pb-212	1.19E-06
Bi-212	1.19E-06
Po-212	7.68E-07
Po-216	1.19E-06
Ra-224	1.19E-06
Ra-228	7.12E-06
Ac-228	7.12E-06
Th-228	1.19E-06
Th-231	6.86E-06
Th-232	7.23E-05
Th-234	8.79E-03
Pa-234	9.01E-07
Pa-234m	8.79E-03
U-235	6.83E-06
U-238	8.79E-03
Pu-238	6.94E-04
Pu-239	5.30E-05
Pu-240	1.85E-04
Pu-241	2.55E-02
Am-241	1.06E-06
Cm-242	1.48E-05
Cm-244	5.30E-06

Shipping Site: ANL-E	Total Volume (m3/yr) 7.35E+02	Total Mass (kg/yr) 2.00E+06

Radionuclide	Activity (Ci/yr)
H-3	1.33E+02
C-14	7.91E-02
Cr-51	2.87E+00
Mn-54	1.43E+01
Fe-55	2.04E+01
Fe-59	1.84E-01
Co-58	1.55E+01
Co-60	8.15E+01
Ni-59	2.63E-01
Ni-63	3.77E+01
Sr-90	3.33E+01
Y-90	3.33E+01
Zr-95	2.24E-01
Tc-99	1.62E-01
Ru-106	2.16E+00
Rh-106	2.16E+00
Sb-125	6.21E-01
Te-125m	1.51E-01
Cs-134	2.09E+01
Cs-137	4.75E+01
Ba-137m	4.50E+01
Ce-144	7.24E+00
Pr-144	7.24E+00
Pr-144m	8.70E-02
Pm-147	1.76E+01
Sm-151	1.72E-01
Eu-152	2.63E-03
Eu-154	4.52E-01
Eu-155	3.58E-01
U-238	9.63E-01
Pu-238	5.44E-01
Pu-239	5.27E-03
Pu-240	2.63E-03
Pu-241	6.09E-01
Am-241	7.91E-03

Shipping Site: ANL-W	Total Volume (m3/yr)	2.59E+02	Total Mass (kg/yr)	2.12E+05

Radionuclide	Activity (Ci/yr)
H-3	7.83E-04
Cr-51	3.58E+03
Mn-54	6.83E+03
Fe-55	2.54E+04
Fe-59	2.30E+02
Co-58	9.16E+03
Co-60	7.18E+04
Ni-59	3.29E+02
Ni-63	4.67E+04
Sr-90	3.17E-02
Y-90	3.17E-02
Zr-95	2.79E+02
Tc-99	5.66E-06
Ru-106	3.09E-03
Rh-106	3.09E-03
Sb-125	8.89E-04
Te-125m	2.17E-04
Cs-134	3.59E-03
Cs-137	3.32E-02
Ba-137m	3.14E-02
Ce-144	1.03E-02
Pr-144	1.03E-02
Pr-144m	1.24E-04
Pm-147	2.52E-02
Sm-151	2.47E-04
Eu-152	3.77E-06
Eu-154	6.47E-04
Eu-155	5.13E-04
Pu-238	7.81E-04
Pu-239	7.72E-06
Pu-240	4.38E-06
Pu-241	9.56E-04
Am-241	1.13E-05
Cm-242	4.88E-08
Cm-244	1.74E-08

Shipping Site: BAPL	Total Volume (m3/yr) 3.98E+02	Total Mass (kg/yr) 1.08E+06

Radionuclide	Activity (Ci/yr)
H-3	2.51E-03
Co-60	1.19E-02
Ni-63	2.38E-02
Sr-90	2.11E+00
Y-90	2.11E+00
Tc-99	3.77E-04
Ru-106	2.06E-01
Rh-106	2.06E-01
Sb-125	5.93E-02
Te-125m	1.44E-02
Cs-134	2.40E-01
Cs-137	2.21E+00
Ba-137m	2.09E+00
Ce-144	6.91E-01
Pr-144	6.91E-01
Pr-144m	8.31E-03
Pm-147	1.68E+00
Sm-151	1.65E-02
Eu-152	2.51E-04
Eu-154	4.32E-02
Eu-155	3.42E-02
Tl-208	3.80E-06
Pb-212	1.00E-05
Bi-212	1.00E-05
Po-212	6.49E-06
Po-216	1.00E-05
Ra-224	1.00E-05
Ra-228	6.02E-05
Ac-228	6.02E-05
Th-228	1.00E-05
Th-231	5.80E-05
Th-232	6.11E-04
Th-234	7.43E-02
Pa-234	7.61E-06
Pa-234m	7.43E-02
U-235	5.77E-05
U-238	7.43E-02
Pu-238	5.20E-02
Pu-239	5.03E-04
Pu-240	2.51E-04
Pu-241	5.81E-02
Am-241	7.55E-04

Shipping Site: FNAL	Total Volume (m3/yr) 4.90E+01	Total Mass (kg/yr) 3.89E+04

Radionuclide	Activity (Ci/yr)
H-3	1.82E-01
Cr-51	1.11E-02
Mn-54	2.12E-02
Fe-55	7.94E-02
Fe-59	7.17E-04
Co-58	2.85E-02
Co-60	2.23E-01
Ni-59	1.02E-03
Ni-63	1.45E-01
Zr-95	8.71E-04
Tl-208	3.78E-07
Pb-212	1.00E-06
Bi-212	1.00E-06
Po-212	6.46E-07
Po-216	1.00E-06
Ra-224	1.00E-06
Ra-228	5.99E-06
Ac-228	5.99E-06
Th-228	1.00E-06
Th-231	5.77E-06
Th-232	6.08E-05
Th-234	7.39E-03
Pa-234	7.57E-07
Pa-234m	7.39E-03
U-235	5.75E-06
U-238	7.39E-03

Shipping Site: INEL	Total Volume (m3/yr)	6.51E+03	Total Mass (kg/yr)	1.64E+07

Radionuclide	Activity (Ci/yr)
H-3	1.56E+00
Cr-51	1.02E+02
Mn-54	1.94E+02
Fe-55	7.24E+02
Fe-59	6.55E+00
Co-58	2.60E+02
Co-60	2.04E+03
Ni-59	9.35E+00
Ni-63	1.33E+03
Sr-90	5.01E+01
Y-90	5.01E+01
Zr-95	7.95E+00
Tc-99	8.95E-03
Ru-106	4.89E+00
Rh-106	4.89E+00
Sb-125	1.40E+00
Te-125m	3.43E-01
Cs-134	5.69E+00
Cs-137	5.25E+01
Ba-137m	4.97E+01
Ce-144	1.63E+01
Pr-144	1.63E+01
Pr-144m	1.97E-01
Pm-147	4.00E+01
Sm-151	3.91E-01
Eu-152	5.97E-03
Eu-154	1.02E+00
Eu-155	8.12E-01
Pu-238	1.23E+00
Pu-239	1.19E-02
Pu-240	5.97E-03
Pu-241	1.37E+00
Am-241	1.79E-02

Shipping Site: ITRI	Total Volume (m3/yr)	1.34E+02	Total Mass (kg/yr)	1.64E+05

Radionuclide	Activity (Ci/yr)
H-3	6.17E+00
C-14	3.03E-01
Mn-54	3.41E+01
Co-58	3.15E+01
Co-60	9.12E+01
Sr-90	4.28E+01
Y-90	4.28E+01
Tc-99	6.07E-01
Cs-134	7.07E+01
Cs-137	9.33E+01
Ba-137m	8.82E+01
U-238	3.69E+00

Shipping Site: K-25	Total Volume (m3/yr)	6.28E+03	Total Mass (kg/yr)	4.67E+07

Radionuclide	Activity (Ci/yr)
Tl-208	1.06E-04
Pb-212	2.82E-04
Bi-212	2.82E-04
Po-212	1.82E-04
Po-216	2.82E-04
Ra-224	2.82E-04
Ra-228	1.68E-03
Ac-228	1.68E-03
Th-228	2.82E-04
Th-231	1.62E-03
Th-232	1.71E-02
Th-234	2.08E+00
Pa-234	2.13E-04
Pa-234m	2.08E+00
U-235	1.62E-03
U-238	2.08E+00

Shipping Site: KAPL	Total Volume (m3/yr)	2.11E+02	Total Mass (kg/yr)	5.36E+05

Radionuclide	Activity (Ci/yr)
H-3	5.14E-04
C-14	2.40E-05
Cr-51	5.11E-03
Mn-54	1.24E-02
Fe-55	3.63E-02
Fe-59	3.28E-04
Co-58	1.55E-02
Co-60	1.09E-01
Ni-59	4.69E-04
Ni-63	6.70E-02
Sr-90	2.58E-02
Y-90	2.58E-02
Zr-95	3.99E-04
Tc-99	5.20E-05
Ru-106	2.19E-03
Rh-106	2.19E-03
Sb-125	6.31E-04
Te-125m	1.54E-04
Cs-134	8.14E-03
Cs-137	3.09E-02
Ba-137m	2.92E-02
Ce-144	7.35E-03
Pr-144	7.35E-03
Pr-144m	8.84E-05
Pm-147	1.79E-02
Sm-151	1.75E-04
Eu-152	2.67E-06
Eu-154	4.59E-04
Eu-155	3.64E-04
Tl-208	4.50E-09
Pb-212	1.19E-08
Bi-212	1.19E-08
Po-212	7.60E-09
Po-216	1.19E-08
Ra-224	1.19E-08
Ra-228	7.11E-08
Ac-228	7.11E-08
Th-228	1.19E-08
Th-231	6.84E-08
Th-232	7.21E-07
Th-234	8.77E-05
Pa-234	8.90E-09
Pa-234m	8.77E-05
U-235	6.82E-08
U-238	3.79E-04
Pu-238	5.53E-04
Pu-239	5.35E-06
Pu-240	2.67E-06
Pu-241	6.18E-04
Am-241	8.03E-06

Shipping Site: KCP	Total Volume (m3/yr)	2.65E+00	Total Mass (kg/yr)	7.23E+03

Radionuclide	Activity (Ci/yr)
H-3	2.70E-02
C-14	1.44E-04
Mn-54	1.62E-02
Co-58	1.50E-02
Co-60	4.34E-02
Sr-90	2.04E-02
Y-90	2.04E-02
Tc-99	2.89E-04
Cs-134	3.37E-02
Cs-137	4.44E-02
Ba-137m	4.20E-02
U-238	1.76E-03

Shipping Site: LANL	Total Volume (m3/yr)	1.42E+04	Total Mass (kg/yr)	1.22E+07

Radionuclide	Activity (Ci/yr)
H-3	3.84E+05
Cr-51	5.93E+00
Mn-54	1.12E+01
Fe-55	4.21E+01
Fe-59	3.81E-01
Co-58	1.51E+01
Co-60	4.85E+02
Ni-59	5.44E-01
Ni-63	8.05E+02
Sr-90	6.47E+04
Y-90	6.47E+04
Zr-95	4.62E-01
Tc-99	1.15E+01
Ru-106	6.32E+03
Rh-106	6.32E+03
Sb-125	1.81E+03
Te-125m	4.43E+02
Cs-134	7.35E+03
Cs-137	6.78E+04
Ba-137m	6.42E+04
Ce-144	2.11E+04
Pr-144	2.11E+04
Pr-144m	2.54E+02
Pm-147	5.16E+04
Sm-151	5.04E+02
Eu-152	7.70E+00
Eu-154	1.32E+03
Eu-155	1.04E+03
Tl-208	1.66E-02
Pb-212	4.41E-02
Bi-212	4.41E-02
Po-212	2.84E-02
Po-216	4.41E-02
Ra-224	4.41E-02
Ra-228	2.64E-01
Ac-228	2.64E-01
Th-228	4.41E-02
Th-231	2.54E-01
Th-232	2.68E+00
Th-234	3.26E+02
Pa-234	3.33E-02
Pa-234m	3.26E+02
U-235	2.53E-01
U-238	3.26E+02
Pu-238	1.59E+03
Pu-239	1.57E+01
Pu-240	8.94E+00
Pu-241	1.95E+03
Am-241	2.31E+01
Cm-242	9.84E-02
Cm-244	3.51E-02

Shipping Site: LBL	Total Volume (m3/yr) 8.48E+01	Total Mass (kg/yr) 4.51E+04

Radionuclide	Activity (Ci/yr)
H-3	6.35E+02
C-14	1.13E+00
Mn-54	1.27E+02
Co-58	1.17E+02
Co-60	3.39E+02
Sr-90	1.59E+02
Y-90	1.59E+02
Tc-99	2.26E+00
Cs-134	2.63E+02
Cs-137	3.47E+02
Ba-137m	3.28E+02
U-238	1.37E+01
Cm-244	1.05E+01

Shipping Site: LLNL	Total Volume (m3/yr) 4.09E+02	Total Mass (kg/yr) 1.06E+06

Radionuclide	Activity (Ci/yr)
H-3	3.33E+04
C-14	1.55E-03
Mn-54	1.74E-01
Co-58	1.61E-01
Co-60	4.69E-01
Ni-63	4.89E-03
Sr-90	6.54E-01
Y-90	6.54E-01
Tc-99	3.18E-03
Ru-106	4.24E-02
Rh-106	4.24E-02
Sb-125	1.21E-02
Te-125m	2.97E-03
Cs-134	4.11E-01
Cs-137	9.33E-01
Ba-137m	8.82E-01
Ce-144	1.42E-01
Pr-144	1.42E-01
Pr-144m	1.70E-03
Pm-147	3.46E-01
Sm-151	3.39E-03
Eu-152	5.17E-05
Eu-154	8.87E-03
Eu-155	7.03E-03
U-238	1.88E-02
Pu-238	7.85E-02
Pu-239	5.28E-03
Pu-240	1.81E-02
Pu-241	2.50E+00
Am-241	2.58E-04
Cm-242	1.44E-03
Cm-244	5.17E-04

Shipping Site: MOUND	Total Volume (m3/yr) 4.33E+03	Total Mass (kg/yr) 9.67E+06

Radionuclide	Activity (Ci/yr)
H-3	1.34E+04
Pu-238	1.60E-01
Pu-239	1.22E-02
Pu-240	4.28E-02
Pu-241	5.90E+00
Am-241	2.44E-04
Cm-242	3.42E-03
Cm-244	1.22E-03

Shipping Site: ORISE	Total Volume (m3/yr)	5.77E+01	Total Mass (kg/yr)	7.36E+04

Radionuclide	Activity (Ci/yr)
H-3	2.00E-02
C-14	1.19E-05
Mn-54	1.34E-03
Co-58	1.24E-03
Co-60	3.59E-03
Sr-90	1.69E-03
Y-90	1.69E-03
Tc-99	2.39E-05
Cs-134	2.79E-03
Cs-137	3.68E-03
Ba-137m	3.48E-03
Tl-208	3.39E-07
Pb-212	8.98E-07
Bi-212	8.98E-07
Po-212	5.78E-07
Po-216	8.98E-07
Ra-224	8.98E-07
Ra-228	5.36E-06
Ac-228	5.36E-06
Th-228	8.98E-07
Th-231	5.16E-06
Th-232	5.44E-05
Th-234	6.62E-03
Pa-234	6.78E-07
Pa-234m	6.62E-03
U-235	5.14E-06
U-238	6.77E-03

Shipping Site: ORNL	Total Volume (m3/yr)	2.68E+03	Total Mass (kg/yr)	3.30E+06

Radionuclide	Activity (Ci/yr)
H-3	1.17E+00
C-14	4.44E-03
Cr-51	1.01E+01
Mn-54	1.97E+01
Fe-55	7.20E+01
Fe-59	6.51E-01
Co-58	2.63E+01
Co-60	2.09E+02
Ni-59	9.30E-01
Ni-63	1.42E+02
Sr-90	9.15E+02
Y-90	9.15E+02
Zr-95	7.90E-01
Tc-99	1.72E-01

Shipping Site: ORNL	Total Volume (m3/yr) 2.68E+03	Total Mass (kg/yr) 3.30E+06

Radionuclide	Activity (Ci/yr)
Ru-106	8.91E+01
Rh-106	8.91E+01
Sb-125	2.56E+01
Te-125m	6.25E+00
Cs-134	1.04E+02
Cs-137	9.58E+02
Ba-137m	9.07E+02
Ce-144	2.98E+02
Pr-144	2.98E+02
Pr-144m	3.58E+00
Pm-147	7.28E+02
Sm-151	7.12E+00
Eu-152	1.08E-01
Eu-154	1.86E+01
Eu-155	1.47E+01
Tl-208	1.70E-06
Pb-212	4.50E-06
Bi-212	4.50E-06
Po-212	2.90E-06
Po-216	4.50E-06
Ra-224	4.50E-06
Ra-228	2.69E-05
Ac-228	2.69E-05
Th-228	4.50E-06
Th-231	2.59E-05
Th-232	2.73E-04
Th-234	3.31E-02
Pa-234	3.40E-06
Pa-234m	3.31E-02
U-235	2.58E-05
U-238	8.72E-02
Pu-238	2.24E+01
Pu-239	2.17E-01
Pu-240	1.09E-01
Pu-241	2.52E+01
Am-241	3.26E-01
Cm-242	5.60E-05
Cm-244	2.00E-05

Shipping Site: PANT	Total Volume (m3/yr) 3.97E+03	Total Mass (kg/yr) 2.88E+07

Radionuclide	Activity (Ci/yr)
H-3	2.34E+02
Tl-208	2.21E-04
Pb-212	5.86E-04
Bi-212	5.86E-04
Po-212	3.78E-04
Po-216	5.86E-04
Ra-224	5.86E-04
Ra-228	3.50E-03
Ac-228	3.50E-03
Th-228	5.86E-04
Th-231	3.37E-03
Th-232	3.56E-02
Th-234	4.32E+00
Pa-234	4.43E-04
Pa-234m	4.32E+00
U-235	3.36E-03
U-238	4.32E+00

Shipping Site: PORTS	Total Volume (m3/yr)	9.75E+03	Total Mass (kg/yr)	6.74E+07

Radionuclide	Activity (Ci/yr)
Tl-208	3.45E-06
Pb-212	9.14E-06
Bi-212	9.14E-06
Po-212	5.89E-06
Po-216	9.14E-06
Ra-224	9.14E-06
Ra-228	5.46E-05
Ac-228	5.46E-05
Th-228	9.14E-06
Th-231	5.26E-05
Th-232	5.55E-04
Th-234	6.74E-02
Pa-234	6.91E-06
Pa-234m	6.74E-02
U-235	5.24E-05
U-238	6.74E-02

Shipping Site: PPPL	Total Volume (m3/yr)	2.21E+01	Total Mass (kg/yr)	4.97E+03

Radionuclide	Activity (Ci/yr)
H-3	2.01E-01
Cr-51	8.50E-04
Mn-54	1.61E-03
Fe-55	6.04E-03
Fe-59	5.46E-05
Co-58	2.17E-03
Co-60	1.70E-02
Ni-59	7.80E-05
Ni-63	1.10E-02
Zr-95	6.63E-05

Shipping Site: Paducah	Total Volume (m3/yr)	5.26E+03	Total Mass (kg/yr)	1.19E+07

Radionuclide	Activity (Ci/yr)
Tc-99	8.84E-03
Tl-208	3.72E-05
Pb-212	9.84E-05
Bi-212	9.84E-05
Po-212	6.34E-05
Po-216	9.84E-05
Ra-224	9.84E-05
Ra-228	5.88E-04
Ac-228	5.88E-04
Th-228	9.84E-05
Th-231	5.66E-04
Th-232	5.97E-03
Th-234	7.26E-01
Pa-234	7.44E-05
Pa-234m	7.26E-01
U-235	5.64E-04
U-238	7.26E-01
Np-237	6.63E-03
Pu-239	6.63E-03

Shipping Site: Pinellas	Total Volume (m3/yr)	1.27E+02	Total Mass (kg/yr)	1.91E+04

Radionuclide	Activity (Ci/yr)
H-3	1.99E+04

Shipping Site: RFP	Total Volume (m3/yr)	4.23E+03	Total Mass (kg/yr)	6.48E+06

Radionuclide	Activity (Ci/yr)
Tl-208	3.60E-05
Pb-212	9.55E-05
Bi-212	9.55E-05
Po-212	6.15E-05
Po-216	9.55E-05
Ra-224	9.55E-05
Ra-228	5.70E-04
Ac-228	5.70E-04
Th-228	9.55E-05
Th-231	5.49E-04
Th-232	5.79E-03
Th-234	7.04E-01
Pa-234	7.21E-05
Pa-234m	7.04E-01
U-235	5.47E-04
U-238	7.04E-01
Pu-238	5.56E-01
Pu-239	4.24E-02
Pu-240	1.48E-01
Pu-241	2.04E+01
Am-241	8.48E-04
Cm-242	1.18E-02
Cm-244	4.24E-03

Shipping Site: RMI	Total Volume (m3/yr)	5.63E+03	Total Mass (kg/yr)	1.46E+07

Radionuclide	Activity (Ci/yr)
Tl-208	3.58E-07
Pb-212	9.47E-07
Bi-212	9.47E-07
Po-212	6.10E-07
Po-216	9.47E-07
Ra-224	9.47E-07
Ra-228	5.66E-06
Ac-228	5.66E-06
Th-228	9.47E-07
Th-231	5.45E-06
Th-232	5.74E-05
Th-234	6.98E-03
Pa-234	7.15E-07
Pa-234m	6.98E-03
U-235	5.43E-06
U-238	6.98E-03

Shipping Site: SLAC	Total Volume (m3/yr)	2.73E+02	Total Mass (kg/yr)	7.45E+05

Radionuclide	Activity (Ci/yr)
Cr-51	3.86E-03
Mn-54	7.36E-03
Fe-55	2.74E-02
Fe-59	2.48E-04
Co-58	9.88E-03
Co-60	7.74E-02
Ni-59	3.54E-04
Ni-63	5.04E-02
Zr-95	3.01E-04

Shipping Site: SNLA	Total Volume (m3/yr) 1.19E+02	Total Mass (kg/yr) 3.28E+05

Radionuclide	Activity (Ci/yr)
H-3	3.00E+00
Co-60	2.85E-05
Ni-63	5.67E-05
Sr-90	5.04E-03
Y-90	5.04E-03
Tc-99	9.00E-07
Ru-106	4.92E-04
Rh-106	4.92E-04
Sb-125	1.41E-04
Te-125m	3.45E-05
Cs-134	5.72E-04
Cs-137	5.28E-03
Ba-137m	4.99E-03
Ce-144	1.64E-03
Pr-144	1.64E-03
Pr-144m	1.98E-05
Pm-147	4.02E-03
Sm-151	3.93E-05
Eu-152	6.00E-07
Eu-154	1.02E-04
Eu-155	8.16E-05
Tl-208	5.10E-06
Pb-212	1.35E-05
Bi-212	1.35E-05
Po-212	8.70E-06
Po-216	1.35E-05
Ra-224	1.35E-05
Ra-228	8.07E-05
Ac-228	8.07E-05
Th-228	1.35E-05
Th-231	7.77E-05
Th-232	8.19E-04
Th-234	9.96E-02
Pa-234	1.02E-05
Pa-234m	9.96E-02
U-235	7.74E-05
U-238	9.96E-02
Pu-238	7.87E-02
Pu-239	6.00E-03
Pu-240	2.10E-02
Pu-241	2.89E+00
Am-241	1.21E-04
Cm-242	1.68E-03
Cm-244	6.00E-04

Shipping Site: SNLL	Total Volume (m3/yr) 3.59E+01	Total Mass (kg/yr) 9.36E+04

Radionuclide	Activity (Ci/yr)
H-3	2.82E+04
Fe-55	3.15E-01
Co-60	3.15E-01
Tl-208	6.40E-05
Pb-212	1.69E-04
Bi-212	1.69E-04
Po-212	1.09E-04
Po-216	1.69E-04
Ra-224	1.69E-04
Ra-228	1.01E-03
Ac-228	1.01E-03
Th-228	1.69E-04
Th-231	9.75E-04
Th-232	1.02E-02
Th-234	1.25E+00
Pa-234	1.28E-04
Pa-234m	1.25E+00
U-235	9.71E-04
U-238	1.25E+00

Shipping Site: SRS	Total Volume (m3/yr)	5.62E+04	Total Mass (kg/yr)	1.29E+08

Radionuclide	Activity (Ci/yr)
H-3	4.77E+04
C-14	1.08E+00
Cr-51	1.95E+03
Mn-54	3.84E+03
Fe-55	1.38E+04
Fe-59	1.25E+02
Co-58	5.10E+03
Co-60	3.94E+04
Ni-59	1.79E+02
Ni-63	2.55E+04
Sr-90	3.56E+03
Y-90	3.56E+03
Zr-95	1.52E+02
Tc-99	2.78E+00
Ru-106	3.32E+02
Rh-106	3.32E+02
Sb-125	9.56E+01
Te-125m	2.33E+01
Cs-134	6.40E+02
Cs-137	3.90E+03
Ba-137m	3.69E+03
Ce-144	1.11E+03
Pr-144	1.11E+03
Pr-144m	1.33E+01
Pm-147	2.72E+03
Sm-151	2.65E+01
Eu-152	4.05E-01
Eu-154	6.96E+01
Eu-155	5.52E+01
Tl-208	8.54E-04
Pb-212	2.26E-03
Bi-212	2.26E-03
Po-212	1.45E-03
Po-216	2.26E-03
Ra-224	2.26E-03
Ra-228	1.35E-02
Ac-228	1.35E-02
Th-228	2.26E-03
Th-231	1.30E-02
Th-232	1.37E-01
Th-234	1.66E+01
Pa-234	1.70E-03
Pa-234m	1.66E+01
U-235	1.29E-02
U-238	2.99E+01
Pu-238	8.45E+01
Pu-239	8.64E-01
Pu-240	5.89E-01
Pu-241	1.19E+02
Am-241	1.21E+00
Cm-242	1.46E-02
Cm-244	5.24E-03

Shipping Site: Y-12	Total Volume (m3/yr)	1.33E+04	Total Mass (kg/yr)	8.27E+07

Radionuclide	Activity (Ci/yr)
Tl-208	6.80E-05
Pb-212	1.80E-04
Bi-212	1.80E-04
Po-212	1.16E-04
Po-216	1.80E-04
Ra-224	1.80E-04
Ra-228	1.07E-03
Ac-228	1.07E-03
Th-228	1.80E-04
Th-231	1.03E-03
Th-232	1.09E-02
Th-234	1.32E+00
Pa-234	1.36E-04
Pa-234m	1.32E+00
U-235	1.03E-03
U-238	1.32E+00

A.28 WM LLW CENTRALIZED 5 ALTERNATIVE (CASE 21): ACTIVATED METALS

Transported Material with Radionuclide Profile

Alternative: #21 Centralized Treat -- 1 Site -- 1 Site Disposal

Waste Stream: LLW Waste Type: Activated Metal

Destination: HANF

Shipping Site: ANL-W Total Volume (m3/yr) 2.06E+01 Total Mass (kg/yr) 1.64E+05

Radionuclide	Activity (Ci/yr)
H-3	1.71E-06
Cr-51	1.24E-04
Mn-54	2.37E-04
Fe-55	8.86E-04
Fe-59	8.00E-06
Co-58	3.18E-04
Co-60	2.50E-03
Ni-59	1.14E-05
Ni-63	1.64E-03
Sr-90	1.43E-03
Y-90	1.43E-03
Zr-95	9.72E-06
Tc-99	2.56E-07
Ru-106	1.40E-04
Rh-106	1.40E-04
Sb-125	4.03E-05
Te-125m	9.84E-06
Cs-134	1.63E-04
Cs-137	2.00E-01
Ba-137m	2.00E-01
Ce-144	4.69E-04
Pr-144	4.69E-04
Pr-144m	5.64E-06
Pm-147	1.14E-03
Sm-151	1.12E-05
Eu-152	1.71E-07
Eu-154	2.93E-05
Eu-155	2.32E-05
Pu-238	3.53E-05
Pu-239	3.42E-07
Pu-240	1.71E-07
Pu-241	3.95E-05
Am-241	5.13E-07

Shipping Site: BAPL	Total Volume (m3/yr) 8.03E+02	Total Mass (kg/yr) 6.43E+06

Radionuclide	Activity (Ci/yr)
Cr-51	4.75E+03
Mn-54	9.04E+03
Fe-55	3.37E+04
Fe-59	3.05E+02
Co-58	1.21E+04
Co-60	9.52E+04
Ni-59	4.36E+02
Ni-63	6.19E+04
Zr-95	3.70E+02
Tl-208	1.36E-08
Pb-212	3.60E-08
Bi-212	3.60E-08
Po-212	2.32E-08
Po-216	3.60E-08
Ra-224	3.60E-08
Ra-228	2.15E-07
Ac-228	2.15E-07
Th-228	3.60E-08
Th-231	2.07E-07
Th-232	2.18E-06
Th-234	2.65E-04
Pa-234	2.72E-08
Pa-234m	2.65E-04
U-235	2.06E-07
U-238	2.65E-04

Shipping Site: FNAL	Total Volume (m3/yr) 1.01E+02	Total Mass (kg/yr) 8.14E+05

Radionuclide	Activity (Ci/yr)
Cr-51	3.35E-02
Mn-54	6.39E-02
Fe-55	2.38E-01
Fe-59	2.15E-03
Co-58	8.57E-02
Co-60	6.72E-01
Ni-59	3.08E-03
Ni-63	4.37E-01
Zr-95	2.61E-03

Shipping Site: KAPL	Total Volume (m3/yr)	1.66E+03	Total Mass (kg/yr)	1.33E+07

Radionuclide	Activity (Ci/yr)
H-3	5.15E-04
C-14	2.40E-05
Cr-51	1.13E+04
Mn-54	2.15E+04
Fe-55	8.05E+04
Fe-59	7.28E+02
Co-58	2.89E+04
Co-60	2.27E+05
Ni-59	1.04E+03
Ni-63	1.47E+05
Sr-90	2.62E-02
Y-90	2.62E-02
Zr-95	8.84E+02
Tc-99	5.20E-05
Ru-106	2.22E-03
Rh-106	2.22E-03
Sb-125	6.40E-04
Te-125m	1.56E-04
Cs-134	8.18E-03
Cs-137	3.13E-02
Ba-137m	2.96E-02
Ce-144	7.46E-03
Pr-144	7.46E-03
Pr-144m	8.97E-05
Pm-147	1.82E-02
Sm-151	1.78E-04
Eu-152	2.71E-06
Eu-154	4.66E-04
Eu-155	3.69E-04
Tl-208	2.96E-08
Pb-212	7.83E-08
Bi-212	7.83E-08
Po-212	5.05E-08
Po-216	7.83E-08
Ra-224	7.83E-08
Ra-228	4.68E-07
Ac-228	4.68E-07
Th-228	7.83E-08
Th-231	4.50E-07
Th-232	4.75E-06
Th-234	5.77E-04
Pa-234	5.92E-08
Pa-234m	5.77E-04
U-235	4.48E-07
U-238	8.69E-04
Pu-238	5.61E-04
Pu-239	5.43E-06
Pu-240	2.71E-06
Pu-241	6.28E-04
Am-241	8.15E-06

Shipping Site: LANL	Total Volume (m3/yr)	1.07E+03	Total Mass (kg/yr)	8.57E+06

Radionuclide	Activity (Ci/yr)
Cr-51	2.42E+01
Mn-54	4.62E+01
Fe-55	1.72E+02
Fe-59	1.55E+00
Co-58	6.20E+01
Co-60	4.86E+02
Ni-59	2.22E+00
Ni-63	3.16E+02
Zr-95	1.89E+00

Shipping Site: LBL	Total Volume (m3/yr)	3.59E+01	Total Mass (kg/yr)	2.87E+05

Radionuclide	Activity (Ci/yr)
Cr-51	6.32E-02
Mn-54	1.20E-01
Fe-55	4.49E-01
Fe-59	4.06E-03
Co-58	1.61E-01
Co-60	1.26E+00
Ni-59	5.80E-03
Ni-63	8.24E-01
Zr-95	4.93E-03

Shipping Site: NRF	Total Volume (m3/yr)	1.17E+03	Total Mass (kg/yr)	9.40E+06

Radionuclide	Activity (Ci/yr)
Cr-51	2.31E+03
Mn-54	4.40E+03
Fe-55	1.64E+04
Fe-59	1.48E+02
Co-58	5.91E+03
Co-60	4.63E+04
Ni-59	2.12E+02
Ni-63	3.01E+04
Zr-95	1.80E+02

Shipping Site: SNLA	Total Volume (m3/yr)	1.43E+01	Total Mass (kg/yr)	1.15E+05

Radionuclide	Activity (Ci/yr)
Cr-51	6.54E-04
Mn-54	1.24E-03
Fe-55	4.64E-03
Fe-59	4.20E-05
Co-58	1.67E-03
Co-60	1.31E-02
Ni-59	6.00E-05
Ni-63	8.53E-03
Zr-95	5.10E-05

APPENDIX B:

TRANSPORTATION RISK ASSESSMENT RESULTS

APPENDIX B:

TRANSPORTATION RISK ASSESSMENT RESULTS

Detailed results of the collective population risk assessment for transportation of low-level waste (LLW) are presented in this appendix for the 14 WM cases. For each case, results are presented separately for heterogeneous solids and activated metals. The total impacts of transportation for a case can be found by summing the quantities for heterogeneous solids and activated metals. In general, the quantity of activated metals transported is insignificant compared with the quantity of heterogeneous solids for each case.

The collective risk results are presented on an *annual* basis (cubic meters per year or kilograms per year). As stated previously, the Waste Management Programmatic Environmental Impact Statement (WM PEIS) considers a 20-year time frame for WM LLW. For most of the WM alternatives considered in the WM PEIS, the assumption was that shipments would occur uniformly over a 10-year period, which would allow an initial 10-year period to build treatment, storage, and disposal facilities. Sites would essentially store their own waste for the first 10 years and ship all waste over the subsequent 10 years; however, the assumption was that, for the No Action Alternative, shipments would be distributed uniformly over a 20-year period because no new facilities would be required to be built. Therefore, although the total inventory considered is the same for all WM cases (current inventories plus 20 years of generation), the annual amounts of waste shipped, as reported in the WASTE_MGMT files in Appendix A, are a function of the assumption concerning the duration of the shipping campaigns for each case.

Because of the differences in the time frames noted and the uncertainties in the actual timing of future waste shipments, the transportation impacts for the various cases are best compared by examining the total impacts of transporting a specific inventory of waste, independent of the annual shipping rates. The total impacts of LLW transported for each case can be calculated by multiplying the annual shipment impacts by 20 years for the No Action Alternative and by 10 years for the other WM cases. The total impacts are provided in Section 5 of the main body of this report.

B.1 WM LLW NO ACTION ALTERNATIVE (CASE 1): HETEROGENEOUS SOLIDS

Table 1. Summary of Route Information

Route		Distance (miles)	Percentage in Zone		
			Rural	Suburban	Urban
Truck					
Ames Laboratory	to Hanford Site	1703	92.6	6.6	0.8
Argonne - East	to Hanford Site	1998	91.5	7.8	0.7
Bettis Atomic	to Hanford Site	2541	85.8	12.8	1.4
Fermilab (FNAL)	to Hanford Site	1975	92.2	7.1	0.8
ITRI	to Nevada Test Site	918	93.8	4.8	1.5
Knolls Atomic	to Hanford Site	2809	82.1	16.1	1.8
Kansas City Plant	to Nevada Test Site	1428	91.0	7.6	1.4
Lawrence Berkeley	to Hanford Site	875	78.1	17.8	4.1
Lawrence Livermore	to Nevada Test Site	678	84.7	9.2	6.1
Mound Plant	to Nevada Test Site	2047	86.1	12.0	1.9
ORISE	to Oak Ridge Reserv.	10	58.8	41.2	0.0
Pantex Plant	to Nevada Test Site	1209	93.9	4.6	1.6
Portsmouth GDP	to Nevada Test Site	2158	85.5	12.6	1.9
Princeton PPL	to Hanford Site	2864	82.0	15.9	2.1
Paducah GDP	to Nevada Test Site	1864	87.6	10.7	1.8
Pinellas Plant	to Savannah River	620	71.9	25.8	2.2
Rocky Flats Plant	to Nevada Test Site	836	89.5	8.5	2.0
Reactive Metals	to Nevada Test Site	2214	85.8	12.2	2.0
SLAC	to Hanford Site	916	75.9	19.0	5.1
SNL - Albuquerque	to Nevada Test Site	909	93.8	4.8	1.4
SNL - Livermore	to Nevada Test Site	678	84.7	9.2	6.1
Rail					
Ames Laboratory	to Hanford Site	1788	93.7	5.6	0.7
Argonne - East	to Hanford Site	2200	93.3	6.0	0.7
Bettis Atomic	to Hanford Site	2611	81.2	15.1	3.7
Fermilab (FNAL)	to Hanford Site	1971	89.9	8.6	1.4
ITRI	to Nevada Test Site	1065	94.6	4.5	0.9
Knolls Atomic	to Hanford Site	2914	79.1	17.0	3.9
Kansas City Plant	to Nevada Test Site	1670	94.5	4.5	1.0
Lawrence Berkeley	to Hanford Site	986	78.5	15.8	5.7
Lawrence Livermore	to Nevada Test Site	1370	94.5	3.8	1.8
Mound Plant	to Nevada Test Site	2386	87.9	10.3	1.8
ORISE	to Oak Ridge Reserv.	40	65.8	33.4	0.8
Pantex Plant	to Nevada Test Site	1376	94.9	4.4	0.7
Portsmouth GDP	to Nevada Test Site	2401	86.3	10.7	2.9
Princeton PPL	to Hanford Site	2985	76.6	19.0	4.3
Paducah GDP	to Nevada Test Site	2131	90.9	7.6	1.5
Pinellas Plant	to Savannah River	485	72.2	25.0	2.8
Rocky Flats Plant	to Nevada Test Site	987	95.9	3.9	0.2
Reactive Metals	to Nevada Test Site	2391	83.1	13.1	3.7
SLAC	to Hanford Site	1036	76.1	16.8	7.1
SNL - Albuquerque	to Nevada Test Site	1065	94.6	4.5	0.9
SNL - Livermore	to Nevada Test Site	1370	94.5	3.8	1.8

Table 2. Annual Number of Shipments and One-Way Shipment Distances

Route		# of Shipments		Total Mileage(mi)	
		Truck	Rail	Truck	Rail
Ames Laboratory	to Hanford Site	1	1	1.70E+03	1.79E+03
Argonne - East	to Hanford Site	53	20	1.06E+05	4.40E+04
Bettis Atomic	to Hanford Site	29	11	7.37E+04	2.87E+04
Fermilab (FNAL)	to Hanford Site	1	1	1.97E+03	1.97E+03
ITRI	to Nevada Test Site	5	2	4.59E+03	2.13E+03
Knolls Atomic	to Hanford Site	16	6	4.50E+04	1.75E+04
Kansas City Plant	to Nevada Test Site	1	1	1.43E+03	1.67E+03
Lawrence Berkeley	to Hanford Site	2	1	1.75E+03	9.86E+02
Lawrence Livermore	to Nevada Test Site	16	6	1.08E+04	8.22E+03
Mound Plant	to Nevada Test Site	256	95	5.24E+05	2.27E+05
ORISE	to Oak Ridge Reserv.	1	1	1.02E+01	3.95E+01
Pantex Plant	to Nevada Test Site	687	272	8.31E+05	3.74E+05
Portsmouth GDP	to Nevada Test Site	1672	637	3.61E+06	1.53E+06
Princeton PPL	to Hanford Site	1	1	2.86E+03	2.98E+03
Paducah GDP	to Nevada Test Site	321	120	5.98E+05	2.56E+05
Pinellas Plant	to Savannah River	2	1	1.24E+03	4.85E+02
Rocky Flats Plant	to Nevada Test Site	160	60	1.34E+05	5.92E+04
Reactive Metals	to Nevada Test Site	365	137	8.08E+05	3.28E+05
SLAC	to Hanford Site	20	8	1.83E+04	8.29E+03
SNL - Albuquerque	to Nevada Test Site	9	4	8.18E+03	4.26E+03
SNL - Livermore	to Nevada Test Site	3	1	2.03E+03	1.37E+03
Totals		3621	1386	6.78E+06	2.90E+06

Table 3. Incident-Free Dose per Shipment (person-rem/shipment)

Source/Route(s)		Crew	General Public			
			Off-Link	On-Link	Stops	Total
LLW(x) AL to HS						
Ames Laboratory	to Hanford Site					
	Truck	4.46E-02	1.62E-03	5.39E-03	4.77E-02	5.47E-02
	Rail	1.03E-02	4.69E-03	1.46E-04	8.98E-03	1.38E-02
LLW(x) AN to HS						
Argonne - East	to Hanford Site					
	Truck	5.29E-02	1.97E-03	6.28E-03	5.59E-02	6.42E-02
	Rail	1.21E-02	5.75E-03	1.82E-04	1.03E-02	1.62E-02
LLW(x) BA to HS						
Bettis Atomic	to Hanford Site					
	Truck	7.21E-02	4.36E-03	9.77E-03	7.11E-02	8.53E-02
	Rail	1.38E-02	2.67E-02	4.53E-04	1.15E-02	3.87E-02
LLW(x) FL to HS						
Fermilab (FNAL)	to Hanford Site					
	Truck	5.20E-02	1.92E-03	6.25E-03	5.53E-02	6.35E-02
	Rail	1.11E-02	9.07E-03	2.12E-04	9.55E-03	1.88E-02
LLW(x) IT to NT						
ITRI	to Nevada Test Site					
	Truck	2.40E-02	1.05E-03	3.25E-03	2.57E-02	3.00E-02
	Rail	7.32E-03	2.85E-03	8.34E-05	6.76E-03	9.69E-03
LLW(x) KA to HS						
Knolls Atomic	to Hanford Site					
	Truck	8.30E-02	6.03E-03	1.19E-02	7.87E-02	9.66E-02
	Rail	1.50E-02	3.18E-02	5.40E-04	1.25E-02	4.48E-02
LLW(x) KC to NT						
Kansas City Plant	to Nevada Test Site					
	Truck	3.84E-02	1.90E-03	5.17E-03	4.00E-02	4.70E-02
	Rail	9.85E-03	4.98E-03	1.34E-04	8.62E-03	1.37E-02
LLW(x) LB to HS						
Lawrence Berkeley	to Hanford Site					
	Truck	2.76E-02	3.02E-03	5.17E-03	2.45E-02	3.27E-02
	Rail	6.99E-03	1.38E-02	2.03E-04	6.51E-03	2.05E-02
LLW(x) LL to NT						
Lawrence Livermore	to Nevada Test Site					
	Truck	2.05E-02	2.57E-03	4.65E-03	1.90E-02	2.62E-02
	Rail	8.60E-03	5.75E-03	1.20E-04	7.70E-03	1.36E-02
LLW(x) MP to NT						
Mound Plant	to Nevada Test Site					
	Truck	5.82E-02	3.93E-03	8.53E-03	5.73E-02	6.98E-02
	Rail	1.28E-02	1.36E-02	2.90E-04	1.08E-02	2.47E-02
LLW(x) OI to OR						
ORISE	to Oak Ridge Reserv.					
	Truck	3.63E-04	3.21E-05	4.23E-05	2.86E-04	3.60E-04
	Rail	3.05E-03	3.36E-04	8.77E-06	3.60E-03	3.95E-03
LLW(x) PP to NT						
Pantex Plant	to Nevada Test Site					
	Truck	3.16E-02	1.43E-03	4.34E-03	3.38E-02	3.96E-02
	Rail	8.62E-03	3.19E-03	1.03E-04	7.72E-03	1.10E-02
LLW(x) PO to NT						
Portsmouth GDP	to Nevada Test Site					
	Truck	6.17E-02	4.18E-03	8.96E-03	6.04E-02	7.36E-02
	Rail	1.29E-02	1.88E-02	3.36E-04	1.09E-02	3.01E-02
LLW(x) PR to HS						
Princeton PPL	to Hanford Site					
	Truck	8.51E-02	6.65E-03	1.28E-02	8.02E-02	9.97E-02
	Rail	1.53E-02	3.63E-02	6.03E-04	1.27E-02	4.96E-02
LLW(x) PA to NT						
Paducah GDP	to Nevada Test Site					
	Truck	5.22E-02	3.26E-03	7.47E-03	5.22E-02	6.29E-02
	Rail	1.18E-02	9.42E-03	2.18E-04	1.00E-02	1.97E-02
LLW(x) PI to SR						
Pinellas Plant	to Savannah River					
	Truck	2.02E-02	1.94E-03	3.10E-03	1.74E-02	2.24E-02
	Rail	4.90E-03	5.13E-03	1.02E-04	4.97E-03	1.02E-02
LLW(x) RF to NT						
Rocky Flats Plant	to Nevada Test Site					
	Truck	2.30E-02	1.44E-03	3.43E-03	2.34E-02	2.83E-02
	Rail	7.00E-03	1.29E-03	6.47E-05	6.52E-03	7.88E-03
LLW(x) RM to NT						
Reactive Metals	to Nevada Test Site					
	Truck	6.33E-02	4.39E-03	9.38E-03	6.20E-02	7.58E-02
	Rail	1.29E-02	2.35E-02	3.91E-04	1.08E-02	3.47E-02

LLW(x) ST to HS SLAC	to Hanford Site					
	Truck	2.98E-02	3.70E-03	6.08E-03	2.56E-02	3.54E-02
	Rail	7.20E-03	1.75E-02	2.40E-04	6.67E-03	2.44E-02
LLW(x) SA to NT SNL - Albuquerque	to Nevada Test Site					
	Truck	2.37E-02	1.02E-03	3.18E-03	2.54E-02	2.97E-02
	Rail	7.32E-03	2.85E-03	8.34E-05	6.76E-03	9.69E-03
LLW(x) SL to NT SNL - Livermore	to Nevada Test Site					
	Truck	2.05E-02	2.57E-03	4.65E-03	1.90E-02	2.62E-02
	Rail	8.60E-03	5.75E-03	1.20E-04	7.70E-03	1.36E-02

Table 4. Accident Dose Risk per Shipment (person-rem/shipment)

Source/Route		Truck	Rail
LLW(x) AL to HS Ames Laboratory	to Hanford Site	5.20E-06	1.96E-06
LLW(x) AN to HS Argonne - East	to Hanford Site	5.51E-04	3.33E-04
LLW(x) BA to HS Bettis Atomic	to Hanford Site	4.37E-05	4.76E-05
LLW(x) FL to HS Fermilab (FNAL)	to Hanford Site	3.36E-05	1.10E-05
LLW(x) IT to NT ITRI	to Nevada Test Site	2.18E-03	4.52E-04
LLW(x) KA to HS Knolls Atomic	to Hanford Site	5.84E-06	5.37E-06
LLW(x) KC to NT Kansas City Plant	to Nevada Test Site	1.27E-05	1.94E-06
LLW(x) LB to HS Lawrence Berkeley	to Hanford Site	3.80E-02	4.24E-02
LLW(x) LL to NT Lawrence Livermore	to Nevada Test Site	7.11E-06	5.70E-06
LLW(x) MP to NT Mound Plant	to Nevada Test Site	4.24E-06	3.27E-06
LLW(x) OI to OR ORISE	to Oak Ridge Reserv.	1.12E-07	3.15E-08
LLW(x) PP to NT Pantex Plant	to Nevada Test Site	7.70E-07	1.96E-07
LLW(x) PO to NT Portsmouth GDP	to Nevada Test Site	2.36E-08	2.55E-08
LLW(x) PR to HS Princeton PPL	to Hanford Site	6.41E-06	2.35E-06
LLW(x) PA to NT Paducah GDP	to Nevada Test Site	1.21E-06	6.68E-07
LLW(x) PI to SR Pinellas Plant	to Savannah River	6.49E-07	2.33E-07
LLW(x) RF to NT Rocky Flats Plant	to Nevada Test Site	4.77E-06	7.11E-07
LLW(x) RM to NT Reactive Metals	to Nevada Test Site	1.30E-08	1.30E-08
LLW(x) ST to HS SLAC	to Hanford Site	4.22E-07	6.17E-07
LLW(x) SA to NT SNL - Albuquerque	to Nevada Test Site	8.17E-06	1.96E-06
LLW(x) SL to NT SNL - Livermore	to Nevada Test Site	3.63E-05	3.45E-05

Table 5. Nonradiological Risk Factors per Shipment (fatalities/shipment)

Mode	Route	Emission	Accident
Truck			
Ames Laboratory	to Hanford Site	4.31E-06	8.93E-05
Argonne - East	to Hanford Site	4.41E-06	1.06E-04
Bettis Atomic	to Hanford Site	1.14E-05	1.36E-04
Fermilab (FNAL)	to Hanford Site	4.86E-06	1.03E-04
ITRI	to Nevada Test Site	4.31E-06	7.08E-05
Knolls Atomic	to Hanford Site	1.59E-05	1.51E-04
Kansas City Plant	to Nevada Test Site	6.44E-06	1.05E-04
Lawrence Berkeley	to Hanford Site	1.16E-05	4.91E-05
Lawrence Livermore	to Nevada Test Site	1.32E-05	5.15E-05
Mound Plant	to Nevada Test Site	1.27E-05	1.43E-04
ORISE	to Oak Ridge Reserv.	0.00E+00	1.07E-06
Pantex Plant	to Nevada Test Site	6.05E-06	9.02E-05
Portsmouth GDP	to Nevada Test Site	1.29E-05	1.48E-04
Princeton PPL	to Hanford Site	1.97E-05	1.63E-04
Paducah GDP	to Nevada Test Site	1.07E-05	1.34E-04
Pinellas Plant	to Savannah River	4.47E-06	4.70E-05
Rocky Flats Plant	to Nevada Test Site	5.50E-06	6.18E-05
Reactive Metals	to Nevada Test Site	1.43E-05	1.36E-04
SLAC	to Hanford Site	1.50E-05	5.14E-05
SNL - Albuquerque	to Nevada Test Site	4.12E-06	7.01E-05
SNL - Livermore	to Nevada Test Site	1.32E-05	5.15E-05
Rail			
Ames Laboratory	to Hanford Site	5.40E-06	3.74E-06
Argonne - East	to Hanford Site	6.15E-06	4.60E-06
Bettis Atomic	to Hanford Site	4.07E-05	5.46E-06
Fermilab (FNAL)	to Hanford Site	1.18E-05	4.12E-06
ITRI	to Nevada Test Site	3.85E-06	2.23E-06
Knolls Atomic	to Hanford Site	4.72E-05	6.10E-06
Kansas City Plant	to Nevada Test Site	7.24E-06	3.49E-06
Lawrence Berkeley	to Hanford Site	2.33E-05	2.06E-06
Lawrence Livermore	to Nevada Test Site	1.01E-05	2.87E-06
Mound Plant	to Nevada Test Site	1.84E-05	4.99E-06
ORISE	to Oak Ridge Reserv.	1.26E-07	8.26E-08
Pantex Plant	to Nevada Test Site	3.98E-06	2.88E-06
Portsmouth GDP	to Nevada Test Site	2.95E-05	5.02E-06
Princeton PPL	to Hanford Site	5.38E-05	6.24E-06
Paducah GDP	to Nevada Test Site	1.29E-05	4.46E-06
Pinellas Plant	to Savannah River	5.69E-06	1.01E-06
Rocky Flats Plant	to Nevada Test Site	8.37E-07	2.07E-06
Reactive Metals	to Nevada Test Site	3.72E-05	5.00E-06
SLAC	to Hanford Site	3.07E-05	2.17E-06
SNL - Albuquerque	to Nevada Test Site	3.85E-06	2.23E-06
SNL - Livermore	to Nevada Test Site	1.01E-05	2.87E-06

Table 6. Annual Incident-Free Dose for the Shipping Campaign (person-rem/yr)

Route		Truck		Rail	
		Crew	Public	Crew	Public
Ames Laboratory	to Hanford Site	4.46E-02	5.47E-02	1.03E-02	1.38E-02
Argonne - East	to Hanford Site	2.80E+00	3.40E+00	2.41E-01	3.24E-01
Bettis Atomic	to Hanford Site	2.09E+00	2.47E+00	1.52E-01	4.26E-01
Fermilab (FNAL)	to Hanford Site	5.20E-02	6.35E-02	1.11E-02	1.88E-02
ITRI	to Nevada Test Site	1.20E-01	1.50E-01	1.46E-02	1.94E-02
Knolls Atomic	to Hanford Site	1.33E+00	1.55E+00	9.02E-02	2.69E-01
Kansas City Plant	to Nevada Test Site	3.84E-02	4.70E-02	9.85E-03	1.37E-02
Lawrence Berkeley	to Hanford Site	5.51E-02	6.54E-02	6.99E-03	2.05E-02
Lawrence Livermore	to Nevada Test Site	3.29E-01	4.19E-01	5.16E-02	8.14E-02
Mound Plant	to Nevada Test Site	1.49E+01	1.79E+01	1.22E+00	2.35E+00
ORISE	to Oak Ridge Reserv.	3.63E-04	3.60E-04	3.05E-03	3.95E-03
Pantex Plant	to Nevada Test Site	2.17E+01	2.72E+01	2.35E+00	3.00E+00
Portsmouth GDP	to Nevada Test Site	1.03E+02	1.23E+02	8.22E+00	1.91E+01
Princeton PPL	to Hanford Site	8.51E-02	9.97E-02	1.53E-02	4.96E-02
Paducah GDP	to Nevada Test Site	1.67E+01	2.02E+01	1.41E+00	2.36E+00
Pinellas Plant	to Savannah River	4.04E-02	4.48E-02	4.90E-03	1.02E-02
Rocky Flats Plant	to Nevada Test Site	3.68E+00	4.52E+00	4.20E-01	4.73E-01
Reactive Metals	to Nevada Test Site	2.31E+01	2.77E+01	1.76E+00	4.76E+00
SLAC	to Hanford Site	5.95E-01	7.08E-01	5.76E-02	1.95E-01
SNL - Albuquerque	to Nevada Test Site	2.13E-01	2.67E-01	2.93E-02	3.88E-02
SNL - Livermore	to Nevada Test Site	6.16E-02	7.86E-02	8.60E-03	1.36E-02
Totals		1.91E+02	2.30E+02	1.61E+01	3.36E+01

Table 7. Annual Accident Dose Risk for the Shipping Campaign (person-rem/yr)

Route		Truck	Rail
Ames Laboratory	to Hanford Site	5.20E-06	1.96E-06
Argonne - East	to Hanford Site	2.92E-02	6.66E-03
Bettis Atomic	to Hanford Site	1.27E-03	5.24E-04
Fermilab (FNAL)	to Hanford Site	3.36E-05	1.10E-05
ITRI	to Nevada Test Site	1.09E-02	9.03E-04
Knolls Atomic	to Hanford Site	9.34E-05	3.22E-05
Kansas City Plant	to Nevada Test Site	1.27E-05	1.94E-06
Lawrence Berkeley	to Hanford Site	7.61E-02	4.24E-02
Lawrence Livermore	to Nevada Test Site	1.14E-04	3.42E-05
Mound Plant	to Nevada Test Site	1.09E-03	3.11E-04
ORISE	to Oak Ridge Reserv.	1.12E-07	3.15E-08
Pantex Plant	to Nevada Test Site	5.29E-04	5.34E-05
Portsmouth GDP	to Nevada Test Site	3.95E-05	1.63E-05
Princeton PPL	to Hanford Site	6.41E-06	2.35E-06
Paducah GDP	to Nevada Test Site	3.88E-04	8.02E-05
Pinellas Plant	to Savannah River	1.30E-06	2.33E-07
Rocky Flats Plant	to Nevada Test Site	7.64E-04	4.27E-05
Reactive Metals	to Nevada Test Site	4.74E-06	1.78E-06
SLAC	to Hanford Site	8.43E-06	4.94E-06
SNL - Albuquerque	to Nevada Test Site	7.35E-05	7.84E-06
SNL - Livermore	to Nevada Test Site	1.09E-04	3.45E-05
Totals		1.21E-01	5.11E-02

Table 8. Expected Annual Fatalities for the Shipping Campaign

Exposure Group	Truck	Rail
Radiological		
Normal Crew	7.6E-02	6.4E-03
Normal Public	1.1E-01	1.7E-02
Accident Public	6.0E-05	2.6E-05
Nonradiological		
Emission	4.0E-02	3.0E-02
Accident	4.6E-01	6.1E-03

Table 9. Expected Annual Cancer Incidence for the Shipping Campaign

Exposure Group	Truck	Rail
Radiological		
Normal Crew	2.7E-01	2.3E-02
Normal Public	3.9E-01	5.7E-02
Accident Public	2.1E-04	8.7E-05
Nonradiological		
Emission	4.0E-02	3.0E-02
Accident	NA	NA

Table 10. Expected Annual Genetic Effects for the Shipping Campaign

Exposure Group	Truck	Rail
Radiological		
Normal Crew	1.1E-02	9.6E-04
Normal Public	2.3E-02	3.4E-03
Accident Public	3.6E-06	1.3E-06
Nonradiological		
Emission	NA	NA
Accident	NA	NA

B.2 WM LLW NO ACTION ALTERNATIVE (CASE 1): ACTIVATED METALS

Table 1. Summary of Route Information

Route		Distance (miles)	Percentage in Zone		
			Rural	Suburban	Urban
Truck					
Bettis Atomic	to Hanford Site	2541	85.8	12.8	1.4
Fermilab (FNAL)	to Hanford Site	1975	92.2	7.1	0.8
Knolls Atomic	to Hanford Site	2809	82.1	16.1	1.8
Lawrence Berkeley	to Hanford Site	875	78.1	17.8	4.1
Naval Reactor Fac.	to Hanford Site	599	91.3	7.6	1.1
SNL - Albuquerque	to Nevada Test Site	909	93.8	4.8	1.4
Rail					
Bettis Atomic	to Hanford Site	2611	81.2	15.1	3.7
Fermilab (FNAL)	to Hanford Site	1971	89.9	8.6	1.4
Knolls Atomic	to Hanford Site	2914	79.1	17.0	3.9
Lawrence Berkeley	to Hanford Site	986	78.5	15.8	5.7
Naval Reactor Fac.	to Hanford Site	658	91.4	7.1	1.4
SNL - Albuquerque	to Nevada Test Site	1065	94.6	4.5	0.9

Table 2. Annual Number of Shipments and One-Way Shipment Distances

Route		# of Shipments		Total Mileage(mi)	
		Truck	Rail	Truck	Rail
Bettis Atomic	to Hanford Site	158	60	4.01E+05	1.57E+05
Fermilab (FNAL)	to Hanford Site	20	8	3.95E+04	1.58E+04
Knolls Atomic	to Hanford Site	327	124	9.19E+05	3.61E+05
Lawrence Berkeley	to Hanford Site	8	3	7.00E+03	2.96E+03
Naval Reactor Fac.	to Hanford Site	231	88	1.38E+05	5.79E+04
SNL - Albuquerque	to Nevada Test Site	3	2	2.73E+03	2.13E+03
Totals		747	285	1.51E+06	5.97E+05

Table 3. Incident-Free Dose per Shipment (person-rem/shipment)

Source/Route(s)		Crew	General Public			
			Off-Link	On-Link	Stops	Total
LLW(I) BA to HS						
Bettis Atomic	to Hanford Site					
		Truck	7.21E-02	4.36E-03	9.77E-03	7.11E-02	8.53E-02
		Rail	1.38E-02	2.67E-02	4.53E-04	1.15E-02	3.87E-02
LLW(I) FL to HS						
Fermilab (FNAL)	to Hanford Site					
		Truck	5.20E-02	1.92E-03	6.25E-03	5.53E-02	6.35E-02
		Rail	1.11E-02	9.07E-03	2.12E-04	9.55E-03	1.88E-02
LLW(I) KA to HS						
Knolls Atomic	to Hanford Site					
		Truck	8.30E-02	6.03E-03	1.19E-02	7.87E-02	9.66E-02
		Rail	1.50E-02	3.18E-02	5.40E-04	1.25E-02	4.48E-02
LLW(I) LB to HS						
Lawrence Berkeley	to Hanford Site					
		Truck	2.76E-02	3.02E-03	5.17E-03	2.45E-02	3.27E-02
		Rail	6.99E-03	1.38E-02	2.03E-04	6.51E-03	2.05E-02
LLW(I) NR to HS						
Naval Reactor Fac.	to Hanford Site					
		Truck	1.60E-02	7.18E-04	2.06E-03	1.68E-02	1.95E-02
		Rail	5.63E-03	2.83E-03	6.58E-05	5.51E-03	8.40E-03
LLW(I) SA to NT						
SNL - Albuquerque	to Nevada Test Site					
		Truck	2.37E-02	1.02E-03	3.18E-03	2.54E-02	2.97E-02
		Rail	7.32E-03	2.85E-03	8.34E-05	6.76E-03	9.69E-03

Table 4. Accident Dose Risk per Shipment (person-rem/shipment)

Source/Route		Truck	Rail
LLW(I) BA to HS Bettis Atomic	to Hanford Site	1.80E-06	1.78E-06
LLW(I) FL to HS Fermilab (FNAL)	to Hanford Site	4.65E-11	3.86E-11
LLW(I) KA to HS Knolls Atomic	to Hanford Site	3.04E-06	2.55E-06
LLW(I) LB to HS Lawrence Berkeley	to Hanford Site	1.59E-10	2.38E-10
LLW(I) NR to HS Naval Reactor Fac.	to Hanford Site	4.44E-08	6.27E-08
LLW(I) SA to NT SNL - Albuquerque	to Nevada Test Site	2.40E-12	2.80E-13

Table 5. Nonradiological Risk Factors per Shipment (fatalities/shipment)

Mode	Route	Emission	Accident
Truck			
Bettis Atomic	to Hanford Site	1.14E-05	1.36E-04
Fermilab (FNAL)	to Hanford Site	4.86E-06	1.03E-04
Knolls Atomic	to Hanford Site	1.59E-05	1.51E-04
Lawrence Berkeley	to Hanford Site	1.16E-05	4.91E-05
Naval Reactor Fac.	to Hanford Site	2.19E-06	3.07E-05
SNL - Albuquerque	to Nevada Test Site	4.12E-06	7.01E-05
Rail			
Bettis Atomic	to Hanford Site	4.07E-05	5.46E-06
Fermilab (FNAL)	to Hanford Site	1.18E-05	4.12E-06
Knolls Atomic	to Hanford Site	4.72E-05	6.10E-06
Lawrence Berkeley	to Hanford Site	2.33E-05	2.06E-06
Naval Reactor Fac.	to Hanford Site	3.98E-06	1.38E-06
SNL - Albuquerque	to Nevada Test Site	3.85E-06	2.23E-06

Table 6. Annual Incident-Free Dose for the Shipping Campaign (person-rem/yr)

Route		Truck		Rail	
		Crew	Public	Crew	Public
Bettis Atomic	to Hanford Site	1.14E+01	1.35E+01	8.27E-01	2.32E+00
Fermilab (FNAL)	to Hanford Site	1.04E+00	1.27E+00	8.89E-02	1.51E-01
Knolls Atomic	to Hanford Site	2.71E+01	3.16E+01	1.87E+00	5.55E+00
Lawrence Berkeley	to Hanford Site	2.21E-01	2.61E-01	2.10E-02	6.16E-02
Naval Reactor Fac.	to Hanford Site	3.70E+00	4.52E+00	4.95E-01	7.40E-01
SNL - Albuquerque	to Nevada Test Site	7.11E-02	8.90E-02	1.46E-02	1.94E-02
Totals		4.35E+01	5.12E+01	3.31E+00	8.85E+00

Table 7. Annual Accident Dose Risk for the Shipping Campaign (person-rem/yr)

Route		Truck	Rail
Bettis Atomic	to Hanford Site	2.84E-04	1.07E-04
Fermilab (FNAL)	to Hanford Site	9.30E-10	3.09E-10
Knolls Atomic	to Hanford Site	9.95E-04	3.16E-04
Lawrence Berkeley	to Hanford Site	1.27E-09	7.14E-10
Naval Reactor Fac.	to Hanford Site	1.02E-05	5.52E-06
SNL - Albuquerque	to Nevada Test Site	7.19E-12	5.61E-13
Totals		1.29E-03	4.29E-04

Table 8. Expected Annual Fatalities for the Shipping Campaign

Exposure Group	Truck	Rail
Radiological		
Normal Crew	1.7E-02	1.3E-03
Normal Public	2.6E-02	4.4E-03
Accident Public	6.4E-07	2.1E-07
Nonradiological		
Emission	7.7E-03	8.8E-03
Accident	8.1E-02	1.2E-03

Table 9. Expected Annual Cancer Incidence for the Shipping Campaign

Exposure Group	Truck	Rail
Radiological		
Normal Crew	6.1E-02	4.6E-03
Normal Public	8.7E-02	1.5E-02
Accident Public	2.2E-06	7.3E-07
Nonradiological		
Emission	7.7E-03	8.8E-03
Accident	NA	NA

Table 10. Expected Annual Genetic Effects for the Shipping Campaign

Exposure Group	Truck	Rail
Radiological		
Normal Crew	2.6E-03	2.0E-04
Normal Public	5.1E-03	8.8E-04
Accident Public	1.3E-07	4.3E-08
Nonradiological		
Emission	NA	NA
Accident	NA	NA

B.3 WM LLW DECENTRALIZED ALTERNATIVE (CASE 2): HETEROGENEOUS SOLIDS

Table 1. Summary of Route Information

Route		Distance (miles)	Percentage in Zone		
			Rural	Suburban	Urban
Truck					
Ames Laboratory	to Argonne - East	351	85.3	14.4	0.3
Bettis Atomic	to West Valley DP	257	58.8	38.0	3.2
Fermilab (FNAL)	to Argonne - East	36	43.2	45.7	11.1
Knolls Atomic	to Brookhaven NL	241	29.0	57.9	13.1
Kansas City Plant	to Paducah GDP	441	77.5	19.6	2.9
Lawrence Berkeley	to Lawrence Livermore	45	38.4	33.3	28.2
Mound Plant	to Portsmouth GDP	152	55.8	38.7	5.5
ORISE	to Oak Ridge Reserv.	10	58.8	41.2	0.0
Princeton PPL	to Brookhaven NL	189	18.4	57.7	23.9
Pinellas Plant	to Savannah River	620	71.9	25.8	2.2
Reactive Metals	to Portsmouth GDP	276	59.5	37.8	2.8
SLAC	to Lawrence Livermore	64	25.2	33.1	41.7
Rail					
Ames Laboratory	to Argonne - East	328	71.7	21.4	6.9
Bettis Atomic	to West Valley DP	244	69.4	29.0	1.7
Fermilab (FNAL)	to Argonne - East	49	28.0	45.0	27.0
Knolls Atomic	to Brookhaven NL	239	26.2	53.1	20.7
Kansas City Plant	to Paducah GDP	482	75.0	20.3	4.8
Lawrence Berkeley	to Lawrence Livermore	46	39.0	34.5	26.5
Mound Plant	to Portsmouth GDP	156	53.2	38.0	8.8
ORISE	to Oak Ridge Reserv.	40	65.8	33.4	0.8
Princeton PPL	to Brookhaven NL	410	28.0	46.3	25.7
Pinellas Plant	to Savannah River	485	72.2	25.0	2.8
Reactive Metals	to Portsmouth GDP	279	48.4	41.8	9.8
SLAC	to Lawrence Livermore	60	45.3	37.8	16.8

Table 2. Annual Number of Shipments and One-Way Shipment Distances

Route		# of Shipments		Total Mileage(mi)	
		Truck	Rail	Truck	Rail
Ames Laboratory	to Argonne - East	2	1	7.02E+02	3.28E+02
Bettis Atomic	to West Valley DP	57	21	1.47E+04	5.13E+03
Fermilab (FNAL)	to Argonne - East	3	2	1.08E+02	9.78E+01
Knolls Atomic	to Brookhaven NL	28	11	6.75E+03	2.63E+03
Kansas City Plant	to Paducah GDP	1	1	4.41E+02	4.82E+02
Lawrence Berkeley	to Lawrence Livermore	3	2	1.35E+02	9.22E+01
Mound Plant	to Portsmouth GDP	512	190	7.79E+04	2.97E+04
ORISE	to Oak Ridge Reserv.	5	2	5.10E+01	7.90E+01
Princeton PPL	to Brookhaven NL	1	1	1.89E+02	4.10E+02
Pinellas Plant	to Savannah River	2	1	1.24E+03	4.85E+02
Reactive Metals	to Portsmouth GDP	768	287	2.12E+05	8.01E+04
SLAC	to Lawrence Livermore	39	15	2.50E+03	9.00E+02
Totals		1421	534	3.17E+05	1.20E+05

