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Radioactive Air Emissions Notice of Construction for 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
Richland, Washington

Approved for Public Release

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

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ACRONYMS

AGV	Automated Guided Vehicle
BARCT	best available radionuclide control technology
CH	contact handled
DF	decontamination factors
DOH	Washington State Department of Health
DOP	dioctyl phthalate
EDE	effective dose equivalent
EPA	U.S. Environmental Protection Agency
GEA	gamma energy assay
HEPA	high efficiency particulate air
HMS	Hanford Meteorological Station
ISEMS	Isokinetic Stack Emission Monitoring System
LLMW	low-level mixed wastes
LLW	low-level waste
MEI	maximally exposed offsite individual
MFP	Mixed Fission Products
NDE/NDA	Nondestructive examination/nondestructive assay
PAN	passive-active neutron
PNL	Pacific Northwest Laboratory
RL	U.S. Department of Energy, Richland Field Office
RTR	real time radiography
RWM	Restricted Waste Management
TRU	transuranic
WG	water gage
WIPP	Waste Isolation Pilot Plant
WRAP	Waste Receiving And Processing Module 1 Facility (also referred to as WRAP 1)

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NOTICE OF CONSTRUCTION AND APPLICATION FOR APPROVAL TO CONSTRUCT THE WASTE RECEIVING AND PROCESSING FACILITY

1.0 FACILITY INFORMATION

The mission of the Waste Receiving And Processing (WRAP) Module 1 facility (also referred to as WRAP 1) includes: examining, assaying, characterizing, treating, and repackaging solid radioactive and mixed waste to enable permanent disposal of the wastes in accordance with all applicable regulations.

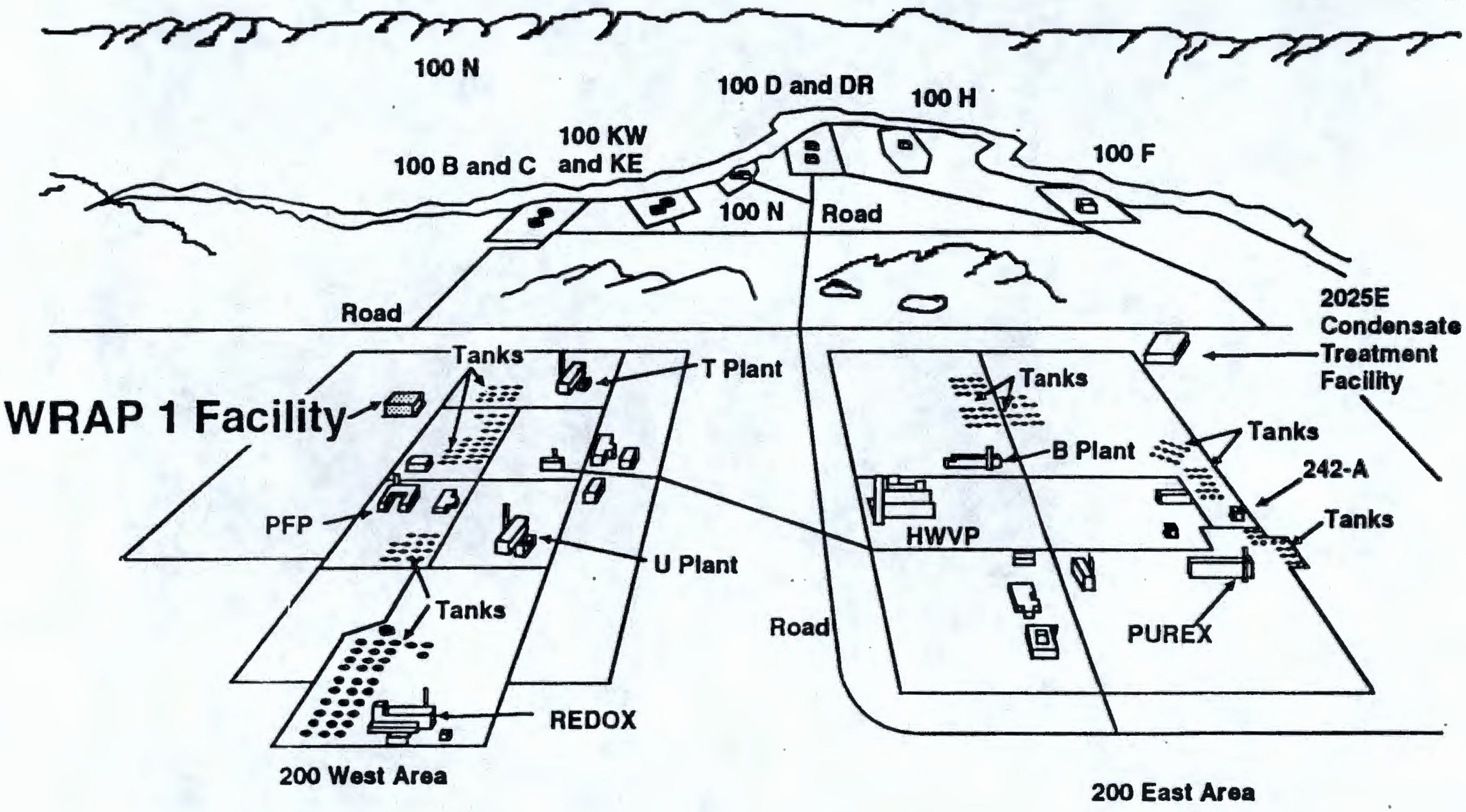
1.1 DESCRIPTION OF FACILITY

The WRAP 1 facility will be located in the new 2336-W Building, which will be located in the 200 West Area of Hanford, south of 23rd St. and west of Dayton Avenue. Figure 1-1 illustrates the location of the WRAP 1 facility. This building will be a 51,300 ft^2 metal building consisting of pre-insulated, pre-finished metal, interlocking roof and wall sandwich panels. WRAP 1 will provide waste handling areas, support areas, mechanical areas, electrical areas, radiological Heating, Ventilation, and Air Conditioning (HVAC) equipment, and administrative areas, which are all located on the 43,700 ft^2 main floor. The second floor, composed of 7,600 ft^2, will consist of a control room, computer room, and nonradiological HVAC equipment.

1.2 DESCRIPTION OF OPERATIONS

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

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 suspect TRU waste that were placed in storage beginning in 1970 (called retrieved waste), and 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 in the Hanford Waste Complex to await future processing.



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 Waste Receiving and Processing Module 1.

All incoming TRU and retrieved containers will have been sampled prior to receipt 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 prior to receipt 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, one liter plastic bottles) packaged inside of the incoming drums. 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).

The general arrangement floor plan for WRAP 1 is shown on Figure 1-2. The facility is composed of the following areas:

- Shipping and receiving
- Non-destructive examination/non-destructive assay (NDE/NDA) systems
- Waste processing area
- Ancillary support areas.

