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Application for Approval to Construct the Waste Receiving and Processing Facility

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

United States
Department of Energy
P.O. Box 550
Richland, Washington 99352

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ACRONYMS

CAP-88	Clean Air Assessment Package 1988
CH	contact handled
DF	decontamination factor
EDE	effective dose equivalent
HEPA	high efficiency particulate air
HMS	Hanford Meteorological Station
HVAC	heating, ventilation, and air conditioning
LLMW	low-level mixed waste
LLW	low-level waste
MEI	maximally exposed offsite individual
MFP	Mixed Fission Products
NDE/NDA	nondestructive examination/nondestructive assay
PNL	Pacific Northwest Laboratory
RTR	real-time radiography
RWM	Restricted Waste Management
TRU	Transuranic (Waste)
WRAP	Waste Receiving and Processing Module 1 Facility (also referred to as WRAP 1)

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APPLICATION FOR APPROVAL TO CONSTRUCT THE WASTE RECEIVING AND PROCESSING FACILITY

1.0 INTRODUCTION

1.1 APPLICANT

Facility Owner: U.S. Department of Energy,
Richland Field Office
P.O. Box 550
Richland, Washington 99352

1.2 PURPOSE OF APPLICATION

The following Application For Approval Of Construction is being submitted by the U.S. Department of Energy, Richland Field Office pursuant to 40 CFR 61.07, "Application for Approval of Construction or Modification," for the Waste Receiving and Processing (WRAP) Module 1 facility (also referred to as WRAP 1). The WRAP 1 facility will be a new source of radioactive emissions to the atmosphere.

1.3 LOCATION

The WRAP 1 facility will be housed in the new 2336-W Building, which will be located in the 200 West Area south of 23rd Street and west of Dayton Avenue, as shown in Figure 1-1. The 200 West Area is located within the boundary of the Hanford Site, as shown in Figure 1-2.

2.0 NATURE OF SOURCE

The mission of the WRAP 1 facility is to examine, assay, characterize, treat, and repackage solid radioactive and mixed waste to enable permanent disposal of the waste in accordance with all applicable regulations.

The solid wastes to be handled in the WRAP 1 facility include low-level waste (LLW), Transuranic (TRU) waste, TRU mixed waste, and low-level mixed waste (LLMW). The WRAP 1 facility will only accept contact handled (CH) waste containers. CH waste is a waste category whose external surface dose rate does not exceed 200 mrem/h. These containers have a surface dose rate of less than 200 mrem/h.

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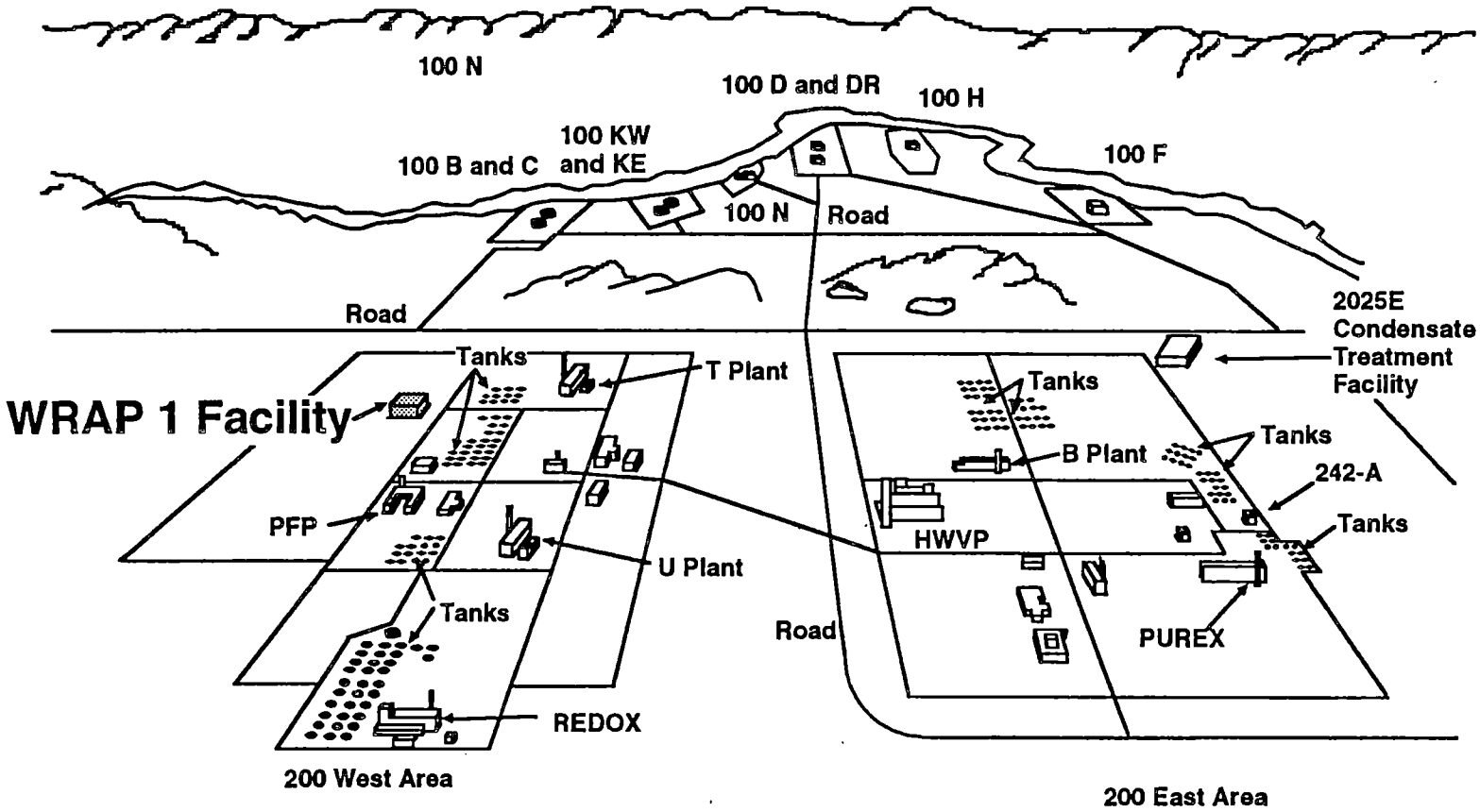

HWVP = Hanford Waste Vitrification Plant
PFP = Plutonium Finishing Plant
PUREX = Plutonium/Uranium Extraction (Plant)
REDOX = Reduction Oxidation (Plant)
WRAP 1 = Waste Receiving and Processing (Module) 1