Table 3. Incident-Free Dose per Shipment (person-rem/shipment)

Source/Route(s)		Crew	General Public			
			Off-Link	On-Link	Stops	Total
LLW(x) AL to AN						
Ames Laboratory	to Argonne - East					
	Truck	9.87E-03	4.50E-04	1.11E-03	9.83E-03	1.14E-02
	Rail	4.25E-03	5.78E-03	8.30E-05	4.49E-03	1.04E-02
LLW(x) BA to WV						
Bettis Atomic	to West Valley DP					
	Truck	9.44E-03	1.16E-03	1.59E-03	7.20E-03	9.95E-03
	Rail	3.90E-03	2.27E-03	5.21E-05	4.23E-03	6.55E-03
LLW(x) FL to AN						
Fermilab (FNAL)	to Argonne - East					
	Truck	1.58E-03	3.26E-04	4.28E-04	1.01E-03	1.77E-03
	Rail	3.09E-03	2.94E-03	3.26E-05	3.63E-03	6.60E-03
LLW(x) KA to BN						
Knolls Atomic	to Brookhaven NL					
	Truck	1.17E-02	2.64E-03	3.31E-03	6.75E-03	1.27E-02
	Rail	3.88E-03	1.19E-02	1.47E-04	4.21E-03	1.63E-02
LLW(x) KC to PA						
Kansas City Plant	to Paducah GDP					
	Truck	1.38E-02	1.32E-03	2.28E-03	1.23E-02	1.59E-02
	Rail	4.89E-03	6.38E-03	1.03E-04	4.96E-03	1.14E-02
LLW(x) LB to LL						
Lawrence Berkeley	to Lawrence Livermore					
	Truck	2.31E-03	7.51E-04	1.03E-03	1.26E-03	3.04E-03
	Rail	3.07E-03	2.62E-03	2.79E-05	3.62E-03	6.27E-03
LLW(x) MP to PO						
Mound Plant	to Portsmouth GDP					
	Truck	5.83E-03	8.71E-04	1.18E-03	4.26E-03	6.31E-03
	Rail	3.53E-03	3.82E-03	5.67E-05	3.96E-03	7.84E-03
LLW(x) OI to OR						
ORISE	to Oak Ridge Reserv.					
	Truck	3.63E-04	3.21E-05	4.23E-05	2.86E-04	3.60E-04
	Rail	3.05E-03	3.36E-04	8.77E-06	3.60E-03	3.95E-03
LLW(x) PR to BN						
Princeton PPL	to Brookhaven NL					
	Truck	1.05E-02	3.09E-03	3.99E-03	5.29E-03	1.24E-02
	Rail	4.59E-03	2.37E-02	2.68E-04	4.74E-03	2.87E-02
LLW(x) PI to SR						
Pinellas Plant	to Savannah River					
	Truck	2.02E-02	1.94E-03	3.10E-03	1.74E-02	2.24E-02
	Rail	4.90E-03	5.13E-03	1.02E-04	4.97E-03	1.02E-02
LLW(x) RM to PO						
Reactive Metals	to Portsmouth GDP					
	Truck	1.00E-02	1.18E-03	1.62E-03	7.73E-03	1.05E-02
	Rail	4.05E-03	7.58E-03	1.11E-04	4.34E-03	1.20E-02
LLW(x) ST to LL						
SLAC	to Lawrence Livermore					
	Truck	3.82E-03	1.50E-03	2.05E-03	1.79E-03	5.35E-03
	Rail	3.13E-03	2.37E-03	2.89E-05	3.66E-03	6.07E-03

Table 4. Accident Dose Risk per Shipment (person-rem/shipment)

Source/Route		Truck	Rail
LLW(x) AL to AN Ames Laboratory	to Argonne - East	4.04E-06	4.73E-06
LLW(x) BA to WV Bettis Atomic	to West Valley DP	6.67E-06	1.93E-06
LLW(x) FL to AN Fermilab (FNAL)	to Argonne - East	4.66E-06	3.23E-06
LLW(x) KA to BN Knolls Atomic	to Brookhaven NL	1.58E-06	1.18E-06
LLW(x) KC to PA Kansas City Plant	to Paducah GDP	2.22E-05	5.69E-06
LLW(x) LB to LL Lawrence Berkeley	to Lawrence Livermore	3.76E-03	4.03E-03
LLW(x) MP to PO Mound Plant	to Portsmouth GDP	4.67E-07	3.08E-07
LLW(x) OI to OR ORISE	to Oak Ridge Reserv.	4.47E-08	3.16E-08
LLW(x) PR to BN Princeton PPL	to Brookhaven NL	3.12E-06	3.36E-06
LLW(x) PI to SR Pinellas Plant	to Savannah River	1.30E-06	4.65E-07
LLW(x) RM to PO Reactive Metals	to Portsmouth GDP	2.26E-09	1.74E-09
LLW(x) ST to LL SLAC	to Lawrence Livermore	4.86E-08	5.69E-08

Table 5. Nonradiological Risk Factors per Shipment (fatalities/shipment)

Mode	Route	Emission	Accident
Truck			
Ames Laboratory	to Argonne - East	3.22E-07	1.87E-05
Bettis Atomic	to West Valley DP	2.64E-06	1.91E-05
Fermilab (FNAL)	to Argonne - East	1.29E-06	4.21E-06
Knolls Atomic	to Brookhaven NL	1.01E-05	1.45E-05
Kansas City Plant	to Paducah GDP	4.12E-06	2.89E-05
Lawrence Berkeley	to Lawrence Livermore	4.09E-06	2.66E-06
Mound Plant	to Portsmouth GDP	2.70E-06	6.66E-06
ORISE	to Oak Ridge Reserv.	0.00E+00	1.07E-06
Princeton PPL	to Brookhaven NL	1.45E-05	1.46E-05
Pinellas Plant	to Savannah River	4.47E-06	4.70E-05
Reactive Metals	to Portsmouth GDP	2.45E-06	1.21E-05
SLAC	to Lawrence Livermore	8.59E-06	3.47E-06
Rail			
Ames Laboratory	to Argonne - East	9.54E-06	6.87E-07
Bettis Atomic	to West Valley DP	1.72E-06	5.11E-07
Fermilab (FNAL)	to Argonne - East	5.52E-06	1.02E-07
Knolls Atomic	to Brookhaven NL	2.07E-05	5.00E-07
Kansas City Plant	to Paducah GDP	9.58E-06	1.01E-06
Lawrence Berkeley	to Lawrence Livermore	5.10E-06	9.64E-08
Mound Plant	to Portsmouth GDP	5.73E-06	3.27E-07
ORISE	to Oak Ridge Reserv.	1.26E-07	8.26E-08
Princeton PPL	to Brookhaven NL	4.40E-05	8.57E-07
Pinellas Plant	to Savannah River	5.69E-06	1.01E-06
Reactive Metals	to Portsmouth GDP	1.14E-05	5.84E-07
SLAC	to Lawrence Livermore	4.23E-06	1.26E-07

Table 6. Annual Incident-Free Dose for the Shipping Campaign (person-rem/yr)

Route		Truck		Rail	
		Crew	Public	Crew	Public
Ames Laboratory	to Argonne - East	1.97E-02	2.28E-02	4.25E-03	1.04E-02
Bettis Atomic	to West Valley DP	5.38E-01	5.67E-01	8.19E-02	1.38E-01
Fermilab (FNAL)	to Argonne - East	4.75E-03	5.30E-03	6.17E-03	1.32E-02
Knolls Atomic	to Brookhaven NL	3.28E-01	3.56E-01	4.27E-02	1.79E-01
Kansas City Plant	to Paducah GDP	1.38E-02	1.59E-02	4.89E-03	1.14E-02
Lawrence Berkeley	to Lawrence Livermore	6.92E-03	9.13E-03	6.15E-03	1.25E-02
Mound Plant	to Portsmouth GDP	2.99E+00	3.23E+00	6.71E-01	1.49E+00
ORISE	to Oak Ridge Reserv.	1.81E-03	1.80E-03	6.09E-03	7.89E-03
Princeton PPL	to Brookhaven NL	1.05E-02	1.24E-02	4.59E-03	2.87E-02
Pinellas Plant	to Savannah River	4.04E-02	4.48E-02	4.90E-03	1.02E-02
Reactive Metals	to Portsmouth GDP	7.71E+00	8.08E+00	1.16E+00	3.45E+00
SLAC	to Lawrence Livermore	1.49E-01	2.09E-01	4.70E-02	9.10E-02
Totals		1.18E+01	1.26E+01	2.04E+00	5.44E+00

Table 7. Annual Accident Dose Risk for the Shipping Campaign (person-rem/yr)

Route		Truck	Rail
Ames Laboratory	to Argonne - East	8.09E-06	4.73E-06
Bettis Atomic	to West Valley DP	3.80E-04	4.05E-05
Fermilab (FNAL)	to Argonne - East	1.40E-05	6.47E-06
Knolls Atomic	to Brookhaven NL	4.43E-05	1.30E-05
Kansas City Plant	to Paducah GDP	2.22E-05	5.69E-06
Lawrence Berkeley	to Lawrence Livermore	1.13E-02	8.05E-03
Mound Plant	to Portsmouth GDP	2.39E-04	5.86E-05
ORISE	to Oak Ridge Reserv.	2.24E-07	6.32E-08
Princeton PPL	to Brookhaven NL	3.12E-06	3.36E-06
Pinellas Plant	to Savannah River	2.59E-06	4.65E-07
Reactive Metals	to Portsmouth GDP	1.73E-06	5.00E-07
SLAC	to Lawrence Livermore	1.89E-06	8.53E-07
Totals		1.20E-02	8.18E-03

Table 8. Expected Annual Fatalities for the Shipping Campaign

Exposure Group	Truck	Rail
Radiological		
Normal Crew	4.7E-03	8.2E-04
Normal Public	6.3E-03	2.7E-03
Accident Public	6.0E-06	4.1E-06
Nonradiological		
Emission	4.1E-03	4.8E-03
Accident	1.4E-02	2.5E-04

Table 9. Expected Annual Cancer Incidence for the Shipping Campaign

Exposure Group	Truck	Rail
Radiological		
Normal Crew	1.7E-02	2.9E-03
Normal Public	2.1E-02	9.3E-03
Accident Public	2.0E-05	1.4E-05
Nonradiological		
Emission	4.1E-03	4.8E-03
Accident	NA	NA

Table 10. Expected Annual Genetic Effects for the Shipping Campaign

Exposure Group	Truck	Rail
Radiological		
Normal Crew	7.1E-04	1.2E-04
Normal Public	1.3E-03	5.4E-04
Accident Public	1.1E-06	7.5E-07
Nonradiological		
Emission	NA	NA
Accident	NA	NA

B.4 WM LLW DECENTRALIZED ALTERNATIVE (CASE 2): ACTIVATED METALS

Table 1. Summary of Route Information

Route		Distance (miles)	Percentage in Zone		
			Rural	Suburban	Urban
Truck					
Bettis Atomic	to West Valley DP	257	58.8	38.0	3.2
Fermilab (FNAL)	to Argonne - East	36	43.2	45.7	11.1
Knolls Atomic	to Brookhaven NL	241	29.0	57.9	13.1
Lawrence Berkeley	to Lawrence Livermore	45	38.4	33.3	28.2
Rail					
Bettis Atomic	to West Valley DP	244	69.4	29.0	1.7
Fermilab (FNAL)	to Argonne - East	49	28.0	45.0	27.0
Knolls Atomic	to Brookhaven NL	239	26.2	53.1	20.7
Lawrence Berkeley	to Lawrence Livermore	46	39.0	34.5	26.5

Table 2. Annual Number of Shipments and One-Way Shipment Distances

Route		# of Shipments		Total Mileage(mi)	
		Truck	Rail	Truck	Rail
Bettis Atomic	to West Valley DP	316	120	8.13E+04	2.93E+04
Fermilab (FNAL)	to Argonne - East	40	15	1.44E+03	7.34E+02
Knolls Atomic	to Brookhaven NL	650	246	1.57E+05	5.88E+04
Lawrence Berkeley	to Lawrence Livermore	15	6	6.75E+02	2.77E+02
Totals		1021	387	2.40E+05	8.91E+04

Table 3. Incident-Free Dose per Shipment (person-rem/shipment)

Source/Route(s)		Crew	General Public			
			Off-Link	On-Link	Stops	Total
LLW(I) BA to WV						
Bettis Atomic	to West Valley DP					
		Truck	9.44E-03	1.16E-03	1.59E-03	7.20E-03	9.95E-03
		Rail	3.90E-03	2.27E-03	5.21E-05	4.23E-03	6.55E-03
LLW(I) FL to AN						
Fermilab (FNAL)	to Argonne - East					
		Truck	1.58E-03	3.26E-04	4.28E-04	1.01E-03	1.77E-03
		Rail	3.09E-03	2.94E-03	3.26E-05	3.63E-03	6.60E-03
LLW(I) KA to BN						
Knolls Atomic	to Brookhaven NL					
		Truck	1.17E-02	2.64E-03	3.31E-03	6.75E-03	1.27E-02
		Rail	3.88E-03	1.19E-02	1.47E-04	4.21E-03	1.63E-02
LLW(I) LB to LL						
Lawrence Berkeley	to Lawrence Livermore					
		Truck	2.31E-03	7.51E-04	1.03E-03	1.26E-03	3.04E-03
		Rail	3.07E-03	2.62E-03	2.79E-05	3.62E-03	6.27E-03

Table 4. Accident Dose Risk per Shipment (person-rem/shipment)

Source/Route		Truck	Rail
LLW(I) BA to WV			
Bettis Atomic	to West Valley DP	4.74E-07	1.26E-07
LLW(I) FL to AN			
Fermilab (FNAL)	to Argonne - East	9.93E-12	1.22E-11
LLW(I) KA to BN			
Knolls Atomic	to Brookhaven NL	1.11E-06	8.57E-07
LLW(I) LB to LL			
Lawrence Berkeley	to Lawrence Livermore	1.27E-11	2.29E-11

Table 5. Nonradiological Risk Factors per Shipment (fatalities/shipment)

Mode	Route	Emission	Accident
Truck			
Bettis Atomic	to West Valley DP	2.64E-06	1.91E-05
Fermilab (FNAL)	to Argonne - East	1.29E-06	4.21E-06
Knolls Atomic	to Brookhaven NL	1.01E-05	1.45E-05
Lawrence Berkeley	to Lawrence Livermore	4.09E-06	2.66E-06
Rail			
Bettis Atomic	to West Valley DP	1.72E-06	5.11E-07
Fermilab (FNAL)	to Argonne - East	5.52E-06	1.02E-07
Knolls Atomic	to Brookhaven NL	2.07E-05	5.00E-07
Lawrence Berkeley	to Lawrence Livermore	5.10E-06	9.64E-08

Table 6. Annual Incident-Free Dose for the Shipping Campaign (person-rem/yr)

		Truck		Rail	
Route		Crew	Public	Crew	Public
Bettis Atomic	to West Valley DP	2.98E+00	3.14E+00	4.68E-01	7.86E-01
Fermilab (FNAL)	to Argonne - East	6.34E-02	7.06E-02	4.63E-02	9.90E-02
Knolls Atomic	to Brookhaven NL	7.62E+00	8.26E+00	9.54E-01	4.01E+00
Lawrence Berkeley	to Lawrence Livermore	3.46E-02	4.57E-02	1.84E-02	3.76E-02
Totals		1.07E+01	1.15E+01	1.49E+00	4.93E+00

Table 7. Annual Accident Dose Risk for the Shipping Campaign (person-rem/yr)

Route		Truck	Rail
Bettis Atomic	to West Valley DP	1.50E-04	1.52E-05
Fermilab (FNAL)	to Argonne - East	3.97E-10	1.83E-10
Knolls Atomic	to Brookhaven NL	7.22E-04	2.11E-04
Lawrence Berkeley	to Lawrence Livermore	1.90E-10	1.37E-10
Totals		8.71E-04	2.26E-04

Table 8. Expected Annual Fatalities for the Shipping Campaign

Exposure Group	Truck	Rail
Radiological		
Normal Crew	4.3E-03	5.9E-04
Normal Public	5.8E-03	2.5E-03
Accident Public	4.4E-07	1.1E-07
Nonradiological		
Emission	7.5E-03	5.4E-03
Accident	1.6E-02	1.9E-04

Table 9. Expected Annual Cancer Incidence for the Shipping Campaign

Exposure Group	Truck	Rail
Radiological		
Normal Crew	1.5E-02	2.1E-03
Normal Public	2.0E-02	8.4E-03
Accident Public	1.5E-06	3.8E-07
Nonradiological		
Emission	7.5E-03	5.4E-03
Accident	NA	NA

Table 10. Expected Annual Genetic Effects for the Shipping Campaign

Exposure Group	Truck	Rail
Radiological		
Normal Crew	6.4E-04	8.9E-05
Normal Public	1.2E-03	4.9E-04
Accident Public	8.7E-08	2.3E-08
Nonradiological		
Emission	NA	NA
Accident	NA	NA

B.5 WM LLW REGIONALIZED 1 ALTERNATIVE (CASE 3): HETEROGENEOUS SOLIDS

Table 1. Summary of Route Information

Route		Distance (miles)	Percentage in Zone		
			Rural	Suburban	Urban
Truck					
Ames Laboratory	to Portsmouth GDP	755	77.4	21.0	1.7
Argonne - East	to Portsmouth GDP	428	64.6	30.5	4.9
Bettis Atomic	to Portsmouth GDP	265	58.8	37.4	3.8
Fermilab (FNAL)	to Portsmouth GDP	460	62.5	32.0	5.5
ITRI	to Los Alamos NL	111	76.8	18.9	4.2
Knolls Atomic	to Portsmouth GDP	688	57.3	40.1	2.5
Kansas City Plant	to Paducah GDP	441	77.5	19.6	2.9
Lawrence Berkeley	to Lawrence Livermore	45	38.4	33.3	28.2
Mound Plant	to Portsmouth GDP	152	55.8	38.7	5.5
ORISE	to Oak Ridge Reserv.	10	58.8	41.2	0.0
Princeton PPL	to Portsmouth GDP	588	55.1	38.8	6.1
Pinellas Plant	to Savannah River	620	71.9	25.8	2.2
Reactive Metals	to Portsmouth GDP	276	59.5	37.8	2.8
SLAC	to Lawrence Livermore	64	25.2	33.1	41.7
SNL - Albuquerque	to Los Alamos NL	102	75.8	20.1	4.1
Rail					
Ames Laboratory	to Portsmouth GDP	727	68.6	23.8	7.7
Argonne - East	to Portsmouth GDP	422	64.8	30.0	5.1
Bettis Atomic	to Portsmouth GDP	429	52.6	39.6	7.8
Fermilab (FNAL)	to Portsmouth GDP	451	61.5	28.9	9.5
ITRI	to Los Alamos NL	104	74.3	20.0	5.7
Knolls Atomic	to Portsmouth GDP	681	52.1	40.3	7.5
Kansas City Plant	to Paducah GDP	482	75.0	20.3	4.8
Lawrence Berkeley	to Lawrence Livermore	46	39.0	34.5	26.5
Mound Plant	to Portsmouth GDP	156	53.2	38.0	8.8
ORISE	to Oak Ridge Reserv.	40	65.8	33.4	0.8
Princeton PPL	to Portsmouth GDP	838	58.3	32.6	9.1
Pinellas Plant	to Savannah River	485	72.2	25.0	2.8
Reactive Metals	to Portsmouth GDP	279	48.4	41.8	9.8
SLAC	to Lawrence Livermore	60	45.3	37.8	16.8
SNL - Albuquerque	to Los Alamos NL	104	74.3	20.0	5.7

Table 2. Annual Number of Shipments and One-Way Shipment Distances

Route		# of Shipments		Total Mileage(mi)	
		Truck	Rail	Truck	Rail
Ames Laboratory	to Portsmouth GDP	2	1	1.51E+03	7.27E+02
Argonne - East	to Portsmouth GDP	105	39	4.50E+04	1.65E+04
Bettis Atomic	to Portsmouth GDP	57	21	1.51E+04	9.01E+03
Fermilab (FNAL)	to Portsmouth GDP	3	2	1.38E+03	9.02E+02
ITRI	to Los Alamos NL	10	4	1.11E+03	4.16E+02
Knolls Atomic	to Portsmouth GDP	28	11	1.93E+04	7.50E+03
Kansas City Plant	to Paducah GDP	1	1	4.41E+02	4.82E+02
Lawrence Berkeley	to Lawrence Livermore	3	2	1.35E+02	9.22E+01
Mound Plant	to Portsmouth GDP	512	190	7.79E+04	2.97E+04
ORISE	to Oak Ridge Reserv.	5	2	5.10E+01	7.90E+01
Princeton PPL	to Portsmouth GDP	1	1	5.88E+02	8.38E+02
Pinellas Plant	to Savannah River	2	1	1.24E+03	4.85E+02
Reactive Metals	to Portsmouth GDP	768	287	2.12E+05	8.01E+04
SLAC	to Lawrence Livermore	39	15	2.50E+03	9.00E+02
SNL - Albuquerque	to Los Alamos NL	17	7	1.73E+03	7.28E+02
Totals		1553	584	3.80E+05	1.48E+05

Table 3. Incident-Free Dose per Shipment (person-rem/shipment)

Source/Route(s)	Crew	General Public			
		Off-Link	On-Link	Stops	Total
LLW(x) AL to PO					
Ames Laboratory	to Portsmouth GDP				
	Truck	2.33E-02	1.86E-03	3.31E-03	2.11E-02	2.63E-02
	Rail	5.91E-03	1.42E-02	2.00E-04	5.72E-03	2.01E-02
LLW(x) AN to PO					
Argonne - East	to Portsmouth GDP				
	Truck	1.53E-02	2.05E-03	2.99E-03	1.20E-02	1.70E-02
	Rail	4.64E-03	6.76E-03	1.14E-04	4.78E-03	1.17E-02
LLW(x) BA to PO					
Bettis Atomic	to Portsmouth GDP				
	Truck	9.78E-03	1.26E-03	1.73E-03	7.42E-03	1.04E-02
	Rail	4.67E-03	9.85E-03	1.53E-04	4.80E-03	1.48E-02
LLW(x) FL to PO					
Fermilab (FNAL)	to Portsmouth GDP				
	Truck	1.68E-02	2.40E-03	3.43E-03	1.29E-02	1.87E-02
	Rail	4.76E-03	1.08E-02	1.48E-04	4.87E-03	1.58E-02
LLW(x) IT to LA					
ITRI	to Los Alamos NL				
	Truck	3.54E-03	4.00E-04	6.71E-04	3.11E-03	4.18E-03
	Rail	3.31E-03	1.55E-03	2.36E-05	3.80E-03	5.37E-03
LLW(x) KA to PO					
Knolls Atomic	to Portsmouth GDP				
	Truck	2.54E-02	2.99E-03	4.01E-03	1.93E-02	2.63E-02
	Rail	5.72E-03	1.54E-02	2.43E-04	5.58E-03	2.13E-02
LLW(x) KC to PA					
Kansas City Plant	to Paducah GDP				
	Truck	1.38E-02	1.32E-03	2.28E-03	1.23E-02	1.59E-02
	Rail	4.89E-03	6.38E-03	1.03E-04	4.96E-03	1.14E-02
LLW(x) LB to LL					
Lawrence Berkeley	to Lawrence Livermore				
	Truck	2.31E-03	7.51E-04	1.03E-03	1.26E-03	3.04E-03
	Rail	3.07E-03	2.62E-03	2.79E-05	3.62E-03	6.27E-03
LLW(x) MP to PO					
Mound Plant	to Portsmouth GDP				
	Truck	5.83E-03	8.71E-04	1.18E-03	4.26E-03	6.31E-03
	Rail	3.53E-03	3.82E-03	5.67E-05	3.96E-03	7.84E-03
LLW(x) OI to OR					
ORISE	to Oak Ridge Reserv.				
	Truck	3.63E-04	3.21E-05	4.23E-05	2.86E-04	3.60E-04
	Rail	3.05E-03	3.36E-04	8.77E-06	3.60E-03	3.95E-03
LLW(x) PR to PO					
Princeton PPL	to Portsmouth GDP				
	Truck	2.28E-02	3.55E-03	4.81E-03	1.65E-02	2.48E-02
	Rail	6.38E-03	2.00E-02	2.85E-04	6.06E-03	2.64E-02
LLW(x) PI to SR					
Pinellas Plant	to Savannah River				
	Truck	2.02E-02	1.94E-03	3.10E-03	1.74E-02	2.24E-02
	Rail	4.90E-03	5.13E-03	1.02E-04	4.97E-03	1.02E-02
LLW(x) RM to PO					
Reactive Metals	to Portsmouth GDP				
	Truck	1.00E-02	1.18E-03	1.62E-03	7.73E-03	1.05E-02
	Rail	4.05E-03	7.58E-03	1.11E-04	4.34E-03	1.20E-02
LLW(x) ST to LL					
SLAC	to Lawrence Livermore				
	Truck	3.82E-03	1.50E-03	2.05E-03	1.79E-03	5.35E-03
	Rail	3.13E-03	2.37E-03	2.89E-05	3.66E-03	6.07E-03
LLW(x) SA to LA					
SNL - Albuquerque	to Los Alamos NL				
	Truck	3.28E-03	3.70E-04	6.13E-04	2.86E-03	3.84E-03
	Rail	3.31E-03	1.55E-03	2.36E-05	3.80E-03	5.37E-03

Table 4. Accident Dose Risk per Shipment (person-rem/shipment)

Source/Route		Truck	Rail
LLW(x) AL to PO Ames Laboratory	to Portsmouth GDP	7.75E-06	6.47E-06
LLW(x) AN to PO Argonne - East	to Portsmouth GDP	3.45E-04	1.88E-04
LLW(x) BA to PO Bettis Atomic	to Portsmouth GDP	6.25E-06	6.87E-06
LLW(x) FL to PO Fermilab (FNAL)	to Portsmouth GDP	2.43E-05	9.49E-06
LLW(x) IT to LA ITRI	to Los Alamos NL	1.53E-03	7.01E-05
LLW(x) KA to PO Knolls Atomic	to Portsmouth GDP	2.39E-06	1.42E-06
LLW(x) KC to PA Kansas City Plant	to Paducah GDP	2.31E-05	6.16E-06
LLW(x) LB to LL Lawrence Berkeley	to Lawrence Livermore	3.75E-03	4.02E-03
LLW(x) MP to PO Mound Plant	to Portsmouth GDP	4.67E-07	3.08E-07
LLW(x) OI to OR ORISE	to Oak Ridge Reserv.	4.49E-08	3.15E-08
LLW(x) PR to PO Princeton PPL	to Portsmouth GDP	4.70E-06	2.47E-06
LLW(x) PI to SR Pinellas Plant	to Savannah River	1.30E-06	4.65E-07
LLW(x) RM to PO Reactive Metals	to Portsmouth GDP	2.26E-09	1.74E-09
LLW(x) ST to LL SLAC	to Lawrence Livermore	4.86E-08	5.69E-08
LLW(x) SA to LA SNL - Albuquerque	to Los Alamos NL	5.39E-06	2.50E-07

Table 5. Nonradiological Risk Factors per Shipment (fatalities/shipment)

Mode	Route	Emission	Accident
Truck			
Ames Laboratory	to Portsmouth GDP	4.02E-06	4.11E-05
Argonne - East	to Portsmouth GDP	6.73E-06	2.60E-05
Bettis Atomic	to Portsmouth GDP	3.22E-06	1.33E-05
Fermilab (FNAL)	to Portsmouth GDP	8.11E-06	3.01E-05
ITRI	to Los Alamos NL	1.51E-06	1.28E-05
Knolls Atomic	to Portsmouth GDP	5.63E-06	3.56E-05
Kansas City Plant	to Paducah GDP	4.12E-06	2.89E-05
Lawrence Berkeley	to Lawrence Livermore	4.09E-06	2.66E-06
Mound Plant	to Portsmouth GDP	2.70E-06	6.66E-06
ORISE	to Oak Ridge Reserv.	0.00E+00	1.07E-06
Princeton PPL	to Portsmouth GDP	1.16E-05	3.99E-05
Pinellas Plant	to Savannah River	4.47E-06	4.70E-05
Reactive Metals	to Portsmouth GDP	2.45E-06	1.21E-05
SLAC	to Lawrence Livermore	8.59E-06	3.47E-06
SNL - Albuquerque	to Los Alamos NL	1.35E-06	1.20E-05
Rail			
Ames Laboratory	to Portsmouth GDP	2.34E-05	1.52E-06
Argonne - East	to Portsmouth GDP	9.08E-06	8.84E-07
Bettis Atomic	to Portsmouth GDP	1.40E-05	8.98E-07
Fermilab (FNAL)	to Portsmouth GDP	1.80E-05	9.43E-07
ITRI	to Los Alamos NL	2.47E-06	2.18E-07
Knolls Atomic	to Portsmouth GDP	2.15E-05	1.43E-06
Kansas City Plant	to Paducah GDP	9.58E-06	1.01E-06
Lawrence Berkeley	to Lawrence Livermore	5.10E-06	9.64E-08
Mound Plant	to Portsmouth GDP	5.73E-06	3.27E-07
ORISE	to Oak Ridge Reserv.	1.26E-07	8.26E-08
Princeton PPL	to Portsmouth GDP	3.18E-05	1.75E-06
Pinellas Plant	to Savannah River	5.69E-06	1.01E-06
Reactive Metals	to Portsmouth GDP	1.14E-05	5.84E-07
SLAC	to Lawrence Livermore	4.23E-06	1.26E-07
SNL - Albuquerque	to Los Alamos NL	2.47E-06	2.18E-07

Table 6. Annual Incident-Free Dose for the Shipping Campaign (person-rem/yr)

Route		Truck		Rail	
		Crew	Public	Crew	Public
Ames Laboratory	to Portsmouth GDP	4.66E-02	5.26E-02	5.91E-03	2.01E-02
Argonne - East	to Portsmouth GDP	1.60E+00	1.79E+00	1.81E-01	4.55E-01
Bettis Atomic	to Portsmouth GDP	5.57E-01	5.94E-01	9.81E-02	3.11E-01
Fermilab (FNAL)	to Portsmouth GDP	5.03E-02	5.61E-02	9.53E-03	3.17E-02
ITRI	to Los Alamos NL	3.54E-02	4.18E-02	1.33E-02	2.15E-02
Knolls Atomic	to Portsmouth GDP	7.10E-01	7.35E-01	6.30E-02	2.34E-01
Kansas City Plant	to Paducah GDP	1.38E-02	1.59E-02	4.89E-03	1.14E-02
Lawrence Berkeley	to Lawrence Livermore	6.92E-03	9.13E-03	6.15E-03	1.25E-02
Mound Plant	to Portsmouth GDP	2.99E+00	3.23E+00	6.71E-01	1.49E+00
ORISE	to Oak Ridge Reserv.	1.81E-03	1.80E-03	6.09E-03	7.89E-03
Princeton PPL	to Portsmouth GDP	2.28E-02	2.48E-02	6.38E-03	2.64E-02
Pinellas Plant	to Savannah River	4.04E-02	4.48E-02	4.90E-03	1.02E-02
Reactive Metals	to Portsmouth GDP	7.71E+00	8.08E+00	1.16E+00	3.45E+00
SLAC	to Lawrence Livermore	1.49E-01	2.09E-01	4.70E-02	9.10E-02
SNL - Albuquerque	to Los Alamos NL	5.58E-02	6.53E-02	2.32E-02	3.76E-02
Totals		1.40E+01	1.50E+01	2.30E+00	6.21E+00

Table 7. Annual Accident Dose Risk for the Shipping Campaign (person-rem/yr)

Route		Truck	Rail
Ames Laboratory	to Portsmouth GDP	1.55E-05	6.47E-06
Argonne - East	to Portsmouth GDP	3.62E-02	7.34E-03
Bettis Atomic	to Portsmouth GDP	3.56E-04	1.44E-04
Fermilab (FNAL)	to Portsmouth GDP	7.30E-05	1.90E-05
ITRI	to Los Alamos NL	1.53E-02	2.80E-04
Knolls Atomic	to Portsmouth GDP	6.69E-05	1.56E-05
Kansas City Plant	to Paducah GDP	2.31E-05	6.16E-06
Lawrence Berkeley	to Lawrence Livermore	1.13E-02	8.05E-03
Mound Plant	to Portsmouth GDP	2.39E-04	5.86E-05
ORISE	to Oak Ridge Reserv.	2.24E-07	6.30E-08
Princeton PPL	to Portsmouth GDP	4.70E-06	2.47E-06
Pinellas Plant	to Savannah River	2.59E-06	4.65E-07
Reactive Metals	to Portsmouth GDP	1.73E-06	5.00E-07
SLAC	to Lawrence Livermore	1.89E-06	8.53E-07
SNL - Albuquerque	to Los Alamos NL	9.16E-05	1.75E-06
Totals		6.36E-02	1.59E-02

Table 8. Expected Annual Fatalities for the Shipping Campaign

Exposure Group	Truck	Rail
Radiological		
Normal Crew	5.6E-03	9.2E-04
Normal Public	7.5E-03	3.1E-03
Accident Public	3.2E-05	8.0E-06
Nonradiological		
Emission	4.8E-03	5.5E-03
Accident	1.8E-02	3.1E-04

Table 9. Expected Annual Cancer Incidence for the Shipping Campaign

Exposure Group	Truck	Rail
Radiological		
Normal Crew	2.0E-02	3.2E-03
Normal Public	2.5E-02	1.1E-02
Accident Public	1.1E-04	2.7E-05
Nonradiological		
Emission	4.8E-03	5.5E-03
Accident	NA	NA

Table 10. Expected Annual Genetic Effects for the Shipping Campaign

Exposure Group	Truck	Rail
Radiological		
Normal Crew	8.4E-04	1.4E-04
Normal Public	1.5E-03	6.2E-04
Accident Public	3.1E-06	6.8E-07
Nonradiological		
Emission	NA	NA
Accident	NA	NA

B.6 WM LLW REGIONALIZED 1 ALTERNATIVE (CASE 3): ACTIVATED METALS

Table 1. Summary of Route Information

Route		Distance (miles)	Percentage in Zone		
			Rural	Suburban	Urban
Truck					
Bettis Atomic	to Portsmouth GDP	265	58.8	37.4	3.8
Fermilab (FNAL)	to Portsmouth GDP	460	62.5	32.0	5.5
Knolls Atomic	to Portsmouth GDP	688	57.3	40.1	2.5
Lawrence Berkeley	to Lawrence Livermore	45	38.4	33.3	28.2
SNL - Albuquerque	to Los Alamos NL	102	75.8	20.1	4.1
Rail					
Bettis Atomic	to Portsmouth GDP	429	52.6	39.6	7.8
Fermilab (FNAL)	to Portsmouth GDP	451	61.5	28.9	9.5
Knolls Atomic	to Portsmouth GDP	681	52.1	40.3	7.5
Lawrence Berkeley	to Lawrence Livermore	46	39.0	34.5	26.5
SNL - Albuquerque	to Los Alamos NL	104	74.3	20.0	5.7

Table 2. Annual Number of Shipments and One-Way Shipment Distances

Route		# of Shipments		Total Mileage(mi)	
		Truck	Rail	Truck	Rail
Bettis Atomic	to Portsmouth GDP	316	120	8.37E+04	5.15E+04
Fermilab (FNAL)	to Portsmouth GDP	40	15	1.84E+04	6.76E+03
Knolls Atomic	to Portsmouth GDP	650	246	4.47E+05	1.68E+05
Lawrence Berkeley	to Lawrence Livermore	15	6	6.75E+02	2.77E+02
SNL - Albuquerque	to Los Alamos NL	6	3	6.12E+02	3.12E+02
Totals		1027	390	5.51E+05	2.26E+05

Table 3. Incident-Free Dose per Shipment (person-rem/shipment)

Source/Route(s)		Crew	General Public			
			Off-Link	On-Link	Stops	Total
LLW(I) BA to PO						
Bettis Atomic	to Portsmouth GDP					
	Truck	9.78E-03	1.26E-03	1.73E-03	7.42E-03	1.04E-02
	Rail	4.67E-03	9.85E-03	1.53E-04	4.80E-03	1.48E-02
LLW(I) FL to PO						
Fermilab (FNAL)	to Portsmouth GDP					
	Truck	1.68E-02	2.40E-03	3.43E-03	1.29E-02	1.87E-02
	Rail	4.76E-03	1.08E-02	1.48E-04	4.87E-03	1.58E-02
LLW(I) KA to PO						
Knolls Atomic	to Portsmouth GDP					
	Truck	2.54E-02	2.99E-03	4.01E-03	1.93E-02	2.63E-02
	Rail	5.72E-03	1.54E-02	2.43E-04	5.58E-03	2.13E-02
LLW(I) LB to LL						
Lawrence Berkeley	to Lawrence Livermore					
	Truck	2.31E-03	7.51E-04	1.03E-03	1.26E-03	3.04E-03
	Rail	3.07E-03	2.62E-03	2.79E-05	3.62E-03	6.27E-03
LLW(I) SA to LA						
SNL - Albuquerque	to Los Alamos NL					
	Truck	3.28E-03	3.70E-04	6.13E-04	2.86E-03	3.84E-03
	Rail	3.31E-03	1.55E-03	2.36E-05	3.80E-03	5.37E-03

Table 4. Accident Dose Risk per Shipment (person-rem/shipment)

Source/Route		Truck	Rail
LLW(I) BA to PO Bettis Atomic	to Portsmouth GDP	3.62E-07	4.12E-07
LLW(I) FL to PO Fermilab (FNAL)	to Portsmouth GDP	5.17E-11	3.57E-11
LLW(I) KA to PO Knolls Atomic	to Portsmouth GDP	1.63E-06	1.01E-06
LLW(I) LB to LL Lawrence Berkeley	to Lawrence Livermore	1.27E-11	2.29E-11
LLW(I) SA to LA SNL - Albuquerque	to Los Alamos NL	1.72E-12	6.51E-14

Table 5. Nonradiological Risk Factors per Shipment (fatalities/shipment)

Mode	Route	Emission	Accident
Truck			
Bettis Atomic	to Portsmouth GDP	3.22E-06	1.33E-05
Fermilab (FNAL)	to Portsmouth GDP	8.11E-06	3.01E-05
Knolls Atomic	to Portsmouth GDP	5.63E-06	3.56E-05
Lawrence Berkeley	to Lawrence Livermore	4.09E-06	2.66E-06
SNL - Albuquerque	to Los Alamos NL	1.35E-06	1.20E-05
Rail			
Bettis Atomic	to Portsmouth GDP	1.40E-05	8.98E-07
Fermilab (FNAL)	to Portsmouth GDP	1.80E-05	9.43E-07
Knolls Atomic	to Portsmouth GDP	2.15E-05	1.43E-06
Lawrence Berkeley	to Lawrence Livermore	5.10E-06	9.64E-08
SNL - Albuquerque	to Los Alamos NL	2.47E-06	2.18E-07

Table 6. Annual Incident-Free Dose for the Shipping Campaign (person-rem/yr)

Route		Truck		Rail	
		Crew	Public	Crew	Public
Bettis Atomic	to Portsmouth GDP	3.09E+00	3.29E+00	5.61E-01	1.78E+00
Fermilab (FNAL)	to Portsmouth GDP	6.70E-01	7.48E-01	7.14E-02	2.37E-01
Knolls Atomic	to Portsmouth GDP	1.65E+01	1.71E+01	1.41E+00	5.23E+00
Lawrence Berkeley	to Lawrence Livermore	3.46E-02	4.57E-02	1.84E-02	3.76E-02
SNL - Albuquerque	to Los Alamos NL	1.97E-02	2.30E-02	9.94E-03	1.61E-02
Totals		2.03E+01	2.12E+01	2.07E+00	7.30E+00

Table 7. Annual Accident Dose Risk for the Shipping Campaign (person-rem/yr)

Route		Truck	Rail
Bettis Atomic	to Portsmouth GDP	1.14E-04	4.94E-05
Fermilab (FNAL)	to Portsmouth GDP	2.07E-09	5.35E-10
Knolls Atomic	to Portsmouth GDP	1.06E-03	2.49E-04
Lawrence Berkeley	to Lawrence Livermore	1.90E-10	1.37E-10
SNL - Albuquerque	to Los Alamos NL	1.03E-11	1.95E-13
Totals		1.17E-03	2.98E-04

Table 8. Expected Annual Fatalities for the Shipping Campaign

Exposure Group	Truck	Rail
Radiological		
Normal Crew	8.1E-03	8.3E-04
Normal Public	1.1E-02	3.6E-03
Accident Public	5.9E-07	1.5E-07
Nonradiological		
Emission	5.1E-03	7.3E-03
Accident	2.9E-02	4.7E-04

Table 9. Expected Annual Cancer Incidence for the Shipping Campaign

Exposure Group	Truck	Rail
Radiological		
Normal Crew	2.8E-02	2.9E-03
Normal Public	3.6E-02	1.2E-02
Accident Public	2.0E-06	5.1E-07
Nonradiological		
Emission	5.1E-03	7.3E-03
Accident	NA	NA

Table 10. Expected Annual Genetic Effects for the Shipping Campaign

Exposure Group	Truck	Rail
Radiological		
Normal Crew	1.2E-03	1.2E-04
Normal Public	2.1E-03	7.3E-04
Accident Public	1.2E-07	3.0E-08
Nonradiological		
Emission	NA	NA
Accident	NA	NA

B.7 WM LLW REGIONALIZED 2 ALTERNATIVE (CASE 9): HETEROGENEOUS SOLIDS

Table 1. Summary of Route Information

Route		Distance (miles)	Percentage in Zone		
			Rural	Suburban	Urban
Truck					
Ames Laboratory	to Fernald (FEMP)	611	80.0	19.1	0.9
Ames Laboratory	to Portsmouth GDP	755	77.4	21.0	1.7
Argonne - East	to Portsmouth GDP	428	64.6	30.5	4.9
Bettis Atomic	to Portsmouth GDP	265	58.8	37.4	3.8
Fernald (FEMP)	to Portsmouth GDP	173	68.0	31.6	0.3
Fermilab (FNAL)	to Fernald (FEMP)	326	59.3	34.8	5.9
Fermilab (FNAL)	to Portsmouth GDP	460	62.5	32.0	5.5
ITRI	to Los Alamos NL	111	76.8	18.9	4.2
Knolls Atomic	to Portsmouth GDP	688	57.3	40.1	2.5
Kansas City Plant	to Paducah GDP	441	77.5	19.6	2.9
Lawrence Berkeley	to Lawrence Livermore	45	38.4	33.3	28.2
Mound Plant	to Fernald (FEMP)	49	24.3	72.2	3.5
Mound Plant	to Portsmouth GDP	152	55.8	38.7	5.5
ORISE	to Oak Ridge Reserv.	10	58.8	41.2	0.0
Princeton PPL	to Portsmouth GDP	588	55.1	38.8	6.1
Pinellas Plant	to Savannah River	620	71.9	25.8	2.2
Reactive Metals	to Portsmouth GDP	276	59.5	37.8	2.8
SLAC	to Lawrence Livermore	64	25.2	33.1	41.7
SNL - Albuquerque	to Los Alamos NL	102	75.8	20.1	4.1
Rail					
Ames Laboratory	to Fernald (FEMP)	717	65.3	26.3	8.4
Ames Laboratory	to Portsmouth GDP	727	68.6	23.8	7.7
Argonne - East	to Portsmouth GDP	422	64.8	30.0	5.1
Bettis Atomic	to Portsmouth GDP	429	52.6	39.6	7.8
Fernald (FEMP)	to Portsmouth GDP	207	69.6	26.5	4.0
Fermilab (FNAL)	to Fernald (FEMP)	441	56.1	33.1	10.8
Fermilab (FNAL)	to Portsmouth GDP	451	61.5	28.9	9.5
ITRI	to Los Alamos NL	104	74.3	20.0	5.7
Knolls Atomic	to Portsmouth GDP	681	52.1	40.3	7.5
Kansas City Plant	to Paducah GDP	482	75.0	20.3	4.8
Lawrence Berkeley	to Lawrence Livermore	46	39.0	34.5	26.5
Mound Plant	to Fernald (FEMP)	69	53.2	36.4	10.4
Mound Plant	to Portsmouth GDP	156	53.2	38.0	8.8
ORISE	to Oak Ridge Reserv.	40	65.8	33.4	0.8
Princeton PPL	to Portsmouth GDP	838	58.3	32.6	9.1
Pinellas Plant	to Savannah River	485	72.2	25.0	2.8
Reactive Metals	to Portsmouth GDP	279	48.4	41.8	9.8
SLAC	to Lawrence Livermore	60	45.3	37.8	16.8
SNL - Albuquerque	to Los Alamos NL	104	74.3	20.0	5.7

Table 2. Annual Number of Shipments and One-Way Shipment Distances

Route		# of Shipments		Total Mileage(mi)	
		Truck	Rail	Truck	Rail
Ames Laboratory	to Fernald (FEMP)	1	1	6.11E+02	7.17E+02
Ames Laboratory	to Portsmouth GDP	2	1	1.51E+03	7.27E+02
Argonne - East	to Portsmouth GDP	105	39	4.50E+04	1.65E+04
Bettis Atomic	to Portsmouth GDP	57	21	1.51E+04	9.01E+03
Fernald (FEMP)	to Portsmouth GDP	7	3	1.21E+03	6.22E+02
Fermilab (FNAL)	to Fernald (FEMP)	1	1	3.26E+02	4.41E+02
Fermilab (FNAL)	to Portsmouth GDP	2	1	9.20E+02	4.51E+02
ITRI	to Los Alamos NL	10	4	1.11E+03	4.16E+02
Knolls Atomic	to Portsmouth GDP	28	11	1.93E+04	7.50E+03
Kansas City Plant	to Paducah GDP	1	1	4.41E+02	4.82E+02
Lawrence Berkeley	to Lawrence Livermore	3	2	1.35E+02	9.22E+01
Mound Plant	to Fernald (FEMP)	12	5	5.88E+02	3.45E+02
Mound Plant	to Portsmouth GDP	496	186	7.54E+04	2.90E+04
ORISE	to Oak Ridge Reserv.	5	2	5.10E+01	7.90E+01
Princeton PPL	to Portsmouth GDP	1	1	5.88E+02	8.38E+02
Pinellas Plant	to Savannah River	2	1	1.24E+03	4.85E+02
Reactive Metals	to Portsmouth GDP	761	285	2.10E+05	7.95E+04
SLAC	to Lawrence Livermore	39	15	2.50E+03	9.00E+02
SNL - Albuquerque	to Los Alamos NL	17	7	1.73E+03	7.28E+02
Totals		1550	587	3.78E+05	1.49E+05

Table 3. Incident-Free Dose per Shipment (person-rem/shipment)

Source/Route(s)		Crew	General Public			
			Off-Link	On-Link	Stops	Total
LLW(x) AL to FE						
Ames Laboratory	to Fernald (FEMP)					
		Truck	1.82E-02	1.19E-03	2.31E-03	1.71E-02	2.06E-02
		Rail	5.87E-03	1.53E-02	2.14E-04	5.69E-03	2.12E-02
LLW(x) AL to PO						
Ames Laboratory	to Portsmouth GDP					
		Truck	2.33E-02	1.86E-03	3.31E-03	2.11E-02	2.63E-02
		Rail	5.91E-03	1.42E-02	2.00E-04	5.72E-03	2.01E-02
LLW(x) AN to PO						
Argonne - East	to Portsmouth GDP					
		Truck	1.53E-02	2.05E-03	2.99E-03	1.20E-02	1.70E-02
		Rail	4.64E-03	6.76E-03	1.14E-04	4.78E-03	1.17E-02
LLW(x) BA to PO						
Bettis Atomic	to Portsmouth GDP					
		Truck	9.78E-03	1.26E-03	1.73E-03	7.42E-03	1.04E-02
		Rail	4.67E-03	9.85E-03	1.53E-04	4.80E-03	1.48E-02
LLW(x) FE to PO						
Fernald (FEMP)	to Portsmouth GDP					
		Truck	5.72E-03	4.51E-04	6.85E-04	4.84E-03	5.98E-03
		Rail	3.75E-03	2.71E-03	4.86E-05	4.12E-03	6.87E-03
LLW(x) FL to FE						
Fermilab (FNAL)	to Fernald (FEMP)					
		Truck	1.22E-02	1.83E-03	2.56E-03	9.12E-03	1.35E-02
		Rail	4.72E-03	1.20E-02	1.62E-04	4.84E-03	1.70E-02
LLW(x) FL to PO						
Fermilab (FNAL)	to Portsmouth GDP					
		Truck	1.68E-02	2.40E-03	3.43E-03	1.29E-02	1.87E-02
		Rail	4.76E-03	1.08E-02	1.48E-04	4.87E-03	1.58E-02
LLW(x) IT to LA						
ITRI	to Los Alamos NL					
		Truck	3.54E-03	4.00E-04	6.71E-04	3.11E-03	4.18E-03
		Rail	3.31E-03	1.55E-03	2.36E-05	3.80E-03	5.37E-03
LLW(x) KA to PO						
Knolls Atomic	to Portsmouth GDP					
		Truck	2.54E-02	2.99E-03	4.01E-03	1.93E-02	2.63E-02
		Rail	5.72E-03	1.54E-02	2.43E-04	5.58E-03	2.13E-02
LLW(x) KC to PA						
Kansas City Plant	to Paducah GDP					
		Truck	1.38E-02	1.32E-03	2.28E-03	1.23E-02	1.59E-02
		Rail	4.89E-03	6.38E-03	1.03E-04	4.96E-03	1.14E-02
LLW(x) LB to LL						
Lawrence Berkeley	to Lawrence Livermore					
		Truck	2.31E-03	7.51E-04	1.03E-03	1.26E-03	3.04E-03
		Rail	3.07E-03	2.62E-03	2.79E-05	3.62E-03	6.27E-03
LLW(x) MP to FE						
Mound Plant	to Fernald (FEMP)					
		Truck	2.29E-03	3.54E-04	3.85E-04	1.37E-03	2.11E-03
		Rail	3.17E-03	1.88E-03	2.62E-05	3.69E-03	5.60E-03
LLW(x) MP to PO						
Mound Plant	to Portsmouth GDP					
		Truck	5.83E-03	8.71E-04	1.18E-03	4.26E-03	6.31E-03
		Rail	3.53E-03	3.82E-03	5.67E-05	3.96E-03	7.84E-03
LLW(x) OI to OR						
ORISE	to Oak Ridge Reserv.					
		Truck	3.63E-04	3.21E-05	4.23E-05	2.86E-04	3.60E-04
		Rail	3.05E-03	3.36E-04	8.77E-06	3.60E-03	3.95E-03
LLW(x) PR to PO						
Princeton PPL	to Portsmouth GDP					
		Truck	2.28E-02	3.55E-03	4.81E-03	1.65E-02	2.48E-02
		Rail	6.38E-03	2.00E-02	2.85E-04	6.06E-03	2.64E-02
LLW(x) PI to SR						
Pinellas Plant	to Savannah River					
		Truck	2.02E-02	1.94E-03	3.10E-03	1.74E-02	2.24E-02
		Rail	4.90E-03	5.13E-03	1.02E-04	4.97E-03	1.02E-02
LLW(x) RM to PO						
Reactive Metals	to Portsmouth GDP					
		Truck	1.00E-02	1.18E-03	1.62E-03	7.73E-03	1.05E-02
		Rail	4.05E-03	7.58E-03	1.11E-04	4.34E-03	1.20E-02
LLW(x) ST to LL						
SLAC	to Lawrence Livermore					
		Truck	3.82E-03	1.50E-03	2.05E-03	1.79E-03	5.35E-03
		Rail	3.13E-03	2.37E-03	2.89E-05	3.66E-03	6.07E-03
LLW(x) SA to LA						
SNL - Albuquerque	to Los Alamos NL					
		Truck	3.28E-03	3.70E-04	6.13E-04	2.86E-03	3.84E-03
		Rail	3.31E-03	1.55E-03	2.36E-05	3.80E-03	5.37E-03

Table 4. Accident Dose Risk per Shipment (person-rem/shipment)

Source/Route		Truck	Rail
LLW(x) AL to FE Ames Laboratory	to Fernald (FEMP)	8.59E-07	4.13E-07
LLW(x) AL to PO Ames Laboratory	to Portsmouth GDP	7.28E-06	6.06E-06
LLW(x) AN to PO Argonne - East	to Portsmouth GDP	3.45E-04	1.88E-04
LLW(x) BA to PO Bettis Atomic	to Portsmouth GDP	6.25E-06	6.87E-06
LLW(x) FE to PO Fernald (FEMP)	to Portsmouth GDP	2.24E-08	1.15E-08
LLW(x) FL to FE Fermilab (FNAL)	to Fernald (FEMP)	1.60E-11	5.07E-12
LLW(x) FL to PO Fermilab (FNAL)	to Portsmouth GDP	3.67E-05	1.89E-05
LLW(x) IT to LA ITRI	to Los Alamos NL	1.53E-03	7.01E-05
LLW(x) KA to PO Knolls Atomic	to Portsmouth GDP	2.39E-06	1.42E-06
LLW(x) KC to PA Kansas City Plant	to Paducah GDP	2.31E-05	6.16E-06
LLW(x) LB to LL Lawrence Berkeley	to Lawrence Livermore	3.75E-03	4.02E-03
LLW(x) MP to FE Mound Plant	to Fernald (FEMP)	3.56E-08	2.03E-08
LLW(x) MP to PO Mound Plant	to Portsmouth GDP	4.81E-07	3.13E-07
LLW(x) OI to OR ORISE	to Oak Ridge Reserv.	4.49E-08	3.15E-08
LLW(x) PR to PO Princeton PPL	to Portsmouth GDP	4.70E-06	2.47E-06
LLW(x) PI to SR Pinellas Plant	to Savannah River	1.30E-06	4.65E-07
LLW(x) RM to PO Reactive Metals	to Portsmouth GDP	2.28E-09	1.75E-09
LLW(x) ST to LL SLAC	to Lawrence Livermore	4.86E-08	5.69E-08
LLW(x) SA to LA SNL - Albuquerque	to Los Alamos NL	5.39E-06	2.50E-07

Table 5. Nonradiological Risk Factors per Shipment (fatalities/shipment)

Mode	Route	Emission	Accident
Truck			
Ames Laboratory	to Fernald (FEMP)	1.77E-06	3.47E-05
Ames Laboratory	to Portsmouth GDP	4.02E-06	4.11E-05
Argonne - East	to Portsmouth GDP	6.73E-06	2.60E-05
Bettis Atomic	to Portsmouth GDP	3.22E-06	1.33E-05
Fernald (FEMP)	to Portsmouth GDP	1.93E-07	7.51E-06
Fermilab (FNAL)	to Fernald (FEMP)	6.18E-06	2.47E-05
Fermilab (FNAL)	to Portsmouth GDP	8.11E-06	3.01E-05
ITRI	to Los Alamos NL	1.51E-06	1.28E-05
Knolls Atomic	to Portsmouth GDP	5.63E-06	3.56E-05
Kansas City Plant	to Paducah GDP	4.12E-06	2.89E-05
Lawrence Berkeley	to Lawrence Livermore	4.09E-06	2.66E-06
Mound Plant	to Fernald (FEMP)	5.47E-07	2.19E-06
Mound Plant	to Portsmouth GDP	2.70E-06	6.66E-06
ORISE	to Oak Ridge Reserv.	0.00E+00	1.07E-06
Princeton PPL	to Portsmouth GDP	1.16E-05	3.99E-05
Pinellas Plant	to Savannah River	4.47E-06	4.70E-05
Reactive Metals	to Portsmouth GDP	2.45E-06	1.21E-05
SLAC	to Lawrence Livermore	8.59E-06	3.47E-06
SNL - Albuquerque	to Los Alamos NL	1.35E-06	1.20E-05
Rail			
Ames Laboratory	to Fernald (FEMP)	2.53E-05	1.50E-06
Ames Laboratory	to Portsmouth GDP	2.34E-05	1.52E-06
Argonne - East	to Portsmouth GDP	9.08E-06	8.84E-07
Bettis Atomic	to Portsmouth GDP	1.40E-05	8.98E-07
Fernald (FEMP)	to Portsmouth GDP	3.43E-06	4.34E-07
Fermilab (FNAL)	to Fernald (FEMP)	1.98E-05	9.22E-07
Fermilab (FNAL)	to Portsmouth GDP	1.80E-05	9.43E-07
ITRI	to Los Alamos NL	2.47E-06	2.18E-07
Knolls Atomic	to Portsmouth GDP	2.15E-05	1.43E-06
Kansas City Plant	to Paducah GDP	9.58E-06	1.01E-06
Lawrence Berkeley	to Lawrence Livermore	5.10E-06	9.64E-08
Mound Plant	to Fernald (FEMP)	3.01E-06	1.44E-07
Mound Plant	to Portsmouth GDP	5.73E-06	3.27E-07
ORISE	to Oak Ridge Reserv.	1.26E-07	8.26E-08
Princeton PPL	to Portsmouth GDP	3.18E-05	1.75E-06
Pinellas Plant	to Savannah River	5.69E-06	1.01E-06
Reactive Metals	to Portsmouth GDP	1.14E-05	5.84E-07
SLAC	to Lawrence Livermore	4.23E-06	1.26E-07
SNL - Albuquerque	to Los Alamos NL	2.47E-06	2.18E-07

Table 6. Annual Incident-Free Dose for the Shipping Campaign (person-rem/yr)

Route		Truck		Rail	
		Crew	Public	Crew	Public
Ames Laboratory	to Fernald (FEMP)	1.82E-02	2.06E-02	5.87E-03	2.12E-02
Ames Laboratory	to Portsmouth GDP	4.66E-02	5.26E-02	5.91E-03	2.01E-02
Argonne - East	to Portsmouth GDP	1.60E+00	1.79E+00	1.81E-01	4.55E-01
Bettis Atomic	to Portsmouth GDP	5.57E-01	5.94E-01	9.81E-02	3.11E-01
Fernald (FEMP)	to Portsmouth GDP	4.00E-02	4.18E-02	1.12E-02	2.06E-02
Fermilab (FNAL)	to Fernald (FEMP)	1.22E-02	1.35E-02	4.72E-03	1.70E-02
Fermilab (FNAL)	to Portsmouth GDP	3.35E-02	3.74E-02	4.76E-03	1.58E-02
ITRI	to Los Alamos NL	3.54E-02	4.18E-02	1.33E-02	2.15E-02
Knolls Atomic	to Portsmouth GDP	7.10E-01	7.35E-01	6.30E-02	2.34E-01
Kansas City Plant	to Paducah GDP	1.38E-02	1.59E-02	4.89E-03	1.14E-02
Lawrence Berkeley	to Lawrence Livermore	6.92E-03	9.13E-03	6.15E-03	1.25E-02
Mound Plant	to Fernald (FEMP)	2.74E-02	2.53E-02	1.58E-02	2.80E-02
Mound Plant	to Portsmouth GDP	2.89E+00	3.13E+00	6.57E-01	1.46E+00
ORISE	to Oak Ridge Reserv.	1.81E-03	1.80E-03	6.09E-03	7.89E-03
Princeton PPL	to Portsmouth GDP	2.28E-02	2.48E-02	6.38E-03	2.64E-02
Pinellas Plant	to Savannah River	4.04E-02	4.48E-02	4.90E-03	1.02E-02
Reactive Metals	to Portsmouth GDP	7.64E+00	8.01E+00	1.15E+00	3.43E+00
SLAC	to Lawrence Livermore	1.49E-01	2.09E-01	4.70E-02	9.10E-02
SNL - Albuquerque	to Los Alamos NL	5.58E-02	6.53E-02	2.32E-02	3.76E-02
Totals		1.39E+01	1.49E+01	2.31E+00	6.23E+00

Table 7. Annual Accident Dose Risk for the Shipping Campaign (person-rem/yr)

Route		Truck	Rail
Ames Laboratory	to Fernald (FEMP)	8.59E-07	4.13E-07
Ames Laboratory	to Portsmouth GDP	1.46E-05	6.06E-06
Argonne - East	to Portsmouth GDP	3.62E-02	7.34E-03
Bettis Atomic	to Portsmouth GDP	3.56E-04	1.44E-04
Fernald (FEMP)	to Portsmouth GDP	1.57E-07	3.45E-08
Fermilab (FNAL)	to Fernald (FEMP)	1.60E-11	5.07E-12
Fermilab (FNAL)	to Portsmouth GDP	7.34E-05	1.89E-05
ITRI	to Los Alamos NL	1.53E-02	2.80E-04
Knolls Atomic	to Portsmouth GDP	6.69E-05	1.56E-05
Kansas City Plant	to Paducah GDP	2.31E-05	6.16E-06
Lawrence Berkeley	to Lawrence Livermore	1.13E-02	8.05E-03
Mound Plant	to Fernald (FEMP)	4.27E-07	1.02E-07
Mound Plant	to Portsmouth GDP	2.39E-04	5.83E-05
ORISE	to Oak Ridge Reserv.	2.24E-07	6.30E-08
Princeton PPL	to Portsmouth GDP	4.70E-06	2.47E-06
Pinellas Plant	to Savannah River	2.59E-06	4.65E-07
Reactive Metals	to Portsmouth GDP	1.73E-06	5.00E-07
SLAC	to Lawrence Livermore	1.89E-06	8.53E-07
SNL - Albuquerque	to Los Alamos NL	9.16E-05	1.75E-06
Totals		6.36E-02	1.59E-02

Table 8. Expected Annual Fatalities for the Shipping Campaign

Exposure Group	Truck	Rail
Radiological		
Normal Crew	5.6E-03	9.2E-04
Normal Public	7.4E-03	3.1E-03
Accident Public	3.2E-05	8.0E-06
Nonradiological		
Emission	4.7E-03	5.5E-03
Accident	1.8E-02	3.1E-04

Table 9. Expected Annual Cancer Incidence for the Shipping Campaign

Exposure Group	Truck	Rail
Radiological		
Normal Crew	1.9E-02	3.2E-03
Normal Public	2.5E-02	1.1E-02
Accident Public	1.1E-04	2.7E-05
Nonradiological		
Emission	4.7E-03	5.5E-03
Accident	NA	NA

Table 10. Expected Annual Genetic Effects for the Shipping Campaign

Exposure Group	Truck	Rail
Radiological		
Normal Crew	8.3E-04	1.4E-04
Normal Public	1.5E-03	6.2E-04
Accident Public	3.1E-06	6.8E-07
Nonradiological		
Emission	NA	NA
Accident	NA	NA

B.8 WM LLW REGIONALIZED 2 ALTERNATIVE (CASE 9): ACTIVATED METALS

Table 1. Summary of Route Information

Route		Distance (miles)	Percentage in Zone		
			Rural	Suburban	Urban
Truck					
Bettis Atomic	to Portsmouth GDP	265	58.8	37.4	3.8
Fernald (FEMP)	to Portsmouth GDP	173	68.0	31.6	0.3
Fermilab (FNAL)	to Fernald (FEMP)	326	59.3	34.8	5.9
Knolls Atomic	to Portsmouth GDP	688	57.3	40.1	2.5
Lawrence Berkeley	to Lawrence Livermore	45	38.4	33.3	28.2
SNL - Albuquerque	to Los Alamos NL	102	75.8	20.1	4.1
Rail					
Bettis Atomic	to Portsmouth GDP	429	52.6	39.6	7.8
Fernald (FEMP)	to Portsmouth GDP	207	69.6	26.5	4.0
Fermilab (FNAL)	to Fernald (FEMP)	441	56.1	33.1	10.8
Knolls Atomic	to Portsmouth GDP	681	52.1	40.3	7.5
Lawrence Berkeley	to Lawrence Livermore	46	39.0	34.5	26.5
SNL - Albuquerque	to Los Alamos NL	104	74.3	20.0	5.7

Table 2. Annual Number of Shipments and One-Way Shipment Distances

Route		# of Shipments		Total Mileage (mi)	
		Truck	Rail	Truck	Rail
Bettis Atomic	to Portsmouth GDP	309	119	8.19E+04	5.11E+04
Fernald (FEMP)	to Portsmouth GDP	31	14	5.36E+03	2.90E+03
Fermilab (FNAL)	to Fernald (FEMP)	39	16	1.27E+04	7.05E+03
Knolls Atomic	to Portsmouth GDP	639	245	4.40E+05	1.67E+05
Lawrence Berkeley	to Lawrence Livermore	14	6	6.30E+02	2.77E+02
SNL - Albuquerque	to Los Alamos NL	6	3	6.12E+02	3.12E+02
Totals		1038	403	5.41E+05	2.29E+05

Table 3. Incident-Free Dose per Shipment (person-rem/shipment)

Source/Route(s)	Crew	General Public			
		Off-Link	On-Link	Stops	Total
LLW(I) BA to PO					
Bettis Atomic	to Portsmouth GDP				
	Truck	9.78E-03	1.26E-03	1.73E-03	7.42E-03	1.04E-02
	Rail	4.67E-03	9.85E-03	1.53E-04	4.80E-03	1.48E-02
LLW(I) FE to PO					
Fernald (FEMP)	to Portsmouth GDP				
	Truck	5.72E-03	4.51E-04	6.85E-04	4.84E-03	5.98E-03
	Rail	3.75E-03	2.71E-03	4.86E-05	4.12E-03	6.87E-03
LLW(I) FL to FE					
Fermilab (FNAL)	to Fernald (FEMP)				
	Truck	1.22E-02	1.83E-03	2.56E-03	9.12E-03	1.35E-02
	Rail	4.72E-03	1.20E-02	1.62E-04	4.84E-03	1.70E-02
LLW(I) KA to PO					
Knolls Atomic	to Portsmouth GDP				
	Truck	2.54E-02	2.99E-03	4.01E-03	1.93E-02	2.63E-02
	Rail	5.72E-03	1.54E-02	2.43E-04	5.58E-03	2.13E-02
LLW(I) LB to LL					
Lawrence Berkeley	to Lawrence Livermore				
	Truck	2.31E-03	7.51E-04	1.03E-03	1.26E-03	3.04E-03
	Rail	3.07E-03	2.62E-03	2.79E-05	3.62E-03	6.27E-03
LLW(I) SA to LA					
SNL - Albuquerque	to Los Alamos NL				
	Truck	3.28E-03	3.70E-04	6.13E-04	2.86E-03	3.84E-03
	Rail	3.31E-03	1.55E-03	2.36E-05	3.80E-03	5.37E-03

Table 4. Accident Dose Risk per Shipment (person-rem/shipment)

Source/Route		Truck	Rail
LLW(I) BA to PO Bettis Atomic	to Portsmouth GDP	3.70E-07	4.16E-07
LLW(I) FE to PO Fernald (FEMP)	to Portsmouth GDP	1.43E-11	7.55E-12
LLW(I) FL to FE Fermilab (FNAL)	to Fernald (FEMP)	4.58E-11	3.57E-11
LLW(I) KA to PO Knolls Atomic	to Portsmouth GDP	1.66E-06	1.02E-06
LLW(I) LB to LL Lawrence Berkeley	to Lawrence Livermore	1.36E-11	2.29E-11
LLW(I) SA to LA SNL - Albuquerque	to Los Alamos NL	1.72E-12	6.51E-14

Table 5. Nonradiological Risk Factors per Shipment (fatalities/shipment)

