FINAL

ENVIRONMENTAL IMPACT STATEMENT FOR TREATMENT OF LOW-LEVEL MIXED WASTE

Prepared by:
Jacobs Engineering Group Inc.
for
Allied Technology Group, Inc.
Richland, Washington

February 1998

FACT SHEET

DOCUMENT TITLE: Final Environmental Impact Statement for Treatment of Low-Level Mixed Waste - Allied Technology Group, Inc., Richland, Washington.

PROPOSED ACTION: Construction and operation of a low-level mixed waste treatment facility that would provide thermal and non-thermal treatment of wastes made up of both low level radioactive and hazardous constituents. The wastes would originate from government and private sector customers and be treated to meet Resource Conservation Recovery Act (RCRA) and Land Disposal Restriction requirements and either returned to the generator or shipped to a permitted landfill for disposal. No disposal of waste would occur at the facility. The current plan is for facility construction beginning in 1998 with operations startup in 1999.

LOCATION: The proposed facility would be located at 2025 Battelle Boulevard, in Richland, Washington, approximately 0.5 miles south of Horn Rapids Road within the northwest quarter of Section 22, Township 10 North, Range 28 East, W.M.

PROPONENT: Allied Technology Group, Inc.
2025 Battelle Boulevard
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REQUIRED PERMITS AND APPROVALS:

Permit	Permitting Agency
Building Permit	City of Richland
RCRA Part B	Washington State Department of Ecology
Radiological Air Permit (NESHAP)	Washington State Department of Health
Radioactive Materials License	Washington State Department of Health
Notice of Construction	Benton County Clean Air Authority
Notification of PCB Activity (TSCA)	U.S. Environmental Protection Agency
Treatment of PCBs by Alternative Methods (TSCA)	U.S. Environmental Protection Agency

NESHAP = National Emission Standards for Hazardous Air Pollutants
PCB = Polychlorinated biphenyls
TSCA = Toxic Substance Control Act

RELATED DOCUMENTS: Copies of the Draft Environmental Impact Statement (EIS), technical reports, background data, materials incorporated by reference, and other related documents are available for review Monday through Friday from 8:00 a.m. to noon and 1:00 p.m. to 5:00 p.m. at the Development and Permit Services Division Office at 925 George Washington Way, Richland, Washington.

PUBLIC COMMENT: Written comments on the Draft EIS were accepted from September 22, 1997 through October 22, 1997. A total of 99 comments were received from one member of the public and the Benton County Clean Air Authority, Washington State Department of Ecology, Washington State Department of Health, and the U.S. Department of Energy. The City of Richland and the Allied Technology Group, Inc. considered all public comments in preparing the Final EIS. The comments and responses are included as Appendix A to this Final EIS.

DATE OF ISSUANCE OF FINAL EIS: February 23, 1998

COST OF EIS: Copies of the Final EIS are available to the public free of charge by contacting the proponent or the lead agency contact person at the addresses listed above.

SUMMARY

The Allied Technology Group, Inc. (ATG) proposes to construct and operate a low-level mixed waste facility in Richland, Washington. The proposed facility would be located adjacent to ATG's existing low-level radioactive waste treatment facility and would be designed to treat low-level mixed waste from the U.S. Department of Energy's (DOE's) Hanford Site and other government and commercial generators of low-level mixed waste. The analysis of potential environmental consequences from the treatment of low-level mixed waste from the Hanford Site was the subject of a previous analysis (DOE 1996a). Therefore, this Final Environmental Impact Statement (EIS), in conformance with the Washington State Environmental Policy Act (SEPA), analyzes the potential environmental consequences from treating low-level mixed waste from generators other than DOE.

The City of Richland reviewed the proposed action and issued a determination of significance (City of Richland 1997). The City of Richland has identified the following areas for discussion in the EIS: Impacts of air emissions; risk associated with the transport of non-Hanford waste; discussion of non-thermal waste treatment process; discussion of polychlorinated biphenyl and the Toxic Substance Control Act; and impacts associated with facility construction and operation, including traffic impacts.

The proposed action involves constructing and operating facilities for non-thermal and thermal (GASVIT™) treatment processes for treating low-level mixed waste to meet Resource Conservation and Recovery Act (RCRA) and Land Disposal Restriction (LDR) requirements. Non-thermal stabilization would include processes such as solidification and stabilization of waste material with grout or polymer materials. The GASVIT™ process is a proprietary treatment process that would include a gasification and vitrification to destroy organic materials and convert the remaining inorganics into a glass-like material. Following treatment the waste would be returned to the generator or shipped directly from the facility to a permitted landfill for disposal. No disposal of waste would occur at the facility.

Under the No Action alternative, the proposed facility would not be constructed. Low-level mixed waste would continue to be generated by government agencies and commercial waste generators. There is no treatment facility currently available for treating all of the waste types that could be treated at the proposed mixed waste facility. Hazardous mixed waste would continue to accumulate at both government and commercial generators. Although difficult to quantify, the human health and environmental risks associated with continued storage of mixed waste under the No Action alternative would continue to increase. There would be a continually increasing risk of accidents associated with untreated stored waste, which could have significant public health impacts. Additionally, generators of mixed waste would not be capable of meeting regulatory treatment requirements for their waste.

In the analysis of the proposed action all impact areas were evaluated, and those areas that had the potential to be substantive or that were identified during the scoping process were analyzed in

detail. Potential impacts to human health and the environment from constructing and operating the proposed facility to treat commercially generated low-level mixed waste are summarized in Table S.1. Health impacts are presented on an annualized basis because the number of years that the facility would operate is uncertain. Impact areas where the potential consequences were determined to be minimal were not analyzed in detail and are discussed in Sections 2.1.2 and 2.2.3. Construction and operation of the facility would not exceed any Federal or State regulatory limits. Because exact volumes and compositions of commercial waste that could be treated at the facility are not known, conservative assumptions were made for inventories, and the treatment facility was assumed to operate at full capacity.