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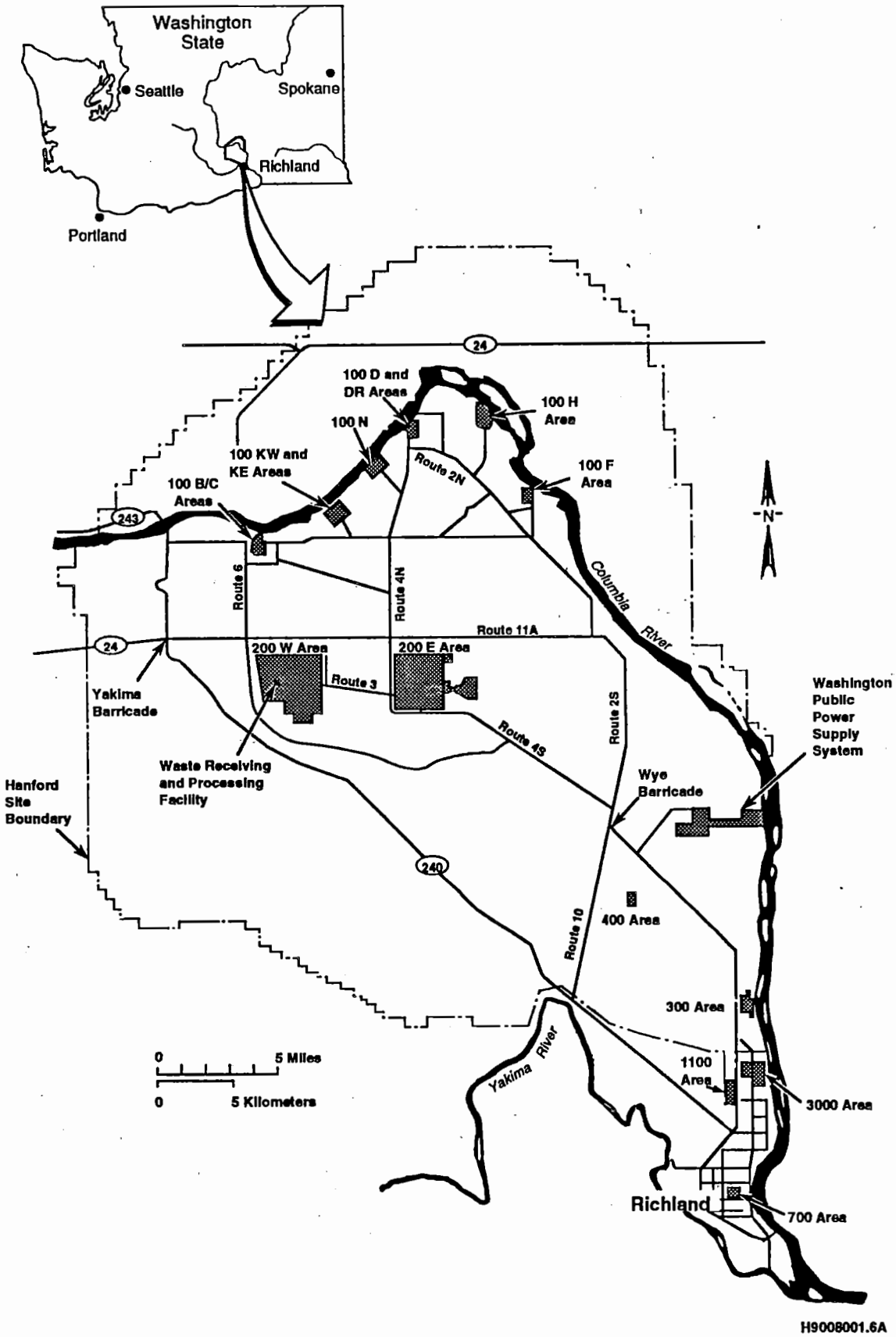
Figure 1-1. Location of the Waste Receiving and Processing Module 1 Facility at the Hanford Site.

Figure 1-2. Location of the 200 Area at the Hanford Site.



3.0 DESIGN PARAMETERS

3.1 PROPOSED SIZE OF FACILITY

The approximate size of the WRAP 1 building will be 4,766 m^2 (51,300 ft^2). The WRAP 1 building is 7 m (24 ft) high. The roof peak runs north-south and extends to 9 m (29 ft). The building is 61 m (200 ft) wide and 73 m (240 ft) long.

3.2 PROPOSED DESIGN OF THE FACILITY

The WRAP 1 facility will be a metal building consisting of pre-insulated, prefinished metal, interlocking roof and wall sandwich panels. WRAP 1 will provide waste handling, support, mechanical, and electrical areas; radiological heating, ventilation, and air conditioning (HVAC) equipment; and administrative areas all located on the 4,066 m^2 (43,700 ft^2) main floor; with a control room, computer room, and non-radiological HVAC equipment located on the 7,600 ft^2 second floor.

Ventilation exhaust points at WRAP 1 can be divided into two general categories; the exhaust stack, and miscellaneous vents. All of the ventilation air that has the potential to contain contaminants will be exhausted through the exhaust stack, which will be the single discharge point. The exhaust stack will be the emission point for ventilation Zone I (gloveboxes) and ventilation Zone II (i.e., rooms in which gloveboxes and Zone I ventilation equipment are located). The Zone I gloveboxes and the glovebox exhaust system (e.g., including the exhaust ducts, treatment system, and fans) are anticipated to contribute the majority of the radioactive air pollutants present in the emissions from the WRAP 1 facility. The miscellaneous vents are not anticipated to be a source of radioactive air pollutant emissions. The miscellaneous vents are the shipping and receiving area, nondestructive examination/nondestructive assay (NDE/NDA) areas, the administrative area, and the locker and change rooms.

3.3 OPERATING DESIGN CAPACITY

The primary function of WRAP 1 will be to examine, assay, characterize, treat, and repackage CH wastes in 55-gallon drums. This will include approximately 38,000 retrieved drums containing TRU waste that were placed in storage beginning in 1970 (called retrieved waste), and suspect TRU drums generated after WRAP 1 start-up in 1997 (called newly generated waste). A secondary function of WRAP 1 will be to examine and assay newly generated CH waste in boxes up to 2.5 m (8 ft) long by 1.5 m (5 ft) wide by 1.5 m (5 ft) high. This boxed waste will not be opened in WRAP 1 facility. If a box is examined and assayed and found to not meet the acceptance criteria of the permanent disposal facility, the box will be sent to another permitted storage facility on the Hanford Waste Complex to await future processing.