Mode	Route	Emission	Accident
Truck			
Bettis Atomic	to Portsmouth GDP	3.22E-06	1.33E-05
Fernald (FEMP)	to Portsmouth GDP	1.93E-07	7.51E-06
Fermilab (FNAL)	to Fernald (FEMP)	6.18E-06	2.47E-05
Knolls Atomic	to Portsmouth GDP	5.63E-06	3.56E-05
Lawrence Berkeley	to Lawrence Livermore	4.09E-06	2.66E-06
SNL - Albuquerque	to Los Alamos NL	1.35E-06	1.20E-05
Rail			
Bettis Atomic	to Portsmouth GDP	1.40E-05	8.98E-07
Fernald (FEMP)	to Portsmouth GDP	3.43E-06	4.34E-07
Fermilab (FNAL)	to Fernald (FEMP)	1.98E-05	9.22E-07
Knolls Atomic	to Portsmouth GDP	2.15E-05	1.43E-06
Lawrence Berkeley	to Lawrence Livermore	5.10E-06	9.64E-08
SNL - Albuquerque	to Los Alamos NL	2.47E-06	2.18E-07

Table 6. Annual Incident-Free Dose for the Shipping Campaign (person-rem/yr)

Route		Truck		Rail	
		Crew	Public	Crew	Public
Bettis Atomic	to Portsmouth GDP	3.02E+00	3.22E+00	5.56E-01	1.76E+00
Fernald (FEMP)	to Portsmouth GDP	1.77E-01	1.85E-01	5.25E-02	9.62E-02
Fermilab (FNAL)	to Fernald (FEMP)	4.76E-01	5.27E-01	7.55E-02	2.72E-01
Knolls Atomic	to Portsmouth GDP	1.62E+01	1.68E+01	1.40E+00	5.21E+00
Lawrence Berkeley	to Lawrence Livermore	3.23E-02	4.26E-02	1.84E-02	3.76E-02
SNL - Albuquerque	to Los Alamos NL	1.97E-02	2.30E-02	9.94E-03	1.61E-02
Totals		1.99E+01	2.08E+01	2.11E+00	7.39E+00

Table 7. Annual Accident Dose Risk for the Shipping Campaign (person-rem/yr)

Route		Truck	Rail
Bettis Atomic	to Portsmouth GDP	1.14E-04	4.95E-05
Fernald (FEMP)	to Portsmouth GDP	4.43E-10	1.06E-10
Fermilab (FNAL)	to Fernald (FEMP)	1.79E-09	5.72E-10
Knolls Atomic	to Portsmouth GDP	1.06E-03	2.49E-04
Lawrence Berkeley	to Lawrence Livermore	1.90E-10	1.37E-10
SNL - Albuquerque	to Los Alamos NL	1.03E-11	1.95E-13
Totals		1.17E-03	2.99E-04

Table 8. Expected Annual Fatalities for the Shipping Campaign

Exposure Group	Truck	Rail
Radiological		
Normal Crew	8.0E-03	8.5E-04
Normal Public	1.0E-02	3.7E-03
Accident Public	5.9E-07	1.5E-07
Nonradiological		
Emission	4.9E-03	7.3E-03
Accident	2.8E-02	4.8E-04

Table 9. Expected Annual Cancer Incidence for the Shipping Campaign

Exposure Group	Truck	Rail
Radiological		
Normal Crew	2.8E-02	3.0E-03
Normal Public	3.5E-02	1.3E-02
Accident Public	2.0E-06	5.1E-07
Nonradiological		
Emission	4.9E-03	7.3E-03
Accident	NA	NA

Table 10. Expected Annual Genetic Effects for the Shipping Campaign

Exposure Group	Truck	Rail
Radiological		
Normal Crew	1.2E-03	1.3E-04
Normal Public	2.1E-03	7.4E-04
Accident Public	1.2E-07	3.0E-08
Nonradiological		
Emission	NA	NA
Accident	NA	NA

B.9 WM LLW REGIONALIZED 3 ALTERNATIVE (CASE 4): HETEROGENEOUS SOLIDS

Table 1. Summary of Route Information

Route		Distance (miles)	Percentage in Zone		
			Rural	Suburban	Urban
Truck					
Ames Laboratory	to Oak Ridge Reserv.	900	75.2	23.4	1.5
Argonne - East	to Oak Ridge Reserv.	584	67.0	30.1	2.9
Bettis Atomic	to Oak Ridge Reserv.	562	70.7	27.4	1.9
Fermilab (FNAL)	to Oak Ridge Reserv.	616	65.3	31.2	3.4
ITRI	to Los Alamos NL	111	76.8	18.9	4.2
Knolls Atomic	to Oak Ridge Reserv.	885	66.6	32.6	0.8
Kansas City Plant	to Oak Ridge Reserv.	723	79.0	19.2	1.9
Lawrence Berkeley	to Nevada Test Site	719	81.9	10.6	7.5
Lawrence Livermore	to Nevada Test Site	678	84.7	9.2	6.1
Mound Plant	to Oak Ridge Reserv.	348	61.6	37.0	1.5
ORISE	to Oak Ridge Reserv.	10	58.8	41.2	0.0
Pantex Plant	to Los Alamos NL	402	89.5	8.0	2.5
Portsmouth GDP	to Oak Ridge Reserv.	371	74.5	24.6	0.9
Princeton PPL	to Oak Ridge Reserv.	715	60.8	32.2	7.0
Paducah GDP	to Oak Ridge Reserv.	304	81.3	18.5	0.2
Pinellas Plant	to Savannah River	620	71.9	25.8	2.2
Rocky Flats Plant	to Los Alamos NL	452	82.2	14.9	2.9
Reactive Metals	to Oak Ridge Reserv.	608	64.1	34.1	1.8
SLAC	to Nevada Test Site	739	79.6	11.3	9.1
SNL - Albuquerque	to Los Alamos NL	102	75.8	20.1	4.1
SNL - Livermore	to Nevada Test Site	678	84.7	9.2	6.1
Rail					
Ames Laboratory	to Oak Ridge Reserv.	954	71.7	22.0	6.3
Argonne - East	to Oak Ridge Reserv.	648	70.7	25.3	4.0
Bettis Atomic	to Oak Ridge Reserv.	903	64.0	31.3	4.7
Fermilab (FNAL)	to Oak Ridge Reserv.	682	67.9	24.1	8.0
ITRI	to Los Alamos NL	104	74.3	20.0	5.7
Knolls Atomic	to Oak Ridge Reserv.	957	42.1	43.9	14.0
Kansas City Plant	to Oak Ridge Reserv.	838	83.0	13.6	3.4
Lawrence Berkeley	to Nevada Test Site	860	75.1	17.7	7.2
Lawrence Livermore	to Nevada Test Site	1370	94.5	3.8	1.8
Mound Plant	to Oak Ridge Reserv.	328	74.0	22.9	3.1
ORISE	to Oak Ridge Reserv.	40	65.8	33.4	0.8
Pantex Plant	to Los Alamos NL	482	89.2	9.6	1.3
Portsmouth GDP	to Oak Ridge Reserv.	442	66.8	31.5	1.7
Princeton PPL	to Oak Ridge Reserv.	760	45.8	44.5	9.7
Paducah GDP	to Oak Ridge Reserv.	527	89.3	9.0	1.7
Pinellas Plant	to Savannah River	485	72.2	25.0	2.8
Rocky Flats Plant	to Los Alamos NL	504	85.7	11.1	3.2
Reactive Metals	to Oak Ridge Reserv.	600	59.4	33.2	7.4
SLAC	to Nevada Test Site	862	75.8	17.7	6.5
SNL - Albuquerque	to Los Alamos NL	104	74.3	20.0	5.7
SNL - Livermore	to Nevada Test Site	1370	94.5	3.8	1.8

Table 2. Annual Number of Shipments and One-Way Shipment Distances

Route		# of Shipments		Total Mileage(mi)	
		Truck	Rail	Truck	Rail
Ames Laboratory	to Oak Ridge Reserv.	2	1	1.80E+03	9.54E+02
Argonne - East	to Oak Ridge Reserv.	105	39	6.13E+04	2.53E+04
Bettis Atomic	to Oak Ridge Reserv.	57	21	3.21E+04	1.90E+04
Fermilab (FNAL)	to Oak Ridge Reserv.	3	2	1.85E+03	1.36E+03
ITRI	to Los Alamos NL	10	4	1.11E+03	4.16E+02
Knolls Atomic	to Oak Ridge Reserv.	28	11	2.48E+04	1.05E+04
Kansas City Plant	to Oak Ridge Reserv.	1	1	7.23E+02	8.38E+02
Lawrence Berkeley	to Nevada Test Site	3	2	2.16E+03	1.72E+03
Lawrence Livermore	to Nevada Test Site	56	21	3.80E+04	2.88E+04
Mound Plant	to Oak Ridge Reserv.	512	190	1.78E+05	6.23E+04
ORISE	to Oak Ridge Reserv.	5	2	5.10E+01	7.90E+01
Pantex Plant	to Los Alamos NL	1450	544	5.83E+05	2.62E+05
Portsmouth GDP	to Oak Ridge Reserv.	3344	1274	1.24E+06	5.63E+05
Princeton PPL	to Oak Ridge Reserv.	1	1	7.15E+02	7.60E+02
Paducah GDP	to Oak Ridge Reserv.	627	237	1.91E+05	1.25E+05
Pinellas Plant	to Savannah River	2	1	1.24E+03	4.85E+02
Rocky Flats Plant	to Los Alamos NL	357	133	1.61E+05	6.70E+04
Reactive Metals	to Oak Ridge Reserv.	768	287	4.67E+05	1.72E+05
SLAC	to Nevada Test Site	39	15	2.88E+04	1.29E+04
SNL - Albuquerque	to Los Alamos NL	17	7	1.73E+03	7.28E+02
SNL - Livermore	to Nevada Test Site	6	2	4.07E+03	2.74E+03
Totals		7393	2795	3.02E+06	1.36E+06

Table 3. Incident-Free Dose per Shipment (person-rem/shipment)

Source/Route(s)	Crew	General Public			
		Off-Link	On-Link	Stops	Total
LLW(x) AL to OR Ames Laboratory	to Oak Ridge Reserv.				
	Truck	2.83E-02	2.29E-03	3.92E-03	2.52E-02	3.14E-02
	Rail	6.86E-03	1.58E-02	2.35E-04	6.42E-03	2.24E-02
LLW(x) AN to OR Argonne - East	to Oak Ridge Reserv.				
	Truck	2.00E-02	2.19E-03	3.27E-03	1.63E-02	2.18E-02
	Rail	5.59E-03	8.34E-03	1.48E-04	5.48E-03	1.40E-02
LLW(x) BA to OR Bettis Atomic	to Oak Ridge Reserv.				
	Truck	1.85E-02	1.72E-03	2.71E-03	1.57E-02	2.02E-02
	Rail	6.65E-03	1.40E-02	2.44E-04	6.26E-03	2.05E-02
LLW(x) FL to OR Fermilab (FNAL)	to Oak Ridge Reserv.				
	Truck	2.15E-02	2.53E-03	3.71E-03	1.72E-02	2.35E-02
	Rail	5.73E-03	1.37E-02	1.92E-04	5.58E-03	1.95E-02
LLW(x) IT to LA ITRI	to Los Alamos NL				
	Truck	3.54E-03	4.00E-04	6.71E-04	3.11E-03	4.18E-03
	Rail	3.31E-03	1.55E-03	2.36E-05	3.80E-03	5.37E-03
LLW(x) KA to OR Knolls Atomic	to Oak Ridge Reserv.				
	Truck	2.98E-02	2.55E-03	3.79E-03	2.48E-02	3.11E-02
	Rail	6.87E-03	3.39E-02	4.49E-04	6.42E-03	4.08E-02
LLW(x) KC to OR Kansas City Plant	to Oak Ridge Reserv.				
	Truck	2.20E-02	1.75E-03	3.21E-03	2.02E-02	2.52E-02
	Rail	6.38E-03	7.77E-03	1.35E-04	6.06E-03	1.40E-02
LLW(x) LB to NT Lawrence Berkeley	to Nevada Test Site				
	Truck	2.27E-02	3.31E-03	5.66E-03	2.01E-02	2.91E-02
	Rail	6.47E-03	1.49E-02	2.04E-04	6.13E-03	2.12E-02
LLW(x) LL to NT Lawrence Livermore	to Nevada Test Site				
	Truck	2.05E-02	2.57E-03	4.65E-03	1.90E-02	2.62E-02
	Rail	8.60E-03	5.75E-03	1.20E-04	7.70E-03	1.36E-02
LLW(x) MP to OR Mound Plant	to Oak Ridge Reserv.				
	Truck	1.23E-02	1.24E-03	1.72E-03	9.73E-03	1.27E-02
	Rail	4.25E-03	3.53E-03	6.69E-05	4.49E-03	8.08E-03
LLW(x) OI to OR ORISE	to Oak Ridge Reserv.				
	Truck	3.63E-04	3.21E-05	4.23E-05	2.86E-04	3.60E-04
	Rail	3.05E-03	3.36E-04	8.77E-06	3.60E-03	3.95E-03
LLW(x) PP to LA Pantex Plant	to Los Alamos NL				
	Truck	1.11E-02	7.76E-04	1.77E-03	1.13E-02	1.38E-02
	Rail	4.89E-03	2.18E-03	5.29E-05	4.96E-03	7.19E-03
LLW(x) PO to OR Portsmouth GDP	to Oak Ridge Reserv.				
	Truck	1.16E-02	8.77E-04	1.50E-03	1.04E-02	1.28E-02
	Rail	4.73E-03	4.37E-03	1.00E-04	4.84E-03	9.32E-03
LLW(x) PR to OR Princeton PPL	to Oak Ridge Reserv.				
	Truck	2.68E-02	4.27E-03	6.06E-03	2.00E-02	3.04E-02
	Rail	6.05E-03	2.10E-02	3.11E-04	5.82E-03	2.71E-02
LLW(x) PA to OR Paducah GDP	to Oak Ridge Reserv.				
	Truck	8.88E-03	4.70E-04	9.98E-04	8.51E-03	9.98E-03
	Rail	5.08E-03	2.75E-03	5.97E-05	5.10E-03	7.91E-03
LLW(x) PI to SR Pinellas Plant	to Savannah River				
	Truck	2.02E-02	1.94E-03	3.10E-03	1.74E-02	2.24E-02
	Rail	4.90E-03	5.13E-03	1.02E-04	4.97E-03	1.02E-02
LLW(x) RF to LA Rocky Flats Plant	to Los Alamos NL				
	Truck	1.35E-02	1.19E-03	2.25E-03	1.27E-02	1.61E-02
	Rail	4.98E-03	4.26E-03	7.35E-05	5.03E-03	9.36E-03
LLW(x) RM to OR Reactive Metals	to Oak Ridge Reserv.				
	Truck	2.11E-02	2.15E-03	3.08E-03	1.70E-02	2.23E-02
	Rail	5.38E-03	1.25E-02	1.91E-04	5.33E-03	1.80E-02

LLW(x) ST to NT						
SLAC	to Nevada Test Site					
	Truck	2.43E-02	4.05E-03	6.67E-03	2.07E-02	3.14E-02
	Rail	6.48E-03	1.38E-02	1.96E-04	6.13E-03	2.01E-02
LLW(x) SA to LA						
SNL - Albuquerque	to Los Alamos NL					
	Truck	3.28E-03	3.70E-04	6.13E-04	2.86E-03	3.84E-03
	Rail	3.31E-03	1.55E-03	2.36E-05	3.80E-03	5.37E-03
LLW(x) SL to NT						
SNL - Livermore	to Nevada Test Site					
	Truck	2.05E-02	2.57E-03	4.65E-03	1.90E-02	2.62E-02
	Rail	8.60E-03	5.75E-03	1.20E-04	7.70E-03	1.36E-02

Table 4. Accident Dose Risk per Shipment (person-rem/shipment)

Source/Route		Truck	Rail
LLW(x) AL to OR			
Ames Laboratory	to Oak Ridge Reserv.	9.48E-06	6.83E-06
LLW(x) AN to OR			
Argonne - East	to Oak Ridge Reserv.	5.16E-04	2.26E-04
LLW(x) BA to OR			
Bettis Atomic	to Oak Ridge Reserv.	9.94E-06	1.12E-05
LLW(x) FL to OR			
Fermilab (FNAL)	to Oak Ridge Reserv.	3.56E-05	1.16E-05
LLW(x) IT to LA			
ITRI	to Los Alamos NL	1.53E-03	7.01E-05
LLW(x) KA to OR			
Knolls Atomic	to Oak Ridge Reserv.	2.13E-06	3.16E-06
LLW(x) KC to OR			
Kansas City Plant	to Oak Ridge Reserv.	3.55E-05	7.40E-06
LLW(x) LB to NT			
Lawrence Berkeley	to Nevada Test Site	2.56E-02	2.61E-02
LLW(x) LL to NT			
Lawrence Livermore	to Nevada Test Site	4.06E-06	3.26E-06
LLW(x) MP to OR			
Mound Plant	to Oak Ridge Reserv.	1.07E-06	3.06E-07
LLW(x) OI to OR			
ORISE	to Oak Ridge Reserv.	4.49E-08	3.15E-08
LLW(x) PP to LA			
Pantex Plant	to Los Alamos NL	5.53E-07	9.15E-08
LLW(x) PO to OR			
Portsmouth GDP	to Oak Ridge Reserv.	7.22E-09	3.57E-09
LLW(x) PR to OR			
Princeton PPL	to Oak Ridge Reserv.	5.74E-06	2.32E-06
LLW(x) PA to OR			
Paducah GDP	to Oak Ridge Reserv.	3.12E-07	1.08E-07
LLW(x) PI to SR			
Pinellas Plant	to Savannah River	1.30E-06	4.65E-07
LLW(x) RF to LA			
Rocky Flats Plant	to Los Alamos NL	4.65E-06	5.34E-07
LLW(x) RM to OR			
Reactive Metals	to Oak Ridge Reserv.	5.68E-09	2.86E-09
LLW(x) ST to NT			
SLAC	to Nevada Test Site	2.14E-07	3.39E-07
LLW(x) SA to LA			
SNL - Albuquerque	to Los Alamos NL	5.39E-06	2.50E-07
LLW(x) SL to NT			
SNL - Livermore	to Nevada Test Site	3.63E-05	3.45E-05

Table 5. Nonradiological Risk Factors per Shipment (fatalities/shipment)

Mode	Route	Emission	Accident
Truck			
Ames Laboratory	to Oak Ridge Reserv.	4.25E-06	5.79E-05
Argonne - East	to Oak Ridge Reserv.	5.38E-06	4.21E-05
Bettis Atomic	to Oak Ridge Reserv.	3.41E-06	3.71E-05
Fermilab (FNAL)	to Oak Ridge Reserv.	6.76E-06	4.62E-05
ITRI	to Los Alamos NL	1.51E-06	1.28E-05
Knolls Atomic	to Oak Ridge Reserv.	2.16E-06	6.08E-05
Kansas City Plant	to Oak Ridge Reserv.	4.31E-06	4.90E-05
Lawrence Berkeley	to Nevada Test Site	1.73E-05	5.39E-05
Lawrence Livermore	to Nevada Test Site	1.32E-05	5.15E-05
Mound Plant	to Oak Ridge Reserv.	1.64E-06	2.43E-05
ORISE	to Oak Ridge Reserv.	0.00E+00	1.07E-06
Pantex Plant	to Los Alamos NL	3.28E-06	3.21E-05
Portsmouth GDP	to Oak Ridge Reserv.	1.09E-06	2.56E-05
Princeton PPL	to Oak Ridge Reserv.	1.60E-05	4.89E-05
Paducah GDP	to Oak Ridge Reserv.	1.93E-07	2.14E-05
Pinellas Plant	to Savannah River	4.47E-06	4.70E-05
Rocky Flats Plant	to Los Alamos NL	4.25E-06	3.76E-05
Reactive Metals	to Oak Ridge Reserv.	3.57E-06	3.56E-05
SLAC	to Nevada Test Site	2.17E-05	5.48E-05
SNL - Albuquerque	to Los Alamos NL	1.35E-06	1.20E-05
SNL - Livermore	to Nevada Test Site	1.32E-05	5.15E-05
Rail			
Ames Laboratory	to Oak Ridge Reserv.	2.52E-05	2.00E-06
Argonne - East	to Oak Ridge Reserv.	1.08E-05	1.36E-06
Bettis Atomic	to Oak Ridge Reserv.	1.78E-05	1.89E-06
Fermilab (FNAL)	to Oak Ridge Reserv.	2.28E-05	1.43E-06
ITRI	to Los Alamos NL	2.47E-06	2.18E-07
Knolls Atomic	to Oak Ridge Reserv.	5.59E-05	2.00E-06
Kansas City Plant	to Oak Ridge Reserv.	1.18E-05	1.75E-06
Lawrence Berkeley	to Nevada Test Site	2.59E-05	1.80E-06
Lawrence Livermore	to Nevada Test Site	1.01E-05	2.87E-06
Mound Plant	to Oak Ridge Reserv.	4.31E-06	6.86E-07
ORISE	to Oak Ridge Reserv.	1.26E-07	8.26E-08
Pantex Plant	to Los Alamos NL	2.59E-06	1.01E-06
Portsmouth GDP	to Oak Ridge Reserv.	3.18E-06	9.25E-07
Princeton PPL	to Oak Ridge Reserv.	3.08E-05	1.59E-06
Paducah GDP	to Oak Ridge Reserv.	3.81E-06	1.10E-06
Pinellas Plant	to Savannah River	5.69E-06	1.01E-06
Rocky Flats Plant	to Los Alamos NL	6.78E-06	1.05E-06
Reactive Metals	to Oak Ridge Reserv.	1.85E-05	1.25E-06
SLAC	to Nevada Test Site	2.35E-05	1.80E-06
SNL - Albuquerque	to Los Alamos NL	2.47E-06	2.18E-07
SNL - Livermore	to Nevada Test Site	1.01E-05	2.87E-06

Table 6. Annual Incident-Free Dose for the Shipping Campaign (person-rem/yr)

Route		Truck		Rail	
		Crew	Public	Crew	Public
Ames Laboratory	to Oak Ridge Reserv.	5.66E-02	6.28E-02	6.86E-03	2.24E-02
Argonne - East	to Oak Ridge Reserv.	2.10E+00	2.29E+00	2.18E-01	5.45E-01
Bettis Atomic	to Oak Ridge Reserv.	1.05E+00	1.15E+00	1.40E-01	4.30E-01
Fermilab (FNAL)	to Oak Ridge Reserv.	6.45E-02	7.04E-02	1.15E-02	3.90E-02
ITRI	to Los Alamos NL	3.54E-02	4.18E-02	1.33E-02	2.15E-02
Knolls Atomic	to Oak Ridge Reserv.	8.33E-01	8.72E-01	7.56E-02	4.48E-01
Kansas City Plant	to Oak Ridge Reserv.	2.20E-02	2.52E-02	6.38E-03	1.40E-02
Lawrence Berkeley	to Nevada Test Site	6.81E-02	8.73E-02	1.29E-02	4.24E-02
Lawrence Livermore	to Nevada Test Site	1.15E+00	1.47E+00	1.81E-01	2.85E-01
Mound Plant	to Oak Ridge Reserv.	6.28E+00	6.50E+00	8.07E-01	1.54E+00
ORISE	to Oak Ridge Reserv.	1.81E-03	1.80E-03	6.09E-03	7.89E-03
Pantex Plant	to Los Alamos NL	1.62E+01	2.00E+01	2.66E+00	3.91E+00
Portsmouth GDP	to Oak Ridge Reserv.	3.90E+01	4.26E+01	6.02E+00	1.19E+01
Princeton PPL	to Oak Ridge Reserv.	2.68E-02	3.04E-02	6.05E-03	2.71E-02
Paducah GDP	to Oak Ridge Reserv.	5.57E+00	6.26E+00	1.20E+00	1.87E+00
Pinellas Plant	to Savannah River	4.04E-02	4.48E-02	4.90E-03	1.02E-02
Rocky Flats Plant	to Los Alamos NL	4.83E+00	5.74E+00	6.63E-01	1.24E+00
Reactive Metals	to Oak Ridge Reserv.	1.62E+01	1.71E+01	1.54E+00	5.17E+00
SLAC	to Nevada Test Site	9.46E-01	1.23E+00	9.72E-02	3.02E-01
SNL - Albuquerque	to Los Alamos NL	5.58E-02	6.53E-02	2.32E-02	3.76E-02
SNL - Livermore	to Nevada Test Site	1.23E-01	1.57E-01	1.72E-02	2.71E-02
Totals		9.46E+01	1.06E+02	1.37E+01	2.79E+01

Table 7. Annual Accident Dose Risk for the Shipping Campaign (person-rem/yr)

Route		Truck	Rail
Ames Laboratory	to Oak Ridge Reserv.	1.90E-05	6.83E-06
Argonne - East	to Oak Ridge Reserv.	5.41E-02	8.83E-03
Bettis Atomic	to Oak Ridge Reserv.	5.67E-04	2.35E-04
Fermilab (FNAL)	to Oak Ridge Reserv.	1.07E-04	2.32E-05
ITRI	to Los Alamos NL	1.53E-02	2.80E-04
Knolls Atomic	to Oak Ridge Reserv.	5.98E-05	3.47E-05
Kansas City Plant	to Oak Ridge Reserv.	3.55E-05	7.40E-06
Lawrence Berkeley	to Nevada Test Site	7.68E-02	5.23E-02
Lawrence Livermore	to Nevada Test Site	2.27E-04	6.85E-05
Mound Plant	to Oak Ridge Reserv.	5.47E-04	5.81E-05
ORISE	to Oak Ridge Reserv.	2.24E-07	6.30E-08
Pantex Plant	to Los Alamos NL	8.02E-04	4.98E-05
Portsmouth GDP	to Oak Ridge Reserv.	2.41E-05	4.55E-06
Princeton PPL	to Oak Ridge Reserv.	5.74E-06	2.32E-06
Paducah GDP	to Oak Ridge Reserv.	1.96E-04	2.56E-05
Pinellas Plant	to Savannah River	2.59E-06	4.65E-07
Rocky Flats Plant	to Los Alamos NL	1.66E-03	7.10E-05
Reactive Metals	to Oak Ridge Reserv.	4.36E-06	8.20E-07
SLAC	to Nevada Test Site	8.33E-06	5.08E-06
SNL - Albuquerque	to Los Alamos NL	9.16E-05	1.75E-06
SNL - Livermore	to Nevada Test Site	2.18E-04	6.89E-05
Totals		1.51E-01	6.20E-02

Table 8. Expected Annual Fatalities for the Shipping Campaign

Exposure Group	Truck	Rail
Radiological		
Normal Crew	3.8E-02	5.5E-03
Normal Public	5.3E-02	1.4E-02
Accident Public	7.5E-05	3.1E-05
Nonradiological		
Emission	1.6E-02	1.6E-02
Accident	2.1E-01	2.8E-03

Table 9. Expected Annual Cancer Incidence for the Shipping Campaign

Exposure Group	Truck	Rail
Radiological		
Normal Crew	1.3E-01	1.9E-02
Normal Public	1.8E-01	4.7E-02
Accident Public	2.6E-04	1.1E-04
Nonradiological		
Emission	1.6E-02	1.6E-02
Accident	NA	NA

Table 10. Expected Annual Genetic Effects for the Shipping Campaign

Exposure Group	Truck	Rail
Radiological		
Normal Crew	5.7E-03	8.2E-04
Normal Public	1.1E-02	2.8E-03
Accident Public	5.7E-06	1.6E-06
Nonradiological		
Emission	NA	NA
Accident	NA	NA

B.10 WM LLW REGIONALIZED 3 ALTERNATIVE (CASE 4): ACTIVATED METALS

Table 1. Summary of Route Information

Route		Distance (miles)	Percentage in Zone		
			Rural	Suburban	Urban
Truck					
Bettis Atomic	to Oak Ridge Reserv.	562	70.7	27.4	1.9
Fermilab (FNAL)	to Oak Ridge Reserv.	616	65.3	31.2	3.4
Knolls Atomic	to Oak Ridge Reserv.	885	66.6	32.6	0.8
Lawrence Berkeley	to Nevada Test Site	719	81.9	10.6	7.5
SNL - Albuquerque	to Los Alamos NL	102	75.8	20.1	4.1
Rail					
Bettis Atomic	to Oak Ridge Reserv.	903	64.0	31.3	4.7
Fermilab (FNAL)	to Oak Ridge Reserv.	682	67.9	24.1	8.0
Knolls Atomic	to Oak Ridge Reserv.	957	42.1	43.9	14.0
Lawrence Berkeley	to Nevada Test Site	860	75.1	17.7	7.2
SNL - Albuquerque	to Los Alamos NL	104	74.3	20.0	5.7

Table 2. Annual Number of Shipments and One-Way Shipment Distances

Route		# of Shipments		Total Mileage (mi)	
		Truck	Rail	Truck	Rail
Bettis Atomic	to Oak Ridge Reserv.	316	120	1.78E+05	1.08E+05
Fermilab (FNAL)	to Oak Ridge Reserv.	40	15	2.46E+04	1.02E+04
Knolls Atomic	to Oak Ridge Reserv.	650	246	5.76E+05	2.35E+05
Lawrence Berkeley	to Nevada Test Site	15	6	1.08E+04	5.16E+03
SNL - Albuquerque	to Los Alamos NL	6	3	6.12E+02	3.12E+02
Totals		1027	390	7.89E+05	3.59E+05

Table 3. Incident-Free Dose per Shipment (person-rem/shipment)

Source/Route(s)		Crew	General Public			
			Off-Link	On-Link	Stops	Total
LLW(I) BA to OR						
Bettis Atomic	to Oak Ridge Reserv.					
		Truck	1.85E-02	1.72E-03	2.71E-03	1.57E-02	2.02E-02
		Rail	6.65E-03	1.40E-02	2.44E-04	6.26E-03	2.05E-02
LLW(I) FL to OR						
Fermilab (FNAL)	to Oak Ridge Reserv.					
		Truck	2.15E-02	2.53E-03	3.71E-03	1.72E-02	2.35E-02
		Rail	5.73E-03	1.37E-02	1.92E-04	5.58E-03	1.95E-02
LLW(I) KA to OR						
Knolls Atomic	to Oak Ridge Reserv.					
		Truck	2.98E-02	2.55E-03	3.79E-03	2.48E-02	3.11E-02
		Rail	6.87E-03	3.39E-02	4.49E-04	6.42E-03	4.08E-02
LLW(I) LB to NT						
Lawrence Berkeley	to Nevada Test Site					
		Truck	2.27E-02	3.31E-03	5.66E-03	2.01E-02	2.91E-02
		Rail	6.47E-03	1.49E-02	2.04E-04	6.13E-03	2.12E-02
LLW(I) SA to LA						
SNL - Albuquerque	to Los Alamos NL					
		Truck	3.28E-03	3.70E-04	6.13E-04	2.86E-03	3.84E-03
		Rail	3.31E-03	1.55E-03	2.36E-05	3.80E-03	5.37E-03

Table 4. Accident Dose Risk per Shipment (person-rem/shipment)

Source/Route		Truck	Rail
LLW(I) BA to OR			
Bettis Atomic	to Oak Ridge Reserv.	7.27E-07	6.36E-07
LLW(I) FL to OR			
Fermilab (FNAL)	to Oak Ridge Reserv.	7.58E-11	4.36E-11
LLW(I) KA to OR			
Knolls Atomic	to Oak Ridge Reserv.	1.47E-06	2.29E-06
LLW(I) LB to NT			
Lawrence Berkeley	to Nevada Test Site	8.23E-11	1.45E-10
LLW(I) SA to LA			
SNL - Albuquerque	to Los Alamos NL	1.72E-12	6.51E-14

Table 5. Nonradiological Risk Factors per Shipment (fatalities/shipment)

Mode	Route	Emission	Accident
Truck			
Bettis Atomic	to Oak Ridge Reserv.	3.41E-06	3.71E-05
Fermilab (FNAL)	to Oak Ridge Reserv.	6.76E-06	4.62E-05
Knolls Atomic	to Oak Ridge Reserv.	2.16E-06	6.08E-05
Lawrence Berkeley	to Nevada Test Site	1.73E-05	5.39E-05
SNL - Albuquerque	to Los Alamos NL	1.35E-06	1.20E-05
Rail			
Bettis Atomic	to Oak Ridge Reserv.	1.78E-05	1.89E-06
Fermilab (FNAL)	to Oak Ridge Reserv.	2.28E-05	1.43E-06
Knolls Atomic	to Oak Ridge Reserv.	5.59E-05	2.00E-06
Lawrence Berkeley	to Nevada Test Site	2.59E-05	1.80E-06
SNL - Albuquerque	to Los Alamos NL	2.47E-06	2.18E-07

Table 6. Annual Incident-Free Dose for the Shipping Campaign (person-rem/yr)

		Truck		Rail	
Route		Crew	Public	Crew	Public
Bettis Atomic	to Oak Ridge Reserv.	5.84E+00	6.38E+00	7.98E-01	2.46E+00
Fermilab (FNAL)	to Oak Ridge Reserv.	8.60E-01	9.39E-01	8.59E-02	2.93E-01
Knolls Atomic	to Oak Ridge Reserv.	1.93E+01	2.02E+01	1.69E+00	1.00E+01
Lawrence Berkeley	to Nevada Test Site	3.41E-01	4.36E-01	3.88E-02	1.27E-01
SNL - Albuquerque	to Los Alamos NL	1.97E-02	2.30E-02	9.94E-03	1.61E-02
Totals		2.64E+01	2.80E+01	2.62E+00	1.29E+01

Table 7. Annual Accident Dose Risk for the Shipping Campaign (person-rem/yr)

Route		Truck	Rail
Bettis Atomic	to Oak Ridge Reserv.	2.30E-04	7.63E-05
Fermilab (FNAL)	to Oak Ridge Reserv.	3.03E-09	6.54E-10
Knolls Atomic	to Oak Ridge Reserv.	9.58E-04	5.64E-04
Lawrence Berkeley	to Nevada Test Site	1.23E-09	8.71E-10
SNL - Albuquerque	to Los Alamos NL	1.03E-11	1.95E-13
Totals		1.19E-03	6.40E-04

Table 8. Expected Annual Fatalities for the Shipping Campaign

Exposure Group	Truck	Rail
Radiological		
Normal Crew	1.1E-02	1.0E-03
Normal Public	1.4E-02	6.5E-03
Accident Public	5.9E-07	3.2E-07
Nonradiological		
Emission	3.0E-03	1.6E-02
Accident	5.4E-02	7.5E-04

Table 9. Expected Annual Cancer Incidence for the Shipping Campaign

Exposure Group	Truck	Rail
Radiological		
Normal Crew	3.7E-02	3.7E-03
Normal Public	4.8E-02	2.2E-02
Accident Public	2.0E-06	1.1E-06
Nonradiological		
Emission	3.0E-03	1.6E-02
Accident	NA	NA

Table 10. Expected Annual Genetic Effects for the Shipping Campaign

Exposure Group	Truck	Rail
Radiological		
Normal Crew	1.6E-03	1.6E-04
Normal Public	2.8E-03	1.3E-03
Accident Public	1.2E-07	6.4E-08
Nonradiological		
Emission	NA	NA
Accident	NA	NA

B.11 WM LLW REGIONALIZED 4 ALTERNATIVE (CASE 12): HETEROGENEOUS SOLIDS

Table 1. Summary of Route Information

Route		Distance (miles)	Percentage in Zone		
			Rural	Suburban	Urban
Truck					
Ames Laboratory	to Oak Ridge Reserv.	900	75.2	23.4	1.5
Ames Laboratory	to Portsmouth GDP	755	77.4	21.0	1.7
Argonne - East	to Oak Ridge Reserv.	584	67.0	30.1	2.9
Bettis Atomic	to Oak Ridge Reserv.	562	70.7	27.4	1.9
Fermilab (FNAL)	to Oak Ridge Reserv.	616	65.3	31.2	3.4
Fermilab (FNAL)	to Portsmouth GDP	460	62.5	32.0	5.5
ITRI	to Los Alamos NL	111	76.8	18.9	4.2
Knolls Atomic	to Oak Ridge Reserv.	885	66.6	32.6	0.8
Kansas City Plant	to Oak Ridge Reserv.	723	79.0	19.2	1.9
Lawrence Berkeley	to Hanford Site	875	78.1	17.8	4.1
Lawrence Berkeley	to Nevada Test Site	719	81.9	10.6	7.5
Lawrence Livermore	to Hanford Site	894	77.2	19.3	3.4
Lawrence Livermore	to Nevada Test Site	678	84.7	9.2	6.1
Mound Plant	to Oak Ridge Reserv.	348	61.6	37.0	1.5
Mound Plant	to Portsmouth GDP	152	55.8	38.7	5.5
ORISE	to Oak Ridge Reserv.	10	58.8	41.2	0.0
Pantex Plant	to Los Alamos NL	402	89.5	8.0	2.5
Portsmouth GDP	to Oak Ridge Reserv.	371	74.5	24.6	0.9
Princeton PPL	to Oak Ridge Reserv.	715	60.8	32.2	7.0
Princeton PPL	to Portsmouth GDP	588	55.1	38.8	6.1
Paducah GDP	to Oak Ridge Reserv.	304	81.3	18.5	0.2
Pinellas Plant	to Savannah River	620	71.9	25.8	2.2
Rocky Flats Plant	to Los Alamos NL	452	82.2	14.9	2.9
Reactive Metals	to Oak Ridge Reserv.	608	64.1	34.1	1.8
Reactive Metals	to Portsmouth GDP	276	59.5	37.8	2.8
SLAC	to Hanford Site	916	75.9	19.0	5.1
SLAC	to Nevada Test Site	739	79.6	11.3	9.1
SNL - Albuquerque	to Los Alamos NL	102	75.8	20.1	4.1
SNL - Livermore	to Hanford Site	894	77.2	19.3	3.4
SNL - Livermore	to Nevada Test Site	678	84.7	9.2	6.1
Rail					
Ames Laboratory	to Oak Ridge Reserv.	954	71.7	22.0	6.3
Ames Laboratory	to Portsmouth GDP	727	68.6	23.8	7.7
Argonne - East	to Oak Ridge Reserv.	648	70.7	25.3	4.0
Bettis Atomic	to Oak Ridge Reserv.	903	64.0	31.3	4.7
Fermilab (FNAL)	to Oak Ridge Reserv.	682	67.9	24.1	8.0
Fermilab (FNAL)	to Portsmouth GDP	451	61.5	28.9	9.5
ITRI	to Los Alamos NL	104	74.3	20.0	5.7
Knolls Atomic	to Oak Ridge Reserv.	957	42.1	43.9	14.0
Kansas City Plant	to Oak Ridge Reserv.	838	83.0	13.6	3.4
Lawrence Berkeley	to Hanford Site	986	78.5	15.8	5.7
Lawrence Berkeley	to Nevada Test Site	860	75.1	17.7	7.2
Lawrence Livermore	to Hanford Site	973	78.9	15.3	5.8
Lawrence Livermore	to Nevada Test Site	1370	94.5	3.8	1.8
Mound Plant	to Oak Ridge Reserv.	328	74.0	22.9	3.1
Mound Plant	to Portsmouth GDP	156	53.2	38.0	8.8
ORISE	to Oak Ridge Reserv.	40	65.8	33.4	0.8
Pantex Plant	to Los Alamos NL	482	89.2	9.6	1.3
Portsmouth GDP	to Oak Ridge Reserv.	442	66.8	31.5	1.7
Princeton PPL	to Oak Ridge Reserv.	760	45.8	44.5	9.7
Princeton PPL	to Portsmouth GDP	838	58.3	32.6	9.1
Paducah GDP	to Oak Ridge Reserv.	527	89.3	9.0	1.7
Pinellas Plant	to Savannah River	485	72.2	25.0	2.8
Rocky Flats Plant	to Los Alamos NL	504	85.7	11.1	3.2
Reactive Metals	to Oak Ridge Reserv.	600	59.4	33.2	7.4
Reactive Metals	to Portsmouth GDP	279	48.4	41.8	9.8
SLAC	to Hanford Site	1036	76.1	16.8	7.1
SLAC	to Nevada Test Site	862	75.8	17.7	6.5
SNL - Albuquerque	to Los Alamos NL	104	74.3	20.0	5.7
SNL - Livermore	to Hanford Site	973	78.9	15.3	5.8
SNL - Livermore	to Nevada Test Site	1370	94.5	3.8	1.8

Table 2. Annual Number of Shipments and One-Way Shipment Distances

Route		# of Shipments		Total Mileage(mi)	
		Truck	Rail	Truck	Rail
Ames Laboratory	to Oak Ridge Reserv.	2	1	1.80E+03	9.54E+02
Ames Laboratory	to Portsmouth GDP	1	1	7.55E+02	7.27E+02
Argonne - East	to Oak Ridge Reserv.	105	39	6.13E+04	2.53E+04
Bettis Atomic	to Oak Ridge Reserv.	57	21	3.21E+04	1.90E+04
Fermilab (FNAL)	to Oak Ridge Reserv.	2	1	1.23E+03	6.82E+02
Fermilab (FNAL)	to Portsmouth GDP	1	1	4.60E+02	4.51E+02
ITRI	to Los Alamos NL	10	4	1.11E+03	4.16E+02
Knolls Atomic	to Oak Ridge Reserv.	28	11	2.48E+04	1.05E+04
Kansas City Plant	to Oak Ridge Reserv.	1	1	7.23E+02	8.38E+02
Lawrence Berkeley	to Hanford Site	2	1	1.75E+03	9.86E+02
Lawrence Berkeley	to Nevada Test Site	2	1	1.44E+03	8.60E+02
Lawrence Livermore	to Hanford Site	17	7	1.52E+04	6.81E+03
Lawrence Livermore	to Nevada Test Site	40	15	2.71E+04	2.06E+04
Mound Plant	to Oak Ridge Reserv.	496	186	1.72E+05	6.10E+04
Mound Plant	to Portsmouth GDP	12	5	1.83E+03	7.80E+02
ORISE	to Oak Ridge Reserv.	5	2	5.10E+01	7.90E+01
Pantex Plant	to Los Alamos NL	1418	537	5.70E+05	2.59E+05
Portsmouth GDP	to Oak Ridge Reserv.	2967	1113	1.10E+06	4.92E+05
Princeton PPL	to Oak Ridge Reserv.	1	1	7.15E+02	7.60E+02
Princeton PPL	to Portsmouth GDP	1	1	5.88E+02	8.38E+02
Paducah GDP	to Oak Ridge Reserv.	627	235	1.91E+05	1.24E+05
Pinellas Plant	to Savannah River	2	1	1.24E+03	4.85E+02
Rocky Flats Plant	to Los Alamos NL	335	123	1.51E+05	6.20E+04
Reactive Metals	to Oak Ridge Reserv.	745	283	4.53E+05	1.70E+05
Reactive Metals	to Portsmouth GDP	7	3	1.93E+03	8.37E+02
SLAC	to Hanford Site	1	1	9.16E+02	1.04E+03
SLAC	to Nevada Test Site	39	15	2.88E+04	1.29E+04
SNL - Albuquerque	to Los Alamos NL	17	7	1.73E+03	7.28E+02
SNL - Livermore	to Hanford Site	1	1	8.94E+02	9.73E+02
SNL - Livermore	to Nevada Test Site	5	2	3.39E+03	2.74E+03
Totals		6947	2620	2.85E+06	1.28E+06

Table 3. Incident-Free Dose per Shipment (person-rem/shipment)

Source/Route(s)		Crew	General Public			
			Off-Link	On-Link	Stops	Total
LLW(x) AL to OR						
Ames Laboratory	to Oak Ridge Reserv.					
	Truck	2.83E-02	2.29E-03	3.92E-03	2.52E-02	3.14E-02
	Rail	6.86E-03	1.58E-02	2.35E-04	6.42E-03	2.24E-02
LLW(x) AL to PO						
Ames Laboratory	to Portsmouth GDP					
	Truck	2.33E-02	1.86E-03	3.31E-03	2.11E-02	2.63E-02
	Rail	5.91E-03	1.42E-02	2.00E-04	5.72E-03	2.01E-02
LLW(x) AN to OR						
Argonne - East	to Oak Ridge Reserv.					
	Truck	2.00E-02	2.19E-03	3.27E-03	1.63E-02	2.18E-02
	Rail	5.59E-03	8.34E-03	1.48E-04	5.48E-03	1.40E-02
LLW(x) BA to OR						
Bettis Atomic	to Oak Ridge Reserv.					
	Truck	1.85E-02	1.72E-03	2.71E-03	1.57E-02	2.02E-02
	Rail	6.65E-03	1.40E-02	2.44E-04	6.26E-03	2.05E-02
LLW(x) FL to OR						
Fermilab (FNAL)	to Oak Ridge Reserv.					
	Truck	2.15E-02	2.53E-03	3.71E-03	1.72E-02	2.35E-02
	Rail	5.73E-03	1.37E-02	1.92E-04	5.58E-03	1.95E-02
LLW(x) FL to PO						
Fermilab (FNAL)	to Portsmouth GDP					
	Truck	1.68E-02	2.40E-03	3.43E-03	1.29E-02	1.87E-02
	Rail	4.76E-03	1.08E-02	1.48E-04	4.87E-03	1.58E-02
LLW(x) IT to LA						
ITRI	to Los Alamos NL					
	Truck	3.54E-03	4.00E-04	6.71E-04	3.11E-03	4.18E-03
	Rail	3.31E-03	1.55E-03	2.36E-05	3.80E-03	5.37E-03
LLW(x) KA to OR						
Knolls Atomic	to Oak Ridge Reserv.					
	Truck	2.98E-02	2.55E-03	3.79E-03	2.48E-02	3.11E-02
	Rail	6.87E-03	3.39E-02	4.49E-04	6.42E-03	4.08E-02
LLW(x) KC to OR						
Kansas City Plant	to Oak Ridge Reserv.					
	Truck	2.20E-02	1.75E-03	3.21E-03	2.02E-02	2.52E-02
	Rail	6.38E-03	7.77E-03	1.35E-04	6.06E-03	1.40E-02
LLW(x) LB to HS						
Lawrence Berkeley	to Hanford Site					
	Truck	2.76E-02	3.02E-03	5.17E-03	2.45E-02	3.27E-02
	Rail	6.99E-03	1.38E-02	2.03E-04	6.51E-03	2.05E-02
LLW(x) LB to NT						
Lawrence Berkeley	to Nevada Test Site					
	Truck	2.27E-02	3.31E-03	5.66E-03	2.01E-02	2.91E-02
	Rail	6.47E-03	1.49E-02	2.04E-04	6.13E-03	2.12E-02
LLW(x) LL to HS						
Lawrence Livermore	to Hanford Site					
	Truck	2.82E-02	2.88E-03	4.92E-03	2.50E-02	3.28E-02
	Rail	6.94E-03	1.38E-02	2.00E-04	6.48E-03	2.05E-02
LLW(x) LL to NT						
Lawrence Livermore	to Nevada Test Site					
	Truck	2.05E-02	2.57E-03	4.65E-03	1.90E-02	2.62E-02
	Rail	8.60E-03	5.75E-03	1.20E-04	7.70E-03	1.36E-02
LLW(x) MP to OR						
Mound Plant	to Oak Ridge Reserv.					
	Truck	1.23E-02	1.24E-03	1.72E-03	9.73E-03	1.27E-02
	Rail	4.25E-03	3.53E-03	6.69E-05	4.49E-03	8.08E-03
LLW(x) MP to PO						
Mound Plant	to Portsmouth GDP					
	Truck	5.83E-03	8.71E-04	1.18E-03	4.26E-03	6.31E-03
	Rail	3.53E-03	3.82E-03	5.67E-05	3.96E-03	7.84E-03
LLW(x) OI to OR						
ORISE	to Oak Ridge Reserv.					
	Truck	3.63E-04	3.21E-05	4.23E-05	2.86E-04	3.60E-04
	Rail	3.05E-03	3.36E-04	8.77E-06	3.60E-03	3.95E-03
LLW(x) PP to LA						
Pantex Plant	to Los Alamos NL					
	Truck	1.11E-02	7.76E-04	1.77E-03	1.13E-02	1.38E-02
	Rail	4.89E-03	2.18E-03	5.29E-05	4.96E-03	7.19E-03
LLW(x) PO to OR						
Portsmouth GDP	to Oak Ridge Reserv.					
	Truck	1.16E-02	8.77E-04	1.50E-03	1.04E-02	1.28E-02
	Rail	4.73E-03	4.37E-03	1.00E-04	4.84E-03	9.32E-03

LLW(x) PR to OR Princeton PPL	to Oak Ridge Reserv.					
	Truck	2.68E-02	4.27E-03	6.06E-03	2.00E-02	3.04E-02
	Rail	6.05E-03	2.10E-02	3.11E-04	5.82E-03	2.71E-02
LLW(x) PR to PO Princeton PPL	to Portsmouth GDP					
	Truck	2.28E-02	3.55E-03	4.81E-03	1.65E-02	2.48E-02
	Rail	6.38E-03	2.00E-02	2.85E-04	6.06E-03	2.64E-02
LLW(x) PA to OR Paducah GDP	to Oak Ridge Reserv.					
	Truck	8.88E-03	4.70E-04	9.98E-04	8.51E-03	9.98E-03
	Rail	5.08E-03	2.75E-03	5.97E-05	5.10E-03	7.91E-03
LLW(x) PI to SR Pinellas Plant	to Savannah River					
	Truck	2.02E-02	1.94E-03	3.10E-03	1.74E-02	2.24E-02
	Rail	4.90E-03	5.13E-03	1.02E-04	4.97E-03	1.02E-02
LLW(x) RF to LA Rocky Flats Plant	to Los Alamos NL					
	Truck	1.35E-02	1.19E-03	2.25E-03	1.27E-02	1.61E-02
	Rail	4.98E-03	4.26E-03	7.35E-05	5.03E-03	9.36E-03
LLW(x) RM to OR Reactive Metals	to Oak Ridge Reserv.					
	Truck	2.11E-02	2.15E-03	3.08E-03	1.70E-02	2.23E-02
	Rail	5.38E-03	1.25E-02	1.91E-04	5.33E-03	1.80E-02
LLW(x) RM to PO Reactive Metals	to Portsmouth GDP					
	Truck	1.00E-02	1.18E-03	1.62E-03	7.73E-03	1.05E-02
	Rail	4.05E-03	7.58E-03	1.11E-04	4.34E-03	1.20E-02
LLW(x) ST to HS SLAC	to Hanford Site					
	Truck	2.98E-02	3.70E-03	6.08E-03	2.56E-02	3.54E-02
	Rail	7.20E-03	1.75E-02	2.40E-04	6.67E-03	2.44E-02
LLW(x) ST to NT SLAC	to Nevada Test Site					
	Truck	2.43E-02	4.05E-03	6.67E-03	2.07E-02	3.14E-02
	Rail	6.48E-03	1.38E-02	1.96E-04	6.13E-03	2.01E-02
LLW(x) SA to LA SNL - Albuquerque	to Los Alamos NL					
	Truck	3.28E-03	3.70E-04	6.13E-04	2.86E-03	3.84E-03
	Rail	3.31E-03	1.55E-03	2.36E-05	3.80E-03	5.37E-03
LLW(x) SL to HS SNL - Livermore	to Hanford Site					
	Truck	2.82E-02	2.88E-03	4.92E-03	2.50E-02	3.28E-02
	Rail	6.94E-03	1.38E-02	2.00E-04	6.48E-03	2.05E-02
LLW(x) SL to NT SNL - Livermore	to Nevada Test Site					
	Truck	2.05E-02	2.57E-03	4.65E-03	1.90E-02	2.62E-02
	Rail	8.60E-03	5.75E-03	1.20E-04	7.70E-03	1.36E-02

Table 4. Accident Dose Risk per Shipment (person-rem/shipment)

Source/Route		Truck	Rail
LLW(x) AL to OR			
Ames Laboratory	to Oak Ridge Reserv.	8.90E-06	6.40E-06
LLW(x) AL to PO			
Ames Laboratory	to Portsmouth GDP	9.76E-07	4.06E-07
LLW(x) AN to OR			
Argonne - East	to Oak Ridge Reserv.	5.16E-04	2.26E-04
LLW(x) BA to OR			
Bettis Atomic	to Oak Ridge Reserv.	9.94E-06	1.12E-05
LLW(x) FL to OR			
Fermilab (FNAL)	to Oak Ridge Reserv.	1.22E-05	5.26E-06
LLW(x) FL to PO			
Fermilab (FNAL)	to Portsmouth GDP	5.67E-05	1.47E-05
LLW(x) IT to LA			
ITRI	to Los Alamos NL	1.53E-03	7.01E-05
LLW(x) KA to OR			
Knolls Atomic	to Oak Ridge Reserv.	2.13E-06	3.16E-06
LLW(x) KC to OR			
Kansas City Plant	to Oak Ridge Reserv.	3.55E-05	7.40E-06
LLW(x) LB to HS			
Lawrence Berkeley	to Hanford Site	6.10E-02	6.80E-02
LLW(x) LB to NT			
Lawrence Berkeley	to Nevada Test Site	7.54E-03	1.03E-02
LLW(x) LL to HS			
Lawrence Livermore	to Hanford Site	1.05E-05	1.34E-05
LLW(x) LL to NT			
Lawrence Livermore	to Nevada Test Site	3.71E-06	2.98E-06
LLW(x) MP to OR			
Mound Plant	to Oak Ridge Reserv.	1.10E-06	3.11E-07
LLW(x) MP to PO			
Mound Plant	to Portsmouth GDP	6.85E-08	4.29E-08
LLW(x) OI to OR			
ORISE	to Oak Ridge Reserv.	4.49E-08	3.15E-08
LLW(x) PP to LA			
Pantex Plant	to Los Alamos NL	5.66E-07	9.26E-08
LLW(x) PO to OR			
Portsmouth GDP	to Oak Ridge Reserv.	2.08E-08	1.05E-08
LLW(x) PR to OR			
Princeton PPL	to Oak Ridge Reserv.	5.74E-06	2.32E-06
LLW(x) PR to PO			
Princeton PPL	to Portsmouth GDP	4.35E-11	2.17E-11
LLW(x) PA to OR			
Paducah GDP	to Oak Ridge Reserv.	3.12E-07	1.09E-07
LLW(x) PI to SR			
Pinellas Plant	to Savannah River	1.30E-06	4.65E-07
LLW(x) RF to LA			
Rocky Flats Plant	to Los Alamos NL	4.96E-06	5.78E-07
LLW(x) RM to OR			
Reactive Metals	to Oak Ridge Reserv.	5.54E-09	2.75E-09
LLW(x) RM to PO			
Reactive Metals	to Portsmouth GDP	1.34E-08	9.03E-09
LLW(x) ST to HS			
SLAC	to Hanford Site	9.15E-10	5.37E-10
LLW(x) ST to NT			
SLAC	to Nevada Test Site	2.14E-07	3.39E-07
LLW(x) SA to LA			
SNL - Albuquerque	to Los Alamos NL	5.39E-06	2.50E-07
LLW(x) SL to HS			
SNL - Livermore	to Hanford Site	1.07E-04	5.69E-05
LLW(x) SL to NT			
SNL - Livermore	to Nevada Test Site	3.48E-05	2.74E-05

Table 5. Nonradiological Risk Factors per Shipment
(fatalities/shipment)

Mode	Route	Emission	Accident
Truck			
Ames Laboratory	to Oak Ridge Reserv.	4.25E-06	5.79E-05
Ames Laboratory	to Portsmouth GDP	4.02E-06	4.11E-05
Argonne - East	to Oak Ridge Reserv.	5.38E-06	4.21E-05
Bettis Atomic	to Oak Ridge Reserv.	3.41E-06	3.71E-05
Fermilab (FNAL)	to Oak Ridge Reserv.	6.76E-06	4.62E-05
Fermilab (FNAL)	to Portsmouth GDP	8.11E-06	3.01E-05
ITRI	to Los Alamos NL	1.51E-06	1.28E-05
Knolls Atomic	to Oak Ridge Reserv.	2.16E-06	6.08E-05
Kansas City Plant	to Oak Ridge Reserv.	4.31E-06	4.90E-05
Lawrence Berkeley	to Hanford Site	1.16E-05	4.91E-05
Lawrence Berkeley	to Nevada Test Site	1.73E-05	5.39E-05
Lawrence Livermore	to Hanford Site	9.85E-06	5.03E-05
Lawrence Livermore	to Nevada Test Site	1.32E-05	5.15E-05
Mound Plant	to Oak Ridge Reserv.	1.64E-06	2.43E-05
Mound Plant	to Portsmouth GDP	2.70E-06	6.66E-06
ORISE	to Oak Ridge Reserv.	0.00E+00	1.07E-06
Pantex Plant	to Los Alamos NL	3.28E-06	3.21E-05
Portsmouth GDP	to Oak Ridge Reserv.	1.09E-06	2.56E-05
Princeton PPL	to Oak Ridge Reserv.	1.60E-05	4.89E-05
Princeton PPL	to Portsmouth GDP	1.16E-05	3.99E-05
Paducah GDP	to Oak Ridge Reserv.	1.93E-07	2.14E-05
Pinellas Plant	to Savannah River	4.47E-06	4.70E-05
Rocky Flats Plant	to Los Alamos NL	4.25E-06	3.76E-05
Reactive Metals	to Oak Ridge Reserv.	3.57E-06	3.56E-05
Reactive Metals	to Portsmouth GDP	2.45E-06	1.21E-05
SLAC	to Hanford Site	1.50E-05	5.14E-05
SLAC	to Nevada Test Site	2.17E-05	5.48E-05
SNL - Albuquerque	to Los Alamos NL	1.35E-06	1.20E-05
SNL - Livermore	to Hanford Site	9.85E-06	5.03E-05
SNL - Livermore	to Nevada Test Site	1.32E-05	5.15E-05
Rail			
Ames Laboratory	to Oak Ridge Reserv.	2.52E-05	2.00E-06
Ames Laboratory	to Portsmouth GDP	2.34E-05	1.52E-06
Argonne - East	to Oak Ridge Reserv.	1.08E-05	1.36E-06
Bettis Atomic	to Oak Ridge Reserv.	1.78E-05	1.89E-06
Fermilab (FNAL)	to Oak Ridge Reserv.	2.28E-05	1.43E-06
Fermilab (FNAL)	to Portsmouth GDP	1.80E-05	9.43E-07
ITRI	to Los Alamos NL	2.47E-06	2.18E-07
Knolls Atomic	to Oak Ridge Reserv.	5.59E-05	2.00E-06
Kansas City Plant	to Oak Ridge Reserv.	1.18E-05	1.75E-06
Lawrence Berkeley	to Hanford Site	2.33E-05	2.06E-06
Lawrence Berkeley	to Nevada Test Site	2.59E-05	1.80E-06
Lawrence Livermore	to Hanford Site	2.36E-05	2.04E-06
Lawrence Livermore	to Nevada Test Site	1.01E-05	2.87E-06
Mound Plant	to Oak Ridge Reserv.	4.31E-06	6.86E-07
Mound Plant	to Portsmouth GDP	5.73E-06	3.27E-07
ORISE	to Oak Ridge Reserv.	1.26E-07	8.26E-08
Pantex Plant	to Los Alamos NL	2.59E-06	1.01E-06
Portsmouth GDP	to Oak Ridge Reserv.	3.18E-06	9.25E-07
Princeton PPL	to Oak Ridge Reserv.	3.08E-05	1.59E-06
Princeton PPL	to Portsmouth GDP	3.18E-05	1.75E-06
Paducah GDP	to Oak Ridge Reserv.	3.81E-06	1.10E-06
Pinellas Plant	to Savannah River	5.69E-06	1.01E-06
Rocky Flats Plant	to Los Alamos NL	6.78E-06	1.05E-06
Reactive Metals	to Oak Ridge Reserv.	1.85E-05	1.25E-06
Reactive Metals	to Portsmouth GDP	1.14E-05	5.84E-07
SLAC	to Hanford Site	3.07E-05	2.17E-06
SLAC	to Nevada Test Site	2.35E-05	1.80E-06
SNL - Albuquerque	to Los Alamos NL	2.47E-06	2.18E-07
SNL - Livermore	to Hanford Site	2.36E-05	2.04E-06
SNL - Livermore	to Nevada Test Site	1.01E-05	2.87E-06

Table 6. Annual Incident-Free Dose for the Shipping Campaign (person-rem/yr)

Route		Truck		Rail	
		Crew	Public	Crew	Public
Ames Laboratory	to Oak Ridge Reserv.	5.66E-02	6.28E-02	6.86E-03	2.24E-02
Ames Laboratory	to Portsmouth GDP	2.33E-02	2.63E-02	5.91E-03	2.01E-02
Argonne - East	to Oak Ridge Reserv.	2.10E+00	2.29E+00	2.18E-01	5.45E-01
Bettis Atomic	to Oak Ridge Reserv.	1.05E+00	1.15E+00	1.40E-01	4.30E-01
Fermilab (FNAL)	to Oak Ridge Reserv.	4.30E-02	4.70E-02	5.73E-03	1.95E-02
Fermilab (FNAL)	to Portsmouth GDP	1.68E-02	1.87E-02	4.76E-03	1.58E-02
ITRI	to Los Alamos NL	3.54E-02	4.18E-02	1.33E-02	2.15E-02
Knolls Atomic	to Oak Ridge Reserv.	8.33E-01	8.72E-01	7.56E-02	4.48E-01
Kansas City Plant	to Oak Ridge Reserv.	2.20E-02	2.52E-02	6.38E-03	1.40E-02
Lawrence Berkeley	to Hanford Site	5.51E-02	6.54E-02	6.99E-03	2.05E-02
Lawrence Berkeley	to Nevada Test Site	4.54E-02	5.82E-02	6.47E-03	2.12E-02
Lawrence Livermore	to Hanford Site	4.79E-01	5.58E-01	4.86E-02	1.43E-01
Lawrence Livermore	to Nevada Test Site	8.22E-01	1.05E+00	1.29E-01	2.03E-01
Mound Plant	to Oak Ridge Reserv.	6.09E+00	6.30E+00	7.90E-01	1.50E+00
Mound Plant	to Portsmouth GDP	7.00E-02	7.58E-02	1.77E-02	3.92E-02
ORISE	to Oak Ridge Reserv.	1.81E-03	1.80E-03	6.09E-03	7.89E-03
Pantex Plant	to Los Alamos NL	1.58E+01	1.96E+01	2.63E+00	3.86E+00
Portsmouth GDP	to Oak Ridge Reserv.	3.46E+01	3.78E+01	5.26E+00	1.04E+01
Princeton PPL	to Oak Ridge Reserv.	2.68E-02	3.04E-02	6.05E-03	2.71E-02
Princeton PPL	to Portsmouth GDP	2.28E-02	2.48E-02	6.38E-03	2.64E-02
Paducah GDP	to Oak Ridge Reserv.	5.57E+00	6.26E+00	1.19E+00	1.86E+00
Pinellas Plant	to Savannah River	4.04E-02	4.48E-02	4.90E-03	1.02E-02
Rocky Flats Plant	to Los Alamos NL	4.53E+00	5.39E+00	6.13E-01	1.15E+00
Reactive Metals	to Oak Ridge Reserv.	1.57E+01	1.66E+01	1.52E+00	5.10E+00
Reactive Metals	to Portsmouth GDP	7.02E-02	7.37E-02	1.21E-02	3.61E-02
SLAC	to Hanford Site	2.98E-02	3.54E-02	7.20E-03	2.44E-02
SLAC	to Nevada Test Site	9.46E-01	1.23E+00	9.72E-02	3.02E-01
SNL - Albuquerque	to Los Alamos NL	5.58E-02	6.53E-02	2.32E-02	3.76E-02
SNL - Livermore	to Hanford Site	2.82E-02	3.28E-02	6.94E-03	2.05E-02
SNL - Livermore	to Nevada Test Site	1.03E-01	1.31E-01	1.72E-02	2.71E-02
Totals		8.92E+01	9.99E+01	1.29E+01	2.63E+01

Table 7. Annual Accident Dose Risk for the Shipping Campaign (person-rem/yr)

Route		Truck	Rail
Ames Laboratory	to Oak Ridge Reserv.	1.78E-05	6.40E-06
Ames Laboratory	to Portsmouth GDP	9.76E-07	4.06E-07
Argonne - East	to Oak Ridge Reserv.	5.41E-02	8.83E-03
Bettis Atomic	to Oak Ridge Reserv.	5.67E-04	2.35E-04
Fermilab (FNAL)	to Oak Ridge Reserv.	2.43E-05	5.26E-06
Fermilab (FNAL)	to Portsmouth GDP	5.67E-05	1.47E-05
ITRI	to Los Alamos NL	1.53E-02	2.80E-04
Knolls Atomic	to Oak Ridge Reserv.	5.98E-05	3.47E-05
Kansas City Plant	to Oak Ridge Reserv.	3.55E-05	7.40E-06
Lawrence Berkeley	to Hanford Site	1.22E-01	6.80E-02
Lawrence Berkeley	to Nevada Test Site	1.51E-02	1.03E-02
Lawrence Livermore	to Hanford Site	1.79E-04	9.36E-05
Lawrence Livermore	to Nevada Test Site	1.48E-04	4.47E-05
Mound Plant	to Oak Ridge Reserv.	5.45E-04	5.79E-05
Mound Plant	to Portsmouth GDP	8.22E-07	2.15E-07
ORISE	to Oak Ridge Reserv.	2.24E-07	6.30E-08
Pantex Plant	to Los Alamos NL	8.02E-04	4.97E-05
Portsmouth GDP	to Oak Ridge Reserv.	6.19E-05	1.17E-05
Princeton PPL	to Oak Ridge Reserv.	5.74E-06	2.32E-06
Princeton PPL	to Portsmouth GDP	4.35E-11	2.17E-11
Paducah GDP	to Oak Ridge Reserv.	1.96E-04	2.57E-05
Pinellas Plant	to Savannah River	2.59E-06	4.65E-07
Rocky Flats Plant	to Los Alamos NL	1.66E-03	7.11E-05
Reactive Metals	to Oak Ridge Reserv.	4.13E-06	7.78E-07
Reactive Metals	to Portsmouth GDP	9.38E-08	2.71E-08
SLAC	to Hanford Site	9.15E-10	5.37E-10
SLAC	to Nevada Test Site	8.33E-06	5.08E-06
SNL - Albuquerque	to Los Alamos NL	9.16E-05	1.75E-06
SNL - Livermore	to Hanford Site	1.07E-04	5.69E-05
SNL - Livermore	to Nevada Test Site	1.74E-04	5.48E-05
Totals		2.11E-01	8.82E-02

Table 8. Expected Annual Fatalities for the Shipping Campaign

Exposure Group	Truck	Rail
Radiological		
Normal Crew	3.6E-02	5.2E-03
Normal Public	5.0E-02	1.3E-02
Accident Public	1.1E-04	4.4E-05
Nonradiological		
Emission	1.6E-02	1.5E-02
Accident	2.0E-01	2.7E-03

Table 9. Expected Annual Cancer Incidence for the Shipping Campaign

Exposure Group	Truck	Rail
Radiological		
Normal Crew	1.2E-01	1.8E-02
Normal Public	1.7E-01	4.5E-02
Accident Public	3.6E-04	1.5E-04
Nonradiological		
Emission	1.6E-02	1.5E-02
Accident	NA	NA

Table 10. Expected Annual Genetic Effects for the Shipping Campaign

Exposure Group	Truck	Rail
Radiological		
Normal Crew	5.4E-03	7.7E-04
Normal Public	1.0E-02	2.6E-03
Accident Public	6.8E-06	2.1E-06
Nonradiological		
Emission	NA	NA
Accident	NA	NA