Mitigation measures would be incorporated into the construction and operation for the low-level mixed waste facility to reduce environmental impacts and meet all regulatory requirements.

Mitigation Measures

Measures would be included in the current MWF design and operations plan to mitigate potential human health and environmental impacts of the proposed action.

- The MWF would be designed, constructed, and operated in compliance with the comprehensive set of commercial requirements that have been established to protect public and worker health and the environment. These requirements encompass a wide variety of topics, including radiation protection, design criteria for nuclear facilities, fire protection, emergency preparedness and response, seismic events, and operations safety requirements.
- Measures would be taken to protect construction and operations personnel from occupational hazards. These measures include the following:
  - Emphasis on safety awareness
  - Radiation and hazardous waste training
  - Use of appropriate personal protective equipment (e.g., gloves, eye protection, and respirators)
  - Personal and environmental radiation monitoring and the application of administrative limits to restrict exposures to within regulatory limits and as low as reasonably achievable levels
  - Administrative controls for potentially hazardous areas
  - Monitoring exposure to occupational noise and the use of Occupational Safety and Health Act (OSHA) -approved hearing protection during construction and operation
  - Good housekeeping of work areas
  - Preparing and implementing safety plans for all field work activities.
- Pollution control or treatment equipment would be used to minimize releases of contaminants to the environment and to meet regulatory standards. Air emissions would be treated through the use of an acid-gas scrubber, a syngas converter, HEPA filters, and activated carbon filters to reduce levels of air emissions below regulatory standards.
- Environmental monitoring systems would be implemented to continually monitor potential releases to the environment.
- All waste handling activities would take place within areas having secondary containment, which would prevent releases to the environment.
- All shipments of radioactive or hazardous materials on public roads would be performed in compliance with all regulatory requirements including requirements (Code of Federal Regulations, Title 49) for the following:
  - Maintaining manifests
  - Using appropriate shipping containers
  - Using trained and licensed transporters
  - Using appropriate signs on vehicles
  - Providing appropriate notices to potentially involved organizations.
- Energy recovery (thermal) from heat in the offgas system would be used to the extent practicable to reduce facility electrical useage.

To mitigate potential transportation impacts ATG is working with the City of Richland to extend Battelle Boulevard from the existing ATG Facility west to Kingsgate Way, which is connected to Highway 240. This would provide access for shipping waste to and from the ATG Facility through the industrial park thus avoiding Stevens Drive. This road improvement would involve constructing a two-lane asphalt road and a turning lane at Kingsgate Way.

1.2 ALTERNATIVES TO THE PROPOSED ACTION

1.2.1 No Action

Under the No Action alternative, the proposed facility would not be constructed. Low-level mixed waste would continue to be generated by government agencies and commercial waste generators. There is no treatment facility currently available that has the capability to treat all of the waste types that the proposed MWF could treat. Hazardous mixed waste would continue to accumulate at both government and commercial generators. Although difficult to quantify, the human health and environmental risks associated with storage of mixed waste under the No Action alternative would continue to increase. There would be a continually increasing risk of accidents associated with untreated stored waste, which could have significant public health impacts. Additionally, generators of mixed waste would not be capable of meeting treatment requirements for their waste.

1.3 COMPARISON OF IMPACTS AMONG ALTERNATIVES

The environmental impacts of the proposed action and the No Action alternative are summarized in Table 1.3.1. Additional details on environmental impacts of the proposed action are provided in Section 2.0.

1.4 CUMULATIVE IMPACTS

This section describes potential cumulative impacts associated with implementing the proposed action. In addition to treating LLMW from commercial generators, the MWF would treat DOE waste from the Hanford Site. Commercial waste and DOE waste would be treated in separate campaigns to accommodate disposal requirements. The cumulative effects of these two waste streams would not be greater on an annual basis than the impacts presented in Section 2.0 because those impacts were based on operating the MWF at full capacity throughout the year. The MWF would be located adjacent to an existing ATG LLW treatment facility. If these two facilities were operated at the same time, impacts from the LLW facility would be cumulative with those of the MWF.

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 [Supply System] Plant 2), a nuclear fuel production plant (Siemens Power Corporation), and a food processing facility (Lamb-Weston). In addition to these facilities, current DOE planning includes constructing and operating treatment plants for high-level tank waste on the Hanford Site. The ongoing operations of these facilities would have cumulative impacts with the proposed action in areas such as air emissions

