DOE/EA-1189

Environmental Assessment

Non-Thermal Treatment of Hanford Site Low-Level Mixed Waste

U.S. Department of Energy
Richland Operations Office

September 1998

DOE/EA-1189

ENVIRONMENTAL ASSESSMENT

FOR

NON-THERMAL TREATMENT OF HANFORD SITE LOW-LEVEL MIXED WASTE

U.S. Department Of Energy

Richland, Washington

September 1998

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LIST OF TERMS

ATG	Advanced Technology Group
CEDE	committed effective dose equivalent
CFR	Code of Federal Regulations
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
EA	Environmental Assessment
Ecology	Washington State Department of Ecology
EDE	effective dose equivalent
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
ERPG	Emergency Response Planning Guideline
GASVIT	gasification and vitrification
HI	Hazard Index
ISC3	Industrial Source Complex
LCF	latent cancer fatality
LDR	land disposal restrictions
LLMW	low-level mixed waste
LLW	low-level waste
MEI	maximally exposed individual
mrem	millirem
MWF	Mixed Waste Facility
NEPA	National Environmental Policy Act
NESHAP	National Emission Standards for Hazardous Air Pollutants
NRC	U.S. Nuclear Regulatory Commission
NSSI	Nuclear Sources and Services Incorporated
OSHA	Occupational Safety and Health Administration
PUREX	Plutonium-Uranium Extraction Plant
RCRA	Resource Conservation and Recovery Act
RCW	Revised Code of Washington
RL	Richland Operations Office
SEPA	State Environmental Policy Act
SPCC	spill prevention, control, and countermeasures
TRU	transuranic
TSDF	treatment, storage, and disposal facility
UV	ultra-violet
WAC	Washington Administrative Code
WSHWMA	Washington State Hazardous Waste Management Act

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READERS GUIDE AND HELPFUL INFORMATION

The following information is provided to help the reader understand the technical data and format of this Environmental Assessment (EA). Listings of acronyms and abbreviations can be found following the Table of Contents.

Reference Citations

Throughout the text of this document, in-text reference citations are presented where information from the referenced document was used. These in-text reference citations are contained within parentheses and provide a brief identification of the referenced document. This brief identification corresponds to the complete reference citation located on the reference list at the end of this document.

Scientific Notation

Scientific notation is used in this document to express very large or very small numbers. For example, the number one million could be written in scientific notation as 1.0E+06 or in traditional form as 1,000,000. Translating from scientific notation to the traditional number requires moving the decimal point either right or left from the number being multiplied by 10 to some power depending on the sign of the power (negative power move left or positive power move right).

TRANSLATING SCIENTIFIC NOTATION

Example 1: 2.6E+06 = 2,600,000
Example 1 shows a positive power of six. To translate, move the decimal to the right six places adding zeros as necessary to achieve 2,600,000.

Example 2: 2.6E-07 = 0.00000026
Example 2 shows a negative power of seven. To translate, move the decimal to the left seven places adding zeros as necessary to achieve 0.00000026.

Units of Measure

The primary units of measure used in this EA are metric. However, the approximate equivalent in the U.S. Customary System of units can be obtained by using the appropriate conversion factor. For example, a distance presented as 10 meters (m) is multiplied by 3.28 feet/meter (unit conversion factor) to obtain 32.8 or 33 feet.

Radioactivity Units

Radioactivity is presented in radioactivity units. The curie (Ci) is the basic unit used to describe an amount of radioactivity. Concentrations of radioactivity generally are expressed in terms of curies or fractions of curies per unit mass, volume, and area. One curie is equivalent to 37 billion disintegrations (radioactive transformations) per second. Disintegrations generally produce emissions of alpha or beta particles, gamma radiation, or combinations of these.

UNITS OF RADIOACTIVITY

Symbol	Name
Ci	curie
mCi	millicurie (1.0E-03 Ci)

Radiation Dose Units

Radioactivity is a broad term that refers to changes in the nuclei of atoms that release radiation. The radiation is an energetic ray or energetic particle. For ionizing radiation, the ray or particle has enough energy to cause changes in the chemical structure of the materials it strikes. These chemical structure changes are the mechanisms by which radiation can cause biological damage to humans. This means that a human body cell may be damaged if it comes into contact with the energy from a particle or ray released by radioactive decay.

UNIT CONVERSIONS

If you know	Multiply by	To get
	Length	
centimeters	0.39	inches
meters	3.28	feet
	Mass (weight)	
grams	0.035	ounces
kilograms	2.2	pounds
	Volume	
liters	0.2624	gallons
cubic meters	35.32	cubic feet
cubic meters	1.308	cubic yards

Radiation comes from many sources, some natural and some human-made. People have always been exposed to natural or background radiation. Natural sources of radiation include the sun, and radioactive materials present in the earth's crust, in building materials and in the air, food, and water. Some sources of ionizing radiation have been created by people for various uses or as byproducts of these activities. These sources include nuclear power generation, medical diagnosis and treatment, and nuclear materials related to nuclear weapons. Radioactive waste can be harmful and thus requires isolation for up to hundreds or even thousands of years. Plutonium-contaminated waste will be radioactive for thousands of years. Radioactive cesium, on the other hand, will be virtually gone in 300 years.

NAMES AND SYMBOLS FOR UNITS OF MEASURE

Length

cm	centimeters
ft	foot
in.	inch
km	kilometer
m	meter
mi	mile

Area

ac	acre
km^2	square kilometer
mi^2	square mile
ft^2	square foot

Volume

cm^3	cubic centimeter
ft^3	cubic foot
gal.	gallon
L	liter
m^3	cubic meter
ppb	parts per billion
ppm	parts per million
yd^3	cubic yard

Mass

kg	kilogram
mg	milligram
µg	microgram
lb	pound

Temperature

°C	degrees centigrade
°F	degrees Fahrenheit

RADIOLOGICAL INFORMATION

People have always been exposed to radiation from natural sources. The average resident of the United States receives an average annual radiation dose from natural sources of about 300 mrem (0.3 rem).

Exposure to large amounts of radiation (50,000 to 600,000 mrem [50 to 600 rem]) can cause serious illness or death. Exposure to small doses of radiation, such as in medical x-rays, may cause no biological damage to humans, although the probability of cancer may be slightly increased.

The Federal government has set the maximum annual exposure limit for workers at 5,000 mrem (5 rem).

The amount of energy deposited by radiation in a living organism is the true radiation dose. Radiation dose to humans is usually reported as effective dose equivalent, expressed in terms of millirem (mrem), which is one-thousandth of a rem. The rem is a measure of the biological effects of ionizing radiation on people. The rem is a relative measure that is used to compensate for observed differences in biological damage caused by equal energies of different nuclear emissions (alpha, beta, or gamma). An individual could be exposed to ionizing radiation externally (from a radioactive source outside the body) and internally (from ingesting or inhaling radioactive material). It is estimated that the average individual in the United States receives an annual dose of about 300 mrem (0.3 rem) from all natural sources of radiation. For perspective, a modern chest x-ray results in an approximate dose of 0.008 rem (8 mrem), while a diagnostic hip x-ray results in an approximate dose of 0.083 rem (83 mrem). The collective radiation dose to a population, which is calculated by adding up the radioactive dose to each member of the population, is expressed in person-rem.

Risk of Radiation Exposure

Impacts from radiation exposure often are expressed using the concept of risk. The most important radiation-related risk is the potential for developing cancers that may eventually lead to a fatality. This delayed effect is measured in latent (future) cancer fatalities. The risk of a latent cancer fatality is estimated by converting radiation doses into possible numbers of cancer fatalities. For an entire exposed population group, the latent cancer fatality numerical value is the chance that someone in that group would develop an additional cancer fatality in the future because of the radiation exposure (i.e., a cancer fatality that otherwise would not occur).

Radiological risk evaluations often refer to the maximally exposed individual. This is the hypothetical member of the public or a worker who would receive the highest possible dose in a given situation under the conditions specified. As a practical matter, the maximally exposed individual likely would be a person working with radiological or hazardous materials. The Federal government has set a maximum annual exposure limit for workers of 5,000 mrem (5 rem).

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TABLE OF CONTENTS

LIST OF TERMS i

1.0 PURPOSE AND NEED FOR AGENCY ACTION 1
1.1 BACKGROUND 1

2.0 DESCRIPTION OF THE PROPOSED ACTION 3
2.1 WASTE TRANSPORT 3
2.2 WASTE HANDLING 5
2.3 FACILITY AND PROCESS DESCRIPTION 7

3.0 ALTERNATIVES TO THE PROPOSED ACTION 14
3.1 NO ACTION 14
3.2 OTHER ALTERNATIVES 14
3.2.1 Treatment at the Advanced Mixed Waste Treatment Project, Idaho 14
3.2.2 Treatment at EnviroCare, Utah 14
3.2.3 Treatment at Nuclear Sources and Services Incorporated (NSSI), Texas 14

4.0 AFFECTED ENVIRONMENT 15
4.1 LOCATION OF THE PROPOSED ACTION 15
4.2 SOCIOECONOMIC ENVIRONMENT 15
4.3 ENVIRONMENTAL JUSTICE 16
4.4 PHYSICAL ENVIRONMENT 16
4.5 ECOLOGY 20
4.5.1 Terrestrial Biota 20
4.5.2 Aquatic Biota 21
4.5.3 Endangered and Threatened Species 21
4.6 CULTURAL RESOURCES 22

5.0 ENVIRONMENTAL IMPACTS OF THE PROPOSED ACTION 23
5.1 FACILITY OPERATION AND WASTE TRANSPORT 23
5.1.1 Air Pollutant Emissions 23
5.1.2 Transportation 25
5.2 HUMAN HEALTH IMPACTS FROM PLANT OPERATIONS 29
5.2.1 Normal Operating Conditions 32
5.2.2 Accident Conditions 37
5.3 MIXED WASTE STORAGE 47
5.3.1 Hazardous Process Chemical Storage 49
5.4 NATURAL HAZARDS 49
5.5 WATER RESOURCES 49

TABLE OF CONTENTS

5.6 BIOLOGICAL RESOURCES 50
5.7 CULTURAL AND ARCHEOLOGICAL RESOURCES 50
5.8 SOCIOECONOMIC IMPACTS 50
5.9 ENVIRONMENTAL JUSTICE 50
5.10 CUMULATIVE IMPACTS 51
5.10.1 Radiation 51
5.10.2 Other Impact Areas 52
5.11 IMPACTS OF ALTERNATIVES TO THE PROPOSED ACTION 53
5.11.1 No Action 53
5.11.2 Other Action Alternatives 53

6.0 PERMITS AND REGULATORY REQUIREMENTS 54

6.1 FACILITY OPERATION 54
6.1.1 Resource Conservation and Recovery Act 54
6.1.2 Radiological License 54
6.1.3 Air Permits 55
6.2 TRANSPORTATION 55
6.3 WORKER SAFETY 56

7.0 AGENCIES CONSULTED 57

8.0 REFERENCES 58

APPENDIX A: COMMENTS AND RESPONSES ON THE DRAFT ENVIRONMENTAL ASSESSMENT FOR THE NON-THERMAL TREATMENT OF HANFORD SITE LOW-LEVEL MIXED WASTE A-1

LIST OF FIGURES

1.1 Hanford Site Map....2
2.1 ATG General Location Map....4
2.2 Layout of ATG Site....8
2.3 ATG Richland Environmental Technology Center Non-Thermal Treatment Process Diagram11

LIST OF TABLES

2.1 Representative Chemical Inventory....6
2.2 Radiological Inventory....7
4.1 Population of Benton and Franklin Counties by Race and Ethnic Origin....16
4.2 Threatened and Endangered Species....22
5.1 Major Air Pollutant Impacts....24
5.2 Incident-Free Transportation Latent Cancer Fatality Risk....26
5.3 Comparison of Chemical Concentrations to Toxic Concentration Limits for Transport Truck Fire....30
5.4 Comparison of Chemical Concentrations to Corrosive/Irritant Concentration Limits for Transport Truck Accident....31
5.5 Involved Worker Radiological Risk From Normal Operations....33
5.6 Annual Radiological Air Emissions....34
5.7 Radiological Risk From Air Emissions During Normal Operations....35
5.8 Human Health Risk to Maximum Exposed Receptor from Inhalation of Routine Chemical Air Emissions....38
5.9 Hanford Site LLMW Inventory Used In Drum Fire Accident Scenario....41
5.10 Radiological Risk From Fire Scenario....43
5.11 Comparison of Chemical Concentrations to Toxic Concentration Limits for Drum Fire Accident....45
5.12 Comparison of Chemical Concentrations to Corrosive/Irritant Concentration Limits for Transport Truck Accident....46
5.13 Nonradiological/Nonchemical Occupational Accidents....47
5.14 Total Storage Capacities of Mixed Waste Storage Building....48
5.15 Cumulative Impacts from Routine Radiological Air Emissions....51
6.1 Major Permits and Approvals Required for ATG Mixed Waste Facility Operation....54

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1.0 PURPOSE AND NEED FOR AGENCY ACTION

The U.S. Department of Energy (DOE), Richland Operations Office (RL) needs to demonstrate the feasibility of commercial treatment of contact-handled low-level mixed waste (LLMW) to meet existing Federal and State regulatory standards for eventual land disposal. Treatment before disposal is required for some constituents of this Hanford Site LLMW under the Resource Conservation and Recovery Act (RCRA), Washington State Administrative Code (WAC), Dangerous Waste Regulations (WAC 173-303), and the Washington State Hazardous Waste Management Act (WSHWMA) (Chapter 70.015l, Revised Code of Washington [RCW]). Under RCRA land disposal restrictions (40 Code of Federal Regulations [CFR] 268), some LLMW is suitable for land disposal only after stabilization.

1.1 BACKGROUND

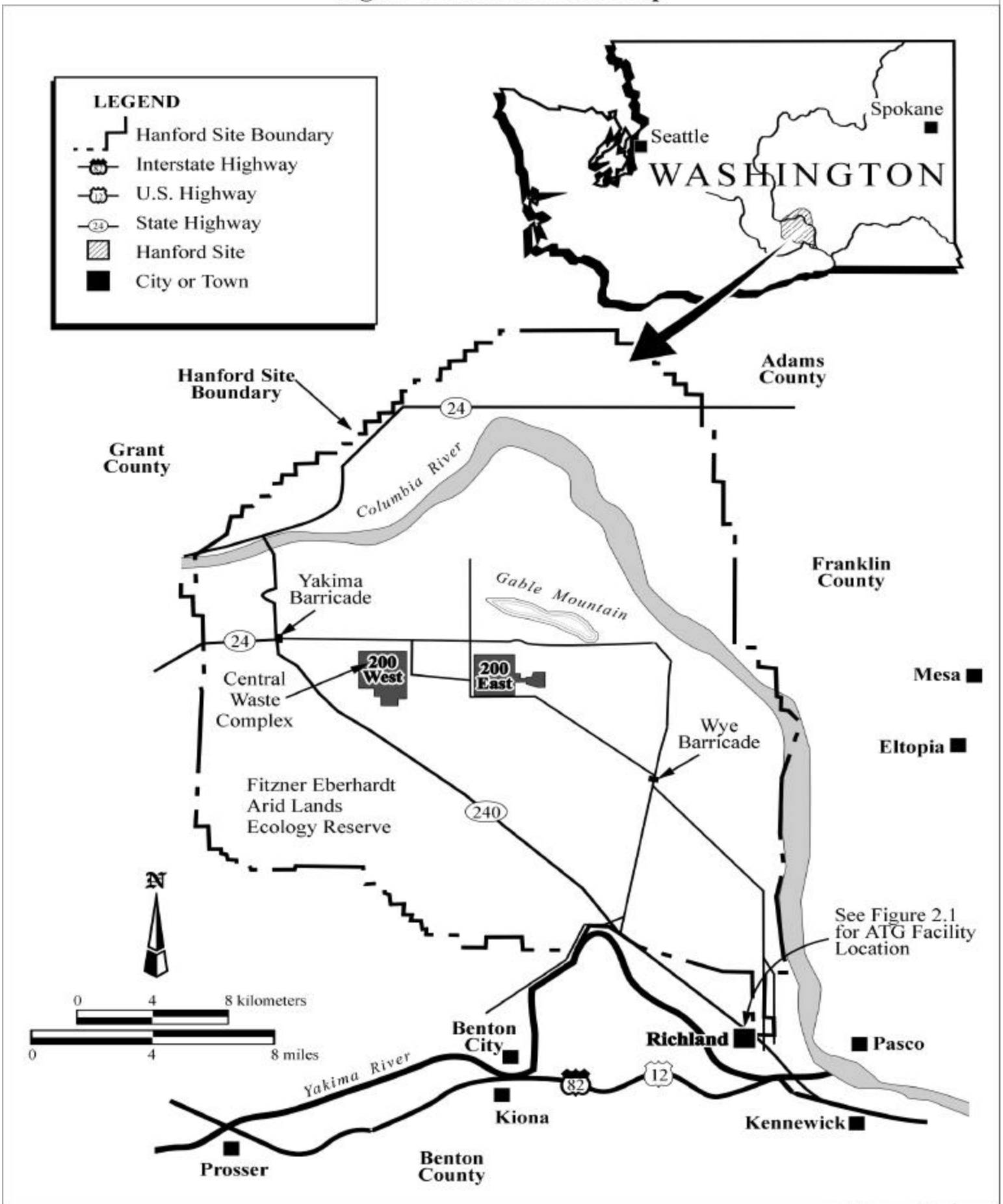
Radioactive and hazardous waste is stored at DOE's Hanford Site located near Richland, Washington (Figure 1.1). The waste inventory includes contact-handled LLMW, which is made up of both low-level radioactive and hazardous constituents. Some of the Hanford Site LLMW contains dangerous waste constituents such as toxic metals that require treatment to meet regulatory standards for land disposal. Stabilization and encapsulation have been identified as relevant treatment technologies for these wastes.

The Hanford Site waste stream evaluated in this Environmental Assessment (EA) is existing waste that is currently stored at the Central Waste Complex located in the 200 West Area of the Hanford Site. Contact-handled waste is defined as waste with transuranic (TRU) concentrations less than 100 nCi/g and container surface dose rates that do not exceed 200 millirem (mrem)/hour (hr). However, most of the waste packages that would be treated under the proposed action have surface radiation dose rates below 1 mrem/hr, and the highest package dose rate is approximately 100 mrem/hr.

A total waste volume of 2,600 cubic meters (m^3) (3,400 cubic yards [yd^3]) was evaluated in this EA. This represents the maximum waste volume that would be treated for demonstration purposes. The waste stream evaluated in this EA represents a small fraction of the projected Hanford Site LLMW volume.

This is an interim action under the Hanford Solid Waste Program Environmental Impact Statement (EIS) (DOE 1997).

Figure 1.1. Hanford Site Map



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2.0 DESCRIPTION OF THE PROPOSED ACTION

DOE proposes to transport contact-handled LLMW from the Hanford Site to the Allied Technology Group (ATG) Mixed Waste Facility (MWF) in Richland, Washington, for non-thermal treatment and to return the treated waste to the Hanford Site for eventual land disposal. Over a 3-year period the waste would be staged to the ATG MWF, and treated waste would be returned to the Hanford Site. The ATG MWF would be located on an 18 hectare (ha) (45 acre [ac]) ATG Site adjacent to ATG's licensed low-level waste processing facility at 2025 Battelle Boulevard. The ATG MWF is located approximately 0.8 kilometers (km) (0.5 miles [mi]) south of Horn Rapids Road and 1.6 km (1 mi) west of Stevens Drive. The property is located within the Horn Rapids triangle in northern Richland (Figure 2.1). The ATG MWF is to be located on the existing ATG Site, near the DOE Hanford Site, in an industrial area in the City of Richland.

The effects of siting, construction, and overall operation of the MWF have been evaluated in a separate State Environmental Policy Act (SEPA) EIS (City of Richland 1998).

The proposed action includes transporting the LLMW from the Hanford Site to the ATG Facility, non-thermal treatment of the LLMW at the ATG MWF, and transporting the waste from ATG back to the Hanford Site. Impacts from waste treatment operations would be bounded by the ATG SEPA EIS, which included an evaluation of the impacts associated with operating the non-thermal portion of the MWF at maximum design capacity (8,500 metric tons per year) (City of Richland 1998).