B.12 WM LLW REGIONALIZED 4 ALTERNATIVE (CASE 12): ACTIVATED METALS

Table 1. Summary of Route Information

Route		Distance (miles)	Percentage in Zone		
			Rural	Suburban	Urban
Truck					
Bettis Atomic	to Portsmouth GDP	265	58.8	37.4	3.8
Fermilab (FNAL)	to Portsmouth GDP	460	62.5	32.0	5.5
Knolls Atomic	to Portsmouth GDP	688	57.3	40.1	2.5
Lawrence Berkeley	to Hanford Site	875	78.1	17.8	4.1
Portsmouth GDP	to Oak Ridge Reserv.	371	74.5	24.6	0.9
SNL - Albuquerque	to Los Alamos NL	102	75.8	20.1	4.1
Rail					
Bettis Atomic	to Portsmouth GDP	429	52.6	39.6	7.8
Fermilab (FNAL)	to Portsmouth GDP	451	61.5	28.9	9.5
Knolls Atomic	to Portsmouth GDP	681	52.1	40.3	7.5
Lawrence Berkeley	to Hanford Site	986	78.5	15.8	5.7
Portsmouth GDP	to Oak Ridge Reserv.	442	66.8	31.5	1.7
SNL - Albuquerque	to Los Alamos NL	104	74.3	20.0	5.7

Table 2. Annual Number of Shipments and One-Way Shipment Distances

Route		# of Shipments		Total Mileage(mi)	
		Truck	Rail	Truck	Rail
Bettis Atomic	to Portsmouth GDP	309	119	8.19E+04	5.11E+04
Fermilab (FNAL)	to Portsmouth GDP	39	16	1.79E+04	7.21E+03
Knolls Atomic	to Portsmouth GDP	639	245	4.40E+05	1.67E+05
Lawrence Berkeley	to Hanford Site	14	6	1.22E+04	5.91E+03
Portsmouth GDP	to Oak Ridge Reserv.	785	337	2.91E+05	1.49E+05
SNL - Albuquerque	to Los Alamos NL	6	3	6.12E+02	3.12E+02
Totals		1792	726	8.43E+05	3.80E+05

Table 3. Incident-Free Dose per Shipment (person-rem/shipment)

Source/Route(s)		Crew	General Public			
			Off-Link	On-Link	Stops	Total
LLW(I) BA to PO						
Bettis Atomic	to Portsmouth GDP					
	Truck	9.78E-03	1.26E-03	1.73E-03	7.42E-03	1.04E-02
	Rail	4.67E-03	9.85E-03	1.53E-04	4.80E-03	1.48E-02
LLW(I) FL to PO						
Fermilab (FNAL)	to Portsmouth GDP					
	Truck	1.68E-02	2.40E-03	3.43E-03	1.29E-02	1.87E-02
	Rail	4.76E-03	1.08E-02	1.48E-04	4.87E-03	1.58E-02
LLW(I) KA to PO						
Knolls Atomic	to Portsmouth GDP					
	Truck	2.54E-02	2.99E-03	4.01E-03	1.93E-02	2.63E-02
	Rail	5.72E-03	1.54E-02	2.43E-04	5.58E-03	2.13E-02
LLW(I) LB to HS						
Lawrence Berkeley	to Hanford Site					
	Truck	2.76E-02	3.02E-03	5.17E-03	2.45E-02	3.27E-02
	Rail	6.99E-03	1.38E-02	2.03E-04	6.51E-03	2.05E-02
LLW(I) PO to OR						
Portsmouth GDP	to Oak Ridge Reserv.					
	Truck	1.16E-02	8.77E-04	1.50E-03	1.04E-02	1.28E-02
	Rail	4.73E-03	4.37E-03	1.00E-04	4.84E-03	9.32E-03
LLW(I) SA to LA						
SNL - Albuquerque	to Los Alamos NL					
	Truck	3.28E-03	3.70E-04	6.13E-04	2.86E-03	3.84E-03
	Rail	3.31E-03	1.55E-03	2.36E-05	3.80E-03	5.37E-03

Table 4. Accident Dose Risk per Shipment (person-rem/shipment)

Source/Route		Truck	Rail
LLW(I) BA to PO Bettis Atomic	to Portsmouth GDP	3.70E-07	4.16E-07
LLW(I) FL to PO Fermilab (FNAL)	to Portsmouth GDP	5.29E-11	3.35E-11
LLW(I) KA to PO Knolls Atomic	to Portsmouth GDP	1.66E-06	1.02E-06
LLW(I) LB to HS Lawrence Berkeley	to Hanford Site	1.81E-10	2.37E-10
LLW(I) PO to OR Portsmouth GDP	to Oak Ridge Reserv.	8.34E-07	3.69E-07
LLW(I) SA to LA SNL - Albuquerque	to Los Alamos NL	1.72E-12	6.51E-14

Table 5. Nonradiological Risk Factors per Shipment (fatalities/shipment)

Mode	Route	Emission	Accident
Truck			
Bettis Atomic	to Portsmouth GDP	3.22E-06	1.33E-05
Fermilab (FNAL)	to Portsmouth GDP	8.11E-06	3.01E-05
Knolls Atomic	to Portsmouth GDP	5.63E-06	3.56E-05
Lawrence Berkeley	to Hanford Site	1.16E-05	4.91E-05
Portsmouth GDP	to Oak Ridge Reserv.	1.09E-06	2.56E-05
SNL - Albuquerque	to Los Alamos NL	1.35E-06	1.20E-05
Rail			
Bettis Atomic	to Portsmouth GDP	1.40E-05	8.98E-07
Fermilab (FNAL)	to Portsmouth GDP	1.80E-05	9.43E-07
Knolls Atomic	to Portsmouth GDP	2.15E-05	1.43E-06
Lawrence Berkeley	to Hanford Site	2.33E-05	2.06E-06
Portsmouth GDP	to Oak Ridge Reserv.	3.18E-06	9.25E-07
SNL - Albuquerque	to Los Alamos NL	2.47E-06	2.18E-07

Table 6. Annual Incident-Free Dose for the Shipping Campaign (person-rem/yr)

		Truck		Rail	
Route		Crew	Public	Crew	Public
Bettis Atomic	to Portsmouth GDP	3.02E+00	3.22E+00	5.56E-01	1.76E+00
Fermilab (FNAL)	to Portsmouth GDP	6.54E-01	7.30E-01	7.62E-02	2.53E-01
Knolls Atomic	to Portsmouth GDP	1.62E+01	1.68E+01	1.40E+00	5.21E+00
Lawrence Berkeley	to Hanford Site	3.86E-01	4.58E-01	4.20E-02	1.23E-01
Portsmouth GDP	to Oak Ridge Reserv.	9.14E+00	1.00E+01	1.59E+00	3.14E+00
SNL - Albuquerque	to Los Alamos NL	1.97E-02	2.30E-02	9.94E-03	1.61E-02
Totals		2.94E+01	3.12E+01	3.68E+00	1.05E+01

Table 7. Annual Accident Dose Risk for the Shipping Campaign (person-rem/yr)

Route		Truck	Rail
Bettis Atomic	to Portsmouth GDP	1.14E-04	4.95E-05
Fermilab (FNAL)	to Portsmouth GDP	2.06E-09	5.35E-10
Knolls Atomic	to Portsmouth GDP	1.06E-03	2.49E-04
Lawrence Berkeley	to Hanford Site	2.53E-09	1.42E-09
Portsmouth GDP	to Oak Ridge Reserv.	6.55E-04	1.24E-04
SNL - Albuquerque	to Los Alamos NL	1.03E-11	1.95E-13
Totals		1.83E-03	4.23E-04

Table 8. Expected Annual Fatalities for the Shipping Campaign

Exposure Group	Truck	Rail
Radiological		
Normal Crew	1.2E-02	1.5E-03
Normal Public	1.6E-02	5.3E-03
Accident Public	9.1E-07	2.1E-07
Nonradiological		
Emission	5.9E-03	8.4E-03
Accident	4.9E-02	8.0E-04

Table 9. Expected Annual Cancer Incidence for the Shipping Campaign

Exposure Group	Truck	Rail
Radiological		
Normal Crew	4.1E-02	5.2E-03
Normal Public	5.3E-02	1.8E-02
Accident Public	3.1E-06	7.2E-07
Nonradiological		
Emission	5.9E-03	8.4E-03
Accident	NA	NA

Table 10. Expected Annual Genetic Effects for the Shipping Campaign

Exposure Group	Truck	Rail
Radiological		
Normal Crew	1.8E-03	2.2E-04
Normal Public	3.1E-03	1.1E-03
Accident Public	1.8E-07	4.2E-08
Nonradiological		
Emission	NA	NA
Accident	NA	NA

B.13 WM LLW REGIONALIZED 5 ALTERNATIVE (CASE 19): HETEROGENEOUS SOLIDS

Table 1. Summary of Route Information

Route		Distance (miles)	Percentage in Zone		
			Rural	Suburban	Urban
Truck					
Ames Laboratory	to Oak Ridge Reserv.	900	75.2	23.4	1.5
Argonne - East	to Oak Ridge Reserv.	584	67.0	30.1	2.9
Bettis Atomic	to Oak Ridge Reserv.	562	70.7	27.4	1.9
Fermilab (FNAL)	to Oak Ridge Reserv.	616	65.3	31.2	3.4
INEL	to Los Alamos NL	1144	88.7	9.8	1.4
ITRI	to INEL	1177	88.6	9.8	1.6
ITRI	to Los Alamos NL	111	76.8	18.9	4.2
Knolls Atomic	to Oak Ridge Reserv.	885	66.6	32.6	0.8
Kansas City Plant	to Oak Ridge Reserv.	723	79.0	19.2	1.9
Lawrence Berkeley	to Hanford Site	875	78.1	17.8	4.1
Lawrence Berkeley	to Nevada Test Site	719	81.9	10.6	7.5
Lawrence Livermore	to Hanford Site	894	77.2	19.3	3.4
Lawrence Livermore	to Nevada Test Site	678	84.7	9.2	6.1
Mound Plant	to Oak Ridge Reserv.	348	61.6	37.0	1.5
ORISE	to Oak Ridge Reserv.	10	58.8	41.2	0.0
Pantex Plant	to INEL	1468	89.8	8.6	1.6
Pantex Plant	to Los Alamos NL	402	89.5	8.0	2.5
Portsmouth GDP	to Oak Ridge Reserv.	371	74.5	24.6	0.9
Princeton PPL	to Oak Ridge Reserv.	715	60.8	32.2	7.0
Paducah GDP	to Oak Ridge Reserv.	304	81.3	18.5	0.2
Pinellas Plant	to Savannah River	620	71.9	25.8	2.2
Rocky Flats Plant	to INEL	716	91.3	8.1	0.6
Rocky Flats Plant	to Los Alamos NL	452	82.2	14.9	2.9
Reactive Metals	to Oak Ridge Reserv.	608	64.1	34.1	1.8
SLAC	to Hanford Site	916	75.9	19.0	5.1
SLAC	to Nevada Test Site	739	79.6	11.3	9.1
SNL - Albuquerque	to INEL	1168	88.6	9.8	1.6
SNL - Albuquerque	to Los Alamos NL	102	75.8	20.1	4.1
SNL - Livermore	to Hanford Site	894	77.2	19.3	3.4
SNL - Livermore	to Nevada Test Site	678	84.7	9.2	6.1
Rail					
Ames Laboratory	to Oak Ridge Reserv.	954	71.7	22.0	6.3
Argonne - East	to Oak Ridge Reserv.	648	70.7	25.3	4.0
Bettis Atomic	to Oak Ridge Reserv.	903	64.0	31.3	4.7
Fermilab (FNAL)	to Oak Ridge Reserv.	682	67.9	24.1	8.0
INEL	to Los Alamos NL	1179	92.2	6.8	1.0
ITRI	to INEL	1247	91.0	7.6	1.4
ITRI	to Los Alamos NL	104	74.3	20.0	5.7
Knolls Atomic	to Oak Ridge Reserv.	957	42.1	43.9	14.0
Kansas City Plant	to Oak Ridge Reserv.	838	83.0	13.6	3.4
Lawrence Berkeley	to Hanford Site	986	78.5	15.8	5.7
Lawrence Berkeley	to Nevada Test Site	860	75.1	17.7	7.2
Lawrence Livermore	to Hanford Site	973	78.9	15.3	5.8
Lawrence Livermore	to Nevada Test Site	1370	94.5	3.8	1.8
Mound Plant	to Oak Ridge Reserv.	328	74.0	22.9	3.1
ORISE	to Oak Ridge Reserv.	40	65.8	33.4	0.8
Pantex Plant	to INEL	1141	91.3	7.6	1.0
Pantex Plant	to Los Alamos NL	482	89.2	9.6	1.3
Portsmouth GDP	to Oak Ridge Reserv.	442	66.8	31.5	1.7
Princeton PPL	to Oak Ridge Reserv.	760	45.8	44.5	9.7
Paducah GDP	to Oak Ridge Reserv.	527	89.3	9.0	1.7
Pinellas Plant	to Savannah River	485	72.2	25.0	2.8
Rocky Flats Plant	to INEL	738	93.0	5.2	1.8
Rocky Flats Plant	to Los Alamos NL	504	85.7	11.1	3.2
Reactive Metals	to Oak Ridge Reserv.	600	59.4	33.2	7.4
SLAC	to Hanford Site	1036	76.1	16.8	7.1
SLAC	to Nevada Test Site	862	75.8	17.7	6.5
SNL - Albuquerque	to INEL	1247	91.0	7.6	1.4
SNL - Albuquerque	to Los Alamos NL	104	74.3	20.0	5.7
SNL - Livermore	to Hanford Site	973	78.9	15.3	5.8
SNL - Livermore	to Nevada Test Site	1370	94.5	3.8	1.8

Table 2. Annual Number of Shipments and One-Way Shipment Distances

Route		# of Shipments		Total Mileage (mi)	
		Truck	Rail	Truck	Rail
Ames Laboratory	to Oak Ridge Reserv.	2	1	1.80E+03	9.54E+02
Argonne - East	to Oak Ridge Reserv.	105	39	6.13E+04	2.53E+04
Bettis Atomic	to Oak Ridge Reserv.	57	21	3.21E+04	1.90E+04
Fermilab (FNAL)	to Oak Ridge Reserv.	3	1	1.85E+03	6.82E+02
INEL	to Los Alamos NL	244	92	2.79E+05	1.08E+05
ITRI	to INEL	2	1	2.35E+03	1.25E+03
ITRI	to Los Alamos NL	9	3	9.99E+02	3.12E+02
Knolls Atomic	to Oak Ridge Reserv.	28	11	2.48E+04	1.05E+04
Kansas City Plant	to Oak Ridge Reserv.	1	1	7.23E+02	8.38E+02
Lawrence Berkeley	to Hanford Site	2	1	1.75E+03	9.86E+02
Lawrence Berkeley	to Nevada Test Site	2	1	1.44E+03	8.60E+02
Lawrence Livermore	to Hanford Site	17	7	1.52E+04	6.81E+03
Lawrence Livermore	to Nevada Test Site	40	15	2.71E+04	2.06E+04
Mound Plant	to Oak Ridge Reserv.	516	190	1.79E+05	6.23E+04
ORISE	to Oak Ridge Reserv.	5	2	5.10E+01	7.90E+01
Pantex Plant	to INEL	1358	528	1.99E+06	6.02E+05
Pantex Plant	to Los Alamos NL	25	10	1.01E+04	4.82E+03
Portsmouth GDP	to Oak Ridge Reserv.	3250	1250	1.20E+06	5.53E+05
Princeton PPL	to Oak Ridge Reserv.	1	1	7.15E+02	7.60E+02
Paducah GDP	to Oak Ridge Reserv.	627	235	1.91E+05	1.24E+05
Pinellas Plant	to Savannah River	2	1	1.24E+03	4.85E+02
Rocky Flats Plant	to INEL	212	79	1.52E+05	5.83E+04
Rocky Flats Plant	to Los Alamos NL	141	54	6.37E+04	2.72E+04
Reactive Metals	to Oak Ridge Reserv.	761	285	4.63E+05	1.71E+05
SLAC	to Hanford Site	1	1	9.16E+02	1.04E+03
SLAC	to Nevada Test Site	39	15	2.88E+04	1.29E+04
SNL - Albuquerque	to INEL	1	1	1.17E+03	1.25E+03
SNL - Albuquerque	to Los Alamos NL	17	7	1.73E+03	7.28E+02
SNL - Livermore	to Hanford Site	1	1	8.94E+02	9.73E+02
SNL - Livermore	to Nevada Test Site	5	2	3.39E+03	2.74E+03
Totals		7474	2856	4.75E+06	1.82E+06

Table 3. Incident-Free Dose per Shipment (person-rem/shipment)

Source/Route(s)		Crew	General Public Off-Link	On-Link	Stops	Total
LLW(x) AL to OR Ames Laboratory	to Oak Ridge Reserv.					
	Truck	2.83E-02	2.29E-03	3.92E-03	2.52E-02	3.14E-02
	Rail	6.86E-03	1.58E-02	2.35E-04	6.42E-03	2.24E-02
LLW(x) AN to OR Argonne - East	to Oak Ridge Reserv.					
	Truck	2.00E-02	2.19E-03	3.27E-03	1.63E-02	2.18E-02
	Rail	5.59E-03	8.34E-03	1.48E-04	5.48E-03	1.40E-02
LLW(x) BA to OR Bettis Atomic	to Oak Ridge Reserv.					
	Truck	1.85E-02	1.72E-03	2.71E-03	1.57E-02	2.02E-02
	Rail	6.65E-03	1.40E-02	2.44E-04	6.26E-03	2.05E-02
LLW(x) FL to OR Fermilab (FNAL)	to Oak Ridge Reserv.					
	Truck	2.15E-02	2.53E-03	3.71E-03	1.72E-02	2.35E-02
	Rail	5.73E-03	1.37E-02	1.92E-04	5.58E-03	1.95E-02
LLW(x) IN to LA INEL	to Los Alamos NL					
	Truck	3.15E-02	1.73E-03	4.27E-03	3.20E-02	3.80E-02
	Rail	7.80E-03	4.00E-03	1.08E-04	7.11E-03	1.12E-02
LLW(x) IT to IN ITRI	to INEL					
	Truck	3.25E-02	1.87E-03	4.53E-03	3.29E-02	3.93E-02
	Rail	8.09E-03	5.30E-03	1.26E-04	7.32E-03	1.27E-02
LLW(x) IT to LA ITRI	to Los Alamos NL					
	Truck	3.54E-03	4.00E-04	6.71E-04	3.11E-03	4.18E-03
	Rail	3.31E-03	1.55E-03	2.36E-05	3.80E-03	5.37E-03
LLW(x) KA to OR Knolls Atomic	to Oak Ridge Reserv.					
	Truck	2.98E-02	2.55E-03	3.79E-03	2.48E-02	3.11E-02
	Rail	6.87E-03	3.39E-02	4.49E-04	6.42E-03	4.08E-02
LLW(x) KC to OR Kansas City Plant	to Oak Ridge Reserv.					
	Truck	2.20E-02	1.75E-03	3.21E-03	2.02E-02	2.52E-02
	Rail	6.38E-03	7.77E-03	1.35E-04	6.06E-03	1.40E-02
LLW(x) LA to IN INEL	to Los Alamos NL					
	Truck	3.15E-02	1.73E-03	4.27E-03	3.20E-02	3.80E-02
	Rail	7.80E-03	4.00E-03	1.08E-04	7.11E-03	1.12E-02
LLW(x) LB to HS Lawrence Berkeley	to Hanford Site					
	Truck	2.76E-02	3.02E-03	5.17E-03	2.45E-02	3.27E-02
	Rail	6.99E-03	1.38E-02	2.03E-04	6.51E-03	2.05E-02
LLW(x) LB to NT Lawrence Berkeley	to Nevada Test Site					
	Truck	2.27E-02	3.31E-03	5.66E-03	2.01E-02	2.91E-02
	Rail	6.47E-03	1.49E-02	2.04E-04	6.13E-03	2.12E-02
LLW(x) LL to HS Lawrence Livermore	to Hanford Site					
	Truck	2.82E-02	2.88E-03	4.92E-03	2.50E-02	3.28E-02
	Rail	6.94E-03	1.38E-02	2.00E-04	6.48E-03	2.05E-02
LLW(x) LL to NT Lawrence Livermore	to Nevada Test Site					
	Truck	2.05E-02	2.57E-03	4.65E-03	1.90E-02	2.62E-02
	Rail	8.60E-03	5.75E-03	1.20E-04	7.70E-03	1.36E-02
LLW(x) MP to OR Mound Plant	to Oak Ridge Reserv.					
	Truck	1.23E-02	1.24E-03	1.72E-03	9.73E-03	1.27E-02
	Rail	4.25E-03	3.53E-03	6.69E-05	4.49E-03	8.08E-03
LLW(x) OI to OR ORISE	to Oak Ridge Reserv.					
	Truck	3.63E-04	3.21E-05	4.23E-05	2.86E-04	3.60E-04
	Rail	3.05E-03	3.36E-04	8.77E-06	3.60E-03	3.95E-03
LLW(x) PP to IN Pantex Plant	to INEL					
	Truck	4.01E-02	2.24E-03	5.63E-03	4.11E-02	4.90E-02
	Rail	7.64E-03	4.12E-03	1.10E-04	6.99E-03	1.12E-02
LLW(x) PP to LA Pantex Plant	to Los Alamos NL					
	Truck	1.11E-02	7.76E-04	1.77E-03	1.13E-02	1.38E-02
	Rail	4.89E-03	2.18E-03	5.29E-05	4.96E-03	7.19E-03

LLW(x) PO to OR						
Portsmouth GDP	to Oak Ridge Reserv.					
	Truck	1.16E-02	8.77E-04	1.50E-03	1.04E-02	1.28E-02
	Rail	4.73E-03	4.37E-03	1.00E-04	4.84E-03	9.32E-03
LLW(x) PR to OR						
Princeton PPL	to Oak Ridge Reserv.					
	Truck	2.68E-02	4.27E-03	6.06E-03	2.00E-02	3.04E-02
	Rail	6.05E-03	2.10E-02	3.11E-04	5.82E-03	2.71E-02
LLW(x) PA to OR						
Paducah GDP	to Oak Ridge Reserv.					
	Truck	8.88E-03	4.70E-04	9.98E-04	8.51E-03	9.98E-03
	Rail	5.08E-03	2.75E-03	5.97E-05	5.10E-03	7.91E-03
LLW(x) PI to SR						
Pinellas Plant	to Savannah River					
	Truck	2.02E-02	1.94E-03	3.10E-03	1.74E-02	2.24E-02
	Rail	4.90E-03	5.13E-03	1.02E-04	4.97E-03	1.02E-02
LLW(x) RF to IN						
Rocky Flats Plant	to INEL					
	Truck	1.90E-02	6.95E-04	2.22E-03	2.00E-02	2.30E-02
	Rail	5.96E-03	3.32E-03	7.00E-05	5.75E-03	9.14E-03
LLW(x) RF to LA						
Rocky Flats Plant	to Los Alamos NL					
	Truck	1.35E-02	1.19E-03	2.25E-03	1.27E-02	1.61E-02
	Rail	4.98E-03	4.26E-03	7.35E-05	5.03E-03	9.36E-03
LLW(x) RM to OR						
Reactive Metals	to Oak Ridge Reserv.					
	Truck	2.11E-02	2.15E-03	3.08E-03	1.70E-02	2.23E-02
	Rail	5.38E-03	1.25E-02	1.91E-04	5.33E-03	1.80E-02
LLW(x) ST to HS						
SLAC	to Hanford Site					
	Truck	2.98E-02	3.70E-03	6.08E-03	2.56E-02	3.54E-02
	Rail	7.20E-03	1.75E-02	2.40E-04	6.67E-03	2.44E-02
LLW(x) ST to NT						
SLAC	to Nevada Test Site					
	Truck	2.43E-02	4.05E-03	6.67E-03	2.07E-02	3.14E-02
	Rail	6.48E-03	1.38E-02	1.96E-04	6.13E-03	2.01E-02
LLW(x) SA to IN						
SNL - Albuquerque	to INEL					
	Truck	3.22E-02	1.83E-03	4.46E-03	3.27E-02	3.90E-02
	Rail	8.09E-03	5.30E-03	1.26E-04	7.32E-03	1.27E-02
LLW(x) SA to LA						
SNL - Albuquerque	to Los Alamos NL					
	Truck	3.28E-03	3.70E-04	6.13E-04	2.86E-03	3.84E-03
	Rail	3.31E-03	1.55E-03	2.36E-05	3.80E-03	5.37E-03
LLW(x) SL to HS						
SNL - Livermore	to Hanford Site					
	Truck	2.82E-02	2.88E-03	4.92E-03	2.50E-02	3.28E-02
	Rail	6.94E-03	1.38E-02	2.00E-04	6.48E-03	2.05E-02
LLW(x) SL to NT						
SNL - Livermore	to Nevada Test Site					
	Truck	2.05E-02	2.57E-03	4.65E-03	1.90E-02	2.62E-02
	Rail	8.60E-03	5.75E-03	1.20E-04	7.70E-03	1.36E-02

Table 4. Accident Dose Risk per Shipment (person-rem/shipment)

Source/Route		Truck	Rail
LLW(x) AL to OR Ames Laboratory	to Oak Ridge Reserv.	9.48E-06	6.83E-06
LLW(x) AN to OR Argonne - East	to Oak Ridge Reserv.	5.16E-04	2.26E-04
LLW(x) BA to OR Bettis Atomic	to Oak Ridge Reserv.	9.94E-06	1.12E-05
LLW(x) FL to OR Fermilab (FNAL)	to Oak Ridge Reserv.	3.56E-05	2.31E-05
LLW(x) IN to LA INEL	to Los Alamos NL	1.92E-01	3.39E-02
LLW(x) IT to IN ITRI	to INEL	1.48E-02	1.85E-03
LLW(x) IT to LA ITRI	to Los Alamos NL	6.71E-04	3.70E-05
LLW(x) KA to OR Knolls Atomic	to Oak Ridge Reserv.	2.13E-06	3.16E-06
LLW(x) KC to OR Kansas City Plant	to Oak Ridge Reserv.	3.55E-05	7.40E-06
LLW(x) LA to IN INEL	to Los Alamos NL	1.10E-01	1.99E-02
LLW(x) LB to HS Lawrence Berkeley	to Hanford Site	6.10E-02	6.80E-02
LLW(x) LB to NT Lawrence Berkeley	to Nevada Test Site	7.54E-03	1.03E-02
LLW(x) LL to HS Lawrence Livermore	to Hanford Site	1.05E-05	1.34E-05
LLW(x) LL to NT Lawrence Livermore	to Nevada Test Site	3.71E-06	2.98E-06
LLW(x) MP to OR Mound Plant	to Oak Ridge Reserv.	1.06E-06	3.06E-07
LLW(x) OI to OR ORISE	to Oak Ridge Reserv.	4.49E-08	3.15E-08
LLW(x) PP to IN Pantex Plant	to INEL	1.50E-06	2.58E-07
LLW(x) PP to LA Pantex Plant	to Los Alamos NL	1.30E-06	2.02E-07
LLW(x) PO to OR Portsmouth GDP	to Oak Ridge Reserv.	7.40E-09	3.64E-09
LLW(x) PR to OR Princeton PPL	to Oak Ridge Reserv.	5.74E-06	2.32E-06
LLW(x) PA to OR Paducah GDP	to Oak Ridge Reserv.	3.12E-07	1.09E-07
LLW(x) PI to SR Pinellas Plant	to Savannah River	1.30E-06	4.65E-07
LLW(x) RF to IN Rocky Flats Plant	to INEL	3.10E-06	1.32E-06
LLW(x) RF to LA Rocky Flats Plant	to Los Alamos NL	2.53E-06	2.82E-07
LLW(x) RM to OR Reactive Metals	to Oak Ridge Reserv.	5.73E-09	2.88E-09
LLW(x) ST to HS SLAC	to Hanford Site	9.15E-10	5.37E-10
LLW(x) ST to NT SLAC	to Nevada Test Site	2.14E-07	3.39E-07
LLW(x) SA to IN SNL - Albuquerque	to INEL	4.36E-05	2.79E-06
LLW(x) SA to LA SNL - Albuquerque	to Los Alamos NL	4.60E-06	2.14E-07
LLW(x) SL to HS SNL - Livermore	to Hanford Site	1.07E-04	5.69E-05
LLW(x) SL to NT SNL - Livermore	to Nevada Test Site	3.48E-05	2.74E-05

Table 5. Nonradiological Risk Factors per Shipment
(fatalities/shipment)

Mode	Route	Emission	Accident
Truck			
Ames Laboratory	to Oak Ridge Reserv.	4.25E-06	5.79E-05
Argonne - East	to Oak Ridge Reserv.	5.38E-06	4.21E-05
Bettis Atomic	to Oak Ridge Reserv.	3.41E-06	3.71E-05
Fermilab (FNAL)	to Oak Ridge Reserv.	6.76E-06	4.62E-05
INEL	to Los Alamos NL	5.25E-06	8.21E-05
ITRI	to INEL	6.02E-06	8.53E-05
ITRI	to Los Alamos NL	1.51E-06	1.28E-05
Knolls Atomic	to Oak Ridge Reserv.	2.16E-06	6.08E-05
Kansas City Plant	to Oak Ridge Reserv.	4.31E-06	4.90E-05
Lawrence Berkeley	to Hanford Site	1.16E-05	4.91E-05
Lawrence Berkeley	to Nevada Test Site	1.73E-05	5.39E-05
Lawrence Livermore	to Hanford Site	9.85E-06	5.03E-05
Lawrence Livermore	to Nevada Test Site	1.32E-05	5.15E-05
Mound Plant	to Oak Ridge Reserv.	1.64E-06	2.43E-05
ORISE	to Oak Ridge Reserv.	0.00E+00	1.07E-06
Pantex Plant	to INEL	7.79E-06	1.05E-04
Pantex Plant	to Los Alamos NL	3.28E-06	3.21E-05
Portsmouth GDP	to Oak Ridge Reserv.	1.09E-06	2.56E-05
Princeton PPL	to Oak Ridge Reserv.	1.60E-05	4.89E-05
Paducah GDP	to Oak Ridge Reserv.	1.93E-07	2.14E-05
Pinellas Plant	to Savannah River	4.47E-06	4.70E-05
Rocky Flats Plant	to INEL	1.42E-06	4.68E-05
Rocky Flats Plant	to Los Alamos NL	4.25E-06	3.76E-05
Reactive Metals	to Oak Ridge Reserv.	3.57E-06	3.56E-05
SLAC	to Hanford Site	1.50E-05	5.14E-05
SLAC	to Nevada Test Site	2.17E-05	5.48E-05
SNL - Albuquerque	to INEL	5.83E-06	8.45E-05
SNL - Albuquerque	to Los Alamos NL	1.35E-06	1.20E-05
SNL - Livermore	to Hanford Site	9.85E-06	5.03E-05
SNL - Livermore	to Nevada Test Site	1.32E-05	5.15E-05
Rail			
Ames Laboratory	to Oak Ridge Reserv.	2.52E-05	2.00E-06
Argonne - East	to Oak Ridge Reserv.	1.08E-05	1.36E-06
Bettis Atomic	to Oak Ridge Reserv.	1.78E-05	1.89E-06
Fermilab (FNAL)	to Oak Ridge Reserv.	2.28E-05	1.43E-06
INEL	to Los Alamos NL	4.90E-06	2.47E-06
ITRI	to INEL	7.11E-06	2.61E-06
ITRI	to Los Alamos NL	2.47E-06	2.18E-07
Knolls Atomic	to Oak Ridge Reserv.	5.59E-05	2.00E-06
Kansas City Plant	to Oak Ridge Reserv.	1.18E-05	1.75E-06
Lawrence Berkeley	to Hanford Site	2.33E-05	2.06E-06
Lawrence Berkeley	to Nevada Test Site	2.59E-05	1.80E-06
Lawrence Livermore	to Hanford Site	2.36E-05	2.04E-06
Lawrence Livermore	to Nevada Test Site	1.01E-05	2.87E-06
Mound Plant	to Oak Ridge Reserv.	4.31E-06	6.86E-07
ORISE	to Oak Ridge Reserv.	1.26E-07	8.26E-08
Pantex Plant	to INEL	4.85E-06	2.39E-06
Pantex Plant	to Los Alamos NL	2.59E-06	1.01E-06
Portsmouth GDP	to Oak Ridge Reserv.	3.18E-06	9.25E-07
Princeton PPL	to Oak Ridge Reserv.	3.08E-05	1.59E-06
Paducah GDP	to Oak Ridge Reserv.	3.81E-06	1.10E-06
Pinellas Plant	to Savannah River	5.69E-06	1.01E-06
Rocky Flats Plant	to INEL	5.44E-06	1.54E-06
Rocky Flats Plant	to Los Alamos NL	6.78E-06	1.05E-06
Reactive Metals	to Oak Ridge Reserv.	1.85E-05	1.25E-06
SLAC	to Hanford Site	3.07E-05	2.17E-06
SLAC	to Nevada Test Site	2.35E-05	1.80E-06
SNL - Albuquerque	to INEL	7.11E-06	2.61E-06
SNL - Albuquerque	to Los Alamos NL	2.47E-06	2.18E-07
SNL - Livermore	to Hanford Site	2.36E-05	2.04E-06
SNL - Livermore	to Nevada Test Site	1.01E-05	2.87E-06

Table 6. Annual Incident-Free Dose for the Shipping Campaign (person-rem/yr)

Route		Truck		Rail	
		Crew	Public	Crew	Public
Ames Laboratory	to Oak Ridge Reserv.	5.66E-02	6.28E-02	6.86E-03	2.24E-02
Argonne - East	to Oak Ridge Reserv.	2.10E+00	2.29E+00	2.18E-01	5.45E-01
Bettis Atomic	to Oak Ridge Reserv.	1.05E+00	1.15E+00	1.40E-01	4.30E-01
Fermilab (FNAL)	to Oak Ridge Reserv.	6.45E-02	7.04E-02	5.73E-03	1.95E-02
INEL	to Los Alamos NL	7.68E+00	9.28E+00	7.18E-01	1.03E+00
ITRI	to INEL	6.50E-02	7.87E-02	8.09E-03	1.27E-02
ITRI	to Los Alamos NL	3.19E-02	3.76E-02	9.94E-03	1.61E-02
Knolls Atomic	to Oak Ridge Reserv.	8.33E-01	8.72E-01	7.56E-02	4.48E-01
Kansas City Plant	to Oak Ridge Reserv.	2.20E-02	2.52E-02	6.38E-03	1.40E-02
Lawrence Berkeley	to Hanford Site	5.51E-02	6.54E-02	6.99E-03	2.05E-02
Lawrence Berkeley	to Nevada Test Site	4.54E-02	5.82E-02	6.47E-03	2.12E-02
Lawrence Livermore	to Hanford Site	4.79E-01	5.58E-01	4.86E-02	1.43E-01
Lawrence Livermore	to Nevada Test Site	8.22E-01	1.05E+00	1.29E-01	2.03E-01
Mound Plant	to Oak Ridge Reserv.	6.33E+00	6.55E+00	8.07E-01	1.54E+00
ORISE	to Oak Ridge Reserv.	1.81E-03	1.80E-03	6.09E-03	7.89E-03
Pantex Plant	to INEL	5.45E+01	6.65E+01	4.03E+00	5.92E+00
Pantex Plant	to Los Alamos NL	2.79E-01	3.45E-01	4.89E-02	7.19E-02
Portsmouth GDP	to Oak Ridge Reserv.	3.79E+01	4.14E+01	5.91E+00	1.16E+01
Princeton PPL	to Oak Ridge Reserv.	2.68E-02	3.04E-02	6.05E-03	2.71E-02
Paducah GDP	to Oak Ridge Reserv.	5.57E+00	6.26E+00	1.19E+00	1.86E+00
Pinellas Plant	to Savannah River	4.04E-02	4.48E-02	4.90E-03	1.02E-02
Rocky Flats Plant	to INEL	4.02E+00	4.87E+00	4.71E-01	7.22E-01
Rocky Flats Plant	to Los Alamos NL	1.91E+00	2.27E+00	2.69E-01	5.05E-01
Reactive Metals	to Oak Ridge Reserv.	1.61E+01	1.69E+01	1.53E+00	5.13E+00
SLAC	to Hanford Site	2.98E-02	3.54E-02	7.20E-03	2.44E-02
SLAC	to Nevada Test Site	9.46E-01	1.23E+00	9.72E-02	3.02E-01
SNL - Albuquerque	to INEL	3.22E-02	3.90E-02	8.09E-03	1.27E-02
SNL - Albuquerque	to Los Alamos NL	5.58E-02	6.53E-02	2.32E-02	3.76E-02
SNL - Livermore	to Hanford Site	2.82E-02	3.28E-02	6.94E-03	2.05E-02
SNL - Livermore	to Nevada Test Site	1.03E-01	1.31E-01	1.72E-02	2.71E-02
Totals		1.41E+02	1.62E+02	1.58E+01	3.08E+01

Table 7. Annual Accident Dose Risk for the Shipping Campaign (person-rem/yr)

Route		Truck	Rail
Ames Laboratory	to Oak Ridge Reserv.	1.90E-05	6.83E-06
Argonne - East	to Oak Ridge Reserv.	5.41E-02	8.83E-03
Bettis Atomic	to Oak Ridge Reserv.	5.67E-04	2.35E-04
Fermilab (FNAL)	to Oak Ridge Reserv.	1.07E-04	2.31E-05
INEL	to Los Alamos NL	3.42E+01	2.30E+00
ITRI	to INEL	2.95E-02	1.85E-03
ITRI	to Los Alamos NL	6.04E-03	1.11E-04
Knolls Atomic	to Oak Ridge Reserv.	5.98E-05	3.47E-05
Kansas City Plant	to Oak Ridge Reserv.	3.55E-05	7.40E-06
Lawrence Berkeley	to Hanford Site	1.22E-01	6.80E-02
Lawrence Berkeley	to Nevada Test Site	1.51E-02	1.03E-02
Lawrence Livermore	to Hanford Site	1.79E-04	9.36E-05
Lawrence Livermore	to Nevada Test Site	1.48E-04	4.47E-05
Mound Plant	to Oak Ridge Reserv.	5.46E-04	5.81E-05
ORISE	to Oak Ridge Reserv.	2.24E-07	6.30E-08
Pantex Plant	to INEL	2.03E-03	1.36E-04
Pantex Plant	to Los Alamos NL	3.25E-05	2.02E-06
Portsmouth GDP	to Oak Ridge Reserv.	2.40E-05	4.55E-06
Princeton PPL	to Oak Ridge Reserv.	5.74E-06	2.32E-06
Paducah GDP	to Oak Ridge Reserv.	1.96E-04	2.57E-05
Pinellas Plant	to Savannah River	2.59E-06	4.65E-07
Rocky Flats Plant	to INEL	6.56E-04	1.04E-04
Rocky Flats Plant	to Los Alamos NL	3.56E-04	1.53E-05
Reactive Metals	to Oak Ridge Reserv.	4.36E-06	8.20E-07
SLAC	to Hanford Site	9.15E-10	5.37E-10
SLAC	to Nevada Test Site	8.33E-06	5.08E-06
SNL - Albuquerque	to INEL	4.36E-05	2.79E-06
SNL - Albuquerque	to Los Alamos NL	7.83E-05	1.50E-06
SNL - Livermore	to Hanford Site	1.07E-04	5.69E-05
SNL - Livermore	to Nevada Test Site	1.74E-04	5.48E-05
Totals		3.44E+01	2.39E+00

Table 8. Expected Annual Fatalities for the Shipping Campaign

Exposure Group	Truck	Rail
Radiological		
Normal Crew	5.6E-02	6.3E-03
Normal Public	8.1E-02	1.5E-02
Accident Public	1.7E-02	1.2E-03
Nonradiological		
Emission	2.3E-02	1.7E-02
Accident	3.3E-01	3.8E-03

Table 9. Expected Annual Cancer Incidence for the Shipping Campaign

Exposure Group	Truck	Rail
Radiological		
Normal Crew	2.0E-01	2.2E-02
Normal Public	2.8E-01	5.2E-02
Accident Public	5.9E-02	4.1E-03
Nonradiological		
Emission	2.3E-02	1.7E-02
Accident	NA	NA

Table 10. Expected Annual Genetic Effects for the Shipping Campaign

Exposure Group	Truck	Rail
Radiological		
Normal Crew	8.5E-03	9.5E-04
Normal Public	1.6E-02	3.1E-03
Accident Public	2.9E-03	1.8E-04
Nonradiological		
Emission	NA	NA
Accident	NA	NA

B.14 WM LLW REGIONALIZED 5 ALTERNATIVE (CASE 19): ACTIVATED METALS

Table 1. Summary of Route Information

Route		Distance (miles)	Percentage in Zone		
			Rural	Suburban	Urban
Truck					
Bettis Atomic	to Oak Ridge Reserv.	562	70.7	27.4	1.9
Fermilab (FNAL)	to Oak Ridge Reserv.	616	65.3	31.2	3.4
INEL	to Los Alamos NL	1144	88.7	9.8	1.4
Knolls Atomic	to Oak Ridge Reserv.	885	66.6	32.6	0.8
Lawrence Berkeley	to Hanford Site	875	78.1	17.8	4.1
SNL - Albuquerque	to INEL	1168	88.6	9.8	1.6
Rail					
Bettis Atomic	to Oak Ridge Reserv.	903	64.0	31.3	4.7
Fermilab (FNAL)	to Oak Ridge Reserv.	682	67.9	24.1	8.0
INEL	to Los Alamos NL	1179	92.2	6.8	1.0
Knolls Atomic	to Oak Ridge Reserv.	957	42.1	43.9	14.0
Lawrence Berkeley	to Hanford Site	986	78.5	15.8	5.7
SNL - Albuquerque	to INEL	1247	91.0	7.6	1.4

Table 2. Annual Number of Shipments and One-Way Shipment Distances

Route		# of Shipments		Total Mileage(mi)	
		Truck	Rail	Truck	Rail
Bettis Atomic	to Oak Ridge Reserv.	309	119	1.74E+05	1.07E+05
Fermilab (FNAL)	to Oak Ridge Reserv.	39	16	2.40E+04	1.09E+04
INEL	to Los Alamos NL	739	298	8.45E+05	3.51E+05
Knolls Atomic	to Oak Ridge Reserv.	639	245	5.66E+05	2.34E+05
Lawrence Berkeley	to Hanford Site	14	6	1.22E+04	5.91E+03
SNL - Albuquerque	to INEL	6	3	7.01E+03	3.74E+03
Totals		1746	687	1.63E+06	7.14E+05

Table 3. Incident-Free Dose per Shipment (person-rem/shipment)

Source/Route(s)	Crew	General Public			
		Off-Link	On-Link	Stops	Total
LLW(I) BA to OR					
Bettis Atomic	to Oak Ridge Reserv.				
	Truck	1.85E-02	1.72E-03	2.71E-03	1.57E-02	2.02E-02
	Rail	6.65E-03	1.40E-02	2.44E-04	6.26E-03	2.05E-02
LLW(I) FL to OR					
Fermilab (FNAL)	to Oak Ridge Reserv.				
	Truck	2.15E-02	2.53E-03	3.71E-03	1.72E-02	2.35E-02
	Rail	5.73E-03	1.37E-02	1.92E-04	5.58E-03	1.95E-02
LLW(I) IN to LA					
INEL	to Los Alamos NL				
	Truck	3.15E-02	1.73E-03	4.27E-03	3.20E-02	3.80E-02
	Rail	7.80E-03	4.00E-03	1.08E-04	7.11E-03	1.12E-02
LLW(I) KA to OR					
Knolls Atomic	to Oak Ridge Reserv.				
	Truck	2.98E-02	2.55E-03	3.79E-03	2.48E-02	3.11E-02
	Rail	6.87E-03	3.39E-02	4.49E-04	6.42E-03	4.08E-02
LLW(I) LA to IN					
INEL	to Los Alamos NL				
	Truck	3.15E-02	1.73E-03	4.27E-03	3.20E-02	3.80E-02
	Rail	7.80E-03	4.00E-03	1.08E-04	7.11E-03	1.12E-02
LLW(I) LB to HS					
Lawrence Berkeley	to Hanford Site				
	Truck	2.76E-02	3.02E-03	5.17E-03	2.45E-02	3.27E-02
	Rail	6.99E-03	1.38E-02	2.03E-04	6.51E-03	2.05E-02
LLW(I) SA to IN					
SNL - Albuquerque	to INEL				
	Truck	3.22E-02	1.83E-03	4.46E-03	3.27E-02	3.90E-02
	Rail	8.09E-03	5.30E-03	1.26E-04	7.32E-03	1.27E-02

Table 4. Accident Dose Risk per Shipment (person-rem/shipment)

Source/Route		Truck	Rail
LLW(I) BA to OR			
Bettis Atomic	to Oak Ridge Reserv.	7.44E-07	6.41E-07
LLW(I) FL to OR			
Fermilab (FNAL)	to Oak Ridge Reserv.	7.76E-11	4.09E-11
LLW(I) IN to LA			
INEL	to Los Alamos NL	3.54E-09	4.78E-10
LLW(I) KA to OR			
Knolls Atomic	to Oak Ridge Reserv.	1.50E-06	2.30E-06
LLW(I) LA to IN			
INEL	to Los Alamos NL	2.80E-09	4.24E-10
LLW(I) LB to HS			
Lawrence Berkeley	to Hanford Site	1.81E-10	2.37E-10
LLW(I) SA to IN			
SNL - Albuquerque	to INEL	5.42E-12	6.53E-13

Table 5. Nonradiological Risk Factors per Shipment (fatalities/shipment)

Mode	Route	Emission	Accident
Truck			
Bettis Atomic	to Oak Ridge Reserv.	3.41E-06	3.71E-05
Fermilab (FNAL)	to Oak Ridge Reserv.	6.76E-06	4.62E-05
INEL	to Los Alamos NL	5.25E-06	8.21E-05
Knolls Atomic	to Oak Ridge Reserv.	2.16E-06	6.08E-05
Lawrence Berkeley	to Hanford Site	1.16E-05	4.91E-05
SNL - Albuquerque	to INEL	5.83E-06	8.45E-05
Rail			
Bettis Atomic	to Oak Ridge Reserv.	1.78E-05	1.89E-06
Fermilab (FNAL)	to Oak Ridge Reserv.	2.28E-05	1.43E-06
INEL	to Los Alamos NL	4.90E-06	2.47E-06
Knolls Atomic	to Oak Ridge Reserv.	5.59E-05	2.00E-06
Lawrence Berkeley	to Hanford Site	2.33E-05	2.06E-06
SNL - Albuquerque	to INEL	7.11E-06	2.61E-06

Table 6. Annual Incident-Free Dose for the Shipping Campaign (person-rem/yr)

		Truck		Rail	
Route		Crew	Public	Crew	Public
Bettis Atomic	to Oak Ridge Reserv.	5.71E+00	6.24E+00	7.91E-01	2.44E+00
Fermilab (FNAL)	to Oak Ridge Reserv.	8.38E-01	9.16E-01	9.16E-02	3.12E-01
INEL	to Los Alamos NL	2.33E+01	2.81E+01	2.32E+00	3.34E+00
Knolls Atomic	to Oak Ridge Reserv.	1.90E+01	1.99E+01	1.68E+00	9.99E+00
Lawrence Berkeley	to Hanford Site	3.86E-01	4.58E-01	4.20E-02	1.23E-01
SNL - Albuquerque	to INEL	1.93E-01	2.34E-01	2.43E-02	3.82E-02
Totals		4.94E+01	5.58E+01	4.96E+00	1.62E+01

Table 7. Annual Accident Dose Risk for the Shipping Campaign (person-rem/yr)

Route		Truck	Rail
Bettis Atomic	to Oak Ridge Reserv.	2.30E-04	7.63E-05
Fermilab (FNAL)	to Oak Ridge Reserv.	3.03E-09	6.54E-10
INEL	to Los Alamos NL	2.31E-06	1.34E-07
Knolls Atomic	to Oak Ridge Reserv.	9.58E-04	5.64E-04
Lawrence Berkeley	to Hanford Site	2.53E-09	1.42E-09
SNL - Albuquerque	to INEL	3.25E-11	1.96E-12
Totals		1.19E-03	6.41E-04

Table 8. Expected Annual Fatalities for the Shipping Campaign

Exposure Group	Truck	Rail
Radiological		
Normal Crew	2.0E-02	2.0E-03
Normal Public	2.8E-02	8.1E-03
Accident Public	6.0E-07	3.2E-07
Nonradiological		
Emission	6.8E-03	1.8E-02
Accident	1.1E-01	1.5E-03

Table 9. Expected Annual Cancer Incidence for the Shipping Campaign

Exposure Group	Truck	Rail
Radiological		
Normal Crew	6.9E-02	6.9E-03
Normal Public	9.5E-02	2.8E-02
Accident Public	2.0E-06	1.1E-06
Nonradiological		
Emission	6.8E-03	1.8E-02
Accident	NA	NA

Table 10. Expected Annual Genetic Effects for the Shipping Campaign

Exposure Group	Truck	Rail
Radiological		
Normal Crew	3.0E-03	3.0E-04
Normal Public	5.6E-03	1.6E-03
Accident Public	1.2E-07	6.4E-08
Nonradiological		
Emission	NA	NA
Accident	NA	NA

B.15 WM LLW REGIONALIZED 6 ALTERNATIVE (CASE 5): HETEROGENEOUS SOLIDS

Table 1. Summary of Route Information

Route		Distance (miles)	Percentage in Zone		
			Rural	Suburban	Urban
Truck					
Ames Laboratory	to Savannah River	1175	77.9	21.0	1.2
Argonne - East	to Savannah River	892	68.8	29.3	1.9
Argonne - West	to Hanford Site	599	91.3	7.6	1.1
Bettis Atomic	to Savannah River	656	71.7	26.4	1.9
Fermilab (FNAL)	to Savannah River	924	67.6	30.1	2.3
INEL	to Hanford Site	599	91.3	7.6	1.1
ITRI	to Hanford Site	1593	89.7	8.8	1.5
Oak Ridge Reserv.	to Savannah River	379	59.1	38.5	2.4
Knolls Atomic	to Savannah River	961	67.3	31.8	0.9
Kansas City Plant	to Savannah River	986	71.7	25.8	2.5
Los Alamos NL	to Hanford Site	1560	89.8	8.8	1.3
Lawrence Berkeley	to Hanford Site	875	78.1	17.8	4.1
Lawrence Livermore	to Hanford Site	894	77.2	19.3	3.4
Mound Plant	to Savannah River	656	66.5	32.7	0.8
ORISE	to Savannah River	369	67.0	32.3	0.8
Pantex Plant	to Hanford Site	1884	90.4	8.0	1.5
Portsmouth GDP	to Savannah River	540	67.1	30.9	2.0
Princeton PPL	to Savannah River	767	58.1	34.8	7.1
Paducah GDP	to Savannah River	568	67.6	30.4	2.1
Pinellas Plant	to Savannah River	620	71.9	25.8	2.2
Rocky Flats Plant	to Hanford Site	1132	91.9	7.3	0.8
Reactive Metals	to Savannah River	726	70.6	28.2	1.2
SLAC	to Hanford Site	916	75.9	19.0	5.1
SNL - Albuquerque	to Hanford Site	1584	89.7	8.8	1.4
SNL - Livermore	to Hanford Site	894	77.2	19.3	3.4
Rail					
Ames Laboratory	to Savannah River	1281	66.8	28.4	4.8
Argonne - East	to Savannah River	976	64.3	31.6	4.0
Argonne - West	to Hanford Site	658	91.4	7.1	1.4
Bettis Atomic	to Savannah River	947	68.5	27.1	4.4
Fermilab (FNAL)	to Savannah River	1001	63.3	31.5	5.2
INEL	to Hanford Site	658	91.4	7.1	1.4
ITRI	to Hanford Site	1793	91.7	7.1	1.2
Oak Ridge Reserv.	to Savannah River	417	68.8	29.8	1.4
Knolls Atomic	to Savannah River	1044	52.0	35.4	12.6
Kansas City Plant	to Savannah River	1161	66.8	28.9	4.3
Los Alamos NL	to Hanford Site	1725	92.5	6.5	0.9
Lawrence Berkeley	to Hanford Site	986	78.5	15.8	5.7
Lawrence Livermore	to Hanford Site	973	78.9	15.3	5.8
Mound Plant	to Savannah River	744	67.4	29.2	3.3
ORISE	to Savannah River	443	64.8	31.7	3.5
Pantex Plant	to Hanford Site	1686	92.0	7.1	1.0
Portsmouth GDP	to Savannah River	655	74.6	24.3	1.1
Princeton PPL	to Savannah River	848	57.6	33.9	8.5
Paducah GDP	to Savannah River	714	65.2	31.4	3.4
Pinellas Plant	to Savannah River	485	72.2	25.0	2.8
Rocky Flats Plant	to Hanford Site	1284	93.1	5.5	1.4
Reactive Metals	to Savannah River	920	67.3	29.1	3.6
SLAC	to Hanford Site	1036	76.1	16.8	7.1
SNL - Albuquerque	to Hanford Site	1793	91.7	7.1	1.2
SNL - Livermore	to Hanford Site	973	78.9	15.3	5.8

Table 2. Annual Number of Shipments and One-Way Shipment Distances

Route		# of Shipments		Total Mileage(mi)	
		Truck	Rail	Truck	Rail
Ames Laboratory	to Savannah River	2	1	2.35E+03	1.28E+03
Argonne - East	to Savannah River	105	39	9.36E+04	3.81E+04
Argonne - West	to Hanford Site	13	5	7.79E+03	3.29E+03
Bettis Atomic	to Savannah River	57	21	3.74E+04	1.99E+04
Fermilab (FNAL)	to Savannah River	3	2	2.77E+03	2.00E+03
INEL	to Hanford Site	852	322	5.10E+05	2.12E+05
ITRI	to Hanford Site	10	4	1.59E+04	7.17E+03
Oak Ridge Reserv.	to Savannah River	6542	2486	2.48E+06	1.04E+06
Knolls Atomic	to Savannah River	28	11	2.69E+04	1.15E+04
Kansas City Plant	to Savannah River	1	1	9.86E+02	1.16E+03
Los Alamos NL	to Hanford Site	724	268	1.13E+06	4.62E+05
Lawrence Berkeley	to Hanford Site	3	2	2.62E+03	1.97E+03
Lawrence Livermore	to Hanford Site	56	21	5.01E+04	2.04E+04
Mound Plant	to Savannah River	512	190	3.36E+05	1.41E+05
ORISE	to Savannah River	5	2	1.84E+03	8.87E+02
Pantex Plant	to Hanford Site	1450	544	2.73E+06	9.17E+05
Portsmouth GDP	to Savannah River	3344	1274	1.81E+06	8.34E+05
Princeton PPL	to Savannah River	1	1	7.67E+02	8.48E+02
Paducah GDP	to Savannah River	627	237	3.56E+05	1.69E+05
Pinellas Plant	to Savannah River	2	1	1.24E+03	4.85E+02
Rocky Flats Plant	to Hanford Site	357	133	4.04E+05	1.71E+05
Reactive Metals	to Savannah River	768	287	5.57E+05	2.64E+05
SLAC	to Hanford Site	39	15	3.57E+04	1.55E+04
SNL - Albuquerque	to Hanford Site	17	7	2.69E+04	1.26E+04
SNL - Livermore	to Hanford Site	6	2	5.36E+03	1.95E+03
Totals		15524	5876	1.06E+07	4.35E+06

Table 3. Incident-Free Dose per Shipment (person-rem/shipment)

Source/Route(s)		Crew	General Public			
			Off-Link	On-Link	Stops	Total
LLW(x) AL to SR						
Ames Laboratory	to Savannah River					
	Truck	3.59E-02	2.61E-03	4.76E-03	3.29E-02	4.03E-02
	Rail	8.23E-03	1.93E-02	3.29E-04	7.42E-03	2.70E-02
LLW(x) AN to SR						
Argonne - East	to Savannah River					
	Truck	2.98E-02	2.86E-03	4.37E-03	2.50E-02	3.22E-02
	Rail	6.95E-03	1.39E-02	2.55E-04	6.49E-03	2.07E-02
LLW(x) AW to HS						
Argonne - West	to Hanford Site					
	Truck	1.60E-02	7.18E-04	2.06E-03	1.68E-02	1.95E-02
	Rail	5.63E-03	2.83E-03	6.58E-05	5.51E-03	8.40E-03
LLW(x) BA to SR						
Bettis Atomic	to Savannah River					
	Truck	2.14E-02	1.96E-03	3.14E-03	1.84E-02	2.35E-02
	Rail	6.83E-03	1.32E-02	2.31E-04	6.39E-03	1.99E-02
LLW(x) FL to SR						
Fermilab (FNAL)	to Savannah River					
	Truck	3.13E-02	3.20E-03	4.81E-03	2.59E-02	3.39E-02
	Rail	7.06E-03	1.65E-02	2.79E-04	6.56E-03	2.33E-02
LLW(x) IN to HS						
INEL	to Hanford Site					
	Truck	1.60E-02	7.18E-04	2.06E-03	1.68E-02	1.95E-02
	Rail	5.63E-03	2.83E-03	6.58E-05	5.51E-03	8.40E-03
LLW(x) IT to HS						
ITRI	to Hanford Site					
	Truck	4.34E-02	2.30E-03	5.91E-03	4.46E-02	5.28E-02
	Rail	1.04E-02	6.90E-03	1.72E-04	9.00E-03	1.61E-02
LLW(x) OR to SR						
Oak Ridge Reserv.	to Savannah River					
	Truck	1.38E-02	1.58E-03	2.15E-03	1.06E-02	1.43E-02
	Rail	4.62E-03	3.76E-03	8.92E-05	4.76E-03	8.61E-03
LLW(x) KA to SR						
Knolls Atomic	to Savannah River					
	Truck	3.22E-02	2.78E-03	4.17E-03	2.69E-02	3.38E-02
	Rail	7.24E-03	3.25E-02	4.25E-04	6.69E-03	3.96E-02
LLW(x) KC to SR						
Kansas City Plant	to Savannah River					
	Truck	3.23E-02	3.20E-03	5.09E-03	2.76E-02	3.59E-02
	Rail	7.73E-03	1.66E-02	2.92E-04	7.05E-03	2.39E-02
LLW(x) LA to HS						
Los Alamos NL	to Hanford Site					
	Truck	4.24E-02	2.16E-03	5.65E-03	4.37E-02	5.15E-02
	Rail	1.01E-02	5.60E-03	1.54E-04	8.79E-03	1.45E-02
LLW(x) LB to HS						
Lawrence Berkeley	to Hanford Site					
	Truck	2.76E-02	3.02E-03	5.17E-03	2.45E-02	3.27E-02
	Rail	6.99E-03	1.38E-02	2.03E-04	6.51E-03	2.05E-02
LLW(x) LL to HS						
Lawrence Livermore	to Hanford Site					
	Truck	2.82E-02	2.88E-03	4.92E-03	2.50E-02	3.28E-02
	Rail	6.94E-03	1.38E-02	2.00E-04	6.48E-03	2.05E-02
LLW(x) MP to SR						
Mound Plant	to Savannah River					
	Truck	2.21E-02	1.91E-03	2.83E-03	1.84E-02	2.31E-02
	Rail	5.99E-03	9.25E-03	1.78E-04	5.77E-03	1.52E-02
LLW(x) OI to SR						
ORISE	to Savannah River					
	Truck	1.24E-02	1.06E-03	1.57E-03	1.03E-02	1.30E-02
	Rail	4.73E-03	5.91E-03	1.13E-04	4.84E-03	1.09E-02
LLW(x) OR to SR						
Oak Ridge Reserv.	to Savannah River					
	Truck	1.38E-02	1.58E-03	2.15E-03	1.06E-02	1.43E-02
	Rail	4.62E-03	3.76E-03	8.92E-05	4.76E-03	8.61E-03
LLW(x) PP to HS						
Pantex Plant	to Hanford Site					
	Truck	5.10E-02	2.68E-03	7.01E-03	5.27E-02	6.24E-02
	Rail	9.92E-03	5.71E-03	1.56E-04	8.67E-03	1.45E-02

LLW(x) PO to SR						
Portsmouth GDP	to Savannah River					
	Truck	1.83E-02	1.82E-03	2.73E-03	1.51E-02	1.97E-02
	Rail	5.61E-03	4.74E-03	1.19E-04	5.49E-03	1.04E-02
LLW(x) PR to SR						
Princeton PPL	to Savannah River					
	Truck	2.93E-02	4.76E-03	6.64E-03	2.15E-02	3.29E-02
	Rail	6.42E-03	1.96E-02	2.87E-04	6.09E-03	2.60E-02
LLW(x) PA to SR						
Paducah GDP	to Savannah River					
	Truck	1.92E-02	1.91E-03	2.88E-03	1.59E-02	2.07E-02
	Rail	5.86E-03	9.30E-03	1.79E-04	5.68E-03	1.52E-02
LLW(x) PI to SR						
Pinellas Plant	to Savannah River					
	Truck	2.02E-02	1.94E-03	3.10E-03	1.74E-02	2.24E-02
	Rail	4.90E-03	5.13E-03	1.02E-04	4.97E-03	1.02E-02
LLW(x) RF to HS						
Rocky Flats Plant	to Hanford Site					
	Truck	2.99E-02	1.13E-03	3.61E-03	3.17E-02	3.64E-02
	Rail	8.24E-03	4.91E-03	1.16E-04	7.43E-03	1.25E-02
LLW(x) RM to SR						
Reactive Metals	to Savannah River					
	Truck	2.37E-02	2.01E-03	3.18E-03	2.03E-02	2.55E-02
	Rail	6.72E-03	1.19E-02	2.23E-04	6.31E-03	1.84E-02
LLW(x) ST to HS						
SLAC	to Hanford Site					
	Truck	2.98E-02	3.70E-03	6.08E-03	2.56E-02	3.54E-02
	Rail	7.20E-03	1.75E-02	2.40E-04	6.67E-03	2.44E-02
LLW(x) SA to HS						
SNL - Albuquerque	to Hanford Site					
	Truck	4.31E-02	2.27E-03	5.84E-03	4.43E-02	5.24E-02
	Rail	1.04E-02	6.90E-03	1.72E-04	9.00E-03	1.61E-02
LLW(x) SL to HS						
SNL - Livermore	to Hanford Site					
	Truck	2.82E-02	2.88E-03	4.92E-03	2.50E-02	3.28E-02
	Rail	6.94E-03	1.38E-02	2.00E-04	6.48E-03	2.05E-02
LLW(x) OR to SR						
Oak Ridge Reserv.	to Savannah River					
	Truck	1.38E-02	1.58E-03	2.15E-03	1.06E-02	1.43E-02
	Rail	4.62E-03	3.76E-03	8.92E-05	4.76E-03	8.61E-03

Table 4. Accident Dose Risk per Shipment (person-rem/shipment)

Source/Route		Truck	Rail
LLW(x) AL to SR			
Ames Laboratory	to Savannah River	1.13E-05	8.56E-06
LLW(x) AN to SR			
Argonne - East	to Savannah River	6.76E-04	4.55E-04
LLW(x) AW to HS			
Argonne - West	to Hanford Site	2.45E-01	3.44E-01
LLW(x) BA to SR			
Bettis Atomic	to Savannah River	9.72E-06	9.30E-06
LLW(x) FL to SR			
Fermilab (FNAL)	to Savannah River	4.57E-05	1.69E-05
LLW(x) IN to HS			
INEL	to Hanford Site	1.10E-04	1.56E-04
LLW(x) IT to HS			
ITRI	to Hanford Site	5.50E-03	1.57E-03
LLW(x) OR to SR			
Oak Ridge Reserv.	to Savannah River	1.66E-07	4.85E-08
LLW(x) KA to SR			
Knolls Atomic	to Savannah River	2.09E-06	3.04E-06
LLW(x) KC to SR			
Kansas City Plant	to Savannah River	5.50E-05	1.34E-05
LLW(x) LA to HS			
Los Alamos NL	to Hanford Site	2.73E-02	9.38E-03
LLW(x) LB to HS			
Lawrence Berkeley	to Hanford Site	5.07E-02	4.24E-02
LLW(x) LL to HS			
Lawrence Livermore	to Hanford Site	9.20E-06	1.28E-05
LLW(x) MP to SR			
Mound Plant	to Savannah River	1.62E-06	8.64E-07
LLW(x) OI to SR			
ORISE	to Savannah River	8.59E-07	4.56E-07
LLW(x) OR to SR			
Oak Ridge Reserv.	to Savannah River	1.66E-07	4.85E-08
LLW(x) PP to HS			
Pantex Plant	to Hanford Site	1.63E-06	4.96E-07
LLW(x) PO to SR			
Portsmouth GDP	to Savannah River	8.36E-09	3.71E-09
LLW(x) PR to SR			
Princeton PPL	to Savannah River	6.14E-06	2.15E-06
LLW(x) PA to SR			
Paducah GDP	to Savannah River	7.70E-07	4.23E-07
LLW(x) PI to SR			
Pinellas Plant	to Savannah River	1.30E-06	4.65E-07
LLW(x) RF to HS			
Rocky Flats Plant	to Hanford Site	3.44E-06	2.49E-06
LLW(x) RM to SR			
Reactive Metals	to Savannah River	4.50E-09	3.34E-09
LLW(x) ST to HS			
SLAC	to Hanford Site	4.30E-07	6.58E-07
LLW(x) SA to HS			
SNL - Albuquerque	to Hanford Site	2.28E-05	7.55E-06
LLW(x) SL to HS			
SNL - Livermore	to Hanford Site	8.79E-05	1.40E-04
LLW(x) OR to SR			
Oak Ridge Reserv.	to Savannah River	1.66E-07	4.85E-08

Table 5. Nonradiological Risk Factors per Shipment
(fatalities/shipment)

Mode	Route	Emission	Accident
Truck			
Ames Laboratory	to Savannah River	4.44E-06	7.44E-05
Argonne - East	to Savannah River	5.41E-06	7.04E-05
Argonne - West	to Hanford Site	2.19E-06	3.07E-05
Bettis Atomic	to Savannah River	3.99E-06	4.90E-05
Fermilab (FNAL)	to Savannah River	6.79E-06	7.45E-05
INEL	to Hanford Site	2.19E-06	3.07E-05
ITRI	to Hanford Site	7.44E-06	1.05E-04
Oak Ridge Reserv.	to Savannah River	2.96E-06	2.92E-05
Knolls Atomic	to Savannah River	2.74E-06	7.17E-05
Kansas City Plant	to Savannah River	7.89E-06	6.87E-05
Los Alamos NL	to Hanford Site	6.66E-06	1.02E-04
Lawrence Berkeley	to Hanford Site	1.16E-05	4.91E-05
Lawrence Livermore	to Hanford Site	9.85E-06	5.03E-05
Mound Plant	to Savannah River	1.67E-06	5.26E-05
ORISE	to Savannah River	9.01E-07	3.61E-05
Pantex Plant	to Hanford Site	9.21E-06	1.25E-04
Portsmouth GDP	to Savannah River	3.48E-06	4.13E-05
Princeton PPL	to Savannah River	1.74E-05	6.30E-05
Paducah GDP	to Savannah River	3.77E-06	4.10E-05
Pinellas Plant	to Savannah River	4.47E-06	4.70E-05
Rocky Flats Plant	to Hanford Site	2.83E-06	6.69E-05
Reactive Metals	to Savannah River	2.80E-06	4.86E-05
SLAC	to Hanford Site	1.50E-05	5.14E-05
SNL - Albuquerque	to Hanford Site	7.24E-06	1.05E-04
SNL - Livermore	to Hanford Site	9.85E-06	5.03E-05
Rail			
Ames Laboratory	to Savannah River	2.57E-05	2.68E-06
Argonne - East	to Savannah River	1.65E-05	2.04E-06
Argonne - West	to Hanford Site	3.98E-06	1.38E-06
Bettis Atomic	to Savannah River	1.74E-05	1.98E-06
Fermilab (FNAL)	to Savannah River	2.18E-05	2.10E-06
INEL	to Hanford Site	3.98E-06	1.38E-06
ITRI	to Hanford Site	9.04E-06	3.75E-06
Oak Ridge Reserv.	to Savannah River	2.51E-06	8.72E-07
Knolls Atomic	to Savannah River	5.51E-05	2.18E-06
Kansas City Plant	to Savannah River	2.10E-05	2.43E-06
Los Alamos NL	to Hanford Site	6.82E-06	3.61E-06
Lawrence Berkeley	to Hanford Site	2.33E-05	2.06E-06
Lawrence Livermore	to Hanford Site	2.36E-05	2.04E-06
Mound Plant	to Savannah River	1.03E-05	1.56E-06
ORISE	to Savannah River	6.53E-06	9.28E-07
Pantex Plant	to Hanford Site	6.78E-06	3.53E-06
Portsmouth GDP	to Savannah River	3.01E-06	1.37E-06
Princeton PPL	to Savannah River	3.01E-05	1.77E-06
Paducah GDP	to Savannah River	1.01E-05	1.49E-06
Pinellas Plant	to Savannah River	5.69E-06	1.01E-06
Rocky Flats Plant	to Hanford Site	7.36E-06	2.69E-06
Reactive Metals	to Savannah River	1.38E-05	1.92E-06
SLAC	to Hanford Site	3.07E-05	2.17E-06
SNL - Albuquerque	to Hanford Site	9.04E-06	3.75E-06
SNL - Livermore	to Hanford Site	2.36E-05	2.04E-06