All incoming TRU and retrieved containers will have been sampled before being received at WRAP 1. The containers will be equipped with passive ventilated high efficiency particulate air (HEPA) filters. The physical,

chemical, and radiological attributes of the newly generated waste is expected to be well known before being received at WRAP 1, while retrieved drums may contain less than fully characterized waste. It is expected that any materials that could emit radioactive air emissions will come from the small containers (e.g., aerosol cans and one liter plastic bottles) packaged inside of the incoming containers. All containers will be maintained in closed condition within the WRAP 1 facility, and only opened inside of gloveboxes. Gloveboxes are sealed, ventilated stainless steel enclosures designed to confine radioactive and toxic materials. A schematic showing the flow of materials through the facility is provided on Figure 3-1. The following paragraphs briefly discuss processing activities taking place in these areas that may result in the release of radioactive or hazardous contaminants.

3.4 METHOD OF OPERATION

Waste material will be delivered to, and processed waste containers will be shipped from, the WRAP 1 shipping and receiving area by truck daily. In the shipping and receiving area, boxes and drums of waste are unloaded, visually inspected, bar code labeled, radiologically surveyed, and the accompanying shipping manifests examined for completeness and accuracy. All information pertaining to each container will be entered into the plant management system correlated to the bar code identification number.

Following visual inspection, drums and boxes will be transferred to the lag storage area. From the lag storage area, incoming drums and boxes are transferred to a weigh station and then on to the NDE/NDA area for further characterization. In the shipping and receiving area, certified TRU waste will be loaded into TRUPACT-2 shipping casks for shipment to the Waste Isolation Pilot Plant in New Mexico. Certified LLW will be shipped for disposal onsite while noncertified LLW or LLMW will be moved to permitted storage outside of WRAP 1.

The NDE/NDA area will be used to examine and certify LLW and TRU drums and boxes without opening the drums and boxes. The drums will be transferred to and from the NDE/NDA using of an Automated Guided Vehicle system. Boxes will be transferred to and from the NDE/NDA area using a fork lift.

The primary function of the NDE is to examine the physical contents of waste containers (i.e., both drums and boxes) entering and leaving the WRAP 1 facility to determine whether there are any noncompliant items or unacceptable conditions in the containers.

This examination of the physical contents of the drums will be accomplished using a real-time radiography (RTR) system. The RTR system consists of an X-ray imaging system that will be used to identify noncompliant waste items such as particulate material, free or containerized liquids, HEPA filters, explosives, compressed gas containers (including aerosol cans) and other suspected hazardous materials. All data from the X-ray examination will be input into the plant management system and correlated to the bar code identification number for the container.

The primary function of the nondestructive assay is to determine the activity levels of radionuclides in the waste entering and leaving the WRAP 1

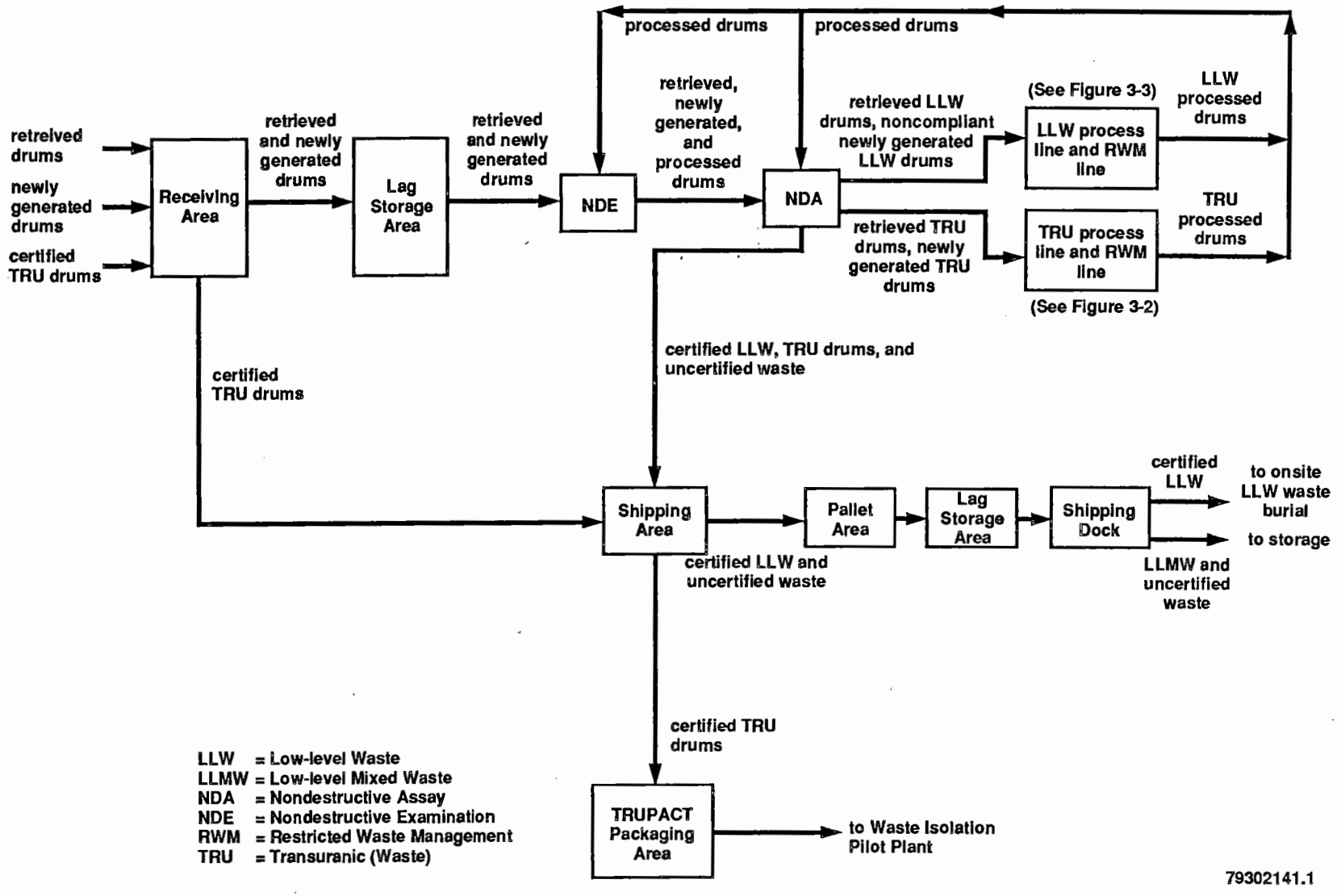


Figure 3-1. Schematic of Waste Flow Diagram.

facility. This information will be used to categorize the waste (e.g., TRU, LLW Class 1, LLW Class 3), provide inventory control information, determine appropriate handling of individual waste containers, and determine if the waste meets applicable transportation and disposal criteria. The NDA equipment will include passive-active neutron assay systems and gamma energy assay systems. Data from each assay of each container will be entered into the plant management system correlated to the bar code identification number of individual containers.