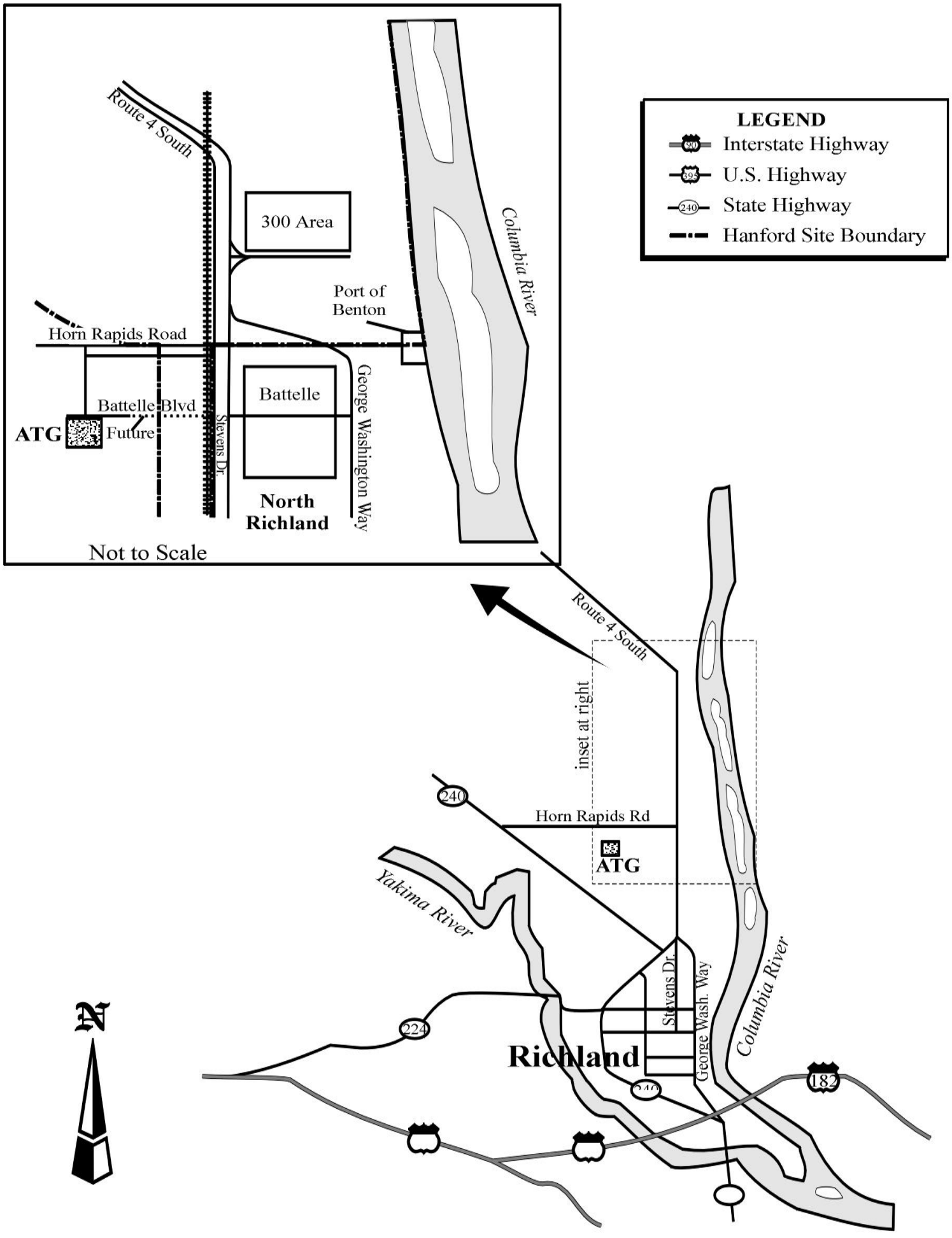
Up to 50 employees would be required for non-thermal treatment portion of the MWF. This includes 40 employees that would perform waste treatment operations and 10 support staff. Similar numbers were projected for the thermal treatment portion of the MWF (City of Richland 1998).

2.1 WASTE TRANSPORT

Untreated waste is or will be stored at the Hanford Site's 200 West Area, approximately 33 km (20 mi) northwest of the ATG MWF. ATG would transport the waste to and from the ATG Facility by truck. Approximately 95 percent of the 33 km (20 mi) transport route would be on the Hanford Site. ATG's waste transport operations are required to meet the requirements of the U.S. Department of Transportation (DOT) and the WSHWMA. Once treated, the waste would be returned to the 200 West Area for eventual land disposal.

All waste transport truck drivers would be required to be trained in proper waste handling, regulatory compliance, and spill emergency response procedures. ATG health and safety technicians would dispatch trucks, check safety equipment (lights, brakes, signals, tires), and ensure that vehicles are in compliance with applicable DOT regulations. Health and safety technicians would also accompany trucks on all trips.

Figure 2.1 ATG General Location Map



2.2 WASTE HANDLING

Waste handling covers packaging or repackaging, loading, receiving and inspecting, assaying, sorting, and tracking the waste containers.

Preacceptance Inspection

Only waste that would be amenable for management, storage, and treatment at the ATG Facility would be accepted. The acceptance determination would be based on information provided by DOE during the preacceptance process. The preacceptance process would use DOE-supplied information to evaluate waste characteristics, additional laboratory analysis requirements, waste confirmation procedures, and waste treatment formulation.

Repackaging and Loading

The waste containers would be loaded from temporary storage at the 200 West Area onto ATG trucks. All waste handling and loading activities at the Central Waste Complex would be conducted by Hanford Site contractors. Activities would include handling, loading, and if necessary waste packaging. ATG would transport the waste to and from the Hanford Site. ATG would be required to follow DOE environmental, health, and safety requirements during the waste handling and loading operations at the Hanford Site. Waste containers would also be profiled and manifested according to all DOT, RCRA, and WSHWMA regulations governing transport of wastes.

Inspecting and Assaying

ATG waste acceptance would follow procedures specified in an approved radioactive materials license and RCRA final facility permit for the characterization of the waste's radioactive, chemical, and physical properties. Waste manifests would ensure that the waste does not exceed the limits permitted by ATG's permits and licenses. If during waste confirmation and verification inspections at ATG, the waste characterizations show higher levels of radioactive or hazardous constituents than permitted by the facility's permits and licenses, the waste would not be accepted but rather returned to the Hanford Site. Facility inspectors also would confirm that the waste is suitable for treatment by stabilization. Each waste container would be labeled and bar-coded, and the waste container properties would be logged into a computerized database. After treatment, waste containers would be reexamined and certified for transport and disposal.

Waste Constituents and Physical Characteristics

The LLMW would contain hazardous constituents regulated by the WAC (WAC 173-303). The hazardous nature of the waste includes many different waste constituents including characteristic waste constituents, listed waste constituents, and Washington State dangerous waste constituents. Specific waste containers that would be potentially treated under this action are identified in the Hanford Mixed Waste "Debris" Statement of Work as a part of the contract between DOE and ATG. DOE and Hanford Site contractors believe the relevant treatment technology for the identified waste containers is non-thermal stabilization. Individual package characteristics are provided in terms of container volume, waste type, waste weight, package dose rate, and dangerous waste codes (Jacobs 1998). Detailed characterization data for the waste that

would be treated under this action were not available. However, data are available on a more global basis for Hanford Site LLMW, which were assumed to provide a conservative basis for evaluating potential environmental impacts from the non-thermal treatment of LLMW. The chemical and radiological characteristics of the waste stream evaluated in this EA were assumed to be similar to those evaluated in the thermal treatment EA, with the exception of polychlorinated biphenyls (PCBs) (DOE 1996a). This is assumed to be a conservative assumption for the chemical-related impacts evaluated in this EA because in general those waste packages with higher concentrations of hazardous chemicals would be targeted for thermal treatment. The chemical and radiological inventories developed in support of the accident analysis are presented in Table 2.1 and 2.2.

The waste's physical characteristics are generally comprised of organic, inorganic, and/or metallic debris type material meeting RCRA's debris definition in 40 CFR 268. Some of the waste packages contain some non-debris material (i.e., soil, particulate, sludge, etc.); however, all packages will contain greater than 50 volume percent debris material based on visual and/or real-time radiography inspection. The waste stream identified for treatment at ATG includes approximately 100 m^3 (130 yd^3) of non-debris waste with the balance of the waste stream volume defined as debris waste.

A number of radiological constituents would be expected in the waste, including alpha emitting radionuclides. TRU radionuclides in the waste matrix will not exceed 100 nanocuries/gram; therefore this waste would not be designated as TRU waste by DOE. The surface dose rates for most of the waste containers is less than 1 mrem/hr (Jacobs 1998).

Table 2.1. Representative Chemical Inventory

Chemical (chemical class)	Inventory in 2,600 m^3 of waste, kg
Benzene (solvents, thinners, glycols, glycol ethers)	8.8E+02
N-butyl alcohol (solvents, thinners, glycols, glycol ethers)	4.6E+02
2-hexanone (solvents, thinners, glycols, glycol ethers)	1.9E+02
Methylene chloride (solvents, thinners, glycols, glycol ethers)	4.0E+02
Tridecane (petroleum, coal tar derivatives)	2.8E+03
Sodium Silicate (metals, metal salts, pigments)	5.7E+01
Ammonia (amines)	1.2E+02
Sodium hydroxide (caustics)	2.0E+02
Other (no acute health impacts)	2.2E+03

Notes:

This inventory represents the chemical inventory developed for accident analysis. This inventory was developed by sorting chemicals into chemical classes by type and selecting a representative chemical from each class that would provide conservative health impacts. Air emissions estimates used to evaluate impacts from normal operations included additional chemicals that fall into the chemical classes identified in the table.

Table 2.2. Radiological Inventory

Isotope	Inventory in 2,600 m^3, Ci
Cs-137	7.8E+01
Sr-90	7.1E+01
H-3	1.2E+01
Fe-55	8.1E+00
Mn-54	4.0E+00
Ce-144	1.2E+00
Co-60	7.9E-01
Eu-154	5.8E-01
Pm-147	5.3E-01
Pu-241	4.0E+02
Pu-238	6.3E+00
Am-241	5.6E+00
Pu-239	2.0E+00
Pu-240	4.7E-01
Np-237	2.3E-02
C-14	2.4E-01
I-129	6.7E-01
Tc-99	4.4E-02

Notes:

This inventory is based on Hanford Site LLMW and is the basis for the accident calculations. Air emissions estimates taken from the RCRA Part B risk assessment work plan that were used in evaluating impacts from routine air emissions includes additional radionuclides that were not reported in Hanford Site LLMW inventory (Tetra Tech 1996b).
Total inventory activity taken from Table 1 (Tetra Tech 1996b).

Tracking

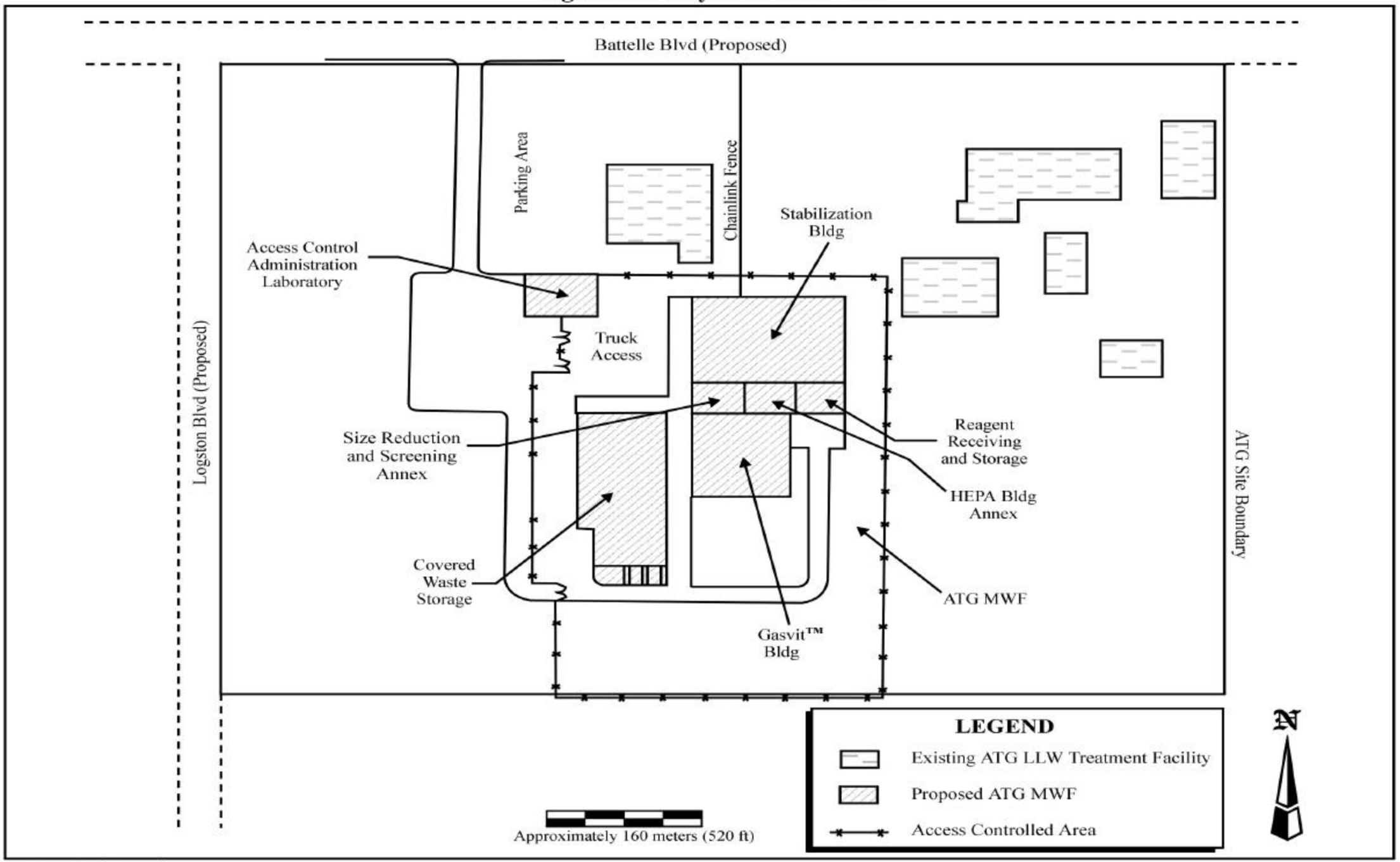
Waste units would be tracked throughout the ATG shipping and treatment activities with the help of automated data systems. Workers handling, receiving, inspecting, and assaying the waste would log in the times, dates, and locations of each transaction and waste type, volume, and weight.

2.3 FACILITY AND PROCESS DESCRIPTION

Facility Description

The non-thermal treatment portion of the MWF would consist of three buildings; the Stabilization (non-thermal treatment) Building, the Waste Storage Building, and the Administrative Building, as shown in Figure 2.2. The MWF would be a RCRA-permitted facility designed with the necessary equipment and safety features to safely store, handle, and treat LLMW. The stabilization treatment operation would be located in an existing ATG building. The remaining portions of the main treatment facility would include an addition to the

Figure 2.2. Layout of ATG Site



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existing building and an annex and an adjacent Gasification and Vitrification (GASVIT™) Building. The annex would be used for size reduction and screening systems, ventilation systems, and process chemical receipt and storage. The GASVIT™ Building would contain the gasification and vitrification operations (thermal treatment) and would not be used to treat the waste stream evaluated in this EA. The waste steam evaluated in this EA would be treated in the Stabilization Building.

The Stabilization Building would be used for receiving, shipping, and staging process chemicals, pre-treatment, non-thermal treatment, nonprocess support, and ancillary systems. The Waste Storage Building would be an 1,850 square meter (m^2) (19,900 square foot [ft^2]) building that would be used to store and stage waste prior to treatment and following treatment pending transport back to the Hanford Site. The storage building would have two sections, an enclosed area and an unenclosed storage pad, with storage cabinets and would be designed specifically for hazardous material storage. The Administrative Building would be approximately 350 m^2 (3,800 ft^2) and would be used for access control functions, administrative offices, and the on-site analytical laboratory.

Waste from commercial generators as well as from DOE potentially could be treated in the Stabilization Building. Waste streams that are required to be kept separate for regulatory, technical, or administrative reasons would be stored, handled, and treated separately. Commercial and DOE generated wastes would be treated in separate campaigns to maintain waste stream segregation.

The ATG MWF would be designed and constructed in accordance with the applicable requirements for RCRA permitted hazardous waste treatment and storage facilities.

Material Movement

The Stabilization Building would receive containerized waste in either boxes or barrels. The methodology used to off-load containerized waste depends on the container size. For example, boxes would typically be off-loaded using a forklift. Following unloading, containers of compatible waste types may be provided with additional secondary containment and would be placed on pallets for processing or storage. Containers of incompatible waste would be provided with additional secondary containment or appropriately segregated and managed in accordance with the MWF regulatory requirements.

Waste acceptance would include inspecting shipping and pre-acceptance documentation. Additional waste acceptance requirements could include waste examination, chemical analysis, and treatability tests. Following waste acceptance procedures, the containerized waste would be transferred to the waste storage facility or to the appropriate pre-treatment or treatment area.

Treatment Processes

Operations at the MWF would include receiving and treating off-site generated waste, treating secondary waste, and temporarily storing waste prior to treatment and following treatment prior to off-site disposal. The facility would use two principal treatment processes; stabilization and macro encapsulation (Figure 2.3). Other treatment processes would be employed as pre-treatments for stabilization. The facility would be designed to meet regulatory-based treatment standards for debris that include the following technology-based and alternative treatment standards; physical extraction, stabilization/micro-encapsulation, neutralization, chemical oxidation, chemical reduction, macro-encapsulation, and deactivation.

Secondary waste generated as a byproduct of the treatment processes would be recycled or treated on-site, as necessary, prior to shipment off-site for disposal with the primary waste stream. For example, wastewater generated from the treatment processes would be treated and recycled for subsequent use in waste treatment (water for the stabilization process).

The non-thermal stabilization would be organized into waste pre-treatment and treatment processes depending on waste designation with four principal treatment lines for stabilization. The four treatment process lines would include soils/inorganic debris stabilization, inorganic liquids/sludge stabilization, lead and other metals stabilization, and heterogeneous debris stabilization.