Table 6. Annual Incident-Free Dose for the Shipping Campaign (person-rem/yr)

Route		Truck		Rail	
		Crew	Public	Crew	Public
Ames Laboratory	to Savannah River	7.18E-02	8.05E-02	8.23E-03	2.70E-02
Argonne - East	to Savannah River	3.13E+00	3.38E+00	2.71E-01	8.06E-01
Argonne - West	to Hanford Site	2.08E-01	2.54E-01	2.81E-02	4.20E-02
Bettis Atomic	to Savannah River	1.22E+00	1.34E+00	1.43E-01	4.17E-01
Fermilab (FNAL)	to Savannah River	9.38E-02	1.02E-01	1.41E-02	4.66E-02
INEL	to Hanford Site	1.36E+01	1.67E+01	1.81E+00	2.71E+00
ITRI	to Hanford Site	4.34E-01	5.28E-01	4.15E-02	6.43E-02
Oak Ridge Reserv.	to Savannah River	9.01E+01	9.38E+01	1.15E+01	2.14E+01
Knolls Atomic	to Savannah River	9.00E-01	9.48E-01	7.96E-02	4.36E-01
Kansas City Plant	to Savannah River	3.23E-02	3.59E-02	7.73E-03	2.39E-02
Los Alamos NL	to Hanford Site	3.07E+01	3.73E+01	2.70E+00	3.90E+00
Lawrence Berkeley	to Hanford Site	8.27E-02	9.80E-02	1.40E-02	4.10E-02
Lawrence Livermore	to Hanford Site	1.58E+00	1.84E+00	1.46E-01	4.30E-01
Mound Plant	to Savannah River	1.13E+01	1.18E+01	1.14E+00	2.89E+00
ORISE	to Savannah River	6.18E-02	6.48E-02	9.46E-03	2.17E-02
Pantex Plant	to Hanford Site	7.40E+01	9.05E+01	5.40E+00	7.91E+00
Portsmouth GDP	to Savannah River	6.12E+01	6.58E+01	7.15E+00	1.32E+01
Princeton PPL	to Savannah River	2.93E-02	3.29E-02	6.42E-03	2.60E-02
Paducah GDP	to Savannah River	1.20E+01	1.30E+01	1.39E+00	3.59E+00
Pinellas Plant	to Savannah River	4.04E-02	4.48E-02	4.90E-03	1.02E-02
Rocky Flats Plant	to Hanford Site	1.07E+01	1.30E+01	1.10E+00	1.66E+00
Reactive Metals	to Savannah River	1.82E+01	1.96E+01	1.93E+00	5.29E+00
SLAC	to Hanford Site	1.16E+00	1.38E+00	1.08E-01	3.66E-01
SNL - Albuquerque	to Hanford Site	7.33E-01	8.92E-01	7.25E-02	1.12E-01
SNL - Livermore	to Hanford Site	1.69E-01	1.97E-01	1.39E-02	4.10E-02
Totals		3.32E+02	3.73E+02	3.51E+01	6.55E+01

Table 7. Annual Accident Dose Risk for the Shipping Campaign (person-rem/yr)

Route		Truck	Rail
Ames Laboratory	to Savannah River	2.25E-05	8.56E-06
Argonne - East	to Savannah River	7.10E-02	1.77E-02
Argonne - West	to Hanford Site	3.18E+00	1.72E+00
Bettis Atomic	to Savannah River	5.54E-04	1.95E-04
Fermilab (FNAL)	to Savannah River	1.37E-04	3.38E-05
INEL	to Hanford Site	9.35E-02	5.04E-02
ITRI	to Hanford Site	5.50E-02	6.27E-03
Oak Ridge Reserv.	to Savannah River	1.09E-03	1.21E-04
Knolls Atomic	to Savannah River	5.84E-05	3.34E-05
Kansas City Plant	to Savannah River	5.50E-05	1.34E-05
Los Alamos NL	to Hanford Site	1.98E+01	2.51E+00
Lawrence Berkeley	to Hanford Site	1.52E-01	8.48E-02
Lawrence Livermore	to Hanford Site	5.15E-04	2.70E-04
Mound Plant	to Savannah River	8.30E-04	1.64E-04
ORISE	to Savannah River	4.30E-06	9.11E-07
Pantex Plant	to Hanford Site	2.36E-03	2.70E-04
Portsmouth GDP	to Savannah River	2.80E-05	4.72E-06
Princeton PPL	to Savannah River	6.14E-06	2.15E-06
Paducah GDP	to Savannah River	4.83E-04	1.00E-04
Pinellas Plant	to Savannah River	2.59E-06	4.65E-07
Rocky Flats Plant	to Hanford Site	1.23E-03	3.31E-04
Reactive Metals	to Savannah River	3.45E-06	9.59E-07
SLAC	to Hanford Site	1.68E-05	9.87E-06
SNL - Albuquerque	to Hanford Site	3.88E-04	5.29E-05
SNL - Livermore	to Hanford Site	5.27E-04	2.79E-04
Totals		2.33E+01	4.40E+00

Table 8. Expected Annual Fatalities for the Shipping Campaign

Exposure Group	Truck	Rail
Radiological		
Normal Crew	1.3E-01	1.4E-02
Normal Public	1.9E-01	3.3E-02
Accident Public	1.2E-02	2.2E-03
Nonradiological		
Emission	6.0E-02	2.9E-02
Accident	7.5E-01	9.1E-03

Table 9. Expected Annual Cancer Incidence for the Shipping Campaign

Exposure Group	Truck	Rail
Radiological		
Normal Crew	4.6E-01	4.9E-02
Normal Public	6.3E-01	1.1E-01
Accident Public	4.0E-02	7.5E-03
Nonradiological		
Emission	6.0E-02	2.9E-02
Accident	NA	NA

Table 10. Expected Annual Genetic Effects for the Shipping Campaign

Exposure Group	Truck	Rail
Radiological		
Normal Crew	2.0E-02	2.1E-03
Normal Public	3.7E-02	6.5E-03
Accident Public	2.0E-03	3.7E-04
Nonradiological		
Emission	NA	NA
Accident	NA	NA

B.16 WM LLW REGIONALIZED 6 ALTERNATIVE (CASE 5): ACTIVATED METALS

Table 1. Summary of Route Information

Route		Distance (miles)	Percentage in Zone		
			Rural	Suburban	Urban
Truck					
Argonne - West	to Hanford Site	599	91.3	7.6	1.1
Bettis Atomic	to Savannah River	656	71.7	26.4	1.9
Fermilab (FNAL)	to Savannah River	924	67.6	30.1	2.3
Knolls Atomic	to Savannah River	961	67.3	31.8	0.9
Los Alamos NL	to Hanford Site	1560	89.8	8.8	1.3
Lawrence Berkeley	to Hanford Site	875	78.1	17.8	4.1
Naval Reactor Fac.	to Hanford Site	599	91.3	7.6	1.1
SNL - Albuquerque	to Hanford Site	1584	89.7	8.8	1.4
Rail					
Argonne - West	to Hanford Site	658	91.4	7.1	1.4
Bettis Atomic	to Savannah River	947	68.5	27.1	4.4
Fermilab (FNAL)	to Savannah River	1001	63.3	31.5	5.2
Knolls Atomic	to Savannah River	1044	52.0	35.4	12.6
Los Alamos NL	to Hanford Site	1725	92.5	6.5	0.9
Lawrence Berkeley	to Hanford Site	986	78.5	15.8	5.7
Naval Reactor Fac.	to Hanford Site	658	91.4	7.1	1.4
SNL - Albuquerque	to Hanford Site	1793	91.7	7.1	1.2

Table 2. Annual Number of Shipments and One-Way Shipment Distances

Route		# of Shipments		Total Mileage(mi)	
		Truck	Rail	Truck	Rail
Argonne - West	to Hanford Site	9	4	5.39E+03	2.63E+03
Bettis Atomic	to Savannah River	316	120	2.07E+05	1.14E+05
Fermilab (FNAL)	to Savannah River	40	15	3.70E+04	1.50E+04
Knolls Atomic	to Savannah River	650	246	6.25E+05	2.57E+05
Los Alamos NL	to Hanford Site	418	159	6.52E+05	2.74E+05
Lawrence Berkeley	to Hanford Site	15	6	1.31E+04	5.91E+03
Naval Reactor Fac.	to Hanford Site	461	175	2.76E+05	1.15E+05
SNL - Albuquerque	to Hanford Site	6	3	9.50E+03	5.38E+03
Totals		1915	728	1.82E+06	7.89E+05

Table 3. Incident-Free Dose per Shipment (person-rem/shipment)

Source/Route(s)	Crew	General Public			
		Off-Link	On-Link	Stops	Total
LLW(I) AW to HS Argonne - West	to Hanford Site				
	Truck	1.60E-02	7.18E-04	2.06E-03	1.68E-02	1.95E-02
	Rail	5.63E-03	2.83E-03	6.58E-05	5.51E-03	8.40E-03
LLW(I) BA to SR Bettis Atomic	to Savannah River				
	Truck	2.14E-02	1.96E-03	3.14E-03	1.84E-02	2.35E-02
	Rail	6.83E-03	1.32E-02	2.31E-04	6.39E-03	1.99E-02
LLW(I) FL to SR Fermilab (FNAL)	to Savannah River				
	Truck	3.13E-02	3.20E-03	4.81E-03	2.59E-02	3.39E-02
	Rail	7.06E-03	1.65E-02	2.79E-04	6.56E-03	2.33E-02
LLW(I) KA to SR Knolls Atomic	to Savannah River				
	Truck	3.22E-02	2.78E-03	4.17E-03	2.69E-02	3.38E-02
	Rail	7.24E-03	3.25E-02	4.25E-04	6.69E-03	3.96E-02
LLW(I) LA to HS Los Alamos NL	to Hanford Site				
	Truck	4.24E-02	2.16E-03	5.65E-03	4.37E-02	5.15E-02
	Rail	1.01E-02	5.60E-03	1.54E-04	8.79E-03	1.45E-02
LLW(I) LB to HS Lawrence Berkeley	to Hanford Site				
	Truck	2.76E-02	3.02E-03	5.17E-03	2.45E-02	3.27E-02
	Rail	6.99E-03	1.38E-02	2.03E-04	6.51E-03	2.05E-02
LLW(I) NR to HS Naval Reactor Fac.	to Hanford Site				
	Truck	1.60E-02	7.18E-04	2.06E-03	1.68E-02	1.95E-02
	Rail	5.63E-03	2.83E-03	6.58E-05	5.51E-03	8.40E-03
LLW(I) SA to HS SNL - Albuquerque	to Hanford Site				
	Truck	4.31E-02	2.27E-03	5.84E-03	4.43E-02	5.24E-02
	Rail	1.04E-02	6.90E-03	1.72E-04	9.00E-03	1.61E-02

Table 4. Accident Dose Risk per Shipment (person-rem/shipment)

Source/Route		Truck	Rail
LLW(I) AW to HS Argonne - West	to Hanford Site	8.15E-12	9.58E-12
LLW(I) BA to SR Bettis Atomic	to Savannah River	7.03E-07	6.43E-07
LLW(I) FL to SR Fermilab (FNAL)	to Savannah River	9.75E-11	6.35E-11
LLW(I) KA to SR Knolls Atomic	to Savannah River	1.44E-06	2.20E-06
LLW(I) LA to HS Los Alamos NL	to Hanford Site	3.10E-09	8.88E-10
LLW(I) LB to HS Lawrence Berkeley	to Hanford Site	1.69E-10	2.37E-10
LLW(I) NR to HS Naval Reactor Fac.	to Hanford Site	4.44E-08	6.34E-08
LLW(I) SA to HS SNL - Albuquerque	to Hanford Site	6.06E-12	1.32E-12

Table 5. Nonradiological Risk Factors per Shipment (fatalities/shipment)

Mode	Route	Emission	Accident
Truck			
Argonne - West	to Hanford Site	2.19E-06	3.07E-05
Bettis Atomic	to Savannah River	3.99E-06	4.90E-05
Fermilab (FNAL)	to Savannah River	6.79E-06	7.45E-05
Knolls Atomic	to Savannah River	2.74E-06	7.17E-05
Los Alamos NL	to Hanford Site	6.66E-06	1.02E-04
Lawrence Berkeley	to Hanford Site	1.16E-05	4.91E-05
Naval Reactor Fac.	to Hanford Site	2.19E-06	3.07E-05
SNL - Albuquerque	to Hanford Site	7.24E-06	1.05E-04
Rail			
Argonne - West	to Hanford Site	3.98E-06	1.38E-06
Bettis Atomic	to Savannah River	1.74E-05	1.98E-06
Fermilab (FNAL)	to Savannah River	2.18E-05	2.10E-06
Knolls Atomic	to Savannah River	5.51E-05	2.18E-06
Los Alamos NL	to Hanford Site	6.82E-06	3.61E-06
Lawrence Berkeley	to Hanford Site	2.33E-05	2.06E-06
Naval Reactor Fac.	to Hanford Site	3.98E-06	1.38E-06
SNL - Albuquerque	to Hanford Site	9.04E-06	3.75E-06

Table 6. Annual Incident-Free Dose for the Shipping Campaign (person-rem/yr)

Route		Truck		Rail	
		Crew	Public	Crew	Public
Argonne - West	to Hanford Site	1.44E-01	1.76E-01	2.25E-02	3.36E-02
Bettis Atomic	to Savannah River	6.75E+00	7.42E+00	8.20E-01	2.38E+00
Fermilab (FNAL)	to Savannah River	1.25E+00	1.36E+00	1.06E-01	3.50E-01
Knolls Atomic	to Savannah River	2.09E+01	2.20E+01	1.78E+00	9.75E+00
Los Alamos NL	to Hanford Site	1.77E+01	2.15E+01	1.60E+00	2.31E+00
Lawrence Berkeley	to Hanford Site	4.14E-01	4.90E-01	4.20E-02	1.23E-01
Naval Reactor Fac.	to Hanford Site	7.37E+00	9.01E+00	9.85E-01	1.47E+00
SNL - Albuquerque	to Hanford Site	2.59E-01	3.15E-01	3.11E-02	4.82E-02
Totals		5.48E+01	6.23E+01	5.39E+00	1.65E+01

Table 7. Annual Accident Dose Risk for the Shipping Campaign (person-rem/yr)

Route		Truck	Rail
Argonne - West	to Hanford Site	7.34E-11	3.83E-11
Bettis Atomic	to Savannah River	2.22E-04	7.71E-05
Fermilab (FNAL)	to Savannah River	3.90E-09	9.53E-10
Knolls Atomic	to Savannah River	9.36E-04	5.42E-04
Los Alamos NL	to Hanford Site	1.29E-06	1.41E-07
Lawrence Berkeley	to Hanford Site	2.53E-09	1.42E-09
Naval Reactor Fac.	to Hanford Site	2.05E-05	1.11E-05
SNL - Albuquerque	to Hanford Site	3.63E-11	3.96E-12
Totals		1.18E-03	6.30E-04

Table 8. Expected Annual Fatalities for the Shipping Campaign

Exposure Group	Truck	Rail
Radiological		
Normal Crew	2.2E-02	2.2E-03
Normal Public	3.1E-02	8.2E-03
Accident Public	5.9E-07	3.2E-07
Nonradiological		
Emission	7.3E-03	1.8E-02
Accident	1.2E-01	1.7E-03

Table 9. Expected Annual Cancer Incidence for the Shipping Campaign

Exposure Group	Truck	Rail
Radiological		
Normal Crew	7.7E-02	7.5E-03
Normal Public	1.1E-01	2.8E-02
Accident Public	2.0E-06	1.1E-06
Nonradiological		
Emission	7.3E-03	1.8E-02
Accident	NA	NA

Table 10. Expected Annual Genetic Effects for the Shipping Campaign

Exposure Group	Truck	Rail
Radiological		
Normal Crew	3.3E-03	3.2E-04
Normal Public	6.2E-03	1.6E-03
Accident Public	1.2E-07	6.3E-08
Nonradiological		
Emission	NA	NA
Accident	NA	NA

B.17 WM LLW REGIONALIZED 7 ALTERNATIVE (CASE 6): HETEROGENEOUS SOLIDS

Table 1. Summary of Route Information

Route		Distance (miles)	Percentage in Zone		
			Rural	Suburban	Urban
Truck					
Ames Laboratory	to Savannah River	1175	77.9	21.0	1.2
Argonne - East	to Savannah River	892	68.8	29.3	1.9
Argonne - West	to Nevada Test Site	712	82.8	13.7	3.5
Bettis Atomic	to Savannah River	656	71.7	26.4	1.9
Fermilab (FNAL)	to Savannah River	924	67.6	30.1	2.3
Hanford Site	to Nevada Test Site	1128	86.5	10.9	2.6
INEL	to Nevada Test Site	712	82.8	13.7	3.5
ITRI	to Nevada Test Site	918	93.8	4.8	1.5
Oak Ridge Reserv.	to Savannah River	379	59.1	38.5	2.4
Knolls Atomic	to Savannah River	961	67.3	31.8	0.9
Kansas City Plant	to Savannah River	986	71.7	25.8	2.5
Los Alamos NL	to Nevada Test Site	997	93.2	5.7	1.1
Lawrence Berkeley	to Nevada Test Site	719	81.9	10.6	7.5
Lawrence Livermore	to Nevada Test Site	678	84.7	9.2	6.1
Mound Plant	to Savannah River	656	66.5	32.7	0.8
ORISE	to Savannah River	369	67.0	32.3	0.8
Pantex Plant	to Nevada Test Site	1209	93.9	4.6	1.6
Portsmouth GDP	to Savannah River	540	67.1	30.9	2.0
Princeton PPL	to Savannah River	767	58.1	34.8	7.1
Paducah GDP	to Savannah River	568	67.6	30.4	2.1
Pinellas Plant	to Savannah River	620	71.9	25.8	2.2
Rocky Flats Plant	to Nevada Test Site	836	89.5	8.5	2.0
Reactive Metals	to Savannah River	726	70.6	28.2	1.2
SLAC	to Nevada Test Site	739	79.6	11.3	9.1
SNL - Albuquerque	to Nevada Test Site	909	93.8	4.8	1.4
SNL - Livermore	to Nevada Test Site	678	84.7	9.2	6.1
Rail					
Ames Laboratory	to Savannah River	1281	66.8	28.4	4.8
Argonne - East	to Savannah River	976	64.3	31.6	4.0
Argonne - West	to Nevada Test Site	756	92.8	5.9	1.3
Bettis Atomic	to Savannah River	947	68.5	27.1	4.4
Fermilab (FNAL)	to Savannah River	1001	63.3	31.5	5.2
Hanford Site	to Nevada Test Site	1302	93.0	5.9	1.1
INEL	to Nevada Test Site	756	92.8	5.9	1.3
ITRI	to Nevada Test Site	1065	94.6	4.5	0.9
Oak Ridge Reserv.	to Savannah River	417	68.8	29.8	1.4
Knolls Atomic	to Savannah River	1044	52.0	35.4	12.6
Kansas City Plant	to Savannah River	1161	66.8	28.9	4.3
Los Alamos NL	to Nevada Test Site	1169	92.8	5.9	1.3
Lawrence Berkeley	to Nevada Test Site	860	75.1	17.7	7.2
Lawrence Livermore	to Nevada Test Site	1370	94.5	3.8	1.8
Mound Plant	to Savannah River	744	67.4	29.2	3.3
ORISE	to Savannah River	443	64.8	31.7	3.5
Pantex Plant	to Nevada Test Site	1376	94.9	4.4	0.7
Portsmouth GDP	to Savannah River	655	74.6	24.3	1.1
Princeton PPL	to Savannah River	848	57.6	33.9	8.5
Paducah GDP	to Savannah River	714	65.2	31.4	3.4
Pinellas Plant	to Savannah River	485	72.2	25.0	2.8
Rocky Flats Plant	to Nevada Test Site	987	95.9	3.9	0.2
Reactive Metals	to Savannah River	920	67.3	29.1	3.6
SLAC	to Nevada Test Site	862	75.8	17.7	6.5
SNL - Albuquerque	to Nevada Test Site	1065	94.6	4.5	0.9
SNL - Livermore	to Nevada Test Site	1370	94.5	3.8	1.8

Table 2. Annual Number of Shipments and One-Way Shipment Distances

Route		# of Shipments		Total Mileage(mi)	
		Truck	Rail	Truck	Rail
Ames Laboratory	to Savannah River	2	1	2.35E+03	1.28E+03
Argonne - East	to Savannah River	105	39	9.36E+04	3.81E+04
Argonne - West	to Nevada Test Site	13	5	9.26E+03	3.78E+03
Bettis Atomic	to Savannah River	57	21	3.74E+04	1.99E+04
Fermilab (FNAL)	to Savannah River	3	2	2.77E+03	2.00E+03
Hanford Site	to Nevada Test Site	1421	531	1.60E+06	6.91E+05
INEL	to Nevada Test Site	852	322	6.07E+05	2.43E+05
ITRI	to Nevada Test Site	10	4	9.18E+03	4.26E+03
Oak Ridge Reserv.	to Savannah River	6542	2486	2.48E+06	1.04E+06
Knolls Atomic	to Savannah River	28	11	2.69E+04	1.15E+04
Kansas City Plant	to Savannah River	1	1	9.86E+02	1.16E+03
Los Alamos NL	to Nevada Test Site	724	268	7.22E+05	3.13E+05
Lawrence Berkeley	to Nevada Test Site	3	2	2.16E+03	1.72E+03
Lawrence Livermore	to Nevada Test Site	56	21	3.80E+04	2.88E+04
Mound Plant	to Savannah River	512	190	3.36E+05	1.41E+05
ORISE	to Savannah River	5	2	1.84E+03	8.87E+02
Pantex Plant	to Nevada Test Site	1450	544	1.75E+06	7.49E+05
Portsmouth GDP	to Savannah River	3344	1274	1.81E+06	8.34E+05
Princeton PPL	to Savannah River	1	1	7.67E+02	8.48E+02
Paducah GDP	to Savannah River	627	237	3.56E+05	1.69E+05
Pinellas Plant	to Savannah River	2	1	1.24E+03	4.85E+02
Rocky Flats Plant	to Nevada Test Site	357	133	2.98E+05	1.31E+05
Reactive Metals	to Savannah River	768	287	5.57E+05	2.64E+05
SLAC	to Nevada Test Site	39	15	2.88E+04	1.29E+04
SNL - Albuquerque	to Nevada Test Site	17	7	1.55E+04	7.45E+03
SNL - Livermore	to Nevada Test Site	6	2	4.07E+03	2.74E+03
Totals		16945	6407	1.08E+07	4.71E+06

Table 3. Incident-Free Dose per Shipment (person-rem/shipment)

Source/Route(s)		Crew	General Public			
			Off-Link	On-Link	Stops	Total
LLW(x) AL to SR						
Ames Laboratory	to Savannah River					
	Truck	3.59E-02	2.61E-03	4.76E-03	3.29E-02	4.03E-02
	Rail	8.23E-03	1.93E-02	3.29E-04	7.42E-03	2.70E-02
LLW(x) AN to SR						
Argonne - East	to Savannah River					
	Truck	2.98E-02	2.86E-03	4.37E-03	2.50E-02	3.22E-02
	Rail	6.95E-03	1.39E-02	2.55E-04	6.49E-03	2.07E-02
LLW(x) AW to NT						
Argonne - West	to Nevada Test Site					
	Truck	2.13E-02	2.03E-03	3.79E-03	1.99E-02	2.58E-02
	Rail	6.04E-03	2.80E-03	6.88E-05	5.81E-03	8.67E-03
LLW(x) BA to SR						
Bettis Atomic	to Savannah River					
	Truck	2.14E-02	1.96E-03	3.14E-03	1.84E-02	2.35E-02
	Rail	6.83E-03	1.32E-02	2.31E-04	6.39E-03	1.99E-02
LLW(x) FL to SR						
Fermilab (FNAL)	to Savannah River					
	Truck	3.13E-02	3.20E-03	4.81E-03	2.59E-02	3.39E-02
	Rail	7.06E-03	1.65E-02	2.79E-04	6.56E-03	2.33E-02
LLW(x) HS to NT						
Hanford Site	to Nevada Test Site					
	Truck	3.22E-02	2.46E-03	5.18E-03	3.16E-02	3.92E-02
	Rail	8.31E-03	4.39E-03	1.15E-04	7.49E-03	1.20E-02
LLW(x) IN to NT						
INEL	to Nevada Test Site					
	Truck	2.13E-02	2.03E-03	3.79E-03	1.99E-02	2.58E-02
	Rail	6.04E-03	2.80E-03	6.88E-05	5.81E-03	8.67E-03
LLW(x) IT to NT						
ITRI	to Nevada Test Site					
	Truck	2.40E-02	1.05E-03	3.25E-03	2.57E-02	3.00E-02
	Rail	7.32E-03	2.85E-03	8.34E-05	6.76E-03	9.69E-03
LLW(x) OR to SR						
Oak Ridge Reserv.	to Savannah River					
	Truck	1.38E-02	1.58E-03	2.15E-03	1.06E-02	1.43E-02
	Rail	4.62E-03	3.76E-03	8.92E-05	4.76E-03	8.61E-03
LLW(x) KA to SR						
Knolls Atomic	to Savannah River					
	Truck	3.22E-02	2.78E-03	4.17E-03	2.69E-02	3.38E-02
	Rail	7.24E-03	3.25E-02	4.25E-04	6.69E-03	3.96E-02
LLW(x) KC to SR						
Kansas City Plant	to Savannah River					
	Truck	3.23E-02	3.20E-03	5.09E-03	2.76E-02	3.59E-02
	Rail	7.73E-03	1.66E-02	2.92E-04	7.05E-03	2.39E-02
LLW(x) LA to NT						
Los Alamos NL	to Nevada Test Site					
	Truck	2.61E-02	1.04E-03	3.33E-03	2.79E-02	3.23E-02
	Rail	7.76E-03	4.40E-03	1.07E-04	7.08E-03	1.16E-02
LLW(x) LB to NT						
Lawrence Berkeley	to Nevada Test Site					
	Truck	2.27E-02	3.31E-03	5.66E-03	2.01E-02	2.91E-02
	Rail	6.47E-03	1.49E-02	2.04E-04	6.13E-03	2.12E-02
LLW(x) LL to NT						
Lawrence Livermore	to Nevada Test Site					
	Truck	2.05E-02	2.57E-03	4.65E-03	1.90E-02	2.62E-02
	Rail	8.60E-03	5.75E-03	1.20E-04	7.70E-03	1.36E-02
LLW(x) MP to SR						
Mound Plant	to Savannah River					
	Truck	2.21E-02	1.91E-03	2.83E-03	1.84E-02	2.31E-02
	Rail	5.99E-03	9.25E-03	1.78E-04	5.77E-03	1.52E-02
LLW(x) OI to SR						
ORISE	to Savannah River					
	Truck	1.24E-02	1.06E-03	1.57E-03	1.03E-02	1.30E-02
	Rail	4.73E-03	5.91E-03	1.13E-04	4.84E-03	1.09E-02
LLW(x) OR to SR						
Oak Ridge Reserv.	to Savannah River					
	Truck	1.38E-02	1.58E-03	2.15E-03	1.06E-02	1.43E-02
	Rail	4.62E-03	3.76E-03	8.92E-05	4.76E-03	8.61E-03
LLW(x) PP to NT						
Pantex Plant	to Nevada Test Site					
	Truck	3.16E-02	1.43E-03	4.34E-03	3.38E-02	3.96E-02
	Rail	8.62E-03	3.19E-03	1.03E-04	7.72E-03	1.10E-02

LLW(x) PO to SR						
Portsmouth GDP	to Savannah River					
	Truck	1.83E-02	1.82E-03	2.73E-03	1.51E-02	1.97E-02
	Rail	5.61E-03	4.74E-03	1.19E-04	5.49E-03	1.04E-02
LLW(x) PR to SR						
Princeton PPL	to Savannah River					
	Truck	2.93E-02	4.76E-03	6.64E-03	2.15E-02	3.29E-02
	Rail	6.42E-03	1.96E-02	2.87E-04	6.09E-03	2.60E-02
LLW(x) PA to SR						
Paducah GDP	to Savannah River					
	Truck	1.92E-02	1.91E-03	2.88E-03	1.59E-02	2.07E-02
	Rail	5.86E-03	9.30E-03	1.79E-04	5.68E-03	1.52E-02
LLW(x) PI to SR						
Pinellas Plant	to Savannah River					
	Truck	2.02E-02	1.94E-03	3.10E-03	1.74E-02	2.24E-02
	Rail	4.90E-03	5.13E-03	1.02E-04	4.97E-03	1.02E-02
LLW(x) RF to NT						
Rocky Flats Plant	to Nevada Test Site					
	Truck	2.30E-02	1.44E-03	3.43E-03	2.34E-02	2.83E-02
	Rail	7.00E-03	1.29E-03	6.47E-05	6.52E-03	7.88E-03
LLW(x) RM to SR						
Reactive Metals	to Savannah River					
	Truck	2.37E-02	2.01E-03	3.18E-03	2.03E-02	2.55E-02
	Rail	6.72E-03	1.19E-02	2.23E-04	6.31E-03	1.84E-02
LLW(x) ST to NT						
SLAC	to Nevada Test Site					
	Truck	2.43E-02	4.05E-03	6.67E-03	2.07E-02	3.14E-02
	Rail	6.48E-03	1.38E-02	1.96E-04	6.13E-03	2.01E-02
LLW(x) SA to NT						
SNL - Albuquerque	to Nevada Test Site					
	Truck	2.37E-02	1.02E-03	3.18E-03	2.54E-02	2.97E-02
	Rail	7.32E-03	2.85E-03	8.34E-05	6.76E-03	9.69E-03
LLW(x) SL to NT						
SNL - Livermore	to Nevada Test Site					
	Truck	2.05E-02	2.57E-03	4.65E-03	1.90E-02	2.62E-02
	Rail	8.60E-03	5.75E-03	1.20E-04	7.70E-03	1.36E-02
LLW(x) OR to SR						
Oak Ridge Reserv.	to Savannah River					
	Truck	1.38E-02	1.58E-03	2.15E-03	1.06E-02	1.43E-02
	Rail	4.62E-03	3.76E-03	8.92E-05	4.76E-03	8.61E-03

Table 4. Accident Dose Risk per Shipment (person-rem/shipment)

Source/Route		Truck	Rail
LLW(x) AL to SR Ames Laboratory	to Savannah River	1.13E-05	8.56E-06
LLW(x) AN to SR Argonne - East	to Savannah River	6.76E-04	4.55E-04
LLW(x) AW to NT Argonne - West	to Nevada Test Site	6.62E-01	2.71E-01
LLW(x) BA to SR Bettis Atomic	to Savannah River	9.72E-06	9.30E-06
LLW(x) FL to SR Fermilab (FNAL)	to Savannah River	4.57E-05	1.69E-05
LLW(x) HS to NT Hanford Site	to Nevada Test Site	3.46E-04	2.24E-04
LLW(x) IN to NT INEL	to Nevada Test Site	2.94E-04	1.23E-04
LLW(x) IT to NT ITRI	to Nevada Test Site	2.18E-03	4.52E-04
LLW(x) OR to SR Oak Ridge Reserv.	to Savannah River	1.66E-07	4.85E-08
LLW(x) KA to SR Knolls Atomic	to Savannah River	2.09E-06	3.04E-06
LLW(x) KC to SR Kansas City Plant	to Savannah River	5.50E-05	1.34E-05
LLW(x) LA to NT Los Alamos NL	to Nevada Test Site	1.51E-02	3.40E-03
LLW(x) LB to NT Lawrence Berkeley	to Nevada Test Site	2.56E-02	2.61E-02
LLW(x) LL to NT Lawrence Livermore	to Nevada Test Site	4.06E-06	3.26E-06
LLW(x) MP to SR Mound Plant	to Savannah River	1.62E-06	8.64E-07
LLW(x) OI to SR ORISE	to Savannah River	8.59E-07	4.56E-07
LLW(x) OR to SR Oak Ridge Reserv.	to Savannah River	1.66E-07	4.85E-08
LLW(x) PP to NT Pantex Plant	to Nevada Test Site	7.30E-07	1.96E-07
LLW(x) PO to SR Portsmouth GDP	to Savannah River	8.36E-09	3.71E-09
LLW(x) PR to SR Princeton PPL	to Savannah River	6.14E-06	2.15E-06
LLW(x) PA to SR Paducah GDP	to Savannah River	7.70E-07	4.23E-07
LLW(x) PI to SR Pinellas Plant	to Savannah River	1.30E-06	4.65E-07
LLW(x) RF to NT Rocky Flats Plant	to Nevada Test Site	4.28E-06	6.40E-07
LLW(x) RM to SR Reactive Metals	to Savannah River	4.50E-09	3.34E-09
LLW(x) ST to NT SLAC	to Nevada Test Site	2.14E-07	3.39E-07
LLW(x) SA to NT SNL - Albuquerque	to Nevada Test Site	8.66E-06	2.24E-06
LLW(x) SL to NT SNL - Livermore	to Nevada Test Site	3.63E-05	3.45E-05
LLW(x) OR to SR Oak Ridge Reserv.	to Savannah River	1.66E-07	4.85E-08

Table 5. Nonradiological Risk Factors per Shipment
(fatalities/shipment)

Mode	Route	Emission	Accident
Truck			
Ames Laboratory	to Savannah River	4.44E-06	7.44E-05
Argonne - East	to Savannah River	5.41E-06	7.04E-05
Argonne - West	to Nevada Test Site	8.08E-06	4.36E-05
Bettis Atomic	to Savannah River	3.99E-06	4.90E-05
Fermilab (FNAL)	to Savannah River	6.79E-06	7.45E-05
Hanford Site	to Nevada Test Site	9.50E-06	6.38E-05
INEL	to Nevada Test Site	8.08E-06	4.36E-05
ITRI	to Nevada Test Site	4.31E-06	7.08E-05
Oak Ridge Reserv.	to Savannah River	2.96E-06	2.92E-05
Knolls Atomic	to Savannah River	2.74E-06	7.17E-05
Kansas City Plant	to Savannah River	7.89E-06	6.87E-05
Los Alamos NL	to Nevada Test Site	3.54E-06	7.82E-05
Lawrence Berkeley	to Nevada Test Site	1.73E-05	5.39E-05
Lawrence Livermore	to Nevada Test Site	1.32E-05	5.15E-05
Mound Plant	to Savannah River	1.67E-06	5.26E-05
ORISE	to Savannah River	9.01E-07	3.61E-05
Pantex Plant	to Nevada Test Site	6.05E-06	9.02E-05
Portsmouth GDP	to Savannah River	3.48E-06	4.13E-05
Princeton PPL	to Savannah River	1.74E-05	6.30E-05
Paducah GDP	to Savannah River	3.77E-06	4.10E-05
Pinellas Plant	to Savannah River	4.47E-06	4.70E-05
Rocky Flats Plant	to Nevada Test Site	5.50E-06	6.18E-05
Reactive Metals	to Savannah River	2.80E-06	4.86E-05
SLAC	to Nevada Test Site	2.17E-05	5.48E-05
SNL - Albuquerque	to Nevada Test Site	4.12E-06	7.01E-05
SNL - Livermore	to Nevada Test Site	1.32E-05	5.15E-05
Rail			
Ames Laboratory	to Savannah River	2.57E-05	2.68E-06
Argonne - East	to Savannah River	1.65E-05	2.04E-06
Argonne - West	to Nevada Test Site	3.98E-06	1.58E-06
Bettis Atomic	to Savannah River	1.74E-05	1.98E-06
Fermilab (FNAL)	to Savannah River	2.18E-05	2.10E-06
Hanford Site	to Nevada Test Site	5.90E-06	2.72E-06
INEL	to Nevada Test Site	3.98E-06	1.58E-06
ITRI	to Nevada Test Site	3.85E-06	2.23E-06
Oak Ridge Reserv.	to Savannah River	2.51E-06	8.72E-07
Knolls Atomic	to Savannah River	5.51E-05	2.18E-06
Kansas City Plant	to Savannah River	2.10E-05	2.43E-06
Los Alamos NL	to Nevada Test Site	6.32E-06	2.45E-06
Lawrence Berkeley	to Nevada Test Site	2.59E-05	1.80E-06
Lawrence Livermore	to Nevada Test Site	1.01E-05	2.87E-06
Mound Plant	to Savannah River	1.03E-05	1.56E-06
ORISE	to Savannah River	6.53E-06	9.28E-07
Pantex Plant	to Nevada Test Site	3.98E-06	2.88E-06
Portsmouth GDP	to Savannah River	3.01E-06	1.37E-06
Princeton PPL	to Savannah River	3.01E-05	1.77E-06
Paducah GDP	to Savannah River	1.01E-05	1.49E-06
Pinellas Plant	to Savannah River	5.69E-06	1.01E-06
Rocky Flats Plant	to Nevada Test Site	8.37E-07	2.07E-06
Reactive Metals	to Savannah River	1.38E-05	1.92E-06
SLAC	to Nevada Test Site	2.35E-05	1.80E-06
SNL - Albuquerque	to Nevada Test Site	3.85E-06	2.23E-06
SNL - Livermore	to Nevada Test Site	1.01E-05	2.87E-06

Table 6. Annual Incident-Free Dose for the Shipping Campaign (person-rem/yr)

Route		Truck		Rail	
		Crew	Public	Crew	Public
Ames Laboratory	to Savannah River	7.18E-02	8.05E-02	8.23E-03	2.70E-02
Argonne - East	to Savannah River	3.13E+00	3.38E+00	2.71E-01	8.06E-01
Argonne - West	to Nevada Test Site	2.77E-01	3.35E-01	3.02E-02	4.34E-02
Bettis Atomic	to Savannah River	1.22E+00	1.34E+00	1.43E-01	4.17E-01
Fermilab (FNAL)	to Savannah River	9.38E-02	1.02E-01	1.41E-02	4.66E-02
Hanford Site	to Nevada Test Site	4.58E+01	5.57E+01	4.42E+00	6.37E+00
INEL	to Nevada Test Site	1.82E+01	2.19E+01	1.94E+00	2.79E+00
ITRI	to Nevada Test Site	2.40E-01	3.00E-01	2.93E-02	3.88E-02
Oak Ridge Reserv.	to Savannah River	9.01E+01	9.38E+01	1.15E+01	2.14E+01
Knolls Atomic	to Savannah River	9.00E-01	9.48E-01	7.96E-02	4.36E-01
Kansas City Plant	to Savannah River	3.23E-02	3.59E-02	7.73E-03	2.39E-02
Los Alamos NL	to Nevada Test Site	1.89E+01	2.34E+01	2.08E+00	3.11E+00
Lawrence Berkeley	to Nevada Test Site	6.81E-02	8.73E-02	1.29E-02	4.24E-02
Lawrence Livermore	to Nevada Test Site	1.15E+00	1.47E+00	1.81E-01	2.85E-01
Mound Plant	to Savannah River	1.13E+01	1.18E+01	1.14E+00	2.89E+00
ORISE	to Savannah River	6.18E-02	6.48E-02	9.46E-03	2.17E-02
Pantex Plant	to Nevada Test Site	4.58E+01	5.74E+01	4.69E+00	5.99E+00
Portsmouth GDP	to Savannah River	6.12E+01	6.58E+01	7.15E+00	1.32E+01
Princeton PPL	to Savannah River	2.93E-02	3.29E-02	6.42E-03	2.60E-02
Paducah GDP	to Savannah River	1.20E+01	1.30E+01	1.39E+00	3.59E+00
Pinellas Plant	to Savannah River	4.04E-02	4.48E-02	4.90E-03	1.02E-02
Rocky Flats Plant	to Nevada Test Site	8.22E+00	1.01E+01	9.31E-01	1.05E+00
Reactive Metals	to Savannah River	1.82E+01	1.96E+01	1.93E+00	5.29E+00
SLAC	to Nevada Test Site	9.46E-01	1.23E+00	9.72E-02	3.02E-01
SNL - Albuquerque	to Nevada Test Site	4.03E-01	5.04E-01	5.13E-02	6.78E-02
SNL - Livermore	to Nevada Test Site	1.23E-01	1.57E-01	1.72E-02	2.71E-02
Totals		3.38E+02	3.83E+02	3.81E+01	6.83E+01

Table 7. Annual Accident Dose Risk for the Shipping Campaign (person-rem/yr)

Route		Truck	Rail
Ames Laboratory	to Savannah River	2.25E-05	8.56E-06
Argonne - East	to Savannah River	7.10E-02	1.77E-02
Argonne - West	to Nevada Test Site	8.60E+00	1.36E+00
Bettis Atomic	to Savannah River	5.54E-04	1.95E-04
Fermilab (FNAL)	to Savannah River	1.37E-04	3.38E-05
Hanford Site	to Nevada Test Site	4.92E-01	1.19E-01
INEL	to Nevada Test Site	2.50E-01	3.95E-02
ITRI	to Nevada Test Site	2.18E-02	1.81E-03
Oak Ridge Reserv.	to Savannah River	1.09E-03	1.21E-04
Knolls Atomic	to Savannah River	5.84E-05	3.34E-05
Kansas City Plant	to Savannah River	5.50E-05	1.34E-05
Los Alamos NL	to Nevada Test Site	1.10E+01	9.10E-01
Lawrence Berkeley	to Nevada Test Site	7.68E-02	5.23E-02
Lawrence Livermore	to Nevada Test Site	2.27E-04	6.85E-05
Mound Plant	to Savannah River	8.30E-04	1.64E-04
ORISE	to Savannah River	4.30E-06	9.11E-07
Pantex Plant	to Nevada Test Site	1.06E-03	1.07E-04
Portsmouth GDP	to Savannah River	2.80E-05	4.72E-06
Princeton PPL	to Savannah River	6.14E-06	2.15E-06
Paducah GDP	to Savannah River	4.83E-04	1.00E-04
Pinellas Plant	to Savannah River	2.59E-06	4.65E-07
Rocky Flats Plant	to Nevada Test Site	1.53E-03	8.52E-05
Reactive Metals	to Savannah River	3.45E-06	9.59E-07
SLAC	to Nevada Test Site	8.33E-06	5.08E-06
SNL - Albuquerque	to Nevada Test Site	1.47E-04	1.57E-05
SNL - Livermore	to Nevada Test Site	2.18E-04	6.89E-05
Totals		2.05E+01	2.50E+00

Table 8. Expected Annual Fatalities for the Shipping Campaign

Exposure Group	Truck	Rail
Radiological		
Normal Crew	1.4E-01	1.5E-02
Normal Public	1.9E-01	3.4E-02
Accident Public	1.0E-02	1.2E-03
Nonradiological		
Emission	7.3E-02	2.9E-02
Accident	7.8E-01	9.9E-03

Table 9. Expected Annual Cancer Incidence for the Shipping Campaign

Exposure Group	Truck	Rail
Radiological		
Normal Crew	4.7E-01	5.3E-02
Normal Public	6.5E-01	1.2E-01
Accident Public	3.5E-02	4.2E-03
Nonradiological		
Emission	7.3E-02	2.9E-02
Accident	NA	NA

Table 10. Expected Annual Genetic Effects for the Shipping Campaign

Exposure Group	Truck	Rail
Radiological		
Normal Crew	2.0E-02	2.3E-03
Normal Public	3.8E-02	6.8E-03
Accident Public	1.9E-03	2.2E-04
Nonradiological		
Emission	NA	NA
Accident	NA	NA

B.18 WM LLW REGIONALIZED 7 ALTERNATIVE (CASE 6): ACTIVATED METALS

Table 1. Summary of Route Information

Route		Distance (miles)	Percentage in Zone		
			Rural	Suburban	Urban
Truck					
Argonne - West	to Nevada Test Site	712	82.8	13.7	3.5
Bettis Atomic	to Savannah River	656	71.7	26.4	1.9
Fermilab (FNAL)	to Savannah River	924	67.6	30.1	2.3
Hanford Site	to Nevada Test Site	1128	86.5	10.9	2.6
Knolls Atomic	to Savannah River	961	67.3	31.8	0.9
Los Alamos NL	to Nevada Test Site	997	93.2	5.7	1.1
Lawrence Berkeley	to Nevada Test Site	719	81.9	10.6	7.5
Naval Reactor Fac.	to Nevada Test Site	712	82.8	13.7	3.5
SNL - Albuquerque	to Nevada Test Site	909	93.8	4.8	1.4
Rail					
Argonne - West	to Nevada Test Site	756	92.8	5.9	1.3
Bettis Atomic	to Savannah River	947	68.5	27.1	4.4
Fermilab (FNAL)	to Savannah River	1001	63.3	31.5	5.2
Hanford Site	to Nevada Test Site	1302	93.0	5.9	1.1
Knolls Atomic	to Savannah River	1044	52.0	35.4	12.6
Los Alamos NL	to Nevada Test Site	1169	92.8	5.9	1.3
Lawrence Berkeley	to Nevada Test Site	860	75.1	17.7	7.2
Naval Reactor Fac.	to Nevada Test Site	756	92.8	5.9	1.3
SNL - Albuquerque	to Nevada Test Site	1065	94.6	4.5	0.9

Table 2. Annual Number of Shipments and One-Way Shipment Distances

Route		# of Shipments		Total Mileage(mi)	
		Truck	Rail	Truck	Rail
Argonne - West	to Nevada Test Site	9	4	6.41E+03	3.02E+03
Bettis Atomic	to Savannah River	316	120	2.07E+05	1.14E+05
Fermilab (FNAL)	to Savannah River	40	15	3.70E+04	1.50E+04
Hanford Site	to Nevada Test Site	33	13	3.72E+04	1.69E+04
Knolls Atomic	to Savannah River	650	246	6.25E+05	2.57E+05
Los Alamos NL	to Nevada Test Site	418	159	4.17E+05	1.86E+05
Lawrence Berkeley	to Nevada Test Site	15	6	1.08E+04	5.16E+03
Naval Reactor Fac.	to Nevada Test Site	461	175	3.28E+05	1.32E+05
SNL - Albuquerque	to Nevada Test Site	6	3	5.45E+03	3.19E+03
Totals		1948	741	1.67E+06	7.32E+05

Table 3. Incident-Free Dose per Shipment (person-rem/shipment)

Source/Route(s)		Crew	General Public			
			Off-Link	On-Link	Stops	Total
LLW(I) AW to NT Argonne - West	to Nevada Test Site					
	Truck	2.13E-02	2.03E-03	3.79E-03	1.99E-02	2.58E-02
	Rail	6.04E-03	2.80E-03	6.88E-05	5.81E-03	8.67E-03
LLW(I) BA to SR Bettis Atomic	to Savannah River					
	Truck	2.14E-02	1.96E-03	3.14E-03	1.84E-02	2.35E-02
	Rail	6.83E-03	1.32E-02	2.31E-04	6.39E-03	1.99E-02
LLW(I) FL to SR Fermilab (FNAL)	to Savannah River					
	Truck	3.13E-02	3.20E-03	4.81E-03	2.59E-02	3.39E-02
	Rail	7.06E-03	1.65E-02	2.79E-04	6.56E-03	2.33E-02
LLW(I) HS to NT Hanford Site	to Nevada Test Site					
	Truck	3.22E-02	2.46E-03	5.18E-03	3.16E-02	3.92E-02
	Rail	8.31E-03	4.39E-03	1.15E-04	7.49E-03	1.20E-02
LLW(I) KA to SR Knolls Atomic	to Savannah River					
	Truck	3.22E-02	2.78E-03	4.17E-03	2.69E-02	3.38E-02
	Rail	7.24E-03	3.25E-02	4.25E-04	6.69E-03	3.96E-02
LLW(I) LA to NT Los Alamos NL	to Nevada Test Site					
	Truck	2.61E-02	1.04E-03	3.33E-03	2.79E-02	3.23E-02
	Rail	7.76E-03	4.40E-03	1.07E-04	7.08E-03	1.16E-02
LLW(I) LB to NT Lawrence Berkeley	to Nevada Test Site					
	Truck	2.27E-02	3.31E-03	5.66E-03	2.01E-02	2.91E-02
	Rail	6.47E-03	1.49E-02	2.04E-04	6.13E-03	2.12E-02
LLW(I) NR to NT Naval Reactor Fac.	to Nevada Test Site					
	Truck	2.13E-02	2.03E-03	3.79E-03	1.99E-02	2.58E-02
	Rail	6.04E-03	2.80E-03	6.88E-05	5.81E-03	8.67E-03
LLW(I) SA to NT SNL - Albuquerque	to Nevada Test Site					
	Truck	2.37E-02	1.02E-03	3.18E-03	2.54E-02	2.97E-02
	Rail	7.32E-03	2.85E-03	8.34E-05	6.76E-03	9.69E-03

Table 4. Accident Dose Risk per Shipment (person-rem/shipment)

Source/Route		Truck	Rail
LLW(I) AW to NT Argonne - West	to Nevada Test Site	2.03E-11	7.25E-12
LLW(I) BA to SR Bettis Atomic	to Savannah River	7.03E-07	6.43E-07
LLW(I) FL to SR Fermilab (FNAL)	to Savannah River	9.75E-11	6.35E-11
LLW(I) HS to NT Hanford Site	to Nevada Test Site	2.71E-08	1.57E-08
LLW(I) KA to SR Knolls Atomic	to Savannah River	1.44E-06	2.20E-06
LLW(I) LA to NT Los Alamos NL	to Nevada Test Site	1.78E-09	3.07E-10
LLW(I) LB to NT Lawrence Berkeley	to Nevada Test Site	8.23E-11	1.45E-10
LLW(I) NR to NT Naval Reactor Fac.	to Nevada Test Site	1.20E-07	4.99E-08
LLW(I) SA to NT SNL - Albuquerque	to Nevada Test Site	2.40E-12	3.74E-13

Table 5. Nonradiological Risk Factors per Shipment (fatalities/shipment)

Mode	Route	Emission	Accident
Truck			
Argonne - West	to Nevada Test Site	8.08E-06	4.36E-05
Bettis Atomic	to Savannah River	3.99E-06	4.90E-05
Fermilab (FNAL)	to Savannah River	6.79E-06	7.45E-05
Hanford Site	to Nevada Test Site	9.50E-06	6.38E-05
Knolls Atomic	to Savannah River	2.74E-06	7.17E-05
Los Alamos NL	to Nevada Test Site	3.54E-06	7.82E-05
Lawrence Berkeley	to Nevada Test Site	1.73E-05	5.39E-05
Naval Reactor Fac.	to Nevada Test Site	8.08E-06	4.36E-05
SNL - Albuquerque	to Nevada Test Site	4.12E-06	7.01E-05
Rail			
Argonne - West	to Nevada Test Site	3.98E-06	1.58E-06
Bettis Atomic	to Savannah River	1.74E-05	1.98E-06
Fermilab (FNAL)	to Savannah River	2.18E-05	2.10E-06
Hanford Site	to Nevada Test Site	5.90E-06	2.72E-06
Knolls Atomic	to Savannah River	5.51E-05	2.18E-06
Los Alamos NL	to Nevada Test Site	6.32E-06	2.45E-06
Lawrence Berkeley	to Nevada Test Site	2.59E-05	1.80E-06
Naval Reactor Fac.	to Nevada Test Site	3.98E-06	1.58E-06
SNL - Albuquerque	to Nevada Test Site	3.85E-06	2.23E-06

Table 6. Annual Incident-Free Dose for the Shipping Campaign (person-rem/yr)

Route		Truck		Rail	
		Crew	Public	Crew	Public
Argonne - West	to Nevada Test Site	1.92E-01	2.32E-01	2.41E-02	3.47E-02
Bettis Atomic	to Savannah River	6.75E+00	7.42E+00	8.20E-01	2.38E+00
Fermilab (FNAL)	to Savannah River	1.25E+00	1.36E+00	1.06E-01	3.50E-01
Hanford Site	to Nevada Test Site	1.06E+00	1.29E+00	1.08E-01	1.56E-01
Knolls Atomic	to Savannah River	2.09E+01	2.20E+01	1.78E+00	9.75E+00
Los Alamos NL	to Nevada Test Site	1.09E+01	1.35E+01	1.23E+00	1.84E+00
Lawrence Berkeley	to Nevada Test Site	3.41E-01	4.36E-01	3.88E-02	1.27E-01
Naval Reactor Fac.	to Nevada Test Site	9.83E+00	1.19E+01	1.06E+00	1.52E+00
SNL - Albuquerque	to Nevada Test Site	1.42E-01	1.78E-01	2.20E-02	2.91E-02
Totals		5.14E+01	5.83E+01	5.19E+00	1.62E+01

Table 7. Annual Accident Dose Risk for the Shipping Campaign (person-rem/yr)

Route		Truck	Rail
Argonne - West	to Nevada Test Site	1.82E-10	2.90E-11
Bettis Atomic	to Savannah River	2.22E-04	7.71E-05
Fermilab (FNAL)	to Savannah River	3.90E-09	9.53E-10
Hanford Site	to Nevada Test Site	8.95E-07	2.05E-07
Knolls Atomic	to Savannah River	9.36E-04	5.42E-04
Los Alamos NL	to Nevada Test Site	7.46E-07	4.89E-08
Lawrence Berkeley	to Nevada Test Site	1.23E-09	8.71E-10
Naval Reactor Fac.	to Nevada Test Site	5.53E-05	8.73E-06
SNL - Albuquerque	to Nevada Test Site	1.44E-11	1.12E-12
Totals		1.21E-03	6.28E-04

Table 8. Expected Annual Fatalities for the Shipping Campaign

Exposure Group	Truck	Rail
Radiological		
Normal Crew	2.1E-02	2.1E-03
Normal Public	2.9E-02	8.1E-03
Accident Public	6.1E-07	3.1E-07
Nonradiological		
Emission	9.2E-03	1.8E-02
Accident	1.2E-01	1.5E-03

Table 9. Expected Annual Cancer Incidence for the Shipping Campaign

Exposure Group	Truck	Rail
Radiological		
Normal Crew	7.2E-02	7.3E-03
Normal Public	9.9E-02	2.8E-02
Accident Public	2.1E-06	1.1E-06
Nonradiological		
Emission	9.2E-03	1.8E-02
Accident	NA	NA

Table 10. Expected Annual Genetic Effects for the Shipping Campaign

Exposure Group	Truck	Rail
Radiological		
Normal Crew	3.1E-03	3.1E-04
Normal Public	5.8E-03	1.6E-03
Accident Public	1.2E-07	6.3E-08
Nonradiological		
Emission	NA	NA
Accident	NA	NA

B.19 WM LLW CENTRALIZED 1 ALTERNATIVE (CASE 7): HETEROGENEOUS SOLIDS

Table 1. Summary of Route Information

Route		Distance (miles)	Percentage in Zone		
			Rural	Suburban	Urban
Truck					
Ames Laboratory	to Hanford Site	1703	92.6	6.6	0.8
Argonne - East	to Hanford Site	1998	91.5	7.8	0.7
Argonne - West	to Hanford Site	599	91.3	7.6	1.1
Bettis Atomic	to Hanford Site	2541	85.8	12.8	1.4
Fermilab (FNAL)	to Hanford Site	1975	92.2	7.1	0.8
INEL	to Hanford Site	599	91.3	7.6	1.1
ITRI	to Hanford Site	1593	89.7	8.8	1.5
Oak Ridge Reserv.	to Hanford Site	2464	87.8	11.0	1.2
Knolls Atomic	to Hanford Site	2809	82.1	16.1	1.8
Kansas City Plant	to Hanford Site	1741	91.5	7.6	0.9
Los Alamos NL	to Hanford Site	1560	89.8	8.8	1.3
Lawrence Berkeley	to Hanford Site	875	78.1	17.8	4.1
Lawrence Livermore	to Hanford Site	894	77.2	19.3	3.4
Mound Plant	to Hanford Site	2291	88.6	10.3	1.1
ORISE	to Hanford Site	2492	87.4	11.4	1.2
Pantex Plant	to Hanford Site	1884	90.4	8.0	1.5
Portsmouth GDP	to Hanford Site	2402	88.0	11.0	1.0
Princeton PPL	to Hanford Site	2864	82.0	15.9	2.1
Paducah GDP	to Hanford Site	2182	88.7	10.0	1.3
Pinellas Plant	to Hanford Site	3033	83.9	14.6	1.5
Rocky Flats Plant	to Hanford Site	1132	91.9	7.3	0.8
Reactive Metals	to Hanford Site	2398	86.6	11.7	1.6
SLAC	to Hanford Site	916	75.9	19.0	5.1
SNL - Albuquerque	to Hanford Site	1584	89.7	8.8	1.4
SNL - Livermore	to Hanford Site	894	77.2	19.3	3.4
Savannah River	to Hanford Site	2727	84.3	14.2	1.5
Rail					
Ames Laboratory	to Hanford Site	1788	93.7	5.6	0.7
Argonne - East	to Hanford Site	2200	93.3	6.0	0.7
Argonne - West	to Hanford Site	658	91.4	7.1	1.4
Bettis Atomic	to Hanford Site	2611	81.2	15.1	3.7
Fermilab (FNAL)	to Hanford Site	1971	89.9	8.6	1.4
INEL	to Hanford Site	658	91.4	7.1	1.4
ITRI	to Hanford Site	1793	91.7	7.1	1.2
Oak Ridge Reserv.	to Hanford Site	2601	91.2	7.4	1.3
Knolls Atomic	to Hanford Site	2914	79.1	17.0	3.9
Kansas City Plant	to Hanford Site	1784	94.1	5.0	0.9
Los Alamos NL	to Hanford Site	1725	92.5	6.5	0.9
Lawrence Berkeley	to Hanford Site	986	78.5	15.8	5.7
Lawrence Livermore	to Hanford Site	973	78.9	15.3	5.8
Mound Plant	to Hanford Site	2472	87.0	11.2	1.9
ORISE	to Hanford Site	2644	89.0	9.5	1.5
Pantex Plant	to Hanford Site	1686	92.0	7.1	1.0
Portsmouth GDP	to Hanford Site	2515	86.4	10.8	2.7
Princeton PPL	to Hanford Site	2985	76.6	19.0	4.3
Paducah GDP	to Hanford Site	2245	90.8	7.9	1.3
Pinellas Plant	to Hanford Site	3267	82.8	15.4	1.8
Rocky Flats Plant	to Hanford Site	1284	93.1	5.5	1.4
Reactive Metals	to Hanford Site	2505	83.4	13.1	3.5
SLAC	to Hanford Site	1036	76.1	16.8	7.1
SNL - Albuquerque	to Hanford Site	1793	91.7	7.1	1.2
SNL - Livermore	to Hanford Site	973	78.9	15.3	5.8
Savannah River	to Hanford Site	2953	84.7	13.5	1.8

Table 2. Annual Number of Shipments and One-Way Shipment Distances

Route		# of Shipments		Total Mileage(mi)	
		Truck	Rail	Truck	Rail
Ames Laboratory	to Hanford Site	2	1	3.41E+03	1.79E+03
Argonne - East	to Hanford Site	105	39	2.10E+05	8.58E+04
Argonne - West	to Hanford Site	13	5	7.79E+03	3.29E+03
Bettis Atomic	to Hanford Site	57	21	1.45E+05	5.48E+04
Fermilab (FNAL)	to Hanford Site	3	2	5.92E+03	3.94E+03
INEL	to Hanford Site	852	322	5.10E+05	2.12E+05
ITRI	to Hanford Site	10	4	1.59E+04	7.17E+03
Oak Ridge Reserv.	to Hanford Site	6542	2486	1.61E+07	6.47E+06
Knolls Atomic	to Hanford Site	28	11	7.87E+04	3.21E+04
Kansas City Plant	to Hanford Site	1	1	1.74E+03	1.78E+03
Los Alamos NL	to Hanford Site	724	268	1.13E+06	4.62E+05
Lawrence Berkeley	to Hanford Site	3	2	2.62E+03	1.97E+03
Lawrence Livermore	to Hanford Site	56	21	5.01E+04	2.04E+04
Mound Plant	to Hanford Site	512	190	1.17E+06	4.70E+05
ORISE	to Hanford Site	5	2	1.25E+04	5.29E+03
Pantex Plant	to Hanford Site	1450	544	2.73E+06	9.17E+05
Portsmouth GDP	to Hanford Site	3344	1274	8.03E+06	3.20E+06
Princeton PPL	to Hanford Site	1	1	2.86E+03	2.98E+03
Paducah GDP	to Hanford Site	627	237	1.37E+06	5.32E+05
Pinellas Plant	to Hanford Site	2	1	6.07E+03	3.27E+03
Rocky Flats Plant	to Hanford Site	357	133	4.04E+05	1.71E+05
Reactive Metals	to Hanford Site	768	287	1.84E+06	7.19E+05
SLAC	to Hanford Site	39	15	3.57E+04	1.55E+04
SNL - Albuquerque	to Hanford Site	17	7	2.69E+04	1.26E+04
SNL - Livermore	to Hanford Site	6	2	5.36E+03	1.95E+03
Savannah River	to Hanford Site	6834	2540	1.86E+07	7.50E+06
Totals		22358	8416	5.26E+07	2.09E+07

Table 3. Incident-Free Dose per Shipment (person-rem/shipment)

Source/Route(s)		Crew	General Public			
			Off-Link	On-Link	Stops	Total
LLW(x) AL to HS						
Ames Laboratory	to Hanford Site					
	Truck	4.46E-02	1.62E-03	5.39E-03	4.77E-02	5.47E-02
	Rail	1.03E-02	4.69E-03	1.46E-04	8.98E-03	1.38E-02
LLW(x) AN to HS						
Argonne - East	to Hanford Site					
	Truck	5.29E-02	1.97E-03	6.28E-03	5.59E-02	6.42E-02
	Rail	1.21E-02	5.75E-03	1.82E-04	1.03E-02	1.62E-02
LLW(x) AW to HS						
Argonne - West	to Hanford Site					
	Truck	1.60E-02	7.18E-04	2.06E-03	1.68E-02	1.95E-02
	Rail	5.63E-03	2.83E-03	6.58E-05	5.51E-03	8.40E-03
LLW(x) BA to HS						
Bettis Atomic	to Hanford Site					
	Truck	7.21E-02	4.36E-03	9.77E-03	7.11E-02	8.53E-02
	Rail	1.38E-02	2.67E-02	4.53E-04	1.15E-02	3.87E-02
LLW(x) FL to HS						
Fermilab (FNAL)	to Hanford Site					
	Truck	5.20E-02	1.92E-03	6.25E-03	5.53E-02	6.35E-02
	Rail	1.11E-02	9.07E-03	2.12E-04	9.55E-03	1.88E-02
LLW(x) IN to HS						
INEL	to Hanford Site					
	Truck	1.60E-02	7.18E-04	2.06E-03	1.68E-02	1.95E-02
	Rail	5.63E-03	2.83E-03	6.58E-05	5.51E-03	8.40E-03
LLW(x) IT to HS						
ITRI	to Hanford Site					
	Truck	4.34E-02	2.30E-03	5.91E-03	4.46E-02	5.28E-02
	Rail	1.04E-02	6.90E-03	1.72E-04	9.00E-03	1.61E-02
LLW(x) OR to HS						
Oak Ridge Reserv.	to Hanford Site					
	Truck	6.83E-02	3.65E-03	8.95E-03	6.90E-02	8.16E-02
	Rail	1.37E-02	1.08E-02	2.59E-04	1.15E-02	2.26E-02
LLW(x) KA to HS						
Knolls Atomic	to Hanford Site					
	Truck	8.30E-02	6.03E-03	1.19E-02	7.87E-02	9.66E-02
	Rail	1.50E-02	3.18E-02	5.40E-04	1.25E-02	4.48E-02
LLW(x) KC to HS						
Kansas City Plant	to Hanford Site					
	Truck	4.62E-02	1.90E-03	5.74E-03	4.87E-02	5.64E-02
	Rail	1.03E-02	5.00E-03	1.44E-04	8.97E-03	1.41E-02
LLW(x) LA to HS						
Los Alamos NL	to Hanford Site					
	Truck	4.24E-02	2.16E-03	5.65E-03	4.37E-02	5.15E-02
	Rail	1.01E-02	5.60E-03	1.54E-04	8.79E-03	1.45E-02
LLW(x) LB to HS						
Lawrence Berkeley	to Hanford Site					
	Truck	2.76E-02	3.02E-03	5.17E-03	2.45E-02	3.27E-02
	Rail	6.99E-03	1.38E-02	2.03E-04	6.51E-03	2.05E-02
LLW(x) LL to HS						
Lawrence Livermore	to Hanford Site					
	Truck	2.82E-02	2.88E-03	4.92E-03	2.50E-02	3.28E-02
	Rail	6.94E-03	1.38E-02	2.00E-04	6.48E-03	2.05E-02
LLW(x) MP to HS						
Mound Plant	to Hanford Site					
	Truck	6.29E-02	3.13E-03	8.05E-03	6.41E-02	7.53E-02
	Rail	1.32E-02	1.47E-02	3.13E-04	1.11E-02	2.61E-02
LLW(x) OI to HS						
ORISE	to Hanford Site					
	Truck	6.94E-02	3.76E-03	9.08E-03	6.98E-02	8.26E-02
	Rail	1.39E-02	1.30E-02	2.98E-04	1.16E-02	2.49E-02
LLW(x) OR to HS						
Oak Ridge Reserv.	to Hanford Site					
	Truck	6.83E-02	3.65E-03	8.95E-03	6.90E-02	8.16E-02
	Rail	1.37E-02	1.08E-02	2.59E-04	1.15E-02	2.26E-02
LLW(x) PP to HS						
Pantex Plant	to Hanford Site					
	Truck	5.10E-02	2.68E-03	7.01E-03	5.27E-02	6.24E-02
	Rail	9.92E-03	5.71E-03	1.56E-04	8.67E-03	1.45E-02
LLW(x) PO to HS						
Portsmouth GDP	to Hanford Site					
	Truck	6.63E-02	3.38E-03	8.48E-03	6.72E-02	7.91E-02
	Rail	1.34E-02	1.89E-02	3.46E-04	1.12E-02	3.04E-02