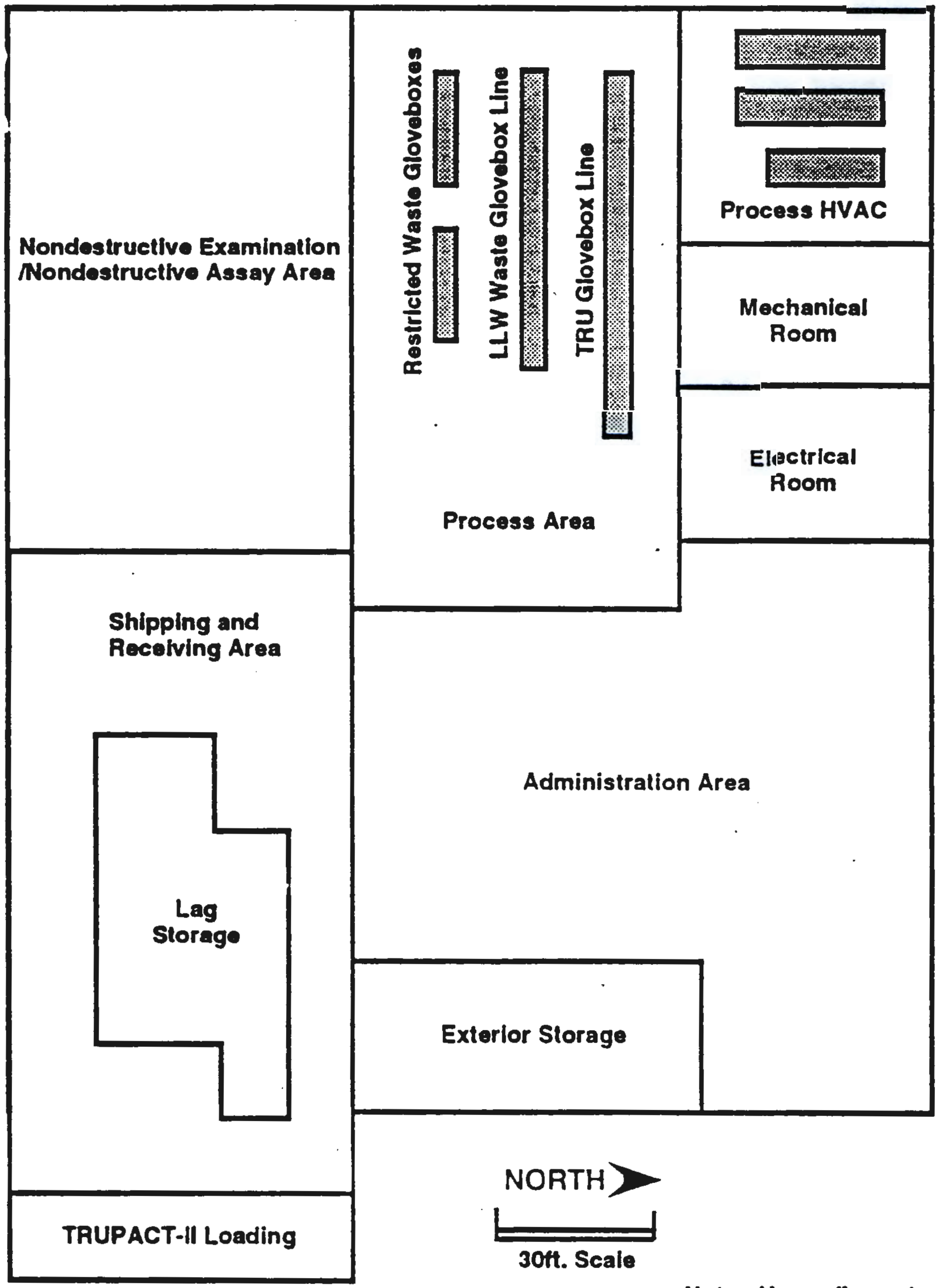
A schematic showing the flow of materials through these areas is provided on Figure 1-3. The remainder of this section will briefly discuss processing activities taking place in these areas that may result in the release of radioactive or hazardous contaminants.

1.2.1 Shipping and Receiving

Waste material will be delivered to, and processed waste containers will be shipped from, the WRAP 1 shipping and receiving area by truck on a daily basis. 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. The shipping and receiving area features an automated stacking, storage, and retrieving system that can accommodate approximately 200 drums packaged four to a pallet. 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 (WIPP) in New Mexico. Certified LLW will be shipped for disposal onsite while non-certified LLW or LLMW will be moved to permitted storage outside of WRAP 1.

Figure 1-2. Waste Receiving and Processing Module 1 Floor Plan.



HVAC = Heating, Ventilation, Air Conditioning
LLW = Low-level Waste
TRU = Transuranic (waste)

Note: Upper floor plan containing the control room is not shown

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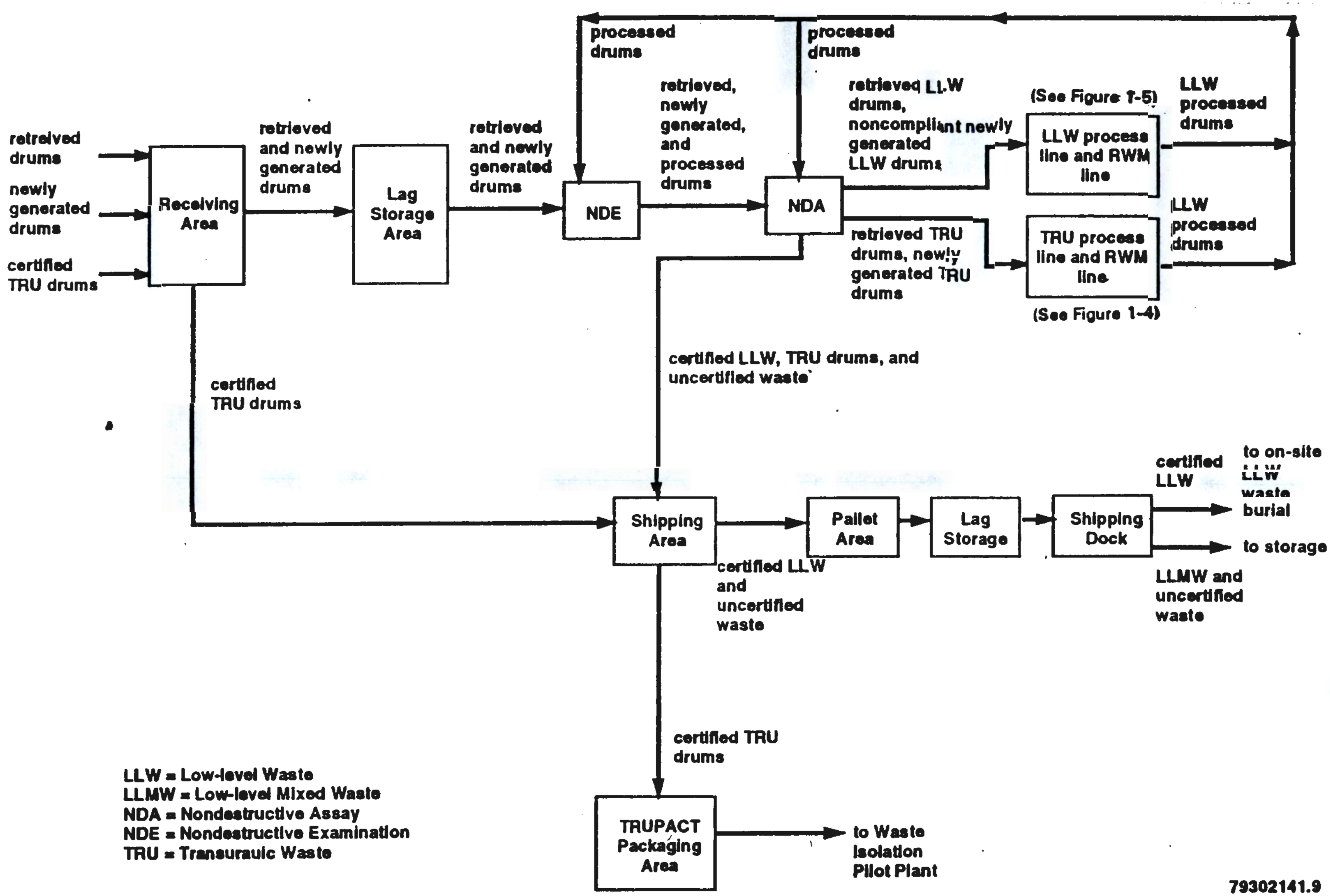

Figure 1-3. Schematic of Waste Flow Diagram.

1.2.2 Nondestructive examination/Nondestructive Assay Systems

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 by means of an Automated Guided Vehicle (AGV) system. Boxes will be transferred to and from the NDE/NDA area by means of a fork lift.

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

This examination of the physical contents of the drums will be accomplished by the use of the real time radiography (RTR) system. The RTR system consists of an X-ray imaging system which will be used to identify non-compliant 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 correlated to the bar code identification number for the container.

The primary function of the NDA is to determine the activity levels of radionuclides in the waste entering and leaving the WRAP 1 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 if the waste meets applicable transportation and disposal criteria. The NDA equipment will include passive-active neutron (PAN) assay systems and gamma energy assay (GEA) 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.

1.2.3 Processing Area

Because drums are opened only in gloveboxes, the airborne contaminants produced at WRAP 1 are expected to be generated in these gloveboxes which 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 1-4 and Figure 1-5, respectively. In the process gloveboxes, drums will be opened, the contents sorted, non-compliant items removed and transferred to the RWM gloveboxes, and the remaining compliant wastes sampled and repackaged into new drums.

1.2.3.1 TRU Waste Process Line. The TRU Waste Process glovebox consists of stainless steel modular gloveboxes that are bolted together in a linear configuration. The overall TRU Waste Process glovebox is approximately 62 ft long by 4 ft wide by 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. Glovebox ventilation is of the once-through type.