Solids Stabilization

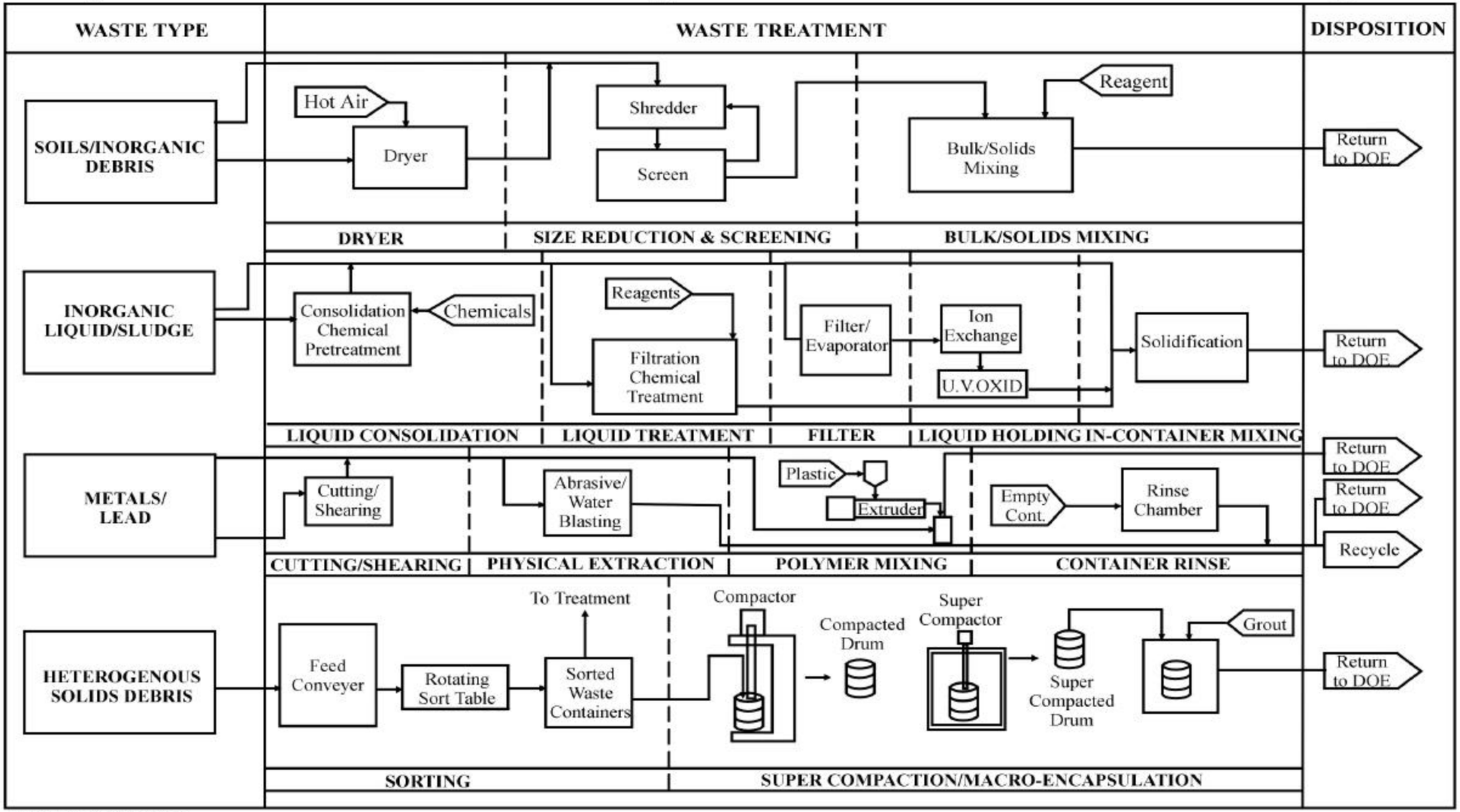
The solids stabilization process line would treat solids/inorganic debris waste and include pre-treatment and stabilization processes. The pre-treatment processes include drying, size reduction, and screening. The size reduction and screening pre-treatment would produce uniformly sized particles that meet the requirements of the stabilization process. The dryer would receive sludge, paste, and debris waste and would remove bound, absorbed, or free liquid.

Once the material was properly dried and sized, the material would be mixed with stabilization reagents (e.g., cement- or polymeric-like materials) in a bulk mixer and transferred to a disposal container to cure. Stabilization processes employ reagents to reduce the hazardous nature of a waste by converting the waste and its hazardous constituents into a form that minimizes the contaminant releases to the environment or reduces the degree of hazard. Typical stabilization reagents include cement-like materials, thermoplastic materials, and organic polymers. Typical disposal containers would include steel barrels or boxes suitable for waste handling, storage, and disposal.

Liquid Stabilization

The liquids stabilization line would treat inorganic liquids/sludges and include pre-treatment and in-container stabilization. The pre-treatment processes for liquids would include consolidation, treatment (e.g., neutralization), filtration, and holding.

Figure 2.3. ATG Richland Environmental Technology Center Non Thermal Treatment Process Flow Block Diagram



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Liquid waste would be transferred from small containers to larger containers in the liquid consolidation tank. Liquid pre-treatment would include neutralization, chemical oxidation, chemical reduction, and deactivation. Deactivation refers to treatments to remove the hazardous characteristics of a waste due to its ignitability, corrosivity, and or reactivity. After pre-treatment in a liquid treatment tank, liquids would be filtered, evaporated, or passed through an ion exchange column as necessary. Organics may also be destroyed by passing the liquids through an ultra-violet (UV) oxidation system. UV oxidation is a process where UV light is used to break down and detoxify organic materials. Empty containers would be decontaminated for reuse or sent to the appropriate waste treatment line for stabilization.

After pre-treatment, the liquid waste would be transferred to steel drums designed for waste storage and disposal. Reagents (e.g., grout) would then be mixed with the waste in the drums, and the drums would be sent to the staging area for inspection and shipping.

Metals/Lead Stabilization

The pre-treatment processes for the lead and other metals stabilization line would include cutting and shearing and physical extraction. In addition to metallic components; wood, plastic, and construction debris such as paneling also may be cut and sheared to the size required for further treatment.

The function of the physical extraction system would be to decontaminate and package the incoming surface contaminated bulk metals, bulk non-metals, loose metals, and empty metal containers by abrasive and non-abrasive blasting processes (e.g., dry ice grit blasting). This system would be designed to decontaminate surfaces of mixed low-level debris waste by removing contaminants. Surface materials and contaminants would be removed by the extraction process and, together with spray water, collected and recycled through a filter to separate the liquids and solids. Debris that cannot be decontaminated would be macro-encapsulated by mixing the debris with a polymer and returned to DOE for eventual land disposal.

The reclaimed water would be returned to the spray system, and filtered solids would be sent to the solids stabilization line for treatment. Excess liquid produced by the decontamination unit operation would be transferred to the liquids stabilization line for treatment.

Heterogeneous Debris Stabilization

The pre-treatment processes in the heterogeneous solid debris stabilization line would include sorting and supercompaction. The sorting operation would include emptying the contents of the waste containers on a sorting table and segregating the waste according to the designated treatment groups (see waste types identified in Figure 2.3). The sorted waste would be placed in conveyor bins and sent to the appropriate treatment line (one of the four other treatment lines). After sorting, the heterogeneous debris would be supercompacted (compaction using specialized equipment producing higher than normal compaction) to reduce its volume.

Equipment in the compaction area would reduce the volume of debris waste by ratios in excess of 7 to 1, leaving a thin compacted puck. The compaction methods would include both in-barrel and super-compaction devices. After compaction, waste would be macro-encapsulated by placing the

compacted pucks in a drum or container and filling the void space between the compacted waste and the container with grout to encapsulate the compacted waste. Macro-encapsulation also may be performed by packaging the compacted pucks into a package meeting the "jacket" requirements under the debris treatment rule (such as stainless-steel or high-density polyethylene containers with the void spaces filled).

Post-Treatment Waste Management and Transportation

Following waste treatment at the MWF, containers of treated waste would be certified prior to shipping, which would include reviewing the processing performed and treated sample test documentation to ensure that the treated waste would meet the Hanford Site acceptance requirements. Treated waste containers would be labeled for shipment, manifested, and either loaded onto trucks for shipment to the Hanford Site for eventual land disposal or transferred to the storage facility. No waste disposal would take place at the MWF.

3.0 ALTERNATIVES TO THE PROPOSED ACTION

3.1 NO ACTION

Under the No Action alternative LLMW would continue to be stored at the Hanford Site, pending future decisions. Life-cycle costs for the long-term storage of the untreated mixed waste are greater than the life-cycle costs for near-term waste treatment and disposal.

3.2 OTHER ALTERNATIVES

The following alternatives and their potential impacts were considered in the process of selecting the vendor for treating the LLMW and identifying the preferred alternative (proposed action), but were not analyzed in detail in this document.

3.2.1 Treatment at the Advanced Mixed Waste Treatment Project, Idaho

Under this alternative DOE would send the waste for treatment at the proposed Advanced Mixed Waste Treatment Project Facility at the Idaho National Engineering and Environmental Laboratory, in Idaho Falls, Idaho, approximately 800 km (500 mi) from the 200 West Area. The proposed treatment facility includes compaction and non-thermal stabilization processes for contact-handled LLMW. The treated waste would be returned to the Hanford Site for eventual disposal. It is assumed that the Advanced Mixed Waste Treatment Project Facility would operate with an efficiency equal to the ATG MWF, and that waste handling procedures would be similar to the ATG Facility.

3.2.2 Treatment at EnviroCare, Utah

Under this alternative DOE would send the waste for treatment at EnviroCare's mixed waste treatment facility in Clive, Utah, approximately 1,040 km (650 mi) from the 200 West Area. The treated waste would be returned to the Hanford Site for eventual disposal. It is assumed that Envirocare's waste treatment facility would operate with an efficiency equal to the ATG MWF, and waste handling procedures would be similar to the ATG Facility.

3.2.3 Treatment at Nuclear Sources and Services Incorporated (NSSI), Texas

Under this alternative DOE would send the waste for treatment at NSSI's facility in Houston, Texas, approximately 3,700 km (2,300 mi) from the 200 West Area. The treated waste would be returned to the Hanford Site for eventual disposal. It is assumed that the NSSI waste treatment facility would operate with an efficiency equal to the ATG MWF, and that waste handling procedures would be similar to the ATG Facility.

4.0 AFFECTED ENVIRONMENT

This section describes the socioeconomic, physical, and biological environment of the ATG Site; the 200 West Area at Hanford Site, where wastes are in temporary storage and where the treated waste would be stored for eventual disposal; and the proposed 33 km (20 mi) waste transport route. The purpose of this assessment is the identification of potential environmental impacts of the proposed action.

The Hanford Site Environmental Report for Calendar Year 1995 (PNNL 1996) and Hanford Site National Environmental Policy Act (NEPA) Characterization (Neitzel 1996) are hereby incorporated by reference. These documents describe the affected environment for the Hanford Site and are the principal sources of the selected information presented in this section. The affected environment at the ATG Site is assumed to be similar to areas at the Hanford Site because of its close proximity. Information is supplemented where environmental conditions described in the referenced reports may not fully reflect conditions at the ATG Site.

4.1 LOCATION OF THE PROPOSED ACTION

Facility Description

The ATG Site is located at 2025 Battelle Boulevard in Richland, Washington (Figure 2.1). The MWF would be located on the existing 18 ha (45 ac) site. This site is near the Hanford Site boundary in an industrial area in the City of Richland and is approximately 0.8 km (0.5 mi) south of Horn Rapids Road and 1.6 km (1 mi) west of Stevens Drive in the northwest quarter of Section 22, Township 10 North, Range 28 East, Willamette Meridian. The property is situated within the Horn Rapids Triangle in northern Richland.

The Central Waste Complex is located in the 200 West Area in the west-central area of Hanford Site. The transport route would extend from the 200 West Area along Route 3 to Route 4 South to Stevens Drive (within the Hanford Site boundary), from Stevens Drive to Horn Rapids Road (outside of Hanford Site) to the ATG Site (Figure 2.1).

4.2 SOCIOECONOMIC ENVIRONMENT

Activity on the Hanford Site plays a dominant role in the socioeconomics of the Tri-Cities and other parts of Benton and Franklin Counties. The agricultural community also has a significant effect on the local economy. The Hanford Site dominates the local employment picture with almost 22 percent (15,767 jobs) of the total nonagricultural jobs in Benton and Franklin Counties in 1995 (72,200 jobs). Major changes in Hanford Site activity potentially would affect the Tri-Cities and other areas of Benton and Franklin Counties (Neitzel 1996).

The total number of employees at the ATG Site is projected to be approximately 200. This includes approximately 100 employees for low-level waste treatment and 100 employees for LLMW treatment. Approximately 40 employees would be involved directly and 10 employees would be involved indirectly (i.e., support staff) with the non-thermal treatment operations. Because the waste volumes are small in comparison to the treatment capacity of the stabilization process, no additional ATG personnel would be required to treat the waste addressed in this EA.

No additional DOE contractor employees would be required to support the activities under this action at the Central Waste Complex.

4.3 ENVIRONMENTAL JUSTICE

On February 11, 1994, President Clinton issued Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority and Low-Income Populations," which is intended to prevent disproportionate adverse environmental or economic impacts from Federal policies or actions to minority and low-income populations. Demographic information on ethnicity and race in Benton and Franklin Counties is presented in Table 4.1.

Table 4.1. Population of Benton and Franklin Counties by Race and Ethnic Origin

Race or Ethnicity	Benton County				Franklin County			
	1990 Population	% of 1990 Total	1994 Population	% of 1994 Total	1990 Population	% of 1990 Total	1994 Population	% of 1994 Total
White	102,832	91.4	113,569	89.4	26,917	71.8	26,668	62.2
African American	1,085	0.96	1,400	1.1	1,310	3.5	1,312	3.1
American Indian, Eskimo, or Aleut	861	0.76	992	0.78	263	0.7	318	0.7
Asian or Pacific Islander	2,246	2.0	3,113	2.45	869	2.3	1,367	3.2
Others	5,536	4.9	7,926	6.3	8,114	21.7	13,235	30.8
TOTALS	**112,560**	**100.02** [1]	**127,000**	**100.03**	**37,473**	**100.0**	**42,900**	**100**
Hispanic Origin [2]	8,624	7.7	12,360	9.73	11,316	30.2	16,662	38.8

Notes:

[1] Totals may not equal to 100% due to rounding.

[2] Hispanic Origin can be any race. It is not included in the percentage total.

Sources: U.S. Bureau of Census (1990); Office of Financial Management (1994).

The data in Table 4.1 indicate that the minority population in Franklin County is greater than in Benton County and the minority population in both counties has increased during the years 1990 to 1994.

Both the Council on Environmental Quality and the U.S. Environmental Protection Agency (EPA) identify low-income populations using annual statistical income thresholds from the Bureau of the Census Current Population Reports, Series P-60 on Income and Poverty. The 1990 Small Area Income and Poverty Estimate for Benton County, published by the Bureau of Census, indicates that 11 percent of the population was below the poverty level, and the estimate for Franklin County was 22.7 percent. In 1990, the Washington State population was 4,741,003, with approximately 517,933 or 10.9 percent of the total population below the poverty level (U.S. Bureau of Census 1990).

4.4 PHYSICAL ENVIRONMENT

The ATG Site is located near the DOE Hanford Site boundary, approximately 2.8 km (1.75 mi) south south-west of the 300 Area, and is in a semiarid region. The Cascade Mountains to the

west greatly influence the area's climate by providing rainshadow. This range also serves as a source of cold air drainage, which has a considerable effect on the area's wind regime.

Predominately, winds at the Hanford 300 Area Meteorological Station are from the southwest and northwest. Monthly average wind speeds are lowest during November, averaging approximately 10 km/hr (6 mi/hr), and highest during June, averaging approximately 15 km/hr (9 mi/hr). Wind speeds that are well above average are usually associated with southwesterly winds. However, the summertime drainage winds are generally northwesterly and frequently reach 50 km/hr (30 mi/hr) (Neitzel 1996).

Winds at the Richland airport predominantly are from the south-southwest or the north-northwest. Wind speeds average 10 to 11 km/hr (6 to 7 mi/hr) during the winter and 13 to 16 km/hr (8 to 10 mi/hr) during the summer.

Severe high winds are often associated with thunderstorms. On average, the ATG vicinity experiences 10 thunderstorms per year, most frequently (80 percent) during May through August.

Good atmospheric dispersion conditions exist about 57 percent of the time during the summer (PNNL 1996). Less favorable dispersion conditions occur when the wind speed is light and the mixing layer is shallow. These conditions are most common during the winter when moderately to extremely stable stratification exists about 66 percent of the time. The probability of an inversion period (e.g., poor dispersion conditions) extending more than 12 hours varies from a low of about 10 percent in May and June to a high of about 64 percent in September and October (Holzworth 1972).

Although fog has been recorded throughout the year, nearly 90 percent of the occurrences are during the late fall and winter months. Other phenomena that restrict visibility to 10 km (6 mi) or less include dust, smoke (typically from wildfires, orchard smudging [e.g., using oil-fired heaters to protect fruit crops during springtime freezes]), and agricultural field burning. Reduced visibility from blowing dust occurs an average of five days per year, and reduced visibility resulting from smoke occurs an average of two days per year.

Average monthly temperatures vary from -1 degrees centigrade (°C) (30 degrees Fahrenheit [°F]) in January to 24°C (76°F) in July, with a yearly average of 12°C (53°F). On the average, 51 days during the year have maximum temperatures greater than or equal to 32°C (90°F), and 12 days have a maximum greater than or equal to 38°C (100°F). Also, an average of 25 days during the year have maximum temperatures less than 0°C (32°F), and 106 days per year have minimum temperatures less than 0°C (32°F).

The average annual precipitation measured is 16 centimeters (cm) (6.5 inches [in.]) with over half of this occurring from November through February. December, the wettest month, receives an average of 2.5 cm (1 in.), while July, the driest month, averages 0.5 cm (0.2 in.) of precipitation. The annual average snowfall is 38 cm (15 in.).

Air Quality

Air quality in the area surrounding the ATG Site is generally good. However, ambient concentrations of particulate matter occasionally exceed regulatory standards. These elevated concentrations are believed to result from natural sources such as the dust storms and brush fires that occur in arid eastern Washington State (Neitzel 1996).

National Ambient Air Quality Standards have been established as mandated in the Clean Air Act. Ambient air refers to air outside of buildings to which the general public has access. The National Ambient Air Quality Standards define levels of air quality that are considered protective of public health (primary standards) and welfare (secondary standards). The standards exist for the following criteria pollutants: sulfur oxides (measured as sulfur dioxide), nitrogen dioxide, carbon monoxide, PM-10 (particle matter that is less than 10 micrometers [0.0004 in.] in diameter), lead, and ozone. The air quality standards specify maximum allowable pollutant concentrations and frequencies of occurrence for averaging periods ranging from one hour to one year, depending on the pollutant. Washington State has largely adopted the current Federal standards. However, Washington State has established more stringent standards for sulfur dioxide and ozone and also maintains an air quality standard for total suspended particulates and gaseous fluorides.

Air quality monitoring data adjacent to the ATG Site on the Hanford Site are available for nitrogen oxides and volatile organic compounds (PNNL 1995). The nearest monitoring station on the Hanford Site is approximately 3.0 km (1.8 mi) north-northeast from the ATG Site. Monitoring of nitrogen oxides was discontinued after 1990 because the primary source (the Hanford Site Plutonium-Uranium Extraction [PUREX] Plant) ceased operation. The highest annual average nitrogen oxides concentration was approximately an order of magnitude below the Federal and Washington State standard of 0.05 parts per million (Neitzel 1996).

Ten volatile organic compound samples were collected on the Hanford Site and analyzed in 1994. The samples were analyzed for halogenated alkanes and alkenes, benzene, and ethylbenzenes. Overall, the concentrations measured in 1994 were within the range of values reported in previous studies and also were well within guidelines and allowable regulatory limits (PNNL 1995).

During 1993, monitoring near the Hanford Site showed the 24-hour particulate matter standard of 50 micrograms per cubic meter ($\mu g/m^3$) being exceeded twice at the Columbia Center monitoring location in Kennewick. The maximum 24-hour concentration of 150 $\mu g/m^3$ was exceeded twice, with the highest level reaching 1,166 $\mu g/m^3$. The suspected cause was windblown dust. The annual primary standard of 50 $\mu g/m^3$ was not exceeded.

Radiological data were collected during 1995 through a network of 47 continuously operating samplers at Hanford Site radiological monitoring stations, at the Hanford Site perimeter, and at nearby and distant communities. Cesium-137, plutonium-239, plutonium-240, strontium-90, and uranium were consistently detected in air samples collected in the Hanford 200 Areas located approximately 25 km (15 mi) northwest of the ATG Site. Concentrations were higher on the Hanford Site than those measured at locations off the Hanford Site and were in the same range as measured in previous years. Emissions from Hanford Site facilities resulted in doses to the public that were lower than the applicable standards (PNNL 1996).

ATG continuously monitors radiation levels at the ATG Site perimeter using both continuous air samplers at four fixed-compass-direction locations and thermoluminescent dosimeters for external radiation dose measurement. Additionally, air is sampled at all release or ventilation points to measure radionuclide emissions (Jacobs 1998).

Radionuclide emissions from ATG facilities during the year of 1996 were 1.4E-10 Ci/year of manganese-54, 2.0E-10 Ci/year of cobalt-60, 1.7E-10 Ci/year of cesium-137, 3.0E-10 Ci/year of bismuth-214, 2.4E-10 Ci/year of lead-214, and 2.0E-09 Ci/year of radium-226 (ATG 1997). These facility emission levels would result in a radiological dose of 4.9E-08 mrem/year for a maximally exposed individual (MEI) at the facility boundary, which is well below the standard of 10 mrem/year (Jacobs 1997).