LLW(x) PR to HS						
Princeton PPL	to Hanford Site					
	Truck	8.51E-02	6.65E-03	1.28E-02	8.02E-02	9.97E-02
	Rail	1.53E-02	3.63E-02	6.03E-04	1.27E-02	4.96E-02
LLW(x) PA to HS						
Paducah GDP	to Hanford Site					
	Truck	6.00E-02	3.22E-03	8.02E-03	6.11E-02	7.23E-02
	Rail	1.22E-02	9.43E-03	2.28E-04	1.04E-02	2.01E-02
LLW(x) PI to HS						
Pinellas Plant	to Hanford Site					
	Truck	8.77E-02	5.74E-03	1.21E-02	8.49E-02	1.03E-01
	Rail	1.65E-02	2.19E-02	4.79E-04	1.35E-02	3.59E-02
LLW(x) RF to HS						
Rocky Flats Plant	to Hanford Site					
	Truck	2.99E-02	1.13E-03	3.61E-03	3.17E-02	3.64E-02
	Rail	8.24E-03	4.91E-03	1.16E-04	7.43E-03	1.25E-02
LLW(x) RM to HS						
Reactive Metals	to Hanford Site					
	Truck	6.76E-02	4.22E-03	9.51E-03	6.71E-02	8.09E-02
	Rail	1.33E-02	2.35E-02	4.01E-04	1.12E-02	3.51E-02
LLW(x) ST to HS						
SLAC	to Hanford Site					
	Truck	2.98E-02	3.70E-03	6.08E-03	2.56E-02	3.54E-02
	Rail	7.20E-03	1.75E-02	2.40E-04	6.67E-03	2.44E-02
LLW(x) SA to HS						
SNL - Albuquerque	to Hanford Site					
	Truck	4.31E-02	2.27E-03	5.84E-03	4.43E-02	5.24E-02
	Rail	1.04E-02	6.90E-03	1.72E-04	9.00E-03	1.61E-02
LLW(x) SL to HS						
SNL - Livermore	to Hanford Site					
	Truck	2.82E-02	2.88E-03	4.92E-03	2.50E-02	3.28E-02
	Rail	6.94E-03	1.38E-02	2.00E-04	6.48E-03	2.05E-02
LLW(x) SR to HS						
Savannah River	to Hanford Site					
	Truck	7.86E-02	5.10E-03	1.08E-02	7.64E-02	9.23E-02
	Rail	1.52E-02	1.85E-02	4.05E-04	1.26E-02	3.15E-02
LLW(x) OR to HS						
Oak Ridge Reserv.	to Hanford Site					
	Truck	6.83E-02	3.65E-03	8.95E-03	6.90E-02	8.16E-02
	Rail	1.37E-02	1.08E-02	2.59E-04	1.15E-02	2.26E-02

Table 4. Accident Dose Risk per Shipment (person-rem/shipment)

Source/Route		Truck	Rail
LLW(x) AL to HS Ames Laboratory	to Hanford Site	5.20E-06	3.93E-06
LLW(x) AN to HS Argonne - East	to Hanford Site	5.56E-04	3.40E-04
LLW(x) AW to HS Argonne - West	to Hanford Site	2.45E-01	3.44E-01
LLW(x) BA to HS Bettis Atomic	to Hanford Site	4.46E-05	5.00E-05
LLW(x) FL to HS Fermilab (FNAL)	to Hanford Site	2.24E-05	1.11E-05
LLW(x) IN to HS INEL	to Hanford Site	1.10E-04	1.56E-04
LLW(x) IT to HS ITRI	to Hanford Site	5.50E-03	1.57E-03
LLW(x) OR to HS Oak Ridge Reserv.	to Hanford Site	3.71E-07	1.96E-07
LLW(x) KA to HS Knolls Atomic	to Hanford Site	4.90E-06	4.19E-06
LLW(x) KC to HS Kansas City Plant	to Hanford Site	2.32E-05	4.82E-06
LLW(x) LA to HS Los Alamos NL	to Hanford Site	2.73E-02	9.38E-03
LLW(x) LB to HS Lawrence Berkeley	to Hanford Site	5.07E-02	4.24E-02
LLW(x) LL to HS Lawrence Livermore	to Hanford Site	9.20E-06	1.28E-05
LLW(x) MP to HS Mound Plant	to Hanford Site	5.89E-06	3.53E-06
LLW(x) OI to HS ORISE	to Hanford Site	2.64E-06	1.38E-06
LLW(x) OR to HS Oak Ridge Reserv.	to Hanford Site	3.71E-07	1.96E-07
LLW(x) PP to HS Pantex Plant	to Hanford Site	1.63E-06	4.96E-07
LLW(x) PO to HS Portsmouth GDP	to Hanford Site	2.56E-08	2.65E-08
LLW(x) PR to HS Princeton PPL	to Hanford Site	1.28E-05	4.69E-06
LLW(x) PA to HS Paducah GDP	to Hanford Site	1.17E-06	7.34E-07
LLW(x) PI to HS Pinellas Plant	to Hanford Site	6.86E-06	3.00E-06
LLW(x) RF to HS Rocky Flats Plant	to Hanford Site	3.44E-06	2.49E-06
LLW(x) RM to HS Reactive Metals	to Hanford Site	1.16E-08	1.29E-08
LLW(x) ST to HS SLAC	to Hanford Site	4.30E-07	6.58E-07
LLW(x) SA to HS SNL - Albuquerque	to Hanford Site	2.28E-05	7.55E-06
LLW(x) SL to HS SNL - Livermore	to Hanford Site	8.79E-05	1.40E-04
LLW(x) SR to HS Savannah River	to Hanford Site	5.07E-03	2.74E-03
LLW(x) OR to HS Oak Ridge Reserv.	to Hanford Site	3.71E-07	1.96E-07

Table 5. Nonradiological Risk Factors per Shipment (fatalities/shipment)

Mode	Route	Emission	Accident
Truck			
Ames Laboratory	to Hanford Site	4.31E-06	8.93E-05
Argonne - East	to Hanford Site	4.41E-06	1.06E-04
Argonne - West	to Hanford Site	2.19E-06	3.07E-05
Bettis Atomic	to Hanford Site	1.14E-05	1.36E-04
Fermilab (FNAL)	to Hanford Site	4.86E-06	1.03E-04
INEL	to Hanford Site	2.19E-06	3.07E-05
ITRI	to Hanford Site	7.44E-06	1.05E-04
Oak Ridge Reserv.	to Hanford Site	9.50E-06	1.61E-04
Knolls Atomic	to Hanford Site	1.59E-05	1.51E-04
Kansas City Plant	to Hanford Site	5.18E-06	1.12E-04
Los Alamos NL	to Hanford Site	6.66E-06	1.02E-04
Lawrence Berkeley	to Hanford Site	1.16E-05	4.91E-05
Lawrence Livermore	to Hanford Site	9.85E-06	5.03E-05
Mound Plant	to Hanford Site	7.89E-06	1.23E-04
ORISE	to Hanford Site	9.50E-06	1.65E-04
Pantex Plant	to Hanford Site	9.21E-06	1.25E-04
Portsmouth GDP	to Hanford Site	8.11E-06	1.28E-04
Princeton PPL	to Hanford Site	1.97E-05	1.63E-04
Paducah GDP	to Hanford Site	9.30E-06	1.41E-04
Pinellas Plant	to Hanford Site	1.43E-05	2.03E-04
Rocky Flats Plant	to Hanford Site	2.83E-06	6.69E-05
Reactive Metals	to Hanford Site	1.27E-05	1.28E-04
SLAC	to Hanford Site	1.50E-05	5.14E-05
SNL - Albuquerque	to Hanford Site	7.24E-06	1.05E-04
SNL - Livermore	to Hanford Site	9.85E-06	5.03E-05
Savannah River	to Hanford Site	1.31E-05	1.81E-04
Rail			
Ames Laboratory	to Hanford Site	5.40E-06	3.74E-06
Argonne - East	to Hanford Site	6.15E-06	4.60E-06
Argonne - West	to Hanford Site	3.98E-06	1.38E-06
Bettis Atomic	to Hanford Site	4.07E-05	5.46E-06
Fermilab (FNAL)	to Hanford Site	1.18E-05	4.12E-06
INEL	to Hanford Site	3.98E-06	1.38E-06
ITRI	to Hanford Site	9.04E-06	3.75E-06
Oak Ridge Reserv.	to Hanford Site	1.45E-05	5.44E-06
Knolls Atomic	to Hanford Site	4.72E-05	6.10E-06
Kansas City Plant	to Hanford Site	6.57E-06	3.73E-06
Los Alamos NL	to Hanford Site	6.82E-06	3.61E-06
Lawrence Berkeley	to Hanford Site	2.33E-05	2.06E-06
Lawrence Livermore	to Hanford Site	2.36E-05	2.04E-06
Mound Plant	to Hanford Site	1.94E-05	5.17E-06
ORISE	to Hanford Site	1.67E-05	5.53E-06
Pantex Plant	to Hanford Site	6.78E-06	3.53E-06
Portsmouth GDP	to Hanford Site	2.88E-05	5.26E-06
Princeton PPL	to Hanford Site	5.38E-05	6.24E-06
Paducah GDP	to Hanford Site	1.23E-05	4.70E-06
Pinellas Plant	to Hanford Site	2.47E-05	6.83E-06
Rocky Flats Plant	to Hanford Site	7.36E-06	2.69E-06
Reactive Metals	to Hanford Site	3.65E-05	5.24E-06
SLAC	to Hanford Site	3.07E-05	2.17E-06
SNL - Albuquerque	to Hanford Site	9.04E-06	3.75E-06
SNL - Livermore	to Hanford Site	2.36E-05	2.04E-06
Savannah River	to Hanford Site	2.21E-05	6.18E-06

Table 6. Annual Incident-Free Dose for the Shipping Campaign (person-rem/yr)

Route		Truck		Rail	
		Crew	Public	Crew	Public
Ames Laboratory	to Hanford Site	8.93E-02	1.09E-01	1.03E-02	1.38E-02
Argonne - East	to Hanford Site	5.55E+00	6.74E+00	4.70E-01	6.31E-01
Argonne - West	to Hanford Site	2.08E-01	2.54E-01	2.81E-02	4.20E-02
Bettis Atomic	to Hanford Site	4.11E+00	4.86E+00	2.89E-01	8.13E-01
Fermilab (FNAL)	to Hanford Site	1.56E-01	1.90E-01	2.22E-02	3.77E-02
INEL	to Hanford Site	1.36E+01	1.67E+01	1.81E+00	2.71E+00
ITRI	to Hanford Site	4.34E-01	5.28E-01	4.15E-02	6.43E-02
Oak Ridge Reserv.	to Hanford Site	4.47E+02	5.34E+02	3.41E+01	5.61E+01
Knolls Atomic	to Hanford Site	2.32E+00	2.70E+00	1.65E-01	4.93E-01
Kansas City Plant	to Hanford Site	4.62E-02	5.64E-02	1.03E-02	1.41E-02
Los Alamos NL	to Hanford Site	3.07E+01	3.73E+01	2.70E+00	3.90E+00
Lawrence Berkeley	to Hanford Site	8.27E-02	9.80E-02	1.40E-02	4.10E-02
Lawrence Livermore	to Hanford Site	1.58E+00	1.84E+00	1.46E-01	4.30E-01
Mound Plant	to Hanford Site	3.22E+01	3.86E+01	2.51E+00	4.96E+00
ORISE	to Hanford Site	3.47E-01	4.13E-01	2.78E-02	4.98E-02
Pantex Plant	to Hanford Site	7.40E+01	9.05E+01	5.40E+00	7.91E+00
Portsmouth GDP	to Hanford Site	2.22E+02	2.65E+02	1.70E+01	3.88E+01
Princeton PPL	to Hanford Site	8.51E-02	9.97E-02	1.53E-02	4.96E-02
Paducah GDP	to Hanford Site	3.76E+01	4.53E+01	2.90E+00	4.75E+00
Pinellas Plant	to Hanford Site	1.75E-01	2.05E-01	1.65E-02	3.59E-02
Rocky Flats Plant	to Hanford Site	1.07E+01	1.30E+01	1.10E+00	1.66E+00
Reactive Metals	to Hanford Site	5.19E+01	6.21E+01	3.83E+00	1.01E+01
SLAC	to Hanford Site	1.16E+00	1.38E+00	1.08E-01	3.66E-01
SNL - Albuquerque	to Hanford Site	7.33E-01	8.92E-01	7.25E-02	1.12E-01
SNL - Livermore	to Hanford Site	1.69E-01	1.97E-01	1.39E-02	4.10E-02
Savannah River	to Hanford Site	5.37E+02	6.31E+02	3.86E+01	8.00E+01
Totals		1.47E+03	1.75E+03	1.11E+02	2.14E+02

Table 7. Annual Accident Dose Risk for the Shipping Campaign (person-rem/yr)

Route		Truck	Rail
Ames Laboratory	to Hanford Site	1.04E-05	3.93E-06
Argonne - East	to Hanford Site	5.84E-02	1.33E-02
Argonne - West	to Hanford Site	3.18E+00	1.72E+00
Bettis Atomic	to Hanford Site	2.54E-03	1.05E-03
Fermilab (FNAL)	to Hanford Site	6.73E-05	2.22E-05
INEL	to Hanford Site	9.35E-02	5.04E-02
ITRI	to Hanford Site	5.50E-02	6.27E-03
Oak Ridge Reserv.	to Hanford Site	2.43E-03	4.87E-04
Knolls Atomic	to Hanford Site	1.37E-04	4.61E-05
Kansas City Plant	to Hanford Site	2.32E-05	4.82E-06
Los Alamos NL	to Hanford Site	1.98E+01	2.51E+00
Lawrence Berkeley	to Hanford Site	1.52E-01	8.48E-02
Lawrence Livermore	to Hanford Site	5.15E-04	2.70E-04
Mound Plant	to Hanford Site	3.01E-03	6.71E-04
ORISE	to Hanford Site	1.32E-05	2.77E-06
Pantex Plant	to Hanford Site	2.36E-03	2.70E-04
Portsmouth GDP	to Hanford Site	8.56E-05	3.38E-05
Princeton PPL	to Hanford Site	1.28E-05	4.69E-06
Paducah GDP	to Hanford Site	7.35E-04	1.74E-04
Pinellas Plant	to Hanford Site	1.37E-05	3.00E-06
Rocky Flats Plant	to Hanford Site	1.23E-03	3.31E-04
Reactive Metals	to Hanford Site	8.90E-06	3.69E-06
SLAC	to Hanford Site	1.68E-05	9.87E-06
SNL - Albuquerque	to Hanford Site	3.88E-04	5.29E-05
SNL - Livermore	to Hanford Site	5.27E-04	2.79E-04
Savannah River	to Hanford Site	3.46E+01	6.96E+00
Totals		5.80E+01	1.14E+01

Table 8. Expected Annual Fatalities for the Shipping Campaign

Exposure Group	Truck	Rail
Radiological		
Normal Crew	5.9E-01	4.5E-02
Normal Public	8.8E-01	1.1E-01
Accident Public	2.9E-02	5.7E-03
Nonradiological		
Emission	2.2E-01	1.6E-01
Accident	3.3E+00	4.4E-02

Table 9. Expected Annual Cancer Incidence for the Shipping Campaign

Exposure Group	Truck	Rail
Radiological		
Normal Crew	2.1E+00	1.6E-01
Normal Public	3.0E+00	3.6E-01
Accident Public	9.9E-02	1.9E-02
Nonradiological		
Emission	2.2E-01	1.6E-01
Accident	NA	NA

Table 10. Expected Annual Genetic Effects for the Shipping Campaign

Exposure Group	Truck	Rail
Radiological		
Normal Crew	8.8E-02	6.7E-03
Normal Public	1.8E-01	2.1E-02
Accident Public	5.3E-03	1.0E-03
Nonradiological		
Emission	NA	NA
Accident	NA	NA

B.20 WM LLW CENTRALIZED 1 ALTERNATIVE (CASE 7): ACTIVATED METALS

Table 1. Summary of Route Information

Route		Distance (miles)	Percentage in Zone		
			Rural	Suburban	Urban
Truck					
Argonne - West	to Hanford Site	599	91.3	7.6	1.1
Bettis Atomic	to Hanford Site	2541	85.8	12.8	1.4
Fermilab (FNAL)	to Hanford Site	1975	92.2	7.1	0.8
Knolls Atomic	to Hanford Site	2809	82.1	16.1	1.8
Los Alamos NL	to Hanford Site	1560	89.8	8.8	1.3
Lawrence Berkeley	to Hanford Site	875	78.1	17.8	4.1
Naval Reactor Fac.	to Hanford Site	599	91.3	7.6	1.1
SNL - Albuquerque	to Hanford Site	1584	89.7	8.8	1.4
Rail					
Argonne - West	to Hanford Site	658	91.4	7.1	1.4
Bettis Atomic	to Hanford Site	2611	81.2	15.1	3.7
Fermilab (FNAL)	to Hanford Site	1971	89.9	8.6	1.4
Knolls Atomic	to Hanford Site	2914	79.1	17.0	3.9
Los Alamos NL	to Hanford Site	1725	92.5	6.5	0.9
Lawrence Berkeley	to Hanford Site	986	78.5	15.8	5.7
Naval Reactor Fac.	to Hanford Site	658	91.4	7.1	1.4
SNL - Albuquerque	to Hanford Site	1793	91.7	7.1	1.2

Table 2. Annual Number of Shipments and One-Way Shipment Distances

Route		# of Shipments		Total Mileage(mi)	
		Truck	Rail	Truck	Rail
Argonne - West	to Hanford Site	9	4	5.39E+03	2.63E+03
Bettis Atomic	to Hanford Site	316	120	8.03E+05	3.13E+05
Fermilab (FNAL)	to Hanford Site	40	15	7.90E+04	2.96E+04
Knolls Atomic	to Hanford Site	650	246	1.83E+06	7.17E+05
Los Alamos NL	to Hanford Site	418	159	6.52E+05	2.74E+05
Lawrence Berkeley	to Hanford Site	15	6	1.31E+04	5.91E+03
Naval Reactor Fac.	to Hanford Site	461	175	2.76E+05	1.15E+05
SNL - Albuquerque	to Hanford Site	6	3	9.50E+03	5.38E+03
Totals		1915	728	3.66E+06	1.46E+06

Table 3. Incident-Free Dose per Shipment (person-rem/shipment)

Source/Route(s)		Crew	General Public Off-Link	On-Link	Stops	Total
LLW(I) AW to HS Argonne - West	to Hanford Site					
	Truck	1.60E-02	7.18E-04	2.06E-03	1.68E-02	1.95E-02
	Rail	5.63E-03	2.83E-03	6.58E-05	5.51E-03	8.40E-03
LLW(I) BA to HS Bettis Atomic	to Hanford Site					
	Truck	7.21E-02	4.36E-03	9.77E-03	7.11E-02	8.53E-02
	Rail	1.38E-02	2.67E-02	4.53E-04	1.15E-02	3.87E-02
LLW(I) FL to HS Fermilab (FNAL)	to Hanford Site					
	Truck	5.20E-02	1.92E-03	6.25E-03	5.53E-02	6.35E-02
	Rail	1.11E-02	9.07E-03	2.12E-04	9.55E-03	1.88E-02
LLW(I) KA to HS Knolls Atomic	to Hanford Site					
	Truck	8.30E-02	6.03E-03	1.19E-02	7.87E-02	9.66E-02
	Rail	1.50E-02	3.18E-02	5.40E-04	1.25E-02	4.48E-02
LLW(I) LA to HS Los Alamos NL	to Hanford Site					
	Truck	4.24E-02	2.16E-03	5.65E-03	4.37E-02	5.15E-02
	Rail	1.01E-02	5.60E-03	1.54E-04	8.79E-03	1.45E-02
LLW(I) LB to HS Lawrence Berkeley	to Hanford Site					
	Truck	2.76E-02	3.02E-03	5.17E-03	2.45E-02	3.27E-02
	Rail	6.99E-03	1.38E-02	2.03E-04	6.51E-03	2.05E-02
LLW(I) NR to HS Naval Reactor Fac.	to Hanford Site					
	Truck	1.60E-02	7.18E-04	2.06E-03	1.68E-02	1.95E-02
	Rail	5.63E-03	2.83E-03	6.58E-05	5.51E-03	8.40E-03
LLW(I) SA to HS SNL - Albuquerque	to Hanford Site					
	Truck	4.31E-02	2.27E-03	5.84E-03	4.43E-02	5.24E-02
	Rail	1.04E-02	6.90E-03	1.72E-04	9.00E-03	1.61E-02

Table 4. Accident Dose Risk per Shipment (person-rem/shipment)

Source/Route		Truck	Rail
LLW(I) AW to HS Argonne - West	to Hanford Site	8.15E-12	9.58E-12
LLW(I) BA to HS Bettis Atomic	to Hanford Site	1.80E-06	1.78E-06
LLW(I) FL to HS Fermilab (FNAL)	to Hanford Site	4.65E-11	4.12E-11
LLW(I) KA to HS Knolls Atomic	to Hanford Site	3.07E-06	2.58E-06
LLW(I) LA to HS Los Alamos NL	to Hanford Site	3.10E-09	8.88E-10
LLW(I) LB to HS Lawrence Berkeley	to Hanford Site	1.69E-10	2.37E-10
LLW(I) NR to HS Naval Reactor Fac.	to Hanford Site	4.44E-08	6.34E-08
LLW(I) SA to HS SNL - Albuquerque	to Hanford Site	6.06E-12	1.32E-12

Table 5. Nonradiological Risk Factors per Shipment (fatalities/shipment)

Mode	Route	Emission	Accident
Truck			
Argonne - West	to Hanford Site	2.19E-06	3.07E-05
Bettis Atomic	to Hanford Site	1.14E-05	1.36E-04
Fermilab (FNAL)	to Hanford Site	4.86E-06	1.03E-04
Knolls Atomic	to Hanford Site	1.59E-05	1.51E-04
Los Alamos NL	to Hanford Site	6.66E-06	1.02E-04
Lawrence Berkeley	to Hanford Site	1.16E-05	4.91E-05
Naval Reactor Fac.	to Hanford Site	2.19E-06	3.07E-05
SNL - Albuquerque	to Hanford Site	7.24E-06	1.05E-04
Rail			
Argonne - West	to Hanford Site	3.98E-06	1.38E-06
Bettis Atomic	to Hanford Site	4.07E-05	5.46E-06
Fermilab (FNAL)	to Hanford Site	1.18E-05	4.12E-06
Knolls Atomic	to Hanford Site	4.72E-05	6.10E-06
Los Alamos NL	to Hanford Site	6.82E-06	3.61E-06
Lawrence Berkeley	to Hanford Site	2.33E-05	2.06E-06
Naval Reactor Fac.	to Hanford Site	3.98E-06	1.38E-06
SNL - Albuquerque	to Hanford Site	9.04E-06	3.75E-06

Table 6. Annual Incident-Free Dose for the Shipping Campaign (person-rem/yr)

Route		Truck		Rail	
		Crew	Public	Crew	Public
Argonne - West	to Hanford Site	1.44E-01	1.76E-01	2.25E-02	3.36E-02
Bettis Atomic	to Hanford Site	2.28E+01	2.69E+01	1.65E+00	4.64E+00
Fermilab (FNAL)	to Hanford Site	2.08E+00	2.54E+00	1.67E-01	2.82E-01
Knolls Atomic	to Hanford Site	5.39E+01	6.28E+01	3.70E+00	1.10E+01
Los Alamos NL	to Hanford Site	1.77E+01	2.15E+01	1.60E+00	2.31E+00
Lawrence Berkeley	to Hanford Site	4.14E-01	4.90E-01	4.20E-02	1.23E-01
Naval Reactor Fac.	to Hanford Site	7.37E+00	9.01E+00	9.85E-01	1.47E+00
SNL - Albuquerque	to Hanford Site	2.59E-01	3.15E-01	3.11E-02	4.82E-02
Totals		1.05E+02	1.24E+02	8.20E+00	1.99E+01

Table 7. Annual Accident Dose Risk for the Shipping Campaign (person-rem/yr)

Route		Truck	Rail
Argonne - West	to Hanford Site	7.34E-11	3.83E-11
Bettis Atomic	to Hanford Site	5.68E-04	2.13E-04
Fermilab (FNAL)	to Hanford Site	1.86E-09	6.17E-10
Knolls Atomic	to Hanford Site	1.99E-03	6.36E-04
Los Alamos NL	to Hanford Site	1.29E-06	1.41E-07
Lawrence Berkeley	to Hanford Site	2.53E-09	1.42E-09
Naval Reactor Fac.	to Hanford Site	2.05E-05	1.11E-05
SNL - Albuquerque	to Hanford Site	3.63E-11	3.96E-12
Totals		2.58E-03	8.60E-04

Table 8. Expected Annual Fatalities for the Shipping Campaign

Exposure Group	Truck	Rail
Radiological		
Normal Crew	4.2E-02	3.3E-03
Normal Public	6.2E-02	1.0E-02
Accident Public	1.3E-06	4.3E-07
Nonradiological		
Emission	1.8E-02	1.9E-02
Accident	2.0E-01	3.1E-03

Table 9. Expected Annual Cancer Incidence for the Shipping Campaign

Exposure Group	Truck	Rail
Radiological		
Normal Crew	1.5E-01	1.1E-02
Normal Public	2.1E-01	3.4E-02
Accident Public	4.4E-06	1.5E-06
Nonradiological		
Emission	1.8E-02	1.9E-02
Accident	NA	NA

Table 10. Expected Annual Genetic Effects for the Shipping Campaign

Exposure Group	Truck	Rail
Radiological		
Normal Crew	6.3E-03	4.9E-04
Normal Public	1.2E-02	2.0E-03
Accident Public	2.6E-07	8.6E-08
Nonradiological		
Emission	NA	NA
Accident	NA	NA

B.21 WM LLW CENTRALIZED 2 ALTERNATIVE (CASE 8): HETEROGENEOUS SOLIDS

Table 1. Summary of Route Information

Route		Distance (miles)	Percentage in Zone		
			Rural	Suburban	Urban
Truck					
Ames Laboratory	to Nevada Test Site	1520	92.0	6.8	1.2
Argonne - East	to Nevada Test Site	1815	91.0	8.0	1.0
Argonne - West	to Nevada Test Site	712	82.8	13.7	3.5
Bettis Atomic	to Nevada Test Site	2297	83.2	14.6	2.2
Fermilab (FNAL)	to Nevada Test Site	1805	91.3	7.5	1.1
Hanford Site	to Nevada Test Site	1128	86.5	10.9	2.6
INEL	to Nevada Test Site	712	82.8	13.7	3.5
ITRI	to Nevada Test Site	918	93.8	4.8	1.5
Oak Ridge Reserv.	to Nevada Test Site	2151	86.9	11.5	1.6
Knolls Atomic	to Nevada Test Site	2626	81.1	16.9	2.1
Kansas City Plant	to Nevada Test Site	1428	91.0	7.6	1.4
Los Alamos NL	to Nevada Test Site	997	93.2	5.7	1.1
Lawrence Berkeley	to Nevada Test Site	719	81.9	10.6	7.5
Lawrence Livermore	to Nevada Test Site	678	84.7	9.2	6.1
Mound Plant	to Nevada Test Site	2047	86.1	12.0	1.9
ORISE	to Nevada Test Site	2180	86.4	12.0	1.5
Pantex Plant	to Nevada Test Site	1209	93.9	4.6	1.6
Portsmouth GDP	to Nevada Test Site	2158	85.5	12.6	1.9
Princeton PPL	to Nevada Test Site	2620	79.4	17.7	2.9
Paducah GDP	to Nevada Test Site	1864	87.6	10.7	1.8
Pinellas Plant	to Nevada Test Site	2720	82.7	15.5	1.8
Rocky Flats Plant	to Nevada Test Site	836	89.5	8.5	2.0
Reactive Metals	to Nevada Test Site	2214	85.8	12.2	2.0
SLAC	to Nevada Test Site	739	79.6	11.3	9.1
SNL - Albuquerque	to Nevada Test Site	909	93.8	4.8	1.4
SNL - Livermore	to Nevada Test Site	678	84.7	9.2	6.1
Savannah River	to Nevada Test Site	2414	83.1	15.1	1.8
Rail					
Ames Laboratory	to Nevada Test Site	1674	94.0	5.1	0.9
Argonne - East	to Nevada Test Site	2348	92.8	6.4	0.8
Argonne - West	to Nevada Test Site	756	92.8	5.9	1.3
Bettis Atomic	to Nevada Test Site	2496	80.9	15.2	4.0
Fermilab (FNAL)	to Nevada Test Site	1997	92.3	6.5	1.2
Hanford Site	to Nevada Test Site	1302	93.0	5.9	1.1
INEL	to Nevada Test Site	756	92.8	5.9	1.3
ITRI	to Nevada Test Site	1065	94.6	4.5	0.9
Oak Ridge Reserv.	to Nevada Test Site	2487	91.4	7.2	1.5
Knolls Atomic	to Nevada Test Site	2800	78.8	17.2	4.1
Kansas City Plant	to Nevada Test Site	1670	94.5	4.5	1.0
Los Alamos NL	to Nevada Test Site	1169	92.8	5.9	1.3
Lawrence Berkeley	to Nevada Test Site	860	75.1	17.7	7.2
Lawrence Livermore	to Nevada Test Site	1370	94.5	3.8	1.8
Mound Plant	to Nevada Test Site	2386	87.9	10.3	1.8
ORISE	to Nevada Test Site	2530	89.0	9.3	1.6
Pantex Plant	to Nevada Test Site	1376	94.9	4.4	0.7
Portsmouth GDP	to Nevada Test Site	2401	86.3	10.7	2.9
Princeton PPL	to Nevada Test Site	2871	76.2	19.3	4.5
Paducah GDP	to Nevada Test Site	2131	90.9	7.6	1.5
Pinellas Plant	to Nevada Test Site	3153	82.6	15.5	1.9
Rocky Flats Plant	to Nevada Test Site	987	95.9	3.9	0.2
Reactive Metals	to Nevada Test Site	2391	83.1	13.1	3.7
SLAC	to Nevada Test Site	862	75.8	17.7	6.5
SNL - Albuquerque	to Nevada Test Site	1065	94.6	4.5	0.9
SNL - Livermore	to Nevada Test Site	1370	94.5	3.8	1.8
Savannah River	to Nevada Test Site	2839	84.5	13.5	1.9

Table 2. Annual Number of Shipments and One-Way Shipment Distances

Route		# of Shipments		Total Mileage(mi)	
		Truck	Rail	Truck	Rail
Ames Laboratory	to Nevada Test Site	2	1	3.04E+03	1.67E+03
Argonne - East	to Nevada Test Site	105	39	1.91E+05	9.16E+04
Argonne - West	to Nevada Test Site	13	5	9.26E+03	3.78E+03
Bettis Atomic	to Nevada Test Site	57	21	1.31E+05	5.24E+04
Fermilab (FNAL)	to Nevada Test Site	3	2	5.41E+03	3.99E+03
Hanford Site	to Nevada Test Site	1421	531	1.60E+06	6.91E+05
INEL	to Nevada Test Site	852	322	6.07E+05	2.43E+05
ITRI	to Nevada Test Site	10	4	9.18E+03	4.26E+03
Oak Ridge Reserv.	to Nevada Test Site	6542	2486	1.41E+07	6.18E+06
Knolls Atomic	to Nevada Test Site	28	11	7.35E+04	3.08E+04
Kansas City Plant	to Nevada Test Site	1	1	1.43E+03	1.67E+03
Los Alamos NL	to Nevada Test Site	724	268	7.22E+05	3.13E+05
Lawrence Berkeley	to Nevada Test Site	3	2	2.16E+03	1.72E+03
Lawrence Livermore	to Nevada Test Site	56	21	3.80E+04	2.88E+04
Mound Plant	to Nevada Test Site	512	190	1.05E+06	4.53E+05
ORISE	to Nevada Test Site	5	2	1.09E+04	5.06E+03
Pantex Plant	to Nevada Test Site	1450	544	1.75E+06	7.49E+05
Portsmouth GDP	to Nevada Test Site	3344	1274	7.22E+06	3.06E+06
Princeton PPL	to Nevada Test Site	1	1	2.62E+03	2.87E+03
Paducah GDP	to Nevada Test Site	627	237	1.17E+06	5.05E+05
Pinellas Plant	to Nevada Test Site	2	1	5.44E+03	3.15E+03
Rocky Flats Plant	to Nevada Test Site	357	133	2.98E+05	1.31E+05
Reactive Metals	to Nevada Test Site	768	287	1.70E+06	6.86E+05
SLAC	to Nevada Test Site	39	15	2.88E+04	1.29E+04
SNL - Albuquerque	to Nevada Test Site	17	7	1.55E+04	7.45E+03
SNL - Livermore	to Nevada Test Site	6	2	4.07E+03	2.74E+03
Savannah River	to Nevada Test Site	6834	2540	1.65E+07	7.21E+06
Totals		23779	8947	4.72E+07	2.05E+07

Table 3. Incident-Free Dose per Shipment (person-rem/shipment)

Source/Route(s)		Crew	General Public			
			Off-Link	On-Link	Stops	Total
LLW(x) AL to NT						
Ames Laboratory	to Nevada Test Site					
	Truck	4.03E-02	1.78E-03	5.25E-03	4.25E-02	4.96E-02
	Rail	9.87E-03	4.68E-03	1.36E-04	8.63E-03	1.34E-02
LLW(x) AN to NT						
Argonne - East	to Nevada Test Site					
	Truck	4.86E-02	2.13E-03	6.15E-03	5.08E-02	5.91E-02
	Rail	1.27E-02	6.96E-03	2.04E-04	1.07E-02	1.79E-02
LLW(x) AW to NT						
Argonne - West	to Nevada Test Site					
	Truck	2.13E-02	2.03E-03	3.79E-03	1.99E-02	2.58E-02
	Rail	6.04E-03	2.80E-03	6.88E-05	5.81E-03	8.67E-03
LLW(x) BA to NT						
Bettis Atomic	to Nevada Test Site					
	Truck	6.75E-02	5.17E-03	1.02E-02	6.43E-02	7.97E-02
	Rail	1.33E-02	2.67E-02	4.43E-04	1.12E-02	3.83E-02
LLW(x) FL to NT						
Fermilab (FNAL)	to Nevada Test Site					
	Truck	4.82E-02	2.15E-03	6.20E-03	5.05E-02	5.89E-02
	Rail	1.12E-02	7.26E-03	1.85E-04	9.63E-03	1.71E-02
LLW(x) HS to NT						
Hanford Site	to Nevada Test Site					
	Truck	3.22E-02	2.46E-03	5.18E-03	3.16E-02	3.92E-02
	Rail	8.31E-03	4.39E-03	1.15E-04	7.49E-03	1.20E-02
LLW(x) IN to NT						
INEL	to Nevada Test Site					
	Truck	2.13E-02	2.03E-03	3.79E-03	1.99E-02	2.58E-02
	Rail	6.04E-03	2.80E-03	6.88E-05	5.81E-03	8.67E-03
LLW(x) IT to NT						
ITRI	to Nevada Test Site					
	Truck	2.40E-02	1.05E-03	3.25E-03	2.57E-02	3.00E-02
	Rail	7.32E-03	2.85E-03	8.34E-05	6.76E-03	9.69E-03
LLW(x) OR to NT						
Oak Ridge Reserv.	to Nevada Test Site					
	Truck	6.04E-02	3.66E-03	8.38E-03	6.02E-02	7.22E-02
	Rail	1.33E-02	1.08E-02	2.50E-04	1.11E-02	2.22E-02
LLW(x) KA to NT						
Knolls Atomic	to Nevada Test Site					
	Truck	7.86E-02	6.20E-03	1.18E-02	7.35E-02	9.15E-02
	Rail	1.46E-02	3.18E-02	5.30E-04	1.21E-02	4.44E-02
LLW(x) KC to NT						
Kansas City Plant	to Nevada Test Site					
	Truck	3.84E-02	1.90E-03	5.17E-03	4.00E-02	4.70E-02
	Rail	9.85E-03	4.98E-03	1.34E-04	8.62E-03	1.37E-02
LLW(x) LA to NT						
Los Alamos NL	to Nevada Test Site					
	Truck	2.61E-02	1.04E-03	3.33E-03	2.79E-02	3.23E-02
	Rail	7.76E-03	4.40E-03	1.07E-04	7.08E-03	1.16E-02
LLW(x) LB to NT						
Lawrence Berkeley	to Nevada Test Site					
	Truck	2.27E-02	3.31E-03	5.66E-03	2.01E-02	2.91E-02
	Rail	6.47E-03	1.49E-02	2.04E-04	6.13E-03	2.12E-02
LLW(x) LL to NT						
Lawrence Livermore	to Nevada Test Site					
	Truck	2.05E-02	2.57E-03	4.65E-03	1.90E-02	2.62E-02
	Rail	8.60E-03	5.75E-03	1.20E-04	7.70E-03	1.36E-02
LLW(x) MP to NT						
Mound Plant	to Nevada Test Site					
	Truck	5.82E-02	3.93E-03	8.53E-03	5.73E-02	6.98E-02
	Rail	1.28E-02	1.36E-02	2.90E-04	1.08E-02	2.47E-02
LLW(x) OI to NT						
ORISE	to Nevada Test Site					
	Truck	6.15E-02	3.77E-03	8.51E-03	6.10E-02	7.33E-02
	Rail	1.34E-02	1.30E-02	2.88E-04	1.13E-02	2.45E-02
LLW(x) OR to NT						
Oak Ridge Reserv.	to Nevada Test Site					
	Truck	6.04E-02	3.66E-03	8.38E-03	6.02E-02	7.22E-02
	Rail	1.33E-02	1.08E-02	2.50E-04	1.11E-02	2.22E-02
LLW(x) PP to NT						
Pantex Plant	to Nevada Test Site					
	Truck	3.16E-02	1.43E-03	4.34E-03	3.38E-02	3.96E-02
	Rail	8.62E-03	3.19E-03	1.03E-04	7.72E-03	1.10E-02

LLW(x) PO to NT						
Portsmouth GDP	to Nevada Test Site					
	Truck	6.17E-02	4.18E-03	8.96E-03	6.04E-02	7.36E-02
	Rail	1.29E-02	1.88E-02	3.36E-04	1.09E-02	3.01E-02
LLW(x) PR to NT						
Princeton PPL	to Nevada Test Site					
	Truck	8.05E-02	7.45E-03	1.33E-02	7.34E-02	9.41E-02
	Rail	1.49E-02	3.63E-02	5.93E-04	1.23E-02	4.92E-02
LLW(x) PA to NT						
Paducah GDP	to Nevada Test Site					
	Truck	5.22E-02	3.26E-03	7.47E-03	5.22E-02	6.29E-02
	Rail	1.18E-02	9.42E-03	2.18E-04	1.00E-02	1.97E-02
LLW(x) PI to NT						
Pinellas Plant	to Nevada Test Site					
	Truck	7.99E-02	5.74E-03	1.15E-02	7.62E-02	9.34E-02
	Rail	1.60E-02	2.19E-02	4.69E-04	1.32E-02	3.55E-02
LLW(x) RF to NT						
Rocky Flats Plant	to Nevada Test Site					
	Truck	2.30E-02	1.44E-03	3.43E-03	2.34E-02	2.83E-02
	Rail	7.00E-03	1.29E-03	6.47E-05	6.52E-03	7.88E-03
LLW(x) RM to NT						
Reactive Metals	to Nevada Test Site					
	Truck	6.33E-02	4.39E-03	9.38E-03	6.20E-02	7.58E-02
	Rail	1.29E-02	2.35E-02	3.91E-04	1.08E-02	3.47E-02
LLW(x) ST to NT						
SLAC	to Nevada Test Site					
	Truck	2.43E-02	4.05E-03	6.67E-03	2.07E-02	3.14E-02
	Rail	6.48E-03	1.38E-02	1.96E-04	6.13E-03	2.01E-02
LLW(x) SA to NT						
SNL - Albuquerque	to Nevada Test Site					
	Truck	2.37E-02	1.02E-03	3.18E-03	2.54E-02	2.97E-02
	Rail	7.32E-03	2.85E-03	8.34E-05	6.76E-03	9.69E-03
LLW(x) SL to NT						
SNL - Livermore	to Nevada Test Site					
	Truck	2.05E-02	2.57E-03	4.65E-03	1.90E-02	2.62E-02
	Rail	8.60E-03	5.75E-03	1.20E-04	7.70E-03	1.36E-02
LLW(x) SR to NT						
Savannah River	to Nevada Test Site					
	Truck	7.07E-02	5.10E-03	1.03E-02	6.76E-02	8.30E-02
	Rail	1.47E-02	1.85E-02	3.95E-04	1.22E-02	3.11E-02
LLW(x) OR to NT						
Oak Ridge Reserv.	to Nevada Test Site					
	Truck	6.04E-02	3.66E-03	8.38E-03	6.02E-02	7.22E-02
	Rail	1.33E-02	1.08E-02	2.50E-04	1.11E-02	2.22E-02

Table 4. Accident Dose Risk per Shipment (person-rem/shipment)

Source/Route		Truck	Rail
LLW(x) AL to NT			
Ames Laboratory	to Nevada Test Site	5.59E-06	3.58E-06
LLW(x) AN to NT			
Argonne - East	to Nevada Test Site	6.21E-04	2.87E-04
LLW(x) AW to NT			
Argonne - West	to Nevada Test Site	6.62E-01	2.71E-01
LLW(x) BA to NT			
Bettis Atomic	to Nevada Test Site	3.74E-05	4.84E-05
LLW(x) FL to NT			
Fermilab (FNAL)	to Nevada Test Site	2.91E-05	1.13E-05
LLW(x) HS to NT			
Hanford Site	to Nevada Test Site	3.46E-04	2.24E-04
LLW(x) IN to NT			
INEL	to Nevada Test Site	2.94E-04	1.23E-04
LLW(x) IT to NT			
ITRI	to Nevada Test Site	2.18E-03	4.52E-04
LLW(x) OR to NT			
Oak Ridge Reserv.	to Nevada Test Site	3.84E-07	1.80E-07
LLW(x) KA to NT			
Knolls Atomic	to Nevada Test Site	5.18E-06	4.08E-06
LLW(x) KC to NT			
Kansas City Plant	to Nevada Test Site	2.53E-05	3.89E-06
LLW(x) LA to NT			
Los Alamos NL	to Nevada Test Site	1.51E-02	3.40E-03
LLW(x) LB to NT			
Lawrence Berkeley	to Nevada Test Site	2.56E-02	2.61E-02
LLW(x) LL to NT			
Lawrence Livermore	to Nevada Test Site	4.06E-06	3.26E-06
LLW(x) MP to NT			
Mound Plant	to Nevada Test Site	4.24E-06	3.27E-06
LLW(x) OI to NT			
ORISE	to Nevada Test Site	2.73E-06	1.28E-06
LLW(x) OR to NT			
Oak Ridge Reserv.	to Nevada Test Site	3.84E-07	1.80E-07
LLW(x) PP to NT			
Pantex Plant	to Nevada Test Site	7.30E-07	1.96E-07
LLW(x) PO to NT			
Portsmouth GDP	to Nevada Test Site	2.36E-08	2.56E-08
LLW(x) PR to NT			
Princeton PPL	to Nevada Test Site	1.35E-05	4.56E-06
LLW(x) PA to NT			
Paducah GDP	to Nevada Test Site	1.23E-06	6.69E-07
LLW(x) PI to NT			
Pinellas Plant	to Nevada Test Site	7.04E-06	2.84E-06
LLW(x) RF to NT			
Rocky Flats Plant	to Nevada Test Site	4.28E-06	6.40E-07
LLW(x) RM to NT			
Reactive Metals	to Nevada Test Site	1.23E-08	1.24E-08
LLW(x) ST to NT			
SLAC	to Nevada Test Site	2.14E-07	3.39E-07
LLW(x) SA to NT			
SNL - Albuquerque	to Nevada Test Site	8.66E-06	2.24E-06
LLW(x) SL to NT			
SNL - Livermore	to Nevada Test Site	3.63E-05	3.45E-05
LLW(x) SR to NT			
Savannah River	to Nevada Test Site	5.24E-03	2.60E-03
LLW(x) OR to NT			
Oak Ridge Reserv.	to Nevada Test Site	3.84E-07	1.80E-07

Table 5. Nonradiological Risk Factors per Shipment (fatalities/shipment)

Mode	Route	Emission	Accident
Truck			
Ames Laboratory	to Nevada Test Site	5.92E-06	9.75E-05
Argonne - East	to Nevada Test Site	6.02E-06	1.14E-04
Argonne - West	to Nevada Test Site	8.08E-06	4.36E-05
Bettis Atomic	to Nevada Test Site	1.62E-05	1.55E-04
Fermilab (FNAL)	to Nevada Test Site	6.57E-06	1.12E-04
Hanford Site	to Nevada Test Site	9.50E-06	6.38E-05
INEL	to Nevada Test Site	8.08E-06	4.36E-05
ITRI	to Nevada Test Site	4.31E-06	7.08E-05
Oak Ridge Reserv.	to Nevada Test Site	1.08E-05	1.54E-04
Knolls Atomic	to Nevada Test Site	1.75E-05	1.60E-04
Kansas City Plant	to Nevada Test Site	6.44E-06	1.05E-04
Los Alamos NL	to Nevada Test Site	3.54E-06	7.82E-05
Lawrence Berkeley	to Nevada Test Site	1.73E-05	5.39E-05
Lawrence Livermore	to Nevada Test Site	1.32E-05	5.15E-05
Mound Plant	to Nevada Test Site	1.27E-05	1.43E-04
ORISE	to Nevada Test Site	1.08E-05	1.58E-04
Pantex Plant	to Nevada Test Site	6.05E-06	9.02E-05
Portsmouth GDP	to Nevada Test Site	1.29E-05	1.48E-04
Princeton PPL	to Nevada Test Site	2.45E-05	1.82E-04
Paducah GDP	to Nevada Test Site	1.07E-05	1.34E-04
Pinellas Plant	to Nevada Test Site	1.56E-05	1.96E-04
Rocky Flats Plant	to Nevada Test Site	5.50E-06	6.18E-05
Reactive Metals	to Nevada Test Site	1.43E-05	1.36E-04
SLAC	to Nevada Test Site	2.17E-05	5.48E-05
SNL - Albuquerque	to Nevada Test Site	4.12E-06	7.01E-05
SNL - Livermore	to Nevada Test Site	1.32E-05	5.15E-05
Savannah River	to Nevada Test Site	1.43E-05	1.74E-04
Rail			
Ames Laboratory	to Nevada Test Site	6.07E-06	3.50E-06
Argonne - East	to Nevada Test Site	7.99E-06	4.91E-06
Argonne - West	to Nevada Test Site	3.98E-06	1.58E-06
Bettis Atomic	to Nevada Test Site	4.14E-05	5.22E-06
Fermilab (FNAL)	to Nevada Test Site	9.67E-06	4.18E-06
Hanford Site	to Nevada Test Site	5.90E-06	2.72E-06
INEL	to Nevada Test Site	3.98E-06	1.58E-06
ITRI	to Nevada Test Site	3.85E-06	2.23E-06
Oak Ridge Reserv.	to Nevada Test Site	1.52E-05	5.20E-06
Knolls Atomic	to Nevada Test Site	4.79E-05	5.86E-06
Kansas City Plant	to Nevada Test Site	7.24E-06	3.49E-06
Los Alamos NL	to Nevada Test Site	6.32E-06	2.45E-06
Lawrence Berkeley	to Nevada Test Site	2.59E-05	1.80E-06
Lawrence Livermore	to Nevada Test Site	1.01E-05	2.87E-06
Mound Plant	to Nevada Test Site	1.84E-05	4.99E-06
ORISE	to Nevada Test Site	1.73E-05	5.29E-06
Pantex Plant	to Nevada Test Site	3.98E-06	2.88E-06
Portsmouth GDP	to Nevada Test Site	2.95E-05	5.02E-06
Princeton PPL	to Nevada Test Site	5.45E-05	6.01E-06
Paducah GDP	to Nevada Test Site	1.29E-05	4.46E-06
Pinellas Plant	to Nevada Test Site	2.54E-05	6.60E-06
Rocky Flats Plant	to Nevada Test Site	8.37E-07	2.07E-06
Reactive Metals	to Nevada Test Site	3.72E-05	5.00E-06
SLAC	to Nevada Test Site	2.35E-05	1.80E-06
SNL - Albuquerque	to Nevada Test Site	3.85E-06	2.23E-06
SNL - Livermore	to Nevada Test Site	1.01E-05	2.87E-06
Savannah River	to Nevada Test Site	2.27E-05	5.94E-06

Table 6. Annual Incident-Free Dose for the Shipping Campaign (person-rem/yr)

Route		Truck		Rail	
		Crew	Public	Crew	Public
Ames Laboratory	to Nevada Test Site	8.06E-02	9.92E-02	9.87E-03	1.34E-02
Argonne - East	to Nevada Test Site	5.10E+00	6.20E+00	4.95E-01	6.97E-01
Argonne - West	to Nevada Test Site	2.77E-01	3.35E-01	3.02E-02	4.34E-02
Bettis Atomic	to Nevada Test Site	3.85E+00	4.54E+00	2.79E-01	8.05E-01
Fermilab (FNAL)	to Nevada Test Site	1.44E-01	1.77E-01	2.24E-02	3.41E-02
Hanford Site	to Nevada Test Site	4.58E+01	5.57E+01	4.42E+00	6.37E+00
INEL	to Nevada Test Site	1.82E+01	2.19E+01	1.94E+00	2.79E+00
ITRI	to Nevada Test Site	2.40E-01	3.00E-01	2.93E-02	3.88E-02
Oak Ridge Reserv.	to Nevada Test Site	3.95E+02	4.73E+02	3.30E+01	5.52E+01
Knolls Atomic	to Nevada Test Site	2.20E+00	2.56E+00	1.60E-01	4.89E-01
Kansas City Plant	to Nevada Test Site	3.84E-02	4.70E-02	9.85E-03	1.37E-02
Los Alamos NL	to Nevada Test Site	1.89E+01	2.34E+01	2.08E+00	3.11E+00
Lawrence Berkeley	to Nevada Test Site	6.81E-02	8.73E-02	1.29E-02	4.24E-02
Lawrence Livermore	to Nevada Test Site	1.15E+00	1.47E+00	1.81E-01	2.85E-01
Mound Plant	to Nevada Test Site	2.98E+01	3.57E+01	2.44E+00	4.70E+00
ORISE	to Nevada Test Site	3.08E-01	3.67E-01	2.69E-02	4.90E-02
Pantex Plant	to Nevada Test Site	4.58E+01	5.74E+01	4.69E+00	5.99E+00
Portsmouth GDP	to Nevada Test Site	2.06E+02	2.46E+02	1.64E+01	3.83E+01
Princeton PPL	to Nevada Test Site	8.05E-02	9.41E-02	1.49E-02	4.92E-02
Paducah GDP	to Nevada Test Site	3.27E+01	3.94E+01	2.79E+00	4.66E+00
Pinellas Plant	to Nevada Test Site	1.60E-01	1.87E-01	1.60E-02	3.55E-02
Rocky Flats Plant	to Nevada Test Site	8.22E+00	1.01E+01	9.31E-01	1.05E+00
Reactive Metals	to Nevada Test Site	4.86E+01	5.82E+01	3.69E+00	9.96E+00
SLAC	to Nevada Test Site	9.46E-01	1.23E+00	9.72E-02	3.02E-01
SNL - Albuquerque	to Nevada Test Site	4.03E-01	5.04E-01	5.13E-02	6.78E-02
SNL - Livermore	to Nevada Test Site	1.23E-01	1.57E-01	1.72E-02	2.71E-02
Savannah River	to Nevada Test Site	4.83E+02	5.67E+02	3.74E+01	7.91E+01
Totals		1.35E+03	1.61E+03	1.11E+02	2.14E+02

Table 7. Annual Accident Dose Risk for the Shipping Campaign (person-rem/yr)

Route		Truck	Rail
Ames Laboratory	to Nevada Test Site	1.12E-05	3.58E-06
Argonne - East	to Nevada Test Site	6.52E-02	1.12E-02
Argonne - West	to Nevada Test Site	8.60E+00	1.36E+00
Bettis Atomic	to Nevada Test Site	2.13E-03	1.02E-03
Fermilab (FNAL)	to Nevada Test Site	8.72E-05	2.26E-05
Hanford Site	to Nevada Test Site	4.92E-01	1.19E-01
INEL	to Nevada Test Site	2.50E-01	3.95E-02
ITRI	to Nevada Test Site	2.18E-02	1.81E-03
Oak Ridge Reserv.	to Nevada Test Site	2.51E-03	4.48E-04
Knolls Atomic	to Nevada Test Site	1.45E-04	4.48E-05
Kansas City Plant	to Nevada Test Site	2.53E-05	3.89E-06
Los Alamos NL	to Nevada Test Site	1.10E+01	9.10E-01
Lawrence Berkeley	to Nevada Test Site	7.68E-02	5.23E-02
Lawrence Livermore	to Nevada Test Site	2.27E-04	6.85E-05
Mound Plant	to Nevada Test Site	2.17E-03	6.21E-04
ORISE	to Nevada Test Site	1.36E-05	2.57E-06
Pantex Plant	to Nevada Test Site	1.06E-03	1.07E-04
Portsmouth GDP	to Nevada Test Site	7.90E-05	3.26E-05
Princeton PPL	to Nevada Test Site	1.35E-05	4.56E-06
Paducah GDP	to Nevada Test Site	7.71E-04	1.59E-04
Pinellas Plant	to Nevada Test Site	1.41E-05	2.84E-06
Rocky Flats Plant	to Nevada Test Site	1.53E-03	8.52E-05
Reactive Metals	to Nevada Test Site	9.48E-06	3.56E-06
SLAC	to Nevada Test Site	8.33E-06	5.08E-06
SNL - Albuquerque	to Nevada Test Site	1.47E-04	1.57E-05
SNL - Livermore	to Nevada Test Site	2.18E-04	6.89E-05
Savannah River	to Nevada Test Site	3.58E+01	6.60E+00
Totals		5.63E+01	9.09E+00

Table 8. Expected Annual Fatalities for the Shipping Campaign

Exposure Group	Truck	Rail
Radiological		
Normal Crew	5.4E-01	4.4E-02
Normal Public	8.0E-01	1.1E-01
Accident Public	2.8E-02	4.5E-03
Nonradiological		
Emission	2.7E-01	1.6E-01
Accident	3.3E+00	4.3E-02

Table 9. Expected Annual Cancer Incidence for the Shipping Campaign

Exposure Group	Truck	Rail
Radiological		
Normal Crew	1.9E+00	1.6E-01
Normal Public	2.7E+00	3.6E-01
Accident Public	9.6E-02	1.5E-02
Nonradiological		
Emission	2.7E-01	1.6E-01
Accident	NA	NA

Table 10. Expected Annual Genetic Effects for the Shipping Campaign

Exposure Group	Truck	Rail
Radiological		
Normal Crew	8.1E-02	6.7E-03
Normal Public	1.6E-01	2.1E-02
Accident Public	5.3E-03	8.5E-04
Nonradiological		
Emission	NA	NA
Accident	NA	NA

B.22 WM LLW CENTRALIZED 2 ALTERNATIVE (CASE 8): ACTIVATED METALS

Table 1. Summary of Route Information

Route		Distance (miles)	Percentage in Zone		
			Rural	Suburban	Urban
Truck					
Argonne - West	to Nevada Test Site	712	82.8	13.7	3.5
Bettis Atomic	to Nevada Test Site	2297	83.2	14.6	2.2
Fermilab (FNAL)	to Nevada Test Site	1805	91.3	7.5	1.1
Hanford Site	to Nevada Test Site	1128	86.5	10.9	2.6
Knolls Atomic	to Nevada Test Site	2626	81.1	16.9	2.1
Los Alamos NL	to Nevada Test Site	997	93.2	5.7	1.1
Lawrence Berkeley	to Nevada Test Site	719	81.9	10.6	7.5
Naval Reactor Fac.	to Nevada Test Site	712	82.8	13.7	3.5
SNL - Albuquerque	to Nevada Test Site	909	93.8	4.8	1.4
Rail					
Argonne - West	to Nevada Test Site	756	92.8	5.9	1.3
Bettis Atomic	to Nevada Test Site	2496	80.9	15.2	4.0
Fermilab (FNAL)	to Nevada Test Site	1997	92.3	6.5	1.2
Hanford Site	to Nevada Test Site	1302	93.0	5.9	1.1
Knolls Atomic	to Nevada Test Site	2800	78.8	17.2	4.1
Los Alamos NL	to Nevada Test Site	1169	92.8	5.9	1.3
Lawrence Berkeley	to Nevada Test Site	860	75.1	17.7	7.2
Naval Reactor Fac.	to Nevada Test Site	756	92.8	5.9	1.3
SNL - Albuquerque	to Nevada Test Site	1065	94.6	4.5	0.9

Table 2. Annual Number of Shipments and One-Way Shipment Distances

Route		# of Shipments		Total Mileage(mi)	
		Truck	Rail	Truck	Rail
Argonne - West	to Nevada Test Site	9	4	6.41E+03	3.02E+03
Bettis Atomic	to Nevada Test Site	316	120	7.26E+05	3.00E+05
Fermilab (FNAL)	to Nevada Test Site	40	15	7.22E+04	3.00E+04
Hanford Site	to Nevada Test Site	33	13	3.72E+04	1.69E+04
Knolls Atomic	to Nevada Test Site	650	246	1.71E+06	6.89E+05
Los Alamos NL	to Nevada Test Site	418	159	4.17E+05	1.86E+05
Lawrence Berkeley	to Nevada Test Site	15	6	1.08E+04	5.16E+03
Naval Reactor Fac.	to Nevada Test Site	461	175	3.28E+05	1.32E+05
SNL - Albuquerque	to Nevada Test Site	6	3	5.45E+03	3.19E+03
Totals		1948	741	3.31E+06	1.36E+06

Table 3. Incident-Free Dose per Shipment (person-rem/shipment)

Source/Route(s)		Crew	General Public			
			Off-Link	On-Link	Stops	Total
LLW(I) AW to NT Argonne - West	to Nevada Test Site					
	Truck	2.13E-02	2.03E-03	3.79E-03	1.99E-02	2.58E-02
	Rail	6.04E-03	2.80E-03	6.88E-05	5.81E-03	8.67E-03
LLW(I) BA to NT Bettis Atomic	to Nevada Test Site					
	Truck	6.75E-02	5.17E-03	1.02E-02	6.43E-02	7.97E-02
	Rail	1.33E-02	2.67E-02	4.43E-04	1.12E-02	3.83E-02
LLW(I) FL to NT Fermilab (FNAL)	to Nevada Test Site					
	Truck	4.82E-02	2.15E-03	6.20E-03	5.05E-02	5.89E-02
	Rail	1.12E-02	7.26E-03	1.85E-04	9.63E-03	1.71E-02
LLW(I) HS to NT Hanford Site	to Nevada Test Site					
	Truck	3.22E-02	2.46E-03	5.18E-03	3.16E-02	3.92E-02
	Rail	8.31E-03	4.39E-03	1.15E-04	7.49E-03	1.20E-02
LLW(I) KA to NT Knolls Atomic	to Nevada Test Site					
	Truck	7.86E-02	6.20E-03	1.18E-02	7.35E-02	9.15E-02
	Rail	1.46E-02	3.18E-02	5.30E-04	1.21E-02	4.44E-02
LLW(I) LA to NT Los Alamos NL	to Nevada Test Site					
	Truck	2.61E-02	1.04E-03	3.33E-03	2.79E-02	3.23E-02
	Rail	7.76E-03	4.40E-03	1.07E-04	7.08E-03	1.16E-02
LLW(I) LB to NT Lawrence Berkeley	to Nevada Test Site					
	Truck	2.27E-02	3.31E-03	5.66E-03	2.01E-02	2.91E-02
	Rail	6.47E-03	1.49E-02	2.04E-04	6.13E-03	2.12E-02
LLW(I) NR to NT Naval Reactor Fac.	to Nevada Test Site					
	Truck	2.13E-02	2.03E-03	3.79E-03	1.99E-02	2.58E-02
	Rail	6.04E-03	2.80E-03	6.88E-05	5.81E-03	8.67E-03
LLW(I) SA to NT SNL - Albuquerque	to Nevada Test Site					
	Truck	2.37E-02	1.02E-03	3.18E-03	2.54E-02	2.97E-02
	Rail	7.32E-03	2.85E-03	8.34E-05	6.76E-03	9.69E-03

Table 4. Accident Dose Risk per Shipment (person-rem/shipment)

Source/Route		Truck	Rail
LLW(I) AW to NT Argonne - West	to Nevada Test Site	2.03E-11	7.25E-12
LLW(I) BA to NT Bettis Atomic	to Nevada Test Site	1.92E-06	1.72E-06
LLW(I) FL to NT Fermilab (FNAL)	to Nevada Test Site	6.08E-11	4.06E-11
LLW(I) HS to NT Hanford Site	to Nevada Test Site	2.71E-08	1.57E-08
LLW(I) KA to NT Knolls Atomic	to Nevada Test Site	3.29E-06	2.51E-06
LLW(I) LA to NT Los Alamos NL	to Nevada Test Site	1.78E-09	3.07E-10
LLW(I) LB to NT Lawrence Berkeley	to Nevada Test Site	8.23E-11	1.45E-10
LLW(I) NR to NT Naval Reactor Fac.	to Nevada Test Site	1.20E-07	4.99E-08
LLW(I) SA to NT SNL - Albuquerque	to Nevada Test Site	2.40E-12	3.74E-13

Table 5. Nonradiological Risk Factors per Shipment (fatalities/shipment)

Mode	Route	Emission	Accident
Truck			
Argonne - West	to Nevada Test Site	8.08E-06	4.36E-05
Bettis Atomic	to Nevada Test Site	1.62E-05	1.55E-04
Fermilab (FNAL)	to Nevada Test Site	6.57E-06	1.12E-04
Hanford Site	to Nevada Test Site	9.50E-06	6.38E-05
Knolls Atomic	to Nevada Test Site	1.75E-05	1.60E-04
Los Alamos NL	to Nevada Test Site	3.54E-06	7.82E-05
Lawrence Berkeley	to Nevada Test Site	1.73E-05	5.39E-05
Naval Reactor Fac.	to Nevada Test Site	8.08E-06	4.36E-05
SNL - Albuquerque	to Nevada Test Site	4.12E-06	7.01E-05
Rail			
Argonne - West	to Nevada Test Site	3.98E-06	1.58E-06
Bettis Atomic	to Nevada Test Site	4.14E-05	5.22E-06
Fermilab (FNAL)	to Nevada Test Site	9.67E-06	4.18E-06
Hanford Site	to Nevada Test Site	5.90E-06	2.72E-06
Knolls Atomic	to Nevada Test Site	4.79E-05	5.86E-06
Los Alamos NL	to Nevada Test Site	6.32E-06	2.45E-06
Lawrence Berkeley	to Nevada Test Site	2.59E-05	1.80E-06
Naval Reactor Fac.	to Nevada Test Site	3.98E-06	1.58E-06
SNL - Albuquerque	to Nevada Test Site	3.85E-06	2.23E-06

Table 6. Annual Incident-Free Dose for the Shipping Campaign (person-rem/yr)

Route		Truck		Rail	
		Crew	Public	Crew	Public
Argonne - West	to Nevada Test Site	1.92E-01	2.32E-01	2.41E-02	3.47E-02
Bettis Atomic	to Nevada Test Site	2.13E+01	2.52E+01	1.60E+00	4.60E+00
Fermilab (FNAL)	to Nevada Test Site	1.93E+00	2.35E+00	1.68E-01	2.56E-01
Hanford Site	to Nevada Test Site	1.06E+00	1.29E+00	1.08E-01	1.56E-01
Knolls Atomic	to Nevada Test Site	5.11E+01	5.95E+01	3.58E+00	1.09E+01
Los Alamos NL	to Nevada Test Site	1.09E+01	1.35E+01	1.23E+00	1.84E+00
Lawrence Berkeley	to Nevada Test Site	3.41E-01	4.36E-01	3.88E-02	1.27E-01
Naval Reactor Fac.	to Nevada Test Site	9.83E+00	1.19E+01	1.06E+00	1.52E+00
SNL - Albuquerque	to Nevada Test Site	1.42E-01	1.78E-01	2.20E-02	2.91E-02
Totals		9.68E+01	1.15E+02	7.83E+00	1.95E+01

Table 7. Annual Accident Dose Risk for the Shipping Campaign . (person-rem/yr)

Route		Truck	Rail
Argonne - West	to Nevada Test Site	1.82E-10	2.90E-11
Bettis Atomic	to Nevada Test Site	6.08E-04	2.06E-04
Fermilab (FNAL)	to Nevada Test Site	2.43E-09	6.09E-10
Hanford Site	to Nevada Test Site	8.95E-07	2.05E-07
Knolls Atomic	to Nevada Test Site	2.14E-03	6.18E-04
Los Alamos NL	to Nevada Test Site	7.46E-07	4.89E-08
Lawrence Berkeley	to Nevada Test Site	1.23E-09	8.71E-10
Naval Reactor Fac.	to Nevada Test Site	5.53E-05	8.73E-06
SNL - Albuquerque	to Nevada Test Site	1.44E-11	1.12E-12
Totals		2.80E-03	8.33E-04

Table 8. Expected Annual Fatalities for the Shipping Campaign

Exposure Group	Truck	Rail
Radiological		
Normal Crew	3.9E-02	3.1E-03
Normal Public	5.7E-02	9.7E-03
Accident Public	1.4E-06	4.2E-07
Nonradiological		
Emission	2.3E-02	1.9E-02
Accident	2.1E-01	2.9E-03

Table 9. Expected Annual Cancer Incidence for the Shipping Campaign

Exposure Group	Truck	Rail
Radiological		
Normal Crew	1.4E-01	1.1E-02
Normal Public	1.9E-01	3.3E-02
Accident Public	4.8E-06	1.4E-06
Nonradiological		
Emission	2.3E-02	1.9E-02
Accident	NA	NA

Table 10. Expected Annual Genetic Effects for the Shipping Campaign

Exposure Group	Truck	Rail
Radiological		
Normal Crew	5.8E-03	4.7E-04
Normal Public	1.1E-02	1.9E-03
Accident Public	2.8E-07	8.4E-08
Nonradiological		
Emission	NA	NA
Accident	NA	NA

B.23 WM LLW CENTRALIZED 3 ALTERNATIVE (CASE 14): HETEROGENEOUS SOLIDS

Table 1. Summary of Route Information

Route		Distance (miles)	Percentage in Zone		
			Rural	Suburban	Urban
Truck					
Ames Laboratory	to Hanford Site	1703	92.6	6.6	0.8
Ames Laboratory	to Portsmouth GDP	755	77.4	21.0	1.7
Argonne - East	to Hanford Site	1998	91.5	7.8	0.7
Argonne - West	to Hanford Site	599	91.3	7.6	1.1
Bettis Atomic	to Hanford Site	2541	85.8	12.8	1.4
Fermilab (FNAL)	to Hanford Site	1975	92.2	7.1	0.8
Fermilab (FNAL)	to Portsmouth GDP	460	62.5	32.0	5.5
INEL	to Hanford Site	599	91.3	7.6	1.1
ITRI	to Hanford Site	1593	89.7	8.8	1.5
ITRI	to Los Alamos NL	111	76.8	18.9	4.2
Oak Ridge Reserv.	to Hanford Site	2464	87.8	11.0	1.2
Knolls Atomic	to Hanford Site	2809	82.1	16.1	1.8
Kansas City Plant	to Hanford Site	1741	91.5	7.6	0.9
Los Alamos NL	to Hanford Site	1560	89.8	8.8	1.3
Lawrence Berkeley	to Hanford Site	875	78.1	17.8	4.1
Lawrence Livermore	to Hanford Site	894	77.2	19.3	3.4
Mound Plant	to Hanford Site	2291	88.6	10.3	1.1
Mound Plant	to Portsmouth GDP	152	55.8	38.7	5.5
ORISE	to Hanford Site	2492	87.4	11.4	1.2
ORISE	to Oak Ridge Reserv.	10	58.8	41.2	0.0
Pantex Plant	to Hanford Site	1884	90.4	8.0	1.5
Pantex Plant	to Los Alamos NL	402	89.5	8.0	2.5
Portsmouth GDP	to Hanford Site	2402	88.0	11.0	1.0
Princeton PPL	to Hanford Site	2864	82.0	15.9	2.1
Princeton PPL	to Portsmouth GDP	588	55.1	38.8	6.1
Paducah GDP	to Hanford Site	2182	88.7	10.0	1.3
Paducah GDP	to Oak Ridge Reserv.	304	81.3	18.5	0.2
Pinellas Plant	to Savannah River	620	71.9	25.8	2.2
Rocky Flats Plant	to Hanford Site	1132	91.9	7.3	0.8
Reactive Metals	to Hanford Site	2398	86.6	11.7	1.6
Reactive Metals	to Portsmouth GDP	276	59.5	37.8	2.8
SLAC	to Hanford Site	916	75.9	19.0	5.1
SNL - Albuquerque	to Hanford Site	1584	89.7	8.8	1.4
SNL - Albuquerque	to Los Alamos NL	102	75.8	20.1	4.1
SNL - Livermore	to Hanford Site	894	77.2	19.3	3.4
Savannah River	to Hanford Site	2727	84.3	14.2	1.5
Rail					
Ames Laboratory	to Hanford Site	1788	93.7	5.6	0.7
Ames Laboratory	to Portsmouth GDP	727	68.6	23.8	7.7
Argonne - East	to Hanford Site	2200	93.3	6.0	0.7
Argonne - West	to Hanford Site	658	91.4	7.1	1.4
Bettis Atomic	to Hanford Site	2611	81.2	15.1	3.7
Fermilab (FNAL)	to Hanford Site	1971	89.9	8.6	1.4
Fermilab (FNAL)	to Portsmouth GDP	451	61.5	28.9	9.5
INEL	to Hanford Site	658	91.4	7.1	1.4
ITRI	to Hanford Site	1793	91.7	7.1	1.2
ITRI	to Los Alamos NL	104	74.3	20.0	5.7
Oak Ridge Reserv.	to Hanford Site	2601	91.2	7.4	1.3
Knolls Atomic	to Hanford Site	2914	79.1	17.0	3.9
Kansas City Plant	to Hanford Site	1784	94.1	5.0	0.9
Los Alamos NL	to Hanford Site	1725	92.5	6.5	0.9
Lawrence Berkeley	to Hanford Site	986	78.5	15.8	5.7
Lawrence Livermore	to Hanford Site	973	78.9	15.3	5.8
Mound Plant	to Hanford Site	2472	87.0	11.2	1.9
Mound Plant	to Portsmouth GDP	156	53.2	38.0	8.8
ORISE	to Hanford Site	2644	89.0	9.5	1.5
ORISE	to Oak Ridge Reserv.	40	65.8	33.4	0.8
Pantex Plant	to Hanford Site	1686	92.0	7.1	1.0
Pantex Plant	to Los Alamos NL	482	89.2	9.6	1.3
Portsmouth GDP	to Hanford Site	2515	86.4	10.8	2.7
Princeton PPL	to Hanford Site	2985	76.6	19.0	4.3
Princeton PPL	to Portsmouth GDP	838	58.3	32.6	9.1
Paducah GDP	to Hanford Site	2245	90.8	7.9	1.3
Paducah GDP	to Oak Ridge Reserv.	527	89.3	9.0	1.7
Pinellas Plant	to Savannah River	485	72.2	25.0	2.8
Rocky Flats Plant	to Hanford Site	1284	93.1	5.5	1.4
Reactive Metals	to Hanford Site	2505	83.4	13.1	3.5
Reactive Metals	to Portsmouth GDP	279	48.4	41.8	9.8