Because drums are opened only in gloveboxes, the airborne contaminants produced at WRAP 1 are expected to be generated in the gloveboxes that are located in the processing area.

The processing area consists of four glovebox lines: a TRU Waste Process glovebox, a TRU Restricted Waste Management (RWM) glovebox, a LLW Process glovebox, and a LLW RWM glovebox. Schematics showing the flow of material through the TRU lines and LLW lines are shown on Figure 3-2 and Figure 3-3, respectively. In the process gloveboxes, drums will be opened, the contents sorted, noncompliant items removed and transferred to the RWM gloveboxes; the remaining compliant wastes will be sampled and repackaged into new drums.

The TRU Waste Process glovebox consists of stainless steel modular gloveboxes that are bolted together in a linear configuration (approximately 19 m [62 ft] long by 1.22 m [4 ft] wide by 37 m [12 ft] high). Windows will be gasketed and bolted to the glovebox wall, and gloveports will be welded to the glovebox wall and accept push-through type gloves. The glovebox ventilation is the once-through type: Air is drawn from the process room, through a HEPA filter, and into the glovebox. Then the air is exhausted from the glovebox, through another HEPA filter, to the combined glovebox exhaust system.

Waste process operations will be performed inside the gloveboxes by using remote controlled manipulators. Drums will be loaded into the glovebox through airlock and sealed entry systems. Noncompliant items will be bar code labelled and transferred to the RWM glovebox using a reusable "bagless" transfer system, and compliant waste will be repackaged into new drums using a double lid transfer system.

The TRU and the LLW RWM gloveboxes each consist of a stainless steel glovebox (approximately 6.1 m [20 ft] long by 1.5 m [5 ft] wide by 3.7 m [12 ft] high). Window, gloveport, ventilation, and manipulator features are similar to those described for the TRU Waste Process glovebox. The noncompliant wastes will be received from the TRU and the LLW Process Lines in a reusable double lid transfer container.

Because the RWM gloveboxes are the only places where individual waste packages will be opened and waste items treated, it is anticipated that the majority of the radioactive air emissions will be generated in these enclosures.

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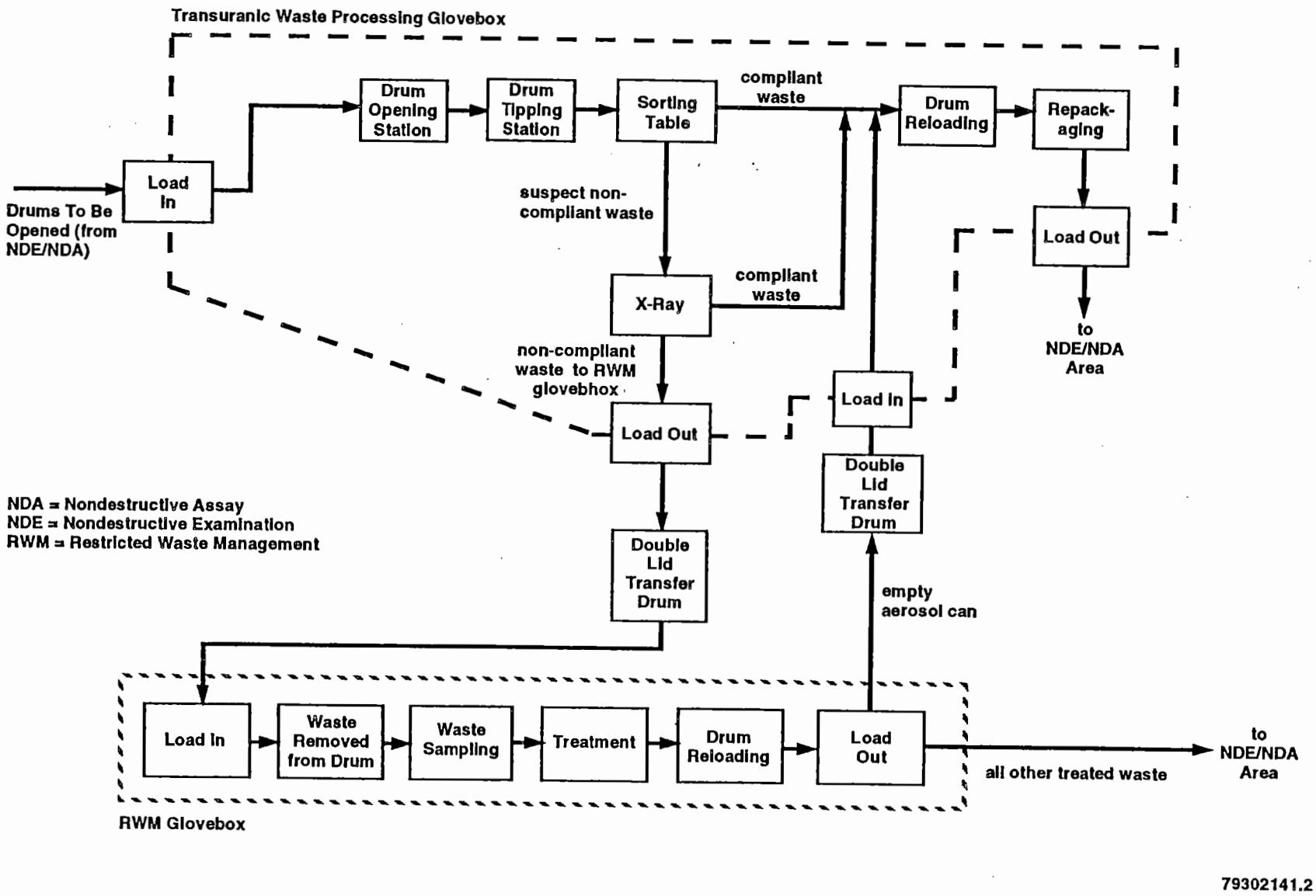

Figure 3-2. Flow Diagram through Transuranic Waste Gloveboxes.