Geology and Soils

The current topography at the ATG Site is flat. All disturbed areas are graded to conform to the surrounding topography and drainage systems.

The facility is situated on stable soils. Soil at the ATG Site has been disturbed, so there would be only a small amount of additional soil disturbance during facility activities. Activities would involve temporary disturbances to soil outside the facility footprint, primarily in the trample zone around work areas, heavy equipment traffic areas, and material laydown areas.
Temporary impacts would include soil compaction and increased potential for soil erosion. However, the total area of disturbance would be approximately 2 ha (5 ac) and within areas previously disturbed by Site activities or agricultural production. Previous site activities include clearing and graveling the surface and constructing access roads within the fenceline.

Seismic Activity

The U.S. Nuclear Regulatory Commission (NRC) concluded that four earthquake sources should be considered for seismic design; the Rattlesnake-Wallula alignment, Gable Mountain, a floating earthquake in the tectonic province, and a swarm area (a floating earthquake) (NRC 1982).

For the Rattlesnake-Wallula alignment, which passes along the southwest boundary of the Hanford Site, the NRC estimated a maximum magnitude quake of 6.5, and for Gable Mountain, an east-west structure that passes through the northern portion of the Hanford Site, a maximum magnitude quake of 5.0. These estimates were based on the inferred sense of slip, the fault length, and/or the fault area. The floating earthquake for the tectonic province was developed from the largest event located in the Columbia Plateau, the magnitude 5.75 Milton-Freewater earthquake. The maximum swarm earthquake for the Washington Public Power Supply System Plant 2 seismic design was a magnitude 4.0 event, based on the maximum swarm earthquake in 1973 (NRC 1982). The most recent probabilistic seismic hazard analysis calculated an annual probability of recurrence of a 0.2 g earthquake at 5E-04 (WHC 1994).

Water

There are no natural perennial surface water bodies within 150 meters (m) (500 feet [ft]) of the ATG Site. The principal river systems within the region surrounding the ATG Site include the Columbia and the Yakima Rivers; however, the ATG Site is not within designated 100-year or

500-year floodplains of either river system (ATG 1995). A small intermittent surface stream is located about 0.8 km (0.5 mi) west of the ATG Site. The 200 West Area is not within the area of probable maximum flood (DOE 1986). Portions of the 33-km (20-mi) proposed waste transport route, however, are within the 100-year floodplain of both the Yakima and the Columbia Rivers (DOE 1986).

On the Hanford Site, smaller surface streams include Rattlesnake Springs, Snively Springs, Cold Creek (ephemeral), and Dry Creek (ephemeral). No wild or scenic river segments are present within the region of influence.

Groundwater in the southeastern portion of Hanford Site and in the vicinity of the ATG Site is less affected by Hanford Site operations than by agricultural irrigation cycles and growing seasons in and around Richland (Newcomer et al. 1992). The aquifer near the ATG Site is recharged both naturally (e.g., via surface water bodies and precipitation) and artificially (e.g., via irrigation, canal seepage, and industrial discharges). Artificial recharge is primarily by the north Richland recharge basins and by irrigated farming in the north Richland area. Groundwater depth at the ATG Site is slightly greater than 3 m (10 ft) (Ecology 1995). The ATG Site is not over a sole source aquifer, as defined in the Safe Drinking Water Act, and is not located in a groundwater management area. No public or private domestic water supply wells are known to exist within 150 m (500 ft) of or downgradient of the ATG Site.

Groundwater in the 200 Areas is strongly influenced by the discharge of large quantities of wastewater to the ground over the last 50 years, which has resulted in elevated water levels across most of the Hanford Site. Discharges of water to the ground have significantly reduced, resulting in decreases in the water table of up to 9 m (29.5 ft) in the 200 Areas.

4.5 ECOLOGY

4.5.1 Terrestrial Biota

Vegetation. Approximately six percent of the 1,450 km^2 (560 mi^2) Hanford Site is developed, and the balance of the site is undeveloped. Hanford Site vegetation is characterized as a shrub-steppe ecosystem (Neitzel 1996). For a complete list of species and a more complete description of habitat types, refer to the Hanford Site NEPA Characterization Report (Neitzel 1996).

The Hanford Site also includes 655 km^2 (257 mi^2) of land designated for research or as wildlife refuges, including the Arid Lands Ecology Reserve, U.S. Fish and Wildlife Service Saddle Mountain National Wildlife Refuge, and the Washington State Department of Fish and Wildlife Wahluke Slope Wildlife Area (Neitzel 1996).

The ATG Site is located within an area of north Richland zoned for heavy industrial uses. Some of the land within the ATG Site and the zoned area remains under agricultural cultivation. Vegetation on the ATG Site also includes shrubs and a variety of wild mustards and sagebrush plants sparsely scattered throughout the site. Site vegetation is dominated by nonnative weeds, including Russian thistle.

Wildlife. Common bird species in the vicinity of the ATG Site include the western meadowlark, white-crowned sparrow, gull, black-billed magpie, American crow, and European starling. Canada geese, red-tailed hawk, and American kestrel are common and are likely to occasionally feed in nearby grain fields (City of Richland 1998).

Approximately 240 terrestrial vertebrate species have been observed at Hanford Site including 40 mammal, 187 bird, 3 amphibian, and 9 reptile. Approximately 600 insect species also have been observed at Hanford Site (Neitzel 1996). The Tri-Cities area is within a major waterfowl flyway and wintering area. Waterfowl use is concentrated along the Columbia River, with limited waterfowl presence at the 200 West Area and in the immediate vicinity of the ATG Site.

4.5.2 Aquatic Biota

Hanford Site includes two types of natural aquatic habitats-the Columbia River and small spring-streams and seeps located mainly on the Arid Lands Ecology Reserve. These habitats include numerous species of phytoplankton, periphyton, macrophytes, zooplankton, benthic organisms, insects, and fish. Fish species common to the Columbia River include the Chinook salmon, sockeye salmon, coho salmon, and steelhead trout. Common waterfowl species include Canada goose, several species of ducks, and coot. A complete species list for the Hanford Site can be found in Neitzel (1996).

Larger Hanford Site wetlands are found along its Columbia River border. The width of the wetlands vary but may include extensive stands of willows, grasses, various aquatic macrophytes, and other plants (Neitzel 1996). Other wetlands areas within the region of influence are within the Saddle Mountain National Wildlife Refuge, Wahluke Wildlife Area, and the Arid Lands Ecology Reserve (Neitzel 1996). No wetlands are found in the immediate vicinity of the ATG Site.

Because there is no surface water in the immediate vicinity of the ATG Site there are no aquatic species. However, the ATG Site is about 3 km (2 mi) west of the Columbia River and is in its region of influence. The ATG Site elevation is about 10 m (30 ft) above the average surface elevation of the river along the Hanford Reach.

4.5.3 Endangered and Threatened Species

No threatened or endangered plant or animal species are known to exist or are suspected to be present on the ATG Site. Table 4.2 provides a list of threatened or endangered plant or animal species known to exist on or near the Hanford Site, which is in close proximity to the ATG Site. The absence of native vegetation and the industrial nature of the area render it unlikely habitat for such species.

Table 4.2. Threatened and Endangered Species

Common Name	Scientific Name	Federal	State
Insects			
Oregon silverspot butterfly [2]	*Speyerra zerone*	T	T [1]
Plants			
Columbia milk-vetch	*Astragalus columbianus*		T

Columbia yellowcress	*Rorippa columbiae*		E [1]
Dwarf evening primrose	*Oenothera pygmaea*		T
Hoover's desert parsley	*Lomatium tuberosum*		T
Northern wormwood	*Artemisia campestris borealis var. wormskioldii*		E
Birds			
Aleutian Canada goose [3]	*Branta canadensis leucopareia*	T	E
American white pelican	*Pelecanus erythrorhychos*		E
Bald eagle	*Haliaeetus leucocephalus*	T	T
Ferruginous hawk	*Buteo regalis*		T
Peregrine falcon [3]	*Falco peregrinus*	E	E
Sandhill crane [3]	*Grus canadensis*		E
Mammals			
Pygmy rabbit [2]	*Brachylagus idahoensis*		E

Notes:
[1] T = Threatened; E = Endangered
[2] Likely not currently inhabiting Hanford Site
[3] Incidental occurrence
Source: Neitzel 1996

No plants or mammals on the Federal endangered species list are known to exist at Hanford Site. Three bird species found at the Hanford Site, however, are on the Federal list of threatened and endangered species. Also, several species of plants and animals found there are under state consideration for formal listing. Table 4.2 lists the threatened and endangered species inhabiting or potentially inhabiting the Hanford Site.

4.6 CULTURAL RESOURCES

Information regarding local cultural resources can be found in the Hanford Site NEPA Characterization report (Neitzel 1996). Two hundred and eighty-three prehistoric sites have been found on Hanford Site (Neitzel 1996). Prehistoric archaeological sites common to Hanford Site include remains of numerous pit house villages, various types of open campsites, cemeteries, spirit quest monuments (rock cairns), hunting camps, game drive complexes, and quarries in mountains and rocky bluffs (Rice 1968a; 1968b; 1980). No cultural or archeological sites or artifacts are known or suspected to be present at the ATG Site (Ecology 1995).

5.0 ENVIRONMENTAL IMPACTS OF THE PROPOSED ACTION

5.1 FACILITY OPERATION AND WASTE TRANSPORT

In this section, the environmental impacts of air emissions, hazardous chemicals and wastes, solid wastes, and transportation were analyzed relative to the conditions described in Section 4.0, Affected Environment.

For the LLMW specified for treatment under this action, there are insufficient characterization data available to develop waste stream-specific chemical and radiological source terms. However, data are available for Hanford Site LLMW on a more global basis, which were assumed to provide a conservative basis for the LLMW evaluated under this action. Based on the discussion provided in Section 2.2, it was assumed that the chemical and radiological inventory of waste that would be treated under this action would be similar to the waste evaluated in the thermal treatment EA (DOE 1996a) with the exception of PCBs. Waste classified as containing PCBs would not be suitable for non-thermal treatment. Air emissions resulting from the non-thermal treatment of LLMW were taken from the ATG risk assessment work plan developed in support of the RCRA Part B permit application (Jacobs 1998). The air emissions estimate in the risk assessment work plan was derived using characterization data from Hanford Site LLMW.

5.1.1 Air Pollutant Emissions

Air pollutant emissions estimates from the non-thermal treatment facility were based on air dispersion modeling that was performed to analyze air quality impacts from thermal treatment of LLMW at the ATG MWF (Tetra Tech 1996a). The emission estimates were adjusted to reflect the contaminants emission rates projected in the ATG risk assessment work plan (Jacobs 1998) for the non-thermal treatment facility. The analyses were conducted to compare the calculated impacts of potential criteria pollutant releases against National Ambient Air Quality Standards and Washington State Air Quality Standards, the calculated impacts of emissions of toxic and hazardous air pollutants against applicable Washington State regulations, and the calculated impacts of emissions of radionuclides against applicable Federal and Washington State standards. Washington State standards are listed in the WAC and include the following:

- Acceptable source impact levels for toxic air pollutants (WAC 173-460)
- Ambient air quality standards for particulate matter (WAC 173-470)
- Ambient air quality standards for sulfur oxides (WAC 173-474)
- Ambient air quality standards for carbon monoxide, ozone, and nitrogen dioxide (WAC 173-475)
- Ambient air quality standards for radionuclides (WAC 173-480)
- Ambient air quality standards for fluorides (WAC 173-481)
- National emission standards for hazardous air pollutants (40 CFR 61)

- Radiation protection - air emissions (WAC 246-247).

The results of the analysis show no exceedance of Federal or State air quality standards for criteria pollutants, hazardous air pollutants, or radionuclides from the non-thermal treatment facility. The pollutants presented in Table 5.1 would result in the highest levels of emission compared to Federal or State standards.

Table 5.1. Major Air Pollutant Impacts

Pollutant	Averaging Period	Concentration g/m^3	State g/m^3	Federal g/m^3
Particulate matter (PM_{10})	24 hr	2.6E-03	1.5E+02	1.5E+02
Formaldehyde	Annual	2.9E-03	7.7E-02	NA
Diphenylene methane (fluorene)	24 hr	9.7E-06	5.3E+00	NA
Phenol	24 hr	1.1E-04	6.3E+01	NA
1,4-Dichlorobenzene (p-dichlorobenzene)	24 hr	1.1E-04	1.5E+00	NA
Combined methylphenol (cresol) isomers	24 hr	9.5E-03	7.3E+01	NA
Naphthalene	24 hr	2.0E-03	1.7E+02	NA
Dimethyl Phthalate	24 hr	1.1E-04	1.7E+01	NA
Di-n-Butyl Phthalate	24 hr	4.6E-04	1.7E+01	NA
Bis(2-ethylhexyl) phthalate	Annual	1.1E-04[a]	2.5E+00	NA
Aluminum (combined particulate and vapor)	24 hr	1.2E-04	6.7E+00	NA
Barium (combined particulate and vapor)	4 hr	1.3E-06	1.7E+00	NA
Cadmium	Annual	8.8E-07[a]	5.6E-04	NA
Iron	24 hr	1.6E-05	1.7E+01	NA
Lead	24 hr	1.5E-03	5.0E-01	NA
Nickel	Annual	1.2E-04[a]	2.1E-03	NA
Radionuclide Emissions	**Units**	**Dose (incremental)**	**State Standard**	**Federal Standard**
Total radionuclides (maximum off-site receptor at point of maximum ground level concentration)	mrem/yr	1.1E-02	1.0E+01[b]	1.0E+01[c]

Notes:

[a] This is a 24-hour concentration value that is less than the annual State standards, therefore annual concentrations were not generated with Industrial Source Complex (ISC3) computer code (annual concentrations values are typically reduced from the 24-hour values by one to two orders of magnitude).

[b] WAC 246-247.

[c] 40 CFR 61.

Air concentrations taken from Tetra Tech (1996a) and adjusted to reflect non-thermal treatment emission rates projected in the Risk Assessment Work Plan (ATG 1998).

NA = Not applicable.

5.1.2 Transportation

The radiological and chemical transportation impacts associated with the non-thermal treatment of LLMW from the Hanford Site as well as nonradiological/nonchemical transportation accidents are evaluated in this section.

5.1.2.1 Radiological Risk

LLMW would be transported by truck from the 200 West Area to the ATG MWF for treatment at the non-thermal treatment building. Approximately 50 percent of the proposed route is subject to access controls. Only authorized personnel are allowed to travel on the access-controlled road. After treatment, the stabilized waste would be transported back to the 200 West Area for storage and eventual land disposal. The incident-free transportation health effects for this analysis were based on RADTRAN 4 computer modeling conducted by Tetra Tech (1996b). The worker population was assumed to consist of two people, the driver and a health and safety technician. Because the transport route is largely on the Hanford Site, the majority of non-workers potentially exposed during incident-free transport would be those sharing the roadway with the truck. Model default parameters designed to provide conservative analyses were used for a number of parameters including traffic counts, population density, and transport speed. Using a traffic count of 470 vehicles per hour (one way), the model estimated that, based on the calculated transport time, 317 people would be exposed during a single incident-free trip. The maximally exposed (MEI) individual non-worker is assumed to be located 10 m (33 ft) from the roadway.

The health effects from transportation accidents were based on RADTRAN 4 computer modeling conducted in Jacobs (1997) to support the Final EIS for Treatment of LLMW at the ATG Site (City of Richland 1998). The waste types evaluated in Jacobs (1998) were similar to the waste types evaluated in this EA.

Other important variables in calculating transportation risk are the number and size of shipments. The size of the shipments of untreated waste was 18,100 kilograms (kg) (40,000 pounds [lb]), which included 16 shipments per year (DOE 1996a). The same shipment size was assumed for the analysis in this EA, and the annual shipments of untreated waste would be approximately 16 shipments per year. Stabilizing the waste would include adding cement-like materials to the waste or encapsulating the waste in polymer materials. This would increase the volume of the treated waste by approximately 25 percent and therefore the number of trips of treated waste from the ATG MWF to the Hanford Site 200 West Area would increase proportionally to 20 shipments per year.

Latent Cancer Fatality Risk From Incident Free Transportation

The annual incident-free transportation latent cancer fatality (LCF) risk to the involved workers and noninvolved workers and general public are summarized in Table 5.2. There would be no anticipated LCFs to the workers (3.0E-05 + 4.0E-05 = 7.0E-05) or the noninvolved workers and general public (1.2E-05 + 1.6E-05 = 2.8E-05) based on three years of operation. The LCF risk to the MEI would be 3.5E-05 (1.5E-05 + 2.0E-05) based on three years of operation.

Table 5.2. Incident-Free Transportation Latent Cancer Fatality Risk

Receptor	Annual Dose person-rem	3-year Dose person-rem	LCF Risk for Duration of Project
Untreated Waste Transported From Hanford 200 West Area to ATG MWF			
Involved worker population	2.5E-02	7.5E-02	3.0E-05
Involved worker MEI	1.3E-02 (rem)	3.8E-02 (rem)	1.5E-05
Noninvolved worker and general public population	9.8E-03	2.9E-02	1.2E-05
Noninvolved worker MEI	9.3E-06 (rem)	2.8E-05 (rem)	1.1E-08
Treated Waste Transported from ATG MWF to Hanford 200 West Area			
Involved worker population	3.3E-02	1.0E-01	4.0E-05
Involved worker MEI	1.7E-02 (rem)	5.0E-02 (rem)	2.0E-05
Noninvolved worker and general public population	1.3E-02	3.9E-02	1.6E-05
Noninvolved worker MEI	1.2E-05 (rem)	3.7E-05 (rem)	1.5E-08

Latent Cancer Fatality Risk From Transportation Accident

Each RADTRAN 4 model run assumes that accidents of six different severities could occur during the transportation of the waste. Accident-severity categories were defined as various combinations of thermal (i.e., fire) and mechanical (i.e., impact, puncture, crush) environments and differed in the degree to which package shielding was damaged and contents were released. More severe accidents were assumed to result in releases of greater amounts of radioactive materials over a larger area and to occur with a much lower frequency than less severe accidents.

The evaluation in Jacobs (1997) showed that the population health impacts from an accident while transporting LLMW would result in an annual health risk of 3.6E-04 LCF. The analysis evaluated transportation accidents in heavily populated areas such as Vancouver, Washington; Spokane, Washington; and Seattle, Washington that would bound the consequences of a transportation accident that could potentially occur en route from the Hanford Site to the ATG Site. The evaluation in Jacobs (1997) was based on 475 trips per year, which would bound the probability of a transportation accident based on 16 trips per year, as evaluated in this EA.

5.1.2.2 Chemical Risk From Transportation Accident

Potential acute hazards associated with exposure to concentrations of chemicals resulting from postulated LLMW transportation accidents were evaluated using a screening-level approach. The screening-level approach involved direct comparison of calculated exposure concentrations of chemicals to an MEI located within an assumed 10 m (33 ft) radius of the accident, to air concentration screening criteria known as Emergency Response Planning Guidelines (ERPGs). ERPGs are defined as follows.

- ERPG-1 - The maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hour without experiencing other than mild transient adverse effects or perceiving a clearly defined objectionable odor.

- ERPG-2 - The maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hour without experiencing or developing irreversible or other serious health effects or symptoms that could impair their ability to take protective action.

- ERPG-3 - The maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hour without experiencing or developing life-threatening health effects.

The health hazards were evaluated based on the corrosive/irritant effects and toxic effects. Chemicals were sorted into chemical classes, and representative chemicals having the highest potential health impacts from each chemical class were selected to provide a conservative prediction of the potential health impacts from the entire chemical class. Risks from chemicals within each group (corrosive/irritant or toxic) were assumed to be additive. This is a conservative assumption because many different chemicals affect different organs. Cumulative hazards for the corrosive/irritant and toxic chemicals were evaluated as follows:

$$\text{Cumulative Hazard} = C_1/E_1 + C_2/E_2 + ... + C_i/E_i$$

Where:

C = Calculated airborne exposure point concentration for an individual chemical (mg/m^3).
E = The ERPG for the chemical (mg/m^3).

A cumulative Hazard Index (HI) greater than 1.0 indicates that the acute hazard guidelines for a chemical class has been exceeded and the chemical class may pose a potential acute health impact.