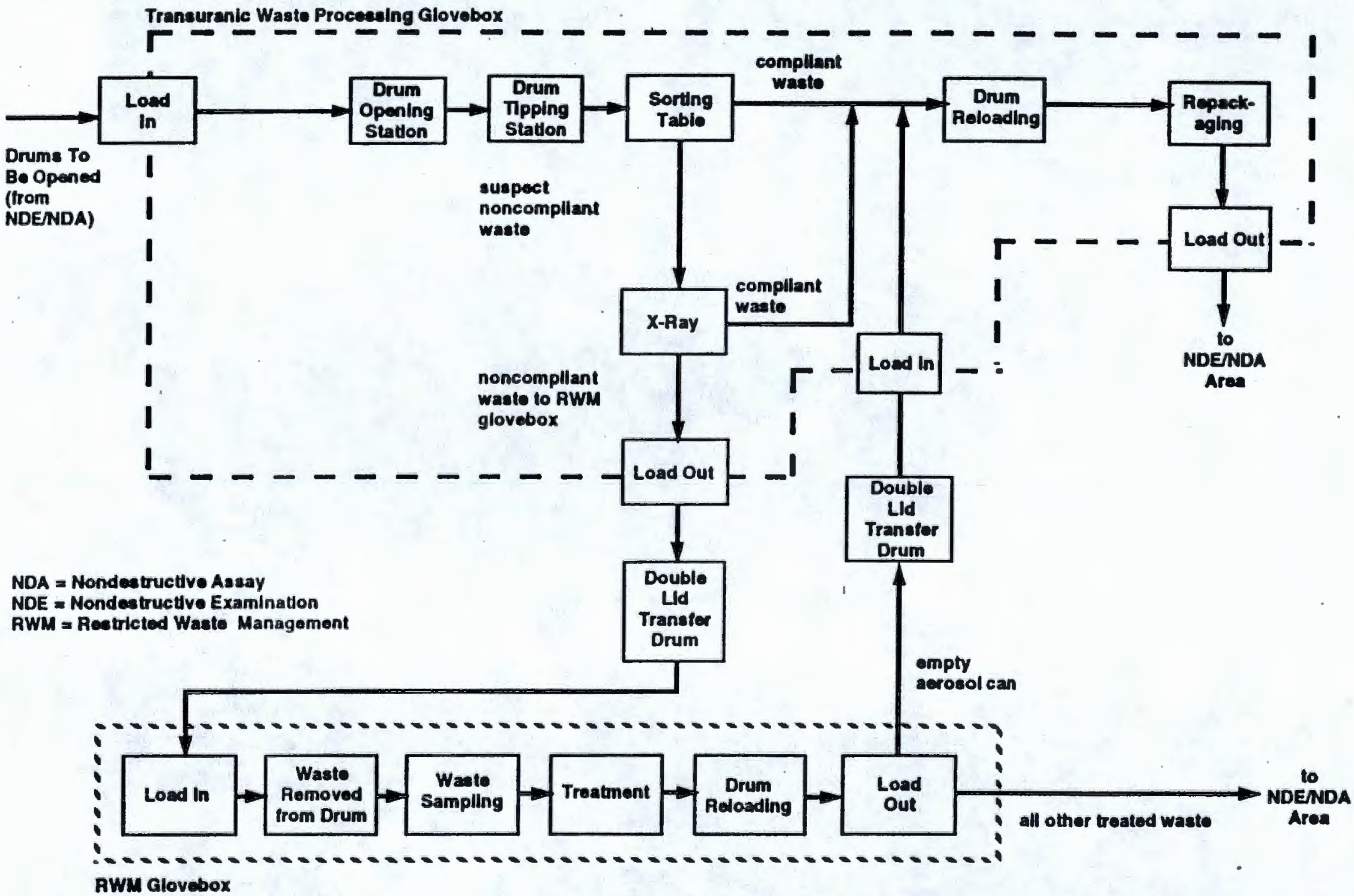

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Figure 1-4. Flow Diagram through Transuranic Gloveboxes.

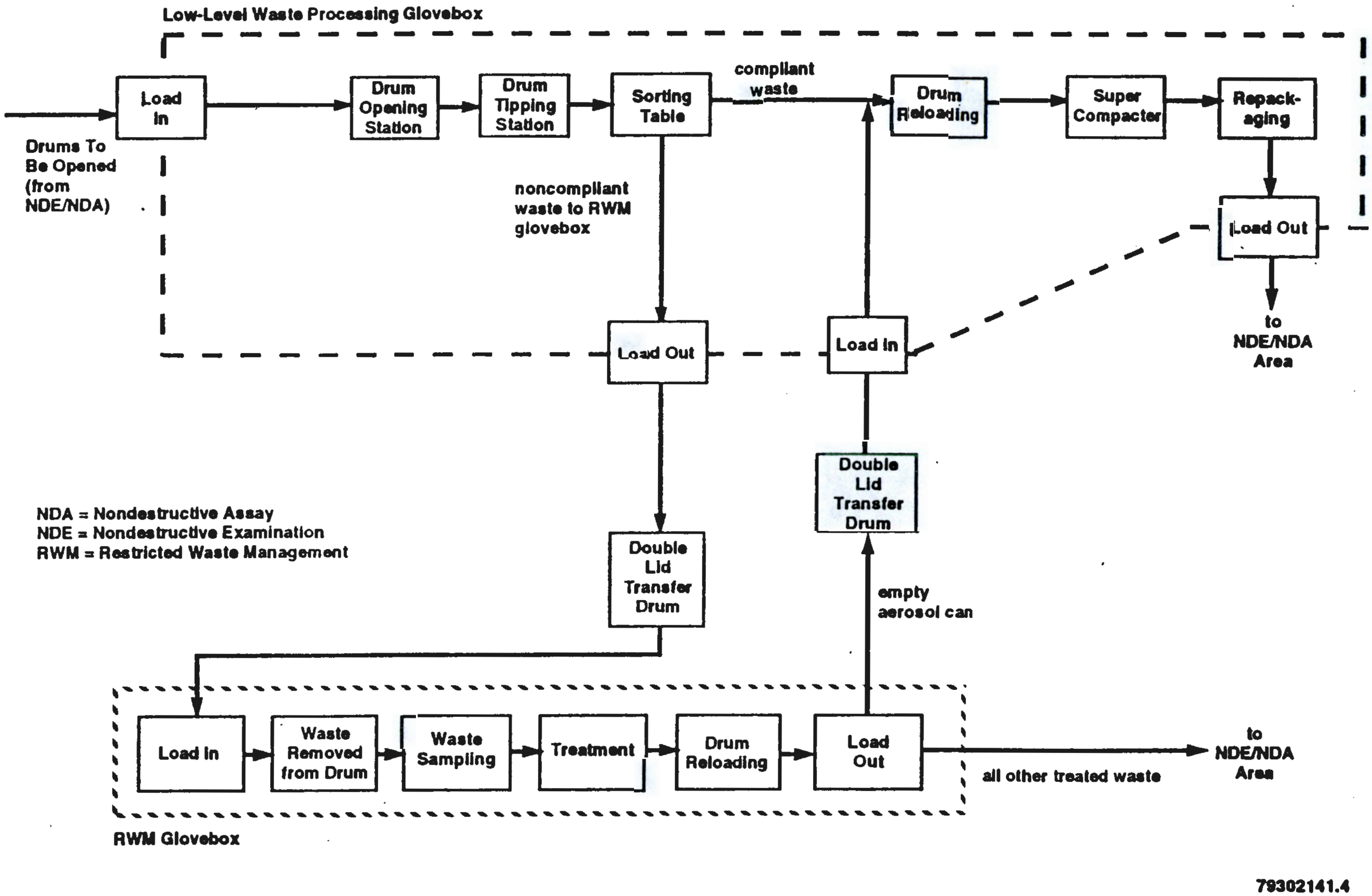


Figure 1-5. Flow Diagram through Low-Level Waste Gloveboxes.

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 of the gloveboxes by using remote controlled manipulators. Drums will be loaded into the glovebox through airlock and sealed type entry systems, non-compliant 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.

1.2.3.2 TRU Restricted Waste Management Line. The TRU RWM glovebox consists of a stainless steel glovebox and is approximately 20 ft long by 5 ft wide by 12 ft high. Window, gloveport, ventilation, and manipulator features are similar to those described for the TRU Waste Process glovebox. The non-compliant wastes will be received from the TRU Waste Process Line 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 toxic air emissions will be generated in these enclosures. The treatment operations which will take place in the TRU RWM glovebox on the non-compliant 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 be vented to the glovebox exhaust.

- Spent HEPA filters from incoming drums will be immobilized using a fixative.

- 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 awaiting 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.