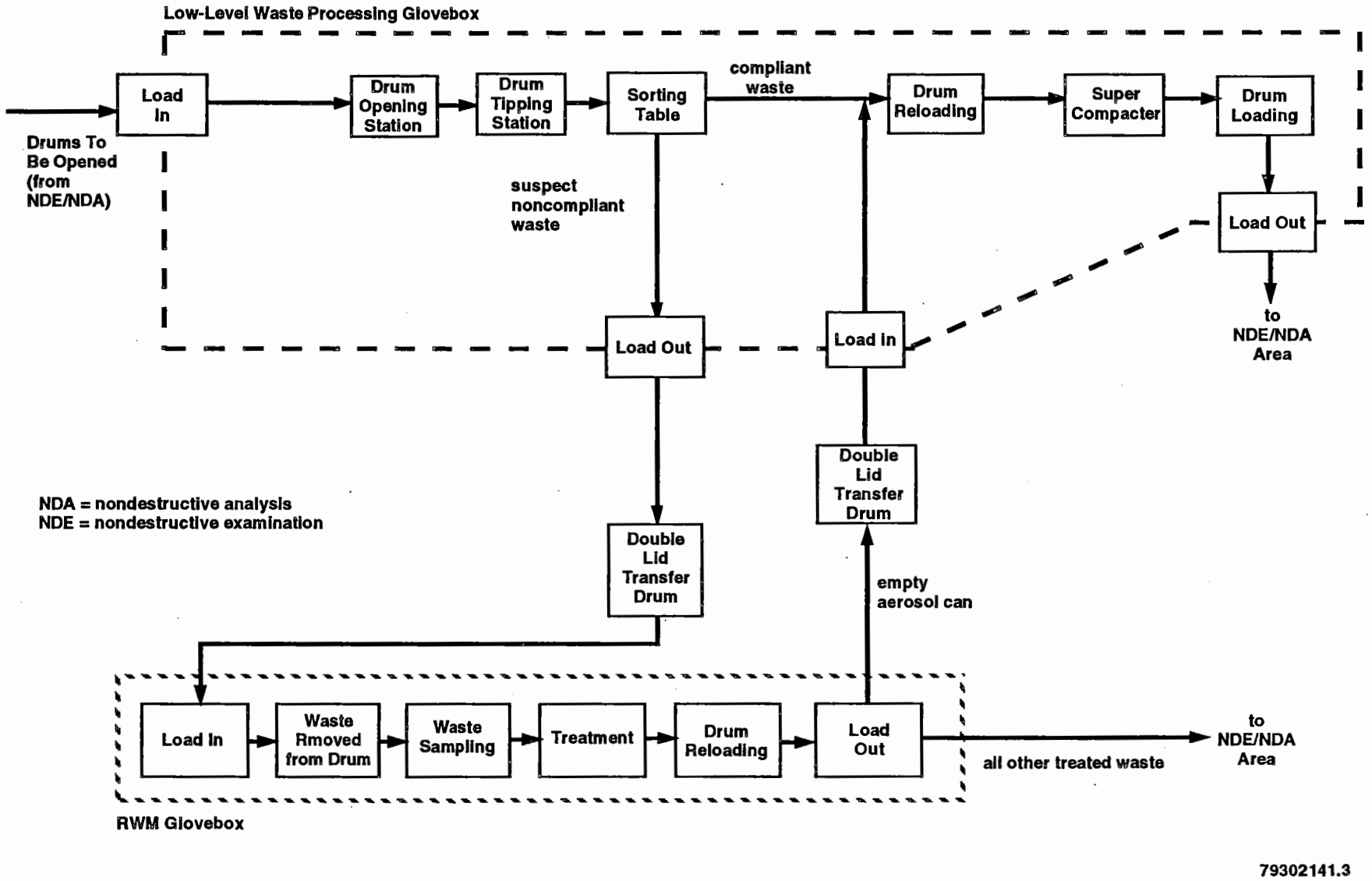

Figure 3-3. Flow Diagram through Low-Level Waste Gloveboxes.

The treatment operations, which will take place in the TRU RWM glovebox on the noncompliant waste following receipt of the sample analysis results, will include:

- Aerosol cans will be depressurized and drained. The drained liquids will be retained in containers, which will be sent to storage outside the WRAP 1 facility. Vapors from the aerosol cans will be passed through a series of demisters for removal of entrained liquids, and then vented to the glovebox exhaust.

- Spent HEPA filters from incoming waste drums will be treated with a fixative to immobilize contaminants.

- Miscellaneous inorganic liquids will be sampled for characterization and neutralized, if required, and solidified by using cement additives.

- Miscellaneous organic liquids will be sampled for characterization, and repackaged for transfer to storage facilities pending future treatment.

- Corrosive materials present in jugs or jars will be neutralized. After neutralization, the materials will be transferred to liquid solidification, particulate immobilization, or loaded out for storage and to await treatment outside the WRAP 1 facility.

- Particulate material not meeting the WIPP criteria will be immobilized with cement or plasticizer additives and sealed in a container.

The empty aerosol cans and other treated packages will be loaded into new drums and routed to the NDA/NDE area.

The LLW Process glovebox consists of stainless steel modular gloveboxes that are bolted together in a linear configuration (approximately 16.2 m [53 ft] long by 1.22 m [4 ft] wide by 3.66 m [12 ft] high). Window, gloveport, ventilation, and manipulator features are similar to those described for the TRU Waste Process glovebox. Drums will be loaded into the glovebox through an airlock entry system, noncompliant items will be bar code labelled and transferred to the RWM glovebox using a reusable "bagless" transfer system, and compliant waste will be repackaged into new drums using a double lid transfer system.

3.5 DESCRIPTION OF EMISSIONS CONTROLS

Because the radioactive airborne emissions from WRAP 1 facility will consist primarily of particulate matter generated during the processing of radioactive solid waste material, the emissions control system must be capable of containing micrometer- and submicrometer-sized particles.

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The WRAP 1 operations are provided with ventilation Zones I and II that have a negative pressure gradient from Zone II to Zone I to provide maximum confinement of radioactive contamination. Zones I and II will use a once-through, push-pull type ventilation system.

Zone I ventilation areas, in which the radioactive materials are processed, obtain inlet air from the Zone II room in which they are located. The glovebox structures and penetrations are designed to confine radioactive contaminants within Zone I. Zone I and Zone II exhausts are each ducted to their own HEPA filtration banks; each bank consisting of two stages of HEPA filters before being combined and subsequently discharged to the atmosphere. Zone I and Zone II each have two banks of HEPA filters, with one serving as backup to the other. During routine maintenance activities (e.g., filter change-out) or if an equipment component fails, the exhaust flow is diverted to the backup filter bank.

Provision of particulate control measures, as described above, allows for high-efficiency removal of particulates and provides system redundancy for a possible failure of one of the emission control units. In addition, the WRAP 1 gloveboxes are equipped with nontestable HEPA filters on both the inlet and outlet flows to minimize the radionuclide contamination of the exhaust ducts and final filter banks.