The chemical health hazards associated with a transportation accident are dependent on the severity of the accident, nature of the chemicals, local population density, and the weather conditions. The worst-case credible accident would be an accident resulting in a fire while transporting LLMW to the ATG MWF to be treated. Chemical consequences from untreated waste would be more severe than treated waste because the treatment process would immobilize hazardous organic chemicals, and the treated waste has a very low probability of igniting.

The following assumptions and parameters were used in calculating the chemical concentrations within a 10 m (33 ft) radius of the accident:

- Waste per truck shipment = 18,100 kg (40,000 lb) (Tetra Tech 1996b)

- Hazardous chemical/shipment = 152 kg (340 lb)

- Amount of waste spilled from the container and available to burn = 50 percent (assumed)

- Respirable release fraction for a fire = 5.0E-04 (DOE 1994). The release fraction was taken from DOE (1994) and is based on experimental data in which various types of packaged waste (e.g., paper, rags, tape, plastic, cardboard, oil) contaminated with uranium dioxide powder, uranyl nitrate liquid, and air-dried uranyl nitrate were burned. The

respirable release fraction is a combination of the airborne release fraction and the respirable fraction or the fraction of the material that is respirable.

- The material released is assumed to spread instantaneously and uniformly over a hemisphere 10 m (33 ft) in radius. The MEI is assumed to be located at the center of the hemisphere.

The chemical concentration within a 10 m (33 ft) hemisphere is calculated using the following equation:

$$C(mg/m^3) = [Q\ (kg)] \quad \left(\frac{3}{2p\ r^3}\right) \quad (1.0E+06\ mg/kg)$$

Where:

C = Concentration
Q = Respirable quantity released based on (truck inventory) (50 percent released in fire) (respirable release fraction)
r = Assumed 10 m (33 ft) radius for distribution of source.

Therefore:

C = (152 kg) (50 percent) (5.0E-04) (4.77E-04/m^3) (1.0E+06 mg/kg) = 1.75E+01 mg/m^3

The chemical inventory involved in a potential truck accident was based on a breakdown of the Hanford Site LLMW by hazardous and toxic material constituents (Jacobs 1997). To facilitate the analysis the chemicals were sorted into chemical classes by chemical type and a representative chemical was selected from the class that would provide a conservative bound on the potential health effects from all chemicals within a given class. This approach provides a conservative prediction of the potential health effects by adding the chemical mass within each class and assuming that the entire mass is the selected representative chemical.

The air concentrations of the chemical classes are compared to the ERPGs in Table 5.3 (toxic concentration limits) and Table 5.4 (corrosive/irritant concentration limits). As shown in these tables, the accident would not result in any anticipated fatalities or the development of irreversible or serious health effects or the development of mild transient adverse effects.

5.1.2.3 Nonradiological/Nonchemical Transportation Impacts

The nonradiological/nonchemical impacts include injuries and fatalities resulting from truck accidents. The LLMW would be transported by truck from the 200 West Area to the ATG MWF. After treatment the stabilized waste would be transported back to the 200 West Area for land disposal. The 200 West Area is located approximately 33 km (20 mi) to the northeast of the ATG MWF. The rates of transportation accidents are assumed comparable to that of average truck transport in the United States. Unit-risk factors were developed based on statistics compiled by DOT (Rao 1982). The unit-risk factors for injuries and fatalities in a suburban zone

are 3.8E-07/km and 1.3E-08/km, respectively. Based on traffic counts and congestion levels that vary considerably throughout the work day along the transport route, injury and fatality rates from suburban zones were used. These rates are slightly higher than the rates for rural zones.

The number of injuries and fatalities during the 3 years of treatment were calculated using the following equation:

$$\text{Injuries} = D(kg/m^3) \quad V(m^3) \times S(kg/\text{shipment})^{-1} \quad T(km/\text{shipment}) \quad I_i(\text{injuries/km}) \quad F$$

$$\text{Fatalities} = D(kg/m^3) \quad V(m^3) \quad S(kg/\text{shipment})^{-1} \quad T(km/\text{shipment}) \quad I_f(\text{fatalities/km}) \quad F$$

Where:

D = Waste density of 347 kg/m^3 (21.7 lb/ft^3) (Tetra Tech 1996b)
V = A volume of 2,600 m^3 (92,000 ft^3) of waste to be transported (Jacobs 1998)
S = 18,100 kg/shipment (40,000 lb/shipment) of waste to be treated (Tetra Tech 1996b)
T = 66 km/shipment (41 mi/shipment) round trip from the 200 West Area to ATG
I_i = Incidence rate of 3.8E-07/km for injuries resulting from truck transport accidents in a suburban zone (Rao 1982)
I_f = Incidence rate of 1.3E-08/km for fatalities resulting from truck transport accidents in a suburban zone (Rao 1982)
F = The waste volume after non-thermal stabilization would increase by 25 percent due to cement-like and polymer-like additives increasing the number of trips from ATG to the 200 West Area by the same proportion.

Therefore, the number of injuries would be less than 1 (1.6E-03) and the number of fatalities would be less than 1 (5.4E-05).

5.2 HUMAN HEALTH IMPACTS FROM PLANT OPERATIONS

Environmental health impacts analyzed in this section include potential LCF risks from radiological exposure and health hazards and incremental lifetime cancer risk (ILCR) from chemical exposures that would occur during routine non-thermal treatment operations or that could result from postulated accidents. The analysis also includes injuries and fatalities from nonradiological and nonchemical industrial type accidents that would be typical to the operations activities associated with the non-thermal treatment facility.

Table 5.3. Comparison of Chemical Concentrations to Toxic Concentration Limits for Transport Truck Fire [6]

Analyte (Threshold values are presented in mg/m^3)		Exposure (mg/m^3)	ERPG-1 (mg/m^3)	ERPG-2 (mg/m^3)	ERPG-3 mg/m^3)
Solvent/Thinner Waste Stream					
Benzene [1]	MEI	1.8E+00	Threshold Value		
			7.80E+01	1.57E+03	3.13E+03
			Ratio of Exposure to ERPG[5]		
			2.40E-02	1.2E-03	5.9 E-04

N-Butyl Alcohol [2]	MEI	9.6E-01	Threshold Value		
			7.50E+01	7.50E+02	7.50E+03
			Ratio of Exposure to ERPG		
			1.3E-02	1.3E-03	1.3E-04
2-Hexanone [3]	MEI	4.0E+00	Threshold Value		
			5.00E+01	5.00E+02	5.00E+03
			Ratio of Exposure to ERPG		
			8.4E-03	8.4E-04	8.4E-05
Petroleum/Coal Tar Derivatives					
Tridecane [4]	MEI	5.8E+00	Threshold Value		
			3.70E+01	1.45E+03	7.33E+03
			Ratio of Exposure to ERPG		
			1.6E-01	4.0E-03	8.0E-04
Total MEI ratios			2.0 E-01	7.3 E-03	1.6E-03

Notes:

ERPG = Emergency Response Planning Guideline values. ERPG values were obtained from the Hanford Environmental Health Foundation (Dentler 1995)

MEI = Maximally exposed individual

[1] Benzene used as a representative chemical for aromatic compounds.

[2] N-butyl alcohol used as a representative chemical for glycols/alcohols.

[3] 2-hexanone used as a representative chemical for aliphatics.

[4] Tridecane (similar to kerosene) used as a representative chemical for petroleum and coal tar derivatives.

[5] A ratio less than 1 indicates that the calculated exposure concentration is lower than the ERPG.

[6] Because of uncertainties surrounding the release fractions for volatile or semi-volatile chemical compounds, exposure concentrations and ratios of exposure to ERPG threshold values were calculated using an airborne release fraction of 1.0 and a respirable release fraction of 1.0. The resulting ratio of exposure concentration to ERPG-3 would be an exceedence of 3.6. However, when the probability of the accident (6.6E-08) is taken into account the resulting risk would be 2.4E-04.

Table 5.4. Comparison of Chemical Concentrations to Corrosive/Irritant Concentration Limits for Transport Truck Accident [7]

Analyte (Threshold values are presented in mg/m^3)		Exposure Concentration (mg/m^3)	ERPG-1 (mg/m^3)	ERPG-2 (mg/m^3)	ERPG-3 (mg/m^3)
Solvent/Thinner/Freon Waste Stream					
Methylene Chloride [1,3]	MEI	8.4E-01	Threshold Value		
			7.00E+02	3.48E+03	1.74E+04
			Ratio of Exposure to ERPG[6]		
			1.2E-03	2.4E-04	4.8E-05
Metals/Metal Salts Waste Stream					
Sodium Silicate [2]	MEI	1.2E-01	Threshold Value		
			5.80E+00	1.16E+02	2.90E+02
			Ratio of Exposure to ERPG		
			2.1E-02	1.1E-03	4.2E-04
Amine Waste Stream					
Ammonia [4]	MEI	2.5E-01	Threshold Value		
			1.70E+01	1.40E+02	6.80E+02
			Ratio of Exposure to ERPG		
			1.4E-02	1.8E-03	3.6E-04
Caustic (Acids/Bases) Waste Stream					
Sodium Hydroxide [5]	MEI	4.6E-01	Threshold Value		
			2.00E+00	4.00E+01	1.00E+02
			Ratio of Exposure to ERPG		
			2.3E-01	1.2E-02	4.6E-03
Total MEI Ratios			2.7E-01	1.5E-02	5.5E-03

Notes:

ERPG = Emergency response planning guideline values. ERPG values were obtained from the Hanford Environmental Health Foundation (Dentler 1995)

MEI = Maximally exposed individual

[1] Methylene chloride used as a representative chemical for chlorinated solvents.

[2] Sodium silicate used as a representative chemical for metals and metal salts.

[3] Methylene chloride used as a representative chemical for freon.

[4] Ammonia used as a representative chemical for amines.

[5] Sodium hydroxide used as a representative chemical for caustics.

[6] A ratio less than 1 indicates that the calculated exposure concentration is lower than the ERPG.

[7] Because of uncertainties surrounding the release fractions for volatile or semi-volatile chemical compounds, exposure concentrations and ratios of exposure to ERPG threshold values were calculated using an airborne release fraction of 1.0 and a respirable release fraction of 1.0. The resulting ratio of exposure concentration to ERPG-2 would be an exceedance of 4.6. However, when the probability of the accident (6.6E-05) is taken into account the resulting risk would be 3.0E-04.

5.2.1 Normal Operating Conditions

The health impacts from routine exposures are evaluated for three receptor groups or populations: the involved workers, noninvolved workers, and general public. Involved workers are those individuals directly involved in a non-thermal treatment activity. Noninvolved workers refer to the ATG Site employees who are not directly involved in the treatment activity. The general public is the population distribution relative to the non-thermal treatment facility to a distance of 80 km (50 mi). Health impacts to the MEI from the involved workers, noninvolved workers, general public groups, and an individual located at the nearby child care center are also evaluated. An MEI is an individual who is assumed to receive the highest possible exposure.

This section examines potential risk from exposure to chemical and radiological contaminants and direct exposure to radiation during normal operations. Risk to the involved workers would be from direct exposure to radiation from non-thermal treatment operations during the work day. Chemical and radiological emissions are from a stack, and it is therefore assumed that the plume passes overhead. Risk to the noninvolved workers would be from potentially inhaling radioactive and chemical atmospheric stack emissions from non-thermal operations. Risk to the general public includes potentially inhaling radioactive and chemical atmospheric stack emissions and ingesting food and water contaminated by airborne deposition. Health impacts are based on 3 years of operation (the maximum duration for waste processing for the waste stream evaluated).

Involved Worker Radiological Consequences From Normal Operations

The LCF risk to the involved workers was calculated by multiplying the radiological exposure by a dose-to-risk conversion factor. The involved worker population dose was assumed to be 200 mrem/year per involved worker (historical average for the existing ATG low-level waste [LLW] treatment facility) and a population of 40 involved workers. The administrative control limit of 1 rem/year was assumed for the MEI. The dose-to-risk conversion factor used in the analysis to calculate the LCF risk to the involved workers was 4.0E-04 LCFs per person-rem taken from the 1990 Recommendations of the International Commission on Radiological Protection (ICRP 1991). These factors are applicable where the dose to an individual would be less than 20 rem and the dose rate would be less than 10 rem per hour. The annual LCF risk to the involved worker population and the MEI involved worker during normal operations are presented in Table 5.5. No LCFs would be expected for the involved workers, and over the three year life of the project, the risk of the MEI receiving a fatal cancer from the LLMW operation is small [1.2E-03]). The results are conservative because the waste stream evaluated (300 metric tons/year) is much lower than the treatment capacity of the non-thermal treatment portion of the MWF (8,500 metric tons/year). Therefore, the waste stream evaluated in this EA would not require a full year of facility operation for treatment.

Table 5.5. Involved Worker Radiological Risk From Normal Operations

Receptor	Annual Dose EDE	Dose EDE for Project	Total Project Radiological Risk (LCF)
Involved worker population	8.0E+00 (person rem)	2.4E+01 (person-rem)	9.6E-03
MEI involved worker	1.0E+00 (rem)	3.0E+00 (rem)	1.2E-03

Notes:

Total project dose and radiological risk based on 3 years of operations
EDE = Effective dose equivalent
LCF = Latent cancer fatality
MEI = Maximally exposed individual
Involved workers dose is based on an annual 200 mrem per involved worker and 40 involved workers per year. The LCF risk is based on a dose-to-risk conversion factor of 4.0E-04 LCF per rem.
MEI-involved worker dose is based on 1,000 mrem per year (ATG administrative control limit). The LCF risk is based on a dose-to-risk conversion factor of 4.0E-04 LCF per rem.

Noninvolved Worker and General Public Radiological Consequences from Normal Operations

The radiological dose to the noninvolved workers and the general public was calculated using the EPA approved CAP88-PC program. The program computes radionuclide concentrations in air, rates of deposition on ground surfaces, concentrations in food, and intake rates to people from ingestion of food produced in the assessment area. It uses a modified Gaussian plume equation to estimate the average dispersion of radionuclides released from either elevated stacks or uniform area sources. Dose is estimated by combining the inhalation and ingestion intake rates, air, and ground surface concentrations with dose conversion factors. The effective dose equivalent is calculated using the weighting factors in the International Commission on Radiological Protection Publication 26 (ICRP 1977). Site-specific meteorological data and population arrays were developed and used with CAP88-PC. The radionuclide source term used with CAP88-PC was taken from air emissions estimates for the ATG MWF that were adjusted to reflect a production rate of 870 m^3/year. The annual emissions are shown in Table 5.6. The annual LCF risk to the noninvolved worker population, MEI noninvolved worker, general public population, and MEI general public during normal operations was calculated using ICRP Publication 60 (ICRP 1991) dose-to-risk conversion factors and are presented in Table 5.7.

The general public evaluation also included an analysis of a maximally exposed individual at a child care center located 2 km (1.25 mi.) to the east-southeast. No LCFs would be expected from the noninvolved worker and general public populations. The incremental risk or probability that the general public MEI would develop a fatal cancer from the non-thermal treatment operation is 1.7E-08. The general public MEI is the receptor within the Site-specific population array that receives the highest dose.

Table 5.6. Annual Radiological Air Emissions

Isotope	Maximum Anticipated Emissions (Ci/year)
Tritium-3 (H-3)	1.22E+01
Carbon-14 (C-14)	2.27E-08
Sodium-22 (Na-22)	8.44E-12
Calcium-45 (Ca-45)	4.46E-12
Chromium-51 (Cr-51)	4.55E-10
Manganese-54 (Mn-54)	4.10E-11
Iron-55 (Fe-55)	6.84E-11
Cobalt-57 (Co-57)	1.04E-10
Cobalt-58 (Co-58)	1.86E-11
Cobalt-60 (Co-60)	5.32E-10
Nickel-63 (Ni-63)	5.21E-11
Zinc-65 (Zn-65)	2.21E-10
Strontium-90 (Sr-90)	2.01E-08
Yttrium-90 (Y-90)	2.01E-08
Zirconium-95 (Zr-95)	8.75E-12
Antimony-125 (Sb-125)	5.85E-11
Tellurium (Te-125m)	1.41E-11
Cesium-134 (Cs-134)	1.12E-11
Cesium-137 (Cs-137)	3.67E-08
Barium-140 (Ba-140)	3.18E-11
Lanthanum-140 (La-140)	3.18E-11
Europium-152 (Eu-152)	3.61E-12
Europium-154 (Eu-154)	1.60E-10
Lead-214 (Pb-214)	1.15E-13
Bismuth-214 (Bi-214)	1.05E-13
Radium-226 (Ra-226)	4.53E-11
Thorium-232 (Th-232)	1.87E-12
Uranium-235 (U-235)	1.34E-10
Uranium-238 (U-238)	9.28E-12
Plutonium-238 (Pu-238)	1.15E-08
Plutonium-239 (Pu-239)	5.19E-10
Plutonium-240 (Pu-240)	1.18E-10
Plutonium-241 (Pu-241)	9.13E-08

Notes:

Maximum anticipated emissions were taken from Attachment 4 of ATG (1998).

Ci = Curies

Table 5.7. Radiological Risk From Air Emissions During Normal Operations

Receptor	Annual Dose EDE	Project Total Dose EDE	Project Total Radiological Risk (LCF)
Noninvolved worker population	1.8E-03 (person-rem)	5.3E-03 (person-rem)	2.1E-06
MEI noninvolved worker	1.1E-05 (rem)	3.3E-05 (rem)	1.3E-08
General public population	1.4E-02 (person-rem)	4.2E-02 (person-rem)	2.1E-05
MEI general public	1.1E-05 (rem)	3.3E-05 (rem)	1.7E-08
MEI child care center	3.0E-06 (rem)	9.0E-06 (rem)	4.5E-09

Notes:
EDE = Effective dose equivalent
LCF = Latent cancer fatality
MEI = Maximally exposed individual
Dose EDE and radiological risk are based on 3 years of operation.
Noninvolved worker population dose was calculated by multiplying the MEI noninvolved worker dose by 160 noninvolved workers. 160 noninvolved workers = 60 workers at the MWF (50 at the thermal treatment facility and 10 support staff associated with non-thermal treatment) and 100 workers at ATG's existing LLW treatment facility.
The population dose represents a collective dose. If 100 people in an exposed population each received a dose of 0.01 rem, the population dose would be 1 person-rem.
Radiological risk calculated by using ICRP dose-to-risk conversion factors.

Involved Worker Nonradiological Chemical Consequences from Normal Operations

Routine chemical emissions from the non-thermal treatment facility would be released from a stack, and it is therefore assumed that the plume passes overhead and would not expose the involved workers working in the facility. Impacts associated with handling hazardous chemicals inside the facility would not be expected because standard hazardous waste storage and handling procedures would be followed. Exposure to hazardous chemicals inside the facility only would occur as a result of an accident.

Noninvolved Worker and General Public Nonradiological Chemical Consequences from Normal Operations

Exposure to chemicals in air emissions was evaluated by estimating inhalation intakes for identified chemical emissions and evaluating potential ILCR (i.e., the excess cancer risk from fatal and nonfatal cancers) and noncarcinogenic health hazards using chemical-specific cancer slope factors and reference doses, respectively. Cancer slope factors and chronic reference doses as published by EPA in the Integrated Risk Information System and Health Effects Assessment Summary Tables were applied in the chemical emissions evaluation.

Routine chemical emissions concentrations from the non-thermal treatment operations were based on emissions concentration data from the Industrial Source Complex (ISC3) air dispersion modeling results for the ATG MWF (Tetra Tech 1996a). The air concentrations were scaled to account for projected emission rates from the risk assessment work plan for the facility's RCRA permit (Jacobs 1998).