Table 1.3.1. Summary of Environmental Impacts

Type of Impact	Proposed Action	No Action
Air Quality	No exceedances of Federal or State air quality standards would occur. Operating emissions would include small quantities of criteria pollutants such as sulfur oxides, carbon monoxide, nitrogen oxides; hazardous chemicals such as furans and formaldehyde; and radionuclides.	No exceedances of Federal or State air quality standards would occur unless an accident were to occur with the continually increasing volume of stored wastes. [2]
Earth	No changes in topography would result. Soil at the proposed facility location has been previously disturbed and only a small amount of additional disturbance would take place during construction. Temporary impacts during construction would include a small increased potential for soil erosion of disturbed areas.	No impact to the existing ATG Facility.
Water	No effluent discharges to surface water bodies or groundwater would take place. All waste handling activities would take place within areas having secondary containment, which would prevent releases to the environment that could potentially impact groundwater.	No impacts unless an accident were to occur with the continually increasing volume of stored waste.
Plants and Animals	No threatened or endangered plant or animal species would be impacted.	No impact.
Energy and Natural Resources	Primary energy and natural resource usage would be electricity. The increased demand on the regional electrical generation system would be small and within the capacity of the regional system.	No impact. [2]
Health Effects - Routine	No latent cancer fatalities would be expected for the involved workers, noninvolved workers or general public populations from radiological exposures associated with routine operations. [1] No potential health effects would be expected from chemical exposures. There would be no anticipated latent cancer fatalities to workers or the general public from incident-free transportation. [1]	Small routine health effects to workers currently occur for ongoing storage of LLMW. These health effects would increase as untreated waste volumes continue to accumulate[2]
Health Effects -Accidents	<u>Occupational Accidents</u> [1] There would be two anticipated recordable injuries or illnesses from construction and 11 anticipated recordable injuries or illnesses from operations. Of the 11 recordable operations injuries and illnesses, 5 would be expected to be lost work day accidents. Injuries and illnesses include all reportable incidences such as falls, cuts, muscle strains, and machinery related accidents. Recordable injuries/illnesses represent minor accidents that do not involve lost work time. Lost worktime accidents have greater consequences and require time off of work to recover. There would be no anticipated fatalities during construction or operations. <u>Radiological Risks</u> No latent cancer fatalities would be expected for onsite or general public populations.	There is a potential for an accident to occur during the storage of LLMW. The accident potential would increase as untreated waste volumes continue to accumulate. [2] Accidents would result in workers at the generator facilities being exposed to increased levels of radiation and hazardous chemicals. Exposures to members of the public could also occur.

Table 1.3.1. Summary of Environmental Impacts (cont'd)

Type of Impact	Proposed Action	No Action
Transportation - Routine	Stevens Drive access from State Route 240 Bypass would experience a small increase in congestion. The daily number of ATG related vehicles would represent approximately 3 percent of peak hourly traffic volume over this roadway. A total of 93 additional vehicles would travel over Stevens Drive daily including an additional 89 passenger vehicles and light trucks and 4 trucks transporting LLMW. No latent cancer fatalities would be expected from radiological doses received during incident-free transportation.[1]	No impacts.[2]
Transportation - Accidents	There would be approximately one injury and no fatalities from nonradiological/ nontoxicological truck accidents.[1] There would be no anticipated fatalities or the development of irreversible, serious, or permanent health effects from chemicals released during an accident.	No impacts.
Land Use	Approximately 5 acres of land would change from disturbed arid grassland to industrial use.	No impacts.
Public Services and Utilities	The level of employment (100 facility workers) would represent less than 0.1 percent of the current total Tri-Cities area employment. There would be no measurable impacts on social services such as the police departments, fire departments, sanitary and water supply systems, schools, and hospitals of the local region.	No impacts.
Cultural and Archeological Resources	The potential for disturbance of cultural and archeological resources is minimal because the soil at the ATG Facility has been previously disturbed by Site activities or agricultural production.	No impacts.

[1] Potential health impacts from routine operations are presented on an annualized basis because the number of years the facility would operate is uncertain.

[2] LLMW would continue to be generated under the No Action alternative. The LLMW would require either ongoing storage or treatment at another LLMW treatment facility. Currently there are no facilities that have the capability to treat all of the waste types identified in this EIS. However, if such facilities were constructed the resulting transportation and operational impacts would be expected to be similar to those identified for the proposed action.

and transportation. A commercial radioactive waste burial site (U.S. Ecology) and a commercial decontamination facility (Interstate Nuclear Services) would also have cummulative impacts from transportation and, to a lesser degree, air emissions with the proposed action.

The potential radiological health effects to ATG Facility workers from routine operations and accident conditions are presented in Section 2.2.1. The noninvolved worker population included workers in the adjacent ATG LLW treatment facility. The routine radiological dose from both treatment facilities combined would not be expected to exceed 200 mrem/year (yr) per involved worker as used in the impact analysis. Based on this, there would be no cumulative radiological impacts to facility workers from routine radiological exposure. Cumulative impact areas that were considered to be potentially significant are quantified to the extent possible in the following discussion. All other impact areas to the natural and built environment were considered to be minor, and therefore no cumulative impacts were calculated.

Air emissions from constructing and operating the proposed MWF would combine with those from ongoing operations at the LLW treatment facility and other facilities in the area. 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 (NESHAPS). Last year the low-level treatment facility NESHAPS estimate was 0.0012 mrem/year at the nearest residence. 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 as demonstrated in Section 2.1.1.

Radiological consequences from routine air emissions were evaluated for the MWF while treating DOE and commercial waste streams. The radiological doses from routine air emissions during the treatment of DOE waste from the Hanford Site were evaluated using the GENII computer code (AES Environmental 1996). Because the radiological doses from routine air emissions for the commercial waste stream were modeled with the Clean Air Act Assessment Package 1988 Personal Computer (CAP88-PC) program, the air emissions from the DOE waste stream were remodeled using the CAP88-PC program for purposes of comparing the radiological consequences from the two waste streams. The annual population dose to the general public from the DOE waste stream would be 3.7E-03 person-roentgen equivalent man (rem)/yr (Jacobs 1997) and the annual population dose from the commercial waste stream would be 3.9E-02 person-rem (Table 2.2.3). The commercial waste stream would result in a higher dose because the waste characteristics were conservatively assumed to be similar to the DOE waste and the waste processing rate was higher. The highest cumulative population dose from the two LLMW streams processed in the MWF (3.9E-02 person-rem/yr) added to the population dose from the existing LLW facility would represent the total contribution from the ATG Facility. Because the LLW air emissions were assumed for the commercial LLMW analysis (see Section 2.2.1.2.1), 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 annual population dose from tank waste remediation activities at the Hanford Site would be 14.4 person rem/yr (DOE 1996). The annual population dose from the nearby Supply System Plant 2 is 0.7 person-rem/yr (DOE 1996). Therefore, the total population dose from the ATG Facility would result in a small incremental increase of approximately 0.5 percent to the population dose from the nearby Hanford Site and commercial nuclear power generation. These population doses represent latent cancer fatality risks of 3.9E-05 for the entire ATG Facility operating at capacity, 7.2E-03 from Hanford Site tank waste remediation activities, and 3.5E-04 from the Supply System Plant 2.