High-efficiency particulate filtration before discharge of the radionuclide contaminated air to the atmosphere is a nuclear industry standard. HEPAs are disposable, extended-medium, dry filters with a rigid casing enclosing the full depth of the pleats. They have a particle removal efficiency range of 99.95 percent to 99.99 percent for 0.3 micron thermally-generated, monodispersed dioctylphthalate particles, and a maximum pressure drop of 1 in. of water column when clean and operated at rated airflow capacity. The core of a HEPA filter is generally made by pleating a continuous web of fiberglass paper back and forth over corrugated separators that add strength to the core and provide air passages between the pleats. The core is then sealed in a wood or metal casing (i.e., frame). The filter paper itself is composed of very fine (i.e., submicron) glass fibers in a matrix of larger (i.e., 1 to 4 micron) fibers and held together with an organic binder.

3.6 RADIONUCLIDE RELEASE RATES

This section presents a comparison of the expected annual average release rates of the radionuclides emitted by WRAP 1 facility. Compared are the release rates calculated using good engineering judgement and release rates calculated using 40 CFR 61 Appendix D methodology.

3.6.1 Emissions Based on Waste Receiving and Processing Module 1 Facility Source Term

Table 3-1 presents a list of radionuclide emissions expected from the WRAP 1 facility based on the source term documentation. Appendix A provides a description of the assumptions used to determine the emissions and the expected process rate.

3.6.2 40 CFR 61, Appendix D Methodology

To estimate the annual release rate of radionuclides from the WRAP 1 facility to atmosphere, 100 percent of the facility's inventory in Ci/year was utilized. Table 3-1 presents the facility's inventory. Then, in accordance with Appendix D of 40 CFR 61, a factor (multiplier) of 0.001 was applied to each particulate radionuclide and a factor of 1.0 was applied to each volatile radionuclide to determine the amount (in Ci/year) released to the facility's emission control system. This resultant release rate (Ci/year) was then multiplied by an adjustment factor of 0.01, for particulates, because HEPA control devices will be installed. The gaseous radionuclides were, again, multiplied by a factor of 1.0. Table 3-2 presents the results of the Appendix D calculations.

3.6.3 Good Engineering Judgement

As discussed in Section 3.5, and presented in Table 3-2, releases of radioactive airborne emissions from WRAP 1 will consist primarily of particulate matter. Table 3-2 presents a list of the radionuclide resultant emissions rate expected from the WRAP 1 based on conservative and good engineering judgement.

The good engineering judgement emission rate was calculated using the "Resultant Emission Rate (Ci/year)" value from Table 3-2 and a decontamination efficiency of 99.99995 for dual banks of HEPA filters. It was assumed that the "Resultant Emission Rate" would provide a conservative estimate of what could be expected to challenge the HVAC system. The "six nines" is an industry standard for the particulate removal efficiency of dual banks of HEPAs. Table 3-3 presents WRAP 1 facility abated radioactive emissions.

A removal efficiency of 99.95 (decontamination factor [DF] of 2,000) will be achieved through the first plenum. The second bank of plenums in parallel will achieve an additional 99.9 percent removal (DF of 1,000). By multiplying the DF of each filter bank, this results in a total removal of 99.99995 (DF of 2.00 E+06) (Carter 1993). The equipment decontamination factor is defined as the reciprocal of 1 minus the fractional removal efficiency, or DF = 1/(1 - efficiency).

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Table 3-1. Waste Receiving and Processing Module 1 Facility Radioactive Emissions Inventory.

Radioisotopes	Average curies/ drum (Ci/drum)	Process rate (Ci/year)
PARTICULATE RADIONUCLIDES		
^{141}Ce	5.28 E-35	1.08 E-30
^{144}Ce, ^{144}Pr	9.64 E-04	1.97 E+01
^{60}Co	1.76 E-02	3.60 E+02
^{137}Cs, ^{137}Ba	8.61 E+00	1.76 E+05
^{155}Eu	4.02 E-05	8.23 E-01
^{85}Kr	5.04 E-02	1.74 E+05
^{147}Pm	1.10 E-01	2.25 E+03
^{106}Ru, ^{106}Rh	4.89 E-04	8.99 E+00
^{90}Sr, ^{90}Y	8.47 E+00	1.73 E+05
^{241}Am	1.41 E-02	2.89 E+02
^{243}Am	2.20 E-02	4.51 E+02
^{252}Cf	3.60 E-03	7.37 E+01
^{245}Cm	1.71 E-04	3.50 E+00
^{238}Pu	3.51 E-01	7.19 E+03
^{239}Pu	6.12 E-01	1.25 E+04
^{240}Pu	1.46 E-01	2.99 E+03
^{241}Pu	1.31 E+00	2.68 E+04
^{242}Pu	8.29 E-06	1.70 E-01
^{232}Pu	1.52 E-05	3.11 E-01
^{233}U	1.81 E-03	3.71 E+01
^{235}U	2.47 E-04	5.05 E+00
^{237}Np	5.63 E-05	1.15 E+00
VOLATILE RADIONUCLIDES		
^{3}H	9.79 E-05	2.00 E+00
^{14}C	3.61 E-05	7.40 E-01

NOTE: Based on processing 20,475 drums per year.

Table 3-2. Emissions Results Based on 40 CFR 61 Methodology.