The inhalation intake of each chemical (milligram/kilogram [mg/kg]-day) was calculated using the following equation:

$$\text{Intake} = [(Ca)\ \ (IR)\ \ (EF)\ \ (ED)] / [(BW)\ \ (AT)]$$

Where: Ca = Estimated air concentration of the ith chemical, mg/m^3
IR = Inhalation rate, 20 m^3/day (710 ft^3)
EF = Exposure frequency, 250 days/year
ED = Exposure duration, 3 years
BW = Body weight, 70 kg (150 lb)
AT = Average time, days
= (ED)(365 day/year) noncarcinogens
= (70 year)(365 day/year) carcinogen (EPA 1989)

Potential health effects from exposure to multiple noncarcinogenic chemicals were estimated using the HI approach. The HI is defined as the summation of the hazard quotients (calculated dose divided by the reference dose [RfD]) for each chemical and is represented by the following equation:

$$HI = \frac{\text{Calculated Dose}_a}{RfD_a} + \frac{\text{Calculated Dose}_b}{RfD_b} + \ldots + \frac{\text{Calculated Dose}_i}{RfD_i}$$

It was assumed that the noncarcinogenic health effects would be additive for all chemicals. This is conservative because to be truly additive in effect, chemicals must affect the same target organ system or result in the same critical toxic endpoint. An HI greater than or equal to 1.0 (unity) would be indicative of potential adverse health effects in the population of concern from exposure to multiple chemicals. Conversely, a HI less than 1.0 would suggest that no adverse health effects would be expected.

Quantitative estimates for ILCR risks were generated for each chemical according to the following equation:

$$R_i = q_i \quad E_i$$

Where:

R_i = Estimated incremental risk of cancer associated with the chemical
q_i = Cancer slope factor for the chemical, $(mg/kg\ \ day)^{-1}$
E_i = Exposure dose for the chemical, mg/kg day

In evaluating potential carcinogenic risks from exposure to multiple carcinogenic chemicals, all carcinogenic risks were assumed to be additive. Consequently, the total ILCR represents the summation of individual chemical cancer risks. Federal (55 FR 8666 and 40 CFR 300) and State (WAC 173-340) regulatory agencies have suggested an acceptable level of risk to be between 1 in 10,000 (1.0E-04) and 1 in 1,000,000 (1.0E-06), with 1.0E-06 being the point below which there is no regulatory concern

Table 5.8 summarizes the noncarcinogenic health hazard and ILCR associated with routine air emissions from LLMW treatment operations. As shown by the results in Table 5.8, the HI (7.8E-05) is well below the benchmark value of 1.0, and the ILCR (9.4E-09) is considered low. Therefore, the proposed action would be expected to result in no adverse health effects from routine air emissions.

5.2.2 Accident Conditions

The health risks resulting from potential accidents associated with operation of the ATG non-thermal treatment facility are evaluated in this section. Accidents are unplanned events or a sequence of events that would cause undesirable consequences. This analysis addresses the following:

- Radiological and chemical risks associated with operations. The risk associated with a radiological release resulting from an accident was expressed as the product of the annual frequency of occurrence and the LCF risk. The risk associated with a chemical release resulting from an accident was expressed as the product of the annual frequency of the accident and the health hazard.

- Occupational risks, including the nonradiological/nonchemical injuries, illnesses, and fatalities from operation accidents common to the workplace such as falls, cuts, and operator-machine impacts. The risk associated with an accident was defined as the product of the fatality or injury/illness incidence rates and the number of workers at risk.

- Health impacts from radiological and chemical accidents are evaluated for the same receptors as for normal operations with the exception that the involved workers are not evaluated separately but are included in the on-site population located a minimum of 100 m (330 ft) from the point of release.

Radiological Consequences from Accident Conditions

Containerized LLMW from Hanford would be unloaded from trucks at the ATG Site, moved to the waste storage building, and would be transported to the non-thermal treatment building for processing. A forklift would be used to handle the containerized waste. A containerized waste handling accident was analyzed similar to a containerized waste handling accident evaluated in the Central Waste Complex Interim Safety Basis (HNF 1997). A fire is postulated to occur when forklift tines puncture two drums igniting the contents. It was assumed that the two drums burn in the resultant fire, which lasts less than one hour. The heat of the fire results in the lid seals failing on two additional drums from which 5.8 percent of the contents burn (HNF 1997). Although facility personnel in the vicinity of the accident would be aware of the accident as it occurred, no credit was taken for emergency response action to the fire. The respirable airborne release fraction for the combustible materials was 5.0E-04 and for noncombustible material it was 6.0E-05. These release fractions were taken from DOE (1994) and used in the Central Waste Complex Interim Safety Basis analysis. The release fraction for combustible materials was based on experimental data in which various types of packaged waste (e.g., paper, rags, tape,

Table 5.8. Human Health Risk to Maximum Exposed Receptor from Inhalation of Routine Chemical Air Emissions

Emissions	Air Concentrations (mg/m^3)	Noncarcinogen Inhalation Intake (mg/kg-day)	Carcinogen Inhalation Intake (mg/kg-day)	Inhalation Reference dose (mg/kg-day)	Inhalation Slope Factor (kg-day/mg)	Noncarcinogen Hazard	Cancer Risk
2-Methylphenol	4.90E-08	9.61E-09	4.12E-10	1.0E-01	NC	9.6E-08	N/A
4-Methylphenol	1.27E-06	2.49E-07	1.07E-08	1.0E-01	NC	2.5E-06	N/A
Acetophenone	3.33E-09	6.53E-10	2.80E-11	1.0E-01	NC	6.5E-09	N/A
Benzoic Acid	1.33E-09	2.61E-10	1.12E-11	4.0E+00	NC	6.5E-11	N/A
bis(2-Ethylhexyl) Phthalate	3.29E-08	6.44E-09	2.76E-10	2.0E-02	1.4E-02	3.2E-07	3.9E-12
Butylbenzyl Phthalate	3.29E-08	6.44E-09	2.76E-10	2.0E+00	ND	3.2E-09	ND
Di-n-Butyl Phthalate	1.32E-07	2.59E-08	1.11E-09	ND	ND	ND	ND
1,4-Dichlorobenzene	3.30E-08	6.46E-09	2.77E-10	2.0E-01	2.4E-02	3.2E-08	6.6E-12
Dimethyl Phthalate	3.28E-08	6.43E-09	2.76E-10	1.0E+01	1.0E+00	6.4E-10	2.8E-10
Fluorene	2.11E-14	4.13E-15	1.77E-16	4.0E-02	NC	1.0E-13	N/A
Formaldehyde	8.79E-07	1.72E-07	7.38E-09	4.5E-02	4.6E-02	3.8E-06	3.4E-10
Naphthalene	5.93E-07	1.16E-07	4.98E-09	4.0E-02	NC	2.9E-06	N/A
Phenol	3.23E-08	6.34E-09	2.72E-10	6.0E-01	NC	1.1E-08	N/A
Barium	3.92E-10	7.68E-11	3.29E-12	1.0E-04	NC	7.7E-07	N/A
Cadmium	2.56E-10	5.02E-11	2.15E-12	5.0E-04	6.3E+00	1.0E-07	1.4E-11
Nickel	3.70E-08	7.25E-09	3.11E-10	2.0E-02	8.4E-01	3.6E-07	2.6E-10
Aluminum	3.65E-08	7.16E-09	3.07E-10	1.4E-02	NC	5.1E-07	N/A
Iron	4.84E-09	9.49E-10	4.07E-11	8.6E-03	NC	1.1E-07	N/A
Chrome	1.61E-08	3.15E-09	1.35E-10	ND	4.2E+01	ND	5.7E-09
Chromium VI	1.20E-09	2.34E-10	1.00E-11	5.0E-03	2.9E+02	4.7E-08	2.9E-09
Lead	1.45E-07	2.84E-08	1.22E-09	4.3E-04	NC	6.6E-05	N/A
					Total HI = 7.8E-05		
					Total Cancer Risk = 9.4E-09		

Table 5.8. Human Health Risk to Maximum Exposed Receptor from Inhalation of Routine Chemical Air Emissions (cont'd)

Notes:

HI = Hazard Index
NC = Noncarcinogen
ND = No data published
Air concentrations taken from Tetra Tech (1996a) and adjusted to reflect projected emission rates from the risk assessment work plan (ATG 1998). Air concentrations are the maximum predicted concentrations downwind of the stack. Modeling analysis results in Tetra Tech (1996a) were based on the ISC3 short-term dispersion model assuming 24 consecutive hours of low wind speeds, poor dispersion conditions (stability categories E and F), and persistent wind directions (randomized fluctuations within 10 degrees either side of the mean direction). Stack tip down wash and building wake effects were included in the model runs.
Noncarcinogen and carcinogen inhalation intake were calculated as follows:

$Intake_i = [(Ca_i) \quad (IR) \quad (EF) \quad (ED)] / [(BW) \quad (AT)]$

Where: Intake = Inhalation intake of the ith chemical, mg/kg-day
Ca_i = Estimated air concentration of the ith chemical, mg/m^3
IR = Inhalation rate, 20 m^3/day
EF = Exposure frequency, 250 days/year
ED = Exposure duration, 3 years
BW = Body weight, 70 kg
AT = Average time, days (noncarcinogens = 3 years, 365 days/year, carcinogens = 70 years 365 days/year)

Noncarcinogenic hazard = noncarcinogen inhalation intake divided by inhalation RfD.
Excess cancer risk = Carcinogen inhalation intake times inhalation slope factor (SF).

plastic, cardboard, oil) contaminated with uranium dioxide powder, uranyl nitrate liquid, and air dried uranyl nitrate were burned. The release fraction for noncombustible material was based on experimental data of suspended reactive powders under thermal stress. Drum contents were considered to be 65 percent combustible and 35 percent noncombustible. The annual frequency of this event was estimated to be 1.1E-04, for the Hanford Site Central Waste Complex using an event tree and was judged to be appropriate for the operations at the ATG Site (HNF 1997).

The waste inventory used to calculate the dose from the accident postulated to occur at the ATG Site is presented in Table 5.9. The inventory is based on the radiological inventory of the Hanford Site LLMW that was characterized for thermal treatment at the ATG thermal treatment facility (DOE 1996a). This inventory represents an averaged waste inventory and does not consider a worst-case inventory in calculating accident consequences. However, the average inventory is reasonable for calculating accident risk, which is the product of the probability of occurrence and the consequence. The probability of a waste package containing the worst-case inventory being involved in the postulated accident would be lower than that of the average container.

Radiation doses from the source term listed in Table 5.9 were computed with the GENII code (Napier et al. 1988) for the noninvolved worker and general public receptors. The doses from radioactivity absorbed into the body were computed using weighting factors for various body organs and the results summed to calculate a committed effective dose equivalent (CEDE). The computer code was used to calculate the inhalation dose for a 70-year dose commitment period. The Hanford Site 300 Area joint-frequency file and a population file that evaluated a population within a 80-km (50 mi) radius of the ATG Facility was used in the code. The code uses the Gaussian plume model for air dispersion.

The exposure pathways for the noninvolved worker receptor includes external exposure from immersion in the plume; external exposure from radioactive material deposited on the ground; internal exposure from inhalation of radionuclides in the airborne plume; and internal exposure from inhalation of previously-deposited radioactive material resuspended in air due to wind actions. The exposure pathways for the general public are the same as the noninvolved worker receptor exposure pathways but also includes internal exposure from the ingestion of food crops and animal products.

For the involved worker dose, the material released is assumed to spread instantaneously and uniformly over a hemisphere 10 m (33 ft) in radius. The 10 m (33 ft) is an assumed value used to calculate airborne concentrations of contaminants in close proximity to the point of release and has been used in similar accident analyses (WHC 1995). The MEI is assumed to be located at the center of the hemisphere. The equation used to estimate the dose is as follows:

$$\text{D(rem CEDE)} = [\text{ST(rem CEDE)}] \left(\frac{3}{2p\ r^3}\right) \text{BR}(\text{m}^3/\text{s}) \quad \text{T(s)}$$

Table 5.9. Hanford Site LLMW Inventory Used In Drum Fire Accident Scenario

Isotope	Source Term (Ci)
Cs-137	4.6E-06
Sr-90	4.1E-06
H-3	7.2E-07
Fe-55	4.8E-07
Mn-54	2.4E-07
Ce-144	6.8E-08
Co-60	4.6E-08
Eu-154	3.4E-08
Pm-147	3.1E-08
Pu-241	2.3E-05
Pu-238	3.7E-07
Am-241	3.3E-07
Pu-239	1.2E-07
Pu-240	2.7E-08
Np-237	1.3E-09
C-14	1.4E-08
Tc-99	2.6E-09
I-129	3.9E-08

Notes:

Source term is the respirable fraction of the total inventory released in the fire. It represents the contents of two 55-gal. drums plus 5.8 percent of two additional drums that burn in the fire or a 1.69E-04fraction of the total inventory. The source term is further reduced by multiplying the burned inventory by respirable airborne release fractions of 5.0E-04 for combustible material and 6.0E-05 for noncombustible material. Sixty five percent of the waste was considered to be combustible and 35 percent of the waste was considered to be noncombustible (HNF 1997).

Where:

CEDE = committed effective dose equivalent
D = Receptor dose in rem CEDE
ST = Respirable quantity of isotopes released in the fire, taken from Table 5.9, times the appropriate dose conversion factor from the GENII code (Napier et al. 1988). The sum of the dose from each isotope was calculated to be 680 rem CEDE.
r = Assumed 10 m (33 ft) radius for distribution of source
BR = Breathing rate of 3.3E-04 m^3/s
s = Second
T = Involved worker exposure time of 10 min.

Therefore:

D = (680 rem CEDE) (4.77E-04/m^3) (3.3E-04 m^3/s) (600 s) = 6.43E-02 rem CEDE

The LCF risk to the receptors was calculated by multiplying the dose (rem committed effective does equivalent [CEDE]) by dose-to-risk conversion factors. Conversion factors have been previously defined and are estimates of health effects from radiation exposure.

The LCF risk is the product of the chance, or frequency, of an accident occurring and the consequences (measured in terms of the number of LCFs caused by the radiation exposure) of the accident if it were to occur. An event that was certain to occur would have a probability of 1 (a 100 percent certainty). If an accident was expected to happen once every 100 years, the annual frequency of occurrence would be 0.01 (1 occurrence divided by 100 years = 0.01 occurrences per year). The LCF risk therefore expresses the expected number of LCFs, taking account of both the chance that an accident might occur and the estimated consequences if it does occur.

The annual LCF risk to the receptors as a result of the accident scenario are presented in Table 5.10. The general public evaluation also included an analysis of a MEI at a child care center located 2 km (1.25 mi) to the east-southeast. No LCFs would be expected for any of the receptors. Because of uncertainties surrounding the release fractions for volatile or semivolatile isotopes, the change in risk resulting from higher release fractions for iodine-129 and H-3 (tritium) was evaluated. If an airborne release fraction of 1.0 and a respirable release fraction of 1.0 are assumed for iodine-129 and H-3, then the risk shown in Table 5.10 would increase by approximately 2.5 percent for each receptor.

Chemical Consequences from Accident Conditions

Chemical health hazards from the containerized waste fire were evaluated based on the corrosive/irritant effects and toxic effects. Chemicals within each group were assumed to be additive. This is a conservative assumption because many different chemicals affect different organs. Cumulative hazards for the corrosive/irritant and toxic chemicals were evaluated using the same methodology as previously presented in Section 5.1.2.2 for transportation accidents.

The following assumptions and parameters were used in calculating the chemical concentrations for the various receptors:

- Volume of waste that burns in two drums plus 5.8 percent of two additional drums = 0.44 m^3
- Density of the waste = 347 kg/m^3
- Weight of waste that burns = 152.6 kg (0.44 m^3 347 kg/m^3)
- Hazardous chemicals in waste = 0.84 percent by weight or 1.28 kg

Table 5.10. Radiological Risk From Fire Scenario

Receptor	Dose (person-rem CEDE)	Dose-to-risk Conversion Factors (LCF/rem)	Annual Frequency	Total Project LCF Risk (LCF)
MEI-involved worker	6.4E-02 (rem)	4E-04	1.1E-04	2.8E-09
Noninvolved worker population	2.4E-02	4E-04	1.1E-04	1.1E-09
MEI-noninvolved worker	1.2E-04 (rem)	4E-04	1.1E-04	5.3E-12
General public	1.8E-02	5E-04	1.1E-04	9.9E-10
MEI-general public	3.4E-04 (rem)	5E-04	1.1E-04	1.9E-11
MEI child care center	1.3E-04 (rem)	5E-04	1.1E-04	7.2E-12

Notes:

CEDE = Committed effective dose equivalent
LCF = Latent cancer fatality
MEI = Maximally exposed individual
On-site population (200 persons = 100 persons at the LLW treatment facility and 100 persons at the MWF) is the sum of the involved workers and noninvolved workers at the ATG Facility. All 200 persons are assumed to receive the same dose as the MEI on-site receptor. This is conservative since it assumes all 200 persons are located 100 m (330 ft) down wind from the point of release.
LCF/rem are dose-to-risk conversion factors taken from Recommendations of the International Commissions on Radiological Protection (ICRP 1991). The difference in the on-site and off-site conversion factors is attributable to the presence of children off-site.
The annual frequency of the fire accident scenario is taken from Central Waste Complex Interim Safety Basis (HNF 1997).
The annual LCF risk is a point estimate risk and is the product of the dose (person-rem) dose-to-risk conversion factor (LCF/person-rem) annual frequency of occurrence of the accident.

- Respirable release fraction for combustible material = 5.0E-04 (DOE 1994). The release fraction is from DOE (1994), which is based on experimental data in which various types of packaged waste (e.g., paper, rags, tape, plastic, cardboard, and oil) contaminated with uranium dioxide powder, uranyl nitrate liquid, and air-dried uranyl nitrate were burned. Respirable release fraction is a combination of the airborne release fraction and the respirable fraction or the fraction of the material that is respirable.

- Respirable release fraction for noncombustible material = 6.0E-05 (DOE 1994)

- Combustible material in waste 65 percent

- Noncombustible material in waste = 35 percent

Therefore, the amount of respirable chemicals released in the fire is:

$$[(1.28\ \text{kg})\ \ (5.0\text{E-}04)\ \ (0.65)] + [(1.28\ \text{kg})\ \ (6.0\text{E-}05)\ \ (0.35)] = 4.4\text{E-}04\ \text{kg}$$

For the involved worker exposure, the material released is assumed to spread instantaneously and uniformly over a hemisphere 10 m (33 ft) in radius. The MEI is assumed to be located at the center of the hemisphere. The chemical concentration within a 10 m (33 ft) hemisphere is calculated using the following equation:

$$C(mg/m^3) = [Q\ (kg)] \left(\frac{3}{2p\ r^3} \right) (1.0E+06\ mg/kg)$$

Where:

C = Concentration
Q = Respirable quantity of hazardous chemicals released
r = Assumed 10 m (33 ft) radius for distribution of source.

Therefore:

C = (4.4E-04 kg) (4.77E-04/m^3) (1.0E+06 mg/kg) = 2.1E-01 mg/m^3

The chemical inventory involved in a potential fire was based on a breakdown of the Hanford Site LLMW by hazardous and toxic material constituents (Jacobs 1997). The chemicals were sorted into chemical classes and representative chemicals from each chemical class were selected that would best represent the class.

The air concentrations of the chemical classes are compared to the ERPGs in Table 5.11 (toxic concentration limits) and Table 5.12 (corrosive/irritant concentration limits). As shown in these tables, the accident would result in hazardous chemical concentrations that would be well below the ERPG-1 value, therefore, there would be no adverse effects to involved workers.
The atmospheric dispersion would dilute the concentration by the time it reached the general public; therefore, there would be no adverse effects to the general public.

Injuries, Illnesses, and Fatalities From Occupational Accidents

Occupational risks defined in the EA include nonradiological/nonchemical injuries, illnesses, and fatalities from operation accidents common to the workplace such as falls, cuts, electrical shocks, muscle strains, and operator-machine impacts.

The risk associated with an accident was defined as the product of the fatality or injury/illness incident rates and the number of workers at risk. The nonradiological/nonchemical occupational accidents would largely be a function of the number of person-years of labor required for operations of the non-thermal treatment facility. The more person-years of labor required, the more injuries, illnesses, and fatalities would occur.

