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Revision 0

RADIOACTIVE AIR EMISSIONS NOTICE OF CONSTRUCTION FOR THE DECOMMISSIONING OF THE 190-D COMPLEX

United States
Department of Energy
Richland, Washington

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Rev. 0

RADIOACTIVE AIR EMISSIONS NOTICE OF CONSTRUCTION FOR THE DECOMMISSIONING OF THE 190-D COMPLEX

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

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1.0 INTRODUCTION

This Notice of Construction (NOC) presents the proposed plan for the decommissioning of the 190-D Complex. The proposed action would demolish the 190-D Complex, as it is no longer in suitable condition for use, and no longer supports a mission. The structure poses a safety hazard to the workers required to perform surveillance and maintenance. This action would eliminate the need to maintain the structure, remove a safety hazard to workers, and help to achieve the environmental restoration goals for the Hanford Site.

1.1 NOTIFICATION REQUIREMENT AND GUIDANCE

This document serves as a NOC pursuant to the requirements of Washington Administrative Code (WAC) 246-247-060 for the decommissioning of 190-D Complex.

1.2 FACILITY IDENTIFICATION

U.S. Department of Energy, Richland Operations Office
Hanford Site
100-D Area, 190-D Complex
Richland, Washington 99352

Responsible Manager:
Mr. R. D. Freeberg, Director
River Sites Restoration Division PH: (509) 376-3603
U.S. Department of Energy, Richland Operations Office
P.O. Box 550
Richland, Washington 99352

The 190-D Complex is located in the 100-D Area of the Hanford Site. The 100-D Area is located in the northern part of the Hanford Site approximately 35 miles northwest of the city of Richland, Washington (Figure 1-1).

The 190-D Complex is located approximately 50 ft west of the 105-D Reactor Building. The 190-D Complex is composed of seven distinct buildings as shown in Figure 1-2; these buildings are identified as the 185-D development laboratory, 189-D mechanical development laboratory, 190-D tankroom highbay, 190-D main process pumphouse, 190-DA main process pumphouse annex, 195-D vertical safety rod test tower, and the 1724-D underwater test facility. The 185-D, 189-D, 190-D and 190-DA are continuous structures separated by common walls, and the 1724-D and 195-D are considered a part of this facility due to their proximity, connections, and use.

Figure 1-1. 100-D Area on the Hanford Site.