1.2.3.3 LLW Process Line. The LLW Process glovebox consists of stainless steel modular gloveboxes that are bolted together in a linear configuration. The overall LLW Process glovebox is approximately 53 ft long by 4 ft wide by 12 ft the glovebox through an airlock entry system, non-compliant 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.

1.2.3.4 LLW RWM Process Line. The operations in the LLW RWM Process Line will be identical to the operations in the TRU RWM Line (see Section 1.2.3.2). A description is therefore not provided here.

1.2.4 Ancillary Support Areas

The WRAP 1 will contain a number of ancillary support areas, the most important of these being the process control room. No radioactive waste material will be handled in these support areas, and there is no significant potential for airborne contaminant releases. The process control room will contain a central processor-based plant management system to control and monitor the following:

- Data acquisition
- Data analysis
- Process system surveillance
- Inventory
- Control and surveillance of building utilities.

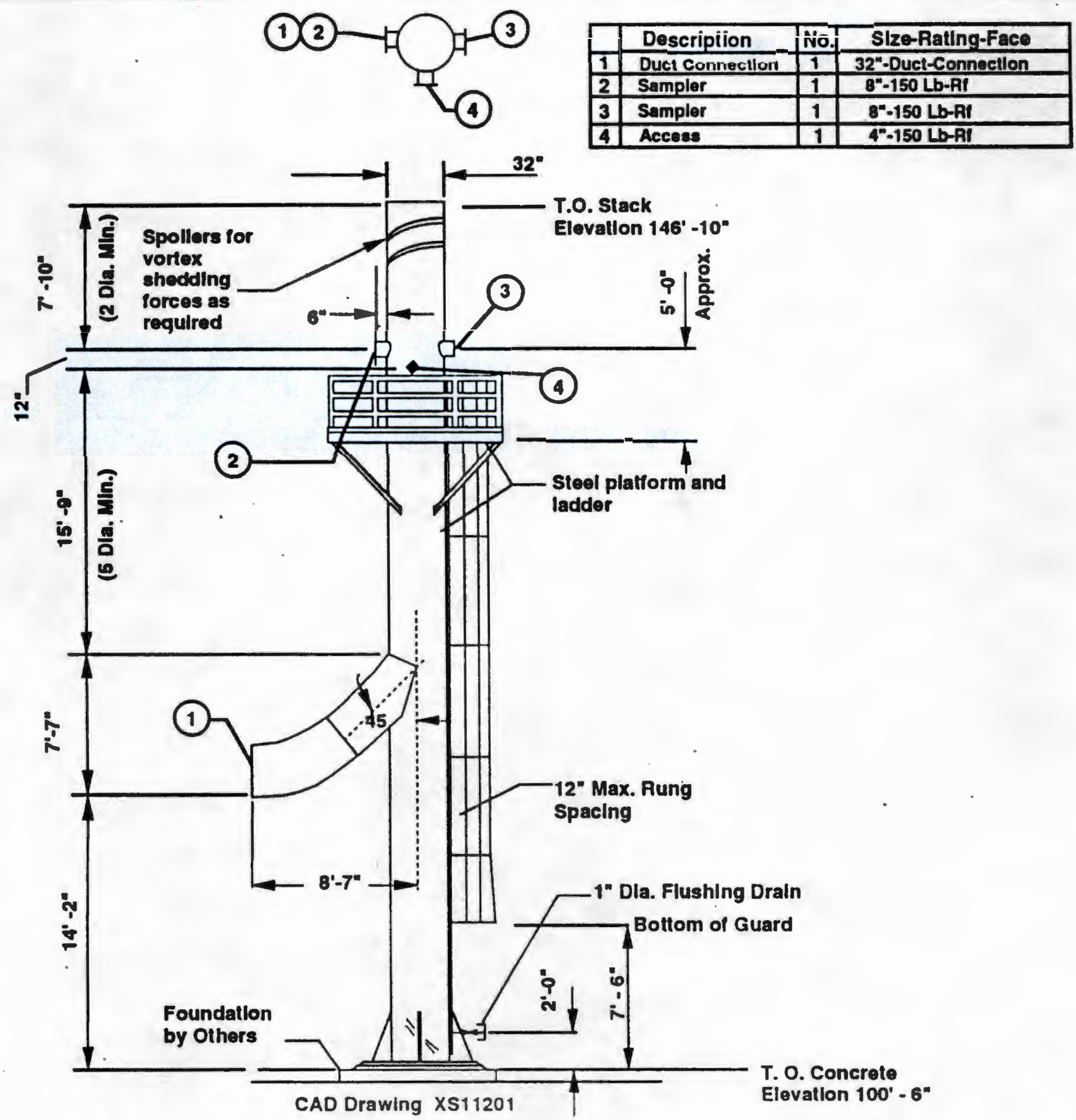
Other support areas will include the electrical equipment room, mechanical equipment room, HVAC rooms, locker and change rooms, telecommunications room, and administrative areas (i.e., offices, restrooms, lunch room, and conference room).

1.3 FACILITY IDENTIFICATION

The WRAP 1 facility represents a new source that has not yet been constructed. Therefore, it has not been registered with the Washington State Department of Health (DOH) as a source of radioactive emissions to the atmosphere. Following completion of the construction, WRAP 1 will be registered with the DOH.

Figure 2-1. Waste Receiving and Processing Module 1 Stack.

	Description	No.	Size-Rating-Face
1	Duct Connection	1	32"-Duct-Connection
2	Sampler	1	8"-150 Lb-Rf
3	Sampler	1	8"-150 Lb-Rf
4	Access	1	4"-150 Lb-Rf



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in the ventilation zones. Zone II areas will be maintained at a differential pressure of -0.1 to -0.25 inches water column (WC) with respect to atmospheric pressure, and Zone I areas will be maintained at a differential pressure of -0.7 to -1.0 in. WC with respect to the rooms in which they are located.

Also, some areas within a specific ventilation zone will be kept at different pressures with respect to each other to maintain desirable airflow patterns. For example, the air pressure in the Process Room (Room 107) will be maintained at -0.15 in. WC, and the air pressure in the Process HVAC Equipment Room (Room 113) will be maintained at -0.10 in. WC, both with respect to atmospheric pressure. Although both rooms are ventilation Zone II, this difference in air pressure will maintain the airflow from the Process HVAC Equipment Room to the Process Room.

2.2.1.1 Exhaust Stack. All of the ventilation air that has the potential to contain contaminants will be exhausted through the exhaust stack. This stack will be approximately 14 m (46 ft) high and will be located approximately 3 m (10 ft) to the west of the northwest corner of the WRAP 1 facility. The exhaust stack will be the emission point for ventilation Zone I (gloveboxes) and ventilation Zone II (rooms in which gloveboxes and Zone I ventilation equipment are located). A pressure differential will be maintained in the WRAP 1 facility so that air flows from Zone II to Zone I. A simplified schematic of the Zone I and Zone II ventilation system is provided on Figure 2-2.

Make-up air to Zone II will include approximately 14,505 ft^3 of supplied air, 1,505 ft^3 of in-leakage, and 370 ft^3 from airlocks. Approximately 930 ft^3 will flow from Zone II into the Zone I processing gloveboxes due to the differential pressure maintained between Zone I and Zone II. As a result, a total of 16,380 ft^3 of air will be discharged through the Zone I and Zone II exhaust stack at a temperature of about 90°F.

2.2.1.1.1 Zone I Area. 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 gloveboxes will receive make-up air from the Zone II area in which they are located (i.e., the Process Room). Air will flow from the room into the gloveboxes through push-through filters by virtue of the pressure differential between the gloveboxes and the room. Each of these push-through filters has a rated capacity of 50 ft^3, and each glovebox will be provided with the appropriate number of push-through filters to prevent the inadvertent migration of contamination from the gloveboxes back into the room through the air inlets. Make-up air to the gloveboxes will include approximately 100 ft^3 to each of the two RWM gloveboxes, 430 ft^3 to the TRU Waste Processing glovebox, and 300 ft^3 to the LLW Processing glovebox, for a total of 930 ft^3 to all of the gloveboxes.