The injury and illness incidence rates used in the analysis for construction and operations were based on the annual injury and illness reports for Washington State for the years 1985 through 1995 (BLS 1985, 1986, 1987, 1988, 1989, 1991, 1992a, 1993, 1994, 1995) and represent an 11-year average. The fatality rate used in the analysis is taken from the fatality report for Washington State (BLS 1992b). The incidence are summarized in Table 5.13 as well as the number of anticipated injuries, illnesses, and fatalities. There would potentially be 16 anticipated

Table 5.11. Comparison of Chemical Concentrations to Toxic Concentration Limits for Drum Fire Accident [8]

Analyte (Threshold values are presented in mg/m^3)	Exposure (mg/m^3)	ERPG-1 (mg/m^3)	ERPG-2 (mg/m^3)	ERPG-3 (mg/m^3)
Solvent/Thinner Waste Stream[1]				
Benzene [2]	MEI	2.51E-02	Threshold Value	
			7.80E+01	1.57E+03	3.13E+03
			Ratio of Exposure to ERPG[7]	
			3.2E-04	1.6E-05	8.0E-06
N-Butyl Alcohol [3]	MEI	1.31E-02	Threshold Value	
			7.50E+01	7.50E+02	7.50E+03
			Ratio of Exposure to ERPG	
			1.8E-04	1.8E-05	1.8E-06
2-Hexanone [4]	MEI	5.46E-03	Threshold Value	
			5.00E+01	5.00E+02	5.00E+03
			Ratio of Exposure to ERPG	
			1.1E-04	1.1E-05	1.1E-06
Petroleum/Coal Tar Derivatives[5]				
Tridecane [6]	MEI	7.98E-02	Threshold Value	
			3.70E+01	1.45E+03	7.33E+03
			Ratio of Exposure to ERPG	
			2.2E-03	5.5E-05	1.1E-05
Total MEI ratios			2.8E-03	9.9E-05	2.2E-05

Notes:

ERPG = Emergency Response Planning Guideline values. ERPG values were obtained from the Hanford Environmental Health Foundation (Dentler 1995)

MEI = Maximally exposed individual

[1] Solvent/thinner waste stream represents 26 percent of the total hazardous chemicals. Aromatic solvents = 46 percent, glycols/glycol ethers/alcohols = 24 percent, and aliphatics = 10 of the solvent/thinner waste stream.

[2] Benzene used as a representative chemical for aromatic compounds.

[3] N-butyl alcohol used as a representative chemical for glycols/alcohols.

[4] 2-hexanone used as a representative chemical for aliphatics.

[5] Petroleum/coal tar derivatives represents 38 percent of the total hazardous chemicals.

[6] Tridecane (similar to kerosene) used as a representative chemical for petroleum and coal tar derivatives.

7 A ratio less than 1 indicates that the calculated exposure concentration is lower than the ERPG.

[8] Because of uncertainties surrounding the release fractions for volatile or semi-volatile chemical compounds, exposure concentrations and ratios of exposure to ERPG threshold values were calculated using an airborne release fraction of 1.0 and a respirable release fraction of 1.0. The resulting ratio of exposure concentration to ERPG-1 would be an exceedence of 7.6. However, when the probability of the accident (1.1E-04) is taken into account the resulting risk would be 8.4E-04.

Table 5.12. Comparison of Chemical Concentrations to Corrosive/Irritant Concentration Limits for Transport Truck Accident [1]

Analyte (Threshold values are presented in mg/m^3)		Exposure Concentration (mg/m^3)	ERPG-1 (mg/m^3)	ERPG-2 (mg/m^3)	ERPG-3 (mg/m^3)
Solvent/Thinner Freon Waste Stream[1,5]					
Methylene Chloride 3,7	MEI	5.51E-02	Threshold Value		
			7.00E+02	3.48E+03	1.74E+04
			Ratio of Exposure to ERPG [12]		
			7.9E-05	1.6E-05	3.2E-06
Metals/Metal Salts Waste Stream[3]					
Sodium Silicate [5]	MEI	2.31E-02	Threshold Value		
			5.80E+00	1.16E+02	2.90E+02
			Ratio of Exposure to ERPG		
			4.0E-03	2.0E-04	8.0E-05
Amine Waste Stream [7]					
Ammonia [9]	MEI	3.36E-03	Threshold Value		
			1.70E+01	1.40E+02	6.80E+02
			Ratio of Exposure to ERPG		
			2.0E-04	2.4E-05	4.9E-06
Caustic (Acids/Bases) Waste Stream [109]					
Sodium Hydroxide [11]	MEI	6.30E-03	Threshold Value		
			2.00E+00	4.00E+01	1.00E+02
			Ratio of Exposure to ERPG		
			3.2E-03	1.6E-04	6.3E-05
Total MEI Ratios			7.4E-03	4.0E-04	1.5E-04

Notes:

ERPG = Emergency response planning guideline values. ERPG values were obtained from the Hanford Environmental Health Foundation (Dentler 1995)

MEI = Maximally exposed individual

[1] Because of uncertainties surrounding the release fractions for volatile or semi-volatile chemical compounds exposure concentrations and ratios of exposure to ERPG threshold values were calculated using an airborne release fraction of 1.0 and a respirable release fraction of 1.0. The resulting ratio of exposure concentration to ERPG-1 would be less than 1 (6.3E-01). However, when the probability of the accident (1.1E-04) is taken into account the resulting risk would be 6.9E-05.

[2] Solvent/thinner waste stream represents 26 percent of the hazardous waste.

[3] Methylene chloride used as a representative chemical for chlorinated solvents and represents 20 percent of the solvent/thinner waste stream.

[4] Metals/metal salts waste stream represents 11 percent of the hazardous waste.

[5] Sodium silicate used as a representative chemical for metals and metal salts.

[6] Freon waste stream represents 0.25 percent of the hazardous waste.

[7] Methylene chloride used as a representative chemical for freon.

[8] Amine waste stream represents 1.6 percent of the hazardous waste.

[9] Ammonia used as a representative chemical for amines.

[10] Caustic (acids/bases) waste stream represents 3 percent of the hazardous waste.

[11] Sodium hydroxide used as a representative chemical for caustics.

[12] A ratio less than 1 indicates that the calculated exposure concentration is lower than the ERPG.

Table 5.13. Nonradiological/Nonchemical Occupational Accidents

Activity	Person-Years	Incidence Rate (incidence/100 person-year)	Incidences
Operations			
Total recordable injury/illness	150 person-year	10.8 injuries/illnesses	16 injuries/illnesses
Lost work day injury/illness	150 person-year	4.8 injuries/illnesses	7.2 injuries/illnesses
Fatalities	150 person-year	1.14E-02 fatalities	1.7E-02 fatalities

Notes:
The total recordable injury/illness incidence rate includes lost work day injuries/illnesses.
Person-years represents 50 workers/year for 3 years of operation.

recordable injuries and illnesses from continuous facility operations over three years and no anticipated fatalities. These results are conservative because the waste stream evaluated in this EA would not require the full capacity of the stabilization facility.

County and State Emergency Response to Accidents

Washington State and Benton county are structured to respond to emergency conditions from operation accidents or transportation accidents that could potentially result in radiological or chemical releases to the environment. County and State emergency response plans have been developed and documented in a contingency plan that is a part of the RCRA Part B permit application. The purpose of this plan is to guide the emergency response actions of facility officials (in this case it would be the ATG emergency response organization) and agencies of the City of Richland, Benton and Franklin Counties, and Washington State. These plans reflect the assignment of responsibilities for off-site protective actions and the methods of communicating among the involved local and State agencies. An effective emergency response can reduce the severity of a postulated accident.

5.3 MIXED WASTE STORAGE

Commercial waste and DOE waste would be kept separate by treating in separate campaigns. Waste streams that are required to be kept separate for regulatory, technical, or administrative reasons would be stored, handled, and treated separately. Commercial and DOE generated wastes would be treated in separate campaigns to maintain waste stream segregation.

Waste storage capacities are summarized in Table 5.14. The waste containers proposed for the scope of work would include 55-gallon (gal.) and 85-gal. drums, 4 by 4 by 8 ft metal boxes, and B-25 boxes. The waste volumes per container are: 0.208 m^3 for 55-gal. drums, 0.322 m^3 for 85-gal. drums, 3.40 m^3 for 4 by 4 by 8 ft metal boxes, and 2.55 m^3 for B-25 boxes.

Waste storage is limited to the physical capacity of containers and facilities as well as by regulatory permit capacities and time limits. RCRA Part B permitted (or RCRA Interim Status) storage facilities are limited by the land disposal restrictions (LDRs) of 40 CFR 268. Untreated mixed waste is not allowed to undergo land disposal. For mixed waste, storage is limited to 1 year (40 CFR 268.50[c]). RCRA allows for temporary extensions due to unforeseen problems, with proper approval.

Table 5.14. Total Storage Capacities of Mixed Waste Storage Building

Building Location	Building Location	Storage Type	Container Type	Container Volume (ft^3)	Total Storage Volume (ft^3)
Pre-engineered building	Bulk raw waste storage area	Sea van storage	Sea van	2,560	5,120
		18-yd^3 roll-off box storage	Roll-off Box	486	1,944
		B-25 box storage	B-25 box	100	400
	Stabilized waste storage	Stabilized waste storage	B-25 box	100	800
		Stabilized waste storage	55-gal drum	7.3	1,051
		Stabilized waste storage	55-gal drum	7.3	1,051
		Stabilized waste storage	55-gal drum	7.3	6,307
		Stabilized waste storage	64 ft^3 box	64	4,608
		Stabilized waste storage	64 ft^3 box	64	576
Modular Waste Storage	Containerized raw wastes storage	Raw waste storage	55-gal drum	7.3	701
		Raw waste storage	85-gal drum	11.2	538
		Raw waste storage	55-gal drum	7.3	2,102
		Raw waste storage	85-gal drum	11.2	134
	Containerized reactive, Corrosive, ignitable waste storage	Reactive waste storage	55-gal drum	7.3	234
		Corrosive waste storage	55-gal drum	7.3	234
		Flammable/ignitable waste storage	55-gal drum	7.3	234

Source: ATG (1996).

The ATG mixed waste storage building would be managed in compliance with an approved spill prevention, control, and countermeasures (SPCC) plan, employing secondary containment, physical barriers between incompatible wastes, and routine inspections.

5.3.1 Hazardous Process Chemical Storage

Storage of hazardous process chemicals will be in accordance with Occupational Safety and Health Administration (OSHA) requirements and the SPCC plan. Hazardous process chemical storage within the ATG MWF would be limited to the amounts required to support daily operations, which in the case of hazardous wastes is equivalent to one to three days of processing. The reagent storage area and chemical handling procedures are designed to allow safe and effective operational access to the hazardous chemicals and to reduce impacts resulting from any spills. Safety measures for acids and bases prevent vapor or liquid contact with skin, eyes, and mucous membranes. Physical barriers will separate oxidizers and flammables/ combustibles. Other controls will include secondary containment, temperature controls, and ventilation.

5.4 NATURAL HAZARDS

The non-thermal treatment facility has been designed to meet or exceed uniform building code design standards. The facility design meets standards for Seismic Zone 3 and wind forces. Design standards for wind forces are generally more stringent than Seismic Zone 3 requirements for the facility, since they require the structure to withstand up to 113 km per hour (70 mi per hour) winds. The release of radiological and chemical constituents resulting from a seismic or high-wind event would require a beyond-design-basis accident. Beyond-design-basis accidents were not evaluated in this analysis.

Tanks and containers of liquids will be secured, to the extent feasible, to prevent overturning in a seismic event. Spill control measures are described in Section 5.3.

5.5 WATER RESOURCES

No effluent discharges to surface water bodies or groundwater would take place. All waste handling, storage, and treatment activities at the ATG MWF would take place within covered areas with a base having a secondary spill containment system, which would prevent releases to the environment that could potentially impact groundwater.

The 200 West Area, the ATG MWF site, and the transport route are not located within the 100- or 500-year flood plain.

In the unlikely event that a transportation accident occurred, appropriate Hazardous Waste Operation and Emergency Response procedures and protocols would be followed to prevent and significantly reduce infiltration into the soils to prevent migration to the groundwater system.

The ATG MWF would be equipped with a secondary spill containment system which collects the waste until it is detected and removed, preventing releases to the environment that could impact groundwater. This spill containment system would prevent spills from impacting surface water and/or groundwater.

The secondary containment system would have to fail in order for liquid waste to be released to the environment. In the unlikely event that such a failure occurred in conjunction with a hazardous materials spill, then a portion of the spill could be released to the ground surface. Normal hazardous material spill recovery procedures would be implemented to control and remediate the spilled material in that event. Based on this secondary containment system and the distance from the surface to the water table, impacts to groundwater are not analyzed in this EA.

5.6 BIOLOGICAL RESOURCES

No threatened or endangered species are known to exist or suspected to be present at the ATG property, and no ground-disturbing activities are planned at the 200 West Area as part of this action. Therefore, no impacts on such species are anticipated. Activities related to the proposed action at the 200 West Area primarily involve loading and unloading of wastes at existing waste storage facilities, which would not adversely affect the relatively few threatened or endangered species found at Hanford Site. Neither wetlands or sensitive habitats would be affected by the proposed action.

5.7 CULTURAL AND ARCHEOLOGICAL RESOURCES

Cultural and archeological resources are most likely to be found in areas that have not previously been disturbed or along shorelines and at elevated locations. Soil at the ATG Facility has been extensively disturbed by previous Site activities associated with construction and operation of the LLW treatment facility and agricultural production. The facility is not near shoreline areas (Columbia and Yakima Rivers) or elevated locations. A cultural resources review was part of the siting process for the ATG MWF conducted by the Washington State Department of Ecology (Ecology). This review found that the proposed MWF is not located within an archeological or historic site. Additionally, the Site is not located within proposed or existing historic districts (Ecology 1995). Therefore, the potential impacts to cultural and archeological resources are minimal.

5.8 SOCIOECONOMIC IMPACTS

No additional employees would be required at the Hanford Site 200 West Area. Approximately 50 employees would be added by ATG to operate the non-thermal treatment portion of the MWF. With an estimated population of approximately 200,000 in the two-county area, the addition of this number of jobs would be expected to have a minor effect on the economy of the area.

5.9 ENVIRONMENTAL JUSTICE

Executive Order 12898, “Federal Actions to Address Environmental Justice in Minority and Low-Income Populations,” requires Federal agencies to identify disproportionately high and adverse effects on low-income and/or minority populations in terms of environmental effects and health effects. The analysis in this EA indicates that implementation of the proposed action would result in minimal impacts to the socioeconomic environment or to human health. It follows that there would not be disproportionately high or adverse impacts to minority or low-income populations.

5.10 CUMULATIVE IMPACTS

5.10.1 Radiation

The cumulative impacts form routine radiological air emissions from the ATG Facility, the Hanford Site, and the Washington Public Power Supply System Plant No. 2 are presented in Table 5.15. Radiological consequences from routine air emissions were previously evaluated for the MWF operating at design capacity while treating DOE and commercial waste streams in the SEPA EIS for treatment of LLMW (City of Richland 1998). The radiological doses from routine air emissions during the thermal treatment of DOE LLMW from the Hanford Site were evaluated (AES Environmental 1996). The highest cumulative population dose from the MWF (3.9E-02 person-rem/year) added to the population dose from the existing LLW facility would represent the total contribution from the ATG Facility from continuous operation of both the LLW and MWF facilities at maximum-design capacity. Because the LLW air emissions were assumed for the commercial LLMW analysis (City of Richland 1998), the annual population dose from the LLW stream would be 3.9E-02 person-rem. Therefore, the total population dose from the ATG Facility would be 7.8E-02 person-rem. The radiological doses from the non-thermal treatment of the waste stream evaluated in this EA would not be additive to the radiological doses from the ATG EIS because that analysis evaluated impacts from continuous facility operation at maximum design capacity. The population dose from Hanford Site operations during 1996 was 0.2 person-rem (PNNL 1997). The annual population dose from the nearby Washington Public Power Supply System Plant No. 2 is 0.7 person-rem/year (DOE 1996b). Therefore, the total population dose from the ATG Facility would result in a small incremental increase of approximately 9 percent of the population dose from the combined current operations at the nearby Hanford Site and commercial power generation. The incremental increase from the ATG Facility would result in an increase of approximately 40 percent of the population dose from Hanford Site operations in 1996. These population doses represent LCF risks of 3.9E-05 for the entire ATG Facility operating at maximum design capacity and 3.5E-04 from the Washington Public Power Supply System Plant No. 2.

Table 5.15. Cumulative Impacts from Routine Radiological Air Emissions

Contributor	Dose (person-rem/yr)	LCF/yr
ATG	7.8E-02	3.9E-05
Hanford Site	2.0E-01[1]	1.0E-04
Supply System	7.0E-01	3.5E-04
Total Contribution	9.8E-01	4.9E-04

Notes:
[1] Population dose from Hanford Site operations during 1996.
Supply System = Washington Public Power Supply System Plant No. 2

Because the LLMW treatment facility would process two different waste streams, DOE waste and commercial waste, the highest cumulative air impacts from the ATG Site would be a combination of the highest emissions from the proposed MWF and the emissions from the existing LLW treatment facility. Air permits will require both facilities to meet the 10 mrem/year at the nearest residence under the National Emission Standards for Hazardous Air Pollutants

(NESHAP). Last year the low-level treatment facility NESHAP estimate was 0.0012 mrem/year at the nearest residence.

The routine radiological dose from the MWF and LLW treatment facilities combined would not be expected to exceed 200 mrem/year per involved worker as used in the impact analyses. Based on this, there would be no cumulative radiological impacts to facility workers from routine radiological exposure.

5.10.2 Other Impact Areas

In addition to ATG waste treatment activities, there are other nuclear and industrial facilities with air emissions or direct radiation exposure near the ATG Site that could potentially contribute to the impacts described for the proposed action. These facilities include a commercial nuclear power plant (Washington Public Power Supply System Plant No. 2), a nuclear fuel production plant (Siemens Power Corporation), and a food processing facility (Lamb-Weston). A commercial radioactive waste burial site (US Ecology) and a commercial decontamination facility (Interstate Nuclear Services) would also have cumulative impacts from transportation and, to a lesser degree, air emissions with the ATG operations. All other impact areas to the natural and built environment not specifically identified were considered to be minor based on the impact discussions in previous sections; therefore, no cumulative impacts were calculated.

Air Quality

Because the LLMW treatment facility would process two different waste streams, DOE waste and commercial waste, the highest cumulative air impacts from the ATG Site would be a combination of the highest emissions from the proposed MWF and the emissions from the existing LLW treatment facility. Other industrial facilities in the local area also would be releasing air pollutants, and the emissions from the ATG Facility would add to the cumulative total in the region. There are no indications that the incremental air emissions from the proposed ATG Facility would result in violations of Federal or State air quality standards because air quality monitoring from the surrounding area indicates that pollutant levels are well below levels of regulatory concern.

Transportation

Transporting untreated waste from the Hanford Site to the ATG Site would require approximately 16 shipments per year, and transporting treated waste from the ATG Site to the Hanford Site would require approximately 20 shipments per year. These shipments in combination with the approximately 50 ATG non-thermal treatment workers commuting to and from the ATG Site would be approximately 1 percent of the 3,000 vehicles per hour projected for peak morning traffic volumes on Stevens Drive near the 1100 Area in 1999 (DOE 1996b).

5.11 IMPACTS OF ALTERNATIVES TO THE PROPOSED ACTION

5.11.1 No Action

Under the No Action alternative, there would be no impacts from transporting or treating the waste. The No Action alternative would however result in potentially larger radiological doses associated with long-term monitoring and storage of the waste.

5.11.2 Other Action Alternatives

Although not analyzed in detail, impacts of treating this waste under the other alternatives would be expected to be higher due to increased transportation impacts for both routine and accident conditions associated with transporting the untreated and treated waste over longer distances. There would be an increased accident probability due to a lack of access controls over much of the transportation route and longer travel times. It is assumed that waste treatment actions under the other action alternatives would be similar and would result in similar operational impacts to those identified for the ATG MWF.

6.0 PERMITS AND REGULATORY REQUIREMENTS

This section describes permits and regulations applicable to hazardous waste transport and ATG Facility operation. The proposed action is subject to Federal, State, and local permits and regulations governing the storage, treatment, handling, and transport of contact-handled LLMW.

6.1 FACILITY OPERATION

Table 6.1 lists the major permits and approvals required for ATG MWF operation and related permitting or approving agencies. The ATG MWF also must comply with WSHWMA, Hanford Site Solid Waste Acceptance Criteria, NRC, and other Federal, State, and local regulations.