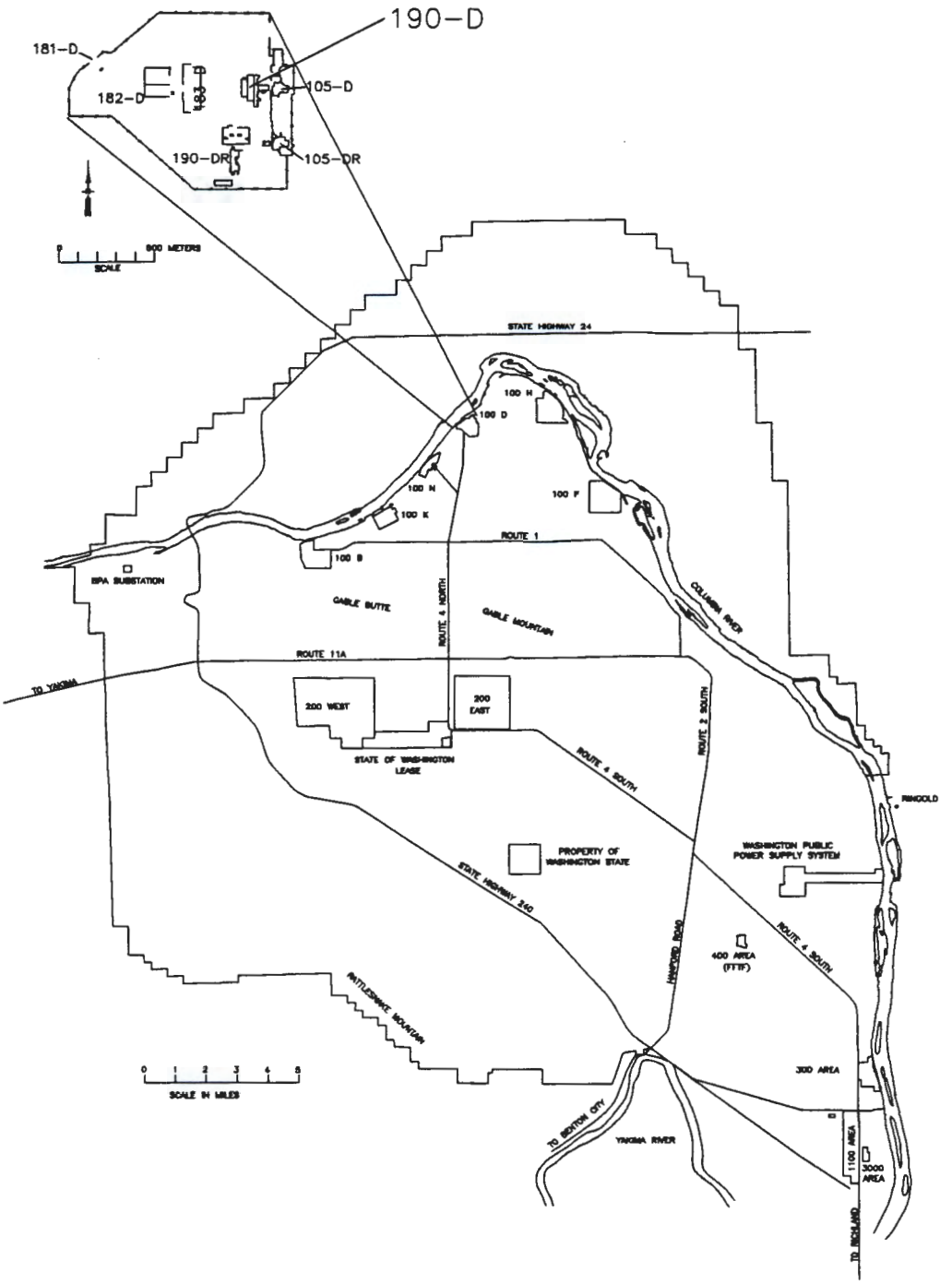