Radioisotopes	Process rate (Ci/year)	Release rate multiplier	Resultant emission rate (Ci/year)	App. D HEPA adj. factor	Total emissions (Ci/year)
PARTICULATE RADIONUCLIDES					
^{141}Ce	1.08 E-30	0.001	1.08 E-33	0.01	1.08 E-35
^{144}Ce, ^{144}Pr	1.97 E+01	0.001	1.97 E-02	0.01	1.97 E-04
^{60}Co	3.60 E+02	0.001	3.60 E-01	0.01	3.60 E-03
^{137}Cs, ^{137}Ba	1.76 E+05	0.001	1.76 E+02	0.01	1.76 E+00
^{155}Eu	8.23 E-01	0.001	8.23 E-04	0.01	8.23 E-06
^{85}Kr	1.74 E+05	0.001	1.74 E+02	0.01	1.74 E+00
^{147}Pm	2.25 E+03	0.001	2.25 E+00	0.01	2.25 E-02
^{106}Ru, ^{106}Rh	8.99 E+00	0.001	8.99 E-03	0.01	8.99 E-05
^{90}Sr, ^{90}Y	1.73 E+05	0.001	1.73 E+02	0.01	1.73 E+00
^{241}Am	2.89 E+02	0.001	2.89 E-01	0.01	2.28 E-03
^{243}Am	4.51 E+02	0.001	4.51 E-01	0.01	4.51 E-03
^{252}Cf	7.37 E+01	0.001	7.37 E-02	0.01	7.37 E-04
^{245}Cm	3.50 E+00	0.001	3.50 E-03	0.01	3.50 E-05
^{238}Pu	7.19 E+03	0.001	7.19 E+00	0.01	7.19 E-02
^{239}Pu	1.25 E+04	0.001	1.25 E+01	0.01	1.25 E-01
^{240}Pu	2.99 E+03	0.001	2.99 E+00	0.01	2.99 E-02
^{241}Pu	2.68 E+04	0.001	2.68 E+01	0.01	2.68 E-01
^{242}Pu	1.70 E-01	0.001	1.70 E-04	0.01	1.70 E-06
^{232}Th	3.11 E-01	0.001	3.11 E-04	0.01	3.11 E-06
^{233}U	3.71 E+01	0.001	3.71 E-02	0.01	3.71 E-04
^{235}U	5.05 E+00	0.001	1.05 E-03	0.01	1.05 E-05
^{237}Np	1.15 E+00	0.001	1.15 E-03	0.01	1.15 E-05
VOLATILE RADIONUCLIDES					
^{3}H	2.00 E+00	1.000	2.00 E+00	N/A	2.00 E+00
^{14}H	7.40 E-01	1.000	7.40 E-01	N/A	7.40 E-01

NOTES: Based on processing 20,475 drums per year.
N/A = Not Applicable.

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Table 3-3. Good Engineering Judgement Radioactive Emissions.

Radioisotopes	Unabated emissions (Ci/year)	HEPA filter DF	Abated emission rate (Ci/year)
PARTICULATE RADIONUCLIDES			
^{141}Ce	1.08 E-33	2.0 E+06	5.40 E-40
^{144}Ce, ^{144}Pr	1.97 E-02	2.0 E+06	9.85 E-09
^{60}Co	3.60 E-01	2.0 E+06	1.80 E-07
^{137}Cs, ^{137}Ba	1.76 E+02	2.0 E+06	8.80 E-05
^{155}Eu	8.23 E-04	2.0 E+06	4.12 E-10
^{85}Kr	1.74 E+02	2.0 E+06	8.70 E-05
^{147}Pm	2.25 E+00	2.0 E+06	1.13 E-06
^{106}Ru, ^{106}Rh	8.99 E-03	2.0 E+06	4.50 E-09
^{90}Sr, ^{90}Y	1.73 E+02	2.0 E+06	8.65 E-05
^{241}Am	2.89 E-01	2.0 E+06	1.45 E-07
^{243}Am	4.51 E-01	2.0 E+06	2.26 E-07
^{252}Cf	7.37 E-02	2.0 E+06	3.69 E-08
^{245}Cm	3.50 E-03	2.0 E+06	1.74 E-09
^{237}Np	1.15 E-03	2.0 E+06	5.75 E-10
^{238}Pu	7.19 E+00	2.0 E+06	3.60 E-06
^{239}Pu	1.25 E+01	2.0 E+06	6.25 E-06
^{240}Pu	2.99 E+00	2.0 E+06	1.50 E-06
^{241}Pu	2.68 E+01	2.0 E+06	1.34 E-05
^{242}Pu	1.70 E-04	2.0 E+06	8.50 E-11
^{232}Th	3.11 E-04	2.0 E+06	1.56 E-10
^{233}U	3.71 E-02	2.0 E+06	1.86 E-08
^{235}U	5.05 E-03	2.0 E+06	2.53 E-09
VOLATILE RADIONUCLIDES			
^{3}H	2.00 E+00	1.00	2.00 E+00
^{14}C	7.40 E-01	1.00	7.40 E-01

NOTES: Based on processing 20,475 drums per year.
Assumed stack flowrate = 78,000 ft^3/min.

3.7 OFFSITE DOSES

The Clean Air Assessment Package 1988 (CAP-88) computer code (WHC 1991) was used to calculate effective dose equivalent (EDE) from WRAP 1 to the maximally exposed offsite individual (MEI), and thus demonstrate compliance with WAC 246-247.

3.7.1 Input Data Used

Dispersion modeling was used to demonstrate compliance with the ambient dose standard. Pacific Northwest Laboratory (PNL) developed a radionuclide dispersion modeling methodology manual, *Unit Dose Calculations for Westinghouse Hanford Facility Effluent Monitoring Plans*, in November 1991. The methodology includes the use of unit dose conversion factors developed by PNL for both airborne and liquid pathways for all Hanford Site Facilities. Atmospheric releases were modeled using the CAP-88 (Beres 1990) Environmental Protection Agency-approved code package, and confirming calculations were performed with the GENII (Napier et al. 1988) code.

Airborne releases from generic locations in the 100, 200 East, 200 West, and 300 Area were modeled for both elevated and ground-level releases. The models calculated the EDE to an individual member of the public based on 1-Ci releases. Standard parameters for Hanford dose calculations were included where possible (McCormack et al. 1984). Meteorology data was collected at weather stations in each of the Site's operating areas and represent the 5-year average of data collected between 1983 and 1987. The location of the maximally exposed individual was determined at 24 km (79,260 ft) east of the WRAP facility using the 5-year meteorological data and past studies of 200 West airborne releases.

The unit dose factors resulting from the dispersion modeling are listed in the modeling methodology manual (WHC 1991) in units of mrem/Ci. These conversion factors are multiplied by the estimated controlled emissions rates expected from the WRAP 1 facility. The results are presented in Table 3-4. Some of the parameters used in the modeling are listed below:

- Source Terms--Projected annual releases from WRAP 1 as presented in Table 3-3, Good Engineering Judgement Radioactive Emissions.
- Release Height--The height the emissions release was taken (i.e., ground level or zero).
- Inhalation Rate--An individual was assumed to breathe 8,500 m^3/year (300,173 ft^3/year).
- Maximally Exposed Individual--Doses were estimated for an individual living 24 km (10 mi) east of the WRAP 1 facility.
- Meteorology--The Hanford Meteorological Station (HMS) data and onsite meteorological data were used (WHC 1991).

3.7.2 Results

Table 3-4 shows the dose factors derived from the CAP-88 modeling and the EDE for each radionuclide. The source term (i.e., emissions after abatement in Ci/year) are multiplied by the dose factors to obtain the EDE. The total projected EDE from controlled airborne radiological emissions to the offsite MEI is 1.31E-03 mrem/year. The dose attributable to radiological emissions from WRAP 1 will, then, constitute 0.013 percent of the WAC 246-247 EDE regulatory limit of 10 mrem/year to the offsite MEI.