2.0 AFFECTED ENVIRONMENT

2.1 NATURAL ENVIRONMENT

This section describes the natural environment of the ATG MWF Site. The section also identifies potential effects of the proposed action on the natural environment and measures that could be implemented to lessen the impacts on the natural environment.

The Hanford Site Environmental Report for Calendar Year 1995 (PNNL 1996) and the Hanford Site National Environmental Policy Act (NEPA) Characterization (Cushing 1995) are hereby incorporated by reference. These documents describe the affected environment for Hanford Site and the ATG Site and are the principal sources of the information presented in this section. The affected environment at the ATG MWF Site is similar to nearby areas at the adjacent Hanford Site because the Hanford Site lies to the north of the ATG Site, and to the west is the Richland Industrial Park, which is slowly filling up with industrial tenants. Information is supplemented where environmental conditions described in the referenced reports may not fully reflect conditions at the ATG Site.

2.1.1 Air

2.1.1.1 Affected Environment

Meteorology

ATG is located adjacent to the DOE Hanford Site boundary, approximately 2.8 km (1.75 mi) south south-west of the 300 Area, and is 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.

Prevailing winds at the Hanford 300 Area Meteorological Station are from the southwest and northwest (Cushing 1995). Monthly average wind speeds are lowest during December, averaging approximately 10 km/hr (6 mi/hr), and highest during June, averaging approximately 15 km/hr (9 mi/hr).

Average monthly temperatures vary from -1 degrees°C (30°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 cm (6.5 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.).

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.

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 1994). 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).

Air Quality

Air quality in the ATG vicinity is good. However, levels of particulate matter occasionally exceed regulatory standards. These elevated levels are believed to result from natural sources such as the dust storms and brush fires that occur in arid eastern Washington State (PNNL 1993 and Cushing 1994).

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 Facility on the Hanford Site are available for nitrogen oxides, polychlorinated biphenyls, 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 Facility. 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. Nine out of 17 PCB samples collected during 1993 were below the detection limit of 0.29 nanograms per cubic meter (nano = $1 \cdot 10^{-9}$) and thus well below the level of regulatory concern. Eight samples were above the detection limit, with results from 0.25 to 3.9 nanograms per cubic meter (Cushing 1995).

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 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. Levels measured at locations both on and off the Hanford Site were much lower than the applicable standards (PNNL 1996).

ATG continuously monitors radiation levels at the facility perimeter using air samplers at four fixed-compass-direction locations. Radionuclide emissions during the year of 1996 were 1.4E-10 Ci/yr of manganese-54, 2.0E-10 Ci/yr of cobalt-60, 1.7E-10 Ci/yr of cesium-137, 3.0E-10 Ci/yr of bismuth-214, 2.4E-10 Ci/yr of lead-214, and 2.0E-09 Ci/yr of radium-226 (ATG 1997). These levels would result in a radiological dose of 4.9E-08 mrem/yr for a maximally exposed individual (MEI) at the facility boundary, which is well below the State standard of 25 mrem/yr (Jacobs 1997).

Environmental Impacts
A three-stage process would filter out nearly all of the syngas impurities, convert the purified gas into water and carbon dioxide, and refilter the gas before discharge. Larger particulates would be removed in the first stage filter. A second stage scrubber would remove acid gases (such as fluorine), nonvolatile or semivolatile metals, and some particulates not removed by the first stage filter. In the third stage, the scrubber gas would be oxidized, converting the syngas to water and carbon dioxide. The water and carbon dioxide would then be filtered through a bank of pre-

filters, HEPA filters, and activated carbon filters. After carbon filtration the gases and potential steam would be discharged via the building stack with the building ventilation exhausts.

Air pollutant emissions estimates were developed and air dispersion modeling was performed to analyze air quality impacts from treating LLMW at the ATG MWF (Tetra Tech 1996a). The emission estimates were based on pilot plant testing conducted by Plasma Energy Applied Technology and assumed efficiencies for HEPA and carbon filters. HEPA filters were assumed to remove 99 percent of all particulate matter greater than 0.3 micron, and carbon filters were assumed to remove 50 percent of the organic compounds. 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.

The results of the modeling (Tetra Tech 1996a) were adjusted to reflect an increased feed rate of 230 kg/hr (500 pound [lb]/hr) and compared with Washington State air quality standards or emission levels. 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).

The modeling results show no exceedance of Federal or State air quality standards for criteria pollutants, hazardous air pollutants, or radionuclides. The pollutants presented in Table 2.1.1 would result in the highest levels of emission compared to Federal or State standards.

Emissions from constructing the new GASVIT™ facility and its support buildings include vehicle exhaust emissions and fugitive dust released during earthmoving operations. Based on the size of the facility and type of construction (e.g., metal sided building on a concrete slab), the construction emissions would be expected to be minor and were not evaluated in detail. Construction activities would include appropriate control measures (such as using surfactants and water spray procedures) that would result in compliance with Federal and State air quality standards.