SLAC	to Hanford Site	1036	76.1	16.8	7.1
SNL - Albuquerque	to Hanford Site	1793	91.7	7.1	1.2
SNL - Albuquerque	to Los Alamos NL	104	74.3	20.0	5.7
SNL - Livermore	to Hanford Site	973	78.9	15.3	5.8
Savannah River	to Hanford Site	2953	84.7	13.5	1.8

Table 2. Annual Number of Shipments and One-Way Shipment Distances

Route		# of Shipments		Total Mileage(mi)	
		Truck	Rail	Truck	Rail
Ames Laboratory	to Hanford Site	2	1	3.41E+03	1.79E+03
Ames Laboratory	to Portsmouth GDP	1	1	7.55E+02	7.27E+02
Argonne - East	to Hanford Site	105	39	2.10E+05	8.58E+04
Argonne - West	to Hanford Site	10	4	5.99E+03	2.63E+03
Bettis Atomic	to Hanford Site	57	21	1.45E+05	5.48E+04
Fermilab (FNAL)	to Hanford Site	2	1	3.95E+03	1.97E+03
Fermilab (FNAL)	to Portsmouth GDP	1	1	4.60E+02	4.51E+02
INEL	to Hanford Site	820	315	4.91E+05	2.07E+05
ITRI	to Hanford Site	9	3	1.43E+04	5.38E+03
ITRI	to Los Alamos NL	2	1	2.22E+02	1.04E+02
Oak Ridge Reserv.	to Hanford Site	6067	2425	1.49E+07	6.31E+06
Knolls Atomic	to Hanford Site	28	11	7.87E+04	3.21E+04
Kansas City Plant	to Hanford Site	1	1	1.74E+03	1.78E+03
Los Alamos NL	to Hanford Site	1965	764	3.06E+06	1.32E+06
Lawrence Berkeley	to Hanford Site	3	2	2.62E+03	1.97E+03
Lawrence Livermore	to Hanford Site	56	21	5.01E+04	2.04E+04
Mound Plant	to Hanford Site	496	186	1.14E+06	4.60E+05
Mound Plant	to Portsmouth GDP	12	5	1.83E+03	7.80E+02
ORISE	to Hanford Site	4	2	9.97E+03	5.29E+03
ORISE	to Oak Ridge Reserv.	1	1	1.02E+01	3.95E+01
Pantex Plant	to Hanford Site	25	10	4.71E+04	1.69E+04
Pantex Plant	to Los Alamos NL	1358	528	5.46E+05	2.55E+05
Portsmouth GDP	to Hanford Site	2950	1107	7.09E+06	2.78E+06
Princeton PPL	to Hanford Site	1	1	2.86E+03	2.98E+03
Princeton PPL	to Portsmouth GDP	1	1	5.88E+02	8.38E+02
Paducah GDP	to Hanford Site	578	215	1.26E+06	4.83E+05
Paducah GDP	to Oak Ridge Reserv.	57	21	1.73E+04	1.11E+04
Pinellas Plant	to Savannah River	2	1	1.24E+03	4.85E+02
Rocky Flats Plant	to Hanford Site	335	123	3.79E+05	1.58E+05
Reactive Metals	to Hanford Site	745	283	1.79E+06	7.09E+05
Reactive Metals	to Portsmouth GDP	7	3	1.93E+03	8.37E+02
SLAC	to Hanford Site	39	15	3.57E+04	1.55E+04
SNL - Albuquerque	to Hanford Site	17	7	2.69E+04	1.26E+04
SNL - Albuquerque	to Los Alamos NL	1	1	1.02E+02	1.04E+02
SNL - Livermore	to Hanford Site	5	2	4.47E+03	1.95E+03
Savannah River	to Hanford Site	6750	2522	1.84E+07	7.45E+06
Totals		22513	8645	4.98E+07	2.04E+07

Table 3. Incident-Free Dose per Shipment (person-rem/shipment)

Source/Route(s)		Crew	General Public			
			Off-Link	On-Link	Stops	Total
LLW(x) AL to HS						
Ames Laboratory	to Hanford Site					
	Truck	4.46E-02	1.62E-03	5.39E-03	4.77E-02	5.47E-02
	Rail	1.03E-02	4.69E-03	1.46E-04	8.98E-03	1.38E-02
LLW(x) AL to PO						
Ames Laboratory	to Portsmouth GDP					
	Truck	2.33E-02	1.86E-03	3.31E-03	2.11E-02	2.63E-02
	Rail	5.91E-03	1.42E-02	2.00E-04	5.72E-03	2.01E-02
LLW(x) AN to HS						
Argonne - East	to Hanford Site					
	Truck	5.29E-02	1.97E-03	6.28E-03	5.59E-02	6.42E-02
	Rail	1.21E-02	5.75E-03	1.82E-04	1.03E-02	1.62E-02
LLW(x) AW to HS						
Argonne - West	to Hanford Site					
	Truck	1.60E-02	7.18E-04	2.06E-03	1.68E-02	1.95E-02
	Rail	5.63E-03	2.83E-03	6.58E-05	5.51E-03	8.40E-03
LLW(x) BA to HS						
Bettis Atomic	to Hanford Site					
	Truck	7.21E-02	4.36E-03	9.77E-03	7.11E-02	8.53E-02
	Rail	1.38E-02	2.67E-02	4.53E-04	1.15E-02	3.87E-02
LLW(x) FL to HS						
Fermilab (FNAL)	to Hanford Site					
	Truck	5.20E-02	1.92E-03	6.25E-03	5.53E-02	6.35E-02
	Rail	1.11E-02	9.07E-03	2.12E-04	9.55E-03	1.88E-02
LLW(x) FL to PO						
Fermilab (FNAL)	to Portsmouth GDP					
	Truck	1.68E-02	2.40E-03	3.43E-03	1.29E-02	1.87E-02
	Rail	4.76E-03	1.08E-02	1.48E-04	4.87E-03	1.58E-02
LLW(x) IN to HS						
INEL	to Hanford Site					
	Truck	1.60E-02	7.18E-04	2.06E-03	1.68E-02	1.95E-02
	Rail	5.63E-03	2.83E-03	6.58E-05	5.51E-03	8.40E-03
LLW(x) IT to HS						
ITRI	to Hanford Site					
	Truck	4.34E-02	2.30E-03	5.91E-03	4.46E-02	5.28E-02
	Rail	1.04E-02	6.90E-03	1.72E-04	9.00E-03	1.61E-02
LLW(x) IT to LA						
ITRI	to Los Alamos NL					
	Truck	3.54E-03	4.00E-04	6.71E-04	3.11E-03	4.18E-03
	Rail	3.31E-03	1.55E-03	2.36E-05	3.80E-03	5.37E-03
LLW(x) OR to HS						
Oak Ridge Reserv.	to Hanford Site					
	Truck	6.83E-02	3.65E-03	8.95E-03	6.90E-02	8.16E-02
	Rail	1.37E-02	1.08E-02	2.59E-04	1.15E-02	2.26E-02
LLW(x) KA to HS						
Knolls Atomic	to Hanford Site					
	Truck	8.30E-02	6.03E-03	1.19E-02	7.87E-02	9.66E-02
	Rail	1.50E-02	3.18E-02	5.40E-04	1.25E-02	4.48E-02
LLW(x) KC to HS						
Kansas City Plant	to Hanford Site					
	Truck	4.62E-02	1.90E-03	5.74E-03	4.87E-02	5.64E-02
	Rail	1.03E-02	5.00E-03	1.44E-04	8.97E-03	1.41E-02
LLW(x) LA to HS						
Los Alamos NL	to Hanford Site					
	Truck	4.24E-02	2.16E-03	5.65E-03	4.37E-02	5.15E-02
	Rail	1.01E-02	5.60E-03	1.54E-04	8.79E-03	1.45E-02
LLW(x) LB to HS						
Lawrence Berkeley	to Hanford Site					
	Truck	2.76E-02	3.02E-03	5.17E-03	2.45E-02	3.27E-02
	Rail	6.99E-03	1.38E-02	2.03E-04	6.51E-03	2.05E-02
LLW(x) LL to HS						
Lawrence Livermore	to Hanford Site					
	Truck	2.82E-02	2.88E-03	4.92E-03	2.50E-02	3.28E-02
	Rail	6.94E-03	1.38E-02	2.00E-04	6.48E-03	2.05E-02
LLW(x) MP to HS						
Mound Plant	to Hanford Site					
	Truck	6.29E-02	3.13E-03	8.05E-03	6.41E-02	7.53E-02
	Rail	1.32E-02	1.47E-02	3.13E-04	1.11E-02	2.61E-02
LLW(x) MP to PO						
Mound Plant	to Portsmouth GDP					
	Truck	5.83E-03	8.71E-04	1.18E-03	4.26E-03	6.31E-03
	Rail	3.53E-03	3.82E-03	5.67E-05	3.96E-03	7.84E-03

LLW(x) OI to HS						
ORISE	to Hanford Site					
	Truck	6.94E-02	3.76E-03	9.08E-03	6.98E-02	8.26E-02
	Rail	1.39E-02	1.30E-02	2.98E-04	1.16E-02	2.49E-02
LLW(x) OI to OR						
ORISE	to Oak Ridge Reserv.					
	Truck	3.63E-04	3.21E-05	4.23E-05	2.86E-04	3.60E-04
	Rail	3.05E-03	3.36E-04	8.77E-06	3.60E-03	3.95E-03
LLW(x) OR to HS						
Oak Ridge Reserv.	to Hanford Site					
	Truck	6.83E-02	3.65E-03	8.95E-03	6.90E-02	8.16E-02
	Rail	1.37E-02	1.08E-02	2.59E-04	1.15E-02	2.26E-02
LLW(x) PP to HS						
Pantex Plant	to Hanford Site					
	Truck	5.10E-02	2.68E-03	7.01E-03	5.27E-02	6.24E-02
	Rail	9.92E-03	5.71E-03	1.56E-04	8.67E-03	1.45E-02
LLW(x) PP to LA						
Pantex Plant	to Los Alamos NL					
	Truck	1.11E-02	7.76E-04	1.77E-03	1.13E-02	1.38E-02
	Rail	4.89E-03	2.18E-03	5.29E-05	4.96E-03	7.19E-03
LLW(x) PO to HS						
Portsmouth GDP	to Hanford Site					
	Truck	6.63E-02	3.38E-03	8.48E-03	6.72E-02	7.91E-02
	Rail	1.34E-02	1.89E-02	3.46E-04	1.12E-02	3.04E-02
LLW(x) PR to HS						
Princeton PPL	to Hanford Site					
	Truck	8.51E-02	6.65E-03	1.28E-02	8.02E-02	9.97E-02
	Rail	1.53E-02	3.63E-02	6.03E-04	1.27E-02	4.96E-02
LLW(x) PR to PO						
Princeton PPL	to Portsmouth GDP					
	Truck	2.28E-02	3.55E-03	4.81E-03	1.65E-02	2.48E-02
	Rail	6.38E-03	2.00E-02	2.85E-04	6.06E-03	2.64E-02
LLW(x) PA to HS						
Paducah GDP	to Hanford Site					
	Truck	6.00E-02	3.22E-03	8.02E-03	6.11E-02	7.23E-02
	Rail	1.22E-02	9.43E-03	2.28E-04	1.04E-02	2.01E-02
LLW(x) PA to OR						
Paducah GDP	to Oak Ridge Reserv.					
	Truck	8.88E-03	4.70E-04	9.98E-04	8.51E-03	9.98E-03
	Rail	5.08E-03	2.75E-03	5.97E-05	5.10E-03	7.91E-03
LLW(x) PI to SR						
Pinellas Plant	to Savannah River					
	Truck	2.02E-02	1.94E-03	3.10E-03	1.74E-02	2.24E-02
	Rail	4.90E-03	5.13E-03	1.02E-04	4.97E-03	1.02E-02
LLW(x) RF to HS						
Rocky Flats Plant	to Hanford Site					
	Truck	2.99E-02	1.13E-03	3.61E-03	3.17E-02	3.64E-02
	Rail	8.24E-03	4.91E-03	1.16E-04	7.43E-03	1.25E-02
LLW(x) RM to HS						
Reactive Metals	to Hanford Site					
	Truck	6.76E-02	4.22E-03	9.51E-03	6.71E-02	8.09E-02
	Rail	1.33E-02	2.35E-02	4.01E-04	1.12E-02	3.51E-02
LLW(x) RM to PO						
Reactive Metals	to Portsmouth GDP					
	Truck	1.00E-02	1.18E-03	1.62E-03	7.73E-03	1.05E-02
	Rail	4.05E-03	7.58E-03	1.11E-04	4.34E-03	1.20E-02
LLW(x) ST to HS						
SLAC	to Hanford Site					
	Truck	2.98E-02	3.70E-03	6.08E-03	2.56E-02	3.54E-02
	Rail	7.20E-03	1.75E-02	2.40E-04	6.67E-03	2.44E-02
LLW(x) SA to HS						
SNL - Albuquerque	to Hanford Site					
	Truck	4.31E-02	2.27E-03	5.84E-03	4.43E-02	5.24E-02
	Rail	1.04E-02	6.90E-03	1.72E-04	9.00E-03	1.61E-02
LLW(x) SA to LA						
SNL - Albuquerque	to Los Alamos NL					
	Truck	3.28E-03	3.70E-04	6.13E-04	2.86E-03	3.84E-03
	Rail	3.31E-03	1.55E-03	2.36E-05	3.80E-03	5.37E-03
LLW(x) SL to HS						
SNL - Livermore	to Hanford Site					
	Truck	2.82E-02	2.88E-03	4.92E-03	2.50E-02	3.28E-02
	Rail	6.94E-03	1.38E-02	2.00E-04	6.48E-03	2.05E-02
LLW(x) SR to HS						
Savannah River	to Hanford Site					
	Truck	7.86E-02	5.10E-03	1.08E-02	7.64E-02	9.23E-02
	Rail	1.52E-02	1.85E-02	4.05E-04	1.26E-02	3.15E-02
LLW(x) OR to HS						
Oak Ridge Reserv.	to Hanford Site					
	Truck	6.83E-02	3.65E-03	8.95E-03	6.90E-02	8.16E-02
	Rail	1.37E-02	1.08E-02	2.59E-04	1.15E-02	2.26E-02

Table 4. Accident Dose Risk per Shipment (person-rem/shipment)

Source/Route		Truck	Rail
LLW(x) AL to HS Ames Laboratory	to Hanford Site	4.88E-06	3.68E-06
LLW(x) AL to PO Ames Laboratory	to Portsmouth GDP	9.76E-07	4.06E-07
LLW(x) AN to HS Argonne - East	to Hanford Site	5.56E-04	3.40E-04
LLW(x) AW to HS Argonne - West	to Hanford Site	3.19E-01	4.31E-01
LLW(x) BA to HS Bettis Atomic	to Hanford Site	4.46E-05	5.00E-05
LLW(x) FL to HS Fermilab (FNAL)	to Hanford Site	3.38E-05	2.22E-05
LLW(x) FL to PO Fermilab (FNAL)	to Portsmouth GDP	1.87E-11	4.79E-12
LLW(x) IN to HS INEL	to Hanford Site	1.14E-04	1.60E-04
LLW(x) IT to HS ITRI	to Hanford Site	2.41E-03	8.26E-04
LLW(x) IT to LA ITRI	to Los Alamos NL	4.63E-03	1.70E-04
LLW(x) OR to HS Oak Ridge Reserv.	to Hanford Site	7.18E-07	3.87E-07
LLW(x) KA to HS Knolls Atomic	to Hanford Site	4.90E-06	4.19E-06
LLW(x) KC to HS Kansas City Plant	to Hanford Site	2.32E-05	4.82E-06
LLW(x) LA to HS Los Alamos NL	to Hanford Site	1.01E-02	3.30E-03
LLW(x) LB to HS Lawrence Berkeley	to Hanford Site	5.07E-02	4.24E-02
LLW(x) LL to HS Lawrence Livermore	to Hanford Site	9.20E-06	1.28E-05
LLW(x) MP to HS Mound Plant	to Hanford Site	6.07E-06	3.60E-06
LLW(x) MP to PO Mound Plant	to Portsmouth GDP	6.85E-08	4.29E-08
LLW(x) OI to HS ORISE	to Hanford Site	1.30E-06	5.47E-07
LLW(x) OI to OR ORISE	to Oak Ridge Reserv.	1.35E-07	3.82E-08
LLW(x) OR to HS Oak Ridge Reserv.	to Hanford Site	7.18E-07	3.87E-07
LLW(x) PP to HS Pantex Plant	to Hanford Site	3.82E-06	1.09E-06
LLW(x) PP to LA Pantex Plant	to Los Alamos NL	5.67E-07	9.05E-08
LLW(x) PO to HS Portsmouth GDP	to Hanford Site	2.97E-08	3.14E-08
LLW(x) PR to HS Princeton PPL	to Hanford Site	1.28E-05	4.69E-06
LLW(x) PR to PO Princeton PPL	to Portsmouth GDP	4.35E-11	2.17E-11
LLW(x) PA to HS Paducah GDP	to Hanford Site	9.56E-07	6.09E-07
LLW(x) PA to OR Paducah GDP	to Oak Ridge Reserv.	8.45E-07	3.01E-07
LLW(x) PI to SR Pinellas Plant	to Savannah River	1.30E-06	4.65E-07
LLW(x) RF to HS Rocky Flats Plant	to Hanford Site	3.66E-06	2.69E-06
LLW(x) RM to HS Reactive Metals	to Hanford Site	1.13E-08	1.24E-08
LLW(x) RM to PO Reactive Metals	to Portsmouth GDP	1.34E-08	9.03E-09
LLW(x) ST to HS SLAC	to Hanford Site	4.30E-07	6.58E-07
LLW(x) SA to HS SNL - Albuquerque	to Hanford Site	1.99E-05	6.73E-06
LLW(x) SA to LA SNL - Albuquerque	to Los Alamos NL	1.33E-05	2.52E-07
LLW(x) SL to HS SNL - Livermore	to Hanford Site	1.06E-04	1.40E-04
LLW(x) SR to HS Savannah River	to Hanford Site	5.13E-03	2.76E-03
LLW(x) OR to HS Oak Ridge Reserv.	to Hanford Site	7.18E-07	3.87E-07

Table 5. Nonradiological Risk Factors per Shipment
(fatalities/shipment)

Mode	Route	Emission	Accident
Truck			
Ames Laboratory	to Hanford Site	4.31E-06	8.93E-05
Ames Laboratory	to Portsmouth GDP	4.02E-06	4.11E-05
Argonne - East	to Hanford Site	4.41E-06	1.06E-04
Argonne - West	to Hanford Site	2.19E-06	3.07E-05
Bettis Atomic	to Hanford Site	1.14E-05	1.36E-04
Fermilab (FNAL)	to Hanford Site	4.86E-06	1.03E-04
Fermilab (FNAL)	to Portsmouth GDP	8.11E-06	3.01E-05
INEL	to Hanford Site	2.19E-06	3.07E-05
ITRI	to Hanford Site	7.44E-06	1.05E-04
ITRI	to Los Alamos NL	1.51E-06	1.28E-05
Oak Ridge Reserv.	to Hanford Site	9.50E-06	1.61E-04
Knolls Atomic	to Hanford Site	1.59E-05	1.51E-04
Kansas City Plant	to Hanford Site	5.18E-06	1.12E-04
Los Alamos NL	to Hanford Site	6.66E-06	1.02E-04
Lawrence Berkeley	to Hanford Site	1.16E-05	4.91E-05
Lawrence Livermore	to Hanford Site	9.85E-06	5.03E-05
Mound Plant	to Hanford Site	7.89E-06	1.23E-04
Mound Plant	to Portsmouth GDP	2.70E-06	6.66E-06
ORISE	to Hanford Site	9.50E-06	1.65E-04
ORISE	to Oak Ridge Reserv.	0.00E+00	1.07E-06
Pantex Plant	to Hanford Site	9.21E-06	1.25E-04
Pantex Plant	to Los Alamos NL	3.28E-06	3.21E-05
Portsmouth GDP	to Hanford Site	8.11E-06	1.28E-04
Princeton PPL	to Hanford Site	1.97E-05	1.63E-04
Princeton PPL	to Portsmouth GDP	1.16E-05	3.99E-05
Paducah GDP	to Hanford Site	9.30E-06	1.41E-04
Paducah GDP	to Oak Ridge Reserv.	1.93E-07	2.14E-05
Pinellas Plant	to Savannah River	4.47E-06	4.70E-05
Rocky Flats Plant	to Hanford Site	2.83E-06	6.69E-05
Reactive Metals	to Hanford Site	1.27E-05	1.28E-04
Reactive Metals	to Portsmouth GDP	2.45E-06	1.21E-05
SLAC	to Hanford Site	1.50E-05	5.14E-05
SNL - Albuquerque	to Hanford Site	7.24E-06	1.05E-04
SNL - Albuquerque	to Los Alamos NL	1.35E-06	1.20E-05
SNL - Livermore	to Hanford Site	9.85E-06	5.03E-05
Savannah River	to Hanford Site	1.31E-05	1.81E-04
Rail			
Ames Laboratory	to Hanford Site	5.40E-06	3.74E-06
Ames Laboratory	to Portsmouth GDP	2.34E-05	1.52E-06
Argonne - East	to Hanford Site	6.15E-06	4.60E-06
Argonne - West	to Hanford Site	3.98E-06	1.38E-06
Bettis Atomic	to Hanford Site	4.07E-05	5.46E-06
Fermilab (FNAL)	to Hanford Site	1.18E-05	4.12E-06
Fermilab (FNAL)	to Portsmouth GDP	1.80E-05	9.43E-07
INEL	to Hanford Site	3.98E-06	1.38E-06
ITRI	to Hanford Site	9.04E-06	3.75E-06
ITRI	to Los Alamos NL	2.47E-06	2.18E-07
Oak Ridge Reserv.	to Hanford Site	1.45E-05	5.44E-06
Knolls Atomic	to Hanford Site	4.72E-05	6.10E-06
Kansas City Plant	to Hanford Site	6.57E-06	3.73E-06
Los Alamos NL	to Hanford Site	6.82E-06	3.61E-06
Lawrence Berkeley	to Hanford Site	2.33E-05	2.06E-06
Lawrence Livermore	to Hanford Site	2.36E-05	2.04E-06
Mound Plant	to Hanford Site	1.94E-05	5.17E-06
Mound Plant	to Portsmouth GDP	5.73E-06	3.27E-07
ORISE	to Hanford Site	1.67E-05	5.53E-06
ORISE	to Oak Ridge Reserv.	1.26E-07	8.26E-08
Pantex Plant	to Hanford Site	6.78E-06	3.53E-06
Pantex Plant	to Los Alamos NL	2.59E-06	1.01E-06
Portsmouth GDP	to Hanford Site	2.88E-05	5.26E-06
Princeton PPL	to Hanford Site	5.38E-05	6.24E-06
Princeton PPL	to Portsmouth GDP	3.18E-05	1.75E-06
Paducah GDP	to Hanford Site	1.23E-05	4.70E-06
Paducah GDP	to Oak Ridge Reserv.	3.81E-06	1.10E-06
Pinellas Plant	to Savannah River	5.69E-06	1.01E-06
Rocky Flats Plant	to Hanford Site	7.36E-06	2.69E-06
Reactive Metals	to Hanford Site	3.65E-05	5.24E-06
Reactive Metals	to Portsmouth GDP	1.14E-05	5.84E-07
SLAC	to Hanford Site	3.07E-05	2.17E-06
SNL - Albuquerque	to Hanford Site	9.04E-06	3.75E-06
SNL - Albuquerque	to Los Alamos NL	2.47E-06	2.18E-07
SNL - Livermore	to Hanford Site	2.36E-05	2.04E-06
Savannah River	to Hanford Site	2.21E-05	6.18E-06

Table 6. Annual Incident-Free Dose for the Shipping Campaign (person-rem/yr)

Route		Truck		Rail	
		Crew	Public	Crew	Public
Ames Laboratory	to Hanford Site	8.93E-02	1.09E-01	1.03E-02	1.38E-02
Ames Laboratory	to Portsmouth GDP	2.33E-02	2.63E-02	5.91E-03	2.01E-02
Argonne - East	to Hanford Site	5.55E+00	6.74E+00	4.70E-01	6.31E-01
Argonne - West	to Hanford Site	1.60E-01	1.95E-01	2.25E-02	3.36E-02
Bettis Atomic	to Hanford Site	4.11E+00	4.86E+00	2.89E-01	8.13E-01
Fermilab (FNAL)	to Hanford Site	1.04E-01	1.27E-01	1.11E-02	1.88E-02
Fermilab (FNAL)	to Portsmouth GDP	1.68E-02	1.87E-02	4.76E-03	1.58E-02
INEL	to Hanford Site	1.31E+01	1.60E+01	1.77E+00	2.65E+00
ITRI	to Hanford Site	3.91E-01	4.75E-01	3.11E-02	4.82E-02
ITRI	to Los Alamos NL	7.08E-03	8.36E-03	3.31E-03	5.37E-03
Oak Ridge Reserv.	to Hanford Site	4.14E+02	4.95E+02	3.33E+01	5.47E+01
Knolls Atomic	to Hanford Site	2.32E+00	2.70E+00	1.65E-01	4.93E-01
Kansas City Plant	to Hanford Site	4.62E-02	5.64E-02	1.03E-02	1.41E-02
Los Alamos NL	to Hanford Site	8.33E+01	1.01E+02	7.70E+00	1.11E+01
Lawrence Berkeley	to Hanford Site	8.27E-02	9.80E-02	1.40E-02	4.10E-02
Lawrence Livermore	to Hanford Site	1.58E+00	1.84E+00	1.46E-01	4.30E-01
Mound Plant	to Hanford Site	3.12E+01	3.74E+01	2.45E+00	4.86E+00
Mound Plant	to Portsmouth GDP	7.00E-02	7.58E-02	1.77E-02	3.92E-02
ORISE	to Hanford Site	2.78E-01	3.31E-01	2.78E-02	4.98E-02
ORISE	to Oak Ridge Reserv.	3.63E-04	3.60E-04	3.05E-03	3.95E-03
Pantex Plant	to Hanford Site	1.28E+00	1.56E+00	9.92E-02	1.45E-01
Pantex Plant	to Los Alamos NL	1.51E+01	1.87E+01	2.58E+00	3.80E+00
Portsmouth GDP	to Hanford Site	1.96E+02	2.33E+02	1.48E+01	3.37E+01
Princeton PPL	to Hanford Site	8.51E-02	9.97E-02	1.53E-02	4.96E-02
Princeton PPL	to Portsmouth GDP	2.28E-02	2.48E-02	6.38E-03	2.64E-02
Paducah GDP	to Hanford Site	3.47E+01	4.18E+01	2.63E+00	4.31E+00
Paducah GDP	to Oak Ridge Reserv.	5.06E-01	5.69E-01	1.07E-01	1.66E-01
Pinellas Plant	to Savannah River	4.04E-02	4.48E-02	4.90E-03	1.02E-02
Rocky Flats Plant	to Hanford Site	1.00E+01	1.22E+01	1.01E+00	1.53E+00
Reactive Metals	to Hanford Site	5.04E+01	6.02E+01	3.77E+00	9.93E+00
Reactive Metals	to Portsmouth GDP	7.02E-02	7.37E-02	1.21E-02	3.61E-02
SLAC	to Hanford Site	1.16E+00	1.38E+00	1.08E-01	3.66E-01
SNL - Albuquerque	to Hanford Site	7.33E-01	8.92E-01	7.25E-02	1.12E-01
SNL - Albuquerque	to Los Alamos NL	3.28E-03	3.84E-03	3.31E-03	5.37E-03
SNL - Livermore	to Hanford Site	1.41E-01	1.64E-01	1.39E-02	4.10E-02
Savannah River	to Hanford Site	5.30E+02	6.23E+02	3.83E+01	7.94E+01
Totals		1.40E+03	1.66E+03	1.10E+02	2.10E+02

Table 7. Annual Accident Dose Risk for the Shipping Campaign (person-rem/yr)

Route		Truck	Rail
Ames Laboratory	to Hanford Site	9.76E-06	3.68E-06
Ames Laboratory	to Portsmouth GDP	9.76E-07	4.06E-07
Argonne - East	to Hanford Site	5.84E-02	1.33E-02
Argonne - West	to Hanford Site	3.19E+00	1.72E+00
Bettis Atomic	to Hanford Site	2.54E-03	1.05E-03
Fermilab (FNAL)	to Hanford Site	6.76E-05	2.22E-05
Fermilab (FNAL)	to Portsmouth GDP	1.87E-11	4.79E-12
INEL	to Hanford Site	9.38E-02	5.04E-02
ITRI	to Hanford Site	2.17E-02	2.48E-03
ITRI	to Los Alamos NL	9.26E-03	1.70E-04
Oak Ridge Reserv.	to Hanford Site	4.36E-03	9.40E-04
Knolls Atomic	to Hanford Site	1.37E-04	4.61E-05
Kansas City Plant	to Hanford Site	2.32E-05	4.82E-06
Los Alamos NL	to Hanford Site	1.98E+01	2.52E+00
Lawrence Berkeley	to Hanford Site	1.52E-01	8.48E-02
Lawrence Livermore	to Hanford Site	5.15E-04	2.70E-04
Mound Plant	to Hanford Site	3.01E-03	6.69E-04
Mound Plant	to Portsmouth GDP	8.22E-07	2.15E-07
ORISE	to Hanford Site	5.20E-06	1.09E-06
ORISE	to Oak Ridge Reserv.	1.35E-07	3.82E-08
Pantex Plant	to Hanford Site	9.56E-05	1.09E-05
Pantex Plant	to Los Alamos NL	7.70E-04	4.78E-05
Portsmouth GDP	to Hanford Site	8.77E-05	3.47E-05
Princeton PPL	to Hanford Site	1.28E-05	4.69E-06
Princeton PPL	to Portsmouth GDP	4.35E-11	2.17E-11
Paducah GDP	to Hanford Site	5.53E-04	1.31E-04
Paducah GDP	to Oak Ridge Reserv.	4.82E-05	6.32E-06
Pinellas Plant	to Savannah River	2.59E-06	4.65E-07
Rocky Flats Plant	to Hanford Site	1.23E-03	3.31E-04
Reactive Metals	to Hanford Site	8.42E-06	3.50E-06
Reactive Metals	to Portsmouth GDP	9.38E-08	2.71E-08
SLAC	to Hanford Site	1.68E-05	9.87E-06
SNL - Albuquerque	to Hanford Site	3.39E-04	4.71E-05
SNL - Albuquerque	to Los Alamos NL	1.33E-05	2.52E-07
SNL - Livermore	to Hanford Site	5.28E-04	2.79E-04
Savannah River	to Hanford Site	3.46E+01	6.96E+00
Totals		5.80E+01	1.14E+01

Table 8. Expected Annual Fatalities for the Shipping Campaign

Exposure Group	Truck	Rail
Radiological		
Normal Crew	5.6E-01	4.4E-02
Normal Public	8.3E-01	1.0E-01
Accident Public	2.9E-02	5.7E-03
Nonradiological		
Emission	2.1E-01	1.5E-01
Accident	3.1E+00	4.3E-02

Table 9. Expected Annual Cancer Incidence for the Shipping Campaign

Exposure Group	Truck	Rail
Radiological		
Normal Crew	2.0E+00	1.5E-01
Normal Public	2.8E+00	3.6E-01
Accident Public	9.9E-02	1.9E-02
Nonradiological		
Emission	2.1E-01	1.5E-01
Accident	NA	NA

Table 10. Expected Annual Genetic Effects for the Shipping Campaign

Exposure Group	Truck	Rail
Radiological		
Normal Crew	8.4E-02	6.6E-03
Normal Public	1.7E-01	2.1E-02
Accident Public	5.3E-03	1.0E-03
Nonradiological		
Emission	NA	NA
Accident	NA	NA

B.24 WM LLW CENTRALIZED 3 ALTERNATIVE (CASE 14): ACTIVATED METALS

Table 1. Summary of Route Information

Route		Distance (miles)	Percentage in Zone		
			Rural	Suburban	Urban
Truck					
Bettis Atomic	to Portsmouth GDP	265	58.8	37.4	3.8
Fermilab (FNAL)	to Portsmouth GDP	460	62.5	32.0	5.5
INEL	to Hanford Site	599	91.3	7.6	1.1
Knolls Atomic	to Portsmouth GDP	688	57.3	40.1	2.5
Los Alamos NL	to Hanford Site	1560	89.8	8.8	1.3
Lawrence Berkeley	to Hanford Site	875	78.1	17.8	4.1
Portsmouth GDP	to Hanford Site	2402	88.0	11.0	1.0
SNL - Albuquerque	to Los Alamos NL	102	75.8	20.1	4.1
Rail					
Bettis Atomic	to Portsmouth GDP	429	52.6	39.6	7.8
Fermilab (FNAL)	to Portsmouth GDP	451	61.5	28.9	9.5
INEL	to Hanford Site	658	91.4	7.1	1.4
Knolls Atomic	to Portsmouth GDP	681	52.1	40.3	7.5
Los Alamos NL	to Hanford Site	1725	92.5	6.5	0.9
Lawrence Berkeley	to Hanford Site	986	78.5	15.8	5.7
Portsmouth GDP	to Hanford Site	2515	86.4	10.8	2.7
SNL - Albuquerque	to Los Alamos NL	104	74.3	20.0	5.7

Table 2. Annual Number of Shipments and One-Way Shipment Distances

Route		# of Shipments		Total Mileage(mi)	
		Truck	Rail	Truck	Rail
Bettis Atomic	to Portsmouth GDP	309	119	8.19E+04	5.11E+04
Fermilab (FNAL)	to Portsmouth GDP	39	16	1.79E+04	7.21E+03
INEL	to Hanford Site	365	157	2.19E+05	1.03E+05
Knolls Atomic	to Portsmouth GDP	639	245	4.40E+05	1.67E+05
Los Alamos NL	to Hanford Site	332	143	5.18E+05	2.47E+05
Lawrence Berkeley	to Hanford Site	14	6	1.22E+04	5.91E+03
Portsmouth GDP	to Hanford Site	785	337	1.89E+06	8.48E+05
SNL - Albuquerque	to Los Alamos NL	6	3	6.12E+02	3.12E+02
Totals		2489	1026	3.17E+06	1.43E+06

Table 3. Incident-Free Dose per Shipment (person-rem/shipment)

Source/Route(s)		Crew	General Public Off-Link	On-Link	Stops	Total
LLW(I) BA to PO						
Bettis Atomic	to Portsmouth GDP					
	Truck	9.78E-03	1.26E-03	1.73E-03	7.42E-03	1.04E-02
	Rail	4.67E-03	9.85E-03	1.53E-04	4.80E-03	1.48E-02
LLW(I) FL to PO						
Fermilab (FNAL)	to Portsmouth GDP					
	Truck	1.68E-02	2.40E-03	3.43E-03	1.29E-02	1.87E-02
	Rail	4.76E-03	1.08E-02	1.48E-04	4.87E-03	1.58E-02
LLW(I) IN to HS						
INEL	to Hanford Site					
	Truck	1.60E-02	7.18E-04	2.06E-03	1.68E-02	1.95E-02
	Rail	5.63E-03	2.83E-03	6.58E-05	5.51E-03	8.40E-03
LLW(I) KA to PO						
Knolls Atomic	to Portsmouth GDP					
	Truck	2.54E-02	2.99E-03	4.01E-03	1.93E-02	2.63E-02
	Rail	5.72E-03	1.54E-02	2.43E-04	5.58E-03	2.13E-02
LLW(I) LA to HS						
Los Alamos NL	to Hanford Site					
	Truck	4.24E-02	2.16E-03	5.65E-03	4.37E-02	5.15E-02
	Rail	1.01E-02	5.60E-03	1.54E-04	8.79E-03	1.45E-02
LLW(I) LB to HS						
Lawrence Berkeley	to Hanford Site					
	Truck	2.76E-02	3.02E-03	5.17E-03	2.45E-02	3.27E-02
	Rail	6.99E-03	1.38E-02	2.03E-04	6.51E-03	2.05E-02
LLW(I) PO to HS						
Portsmouth GDP	to Hanford Site					
	Truck	6.63E-02	3.38E-03	8.48E-03	6.72E-02	7.91E-02
	Rail	1.34E-02	1.89E-02	3.46E-04	1.12E-02	3.04E-02
LLW(I) SA to LA						
SNL - Albuquerque	to Los Alamos NL					
	Truck	3.28E-03	3.70E-04	6.13E-04	2.86E-03	3.84E-03
	Rail	3.31E-03	1.55E-03	2.36E-05	3.80E-03	5.37E-03

Table 4. Accident Dose Risk per Shipment (person-rem/shipment)

Source/Route		Truck	Rail
LLW(I) BA to PO			
Bettis Atomic	to Portsmouth GDP	3.70E-07	4.16E-07
LLW(I) FL to PO			
Fermilab (FNAL)	to Portsmouth GDP	5.29E-11	3.35E-11
LLW(I) IN to HS			
INEL	to Hanford Site	5.63E-08	7.06E-08
LLW(I) KA to PO			
Knolls Atomic	to Portsmouth GDP	1.66E-06	1.02E-06
LLW(I) LA to HS			
Los Alamos NL	to Hanford Site	3.90E-09	9.87E-10
LLW(I) LB to HS			
Lawrence Berkeley	to Hanford Site	1.81E-10	2.37E-10
LLW(I) PO to HS			
Portsmouth GDP	to Hanford Site	2.14E-06	1.80E-06
LLW(I) SA to LA			
SNL - Albuquerque	to Los Alamos NL	1.72E-12	6.51E-14

Table 5. Nonradiological Risk Factors per Shipment (fatalities/shipment)

Mode	Route	Emission	Accident
Truck			
Bettis Atomic	to Portsmouth GDP	3.22E-06	1.33E-05
Fermilab (FNAL)	to Portsmouth GDP	8.11E-06	3.01E-05
INEL	to Hanford Site	2.19E-06	3.07E-05
Knolls Atomic	to Portsmouth GDP	5.63E-06	3.56E-05
Los Alamos NL	to Hanford Site	6.66E-06	1.02E-04
Lawrence Berkeley	to Hanford Site	1.16E-05	4.91E-05
Portsmouth GDP	to Hanford Site	8.11E-06	1.28E-04
SNL - Albuquerque	to Los Alamos NL	1.35E-06	1.20E-05
Rail			
Bettis Atomic	to Portsmouth GDP	1.40E-05	8.98E-07
Fermilab (FNAL)	to Portsmouth GDP	1.80E-05	9.43E-07
INEL	to Hanford Site	3.98E-06	1.38E-06
Knolls Atomic	to Portsmouth GDP	2.15E-05	1.43E-06
Los Alamos NL	to Hanford Site	6.82E-06	3.61E-06
Lawrence Berkeley	to Hanford Site	2.33E-05	2.06E-06
Portsmouth GDP	to Hanford Site	2.88E-05	5.26E-06
SNL - Albuquerque	to Los Alamos NL	2.47E-06	2.18E-07

Table 6. Annual Incident-Free Dose for the Shipping Campaign (person-rem/yr)

Route		Truck		Rail	
		Crew	Public	Crew	Public
Bettis Atomic	to Portsmouth GDP	3.02E+00	3.22E+00	5.56E-01	1.76E+00
Fermilab (FNAL)	to Portsmouth GDP	6.54E-01	7.30E-01	7.62E-02	2.53E-01
INEL	to Hanford Site	5.84E+00	7.13E+00	8.83E-01	1.32E+00
Knolls Atomic	to Portsmouth GDP	1.62E+01	1.68E+01	1.40E+00	5.21E+00
Los Alamos NL	to Hanford Site	1.41E+01	1.71E+01	1.44E+00	2.08E+00
Lawrence Berkeley	to Hanford Site	3.86E-01	4.58E-01	4.20E-02	1.23E-01
Portsmouth GDP	to Hanford Site	5.21E+01	6.21E+01	4.51E+00	1.03E+01
SNL - Albuquerque	to Los Alamos NL	1.97E-02	2.30E-02	9.94E-03	1.61E-02
Totals		9.23E+01	1.08E+02	8.92E+00	2.10E+01

Table 7. Annual Accident Dose Risk for the Shipping Campaign (person-rem/yr)

Route		Truck	Rail
Bettis Atomic	to Portsmouth GDP	1.14E-04	4.95E-05
Fermilab (FNAL)	to Portsmouth GDP	2.06E-09	5.35E-10
INEL	to Hanford Site	2.06E-05	1.11E-05
Knolls Atomic	to Portsmouth GDP	1.06E-03	2.49E-04
Los Alamos NL	to Hanford Site	1.29E-06	1.41E-07
Lawrence Berkeley	to Hanford Site	2.53E-09	1.42E-09
Portsmouth GDP	to Hanford Site	1.68E-03	6.06E-04
SNL - Albuquerque	to Los Alamos NL	1.03E-11	1.95E-13
Totals		2.87E-03	9.16E-04

Table 8. Expected Annual Fatalities for the Shipping Campaign

Exposure Group	Truck	Rail
Radiological		
Normal Crew	3.7E-02	3.6E-03
Normal Public	5.4E-02	1.1E-02
Accident Public	1.4E-06	4.6E-07
Nonradiological		
Emission	1.4E-02	1.9E-02
Accident	1.7E-01	3.0E-03

Table 9. Expected Annual Cancer Incidence for the Shipping Campaign

Exposure Group	Truck	Rail
Radiological		
Normal Crew	1.3E-01	1.2E-02
Normal Public	1.8E-01	3.6E-02
Accident Public	4.9E-06	1.6E-06
Nonradiological		
Emission	1.4E-02	1.9E-02
Accident	NA	NA

Table 10. Expected Annual Genetic Effects for the Shipping Campaign

Exposure Group	Truck	Rail
Radiological		
Normal Crew	5.5E-03	5.4E-04
Normal Public	1.1E-02	2.1E-03
Accident Public	2.9E-07	9.2E-08
Nonradiological		
Emission	NA	NA
Accident	NA	NA

B.25 WM LLW CENTRALIZED 4 ALTERNATIVE (CASE 14A): HETEROGENEOUS SOLIDS

Table 1. Summary of Route Information

Route		Distance (miles)	Percentage in Zone		
			Rural	Suburban	Urban
Truck					
Ames Laboratory	to Nevada Test Site	1520	92.0	6.8	1.2
Ames Laboratory	to Portsmouth GDP	755	77.4	21.0	1.7
Argonne - East	to Nevada Test Site	1815	91.0	8.0	1.0
Argonne - West	to Nevada Test Site	712	82.8	13.7	3.5
Bettis Atomic	to Nevada Test Site	2297	83.2	14.6	2.2
Fermilab (FNAL)	to Nevada Test Site	1805	91.3	7.5	1.1
Fermilab (FNAL)	to Portsmouth GDP	460	62.5	32.0	5.5
Hanford Site	to Nevada Test Site	1128	86.5	10.9	2.6
INEL	to Nevada Test Site	712	82.8	13.7	3.5
ITRI	to Los Alamos NL	111	76.8	18.9	4.2
ITRI	to Nevada Test Site	918	93.8	4.8	1.5
Oak Ridge Reserv.	to Nevada Test Site	2151	86.9	11.5	1.6
Knolls Atomic	to Nevada Test Site	2626	81.1	16.9	2.1
Kansas City Plant	to Nevada Test Site	1428	91.0	7.6	1.4
Los Alamos NL	to Nevada Test Site	997	93.2	5.7	1.1
Lawrence Berkeley	to Hanford Site	875	78.1	17.8	4.1
Lawrence Berkeley	to Nevada Test Site	719	81.9	10.6	7.5
Lawrence Livermore	to Hanford Site	894	77.2	19.3	3.4
Lawrence Livermore	to Nevada Test Site	678	84.7	9.2	6.1
Mound Plant	to Nevada Test Site	2047	86.1	12.0	1.9
Mound Plant	to Portsmouth GDP	152	55.8	38.7	5.5
ORISE	to Nevada Test Site	2180	86.4	12.0	1.5
ORISE	to Oak Ridge Reserv.	10	58.8	41.2	0.0
Pantex Plant	to Los Alamos NL	402	89.5	8.0	2.5
Pantex Plant	to Nevada Test Site	1209	93.9	4.6	1.6
Portsmouth GDP	to Nevada Test Site	2158	85.5	12.6	1.9
Princeton PPL	to Nevada Test Site	2620	79.4	17.7	2.9
Princeton PPL	to Portsmouth GDP	588	55.1	38.8	6.1
Paducah GDP	to Nevada Test Site	1864	87.6	10.7	1.8
Paducah GDP	to Oak Ridge Reserv.	304	81.3	18.5	0.2
Pinellas Plant	to Savannah River	620	71.9	25.8	2.2
Rocky Flats Plant	to Nevada Test Site	836	89.5	8.5	2.0
Reactive Metals	to Nevada Test Site	2214	85.8	12.2	2.0
Reactive Metals	to Portsmouth GDP	276	59.5	37.8	2.8
SLAC	to Hanford Site	916	75.9	19.0	5.1
SLAC	to Nevada Test Site	739	79.6	11.3	9.1
SNL - Albuquerque	to Los Alamos NL	102	75.8	20.1	4.1
SNL - Albuquerque	to Nevada Test Site	909	93.8	4.8	1.4
SNL - Livermore	to Hanford Site	894	77.2	19.3	3.4
SNL - Livermore	to Nevada Test Site	678	84.7	9.2	6.1
Savannah River	to Nevada Test Site	2414	83.1	15.1	1.8
Rail					
Ames Laboratory	to Nevada Test Site	1674	94.0	5.1	0.9
Ames Laboratory	to Portsmouth GDP	727	68.6	23.8	7.7
Argonne - East	to Nevada Test Site	2348	92.8	6.4	0.8
Argonne - West	to Nevada Test Site	756	92.8	5.9	1.3
Bettis Atomic	to Nevada Test Site	2496	80.9	15.2	4.0
Fermilab (FNAL)	to Nevada Test Site	1997	92.3	6.5	1.2
Fermilab (FNAL)	to Portsmouth GDP	451	61.5	28.9	9.5
Hanford Site	to Nevada Test Site	1302	93.0	5.9	1.1
INEL	to Nevada Test Site	756	92.8	5.9	1.3
ITRI	to Los Alamos NL	104	74.3	20.0	5.7
ITRI	to Nevada Test Site	1065	94.6	4.5	0.9
Oak Ridge Reserv.	to Nevada Test Site	2487	91.4	7.2	1.5
Knolls Atomic	to Nevada Test Site	2800	78.8	17.2	4.1
Kansas City Plant	to Nevada Test Site	1670	94.5	4.5	1.0
Los Alamos NL	to Nevada Test Site	1169	92.8	5.9	1.3
Lawrence Berkeley	to Hanford Site	986	78.5	15.8	5.7
Lawrence Berkeley	to Nevada Test Site	860	75.1	17.7	7.2
Lawrence Livermore	to Hanford Site	973	78.9	15.3	5.8
Lawrence Livermore	to Nevada Test Site	1370	94.5	3.8	1.8
Mound Plant	to Nevada Test Site	2386	87.9	10.3	1.8
Mound Plant	to Portsmouth GDP	156	53.2	38.0	8.8
ORISE	to Nevada Test Site	2530	89.0	9.3	1.6
ORISE	to Oak Ridge Reserv.	40	65.8	33.4	0.8
Pantex Plant	to Los Alamos NL	482	89.2	9.6	1.3
Pantex Plant	to Nevada Test Site	1376	94.9	4.4	0.7
Portsmouth GDP	to Nevada Test Site	2401	86.3	10.7	2.9

Princeton PPL	to Nevada Test Site	2871	76.2	19.3	4.5
Princeton PPL	to Portsmouth GDP	838	58.3	32.6	9.1
Paducah GDP	to Nevada Test Site	2131	90.9	7.6	1.5
Paducah GDP	to Oak Ridge Reserv.	527	89.3	9.0	1.7
Pinellas Plant	to Savannah River	485	72.2	25.0	2.8
Rocky Flats Plant	to Nevada Test Site	987	95.9	3.9	0.2
Reactive Metals	to Nevada Test Site	2391	83.1	13.1	3.7
Reactive Metals	to Portsmouth GDP	279	48.4	41.8	9.8
SLAC	to Hanford Site	1036	76.1	16.8	7.1
SLAC	to Nevada Test Site	862	75.8	17.7	6.5
SNL - Albuquerque	to Los Alamos NL	104	74.3	20.0	5.7
SNL - Albuquerque	to Nevada Test Site	1065	94.6	4.5	0.9
SNL - Livermore	to Hanford Site	973	78.9	15.3	5.8
SNL - Livermore	to Nevada Test Site	1370	94.5	3.8	1.8
Savannah River	to Nevada Test Site	2839	84.5	13.5	1.9

Table 2. Annual Number of Shipments and One-Way Shipment Distances

Route		# of Shipments		Total Mileage (mi)	
		Truck	Rail	Truck	Rail
Ames Laboratory	to Nevada Test Site	2	1	3.04E+03	1.67E+03
Ames Laboratory	to Portsmouth GDP	1	1	7.55E+02	7.27E+02
Argonne - East	to Nevada Test Site	105	39	1.91E+05	9.16E+04
Argonne - West	to Nevada Test Site	10	4	7.12E+03	3.02E+03
Bettis Atomic	to Nevada Test Site	57	21	1.31E+05	5.24E+04
Fermilab (FNAL)	to Nevada Test Site	2	1	3.61E+03	2.00E+03
Fermilab (FNAL)	to Portsmouth GDP	1	1	4.60E+02	4.51E+02
Hanford Site	to Nevada Test Site	1363	520	1.54E+06	6.77E+05
INEL	to Nevada Test Site	820	315	5.84E+05	2.38E+05
ITRI	to Los Alamos NL	2	1	2.22E+02	1.04E+02
ITRI	to Nevada Test Site	9	3	8.26E+03	3.19E+03
Oak Ridge Reserv.	to Nevada Test Site	6067	2425	1.30E+07	6.03E+06
LLW(x) OR	to NT	12	5	2.58E+04	1.24E+04
LLW(x) OR	to NT	5975	2390	1.28E+07	5.94E+06
LLW(x) OR	to NT	80	30	1.72E+05	7.46E+04
Knolls Atomic	to Nevada Test Site	28	11	7.35E+04	3.08E+04
Kansas City Plant	to Nevada Test Site	1	1	1.43E+03	1.67E+03
Los Alamos NL	to Nevada Test Site	1965	764	1.96E+06	8.93E+05
Lawrence Berkeley	to Hanford Site	2	1	1.75E+03	9.86E+02
Lawrence Berkeley	to Nevada Test Site	2	1	1.44E+03	8.60E+02
Lawrence Livermore	to Hanford Site	17	7	1.52E+04	6.81E+03
Lawrence Livermore	to Nevada Test Site	40	15	2.71E+04	2.06E+04
Mound Plant	to Nevada Test Site	496	186	1.02E+06	4.44E+05
Mound Plant	to Portsmouth GDP	12	5	1.83E+03	7.80E+02
ORISE	to Nevada Test Site	4	2	8.72E+03	5.06E+03
ORISE	to Oak Ridge Reserv.	1	1	1.02E+01	3.95E+01
Pantex Plant	to Los Alamos NL	1358	528	5.46E+05	2.55E+05
Pantex Plant	to Nevada Test Site	25	10	3.02E+04	1.38E+04
Portsmouth GDP	to Nevada Test Site	2950	1107	6.37E+06	2.66E+06
Princeton PPL	to Nevada Test Site	1	1	2.62E+03	2.87E+03
Princeton PPL	to Portsmouth GDP	1	1	5.88E+02	8.38E+02
Paducah GDP	to Nevada Test Site	578	215	1.08E+06	4.58E+05
Paducah GDP	to Oak Ridge Reserv.	57	21	1.73E+04	1.11E+04
Pinellas Plant	to Savannah River	2	1	1.24E+03	4.85E+02
Rocky Flats Plant	to Nevada Test Site	335	123	2.80E+05	1.21E+05
Reactive Metals	to Nevada Test Site	745	283	1.65E+06	6.77E+05
Reactive Metals	to Portsmouth GDP	7	3	1.93E+03	8.37E+02
SLAC	to Hanford Site	1	1	9.16E+02	1.04E+03
SLAC	to Nevada Test Site	39	15	2.88E+04	1.29E+04
SNL - Albuquerque	to Los Alamos NL	1	1	1.02E+02	1.04E+02
SNL - Albuquerque	to Nevada Test Site	17	7	1.55E+04	7.45E+03
SNL - Livermore	to Hanford Site	1	1	8.94E+02	9.73E+02
SNL - Livermore	to Nevada Test Site	5	2	3.39E+03	2.74E+03
Savannah River	to Nevada Test Site	6750	2522	1.63E+07	7.16E+06
Totals		23880	9168	4.49E+07	1.99E+07

Table 3. Incident-Free Dose per Shipment (person-rem/shipment)

Source/Route(s)		Crew	General Public			
			Off-Link	On-Link	Stops	Total
LLW(x) AL to NT						
Ames Laboratory	to Nevada Test Site					
	Truck	4.03E-02	1.78E-03	5.25E-03	4.25E-02	4.96E-02
	Rail	9.87E-03	4.68E-03	1.36E-04	8.63E-03	1.34E-02
LLW(x) AL to PO						
Ames Laboratory	to Portsmouth GDP					
	Truck	2.33E-02	1.86E-03	3.31E-03	2.11E-02	2.63E-02
	Rail	5.91E-03	1.42E-02	2.00E-04	5.72E-03	2.01E-02
LLW(x) AN to NT						
Argonne - East	to Nevada Test Site					
	Truck	4.86E-02	2.13E-03	6.15E-03	5.08E-02	5.91E-02
	Rail	1.27E-02	6.96E-03	2.04E-04	1.07E-02	1.79E-02
LLW(x) AW to NT						
Argonne - West	to Nevada Test Site					
	Truck	2.13E-02	2.03E-03	3.79E-03	1.99E-02	2.58E-02
	Rail	6.04E-03	2.80E-03	6.88E-05	5.81E-03	8.67E-03
LLW(x) BA to NT						
Bettis Atomic	to Nevada Test Site					
	Truck	6.75E-02	5.17E-03	1.02E-02	6.43E-02	7.97E-02
	Rail	1.33E-02	2.67E-02	4.43E-04	1.12E-02	3.83E-02
LLW(x) FL to NT						
Fermilab (FNAL)	to Nevada Test Site					
	Truck	4.82E-02	2.15E-03	6.20E-03	5.05E-02	5.89E-02
	Rail	1.12E-02	7.26E-03	1.85E-04	9.63E-03	1.71E-02
LLW(x) FL to PO						
Fermilab (FNAL)	to Portsmouth GDP					
	Truck	1.68E-02	2.40E-03	3.43E-03	1.29E-02	1.87E-02
	Rail	4.76E-03	1.08E-02	1.48E-04	4.87E-03	1.58E-02
LLW(x) HS to NT						
Hanford Site	to Nevada Test Site					
	Truck	3.22E-02	2.46E-03	5.18E-03	3.16E-02	3.92E-02
	Rail	8.31E-03	4.39E-03	1.15E-04	7.49E-03	1.20E-02
LLW(x) IN to NT						
INEL	to Nevada Test Site					
	Truck	2.13E-02	2.03E-03	3.79E-03	1.99E-02	2.58E-02
	Rail	6.04E-03	2.80E-03	6.88E-05	5.81E-03	8.67E-03
LLW(x) IT to LA						
ITRI	to Los Alamos NL					
	Truck	3.54E-03	4.00E-04	6.71E-04	3.11E-03	4.18E-03
	Rail	3.31E-03	1.55E-03	2.36E-05	3.80E-03	5.37E-03
LLW(x) IT to NT						
ITRI	to Nevada Test Site					
	Truck	2.40E-02	1.05E-03	3.25E-03	2.57E-02	3.00E-02
	Rail	7.32E-03	2.85E-03	8.34E-05	6.76E-03	9.69E-03
LLW(x) OR to NT						
Oak Ridge Reserv.	to Nevada Test Site					
	Truck	6.04E-02	3.66E-03	8.38E-03	6.02E-02	7.22E-02
	Rail	1.33E-02	1.08E-02	2.50E-04	1.11E-02	2.22E-02
LLW(x) KA to NT						
Knolls Atomic	to Nevada Test Site					
	Truck	7.86E-02	6.20E-03	1.18E-02	7.35E-02	9.15E-02
	Rail	1.46E-02	3.18E-02	5.30E-04	1.21E-02	4.44E-02
LLW(x) KC to NT						
Kansas City Plant	to Nevada Test Site					
	Truck	3.84E-02	1.90E-03	5.17E-03	4.00E-02	4.70E-02
	Rail	9.85E-03	4.98E-03	1.34E-04	8.62E-03	1.37E-02
LLW(x) LA to NT						
Los Alamos NL	to Nevada Test Site					
	Truck	2.61E-02	1.04E-03	3.33E-03	2.79E-02	3.23E-02
	Rail	7.76E-03	4.40E-03	1.07E-04	7.08E-03	1.16E-02
LLW(x) LB to HS						
Lawrence Berkeley	to Hanford Site					
	Truck	2.76E-02	3.02E-03	5.17E-03	2.45E-02	3.27E-02
	Rail	6.99E-03	1.38E-02	2.03E-04	6.51E-03	2.05E-02
LLW(x) LB to NT						
Lawrence Berkeley	to Nevada Test Site					
	Truck	2.27E-02	3.31E-03	5.66E-03	2.01E-02	2.91E-02
	Rail	6.47E-03	1.49E-02	2.04E-04	6.13E-03	2.12E-02
LLW(x) LL to HS						
Lawrence Livermore	to Hanford Site					
	Truck	2.82E-02	2.88E-03	4.92E-03	2.50E-02	3.28E-02
	Rail	6.94E-03	1.38E-02	2.00E-04	6.48E-03	2.05E-02

LLW(x) LL to NT						
Lawrence Livermore	to Nevada Test Site					
	Truck	2.05E-02	2.57E-03	4.65E-03	1.90E-02	2.62E-02
	Rail	8.60E-03	5.75E-03	1.20E-04	7.70E-03	1.36E-02
LLW(x) MP to NT						
Mound Plant	to Nevada Test Site					
	Truck	5.82E-02	3.93E-03	8.53E-03	5.73E-02	6.98E-02
	Rail	1.28E-02	1.36E-02	2.90E-04	1.08E-02	2.47E-02
LLW(x) MP to PO						
Mound Plant	to Portsmouth GDP					
	Truck	5.83E-03	8.71E-04	1.18E-03	4.26E-03	6.31E-03
	Rail	3.53E-03	3.82E-03	5.67E-05	3.96E-03	7.84E-03
LLW(x) OI to NT						
ORISE	to Nevada Test Site					
	Truck	6.15E-02	3.77E-03	8.51E-03	6.10E-02	7.33E-02
	Rail	1.34E-02	1.30E-02	2.88E-04	1.13E-02	2.45E-02
LLW(x) OI to OR						
ORISE	to Oak Ridge Reserv.					
	Truck	3.63E-04	3.21E-05	4.23E-05	2.86E-04	3.60E-04
	Rail	3.05E-03	3.36E-04	8.77E-06	3.60E-03	3.95E-03
LLW(x) OR to NT						
Oak Ridge Reserv.	to Nevada Test Site					
	Truck	6.04E-02	3.66E-03	8.38E-03	6.02E-02	7.22E-02
	Rail	1.33E-02	1.08E-02	2.50E-04	1.11E-02	2.22E-02
LLW(x) PP to LA						
Pantex Plant	to Los Alamos NL					
	Truck	1.11E-02	7.76E-04	1.77E-03	1.13E-02	1.38E-02
	Rail	4.89E-03	2.18E-03	5.29E-05	4.96E-03	7.19E-03
LLW(x) PP to NT						
Pantex Plant	to Nevada Test Site					
	Truck	3.16E-02	1.43E-03	4.34E-03	3.38E-02	3.96E-02
	Rail	8.62E-03	3.19E-03	1.03E-04	7.72E-03	1.10E-02
LLW(x) PO to NT						
Portsmouth GDP	to Nevada Test Site					
	Truck	6.17E-02	4.18E-03	8.96E-03	6.04E-02	7.36E-02
	Rail	1.29E-02	1.88E-02	3.36E-04	1.09E-02	3.01E-02
LLW(x) PR to NT						
Princeton PPL	to Nevada Test Site					
	Truck	8.05E-02	7.45E-03	1.33E-02	7.34E-02	9.41E-02
	Rail	1.49E-02	3.63E-02	5.93E-04	1.23E-02	4.92E-02
LLW(x) PR to PO						
Princeton PPL	to Portsmouth GDP					
	Truck	2.28E-02	3.55E-03	4.81E-03	1.65E-02	2.48E-02
	Rail	6.38E-03	2.00E-02	2.85E-04	6.06E-03	2.64E-02
LLW(x) PA to NT						
Paducah GDP	to Nevada Test Site					
	Truck	5.22E-02	3.26E-03	7.47E-03	5.22E-02	6.29E-02
	Rail	1.18E-02	9.42E-03	2.18E-04	1.00E-02	1.97E-02
LLW(x) PA to OR						
Paducah GDP	to Oak Ridge Reserv.					
	Truck	8.88E-03	4.70E-04	9.98E-04	8.51E-03	9.98E-03
	Rail	5.08E-03	2.75E-03	5.97E-05	5.10E-03	7.91E-03
LLW(x) PI to SR						
Pinellas Plant	to Savannah River					
	Truck	2.02E-02	1.94E-03	3.10E-03	1.74E-02	2.24E-02
	Rail	4.90E-03	5.13E-03	1.02E-04	4.97E-03	1.02E-02
LLW(x) RF to NT						
Rocky Flats Plant	to Nevada Test Site					
	Truck	2.30E-02	1.44E-03	3.43E-03	2.34E-02	2.83E-02
	Rail	7.00E-03	1.29E-03	6.47E-05	6.52E-03	7.88E-03
LLW(x) RM to NT						
Reactive Metals	to Nevada Test Site					
	Truck	6.33E-02	4.39E-03	9.38E-03	6.20E-02	7.58E-02
	Rail	1.29E-02	2.35E-02	3.91E-04	1.08E-02	3.47E-02
LLW(x) RM to PO						
Reactive Metals	to Portsmouth GDP					
	Truck	1.00E-02	1.18E-03	1.62E-03	7.73E-03	1.05E-02
	Rail	4.05E-03	7.58E-03	1.11E-04	4.34E-03	1.20E-02
LLW(x) ST to HS						
SLAC	to Hanford Site					
	Truck	2.98E-02	3.70E-03	6.08E-03	2.56E-02	3.54E-02
	Rail	7.20E-03	1.75E-02	2.40E-04	6.67E-03	2.44E-02
LLW(x) ST to NT						
SLAC	to Nevada Test Site					
	Truck	2.43E-02	4.05E-03	6.67E-03	2.07E-02	3.14E-02
	Rail	6.48E-03	1.38E-02	1.96E-04	6.13E-03	2.01E-02
LLW(x) SA to LA						
SNL - Albuquerque	to Los Alamos NL					
	Truck	3.28E-03	3.70E-04	6.13E-04	2.86E-03	3.84E-03
	Rail	3.31E-03	1.55E-03	2.36E-05	3.80E-03	5.37E-03

LLW(x) SA to NT						
SNL - Albuquerque	to Nevada Test Site					
	Truck	2.37E-02	1.02E-03	3.18E-03	2.54E-02	2.97E-02
	Rail	7.32E-03	2.85E-03	8.34E-05	6.76E-03	9.69E-03
LLW(x) SL to HS						
SNL - Livermore	to Hanford Site					
	Truck	2.82E-02	2.88E-03	4.92E-03	2.50E-02	3.28E-02
	Rail	6.94E-03	1.38E-02	2.00E-04	6.48E-03	2.05E-02
LLW(x) SL to NT						
SNL - Livermore	to Nevada Test Site					
	Truck	2.05E-02	2.57E-03	4.65E-03	1.90E-02	2.62E-02
	Rail	8.60E-03	5.75E-03	1.20E-04	7.70E-03	1.36E-02
LLW(x) SR to NT						
Savannah River	to Nevada Test Site					
	Truck	7.07E-02	5.10E-03	1.03E-02	6.76E-02	8.30E-02
	Rail	1.47E-02	1.85E-02	3.95E-04	1.22E-02	3.11E-02
LLW(x) OR to NT						
Oak Ridge Reserv.	to Nevada Test Site					
	Truck	6.04E-02	3.66E-03	8.38E-03	6.02E-02	7.22E-02
	Rail	1.33E-02	1.08E-02	2.50E-04	1.11E-02	2.22E-02

Table 4. Accident Dose Risk per Shipment (person-rem/shipment)