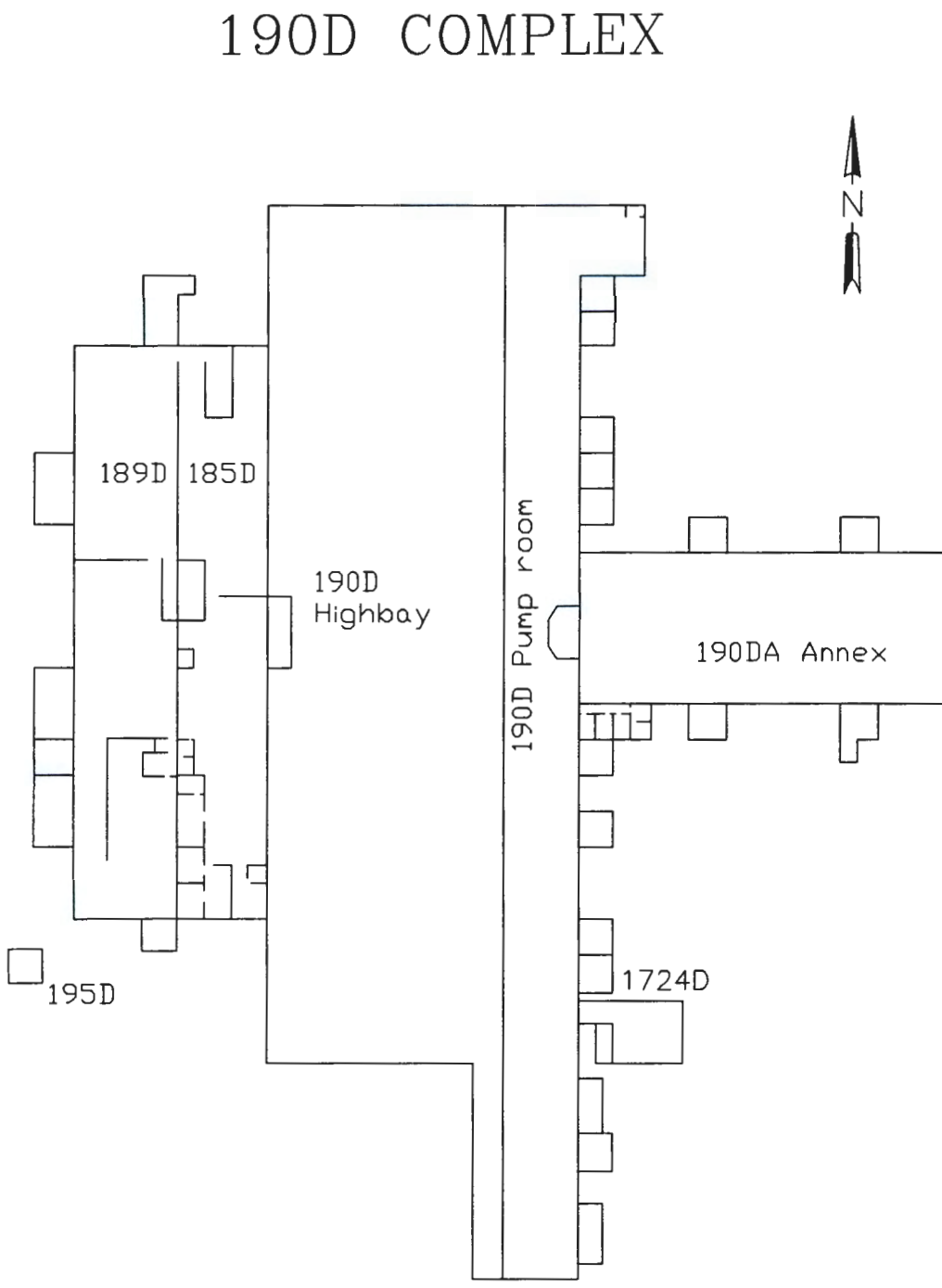