Table 2.1.1. Major Pollutant Impacts

Pollutant	Averaging Period	Concentration $\mu g/m^3$	State $\mu g/m^3$	Federal $\mu g/m^3$
Particulate Matter (PM_{10})	24 hr	1.5E-03	1.5E+02	1.5E+02
Carbon Monoxide	1 hr	1.1E+01	4.0E+04	4.0E+04
Nitrogen Oxides	annual	7.5E-01[a]	1.0E+02	1.0E+02
Sulfur Oxides	1 hr 3 hr 24 hr	1.3E-01 1.2E-01 5.3E-02	6.6E+02 NA 2.6E+02	NA 1.3E+03 3.7E+02
Hydrogen Fluoride	24 hr	9.7E-04	8.7	NA
Formaldehyde	annual	4.2E-02[a]	7.7E-02	NA
Acetaldehyde	annual	2.12E-01[a]	4.5E-01	NA
Diphenylene Methane (Fluorene)	24 hr	9.7E-06	5.3E+00	NA
Phenol	24 hr	2.8E-04	6.3E+01	NA
1,4-Dichlorobenzene (p-Dichlorobenzene)	24 hr	3.9E-06	1.5E+00	NA
Combined Methylphenol (Cresol) isomers	24 hr	4.3E-05	7.3E+01	NA
Naphthalene	24 hr	1.3E-04	1.7E+02	NA
Dimethyl Phthalate	24 hr	8.1E-06	1.7E+01	NA
Diethyl Phthalate	24 hr	4.8E-05	1.7E+01	NA
Di-n-Butyl Phthalate	24 hr	1.2E-04	1.7E+01	NA
bis(2-Ethylhexyl) Phthalate	annual	5.6E-02[a]	2.5E+00	NA
Total Dioxin + Furan Toxicity Equivalent	24 hr	5.2E-10	3.0E-08	NA
Aluminum (combined particulate and vapor)	24 hr	6.9E-05	6.7E+00	NA
Barium (combined particulate and vapor)	4 hr	3.5E-06	1.7E+00	NA
Cadmium	annual	1.2E-06[a]	5.6E-04	NA
Copper	24 hr	2.9E-06	6.7E-01	NA
Iron	24 hr	4.1E-05	1.7E+01	NA
Lead	24 hr	1.3E-05	5.0E-01	NA
Magnesium	24 hr	4.7E-06	3.3E+01	NA
Zinc	24 hr	1.6E-05	1.7E+01	NA
Nickel	annual	1.0E-05[a]	2.1E-03	NA
Total Radionuclide	mrem/yr	8.0E-03 3.2E-02	2.5E+01[b] NA	NA 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 ISC3 computer code (annual concentrations values are typically reduced from the 24-hour values by one to two orders of magnitude).
[b]Maximum at any offsite receptor, WAC 173-480.
[c]Maximum at nearest residence, 40 CFR 61.
Air concentrations taken from Tetra Tech (1996a) and adjusted to reflect increased feed rate from 68 kg/hr (150 lb/hr) to 230 kg/hr (500 lb/hr).
Total dioxin and furan toxicity equivalent pollutants come from PCBs.
NA = Not applicable.

The ATG Facility is located in an industrial area in the northern portion of the City of Richland. Most developed land in the surrounding area is used for agriculture, light industry, or residences. The area to the north of the Site is the DOE Hanford Site.

The nearest neighbors to the ATG Facility is the Siemens Power Corporation Facility approximately 0.64 km (0.4 mi.) to the northwest; a farm is located on the south and west sides of the site; the Richland Industrial Park is to the northwest; the Richland Disposal Site and Horn Rapids Off-Road Vehicle Park is approximately 3.86 km (2.4 mi.) to the northwest; and the PNNL complex is located 1.6 km (1 mi.) to the northeast of the site. The nearest residential dwellings are located in North Richland and are approximately 2.7 km (1.7 mi.) to the southeast, and there is a child care center located 2 km (1.25 mi.) to the east-southeast.

2.2.1 Environmental Health

2.2.1.1 Affected Environment

The ATG MWF would employee approximately 100 people (workers) per year in addition to its current staff level of 100. The facility would be located adjacent to the DOE Hanford Site boundary in an industrial area in the City of Richland. There are approximately 281,600 people (general public) that live within an 80-km (50-mi) radius of the facility. This includes residents of Grant County to the north; Franklin and Walla Walla counties to the east; Benton, Umatilla, and Morrow counties to the south; Klickitat County to the southwest; Yakima County to the west; and Kittitas County to the northwest. Analyses of potential health impacts from routine and accident conditions during construction and operations of the ATG MWF are based on these worker and general public populations.

2.2.1.2 Health Impacts

Environmental health impacts analyzed in this section include potential latent cancer fatality (LCF) risks from radiological exposure and health hazards and incremental lifetime cancer risk (ILCR) from chemical exposures that would occur during routine MWF 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 construction and operations activities associated with the MWF.

The effects of radiation emitted during disintegration (decay) of a radioactive substance depend on the kind of radiation (alpha and beta particles and gamma and x-rays) and the total amount of radiation energy absorbed by the body. This absorbed energy is referred to as the absorbed dose. The absorbed dose, when multiplied by certain quality factors that take into account different sensitivities of various tissues, is referred to as the effective dose equivalent, or simply dose. The common unit of effective dose equivalent is the rem (1 rem equals 1,000 mrem). The total dose received by the exposed population is measured in person-rem. For example, if 1,000 people each received a dose of 0.3 rem (300 mrem), the collective dose would be 1,000 persons · 0.3 rem (300 mrem) = 300 person-rem. Alternatively, the same collective dose (300 person-rem) would result from 10,000 people, each of whom received a dose of 0.03 rem (30 mrem) (10,000 · 0.03 = 300 person-rem).

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 a dose of about 0.3 rem (300 mrem) per year from 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). Radiation can cause a variety of ill-health effects in people. The consequence of environmental and occupational radiation exposure is the induction of a LCF. This effect is referred to as LCF because the cancer may take many years to develop and for a fatality to occur.

In the case of an exposed population, risk is expressed as the expected incremental increase in the probability of developing LCFs in the population at risk. For the MEI, it is expressed as the increased probability of dying from cancer as a result of the exposure.