Source/Route		Truck	Rail
LLW(x) AL to NT			
Ames Laboratory	to Nevada Test Site	5.25E-06	3.35E-06
LLW(x) AL to PO			
Ames Laboratory	to Portsmouth GDP	9.76E-07	4.06E-07
LLW(x) AN to NT			
Argonne - East	to Nevada Test Site	6.07E-04	2.78E-04
LLW(x) AW to NT			
Argonne - West	to Nevada Test Site	8.61E-01	3.39E-01
LLW(x) BA to NT			
Bettis Atomic	to Nevada Test Site	3.74E-05	4.84E-05
LLW(x) FL to NT			
Fermilab (FNAL)	to Nevada Test Site	4.38E-05	2.26E-05
LLW(x) FL to PO			
Fermilab (FNAL)	to Portsmouth GDP	1.87E-11	4.79E-12
LLW(x) HS to NT			
Hanford Site	to Nevada Test Site	4.27E-04	2.70E-04
LLW(x) IN to NT			
INEL	to Nevada Test Site	3.06E-04	1.25E-04
LLW(x) IT to LA			
ITRI	to Los Alamos NL	4.62E-03	1.69E-04
LLW(x) IT to NT			
ITRI	to Nevada Test Site	9.67E-04	2.47E-04
LLW(x) OR to NT			
Oak Ridge Reserv.	to Nevada Test Site	7.44E-07	3.56E-07
LLW(x) KA to NT			
Knolls Atomic	to Nevada Test Site	5.15E-06	4.05E-06
LLW(x) KC to NT			
Kansas City Plant	to Nevada Test Site	2.46E-05	3.62E-06
LLW(x) LA to NT			
Los Alamos NL	to Nevada Test Site	5.60E-03	1.19E-03
LLW(x) LB to HS			
Lawrence Berkeley	to Hanford Site	6.11E-02	6.81E-02
LLW(x) LB to NT			
Lawrence Berkeley	to Nevada Test Site	7.66E-03	1.04E-02
LLW(x) LL to HS			
Lawrence Livermore	to Hanford Site	1.05E-05	1.33E-05
LLW(x) LL to NT			
Lawrence Livermore	to Nevada Test Site	3.74E-06	2.99E-06
LLW(x) MP to NT			
Mound Plant	to Nevada Test Site	4.37E-06	3.33E-06
LLW(x) MP to PO			
Mound Plant	to Portsmouth GDP	6.85E-08	4.29E-08
LLW(x) OI to NT			
ORISE	to Nevada Test Site	1.33E-06	4.97E-07
LLW(x) OI to OR			
ORISE	to Oak Ridge Reserv.	1.35E-07	3.82E-08
LLW(x) OR to NT			
Oak Ridge Reserv.	to Nevada Test Site	7.44E-07	3.56E-07
LLW(x) PP to LA			
Pantex Plant	to Los Alamos NL	5.67E-07	9.05E-08
LLW(x) PP to NT			
Pantex Plant	to Nevada Test Site	1.72E-06	4.32E-07
LLW(x) PO to NT			
Portsmouth GDP	to Nevada Test Site	2.74E-08	3.02E-08
LLW(x) PR to NT			
Princeton PPL	to Nevada Test Site	1.35E-05	4.56E-06
LLW(x) PR to PO			
Princeton PPL	to Portsmouth GDP	4.35E-11	2.17E-11
LLW(x) PA to NT			
Paducah GDP	to Nevada Test Site	1.00E-06	5.55E-07
LLW(x) PA to OR			
Paducah GDP	to Oak Ridge Reserv.	8.45E-07	3.01E-07
LLW(x) PI to SR			
Pinellas Plant	to Savannah River	1.30E-06	4.65E-07
LLW(x) RF to NT			
Rocky Flats Plant	to Nevada Test Site	4.56E-06	6.93E-07
LLW(x) RM to NT			
Reactive Metals	to Nevada Test Site	1.20E-08	1.19E-08
LLW(x) RM to PO			
Reactive Metals	to Portsmouth GDP	1.34E-08	9.03E-09
LLW(x) ST to HS			
SLAC	to Hanford Site	9.15E-10	5.37E-10
LLW(x) ST to NT			
SLAC	to Nevada Test Site	2.14E-07	3.39E-07

LLW(x) SA to LA			
SNL - Albuquerque	to Los Alamos NL	1.33E-05	2.52E-07
LLW(x) SA to NT			
SNL - Albuquerque	to Nevada Test Site	7.53E-06	2.01E-06
LLW(x) SL to HS			
SNL - Livermore	to Hanford Site	1.07E-04	5.69E-05
LLW(x) SL to NT			
SNL - Livermore	to Nevada Test Site	3.48E-05	2.74E-05
LLW(x) SR to NT			
Savannah River	to Nevada Test Site	5.34E-03	2.62E-03
LLW(x) OR to NT			
Oak Ridge Reserv.	to Nevada Test Site	7.44E-07	3.56E-07

Table 5. Nonradiological Risk Factors per Shipment
(fatalities/shipment)

Mode	Route	Emission	Accident
Truck			
Ames Laboratory	to Nevada Test Site	5.92E-06	9.75E-05
Ames Laboratory	to Portsmouth GDP	4.02E-06	4.11E-05
Argonne - East	to Nevada Test Site	6.02E-06	1.14E-04
Argonne - West	to Nevada Test Site	8.08E-06	4.36E-05
Bettis Atomic	to Nevada Test Site	1.62E-05	1.55E-04
Fermilab (FNAL)	to Nevada Test Site	6.57E-06	1.12E-04
Fermilab (FNAL)	to Portsmouth GDP	8.11E-06	3.01E-05
Hanford Site	to Nevada Test Site	9.50E-06	6.38E-05
INEL	to Nevada Test Site	8.08E-06	4.36E-05
ITRI	to Los Alamos NL	1.51E-06	1.28E-05
ITRI	to Nevada Test Site	4.31E-06	7.08E-05
Oak Ridge Reserv.	to Nevada Test Site	1.08E-05	1.54E-04
Knolls Atomic	to Nevada Test Site	1.75E-05	1.60E-04
Kansas City Plant	to Nevada Test Site	6.44E-06	1.05E-04
Los Alamos NL	to Nevada Test Site	3.54E-06	7.82E-05
Lawrence Berkeley	to Hanford Site	1.16E-05	4.91E-05
Lawrence Berkeley	to Nevada Test Site	1.73E-05	5.39E-05
Lawrence Livermore	to Hanford Site	9.85E-06	5.03E-05
Lawrence Livermore	to Nevada Test Site	1.32E-05	5.15E-05
Mound Plant	to Nevada Test Site	1.27E-05	1.43E-04
Mound Plant	to Portsmouth GDP	2.70E-06	6.66E-06
ORISE	to Nevada Test Site	1.08E-05	1.58E-04
ORISE	to Oak Ridge Reserv.	0.00E+00	1.07E-06
Pantex Plant	to Los Alamos NL	3.28E-06	3.21E-05
Pantex Plant	to Nevada Test Site	6.05E-06	9.02E-05
Portsmouth GDP	to Nevada Test Site	1.29E-05	1.48E-04
Princeton PPL	to Nevada Test Site	2.45E-05	1.82E-04
Princeton PPL	to Portsmouth GDP	1.16E-05	3.99E-05
Paducah GDP	to Nevada Test Site	1.07E-05	1.34E-04
Paducah GDP	to Oak Ridge Reserv.	1.93E-07	2.14E-05
Pinellas Plant	to Savannah River	4.47E-06	4.70E-05
Rocky Flats Plant	to Nevada Test Site	5.50E-06	6.18E-05
Reactive Metals	to Nevada Test Site	1.43E-05	1.36E-04
Reactive Metals	to Portsmouth GDP	2.45E-06	1.21E-05
SLAC	to Hanford Site	1.50E-05	5.14E-05
SLAC	to Nevada Test Site	2.17E-05	5.48E-05
SNL - Albuquerque	to Los Alamos NL	1.35E-06	1.20E-05
SNL - Albuquerque	to Nevada Test Site	4.12E-06	7.01E-05
SNL - Livermore	to Hanford Site	9.85E-06	5.03E-05
SNL - Livermore	to Nevada Test Site	1.32E-05	5.15E-05
Savannah River	to Nevada Test Site	1.43E-05	1.74E-04
Rail			
Ames Laboratory	to Nevada Test Site	6.07E-06	3.50E-06
Ames Laboratory	to Portsmouth GDP	2.34E-05	1.52E-06
Argonne - East	to Nevada Test Site	7.99E-06	4.91E-06
Argonne - West	to Nevada Test Site	3.98E-06	1.58E-06
Bettis Atomic	to Nevada Test Site	4.14E-05	5.22E-06
Fermilab (FNAL)	to Nevada Test Site	9.67E-06	4.18E-06
Fermilab (FNAL)	to Portsmouth GDP	1.80E-05	9.43E-07
Hanford Site	to Nevada Test Site	5.90E-06	2.72E-06
INEL	to Nevada Test Site	3.98E-06	1.58E-06
ITRI	to Los Alamos NL	2.47E-06	2.18E-07
ITRI	to Nevada Test Site	3.85E-06	2.23E-06
Oak Ridge Reserv.	to Nevada Test Site	1.52E-05	5.20E-06
Knolls Atomic	to Nevada Test Site	4.79E-05	5.86E-06
Kansas City Plant	to Nevada Test Site	7.24E-06	3.49E-06
Los Alamos NL	to Nevada Test Site	6.32E-06	2.45E-06
Lawrence Berkeley	to Hanford Site	2.33E-05	2.06E-06
Lawrence Berkeley	to Nevada Test Site	2.59E-05	1.80E-06
Lawrence Livermore	to Hanford Site	2.36E-05	2.04E-06
Lawrence Livermore	to Nevada Test Site	1.01E-05	2.87E-06
Mound Plant	to Nevada Test Site	1.84E-05	4.99E-06
Mound Plant	to Portsmouth GDP	5.73E-06	3.27E-07
ORISE	to Nevada Test Site	1.73E-05	5.29E-06
ORISE	to Oak Ridge Reserv.	1.26E-07	8.26E-08
Pantex Plant	to Los Alamos NL	2.59E-06	1.01E-06
Pantex Plant	to Nevada Test Site	3.98E-06	2.88E-06
Portsmouth GDP	to Nevada Test Site	2.95E-05	5.02E-06
Princeton PPL	to Nevada Test Site	5.45E-05	6.01E-06
Princeton PPL	to Portsmouth GDP	3.18E-05	1.75E-06
Paducah GDP	to Nevada Test Site	1.29E-05	4.46E-06
Paducah GDP	to Oak Ridge Reserv.	3.81E-06	1.10E-06
Pinellas Plant	to Savannah River	5.69E-05	1.01E-06
Rocky Flats Plant	to Nevada Test Site	8.37E-07	2.07E-06

Reactive Metals	to Nevada Test Site	3.72E-05	5.00E-06
Reactive Metals	to Portsmouth GDP	1.14E-05	5.84E-07
SLAC	to Hanford Site	3.07E-05	2.17E-06
SLAC	to Nevada Test Site	2.35E-05	1.80E-06
SNL - Albuquerque	to Los Alamos NL	2.47E-06	2.18E-07
SNL - Albuquerque	to Nevada Test Site	3.85E-06	2.23E-06
SNL - Livermore	to Hanford Site	2.36E-05	2.04E-06
SNL - Livermore	to Nevada Test Site	1.01E-05	2.87E-06
Savannah River	to Nevada Test Site	2.27E-05	5.94E-06

Table 6. Annual Incident-Free Dose for the Shipping Campaign (person-rem/yr)

		Truck		Rail	
Route		Crew	Public	Crew	Public
Ames Laboratory	to Nevada Test Site	8.06E-02	9.92E-02	9.87E-03	1.34E-02
Ames Laboratory	to Portsmouth GDP	2.33E-02	2.63E-02	5.91E-03	2.01E-02
Argonne - East	to Nevada Test Site	5.10E+00	6.20E+00	4.95E-01	6.97E-01
Argonne - West	to Nevada Test Site	2.13E-01	2.58E-01	2.41E-02	3.47E-02
Bettis Atomic	to Nevada Test Site	3.85E+00	4.54E+00	2.79E-01	8.05E-01
Fermilab (FNAL)	to Nevada Test Site	9.63E-02	1.18E-01	1.12E-02	1.71E-02
Fermilab (FNAL)	to Portsmouth GDP	1.68E-02	1.87E-02	4.76E-03	1.58E-02
Hanford Site	to Nevada Test Site	4.39E+01	5.35E+01	4.32E+00	6.24E+00
INEL	to Nevada Test Site	1.75E+01	2.11E+01	1.90E+00	2.73E+00
ITRI	to Los Alamos NL	7.08E-03	8.36E-03	3.31E-03	5.37E-03
ITRI	to Nevada Test Site	2.16E-01	2.70E-01	2.20E-02	2.91E-02
Oak Ridge Reserv.	to Nevada Test Site	3.67E+02	4.38E+02	3.21E+01	5.38E+01
Knolls Atomic	to Nevada Test Site	2.20E+00	2.56E+00	1.60E-01	4.89E-01
Kansas City Plant	to Nevada Test Site	3.84E-02	4.70E-02	9.85E-03	1.37E-02
Los Alamos NL	to Nevada Test Site	5.12E+01	6.34E+01	5.93E+00	8.86E+00
Lawrence Berkeley	to Hanford Site	5.51E-02	6.54E-02	6.99E-03	2.05E-02
Lawrence Berkeley	to Nevada Test Site	4.54E-02	5.82E-02	6.47E-03	2.12E-02
Lawrence Livermore	to Hanford Site	4.79E-01	5.58E-01	4.86E-02	1.43E-01
Lawrence Livermore	to Nevada Test Site	8.22E-01	1.05E+00	1.29E-01	2.03E-01
Mound Plant	to Nevada Test Site	2.89E+01	3.46E+01	2.39E+00	4.60E+00
Mound Plant	to Portsmouth GDP	7.00E-02	7.58E-02	1.77E-02	3.92E-02
ORISE	to Nevada Test Site	2.46E-01	2.93E-01	2.69E-02	4.90E-02
ORISE	to Oak Ridge Reserv.	3.63E-04	3.60E-04	3.05E-03	3.95E-03
Pantex Plant	to Los Alamos NL	1.51E+01	1.87E+01	2.58E+00	3.80E+00
Pantex Plant	to Nevada Test Site	7.89E-01	9.90E-01	8.62E-02	1.10E-01
Portsmouth GDP	to Nevada Test Site	1.82E+02	2.17E+02	1.43E+01	3.33E+01
Princeton PPL	to Nevada Test Site	8.05E-02	9.41E-02	1.49E-02	4.92E-02
Princeton PPL	to Portsmouth GDP	2.28E-02	2.48E-02	6.38E-03	2.64E-02
Paducah GDP	to Nevada Test Site	3.01E+01	3.64E+01	2.53E+00	4.23E+00
Paducah GDP	to Oak Ridge Reserv.	5.06E-01	5.69E-01	1.07E-01	1.66E-01
Pinellas Plant	to Savannah River	4.04E-02	4.48E-02	4.90E-03	1.02E-02
Rocky Flats Plant	to Nevada Test Site	7.71E+00	9.47E+00	8.61E-01	9.69E-01
Reactive Metals	to Nevada Test Site	4.72E+01	5.64E+01	3.64E+00	9.83E+00
Reactive Metals	to Portsmouth GDP	7.02E-02	7.37E-02	1.21E-02	3.61E-02
SLAC	to Hanford Site	2.98E-02	3.54E-02	7.20E-03	2.44E-02
SLAC	to Nevada Test Site	9.46E-01	1.23E+00	9.72E-02	3.02E-01
SNL - Albuquerque	to Los Alamos NL	3.28E-03	3.84E-03	3.31E-03	5.37E-03
SNL - Albuquerque	to Nevada Test Site	4.03E-01	5.04E-01	5.13E-02	6.78E-02
SNL - Livermore	to Hanford Site	2.82E-02	3.28E-02	6.94E-03	2.05E-02
SNL - Livermore	to Nevada Test Site	1.03E-01	1.31E-01	1.72E-02	2.71E-02
Savannah River	to Nevada Test Site	4.77E+02	5.60E+02	3.71E+01	7.85E+01
Totals		1.28E+03	1.53E+03	1.09E+02	2.10E+02

Table 7. Annual Accident Dose Risk for the Shipping Campaign (person-rem/yr)

Route		Truck	Rail
Ames Laboratory	to Nevada Test Site	1.05E-05	3.35E-06
Ames Laboratory	to Portsmouth GDP	9.76E-07	4.06E-07
Argonne - East	to Nevada Test Site	6.37E-02	1.08E-02
Argonne - West	to Nevada Test Site	8.61E+00	1.36E+00
Bettis Atomic	to Nevada Test Site	2.13E-03	1.02E-03
Fermilab (FNAL)	to Nevada Test Site	8.76E-05	2.26E-05
Fermilab (FNAL)	to Portsmouth GDP	1.87E-11	4.79E-12
Hanford Site	to Nevada Test Site	5.82E-01	1.41E-01
INEL	to Nevada Test Site	2.51E-01	3.95E-02
ITRI	to Los Alamos NL	9.23E-03	1.69E-04
ITRI	to Nevada Test Site	8.70E-03	7.41E-04
Oak Ridge Reserv.	to Nevada Test Site	4.51E-03	8.64E-04
Knolls Atomic	to Nevada Test Site	1.44E-04	4.46E-05
Kansas City Plant	to Nevada Test Site	2.46E-05	3.62E-06
Los Alamos NL	to Nevada Test Site	1.10E+01	9.12E-01
Lawrence Berkeley	to Hanford Site	1.22E-01	6.81E-02
Lawrence Berkeley	to Nevada Test Site	1.53E-02	1.04E-02
Lawrence Livermore	to Hanford Site	1.79E-04	9.34E-05
Lawrence Livermore	to Nevada Test Site	1.49E-04	4.49E-05
Mound Plant	to Nevada Test Site	2.17E-03	6.19E-04
Mound Plant	to Portsmouth GDP	8.22E-07	2.15E-07
ORISE	to Nevada Test Site	5.33E-06	9.93E-07
ORISE	to Oak Ridge Reserv.	1.35E-07	3.82E-08
Pantex Plant	to Los Alamos NL	7.70E-04	4.78E-05
Pantex Plant	to Nevada Test Site	4.29E-05	4.32E-06
Portsmouth GDP	to Nevada Test Site	8.08E-05	3.34E-05
Princeton PPL	to Nevada Test Site	1.35E-05	4.56E-06
Princeton PPL	to Portsmouth GDP	4.35E-11	2.17E-11
Paducah GDP	to Nevada Test Site	5.80E-04	1.19E-04
Paducah GDP	to Oak Ridge Reserv.	4.82E-05	6.32E-06
Pinellas Plant	to Savannah River	2.59E-06	4.65E-07
Rocky Flats Plant	to Nevada Test Site	1.53E-03	8.53E-05
Reactive Metals	to Nevada Test Site	8.98E-06	3.38E-06
Reactive Metals	to Portsmouth GDP	9.38E-08	2.71E-08
SLAC	to Hanford Site	9.15E-10	5.37E-10
SLAC	to Nevada Test Site	8.33E-06	5.08E-06
SNL - Albuquerque	to Los Alamos NL	1.33E-05	2.52E-07
SNL - Albuquerque	to Nevada Test Site	1.28E-04	1.40E-05
SNL - Livermore	to Hanford Site	1.07E-04	5.69E-05
SNL - Livermore	to Nevada Test Site	1.74E-04	5.48E-05
Savannah River	to Nevada Test Site	3.61E+01	6.62E+00
Totals		5.67E+01	9.16E+00

Table 8. Expected Annual Fatalities for the Shipping Campaign

Exposure Group	Truck	Rail
Radiological		
Normal Crew	5.1E-01	4.4E-02
Normal Public	7.6E-01	1.1E-01
Accident Public	2.8E-02	4.6E-03
Nonradiological		
Emission	2.6E-01	1.6E-01
Accident	3.2E+00	4.2E-02

Table 9. Expected Annual Cancer Incidence for the Shipping Campaign

Exposure Group	Truck	Rail
Radiological		
Normal Crew	1.8E+00	1.5E-01
Normal Public	2.6E+00	3.6E-01
Accident Public	9.6E-02	1.6E-02
Nonradiological		
Emission	2.6E-01	1.6E-01
Accident	NA	NA

Table 10. Expected Annual Genetic Effects for the Shipping Campaign

Exposure Group	Truck	Rail
Radiological		
Normal Crew	7.7E-02	6.6E-03
Normal Public	1.5E-01	2.1E-02
Accident Public	5.4E-03	8.6E-04
Nonradiological		
Emission	NA	NA
Accident	NA	NA

B.26 WM LLW CENTRALIZED 4 ALTERNATIVE (CASE 14A): ACTIVATED METALS

Table 1. Summary of Route Information

Route		Distance (miles)	Percentage in Zone		
			Rural	Suburban	Urban
Truck					
Bettis Atomic	to Portsmouth GDP	265	58.8	37.4	3.8
Fermilab (FNAL)	to Portsmouth GDP	460	62.5	32.0	5.5
Hanford Site	to Nevada Test Site	1128	86.5	10.9	2.6
INEL	to Nevada Test Site	712	82.8	13.7	3.5
Knolls Atomic	to Portsmouth GDP	688	57.3	40.1	2.5
Los Alamos NL	to Nevada Test Site	997	93.2	5.7	1.1
Lawrence Berkeley	to Hanford Site	875	78.1	17.8	4.1
Portsmouth GDP	to Nevada Test Site	2158	85.5	12.6	1.9
SNL - Albuquerque	to Los Alamos NL	102	75.8	20.1	4.1
Rail					
Bettis Atomic	to Portsmouth GDP	429	52.6	39.6	7.8
Fermilab (FNAL)	to Portsmouth GDP	451	61.5	28.9	9.5
Hanford Site	to Nevada Test Site	1302	93.0	5.9	1.1
INEL	to Nevada Test Site	756	92.8	5.9	1.3
Knolls Atomic	to Portsmouth GDP	681	52.1	40.3	7.5
Los Alamos NL	to Nevada Test Site	1169	92.8	5.9	1.3
Lawrence Berkeley	to Hanford Site	986	78.5	15.8	5.7
Portsmouth GDP	to Nevada Test Site	2401	86.3	10.7	2.9
SNL - Albuquerque	to Los Alamos NL	104	74.3	20.0	5.7

Table 2. Annual Number of Shipments and One-Way Shipment Distances

Route		# of Shipments		Total Mileage(mi)	
		Truck	Rail	Truck	Rail
Bettis Atomic	to Portsmouth GDP	309	119	8.19E+04	5.11E+04
Fermilab (FNAL)	to Portsmouth GDP	39	16	1.79E+04	7.21E+03
Hanford Site	to Nevada Test Site	37	16	4.17E+04	2.08E+04
INEL	to Nevada Test Site	365	157	2.60E+05	1.19E+05
Knolls Atomic	to Portsmouth GDP	639	245	4.40E+05	1.67E+05
Los Alamos NL	to Nevada Test Site	332	143	3.31E+05	1.67E+05
Lawrence Berkeley	to Hanford Site	14	6	1.22E+04	5.91E+03
Portsmouth GDP	to Nevada Test Site	785	337	1.69E+06	8.09E+05
SNL - Albuquerque	to Los Alamos NL	6	3	6.12E+02	3.12E+02
Totals		2526	1042	2.88E+06	1.35E+06

Table 3. Incident-Free Dose per Shipment (person-rem/shipment)

Source/Route(s)		Crew	General Public Off-Link	On-Link	Stops	Total
LLW(I) BA to PO Bettis Atomic	to Portsmouth GDP					
	Truck	9.78E-03	1.26E-03	1.73E-03	7.42E-03	1.04E-02
	Rail	4.67E-03	9.85E-03	1.53E-04	4.80E-03	1.48E-02
LLW(I) FL to PO Fermilab (FNAL)	to Portsmouth GDP					
	Truck	1.68E-02	2.40E-03	3.43E-03	1.29E-02	1.87E-02
	Rail	4.76E-03	1.08E-02	1.48E-04	4.87E-03	1.58E-02
LLW(I) HS to NT Hanford Site	to Nevada Test Site					
	Truck	3.22E-02	2.46E-03	5.18E-03	3.16E-02	3.92E-02
	Rail	8.31E-03	4.39E-03	1.15E-04	7.49E-03	1.20E-02
LLW(I) IN to NT INEL	to Nevada Test Site					
	Truck	2.13E-02	2.03E-03	3.79E-03	1.99E-02	2.58E-02
	Rail	6.04E-03	2.80E-03	6.88E-05	5.81E-03	8.67E-03
LLW(I) KA to PO Knolls Atomic	to Portsmouth GDP					
	Truck	2.54E-02	2.99E-03	4.01E-03	1.93E-02	2.63E-02
	Rail	5.72E-03	1.54E-02	2.43E-04	5.58E-03	2.13E-02
LLW(I) LA to NT Los Alamos NL	to Nevada Test Site					
	Truck	2.61E-02	1.04E-03	3.33E-03	2.79E-02	3.23E-02
	Rail	7.76E-03	4.40E-03	1.07E-04	7.08E-03	1.16E-02
LLW(I) LB to HS Lawrence Berkeley	to Hanford Site					
	Truck	2.76E-02	3.02E-03	5.17E-03	2.45E-02	3.27E-02
	Rail	6.99E-03	1.38E-02	2.03E-04	6.51E-03	2.05E-02
LLW(I) PO to NT Portsmouth GDP	to Nevada Test Site					
	Truck	6.17E-02	4.18E-03	8.96E-03	6.04E-02	7.36E-02
	Rail	1.29E-02	1.88E-02	3.36E-04	1.09E-02	3.01E-02
LLW(I) SA to LA SNL - Albuquerque	to Los Alamos NL					
	Truck	3.28E-03	3.70E-04	6.13E-04	2.86E-03	3.84E-03
	Rail	3.31E-03	1.55E-03	2.36E-05	3.80E-03	5.37E-03

Table 4. Accident Dose Risk per Shipment (person-rem/shipment)

Source/Route		Truck	Rail
LLW(I) BA to PO Bettis Atomic	to Portsmouth GDP	3.70E-07	4.16E-07
LLW(I) FL to PO Fermilab (FNAL)	to Portsmouth GDP	5.29E-11	3.35E-11
LLW(I) HS to NT Hanford Site	to Nevada Test Site	2.43E-08	1.28E-08
LLW(I) IN to NT INEL	to Nevada Test Site	1.52E-07	5.55E-08
LLW(I) KA to PO Knolls Atomic	to Portsmouth GDP	1.66E-06	1.02E-06
LLW(I) LA to NT Los Alamos NL	to Nevada Test Site	2.25E-09	3.42E-10
LLW(I) LB to HS Lawrence Berkeley	to Hanford Site	1.81E-10	2.37E-10
LLW(I) PO to NT Portsmouth GDP	to Nevada Test Site	2.31E-06	1.73E-06
LLW(I) SA to LA SNL - Albuquerque	to Los Alamos NL	1.72E-12	6.51E-14

Table 5. Nonradiological Risk Factors per Shipment (fatalities/shipment)

Mode	Route	Emission	Accident
Truck			
Bettis Atomic	to Portsmouth GDP	3.22E-06	1.33E-05
Fermilab (FNAL)	to Portsmouth GDP	8.11E-06	3.01E-05
Hanford Site	to Nevada Test Site	9.50E-06	6.38E-05
INEL	to Nevada Test Site	8.08E-06	4.36E-05
Knolls Atomic	to Portsmouth GDP	5.63E-06	3.56E-05
Los Alamos NL	to Nevada Test Site	3.54E-06	7.82E-05
Lawrence Berkeley	to Hanford Site	1.16E-05	4.91E-05
Portsmouth GDP	to Nevada Test Site	1.29E-05	1.48E-04
SNL - Albuquerque	to Los Alamos NL	1.35E-06	1.20E-05
Rail			
Bettis Atomic	to Portsmouth GDP	1.40E-05	8.98E-07
Fermilab (FNAL)	to Portsmouth GDP	1.80E-05	9.43E-07
Hanford Site	to Nevada Test Site	5.90E-06	2.72E-06
INEL	to Nevada Test Site	3.98E-06	1.58E-06
Knolls Atomic	to Portsmouth GDP	2.15E-05	1.43E-06
Los Alamos NL	to Nevada Test Site	6.32E-06	2.45E-06
Lawrence Berkeley	to Hanford Site	2.33E-05	2.06E-06
Portsmouth GDP	to Nevada Test Site	2.95E-05	5.02E-06
SNL - Albuquerque	to Los Alamos NL	2.47E-06	2.18E-07

Table 6. Annual Incident-Free Dose for the Shipping Campaign (person-rem/yr)

Route		Truck		Rail	
		Crew	Public	Crew	Public
Bettis Atomic	to Portsmouth GDP	3.02E+00	3.22E+00	5.56E-01	1.76E+00
Fermilab (FNAL)	to Portsmouth GDP	6.54E-01	7.30E-01	7.62E-02	2.53E-01
Hanford Site	to Nevada Test Site	1.19E+00	1.45E+00	1.33E-01	1.92E-01
INEL	to Nevada Test Site	7.78E+00	9.40E+00	9.48E-01	1.36E+00
Knolls Atomic	to Portsmouth GDP	1.62E+01	1.68E+01	1.40E+00	5.21E+00
Los Alamos NL	to Nevada Test Site	8.66E+00	1.07E+01	1.11E+00	1.66E+00
Lawrence Berkeley	to Hanford Site	3.86E-01	4.58E-01	4.20E-02	1.23E-01
Portsmouth GDP	to Nevada Test Site	4.84E+01	5.77E+01	4.35E+00	1.01E+01
SNL - Albuquerque	to Los Alamos NL	1.97E-02	2.30E-02	9.94E-03	1.61E-02
Totals		8.64E+01	1.01E+02	8.62E+00	2.07E+01

Table 7. Annual Accident Dose Risk for the Shipping Campaign (person-rem/yr)

Route		Truck	Rail
Bettis Atomic	to Portsmouth GDP	1.14E-04	4.95E-05
Fermilab (FNAL)	to Portsmouth GDP	2.06E-09	5.35E-10
Hanford Site	to Nevada Test Site	8.98E-07	2.05E-07
INEL	to Nevada Test Site	5.56E-05	8.72E-06
Knolls Atomic	to Portsmouth GDP	1.06E-03	2.49E-04
Los Alamos NL	to Nevada Test Site	7.46E-07	4.88E-08
Lawrence Berkeley	to Hanford Site	2.53E-09	1.42E-09
Portsmouth GDP	to Nevada Test Site	1.81E-03	5.81E-04
SNL - Albuquerque	to Los Alamos NL	1.03E-11	1.95E-13
Totals		3.04E-03	8.89E-04

Table 8. Expected Annual Fatalities for the Shipping Campaign

Exposure Group	Truck	Rail
Radiological		
Normal Crew	3.5E-02	3.4E-03
Normal Public	5.0E-02	1.0E-02
Accident Public	1.5E-06	4.4E-07
Nonradiological		
Emission	2.0E-02	1.9E-02
Accident	1.9E-01	2.8E-03

Table 9. Expected Annual Cancer Incidence for the Shipping Campaign

Exposure Group	Truck	Rail
Radiological		
Normal Crew	1.2E-01	1.2E-02
Normal Public	1.7E-01	3.5E-02
Accident Public	5.2E-06	1.5E-06
Nonradiological		
Emission	2.0E-02	1.9E-02
Accident	NA	NA

Table 10. Expected Annual Genetic Effects for the Shipping Campaign

Exposure Group	Truck	Rail
Radiological		
Normal Crew	5.2E-03	5.2E-04
Normal Public	1.0E-02	2.1E-03
Accident Public	3.0E-07	8.9E-08
Nonradiological		
Emission	NA	NA
Accident	NA	NA

B.27 WM LLW CENTRALIZED 5 ALTERNATIVE (CASE 21): HETEROGENEOUS SOLIDS

Table 1. Summary of Route Information

Route		Distance (miles)	Percentage in Zone		
			Rural	Suburban	Urban
Truck					
Ames Laboratory	to Hanford Site	1703	92.6	6.6	0.8
Argonne - East	to Hanford Site	1998	91.5	7.8	0.7
Argonne - West	to Hanford Site	599	91.3	7.6	1.1
Bettis Atomic	to Hanford Site	2541	85.8	12.8	1.4
Fermilab (FNAL)	to Hanford Site	1975	92.2	7.1	0.8
INEL	to Hanford Site	599	91.3	7.6	1.1
ITRI	to Hanford Site	1593	89.7	8.8	1.5
Oak Ridge Reserv.	to Hanford Site	2464	87.8	11.0	1.2
Knolls Atomic	to Hanford Site	2809	82.1	16.1	1.8
Kansas City Plant	to Hanford Site	1741	91.5	7.6	0.9
Los Alamos NL	to Hanford Site	1560	89.8	8.8	1.3
Lawrence Berkeley	to Hanford Site	875	78.1	17.8	4.1
Lawrence Livermore	to Hanford Site	894	77.2	19.3	3.4
Mound Plant	to Hanford Site	2291	88.6	10.3	1.1
ORISE	to Hanford Site	2492	87.4	11.4	1.2
Pantex Plant	to Hanford Site	1884	90.4	8.0	1.5
Portsmouth GDP	to Hanford Site	2402	88.0	11.0	1.0
Princeton PPL	to Hanford Site	2864	82.0	15.9	2.1
Paducah GDP	to Hanford Site	2182	88.7	10.0	1.3
Pinellas Plant	to Hanford Site	3033	83.9	14.6	1.5
Rocky Flats Plant	to Hanford Site	1132	91.9	7.3	0.8
Reactive Metals	to Hanford Site	2398	86.6	11.7	1.6
SLAC	to Hanford Site	916	75.9	19.0	5.1
SNL - Albuquerque	to Hanford Site	1584	89.7	8.8	1.4
SNL - Livermore	to Hanford Site	894	77.2	19.3	3.4
Savannah River	to Hanford Site	2727	84.3	14.2	1.5
Rail					
Ames Laboratory	to Hanford Site	1788	93.7	5.6	0.7
Argonne - East	to Hanford Site	2200	93.3	6.0	0.7
Argonne - West	to Hanford Site	658	91.4	7.1	1.4
Bettis Atomic	to Hanford Site	2611	81.2	15.1	3.7
Fermilab (FNAL)	to Hanford Site	1971	89.9	8.6	1.4
INEL	to Hanford Site	658	91.4	7.1	1.4
ITRI	to Hanford Site	1793	91.7	7.1	1.2
Oak Ridge Reserv.	to Hanford Site	2601	91.2	7.4	1.3
Knolls Atomic	to Hanford Site	2914	79.1	17.0	3.9
Kansas City Plant	to Hanford Site	1784	94.1	5.0	0.9
Los Alamos NL	to Hanford Site	1725	92.5	6.5	0.9
Lawrence Berkeley	to Hanford Site	986	78.5	15.8	5.7
Lawrence Livermore	to Hanford Site	973	78.9	15.3	5.8
Mound Plant	to Hanford Site	2472	87.0	11.2	1.9
ORISE	to Hanford Site	2644	89.0	9.5	1.5
Pantex Plant	to Hanford Site	1686	92.0	7.1	1.0
Portsmouth GDP	to Hanford Site	2515	86.4	10.8	2.7
Princeton PPL	to Hanford Site	2985	76.6	19.0	4.3
Paducah GDP	to Hanford Site	2245	90.8	7.9	1.3
Pinellas Plant	to Hanford Site	3267	82.8	15.4	1.8
Rocky Flats Plant	to Hanford Site	1284	93.1	5.5	1.4
Reactive Metals	to Hanford Site	2505	83.4	13.1	3.5
SLAC	to Hanford Site	1036	76.1	16.8	7.1
SNL - Albuquerque	to Hanford Site	1793	91.7	7.1	1.2
SNL - Livermore	to Hanford Site	973	78.9	15.3	5.8
Savannah River	to Hanford Site	2953	84.7	13.5	1.8

Table 2. Annual Number of Shipments and One-Way Shipment Distances

Route		# of Shipments		Total Mileage(mi)	
		Truck	Rail	Truck	Rail
Ames Laboratory	to Hanford Site	2	1	3.41E+03	1.79E+03
Argonne - East	to Hanford Site	105	39	2.10E+05	8.58E+04
Argonne - West	to Hanford Site	13	5	7.79E+03	3.29E+03
Bettis Atomic	to Hanford Site	57	21	1.45E+05	5.48E+04
Fermilab (FNAL)	to Hanford Site	3	1	5.92E+03	1.97E+03
INEL	to Hanford Site	857	320	5.13E+05	2.11E+05
ITRI	to Hanford Site	10	4	1.59E+04	7.17E+03
Oak Ridge Reserv.	to Hanford Site	6584	2489	1.62E+07	6.47E+06
Knolls Atomic	to Hanford Site	28	11	7.87E+04	3.21E+04
Kansas City Plant	to Hanford Site	1	1	1.74E+03	1.78E+03
Los Alamos NL	to Hanford Site	710	265	1.11E+06	4.57E+05
Lawrence Berkeley	to Hanford Site	3	2	2.62E+03	1.97E+03
Lawrence Livermore	to Hanford Site	56	21	5.01E+04	2.04E+04
Mound Plant	to Hanford Site	516	190	1.18E+06	4.70E+05
ORISE	to Hanford Site	5	2	1.25E+04	5.29E+03
Pantex Plant	to Hanford Site	1418	537	2.67E+06	9.06E+05
Portsmouth GDP	to Hanford Site	3250	1250	7.81E+06	3.14E+06
Princeton PPL	to Hanford Site	1	1	2.86E+03	2.98E+03
Paducah GDP	to Hanford Site	627	235	1.37E+06	5.28E+05
Pinellas Plant	to Hanford Site	2	1	6.07E+03	3.27E+03
Rocky Flats Plant	to Hanford Site	353	132	3.99E+05	1.70E+05
Reactive Metals	to Hanford Site	761	285	1.82E+06	7.14E+05
SLAC	to Hanford Site	39	15	3.57E+04	1.55E+04
SNL - Albuquerque	to Hanford Site	17	7	2.69E+04	1.26E+04
SNL - Livermore	to Hanford Site	5	2	4.47E+03	1.95E+03
Savannah River	to Hanford Site	6854	2532	1.87E+07	7.48E+06
Totals		22277	8369	5.24E+07	2.08E+07

Table 3. Incident-Free Dose per Shipment (person-rem/shipment)

Source/Route(s)		Crew	General Public			
			Off-Link	On-Link	Stops	Total
LLW(x) AL to HS						
Ames Laboratory	to Hanford Site					
	Truck	4.46E-02	1.62E-03	5.39E-03	4.77E-02	5.47E-02
	Rail	1.03E-02	4.69E-03	1.46E-04	8.98E-03	1.38E-02
LLW(x) AN to HS						
Argonne - East	to Hanford Site					
	Truck	5.29E-02	1.97E-03	6.28E-03	5.59E-02	6.42E-02
	Rail	1.21E-02	5.75E-03	1.82E-04	1.03E-02	1.62E-02
LLW(x) AW to HS						
Argonne - West	to Hanford Site					
	Truck	1.60E-02	7.18E-04	2.06E-03	1.68E-02	1.95E-02
	Rail	5.63E-03	2.83E-03	6.58E-05	5.51E-03	8.40E-03
LLW(x) BA to HS						
Bettis Atomic	to Hanford Site					
	Truck	7.21E-02	4.36E-03	9.77E-03	7.11E-02	8.53E-02
	Rail	1.38E-02	2.67E-02	4.53E-04	1.15E-02	3.87E-02
LLW(x) FL to HS						
Fermilab (FNAL)	to Hanford Site					
	Truck	5.20E-02	1.92E-03	6.25E-03	5.53E-02	6.35E-02
	Rail	1.11E-02	9.07E-03	2.12E-04	9.55E-03	1.88E-02
LLW(x) IN to HS						
INEL	to Hanford Site					
	Truck	1.60E-02	7.18E-04	2.06E-03	1.68E-02	1.95E-02
	Rail	5.63E-03	2.83E-03	6.58E-05	5.51E-03	8.40E-03
LLW(x) IT to HS						
ITRI	to Hanford Site					
	Truck	4.34E-02	2.30E-03	5.91E-03	4.46E-02	5.28E-02
	Rail	1.04E-02	6.90E-03	1.72E-04	9.00E-03	1.61E-02
LLW(x) OR to HS						
Oak Ridge Reserv.	to Hanford Site					
	Truck	6.83E-02	3.65E-03	8.95E-03	6.90E-02	8.16E-02
	Rail	1.37E-02	1.08E-02	2.59E-04	1.15E-02	2.26E-02
LLW(x) KA to HS						
Knolls Atomic	to Hanford Site					
	Truck	8.30E-02	6.03E-03	1.19E-02	7.87E-02	9.66E-02
	Rail	1.50E-02	3.18E-02	5.40E-04	1.25E-02	4.48E-02
LLW(x) KC to HS						
Kansas City Plant	to Hanford Site					
	Truck	4.62E-02	1.90E-03	5.74E-03	4.87E-02	5.64E-02
	Rail	1.03E-02	5.00E-03	1.44E-04	8.97E-03	1.41E-02
LLW(x) LA to HS						
Los Alamos NL	to Hanford Site					
	Truck	4.24E-02	2.16E-03	5.65E-03	4.37E-02	5.15E-02
	Rail	1.01E-02	5.60E-03	1.54E-04	8.79E-03	1.45E-02
LLW(x) LB to HS						
Lawrence Berkeley	to Hanford Site					
	Truck	2.76E-02	3.02E-03	5.17E-03	2.45E-02	3.27E-02
	Rail	6.99E-03	1.38E-02	2.03E-04	6.51E-03	2.05E-02
LLW(x) LL to HS						
Lawrence Livermore	to Hanford Site					
	Truck	2.82E-02	2.88E-03	4.92E-03	2.50E-02	3.28E-02
	Rail	6.94E-03	1.38E-02	2.00E-04	6.48E-03	2.05E-02
LLW(x) MP to HS						
Mound Plant	to Hanford Site					
	Truck	6.29E-02	3.13E-03	8.05E-03	6.41E-02	7.53E-02
	Rail	1.32E-02	1.47E-02	3.13E-04	1.11E-02	2.61E-02
LLW(x) OI to HS						
ORISE	to Hanford Site					
	Truck	6.94E-02	3.76E-03	9.08E-03	6.98E-02	8.26E-02
	Rail	1.39E-02	1.30E-02	2.98E-04	1.16E-02	2.49E-02
LLW(x) OR to HS						
Oak Ridge Reserv.	to Hanford Site					
	Truck	6.83E-02	3.65E-03	8.95E-03	6.90E-02	8.16E-02
	Rail	1.37E-02	1.08E-02	2.59E-04	1.15E-02	2.26E-02
LLW(x) PP to HS						
Pantex Plant	to Hanford Site					
	Truck	5.10E-02	2.68E-03	7.01E-03	5.27E-02	6.24E-02
	Rail	9.92E-03	5.71E-03	1.56E-04	8.67E-03	1.45E-02
LLW(x) PO to HS						
Portsmouth GDP	to Hanford Site					
	Truck	6.63E-02	3.38E-03	8.48E-03	6.72E-02	7.91E-02
	Rail	1.34E-02	1.89E-02	3.46E-04	1.12E-02	3.04E-02

LLW(x) PR to HS						
Princeton PPL	to Hanford Site					
	Truck	8.51E-02	6.65E-03	1.28E-02	8.02E-02	9.97E-02
	Rail	1.53E-02	3.63E-02	6.03E-04	1.27E-02	4.96E-02
LLW(x) PA to HS						
Paducah GDP	to Hanford Site					
	Truck	6.00E-02	3.22E-03	8.02E-03	6.11E-02	7.23E-02
	Rail	1.22E-02	9.43E-03	2.28E-04	1.04E-02	2.01E-02
LLW(x) PI to HS						
Pinellas Plant	to Hanford Site					
	Truck	8.77E-02	5.74E-03	1.21E-02	8.49E-02	1.03E-01
	Rail	1.65E-02	2.19E-02	4.79E-04	1.35E-02	3.59E-02
LLW(x) RF to HS						
Rocky Flats Plant	to Hanford Site					
	Truck	2.99E-02	1.13E-03	3.61E-03	3.17E-02	3.64E-02
	Rail	8.24E-03	4.91E-03	1.16E-04	7.43E-03	1.25E-02
LLW(x) RM to HS						
Reactive Metals	to Hanford Site					
	Truck	6.76E-02	4.22E-03	9.51E-03	6.71E-02	8.09E-02
	Rail	1.33E-02	2.35E-02	4.01E-04	1.12E-02	3.51E-02
LLW(x) ST to HS						
SLAC	to Hanford Site					
	Truck	2.98E-02	3.70E-03	6.08E-03	2.56E-02	3.54E-02
	Rail	7.20E-03	1.75E-02	2.40E-04	6.67E-03	2.44E-02
LLW(x) SA to HS						
SNL - Albuquerque	to Hanford Site					
	Truck	4.31E-02	2.27E-03	5.84E-03	4.43E-02	5.24E-02
	Rail	1.04E-02	6.90E-03	1.72E-04	9.00E-03	1.61E-02
LLW(x) SL to HS						
SNL - Livermore	to Hanford Site					
	Truck	2.82E-02	2.88E-03	4.92E-03	2.50E-02	3.28E-02
	Rail	6.94E-03	1.38E-02	2.00E-04	6.48E-03	2.05E-02
LLW(x) SR to HS						
Savannah River	to Hanford Site					
	Truck	7.86E-02	5.10E-03	1.08E-02	7.64E-02	9.23E-02
	Rail	1.52E-02	1.85E-02	4.05E-04	1.26E-02	3.15E-02
LLW(x) OR to HS						
Oak Ridge Reserv.	to Hanford Site					
	Truck	6.83E-02	3.65E-03	8.95E-03	6.90E-02	8.16E-02
	Rail	1.37E-02	1.08E-02	2.59E-04	1.15E-02	2.26E-02

Table 4. Accident Dose Risk per Shipment (person-rem/shipment)

Source/Route		Truck	Rail
LLW(x) AL to HS Ames Laboratory	to Hanford Site	5.20E-06	3.93E-06
LLW(x) AN to HS Argonne - East	to Hanford Site	5.56E-04	3.40E-04
LLW(x) AW to HS Argonne - West	to Hanford Site	2.45E-01	3.44E-01
LLW(x) BA to HS Bettis Atomic	to Hanford Site	4.46E-05	5.00E-05
LLW(x) FL to HS Fermilab (FNAL)	to Hanford Site	2.24E-05	2.22E-05
LLW(x) IN to HS INEL	to Hanford Site	1.09E-04	1.57E-04
LLW(x) IT to HS ITRI	to Hanford Site	5.50E-03	1.57E-03
LLW(x) OR to HS Oak Ridge Reserv.	to Hanford Site	3.63E-07	1.97E-07
LLW(x) KA to HS Knolls Atomic	to Hanford Site	4.90E-06	4.19E-06
LLW(x) KC to HS Kansas City Plant	to Hanford Site	2.32E-05	4.82E-06
LLW(x) LA to HS Los Alamos NL	to Hanford Site	2.79E-02	9.49E-03
LLW(x) LB to HS Lawrence Berkeley	to Hanford Site	5.07E-02	4.24E-02
LLW(x) LL to HS Lawrence Livermore	to Hanford Site	9.20E-06	1.28E-05
LLW(x) MP to HS Mound Plant	to Hanford Site	5.83E-06	3.53E-06
LLW(x) OI to HS ORISE	to Hanford Site	2.64E-06	1.38E-06
LLW(x) OR to HS Oak Ridge Reserv.	to Hanford Site	3.63E-07	1.97E-07
LLW(x) PP to HS Pantex Plant	to Hanford Site	1.67E-06	5.03E-07
LLW(x) PO to HS Portsmouth GDP	to Hanford Site	2.62E-08	2.70E-08
LLW(x) PR to HS Princeton PPL	to Hanford Site	1.28E-05	4.69E-06
LLW(x) PA to HS Paducah GDP	to Hanford Site	1.17E-06	7.40E-07
LLW(x) PI to HS Pinellas Plant	to Hanford Site	6.86E-06	3.00E-06
LLW(x) RF to HS Rocky Flats Plant	to Hanford Site	3.48E-06	2.51E-06
LLW(x) RM to HS Reactive Metals	to Hanford Site	1.17E-08	1.30E-08
LLW(x) ST to HS SLAC	to Hanford Site	4.30E-07	6.58E-07
LLW(x) SA to HS SNL - Albuquerque	to Hanford Site	2.28E-05	7.55E-06
LLW(x) SL to HS SNL - Livermore	to Hanford Site	1.06E-04	1.40E-04
LLW(x) SR to HS Savannah River	to Hanford Site	5.05E-03	2.74E-03
LLW(x) OR to HS Oak Ridge Reserv.	to Hanford Site	3.63E-07	1.97E-07

Table 5. Nonradiological Risk Factors per Shipment (fatalities/shipment)

Mode	Route	Emission	Accident
Truck			
Ames Laboratory	to Hanford Site	4.31E-06	8.93E-05
Argonne - East	to Hanford Site	4.41E-06	1.06E-04
Argonne - West	to Hanford Site	2.19E-06	3.07E-05
Bettis Atomic	to Hanford Site	1.14E-05	1.36E-04
Fermilab (FNAL)	to Hanford Site	4.86E-06	1.03E-04
INEL	to Hanford Site	2.19E-06	3.07E-05
ITRI	to Hanford Site	7.44E-06	1.05E-04
Oak Ridge Reserv.	to Hanford Site	9.50E-06	1.61E-04
Knolls Atomic	to Hanford Site	1.59E-05	1.51E-04
Kansas City Plant	to Hanford Site	5.18E-06	1.12E-04
Los Alamos NL	to Hanford Site	6.66E-06	1.02E-04
Lawrence Berkeley	to Hanford Site	1.16E-05	4.91E-05
Lawrence Livermore	to Hanford Site	9.85E-06	5.03E-05
Mound Plant	to Hanford Site	7.89E-06	1.23E-04
ORISE	to Hanford Site	9.50E-06	1.65E-04
Pantex Plant	to Hanford Site	9.21E-06	1.25E-04
Portsmouth GDP	to Hanford Site	8.11E-06	1.28E-04
Princeton PPL	to Hanford Site	1.97E-05	1.63E-04
Paducah GDP	to Hanford Site	9.30E-06	1.41E-04
Pinellas Plant	to Hanford Site	1.43E-05	2.03E-04
Rocky Flats Plant	to Hanford Site	2.83E-06	6.69E-05
Reactive Metals	to Hanford Site	1.27E-05	1.28E-04
SLAC	to Hanford Site	1.50E-05	5.14E-05
SNL - Albuquerque	to Hanford Site	7.24E-06	1.05E-04
SNL - Livermore	to Hanford Site	9.85E-06	5.03E-05
Savannah River	to Hanford Site	1.31E-05	1.81E-04
Rail			
Ames Laboratory	to Hanford Site	5.40E-06	3.74E-06
Argonne - East	to Hanford Site	6.15E-06	4.60E-06
Argonne - West	to Hanford Site	3.98E-06	1.38E-06
Bettis Atomic	to Hanford Site	4.07E-05	5.46E-06
Fermilab (FNAL)	to Hanford Site	1.18E-05	4.12E-06
INEL	to Hanford Site	3.98E-06	1.38E-06
ITRI	to Hanford Site	9.04E-06	3.75E-06
Oak Ridge Reserv.	to Hanford Site	1.45E-05	5.44E-06
Knolls Atomic	to Hanford Site	4.72E-05	6.10E-06
Kansas City Plant	to Hanford Site	6.57E-06	3.73E-06
Los Alamos NL	to Hanford Site	6.82E-06	3.61E-06
Lawrence Berkeley	to Hanford Site	2.33E-05	2.06E-06
Lawrence Livermore	to Hanford Site	2.36E-05	2.04E-06
Mound Plant	to Hanford Site	1.94E-05	5.17E-06
ORISE	to Hanford Site	1.67E-05	5.53E-06
Pantex Plant	to Hanford Site	6.78E-06	3.53E-06
Portsmouth GDP	to Hanford Site	2.88E-05	5.26E-06
Princeton PPL	to Hanford Site	5.38E-05	6.24E-06
Paducah GDP	to Hanford Site	1.23E-05	4.70E-06
Pinellas Plant	to Hanford Site	2.47E-05	6.83E-06
Rocky Flats Plant	to Hanford Site	7.36E-06	2.69E-06
Reactive Metals	to Hanford Site	3.65E-05	5.24E-06
SLAC	to Hanford Site	3.07E-05	2.17E-06
SNL - Albuquerque	to Hanford Site	9.04E-06	3.75E-06
SNL - Livermore	to Hanford Site	2.36E-05	2.04E-06
Savannah River	to Hanford Site	2.21E-05	6.18E-06

Table 6. Annual Incident-Free Dose for the Shipping Campaign (person-rem/yr)

Route		Truck		Rail	
		Crew	Public	Crew	Public
Ames Laboratory	to Hanford Site	8.93E-02	1.09E-01	1.03E-02	1.38E-02
Argonne - East	to Hanford Site	5.55E+00	6.74E+00	4.70E-01	6.31E-01
Argonne - West	to Hanford Site	2.08E-01	2.54E-01	2.81E-02	4.20E-02
Bettis Atomic	to Hanford Site	4.11E+00	4.86E+00	2.89E-01	8.13E-01
Fermilab (FNAL)	to Hanford Site	1.56E-01	1.90E-01	1.11E-02	1.88E-02
INEL	to Hanford Site	1.37E+01	1.68E+01	1.80E+00	2.69E+00
ITRI	to Hanford Site	4.34E-01	5.28E-01	4.15E-02	6.43E-02
Oak Ridge Reserv.	to Hanford Site	4.50E+02	5.37E+02	3.42E+01	5.62E+01
Knolls Atomic	to Hanford Site	2.32E+00	2.70E+00	1.65E-01	4.93E-01
Kansas City Plant	to Hanford Site	4.62E-02	5.64E-02	1.03E-02	1.41E-02
Los Alamos NL	to Hanford Site	3.01E+01	3.66E+01	2.67E+00	3.85E+00
Lawrence Berkeley	to Hanford Site	8.27E-02	9.80E-02	1.40E-02	4.10E-02
Lawrence Livermore	to Hanford Site	1.58E+00	1.84E+00	1.46E-01	4.30E-01
Mound Plant	to Hanford Site	3.24E+01	3.89E+01	2.51E+00	4.96E+00
ORISE	to Hanford Site	3.47E-01	4.13E-01	2.78E-02	4.98E-02
Pantex Plant	to Hanford Site	7.23E+01	8.85E+01	5.33E+00	7.81E+00
Portsmouth GDP	to Hanford Site	2.16E+02	2.57E+02	1.67E+01	3.80E+01
Princeton PPL	to Hanford Site	8.51E-02	9.97E-02	1.53E-02	4.96E-02
Paducah GDP	to Hanford Site	3.76E+01	4.53E+01	2.88E+00	4.71E+00
Pinellas Plant	to Hanford Site	1.75E-01	2.05E-01	1.65E-02	3.59E-02
Rocky Flats Plant	to Hanford Site	1.05E+01	1.29E+01	1.09E+00	1.65E+00
Reactive Metals	to Hanford Site	5.15E+01	6.15E+01	3.80E+00	1.00E+01
SLAC	to Hanford Site	1.16E+00	1.38E+00	1.08E-01	3.66E-01
SNL - Albuquerque	to Hanford Site	7.33E-01	8.92E-01	7.25E-02	1.12E-01
SNL - Livermore	to Hanford Site	1.41E-01	1.64E-01	1.39E-02	4.10E-02
Savannah River	to Hanford Site	5.39E+02	6.32E+02	3.85E+01	7.98E+01
Totals		1.47E+03	1.75E+03	1.11E+02	2.13E+02

Table 7. Annual Accident Dose Risk for the Shipping Campaign (person-rem/yr)

Route		Truck	Rail
Ames Laboratory	to Hanford Site	1.04E-05	3.93E-06
Argonne - East	to Hanford Site	5.84E-02	1.33E-02
Argonne - West	to Hanford Site	3.18E+00	1.72E+00
Bettis Atomic	to Hanford Site	2.54E-03	1.05E-03
Fermilab (FNAL)	to Hanford Site	6.73E-05	2.22E-05
INEL	to Hanford Site	9.37E-02	5.04E-02
ITRI	to Hanford Site	5.50E-02	6.27E-03
Oak Ridge Reserv.	to Hanford Site	2.39E-03	4.90E-04
Knolls Atomic	to Hanford Site	1.37E-04	4.61E-05
Kansas City Plant	to Hanford Site	2.32E-05	4.82E-06
Los Alamos NL	to Hanford Site	1.98E+01	2.52E+00
Lawrence Berkeley	to Hanford Site	1.52E-01	8.48E-02
Lawrence Livermore	to Hanford Site	5.15E-04	2.70E-04
Mound Plant	to Hanford Site	3.01E-03	6.71E-04
ORISE	to Hanford Site	1.32E-05	2.77E-06
Pantex Plant	to Hanford Site	2.36E-03	2.70E-04
Portsmouth GDP	to Hanford Site	8.53E-05	3.38E-05
Princeton PPL	to Hanford Site	1.28E-05	4.69E-06
Paducah GDP	to Hanford Site	7.35E-04	1.74E-04
Pinellas Plant	to Hanford Site	1.37E-05	3.00E-06
Rocky Flats Plant	to Hanford Site	1.23E-03	3.31E-04
Reactive Metals	to Hanford Site	8.89E-06	3.69E-06
SLAC	to Hanford Site	1.68E-05	9.87E-06
SNL - Albuquerque	to Hanford Site	3.88E-04	5.29E-05
SNL - Livermore	to Hanford Site	5.28E-04	2.79E-04
Savannah River	to Hanford Site	3.46E+01	6.94E+00
Totals		5.80E+01	1.13E+01

Table 8. Expected Annual Fatalities for the Shipping Campaign

Exposure Group	Truck	Rail
Radiological		
Normal Crew	5.9E-01	4.4E-02
Normal Public	8.7E-01	1.1E-01
Accident Public	2.9E-02	5.7E-03
Nonradiological		
Emission	2.2E-01	1.6E-01
Accident	3.3E+00	4.4E-02

Table 9. Expected Annual Cancer Incidence for the Shipping Campaign

Exposure Group	Truck	Rail
Radiological		
Normal Crew	2.1E+00	1.6E-01
Normal Public	3.0E+00	3.6E-01
Accident Public	9.9E-02	1.9E-02
Nonradiological		
Emission	2.2E-01	1.6E-01
Accident	NA	NA

Table 10. Expected Annual Genetic Effects for the Shipping Campaign

Exposure Group	Truck	Rail
Radiological		
Normal Crew	8.8E-02	6.7E-03
Normal Public	1.7E-01	2.1E-02
Accident Public	5.3E-03	1.0E-03
Nonradiological		
Emission	NA	NA
Accident	NA	NA

B.28 WM LLW CENTRALIZED 5 ALTERNATIVE (CASE 21): ACTIVATED METALS

Table 1. Summary of Route Information

Route		Distance (miles)	Percentage in Zone		
			Rural	Suburban	Urban
Truck					
Argonne - West	to Hanford Site	599	91.3	7.6	1.1
Bettis Atomic	to Hanford Site	2541	85.8	12.8	1.4
Fermilab (FNAL)	to Hanford Site	1975	92.2	7.1	0.8
Knolls Atomic	to Hanford Site	2809	82.1	16.1	1.8
Los Alamos NL	to Hanford Site	1560	89.8	8.8	1.3
Lawrence Berkeley	to Hanford Site	875	78.1	17.8	4.1
Naval Reactor Fac.	to Hanford Site	599	91.3	7.6	1.1
SNL - Albuquerque	to Hanford Site	1584	89.7	8.8	1.4
Rail					
Argonne - West	to Hanford Site	658	91.4	7.1	1.4
Bettis Atomic	to Hanford Site	2611	81.2	15.1	3.7
Fermilab (FNAL)	to Hanford Site	1971	89.9	8.6	1.4
Knolls Atomic	to Hanford Site	2914	79.1	17.0	3.9
Los Alamos NL	to Hanford Site	1725	92.5	6.5	0.9
Lawrence Berkeley	to Hanford Site	986	78.5	15.8	5.7
Naval Reactor Fac.	to Hanford Site	658	91.4	7.1	1.4
SNL - Albuquerque	to Hanford Site	1793	91.7	7.1	1.2

Table 2. Annual Number of Shipments and One-Way Shipment Distances

Route		# of Shipments		Total Mileage(mi)	
		Truck	Rail	Truck	Rail
Argonne - West	to Hanford Site	8	4	4.79E+03	2.63E+03
Bettis Atomic	to Hanford Site	309	119	7.85E+05	3.11E+05
Fermilab (FNAL)	to Hanford Site	39	16	7.70E+04	3.15E+04
Knolls Atomic	to Hanford Site	639	245	1.80E+06	7.14E+05
Los Alamos NL	to Hanford Site	412	158	6.43E+05	2.73E+05
Lawrence Berkeley	to Hanford Site	14	6	1.22E+04	5.91E+03
Naval Reactor Fac.	to Hanford Site	450	178	2.70E+05	1.17E+05
SNL - Albuquerque	to Hanford Site	6	3	9.50E+03	5.38E+03
Totals		1877	729	3.60E+06	1.46E+06

Table 3. Incident-Free Dose per Shipment (person-rem/shipment)

Source/Route(s)		Crew	General Public Off-Link	On-Link	Stops	Total
LLW(I) AW to HS Argonne - West	to Hanford Site					
		Truck	1.60E-02	7.18E-04	2.06E-03	1.68E-02	1.95E-02
		Rail	5.63E-03	2.83E-03	6.58E-05	5.51E-03	8.40E-03
LLW(I) BA to HS Bettis Atomic	to Hanford Site					
		Truck	7.21E-02	4.36E-03	9.77E-03	7.11E-02	8.53E-02
		Rail	1.38E-02	2.67E-02	4.53E-04	1.15E-02	3.87E-02
LLW(I) FL to HS Fermilab (FNAL)	to Hanford Site					
		Truck	5.20E-02	1.92E-03	6.25E-03	5.53E-02	6.35E-02
		Rail	1.11E-02	9.07E-03	2.12E-04	9.55E-03	1.88E-02
LLW(I) KA to HS Knolls Atomic	to Hanford Site					
		Truck	8.30E-02	6.03E-03	1.19E-02	7.87E-02	9.66E-02
		Rail	1.50E-02	3.18E-02	5.40E-04	1.25E-02	4.48E-02
LLW(I) LA to HS Los Alamos NL	to Hanford Site					
		Truck	4.24E-02	2.16E-03	5.65E-03	4.37E-02	5.15E-02
		Rail	1.01E-02	5.60E-03	1.54E-04	8.79E-03	1.45E-02
LLW(I) LB to HS Lawrence Berkeley	to Hanford Site					
		Truck	2.76E-02	3.02E-03	5.17E-03	2.45E-02	3.27E-02
		Rail	6.99E-03	1.38E-02	2.03E-04	6.51E-03	2.05E-02
LLW(I) NR to HS Naval Reactor Fac.	to Hanford Site					
		Truck	1.60E-02	7.18E-04	2.06E-03	1.68E-02	1.95E-02
		Rail	5.63E-03	2.83E-03	6.58E-05	5.51E-03	8.40E-03
LLW(I) SA to HS SNL - Albuquerque	to Hanford Site					
		Truck	4.31E-02	2.27E-03	5.84E-03	4.43E-02	5.24E-02
		Rail	1.04E-02	6.90E-03	1.72E-04	9.00E-03	1.61E-02

Table 4. Accident Dose Risk per Shipment (person-rem/shipment)

Source/Route		Truck	Rail
LLW(I) AW to HS Argonne - West	to Hanford Site	9.18E-12	9.58E-12
LLW(I) BA to HS Bettis Atomic	to Hanford Site	1.84E-06	1.79E-06
LLW(I) FL to HS Fermilab (FNAL)	to Hanford Site	4.76E-11	3.86E-11
LLW(I) KA to HS Knolls Atomic	to Hanford Site	3.12E-06	2.60E-06
LLW(I) LA to HS Los Alamos NL	to Hanford Site	3.15E-09	8.94E-10
LLW(I) LB to HS Lawrence Berkeley	to Hanford Site	1.81E-10	2.37E-10
LLW(I) NR to HS Naval Reactor Fac.	to Hanford Site	4.57E-08	6.22E-08
LLW(I) SA to HS SNL - Albuquerque	to Hanford Site	6.06E-12	1.32E-12

Table 5. Nonradiological Risk Factors per Shipment (fatalities/shipment)

Mode	Route	Emission	Accident
Truck			
Argonne - West	to Hanford Site	2.19E-06	3.07E-05
Bettis Atomic	to Hanford Site	1.14E-05	1.36E-04
Fermilab (FNAL)	to Hanford Site	4.86E-06	1.03E-04
Knolls Atomic	to Hanford Site	1.59E-05	1.51E-04
Los Alamos NL	to Hanford Site	6.66E-06	1.02E-04
Lawrence Berkeley	to Hanford Site	1.16E-05	4.91E-05
Naval Reactor Fac.	to Hanford Site	2.19E-06	3.07E-05
SNL - Albuquerque	to Hanford Site	7.24E-06	1.05E-04
Rail			
Argonne - West	to Hanford Site	3.98E-06	1.38E-06
Bettis Atomic	to Hanford Site	4.07E-05	5.46E-06
Fermilab (FNAL)	to Hanford Site	1.18E-05	4.12E-06
Knolls Atomic	to Hanford Site	4.72E-05	6.10E-06
Los Alamos NL	to Hanford Site	6.82E-06	3.61E-06
Lawrence Berkeley	to Hanford Site	2.33E-05	2.06E-06
Naval Reactor Fac.	to Hanford Site	3.98E-06	1.38E-06
SNL - Albuquerque	to Hanford Site	9.04E-06	3.75E-06

Table 6. Annual Incident-Free Dose for the Shipping Campaign (person-rem/yr)

Route	Truck		Rail	
	Crew	Public	Crew	Public
Argonne - West to Hanford Site	1.28E-01	1.56E-01	2.25E-02	3.36E-02
Bettis Atomic to Hanford Site	2.23E+01	2.63E+01	1.64E+00	4.61E+00
Fermilab (FNAL) to Hanford Site	2.03E+00	2.47E+00	1.78E-01	3.01E-01
Knolls Atomic to Hanford Site	5.30E+01	6.17E+01	3.68E+00	1.10E+01
Los Alamos NL to Hanford Site	1.75E+01	2.12E+01	1.59E+00	2.30E+00
Lawrence Berkeley to Hanford Site	3.86E-01	4.58E-01	4.20E-02	1.23E-01
Naval Reactor Fac. to Hanford Site	7.20E+00	8.80E+00	1.00E+00	1.50E+00
SNL - Albuquerque to Hanford Site	2.59E-01	3.15E-01	3.11E-02	4.82E-02
Totals	1.03E+02	1.21E+02	8.19E+00	1.99E+01

Table 7. Annual Accident Dose Risk for the Shipping Campaign (person-rem/yr)

Route	Truck	Rail
Argonne - West to Hanford Site	7.34E-11	3.83E-11
Bettis Atomic to Hanford Site	5.68E-04	2.13E-04
Fermilab (FNAL) to Hanford Site	1.86E-09	6.17E-10
Knolls Atomic to Hanford Site	1.99E-03	6.36E-04
Los Alamos NL to Hanford Site	1.30E-06	1.41E-07
Lawrence Berkeley to Hanford Site	2.53E-09	1.42E-09
Naval Reactor Fac. to Hanford Site	2.06E-05	1.11E-05
SNL - Albuquerque to Hanford Site	3.63E-11	3.96E-12
Totals	2.58E-03	8.61E-04

Table 8. Expected Annual Fatalities for the Shipping Campaign

Exposure Group	Truck	Rail
Radiological		
Normal Crew	4.1E-02	3.3E-03
Normal Public	6.1E-02	9.9E-03
Accident Public	1.3E-06	4.3E-07
Nonradiological		
Emission	1.8E-02	1.9E-02
Accident	2.0E-01	3.1E-03

Table 9. Expected Annual Cancer Incidence for the Shipping Campaign

Exposure Group	Truck	Rail
Radiological		
Normal Crew	1.4E-01	1.1E-02
Normal Public	2.1E-01	3.4E-02
Accident Public	4.4E-06	1.5E-06
Nonradiological		
Emission	1.8E-02	1.9E-02
Accident	NA	NA

Table 10. Expected Annual Genetic Effects for the Shipping Campaign

Exposure Group	Truck	Rail
Radiological		
Normal Crew	6.2E-03	4.9E-04
Normal Public	1.2E-02	2.0E-03
Accident Public	2.6E-07	8.7E-08
Nonradiological		
Emission	NA	NA
Accident	NA	NA

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