Exhaust air from the gloveboxes will flow through push-through filters to the Zone I exhaust filters, which are separate from the Zone I exhaust filters. Each of these push-through filters has a rated capacity of 50 ft^3, and each glovebox will be provided with the appropriate number of push-through filters to prevent the inadvertent migration of contamination from the

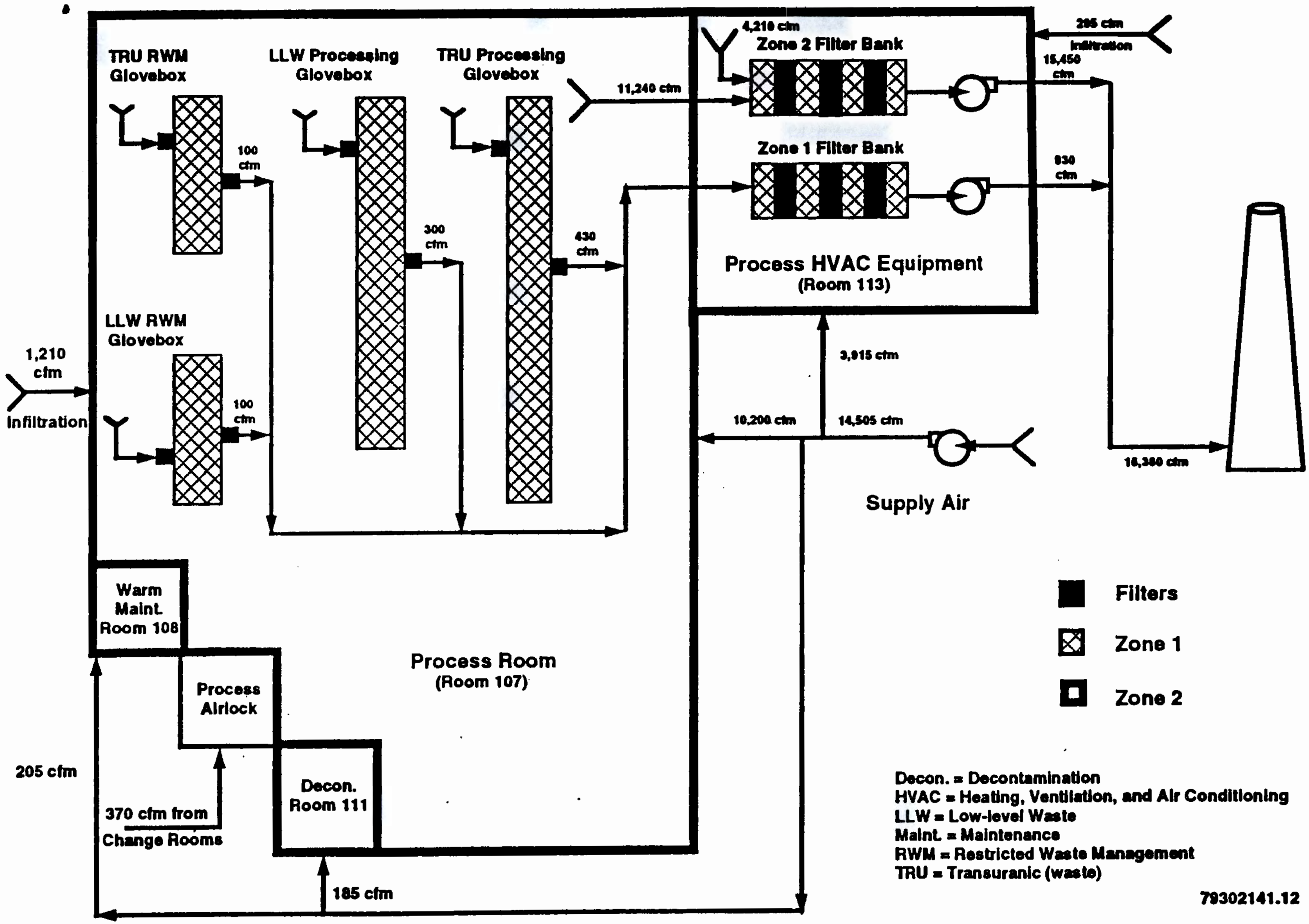


Figure 2-2. Schematic of Zone I and Zone II Ventilation System.

gloveboxes back into the room through the air outlets. After treatment in the Zone I exhaust filters, the 930 ft^3 of filtered exhaust air will be combined with the filtered air from the Zone II exhaust system for discharge through the stack.

2.2.1.1.2 Zone II Areas. Zone II areas include the Process Room (Room 107), the Process HVAC Equipment room (Room 113), the Decontamination room (Room 111), and the Warm Maintenance room (Room 108). Ventilation of Zone II areas will be accomplished using use a push-pull, once-through system. Make-up air to Zone II areas will include filtered outside air supplied by fans, planned air in-leakage, and from airlocks. Total make-up air to the Zone II areas from all sources will be approximately 16,380 ft^3.

A total of approximately 14,505 ft^3 of filtered outside air will be supplied by fans to the Zone II areas. Of this, 3,915 ft^3 will be supplied to the Process HVAC Equipment Room, 10,200 ft^3 will be supplied to the Process Room, 205 ft^3 will be supplied to the Warm Maintenance room, and 185 ft^3 will be supplied to the Decontamination room. Other make-up air will include approximately 1,210 ft^3 air in-leakage to the process room, 295 ft^3 air in-leakage to the process HVAC room, and 370 ft^3 from the process airlock which maintains airflow from the change rooms to the Process room.

A total of approximately 15,450 ft^3 of air will be exhausted by the Zone II exhaust system, and approximately 930 ft^3 of air will be supplied from the Process Room to the gloveboxes for eventual exhaust by the Zone 1 exhaust system. The 15,450 ft^3 of air will be exhausted using a ventilation control and air treatment system which is separate from that used for the Zone I areas. After treatment, the Zone II exhaust will be combined with treated exhaust from the Zone I areas and discharged through the exhaust stack.

2.2.1.2 Miscellaneous Vents. None of the vents described in this section have significant potential for airborne contaminant emissions. They are described here only to provide a complete picture of the WRAP 1 facility.

2.2.1.2.1 Shipping/Receiving and NDE/NDA Areas. The Shipping/Receiving area is located in Room 101, and the NDE/NDA area is located in Room 104. During normal HVAC system operation, air will be recirculated, with only 3,205 ft^3 of air exhausted by leakage through doorways and miscellaneous points. In the economizer mode, 28,830 ft^3 of air will be exhausted through the wall louver (LV-11-1-1). Emissions from these areas are not anticipated to contain radioactive air pollutants.

Only closed waste containers will be handled in these areas, and the Shipping/Receiving and NDA/NDE areas are separated from the Process Room by a system of airlocks to prevent contaminant migration from the Process Room to the Shipping/Receiving and NDA/NDE area.

2.2.1.2.2 Locker/Change Rooms. Approximately 1,800 ft^3 of air from the Locker/Change Rooms will be exhausted through a wall louver (LV-11-302). Emissions from the Locker/Change Rooms are not anticipated to contain radioactive air pollutants, since wastes will not be handled in these areas.

2.2.1.2.3 **Administrative Areas.** During normal operation, approximately 300 ft^3 of air will exhaust through wall louver, RV-11-402, from the material preparation room which is part of the administrative and office areas of the WRAP 1 facility. In economizer mode, approximately 9,815 ft^3 of additional air is exhausted through the wall louver LV-11-401. Emissions from the administrative areas is not anticipated to contain radioactive air pollutants as wastes will not be handled in these areas.

2.2.2 Effluent System Layout

Because the radioactive airborne emissions from WRAP 1 facility will consist primarily of particulate matter generated during the processing of radioactive solid waste material (Section 1.2), the emissions control system must be capable of containing micrometer- and submicrometer- sized particles.

As discussed in Section 2.2, the WRAP 1 operations are provided with ventilation Zones I and II with a negative pressure gradient from Zone II to Zone I, to provide maximum confinement of radioactive contamination. Zone I gloveboxes will be operated at -0.70 to -1.0 in. water gage (WG) pressure relative to Zone II atmosphere. Zone II will be operated at -0.10 in. to -0.05 in. WG pressure relative to the non-zoned areas of the WRAP 1 facility. The air pressure in the non-zoned areas (including the shipping/receiving, NDA/NDE, locker and change rooms, and administrative areas) will not be controlled relative to outside atmosphere. Zones I and II will use a once-through, push-pull type ventilation system. The uncontrolled areas of WRAP 1 will use recirculated air, supplemented by outside air.

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 in the event of a failure of an equipment component, the exhaust flow is diverted to the backup filter bank.

A removal efficiency of 99.95 percent (decontamination factor [DF] of 2000) will be achieved through the first plenum. The second bank of plenums in parallel will achieve an additional 99.9 percent removal (DF of 1000). By multiplying the DF of each filter bank, this results in a total removal of 99.99995 percent (DF of 2.00 E+06). The equipment decontamination factor is defined as the reciprocal of 1 minus the fractional removal efficiency, or

$$DF = 1/(1 - \text{efficiency}).$$

Provision of particulate control measures, as described above, allows for high-efficiency removal of particulates and provides system redundancy in the event of a possible failure of one of the emission control units. In addition, the WRAP 1 gloveboxes are equipped with non-testable 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. The best available radionuclide control technology (BARCT) assessment developed for this proposed project demonstrated that the prefilter and HEPA system provides the highest degree of removal efficiency (WHC 1993).