For comparison, the natural background radiation dose for the Tri-Cities (i.e., the cities of Richland, Kennewick, and Pasco) area of Washington State is estimated to be 300 mrem (Jaquish 1989). The projected EDE to the MEI from the WRAP 1 facility would constitute 0.00043 percent of the natural ambient radiation.

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Table 3-4. Waste Receiving and Processing Module 1 Facility Effective Dose Equivalent Estimates for an Individual Receiving Maximum Exposure to Radiological Emissions.

Radioisotopes	Abated emission rate (Ci/year)	Modeled dose factor (mrem/Ci)	Abated MEI dose (mrem/year)	Percent of abated MEI dose
PARTICULATE RADIONUCLIDES				
^{141}Ce	5.40 E-40	8.14 E-03	4.40 E-12	3.36 E-37
^{144}Ce, ^{144}Pr	9.85 E-09	8.14 E-03	8.02 E-11	6.12 E-06
^{60}Co	1.80 E-07	1.72 E-02	3.10 E-09	2.37 E-04
^{137}Cs, ^{137}Ba	8.80 E-05	1.42 E-02	1.25 E-06	9.54 E-02
^{155}Eu	4.12 E-10	1.16 E-03	4.80 E-13	3.66 E-08
^{85}Kr	8.70 E-05	3.07 E-08	2.67 E-12	2.04 E-07
^{147}Pm	1.13 E-06	6.75 E-04	7.63 E-10	5.82 E-05
^{106}Ru, ^{106}Rh	4.50 E-09	1.24 E-02	5.58 E-11	4.26 E-06
^{90}Sr, ^{90}Y	8.65 E-05	2.60 E-02	1.25 E-06	0.095
^{241}Am	1.45 E-07	7.79 E+00	1.13 E-06	0.086
^{243}Am	2.26 E-07	7.79 E+00	1.76 E-06	0.134
^{252}Cf	3.69 E-08	NA	NA	0.000
^{245}Cm	1.74 E-09	NA	NA	0.000
^{237}Np	5.75 E-10	7.05 E+00	4.05 E-09	3.09 E-04
^{238}Pu	3.60 E-06	4.76 E+00	1.17 E-05	0.893
^{239}Pu	6.25 E-06	5.15 E+00	3.22 E-05	2.45
^{240}Pu	1.50 E-06	5.14 E+00	7.71 E-06	0.589
^{241}Pu	1.34 E-05	8.17 E-02	1.09 E-06	0.083
^{242}Pu	8.50 E-11	5.15 E+00	4.38 E-10	3.35 E-05
^{232}Th	1.56 E-10	4.83 E+00	7.53 E-10	5.75 E-05
^{233}U	1.86 E-08	1.92 E+00	3.57 E-08	2.73 E-03
^{235}U	2.53 E-09	1.76 E+00	4.45 E-09	3.40 E-04
Subtotal Particulate Radionuclide Dose			6.46 E-05	4.69
VOLATILE RADIONUCLIDES				
Subtotal Volatile Radionuclides			0.00125	95.3
TOTAL ABATED DOSE			0.00131	100.00

NOTES: Based on processing 20,475 drums per year.
Assumed stack flowrate = 78,000 ft^3/min.

4.0 REFERENCES

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Jaquish, R. E., R. W. Bryce, 1989, *Hanford Site Environmental Report for Calendar Year 1988*, PNL-7346, Pacific Northwest Laboratories, Richland, Washington.

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WHC, 1992, *WRAP Module 1 Air Emissions Source Term*, WHC-SD-W026-TI-003, Westinghouse Hanford Company, Richland, Washington.

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APPENDIX A

WASTE RECEIVING AND PROCESSING MODULE 1 FACILITY SOURCE TERM ASSUMPTIONS

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APPENDIX A

WASTE RECEIVING AND PROCESSING MODULE 1 FACILITY SOURCE TERM ASSUMPTIONS

One of the functions of Waste Receiving and Processing Module 1 (WRAP 1) facility is to characterize wastes for which characterization data are incomplete or unavailable. By the very nature of the facility, detailed data on the radionuclides present in the materials to be processed are not available to develop a precise source term; therefore, several key assumptions have been made in estimating the radionuclide emissions and are presented below.

The source term assumes that only 55-gallon drums of waste will be handled in such a manner as to release radionuclides, and that up to 6,825 drums per year per operating shift, or 20,475 drums per year with three shifts operating, will be handled in the WRAP 1 facility[1]. Of these drums, approximately one third will be retrieved waste and approximately two thirds will be currently generated waste.

The radioactive materials source term was estimated from historical data for approximately 37,600 drums of suspect TRU placed in storage between 1970 and 1989[2]. The estimated average quantities of radioactive materials contained in the annual drum workload of the WRAP 1 facility are presented in RL-, Table 3.1. Major assumptions are as follows.

- The waste in drums will contain 85 percent of the total activity in all stored suspect TRU containers. This is based on WHC-EP-0225, Table 4-4[2], which indicated that approximately 86.1 percent of the total grams of transuranic radionuclides in the waste placed in storage between 1970 and 1989 is in 55-gallon drums (the remaining 13.9 percent is in the boxes and other nondrum containers).

- Some stored activity was historically reported as Mixed Fission Products (MFP). To estimate the source term, it will be assumed that the contribution from shorter lived radionuclides is negligible and that the remaining MFP activity consists of 50 percent ^{137}Cs and 50 percent ^{90}Sr.

- The average radionuclide content per drum was estimated by the following calculation: (1) multiplying the total activity in the stored suspect TRU waste by 85 percent, (2) decaying the activity

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[1] *WRAP Module 1 Air Emissions Source Term*, WHC-SD-W026-TI-003, Westinghouse Hanford Company, Richland, Washington, 1992.

[2] *Unit Dose Calculation Methods and Summary of Facility Effluent Monitoring Plan Determinations*, WHC-EP-0498, Westinghouse Hanford Company, Richland, Washington, 1991.

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for each radioisotope from 1989 (i.e., issuance of WHC-EP-0225[3]) to 1997 (i.e., start of operations for WRAP 1 facility), and (3) dividing by the number of drums in storage in 1989.

- It is assumed that the average activity per drum for retrieved suspect TRU drums is also representative for newly generated TRU and LLW drums.

- This waste will consist primarily of contaminated plastic, metal, paper, rubber, and cloth, with about 65 percent volume combustibles and 35 percent volume noncombustibles.

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[3]*Contact-Handled Transuranic Waste Characterization Based on Existing Records*, WHC-EP-0225, Westinghouse Hanford Company, Richland, Washington.

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