Figure 1-2. 190-D Complex and The Seven Distinct Buildings.



1.3 PROPOSED ACTION

The proposed action will modify the existing facility by removing all radioactive and hazardous substances from the building, to the maximum extent possible, prior to demolition.

The 190-D Complex is not associated with any registered stacks, in accordance with WAC 246-247.

1.4 STATE ENVIRONMENTAL POLICY ACT ENVIRONMENTAL CHECKLIST

The State of Washington Department of Health (DOH) in WAC 246-03-020 adopted by reference the categorical exemption in WAC 197-11-845(1) from the State Environmental Policy Act checklist process.

2.0 SOURCE INFORMATION

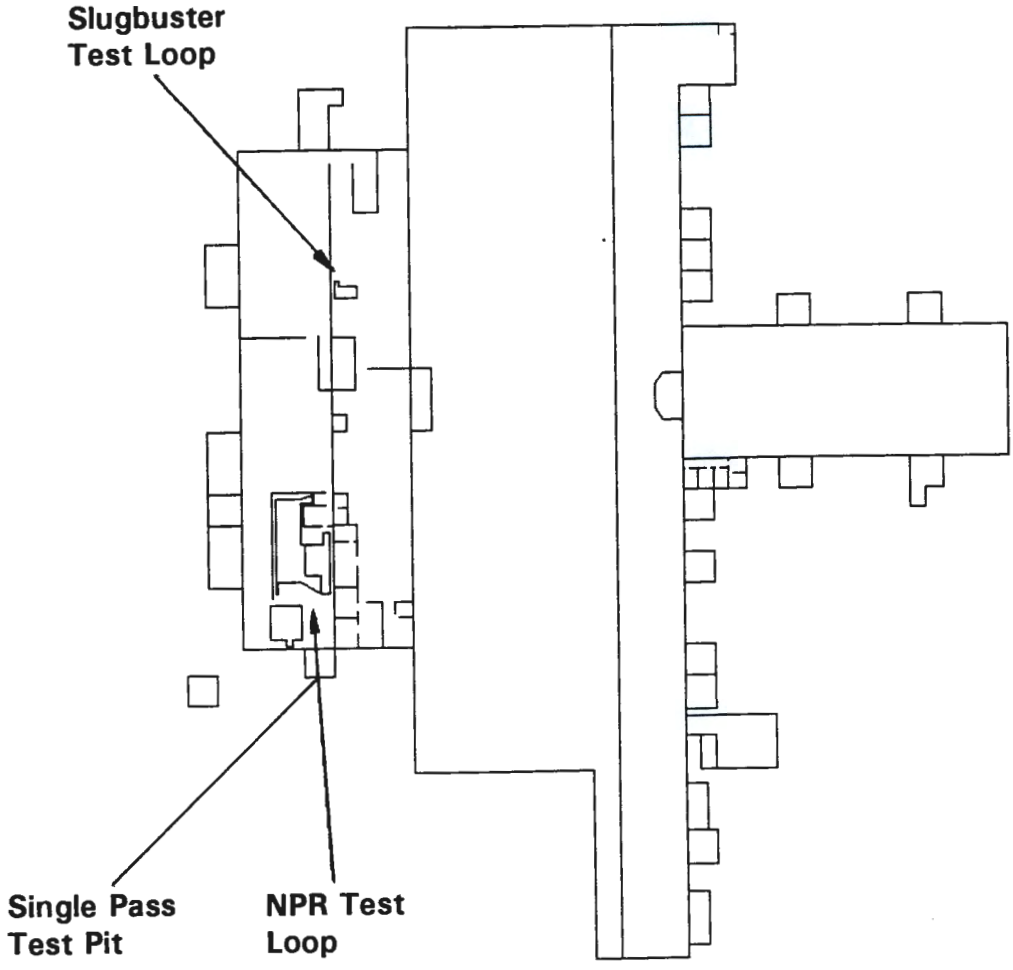
This section provides detailed information regarding the source and quantity of airborne radionuclide emissions resulting from the decommissioning of 190-D Complex.

2.1 PROCESS DESCRIPTION

The decontamination and decommissioning (D&D) of the 190-D Complex will take less than 1 year. The proposed D&D work will dismantle and dispose of the contaminated test loops, decontaminate floors and trenches, and/or remove whole sections of fixed radionuclide contaminated concrete. The test loops contain pumps, heaters and heat exchangers, pressurizers, water treatment chemical addition tanks and ion-exchange columns, test sections, and piping which connect all the components together. Radiological controls will be used to package and remove the contaminated materials. The contaminated piping from the test loops and equipment will be removed prior to demolishing the buildings, which enclose these materials.

Decommissioning activities are planned to begin with the test loops. The New Production Reactor-Prototype Concept Evaluation (NPR-PCE) test loop is located in the southeast end of the 189-D building, with portions above and in the open top trench, which runs the full length of the 189-D building. The slug-buster test loop is located in the northwest end of the 185-D building, just on the other side of the common wall that separates the 185-D and 189-D buildings (see Figure 2-1). The work area will be covered with two layers of plastic to catch any small amounts of residual water in the loop piping systems or metal shavings from the dismantlement procedures.

Figure 2-1. 190-D Complex Radionuclide Contaminated Test Sections.



Dismantlement of the test loops will utilize flanged connections to provide piping break points. Mechanical methods such as portable band saws, hydraulic shears, and mechanical cutting devices will be used to cut the piping if flanged connections are not available and if the pipes need to be sectioned to fit into disposal containers. Dedicated high-efficiency particulate air (HEPA) filtered vacuums will be used during the dismantlement of the test loops.

If the radioactive material to be disposed of is not defined as transuranic (TRU) waste, or high-level waste (spent nuclear fuel or by-product material) it will be disposed of as low-level radioactive waste. Transuranic waste is contaminated with alpha-emitting TRU radionuclides with half-lives greater than 29 years and in concentrations greater than 100 nCi/g of the waste matrix at the time of assay. Transuranic waste will be stored on the Hanford Site pending processing and shipment to an approved disposal facility.

Decommissioning activities will utilize as low as reasonably achievable (ALARA) planning to minimize worker exposure. Grab air samples will be utilized to monitor the work environment and alpha and beta continuous air monitors (CAMs) may be used as conditions warrant. Monitoring will be performed during radioactive work (i.e., loop dismantlement, concrete decontamination).