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 LLMW treatment activity. Noninvolved workers refer to the ATG Facility employees who are not directly involved in the treatment activity. The general public is the offsite population distribution from the LLMW treatment facilities to a distance of 80 km (50 mi). Health impacts to the MEI from the involved workers, noninvolved workers, and general public groups are also evaluated. An MEI is an individual who is assumed to receive the highest possible exposure. Health impacts from radiological and chemical accidents are evaluated for the same receptors with the exception that the involved workers are not evaluated separately but are included in the onsite population located a minimum of 100 m (330 ft) from the point of release.

2.2.1.2.1 Routine Conditions

Routine risk is the potential risk from exposure to chemical and radiological contaminants and direct exposure to radiation during normal operations. Routine risk to the involved workers would be from direct exposure to radiation from LLMW operations during the work day. Routine chemical and radiological emissions are from a stack, and it is therefore assumed that the plume passes overhead. Routine risk to the noninvolved workers would be from potentially inhaling radioactive and chemical atmospheric stack emissions from LLMW operations. Routine 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 presented on an annualized basis because the number of years that the facility would operate is uncertain. However, the risk from the lifetime operation of the facility is the product of the annual risk and the number of years of operation, which could be reasonably estimated at 20 years.

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Involved Worker Radiological Consequences From Routine Conditions

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/yr per involved worker (historical average for the existing ATG LLW treatment facility) and a population of 80 involved workers (of the 100 facility workers, 80 are assumed to be directly involved with treatment). 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 4.0 E-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 2.2.1. No LCFs would be expected for the involved workers, and the annual risk of the MEI receiving a fatal cancer from the LLMW operation is unlikely (4.0E-04/yr).

Table 2.2.1. Involved Worker Annual Radiological Risk From Routine Operations

Receptor	Dose EDE (person-rem)	Radiological Risk (LCF)
Involved worker population	1.6 E+01	6.4E-03
MEI involved worker	1.0 E+00	4.0 E-04

Notes:
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 80 involved workers per year. The LCF risk is based on a dose-to-risk conversion factor of 4.0 E-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 4.0 E-04 LCF per rem.

Noninvolved Worker and General Public Radiological Consequences from Routine Conditions

The LCF risk 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 and risk are estimated by combining the inhalation and ingestion intake rates, air, and ground surface concentrations with dose and risk conversion factors. The effective dose equivalent is calculated using the weighting factors in the International Commission on Radiological Protection Publication 26 (ICRP 1977). Risks are based on lifetime risk from lifetime exposure, with a nominal value of 4.0E-04 cancers/rem for workers and 5.0E-04 cancers/rem for members of the general public. The number of cancers per rem for the general public is higher to account for different age distributions in the general public compared to the work force. Site-specific meteorological data and population arrays were used with CAP88-PC. The radionuclide source term used with CAP88-PC was taken from air emissions estimates for the ATG MWF facility and is shown in Table 2.2.2 (Jacobs 1997). The annual LCF risk to the noninvolved worker population, MEI noninvolved worker, general public population, and MEI general public during normal operations are presented in Table 2.2.3.

Table 2.2.2. Annual Radiological Air Emissions

Isotope	Maximum Anticipated Emissions (Ci/yr)
Tritium-3 (H-3)	3.22E+01
Carbon-14 (C-14)	3.01E-02
Sodium-22 (Na-22)	1.63E-08
Calcium-45 (Ca-45)	1.78E-09
Chronium-51 (Cr-51)	4.55E-07
Manganese-54 (Mn-54)	9.04E-08
Iron-55 (Fe-55)	1.03E-07
Cobalt-57 (Co-57)	3.00E-07
Cobalt-58 (Co-58)	2.18E-08
Cobalt-60 (Co-60)	8.12E-07
Nickel-63 (Ni-63)	4.90E-09
Zinc-65 (Zn-65)	4.26E-07
Strontium-90 (Sr-90)	7.31E-08
Yttrium-90 (Y-90)	7.31E-08
Zirconium-95 (Zr-95)	1.85E-08
Antimony-125 (Sb-125)	1.64E-07
Tellurium (Te-125m)	3.78E-08
Cesium-134 (Cs-134)	1.77E-08
Cesium-137 (Cs-137)	1.29E-07
Barium-140 (Ba-140)	5.59E-08
Lanthanum-140 (La-140)	5.54E-08
Europium-152 (Eu-152)	5.13E-10
Europium-154 (Eu-154)	8.59E-10
Lead-214 (Pb-214)	6.95E-04
Bismuth-214 (Bi-214)	1.96E-10
Radium-226 (Ra-226)	4.33E-08
Thorium-232 (Th-232)	1.96E-09
Uranium-235 (U-235)	3.77E-07
Uranium-238 (U-238)	1.10E-08
Plutonium-238 (Pu-238)	2.21E-10
Plutonium-239 (Pu-239)	6.60E-09
Plutonium-240 (Pu-240)	1.48E-09
Plutonium-241 (Pu-241)	6.39E-08

Notes:

Maximum anticipated emissions taken from Jacobs 1997.
Ci = Curies

Table 2.2.3. Noninvolved Worker and General Public Annual Radiological Risk From Routine Operations

Receptor	Dose EDE (person-rem)	Radiological Risk (LCF)
Noninvolved Worker Population	3.6E-03	1.4E-06
MEI Noninvolved Worker	3.1E-05	8.4E-07
General Public Population	3.9E-02	1.5E-05
MEI General Public	3.2E-05	8.5E-07
MEI Child Care Center	8.3E-06	2.2E-07

Notes:
EDE = Effective dose equivalent
LCF = Latent cancer fatality
MEI = Maximally exposed individual

Noninvolved worker dose and the LCF risk were calculated using the CAP88-PC program and assuming 120 noninvolved workers per year. 120 noninvolved workers = 20 workers at the MWF and 100 workers at ATG's existing LLW treatment facility.