2.2.3 Efficiency Values of Each Control Device for Removal of Radioactivity

As shown in Figure 7, and discussed in Sections 2.2.2, HEPA filters are the control devices used for removal of radioactive particles from the WRAP 1 Zone 1 ventilation system. A HEPA filter is a throwaway, extended-pleated media, dry-type filter. Hanford Site HEPA filters must meet the following requirements:

- Permissible penetration at test airflows shall be no greater than 0.03 percent when tested in accordance with Nuclear Standard Quality Assurance Testing of HEPA filters (NE F 3-43, Article 6).

- Filters shall have a minimum particle collection efficiency of 99.97 percent for 0.3-μm particle size, thermally generated dioctyl phthalate (DOP) aerosol (or equivalent) at 100 percent and at 20 percent of rated flow capacity for filters with a nominal airflow rating of 3.5 m^3/min (size 3) and larger and 100 percent rated flow for filters with a nominal rating below 3.5 m^3/min (NE F 3-43, Article 4).

- The pressure differential for air flow across a clean filter assembly when tested at appropriate nominal flows shall not exceed 1.3 in. WG for size 3 HEPAs and smaller, and 1.0 in. WG for HEPAs larger than size 3.

2.2.4 Means and Frequency of Testing and Inspecting Effluent Treatment System

The WRAP 1 radioactive emissions abatement system comprises of two HEPA filters in series. (The glovebox enclosures have an additional HEPA, but they are not testable.)

All Hanford Site HEPA filters are tested in place on an annual basis and must meet the following requirements:

- All filters shall remove at least 99.95 percent of the DOP particles, or equivalent, ranging in size from 0.1 μm to 3.0 μm with a mean particle size of 0.5 μm.

- The HEPA filter cartridges shall be replaced when continuous exposure rates exceed 1 R/h at 15.3 cm (6 in.), or when the pressure drop across the filter exceeds 3 in. WG., 2 in. WG on the second filter. Remotely installed HEPA filters shall be replaced when the pressure drop across the filter exceeds 2.5 in. WG, or exposure rates exceed limits provided by Radiation Protection.

2.2.5 Operating Mode

The WRAP 1 facility will process radioactive waste up to 24 hours/day (three shifts), 5 days/week, 52 weeks/year. This means the WRAP 1 facility will be operating up to 71.4 percent of the time (based on 24 hours/day, 7 days/week, 52 weeks/year being equal to 100 percent).

2.2.6 Chemical and Physical Forms of the Releases

Airborne releases from the WRAP 1 facility will be primarily in particulate forms (99.999 percent of total unabated emissions). The release of two volatilized radionuclides, tritium and carbon-14 will contribute less than 0.001 percent of the total unabated emissions. Table 2-1 lists the radionuclides which are anticipated to be emitted from WRAP 1 exhaust stack.

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 (WHC 1992). Of these drums, approximately one third will be retrieved wastes and approximately two thirds will be currently generated wastes.

The radioactive materials source term was estimated from the historical data for approximately 37,600 drums of suspect TRU placed in storage between 1970 and 1989 (WHC 1990). The estimated average quantities of radioactive materials contained in the annual drum workload of the WRAP 1 facility are presented in Table 2-2. 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 (WHC 1990), 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 non-drum containers).

- Some stored activity was historically reported as Mixed Fission Products (MFP). For the purposes of estimating 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 Cs-137 and 50 percent Sr-90.

- The average radionuclide content per drum was estimated by multiplying the total activity in the stored suspect TRU waste by 85 percent, decaying the activity for each radioisotope from 1989 (issuance of WHC-EP-0225) to 1997 (start of operations for WRAP 1 facility), and dividing by the number of drums (37,629).

- 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 non-combustibles.
- The uncontrolled decontamination factors (DF) are taken from 40 CFR 61, Appendix D, Methods for Estimating Radionuclide Emissions.

Particulate radionuclides represent 99.999 percent of the unabated MEI dose. The uncontrolled release of the two volatilized radionuclides, tritium and carbon-14, will contribute less than 0.001 percent of the total dose to the MEI; this insignificant dose contribution does not necessitate a separate BARCT evaluation for these two radionuclides (WHC 1992b).

2.2.7 Stack (or Release Point) Data

The following sections provide detailed information required to perform offsite dose modelling for radionuclide airborne emissions from WRAP 1.

2.2.7.1 Height from Ground and Inside Diameter. The WRAP 1 stack is 14 m (46 ft) high with a 1 m (32 in.) circular cross section (see Figure 2-1).

2.2.7.2 Building Height, Width, and Length. The WRAP 1 building structure is 7 m (24 ft) high. The roof peak runs north-south and extends to 9 m (29 ft). The WRAP 1 building is 61 m (200 ft) wide and 73 m (240 ft) long (see Figure 1-2).

2.2.7.3 Annual Average Stack and Ambient Air Temperatures. The annual average stack temperature is 32 °C (90 °F). The annual average ambient air temperature is 11.6 °C (53 °F). This average was determined by the Hanford Meteorology Station using meteorology data for the Hanford Site area from the period 1912 to 1980 (Stone et al. 1983).

2.2.7.4 Annual Wind Rose. Wind rose data for the Hanford Site have been provided previously to the DOH and U. S. Environmental Protection Agency (EPA) as a part of annual reports that are provided to the DOH and EPA upon publication (e.g., Woodruff et al. 1991, page 60).

2.2.7.5 Chi/Q Data. The Chi/Q values for the modeled release data presented in Section 4.0 of this document were determined by, and are an integral part of the CAP-88 computer code (WHC 1991), a copy of which has been provided to the DOH.

2.2.7.6 Annual Average Volumetric Flow Rate. The annual average volumetric flow rate for the WRAP 1 exhaust stack is approximately 8.6 x 10^9 ft^3 of air.

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

Table 2-1. Waste Receiving and Packaging 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.

2.2.7.7.1 Appendix D of 40 CFR 61 Methodology. To estimate the annual release of radionuclides from the WRAP 1 facility to atmosphere, 100 percent release of the facility's inventory was utilized (see Table 2-1). 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. This resultant release rate (Ci/yr) was then multiplied by an adjustment furlong 0.01, because HEPA control devices will be installed. the gaseous radionuclides were again multiplied by a factor of 1.0. Table 2-2 presents the results of the Appendix D calculations.

2.2.7.7.2 Good Engineering Judgement. As discussed in Section 2.2.2, releases of radioactive airborne emissions from WRAP 1 will consist primarily of particulate matter. Table 2-4 presents the radionuclides emissions rate expected from the WRAP 1 based on conservative and good engineering judgement.

The GEJ emission rate was calculated using the "Resultant Emission Rate (Ci/yr)." Values from Table 2-2 and a decontamination efficiency of 99.99995 for dual banks of NEPA 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 industry standard for the particulate removed efficiency of dual banks of HEPAs.

2.2.7.8 Fraction of Facility's Inventory Available for Potential Release to the Air. The phrase "fraction of inventory available for potential release to the air" is interpreted to mean "potential to emit." Neither phrase is defined in existing DOH regulations; however, a definition for "potential to emit" currently is being developed by the DOH for inclusion in revised regulations. Until the revised regulations have been issued, the DOH has provided guidance that the definition of "potential to emit" found in 40 CFR 61 is to be followed. Therefore, the calculated potential radionuclide release rates to air from the WRAP 1 facility are based on a discharge from the facility that would result if no pollution control equipment were in place but the operations were otherwise normal.

The resulting estimated uncontrolled emissions are presented in Table 2-2 "Resultant Emission Rate."

2.3 DESCRIPTION OF THE EFFLUENT SAMPLING/MONITORING SYSTEMS

The WRAP 1 stack monitoring and sampling system (Figure 2-3) was designed in accordance with the guidance provided in DOE Order 6430.1A, Section 1589-99.0.1, ANSI N13.1-1969 and 40 CFR 61, Subpart H.

The WRAP 1 stack exhaust is monitored with an Isokinetic Stack Emission Monitoring System (ISEMS). The ISEMS is a self-contained, microprocessor-based, radiation detection system used to monitor for particulates in the air. The WRAP 1 analyzers are capable of monitoring beta-emitting particulates, and alpha-emitting particulates. The other components of the sampling/monitoring system are described below.