One option for removal of the water and sludge present in the 189-D open top trench and the single pass test pit will be to pump into drums using a peristolic or similar pump. The water and sludge in drums will be solidified using available products. Another option includes using a permitted treatment device to evaporate the water (such as the Hanford Site Tank Farms 242-A Evaporator facility). After the water, equipment, and piping are removed during loop dismantlement, the presence of contaminated concrete in each area will be determined by a radiological survey. Decontamination of the trenches and other concrete surfaces will be performed using dustless decontamination systems. These systems utilize proven components (such as needle guns, scabblers, and shot peen systems) fitted with vacuum shrouds that gather particulate contaminants utilizing HEPA-filtered vacuums (see Section 4.0). In the event that these systems do not remove all the contamination or contamination that exists in cracks deep in the concrete, these contaminant locations will be marked and fixed with fixative paint, removed and handled separately from the rest of the trench and concrete during slab demolition.

Post radiological surveys will be performed to determine the conditions of the decontaminated and fixed contaminant areas to ensure no surface or unexpected contamination exists.

The methods to be used to decommission the 190-D Complex will be selected after evaluating the structural conditions and remaining radionuclide contamination. A post decontamination radiological survey will be conducted to determine the degree of decontamination attained. Any remaining areas of contamination will be fixed and removed using techniques such as wire cutting and concrete sawing. Temporary containment

enclosures will be used, as required, to control dust resulting from the activities. Also dust suppression techniques may be employed with the cutting equipment. Final demolition of the facility will use standard commercial techniques.

A soil survey of the 190-D Complex area will be performed after the buildings are removed to identify any areas of contamination. If contaminated areas are identified, sampling and surveying efforts will be performed to determine the extent of contamination. Depending on the degree and extent of contamination, the site may be remediated in accordance with overall Hanford Site cleanup strategies, or the site will be covered with clean soil and left for large-scale remediation.

2.2 FACILITY INVENTORY

This facility was originally one of the 105-D Reactor support buildings, which was a nonradioactive facility, and supplied coolant water to the reactor. It was later modified to serve as a research and development (R&D) laboratory. Uranium fuel element experiments were conducted in the R&D test loops from the 1960's until the 1980's. These experiments primarily used N Reactor type fuel, which is approximately 1% enriched uranium.

2.2.1 Background

The source of contamination within the 190-D Complex was produced from two test loops, the NPR-PCE test loop located in the 189-D building, and the slugbuster test loop located in the 185-D building. The test loops and equipment contain low levels of alpha, beta, and gamma emitting radionuclide contamination.

The NPR test loop was a high temperature, high pressure water test loop. This test loop had the ability to test components used in or destined for N Reactor. New modifications or components could be tested in the controlled conditions of the NPR test loop without the problems associated with tests run in an operating reactor. Water leaks from the NPR test loop during test runs have contaminated the large 189-D open top trench, and combined with oils from the lubricated components of the test loops located in a small 10-in-wide waste trench. The NPR test loop was also used to supply water to the environmental test chamber. This test chamber performed tests on reactor valves and then deposited the used water in the single pass test pit on the south end of the 189-D building.

The slugbuster loop tested "green" (unirradiated fuel elements that have not been put through a reactor) uranium fuel elements and their claddings in a pressurized water-flow system until they failed or ruptured. Fuel elements were heated by attached electrodes until failure or rupture. Various measurements then were taken as the failures occurred. Water leaks during these tests have contaminated the floor area surrounding the loop work area.

2.2.2 Radionuclide Sources

To determine the radionuclide inventory in the 190-D Complex, a radiological characterization survey was conducted in late 1993. The characterization survey began by reviewing historical data to help identify areas of contamination. The data quality objectives for the sampling and characterization effort were based on waste disposal requirements provided in WHC-EP-0063, Rev. 4, *Hanford Site Solid Waste Acceptance Criteria* (WHC 1993). Water and sludge samples were taken from the contaminated areas and test loops. Radiological analysis techniques included total activity, gross alpha activity, gross beta activity, gamma energy analysis, alpha energy analysis, and specific techniques to determine beta specific emitters and radium emitters. The radionuclides found were typical of nonirradiated green fuel (see Tables 2-2 through 2-6).