The MEI general public receives a higher dose than the MEI noninvolved worker because the release is a stack release which results in higher peak concentrations outside the facility boundary.

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.

The general public evaluation also included an analysis of a maximally exposed child 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 annual incremental risk that the MEI would develop a fatal cancer from the LLMW operation is 8.5E-07/yr.

Noninvolved Worker and General Public Nonradiological Chemical Consequences from Routine Conditions

Routine 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 (IRIS) and Health Effects Assessment Summary Tables (HEAST) were applied in the chemical emissions evaluation.

Routine chemical emissions concentrations from the LLMW treatment operations were based on emissions concentration data from the ISCST3 Air Dispersion Modeling Results for the ATG MWF (Tetra Tech 1996a). The air concentrations were scaled up to account for a feed rate of 230 kg/hr (500 lb/hr) (Jacobs 1997).

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

2.2.2.2 Transportation Impacts

The radiological and toxicological transportation impacts associated with this activity as well as nonradiological/nontoxicological transportation accidents are evaluated in this section.

2.2.2.2.1 Radiological Risk

The radiological risk resulting from routine exposures and accidents while the untreated LLMW is in transit to the ATG MWF and while the treated LLMW is in transit to the disposal site were analyzed using RADTRAN 4 (Neuhauser-Kanipe 1992). RADTRAN 4 was developed at Sandia National Laboratories to evaluate the risk of transporting radioactive material.

The distance traveled in population zones and population densities for the truck shipments from Vancouver, Washington; Spokane, Washington; and Seattle, Washington to Richland, Washington and Richland, Washington to Clive, Utah were used from the RADTRAN 4 computer code and are summarized in Table 2.2.9.

Table 2.2.9. RADTRAN 4 Input Data

Shipping Route	Distance (km)	Distance Traveled In Population Zone (km)			Population Density (people/km^2)		
		Rural	Suburban	Urban	Rural	Suburban	Urban
From Vancouver, WA to Richland, WA	365	295	62.5	7.4	5.4	411	2,200
From Spokane, WA to Richland, WA	251	209	30.3	11.3	4.4	510	2,100
From Seattle, WA to Richland, WA	319	285	28.8	5.3	4.1	363	1,870
From Richland, WA to Clive, UT	1,041	954	77.8	9.6	3.9	394	1,949

The radiological inventory used in the RADTRAN 4 accident analysis was assumed to be the same inventory used to calculate the radiological risk of the LLMW stream coming from the Hanford Site 200 West Area to be treated at the ATG Facility (Tetra Tech 1996b). The key variable in the code for routine risk was the dose rate from the vehicle package. A screening-level approach was taken to evaluate radiological risk from routine transportation. Based on historical data for commerically generated LLW, the inbound radioactive shipments in this analysis were assumed to be at an average dose rate of 0.05 mrem per hour at 1 m (3.3 ft). The dose rate for outbound shipments was reduced to 0.01 mrem/hr at 1 m (3.3 ft) because the treatment processes result in increased waste form density and lower dose rates. It is anticipated that the average radiological constituent concentrations for commercial LLMW treated in the proposed ATG MWF would be less than those from the Hanford Site.

Latent Cancer Fatality Risk From Incident Free Transportation

The radiological dose to the workers (assumed to be two drivers) and the public were calculated for a single trip for each shipping route using RADTRAN 4. The annual dose was calculated by multiplying the dose per trip by the annual trips. It was estimated that 475 truck loads of LLMW, which corresponds to the peak annual operating capacity of the MWF, would be transported annually to the ATG MWF. It was assumed that of the 475 annual trips, 24 trips/yr would come from the Seattle area, 226 trips/yr would come from the Spokane area, and 225 trips/yr would come from the Vancouver area. It was estimated that 475 truck loads of treated LLMW annually would be transported from Richland, Washington to Clive, Utah for disposal. The LCF risk to the general public and onsite receptors was calculated by multiplying the calculated dose (rem) by dose-to-risk conversion factors. Conversion factors are predications of health effects from radiation exposure. The dose-to-risk conversion factors used for estimating cancer fatalities from low doses of radiological exposure were taken from International Commission on Radiological Protection (ICRP 1991). The dose-to-risk conversion factors are 5.0 E-04 LCFs per person-rem for the general population and 4.0 E-04 LCFs per person-rem for the workers. The difference in the conversion factors is attributable to age distribution in the general population. The annual dose from each shipping route contributes to the total annual risk; therefore, the annual LCF risk is the sum of the contributing shipping routes. The annual incident-free transportation LCF risk to the general public and the workers are summarized in Table 2.2.10. There would be no anticipated LCFs to the workers (3.59E-04/yr) or the general public (3.36E-05/yr) on an annual basis. The risk to the MEI would be 5.56E-10/yr.

Table 2.2.10. Incident-Free Transportation Latent Cancer Fatality Risk

Shipping Route	Receptor	Dose/trip (person-rem)	Annual Trips (trips/yr)	Dose-to-Risk Conversion Factors LCF/person-rem	Annual LCF Risk
Vancouver to Richland	Worker	1.40E-03	225	4.0E-04	1.26E-04
	Public	8.79E-05		5.0E-04	9.89E-06
Spokane to Richland	Worker	9.69E-04	226	4.0E-04	8.76E-05
	Public	6.65E-05		5.0E-04	7.51E-06
Seattle to Richland	Worker	1.12E-03	24	4.0E-04	1.08E-05
	Public	5.82E-05		5.0E-04	6.98E-07
Richland to Clive, Utah	Worker	7.08E-04	475	4.0E-04	1.35E-04
	Public	6.51E-05		5.0E-04	1.55E-05
			Total LCF Risk	Worker	3.59E-04
				Public	3.36E-05

Notes:
LCF = Latent cancer fatality

Latent Cancer Fatality Risk From Transportation Accident

Accidents of six different severities could occur during the transportation of LLMW. Accident-severity categories are defined as 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. All six accident severities and their probability of occurrence are included in the RADTRAN 4 analysis. 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. Radiological accident impacts were analyzed as an integrated population LCF risk (i.e., accident frequency times consequences integrated over the entire shipping route). The LCF risk for each shipping route is summarized in Table 2.2.11. The Vancouver, Washington to Richland, Washington shipping route has the highest LCF risk of

The petroleum/coal tar waste stream represents 38 percent (5,657.9 kg/14,917.36 kg) of the total hazardous chemicals. The air concentration of this waste stream would be 6.19 mg/m^3 (16.3 mg/m^3 · 38 percent). The entire air concentration of the petroleum/coal tar waste stream was conservatively assumed to be represented by tridecane (similar to kerosene).