Table 6.1. Major Permits and Approvals Required for ATG Mixed Waste Facility Operation

Permit Permitting Agency	
RCRA Part B Permit	Washington State Department of Ecology
Radiological Air Permit (NESHAP)	Washington State Department of Health
Radiological Permit Update	Washington State Department of Health

Source: RCRA Part B Application.

6.1.1 Resource Conservation and Recovery Act

RCRA required the EPA to establish regulations governing the handling of hazardous wastes. These regulations are set forth in EPA Administered Permit Programs. The Hazardous Waste Permit Program (40 CFR 270) sets standards for generators and transporters of hazardous wastes, including owners and operators of treatment, storage, and disposal facilities (TSDF). The general permit requirements for all TSDF are described in Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities (40 CFR 264). RCRA regulations also require ATG to obtain an operating permit for the MWF from the appropriate state regulatory agency, which is Ecology.

ATG has submitted a Part B Permit application to Ecology for the MWF and is expected to be permitted as a miscellaneous treatment unit under Washington Administrative Code 173-303-680, Miscellaneous Units.

The Part B permit application for the ATG MWF contains detailed information on the facility description and site specific information, such as facility inspection schedules (40 CFR 270). The application outlines and details the general requirements necessary to demonstrate compliance with 40 CFR 264 standards, including emission controls.

6.1.2 Radiological License

ATG would obtain a new radioactive materials license for the MWF operations through the Washington State Department of Health.

6.1.3 Air Permits

The Clean Air Act and State of Washington Clean Air Act regulations require many types of industrial facilities to obtain air quality permits prior to construction or operation. State and Federal requirements generally are addressed through integrated permit regulations established by State or local air pollution control agencies. Air quality permits for facilities in Benton, Franklin, or Walla Walla Counties are processed by the Benton, Franklin, Walla Walla Air Pollution Control Authority. Federal aspects of such permits include prevention of significant deterioration requirements for attainment areas, new source review requirements for nonattainment areas, and NESHAP requirements. Federal Title V operating permit requirements also might apply if the MWF causes emissions from the overall ATG Site to exceed threshold quantities for either criteria pollutants or hazardous air pollutants. Compliance with State hazardous air pollutant ambient concentration limits also will be addressed as part of the air quality permit process.

For ATG, Ecology would regulate emissions of nonradioactive pollutants (WAC 173-480, WAC 173-460) while the Washington State Department of Health would regulate emissions of radioactive pollutants to the air under WAC 246-247. These regulations require that new sources of hazardous pollutants comply with requirements for measurement of emissions and best available control technologies for potential hazardous emissions to the environment.

Washington Ambient Air Quality Standards are equal to or more stringent than the National Ambient Air Quality Standards, and thus compliance with the Washington Ambient Air Quality Standards results in compliance with the National Ambient Air Quality Standards.

6.2 TRANSPORTATION

The loading and transport of hazardous waste will be governed by the applicable regulations, orders, and guidance of agencies such as DOE, Ecology, DOT, NRC, and EPA. These regulations, orders, and guidance cover shipping, packaging, vehicle safety, routing of shipments, and protection of workers. Regulations specific to hazardous waste transport include the following:

Washington State

WAC 173-303 State of Washington Administrative Code, “Dangerous Waste Regulations,” as amended (administered through Ecology).

Other

10 CFR 71	Packing and Transportation of Radiological Material
40 CFR 260	Hazardous Waste Management System: General
40 CFR 261	Identification and Listing of Hazardous Waste
40 CFR 262	Standards Applicable to Generators of Hazardous Waste
49 CFR 107	Hazardous Materials Program Procedures
49 CFR 263	Standards Applicable to Transporters of Hazardous Waste
49 USC 1801	Hazardous Materials Transportation Act

6.3 WORKER SAFETY

OSHA, RCRA, and the Comprehensive Environmental Response, Compensation, and Liability Act, as amended by the Superfund Amendments and Reauthorization Act, require RCRA TSDFs to take steps to prevent injury and illness, limit worker exposure to hazardous chemicals, limit worker exposures to radiation (10 CFR 20), develop emergency planning, and provide the community with information. ATG will be required to annually report on these required activities, including the reporting of hazardous chemicals quantities.

ATG would use a hazard communication program (29 CFR 1910.1200), train waste operation and emergency response personnel (29 CFR 1910.120), educate employees, and prevent, control, and minimize impacts resulting from hazardous chemical releases according to an SPCC plan (40 CFR 264.52). For the ATG GASVIT™ Building ATG would be required to maintain up-to-date copies of material safety data sheets and a master list of all hazardous chemicals associated with operations. The SPCC plan contained within the RCRA Part B permit application would include information on personal protective equipment (e.g., respirators, suits, gloves), engineering controls, and management procedures to minimize hazards to personnel and the environment. Laboratory personnel would be protected by conformance with the regulatory requirements of 29 CFR 1910.1450.

7.0 AGENCIES CONSULTED

Prior to approval, this Draft EA was provided for a 30-day review and comment period to the Confederated Tribes of the Umatilla Indian Reservation, the Wanapum People, the Nez Perce Tribe, the Yakama Indian Nation, the U.S. Fish and Wildlife Service, the State of Washington, the State of Oregon, Benton County, the City of Richland, the Hanford Education Action League, Heart of America, and Physicians for Social Responsibility. The draft also was made available in the DOE-RL Reading Room and placed on the Internet on the DOE-RL home page (www.hanford.gov).

Comments were received from the State of Oregon (Appendix A) and were considered in preparing the final EA and in the DOE decision whether to resolve the EA as a Finding of No Significant Impact (FONSI) or as a determination to prepare an EIS. Comments and responses are included in Appendix A.

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APPENDIX A

COMMENTS AND RESPONSES ON THE DRAFT ENVIRONMENTAL ASSESSMENT FOR THE NON-THERMAL TREATMENT OF HANFORD SITE LOW-LEVEL MIXED WASTE

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Oregon
John A. Kitzhaber, M.D., Governor

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September 11, 1998

Mr. Paul F.X. Dunigan, Jr.
NEPA Compliance Officer
Department of Energy
Richland Operations Office
PO Box 550
Richland, Washington 99352

Re: Oregon Office of Energy's comments on the Draft Environmental Assessment for The Non-Thermal Treatment of Hanford Site Low-Level Mixed Waste, Hanford Site, Richland Washington

Dear Mr. Dunnigan,

Thank you for the opportunity to comment on the Draft Environmental Assessment for The Non-Thermal Treatment of Hanford Site Low-Level Mixed Waste. The citizens of Oregon are vitally affected by and interested in the clean up of Hanford and appreciate the chance to participate in the decisions involving this project.

Attached are our specific comments on this draft environmental assessment. Should you have any questions, please contact Doug Huston of my staff at (503)378-4456.

Sincerely,

Mary Lou Blazek
Administrator, Nuclear Safety Division
Oregon Office of Energy

cc: Ms. Donna Powaukee - Nez Perce Tribe
Mr. A. Conklin – Washington Dept. of Health
Mr. J. R. Wilkerson- CTUIR
Mr. Michael Wilson - Washington Ecology
Mr. Douglas Sherwood - EPA
Mr. Russell Jim - Yakama Nation

Oregon Office of Energy Comments On Draft Environmental Assessment for The Non-Thermal Treatment of Hanford Site Low-Level Mixed Waste, Hanford Site, Richland Washington
Page 1 of 2

Section 1.1 needs more clarification on the 2600 cubic meters (m^3) selected for evaluation. Since the paragraph states that it is uncertain which waste packages would be selected for treatment, and waste characteristics may very depending on the package, this section needs more discussion as to why this particular hypothetical 2600 m^3 of waste makes an acceptable, conservative volume of waste for this assessment.

Section 4.2 states that the total number of employees at the site would be 200 with 100 involved in Low Level Waste processing and 100 involved in Low Level Mixed Waste (LLMW) processing. However, the paragraph then states that 40 people will be involved directly with the LLMW and 10 people would be indirectly involved. What would be the function of the remaining 50 people? This paragraph needs to be clarified.

It is unclear why a two step process was used to determine air emission estimates in Section 5.1.1. Why weren't the estimates in the ATG risk assessment work plan for the non-thermal treatment facility used directly? This needs to be clarified.

The Surplus Plutonium Disposition Draft Environmental Impact Statement states that no lead emission sources had been identified at Hanford. However, Table 5.1 indicates that the non-thermal treatment facility would be a source of lead emission. We recommend that this information be communicated to Mr. Howard Canter, Acting Director, Office of Fissile Materials Disposition.

Section 5.1.2.1 states that waste containers will have surface radiation doses up to 200 mrem/hr while Section 1.1 defines contact-handled LLMW as waste in containers with surface radiation doses of less than 200 mrem/hr. These inconsistencies need to be corrected.

Section 5.1.2.1 states: "The model default parameters provide a bounding population estimate for some on-site portions of the transport route where the Hanford Site workforce population is lower." How do the model default parameters relate to the remainder of the on-site portions of the transport route and what analysis was done for the off-site portions of the transport route? We recommend these questions be answered in the Environmental Assessment.

Section 5.1.2.2 assumes only 50% of container contents are spilled in a transportation accident and are available to burn. We recommend including some information justifying 50% rather than assuming 100% of the container contents are spilled.

Oregon Office of Energy Comments On Draft Environmental Assessment for The Non-Thermal Treatment of Hanford Site Low-Level Mixed Waste, Hanford Site, Richland Washington
Page 2 of 2

We recommend information be included on what criteria were used to "provide a conservative prediction of potential health effects" as discussed in Section 5.1.2.2, page 28. For example: Were the possible chronic health effects considered or just the acute effects?

The final footnote for Tables 5.3 and 5.4 does not appear to refer to anything in the tables. We recommend this be clarified.

The Involved Worker Radiological Consequences from Normal Operations portion of Section 5.2.1 states the dose-to-risk conversion factor used to calculate the Latent Cancer Fatality risk was taken from the 1990 recommendations of the International Commission on Radiological Protection. The Non-Involved Worker and General Public Radiological Consequences from Normal Operations section references the 1977 version of the same document. The reason for this difference needs to be clarified.

The Non-Involved Worker and General Public Radiological Consequences from Normal Operations portion Section 5.2.1 states that the radionuclide source term used was based on a production rate of 870 cubic meters per year. Include in this section the basis for this number.

In several places the Environmental Assessment (EA) explains release fractions for combustible materials are based on experimental data obtained when various types of packaged waste contaminated with various substances was burned. We recommend that you include in the EA a discussion of how well this surrogate waste and the experimental conditions correlate to the actual waste and the actual conditions. Also, include a discussion on what assumptions were made to off-set any non-conservative differences between the actual situation and the experimental set up.

Section 5.2.1 does not discuss chemical consequences to involved workers from normal operation. Paragraph two of this section contains the statement: "Risk to the involved workers would be from direct exposure to radiation from non-thermal treatment operations during the day. Chemical and radiological emissions are from a stack, and it is therefore assumed that the plume passes overhead." We recommend that a discussion of the consequences of handling the chemicals to be used in this process be included for the involved worker.

The relationship between the radiation doses and the various documents discussed in the first paragraph of Section 5.10.1 is very confusing. We recommend this paragraph be clarified.

Department of Energy
Richland Operations Office
P.O. Box 550
Richland, Washington 99352

OCT 05 1998

98-EAP-540

Ms. Mary Lou Blazek
Administrator, Nuclear Safety Division
Oregon Office of Energy
625 Marion St. NE
Salem, Oregon 97310-0830

Dear Ms. Blazek:

ENVIRONMENTAL ASSESSMENT (EA) FOR THE NON-THERMAL TREATMENT OF HANFORD SITE LOW-LEVEL MIXED WASTE

The U.S. Department of Energy, Richland Operations Office (RL), has received your comments on the Environmental Assessment (EA) for the Non-Thermal Treatment of Hanford Site Low-Level Mixed Waste and would like to thank you for taking the time to review the document.

Attached is a verbatim listing of all comments received and responses to the comments. Where appropriate, the reponses include an indication of changes made or not made to the EA. If you have any questions concerning the proposed action, please contact Anna Beard, of the Waste Programs Division, at (509) 376-7472.

Sincerely,

Paul F.X. Dunigan, Jr.

Paul F.X. Dunigan, Jr.
NEPA Compliance Officer

EAP:PFXD

Attachment

This appendix provides a verbatim listing of all comments received and responses to the comments. Where appropriate, the responses to comments include an indication of changes made to the EA based on the comments or when changes were not made, why they were not made.

Comment Number: 01 *Oregon Office of Energy*

Comment: Section 1.1 needs more clarification on the 2600 cubic meters (m^3) selected for evaluation. Since the paragraph states that it is uncertain which waste packages would be selected for treatment, and waste characteristics may vary depending on the package, this section needs more discussion as to why this particular hypothetical 2600 m^3 of waste makes an acceptable, conservative volume of waste for this assessment.

Response: The text in Section 1.1 was revised in the Final Environmental Assessment to clarify the conservatism of the 2600 cubic meters selected for evaluation.

Comment Number: 02 *Oregon Office of Energy*

Comment: Section 4.2 states that the total number of employees at the site would be 200 with 100 involved in Low Level Waste processing and 100 involved in Low Level Mixed Waste (LLMW) processing. However, the paragraph then state that 40 people will be involved directly with the LLMW and 10 people would be indirectly involved. What would be the function of the remaining 50 people? This paragraph needs to be clarified.

Response: There are 50 employees involved in the non-thermal treatment operations as stated (40 + 10). The "remaining 50 people" are involved with the thermal treatment operations, which are not in the scope of this analysis.

Comment Number: 03 *Oregon Office of Energy*

Comment: It is unclear why a two step process was used to determine air emission estimates in Section 5.1.1. Why weren't the estimates in the ATG risk assessment work plan for the non-thermal treatment facility used directly? This needs to be clarified.

Response: The air pollutant concentrations for this EA were scaled from the air modeling in Tetra Tech (1996a), as explained in Section 5.1.1. The estimates in the ATG risk assessment work plan were selectively used to support the EA for constituents relevant to the Hanford Waste Stream. Detailed information is available in the administrative record.

Comment Number: 04 *Oregon Office of Energy*

Comment: The Surplus Plutonium Disposition Draft Environmental Impact Statement states that no lead emission sources had been identified at Hanford. However, Table 5.1 indicates that the non-thermal treatment facility would be a source of lead emission. We recommend that this information be communicated to Mr. Howard Canter, Acting Director, Office of Fissile Materials Disposition.

Response: ATG is a private facility located off the Hanford Site and is not within the scope of the Surplus Plutonium Disposition Draft Environmental Impact Statement.

Comment Number: **05** *Oregon Office of Energy*

Comment: Section 5.1.2.1 states that waste containers will have surface radiation doses up to 200 mrem/hr while Section 1.1 defines contact-handled LLMW as waste in containers with surface radiation doses of less than 200 mrem/hr. These inconsistencies need to be corrected.

Response: The text in Section 5.1.2.1 and Section 1.1 was revised in the Final EA for clarity and consistency.

Comment Number: 06 *Oregon Office of Energy*

Comment: Section 5.1.2.1 states: 'The model default parameters provided a bounding population estimate for some on-site portions of the transport route where the Hanford Site workforce population is lower.' How do the model default parameters relate to the remainder of the on-site portions of the transport route and what analysis was done for the off-site portions of the transport route? We recommend these questions be answered in the Environmental Assessment.

Response: The text in Section 5.1.2.1 was revised to account for a more conservative population that could receive a radiological dose resulting from a transportation accident.

Comment Number: 07 *Oregon Office of Energy*

Comment: Section 5.1.2.2 assumes only 50% of container contents are spilled in a transportation accident and are available to burn. We recommend including some information justifying 50% rather than assuming 100% of the container contents are spilled.

Response: A 50 percent damage ratio for 55-gal. drums impacted in a transportation accident or by heavy equipment was assumed in other Safety Analysis Reports and EISs (i.e., WHC-SD-WM-SAR-058, Rev. 0 [WHC 1993] and The Final EIS for Treatment of LLMW [City of Richland 1998]) and is applicable for this EA.

Comment Number: 08 *Oregon Office of Energy*

Comment: We recommend information be included on what criteria were used to "provide a conservative prediction of potential health effects" as discussed in Section 5.1.2.2, page 28. For example: Were the possible chronic health effects considered or just the acute effects?

Response: Since the evaluated health effects in Section 5.1.2.2 were from a postulated accident only acute health effects were considered. This is appropriate for evaluating accidents because of the acute exposures associated with accidents. Radiological health effects from the acute exposure were based on a 70-year dose commitment period.

Comment Number: 09 *Oregon Office of Energy*

Comment: The final footnote for Table 5.3 and 5.4 does not appear to refer to anything in the tables. We recommend this be clarified.

Response: The tables were revised to make an association between the footnote and the table.

Comment Number: 10 *Oregon Office of Energy*

Comment: The Involved Worker Radiological Consequences form Normal Operations portion of Section 5.2.1 states the dose-to-risk conversion factor used to calculate the Latent Cancer Fatality risk was taken from the1990 recommendations of the International Commission on Radiological Protection. The Non-Involved Worker and General Public Radiological Consequences from Normal Operations section references the 1977 version of the same document. The reason for this difference needs to be clarified.

Response: The text in Section 5.2.1 was revised for clarity. It should be noted that there is a distinction between ICRP Publication 26 (ICRP 1977) and ICRP Publication 60 (ICRP 1991). The EDE calculations were based on ICRP 1977, and the dose-to-risk conversion factors were based on ICRP 1991.

Comment Number: 11 *Oregon Office of Energy*

Comment: The Non-Involved Worker and General Public Radiological Consequences form Normal Operations portion of Section 5.2.1 states that the radionuclide source term used was based on a production rate of 870 cubic meters per year. Include in this section the basis for this number.

Response: If 2,600 m^3 are processed in 3 years then the production rate for 1 year would be one-third of 2,600 m^3 or 870 m^3 per year.

Comment Number: 12 *Oregon Office of Energy*

Comment: In several places the Environmental Assessment (EA) explains release fractions for combustible materials are based on experimental data obtained when various types of packaged waste contaminated with various substances was burned. We recommend that you include in the EA a discussion of how well this surrogate waste and the experimental conditions correlate to the actual waste and the actual conditions. Also, include a discussion on what assumptions were made to off-set any non-conservative differences between the actual situation and the experimental set up.

Response: The drum accident evaluated in this EA is the same drum accident referenced in the Central Waste Complex Interim Safety Basis (HNF 1997). Therefore, the same release fractions were used based on similar combustible materials.

Comment Number: 13 *Oregon Office of Energy*

Comment: Section 5.2.1 does not discuss chemical consequences to involved workers from normal operation. Paragraph two of this section contains the statement: "Risk to the involved workers would be from direct exposure to radiation from non-thermal treatment operations during the day. Chemical and radiological emissions are from a stack, and it is therefore assumed that the plume passes overhead." We recommend that a discussion of the consequence of handling the chemicals to be used in this process be included for the involved worker.

Response: The text in Section 5.2.1 was revised to include a more detailed discussion of the risk to the involved worker from chemical exposures.

Comment Number: 14 *Oregon Office of Energy*

Comment: The relationship between the radiation doses and the various documents discussed in the first paragraph of Section 5.10.1 is very confusing. We recommend this paragraph be clarified.

Response: The text in Section 5.2.1 was revised, and a table was added for clarity.

REFERENCES

HNF 1997. Central Waste Complex Interim Safety Basis. HNF-SD-WM-ISB-007, Rev. 1. Fluor Daniel Northwest. Richland, Washington. March 1997.

ICRP 1991. International Commission on Radiological Protection. 1990 Recommendations of the International Commission on Radiological Protection. ICRP Publication 60. Pergamon Press. New York. 1991.

ICRP 1977. International Commission on Radiological Protection. Recommendations of the International Commission on Radiological Protection. ICRP Publication 26. Pergamon Press. New York. 1977.

WHC 1993. Final Safety Analysis for Contact-Handled, Transuranic Waste Drum In Situ Inspection and Vented Drum Retrieval. WHC-SD-WM-SAR-058, Rev. 0. Westinghouse Hanford Company. Richland, Washington. May 1993.