Data from the sludge samples was used in developing the source inventory. The total curie inventory for the isotopes present in each of the contaminated areas was determined by multiplying the radionuclide activity found in the samples (pCi/g) by the volume (m^3) of contaminated material and the density of the contaminated material (g/m^3). The test loops were made with stainless steel, therefore, the density of stainless steel (7.92 E+06 g/m^3) was used in the inventory calculations. The single pass test pit and 189-D open trench are concrete structures, accordingly, the density of concrete (2.4.1 E+06 g/m^3) was used for inventory calculations.

Table 2-1 summarizes the volume of contamination for each area, and the following information provides the method used to calculate that volume.

Table 2-1. Contamination Volume.

Area	Volume (m^3)
NPR test loop	.556
Slugbuster test loop	.03475
Single pass test pit	.26193
189-D open top trench	2.1214

The NPR and slugbuster test loops are complex piping systems, which do not easily lend to contaminant volume calculations. Approximations were made to quantify the volume present in the test loops. These approximations were based on piping densities per given square footage of the test loop. The NPR and slugbuster test loops were determined to contain five vertical 4-in-diameter pipes for every 100 ft^2 of floor area the test loop covers.

Each test loop was also given a representative height. The contaminated scale thickness within the loop was estimated (based on process knowledge and duration of use) to be 1/8 in. thick so that a volume could be determined. The radionuclides are conservatively assumed to be dispersed uniformly throughout this contaminated scale.

The depth of contaminant penetration into concrete surfaces was estimated to be 1/4 in. This approximation utilized quantitative data found during other projects that dealt with contaminated concrete trenches and pools (e.g., 183-H Solar Evaporation Ponds). The surface area of effected concrete floors, trenches and water pits was used for source calculations. This estimate is conservative since the water samples met the unconditional offsite release criteria and the assumed wall height may not be contaminated.

The NPR test loop covered a floor area measuring approximately 20 ft wide and 60 ft long, with a height of approximately 30 ft. Since the source term assumption for the test loops utilizes a contaminated pipe inventory per 100 ft^2 of floor area, a volume of contaminated material can be found while using the assumed scale thickness (Equation 1).

$$\text{Volume} = \left(\frac{\text{no. pipes}}{100\ ft^2}\right) \times \text{loop } ft^2 \times \text{internal area each pipe} \times \text{scale thickness} \qquad (1)$$

The history of the slugbuster test loop and field instruments indicates that contamination does exist. Since green fuel was used in the slugbuster test loop as well, the radionuclide contaminants and the levels found in the NPR test loop were assumed to exist in the slugbuster test loop. The physical size of the slugbuster test loop is 15 ft by 15 ft and 10 ft tall. The same piping density as used for the NPR test loop calculation was assumed for the slugbuster test loop.

The single pass test pit is a rectangular concrete pit approximately 6 ft wide, 10 ft long and 12 ft deep. The entire interior surface concrete is assumed to be contaminated 1/4 in. deep. The volume can be determined by finding the surface area of all potentially contaminated surfaces (4 walls and the floor) and multiplying by the depth of contamination (1/4 in) (see Table 2-1).

The 189-D open top concrete trench, which runs the length of the 189-D building, is approximately 7 ft wide, 6 ft deep and 340 ft long. The concrete trench is expected to be contaminated approximately 2 ft up the side walls with contaminants penetrating the walls approximately 1/4 in.

The radionuclide inventory for each contaminated area is presented in Table 2-2 through Table 2-5. Table 2-6 summarizes the total radionuclide inventory present in the 190-D Complex.

Table 2-2. NPR Test Loop.

Radionuclide	Activity/sample* (Ci/g)	Total activity (Ci)
^{40}K	3.58 E-12	1.58 E-05
^{90}Sr	3.72 E-14	1.63 E-07
^{137}Cs	5.37 E-11	2.36 E-04
^{234}U	1.057 E-12	4.66 E-06
^{238}U	1.057 E-12	4.66 E-06

*Results of 1993 characterization survey discussed in Section 2.2.2

Table 2-3. Slugbuster Test Loop.