PCBs/pesticides represent 3 percent (516.88 kg/14.917.36 kg) of the total hazardous chemicals and is comprised almost entirely of PCBs. The air concentration of PCBs would be 0.49 mg/m^3 (16.3 mg/m^3 · 3 percent).

Freons represent 0.25 percent (37.45 kg/14,917.36 kg) of the total hazardous chemicals. The air concentration of freons would be 0.04 mg/m^3 (16.3 mg/m^3 · 0.25 percent). The entire air concentration of freons was assumed to be represented by the chlorinated solvent methylene chloride.

The amine waste stream represents 1.6 percent (240.71 kg/14,917.36 kg) of the total hazardous chemicals. The air concentration of this waste stream would be 0.26 mg/m^3 (16.3 mg/m^3 · 1.6 percent). The entire air concentration of amines was conservatively assumed to be represented by ammonia.

The air concentrations of the chemical classes are compared to the ERPGs in Table 2.2.12 (central nervous system depression concentration limits), Table 2.2.13 (corrosive/irritant concentration limits), and Table 2.2.14 (toxic 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.

2.2.2.2.3 Nonradiological/Nontoxicological Transportation Impacts

The nonradiological/nontoxicological impacts include injuries and fatalities resulting from truck accidents. The transport trucks would pass through different population zones from point of origin to point of destination. The distance traveled in each population zone (from the RADTRAN 4 data files) are summarized in Table 2.2.15. 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 the U.S. Department of Transportation (Rao 1982). The unit-risk factors for injuries and fatalities in each zone are summarized in Table 2.2.15.

The annual number of injuries and fatalities were calculated by multiplying the annual distance traveled in each zone by the appropriate unit risk factors and are presented in Table 2.2.16. The annual anticipated risk from nonradiological/nontoxicological truck accidents would be approximately one injury and no fatalities per year.

2.2.2.3 Mitigative Measures

Mitigative measure would be incorporated into waste transport activities. Mitigative measures are described in Section 1.1.1.

Table 2.2.16. Anticipated Nonradiological/Nontoxicological Risk From Truck Accidents

Population Zone	Annual Distance (km)				Unit Risk Factors[m]		Incidence/yr	
	Seattle	Spokane	Vancouver	Clive, Utah	Injury/km	Fatality/km	Injury	Fatality
Urban	2.54E+02[a]	5.11E+03[d]	3.33E+03[g]	9.12E+03[j]	3.70E-07	7.50E-09	6.59E-03	1.34E-04
Suburban	1.38E+03[b]	1.37E+04[e]	2.81E+04[h]	7.39E+04[k]	3.80E-07	1.30E-08	4.45E-02	1.52E-03
Rural	1.37E+04[c]	9.46E+04[f]	1.33E+05[i]	9.06E+05[l]	8.00E-07	5.30E-08	9.18E-01	6.08E-02
						Total	9.69E-01	6.25E-02

Notes:

[a]Is the product of [5.3 km/trip (from RADTRAN4 data files)] · [2.0 (account for round trip)] · [24 trips/yr (5 percent of 475 annual trips)].
[b]Is the product of [28.8 km/trip (from RADTRAN4 data files)] · [2.0 (account for round trip)] · [24 trips/yr (5 percent of 475 annual trips)].
[c]Is the product of [284.6 km/trip (from RADTRAN4 data files)] · [2.0 (account for round trip)] · [24 trips/yr (5 percent of 475 annual trips)].
[d]Is the product of [11.3 km/trip (from RADTRAN4 data files)] · [2.0 (account for round trip)] · [226 trips/yr (47.5 percent of 475 annual trips)].
[e]Is the product of [30.3 km/trip (from RADTRAN4 data files)] · [2.0 (account for round trip)] · [226 trips/yr (47.5 percent of 475 annual trips)].
[f]Is the product of [209.3 km/trip (from RADTRAN4 data files)] · [2.0 (account for round trip)] · [226 trips/yr (47.5 percent of 475 annual trips)].
[g]Is the product of [7.4 km/trip (from RADTRAN4 data files)] · [2.0 (account for round trip)] · [225 trips/yr (47.5 percent of 475 annual trips)].
[h]Is the product of [62.5 km/trip (from RADTRAN4 data files)] · [2.0 (account for round trip)] · [225 trips/yr (47.5 percent of 475 annual trips)].
[i]Is the product of [295.4 km/trip (from RADTRAN4 data files)] · [2.0 (account for round trip)] · [225 trips/yr (47.5 percent of 475 annual trips)].
[j]Is the product of [9.6 km/trip (from RADTRAN4 data files)] · [2.0 (account for round trip)] · [475 trips/yr].
[k]Is the product of [9.6 km/trip (from RADTRAN4 data files)] · [2.0 (account for round trip)] · [475 trips/yr].
[l]Is the product of [9.6 km/trip (from RADTRAN4 data files)] · [2.0 (account for round trip)] · [475 trips/yr].
[m]Injury and fatality unit risk factors for each zone are from Rao (1982).