Table 2-2. Emission 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/yr)
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.

Table 2-3. 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

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

2.3.1 Stack Flow Measuring System

The WRAP 1 stack flow rate of 464 m^3/min (16,380 ft^3/min) is measured by summing the flow through the operating exhaust fans. The exhaust fan flows are measured by flow meters on each fan outlet and displayed in the WRAP 1 control room. The exhaust fan flow control dampers are automatically adjusted as necessary to control the final HEPA filter inlet header pressure. The WRAP 1 supply fan outlet header pressure is controlled in a similar manner by adjusting the supply fan control dampers. The header pressure setpoints were determined during WRAP 1 design, and will be confirmed during air balance testing prior to start-up as those necessary to maintain the internal WRAP 1 flows and zone pressures.

2.3.1.1 Sample Probes. The WRAP 1 stack sample probe is isokinetic consisting of a single probe assembly mounted by direct insertion into the stack monitoring flange perpendicular to the stack air flow. The isokinetic probe assembly shall have a multi-point velocity probe, isokinetic, and multi-point nozzle arrays for particulate collection. Each nozzle orifice shall be tapered (<30° taper on the outside edge of the orifice) and face directly into the exhaust stream. Each independent multi-point nozzle array shall have thread-on sampling nozzles placed at the centroid of each equal area within the stack. The number and placement of the nozzles shall be consistent with ANSI N13.1.

2.3.1.2 Number and Location of Sampling Points. There are three stack sampling points, one for Alpha sampling, one for Beta sampling, and one for the filter paper, located as shown in Figure 2-3. The sampling points will be positioned permanently and designed and operated in accordance with 40 CFR 61.93.

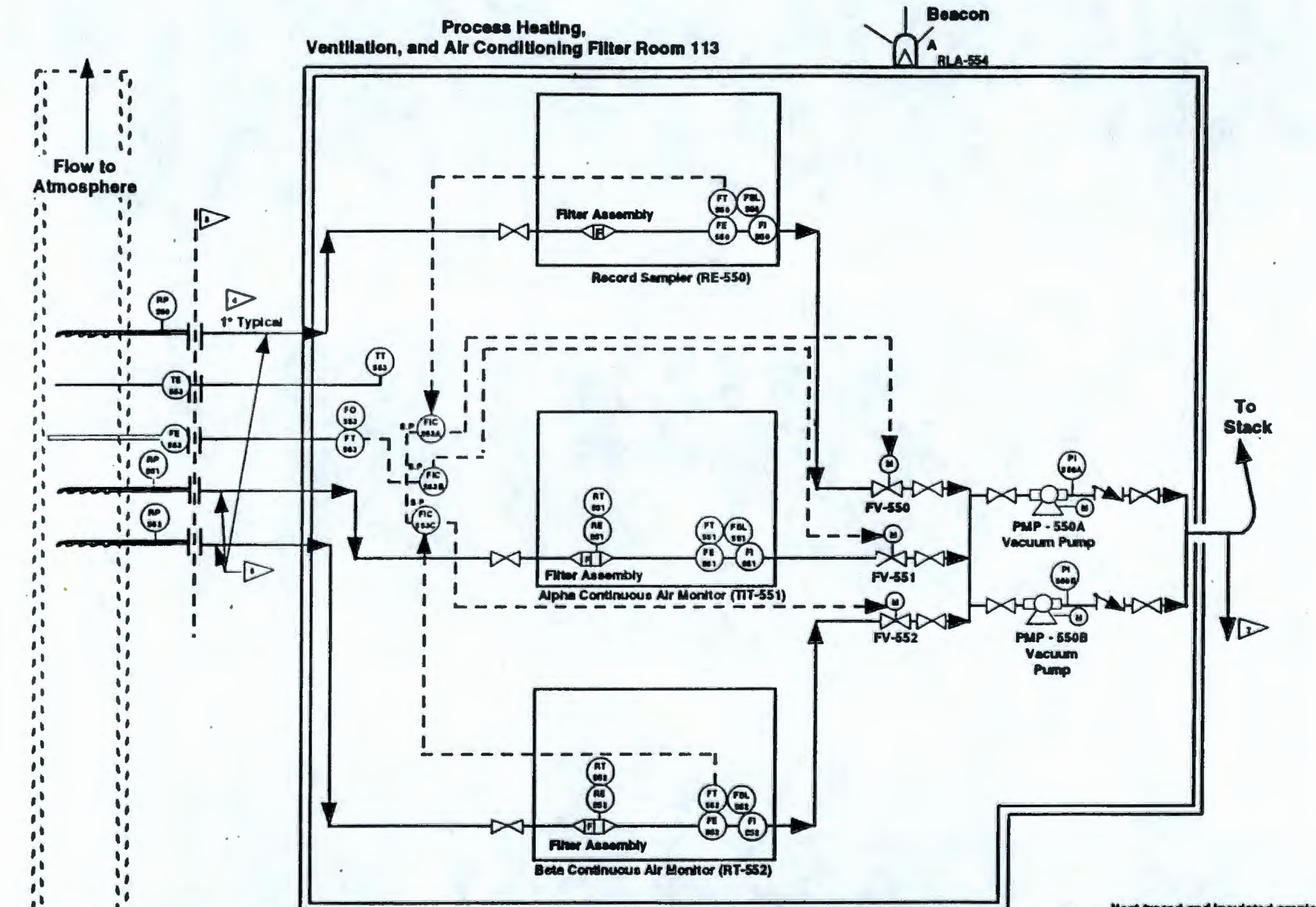
The sample points will be located at least 5 stack diameters downstream from any flow perturbation (such as a duct connection). In addition, probes will be at least 2 stack diameters upstream of any flow disturbance (the top of stack).

2.3.1.3 Description of Sample Lines. (Including diameters, lengths, materials, bends--radii, entry points into the effluent line, and angles of entry into effluent.) Figure 2-3, provides the following information relative to sample lines: diameters, lengths, materials, bends (radii), entry points into effluent line, and angles of entry into effluent. The following characteristics of sample transport line/tubes will be incorporated into the WRAP 1 design to ensure accurate and reliable sampling.

- The design of sample transport tubing shall assure that the lines are as short as possible. They shall have no sharp bends, and any changes in direction shall be made with radii curvatures greater than five tube diameters.

- Tubing size shall be selected to minimize particle deposition due to gravitational settling and/or impaction.

- The sampling transport tubing shall be constructed of seamless stainless steel and shall be rigid and adequately supported to prevent sagging.



1. Heating, Ventilation, and Air Conditioning exhaust stack and instrumentation functions shown in control room to be provided by the buyer.
2. All instrument tag number to be refixed w26-12-
3. All probe connections on stack to be grouped onto a single ane 8 inch raised face blind flange
4. 1" (Typical) indicates an approximate size all sample. All sample tubing provided by vendor including supporting carrier wire. All line sizes to be calculated by the vendor to provide maximum particle collection efficiency. All sample tubing to be 316 stainless steel.
5. All elctric power to leems will be provided through an uninterruptible power supply (UPS).
6. Heat traced and insulated ample line between probe assembly and facility.
7. Dead leg for collection of pipe condensatt.

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Figure 2-3. WRAP 1 Stack Monitoring & Sampling Systems.

- Use of pipe or tube fittings between the sample probes and the sample collectors shall be minimized.

- Sample tubing shall be electrically grounded to the point where the particles are collected.

- The heat tracing and sample transport tubing shall be thermally insulated to reduce heat loss to atmosphere.

- Easily accessible calibration taps shall be included in the sample line to allow in-place verification of the sample line flow rate. A block valve shall be included in the sample delivery lines upstream and downstream of the electronic cabinet to isolate the cabinet from the stack effluent for maintenance. Block valves shall also be located upstream and downstream of the sample delivery pumps for isolation.

2.3.1.4 Sample Flow Regulation. The stack monitor flow is drawn from the stack to the analyzer with a regulated air pump. The sample flowrate will be controlled to maintain an isokinetic sample. The sample flowrate is controlled with an adjustment on the pump and monitored with a differential pressure gauge (calibrated in L/min) connected across a flow orifice.

2.3.1.5 Sampling Media. Millipore membrane filters are used as the sampling medium. These filters are made of cellulose esters, and polyvinyl chloride or acrylonitrile. Because the filters are not very stiff, they are supported on a metal gauze or other grid. The filters are 140 μm thick and have a porosity of 0.45 μm. and have a collection efficiency of 95.8 percent.

2.3.1.6 Frequency of Sampling (Continuous or Batch). The WRAP 1 stack monitoring system provides for both continuous and batch sampling.

2.3.1.7 Frequency of Sampling (Collection). A sample schedule is being developed. Current design criteria call for the WRAP 1 airborne effluent samples to be collected weekly.

2.3.1.8 Calibration and Audit Schedules. Calibration and audit schedules have not yet been established for the WRAP 1 facility. Upon the start of operations, the WRAP 1 sampling/monitoring quality assurance program will adhere to DOE Order 5700.6C, *Quality Assurance* (DOE 1991), and ANSI/ASME (1989), *Quality Assurance Program Requirement for Nuclear Facilities* (or equivalent requirements valid at the time of operation). A quality assurance program will be established to conform to the requirements of 40 CFR 61, Appendix B, Method 114 (or equivalent requirement, as applicable).

2.3.2 Environmental Sampling Monitoring System

The Hanford Site maintains a comprehensive environmental sampling and monitoring program. Information describing the program has been provided to the DOH previously as a part of data packages submitted in support of the *State of Washington Department of Health Radioactive Air emissions Permit Number FF-01* (DOH 1989). Applicable information is provided in the following submittals to the DOH:

- *State of Washington Department of Health, Radioactive Air Emissions Permit FF-01: Supplemental Information* (DOH-RL 1990), Appendix A
- *Response to State of Washington Department of Health Technical Review of Hanford Site Permit FF-01 Supplemental Information* (DOE-RL 1992), Chapter III, Section III.C. of each facility-specific section.

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3.0 GENERAL INFORMATION

This section provides general information about Hanford Site requirements for effluent and environmental sampling and monitoring systems. In addition, references are provided for data resulting from existing effluent and environmental sampling and monitoring programs at the Hanford Site.

3.1 HANFORD SITE REQUIREMENTS FOR EFFLUENT SAMPLING/MONITORING SYSTEM DESIGN, PROCEDURES, AND QUALITY ASSURANCE STANDARDS (APPROPRIATE STANDARDS AND DESCRIPTION OF HOW THEY ARE USED)

Information describing Hanford Site requirements for effluent sampling/monitoring system designs, procedures, and quality assurance standards has been provided to the DOH previously, as a part of data packages submitted in support of the Hanford Site's *State of Washington Department of Health Radioactive Air Emissions Permit Number FF-01* (DOH 1989). Applicable information is provided in the following submittals to the DOH:

- *State of Washington Department of Health, Radioactive Air Emissions Permit FF-01: Supplemental Information* (DOH-RL 1990), Chapter 1.0, Section 1.1 of Appendix B

- *Response to State of Washington Department of Health Technical Review of Hanford Site Permit FF-01 Supplemental Information* (DOE-RL 1992), Chapter III, Section III.A of each facility-specific section.

3.2 EFFLUENT SAMPLE ANALYSIS

Information pertaining to the Hanford Site effluent sample analysis program has been provided to the DOH previously as a part of data packages submitted in support of the *State of Washington Department of Health Radioactive Air Emissions Permit Number FF-01* (DOH 1989). Applicable information is provided in the following submittals to the DOH:

- *State of Washington Department of Health, Radioactive Air Emissions Permit FF-01: Supplemental Information* (DOH-RL 1990), Chapter 1.0, Section 1.2 of Appendix B

- *Response to State of Washington Department of Health Technical Review of Hanford Site Permit FF-01 Supplemental Information* (DOE-RL 1992), Chapter III, Section III.B of each facility-specific section.

3.3 ENVIRONMENTAL SAMPLE ANALYSIS

Information pertaining to the Hanford Site environmental sample analysis program has been provided to the DOH previously as a part of data packages submitted in support of the *State of Washington Department of Health Radioactive Air Emissions Permit Number FF-01* (DOH 1989). Applicable information is provided in the following submittals to the DOH:

- *State of Washington Department of Health, Radioactive Air Emissions Permit FF-01: Supplemental Information* (DOH-RL 1990), Chapter 1.0, Section 1.2 of Appendix B
- *Response to State of Washington Department of Health Technical Review of Hanford Site Permit FF-01 Supplemental Information* (DOE-RL 1992), Chapter III, Section III.B of each facility-specific section.

3.4 DATA FROM EFFLUENT AND ENVIRONMENTAL MONITORING PROGRAMS, INCLUDING BACKGROUND OR LOCAL CONTROL DATA

Background data and the data collected from existing effluent and environmental surveillance programs conducted at the Hanford Site are collated and published in annual reports that are provided to the DOH and EPA upon publication. The effluent sampling and monitoring program data are published in annual Westinghouse Hanford reports. Data and trend analyses resulting from Westinghouse Hanford and Pacific Northwest Laboratory (PNL) environmental sampling and monitoring programs are published in annual Westinghouse Hanford environmental surveillance reports and in the annual PNL Hanford Site environmental monitoring report. Specific reports containing recent data are referenced in *Response to State of Washington Department of Health Technical Review of Hanford Site Permit FF-01 Supplemental Information* (DOE-RL 1992), Chapter III, Section III.C of each facility-specific section.

4.0 DEMONSTRATION OF COMPLIANCE

This section contains the information about the dose modelling effort required to demonstrate compliance with the national and state offsite dose impact standard of 10 millirem per year (mrem/year).

4.1 METHODOLOGY USED TO DEMONSTRATE COMPLIANCE

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.

4.2 MODELLING METHODOLOGY

Dispersion modelling was used to demonstrate compliance with the ambient dose standard. The PNL developed a radionuclide dispersion modelling 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 Facilities. Atmospheric releases were modeled using the CAP-88 (Beres 1990) EPA 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 modelled for both elevated and ground level releases. The models calculated the EDE to an individual member of the public based on one curie releases. Standard parameters for Hanford dose calculations were includes where possible (McCormack et al. 1984). Meteorology data was collected at weather stations in each of the Hanford operating areas and represent the 5-year average of data taken 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 modelling are listed in the modeling methodology manual (WHC 1991) in units of mrem/curie. These conversion factors are multiplied by the estimated controlled emissions rates expected from the WRAP 1 facility. The results are presented in Table 4-1. Some of the parameters used in the modelling are listed below:

<u>Source Terms</u>: Projected annual releases from WRAP 1 as presented in Table 2-3, Abated Emission Rate.

<u>Release Height</u>: The emissions release height was taken as zero (ground level).

<u>Inhalation Rate</u>: An individual was assumed to breathe 8,500 m^3/year (300,173 ft^3/year).

Table 4-1. WRAP 1 EDE 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

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

<u>Maximally Exposed Individual</u>: Doses were estimated for an individual living 24 km (10 mi) east of the WRAP 1 facility.

<u>Meteorology</u>: The Hanford Meteorological Station (HMS) data and onsite meteorological data were used (WHC 1991).

4.3 RESULTS OF METHOD (EFFECTIVE DOSE EQUIVALENT FOR WHOLE BODY AND RELEVANT ORGANS)

Table 4-1 shows the dose factors derived from the CAP-88 modelling and the EDE for each radionuclide. The source term (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, natural background radiation dose for the Tri-Cities 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.

4.4 DESCRIPTION OF INTERNAL STANDARDS USED TO ENSURE COMPLIANCE WITH APPLICABLE STATE AND FEDERAL LAWS AND REGULATIONS

Information pertaining to the internal standard used at the Hanford Site to ensure compliance with applicable state and federal laws and regulations has been provided to the DOH previously, as a part of data packages submitted in support of the Hanford Site's *State of Washington Department of Health Radioactive Air Emissions Permit Number FF-01* (DOH 1989). From that supporting documentation, the following responds to the requirements of this sections:

- *State of Washington Department of Health, Radioactive Air Emissions Permit FF-01: Supplemental Information* (DOH-RL 1990), Chapter 3.0, Section 3.4 of each facility-specific chapter

- *Response to State of Washington Department of Health Technical Review of Hanford Site Permit FF-01 Supplemental Information* (DOE-RL 1992).

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5.0 REFERENCES

40 CFR 61, *National Emission Standards for Hazardous Air Pollutants*, Title 40, Code of Federal Regulations, Part 61, U.S. Environmental Protection Agency, Washington, D.C.

ANSI, 1969, *Guide to Sampling Airborne Radioactive Materials in A Nuclear Facility*, N13.1-1969, American National Standards Institute, New York, New York.

ANSI/ASME, 1989, *Quality Assurance Program Requirements for Nuclear Facilities*, NQA-1-1989, American National Standards Institute and American Society of Mechanical Engineers, New York, New York.

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