Radionuclide	Activity/sample* (Ci/g)	Total activity (Ci)
^{40}K	3.58 E-12	9.84 E-07
^{90}Sr	3.72 E-14	1.02 E-08
^{137}Cs	5.37 E-11	1.48 E-05
^{234}U	1.057 E-12	2.90 E-07
^{238}U	1.057 E-12	2.90 E-07

*Results of 1993 characterization survey discussed in Section 2.2.2

Table 2-4. Single Pass Test Pit.

Radionuclide	Activity/sample* (Ci/g)	Total activity (Ci)
^{90}Co	1.52 E-12	9.60 E-07
^{90}Sr	1.55 E-13	9.78 E-08
^{137}Cs	3.62 E-12	2.29 E-06
^{234}U	7.82 E-10	4.94 E-04
^{235}U	1.17 E-10	7.39 E-05
^{238}U	7.82 E-10	4.94 E-04

*Results of 1993 characterization survey discussed in Section 2.2.2

Table 2-5. 189-D Open Top Trench.

Radionuclide	Activity/sample* (Ci/g)	Total activity (Ci)
^{40}K	1.57 E-11	8.03 E-05
^{60}Co	1.75 E-12	8.94 E-06
^{90}Sr	7.61 E-13	3.89 E-06
^{137}Cs	6.61 E-12	3.38 E-05
^{234}U	2.55 E-10	1.30 E-03
^{235}U	1.03 E-10	5.27 E-04
^{238}U	2.55 E-10	1.30 E-03

*Results of 1993 characterization survey discussed in Section 2.2.2

Table 2-6. 190-D Complex Source Term Totals.

Radionuclide	Total activity (Ci)
^{40}K	9.71 E-05
^{60}Co	9.90 E-06
^{90}Sr	4.16 E-06
^{137}Cs	2.87 E-04
^{234}U	1.80 E-03
^{235}U	6.01 E-04
^{238}U	1.80 E-03

2.2.3 Operating Mode

The majority of the decommissioning work will be accomplished on day-shift, 5 days/week. The decontamination and decommissioning activities of the 190-D Complex is less than 1 year.

2.2.4 Physical Forms of Releases

If airborne releases occur from the 190-D Complex activities, they will be particulate; however, since decontamination methods will use a vacuum system, the release fraction for this permit application has been assumed conservatively to be "1" per direction provided by DOH (letter dated August 1, 1994, from A. W. Conklin to S. H. Wisness). Whether a release fraction of "1" (or some lesser fraction) is appropriate is still a subject of discussion with DOH.

Table 2-7 presents the potential release rates expected from the project's activities. Since the project duration is less than 1 year, the release rate will be assumed as the total curie inventory in 1 year.

Table 2-7. Potential Release Rate from Decommissioning of the 190-D Complex.

Radionuclide	Total curies/Total activity*	Release fraction	Annual release rate (Ci/yr)
^{40}K	9.71 E-05	1	9.71 E-05
^{60}Co	9.91 E-06	1	9.91 E-06
^{90}Sr	4.16 E-06	1	4.16 E-06
^{137}Cs	2.87 E-04	1	2.87 E-04
^{234}U	1.80 E-03	1	1.80 E-03
^{235}U	6.01 E-04	1	6.01 E-04
^{238}U	1.80 E-03	1	1.80 E-03

*From Table 2-6.

3.0 UNABATED RELEASE RATES

This section provides information regarding the emission release rates from the decommissioning of the 190-D Complex without an emission control system in place. Also included is the effective dose equivalent (EDE) to the maximally exposed individual (MEI) offsite resulting from unabated emissions.

3.1 UNABATED EMISSIONS

Table 2-7 presents the potential annual radionuclide release rates to the air, assuming no pollution control equipment is in place.

3.2 UNABATED DOSE

The unabated dose to the MEI, located 16.2 km east (equivalent to the actual offsite location 11.7 km west) of the 190-D Complex, is shown in Table 3-1. The total projected EDE to the offsite MEI from unabated emissions is 1.32 E-02 mrem/yr.

A Clean Air Assessment Package 1988 (CAP-88) evaluation was run specifically for the projected releases from the 190-D Complex (Appendix B). The dose from radioactive daughter products of primary radionuclides are included in the unit dose factor. The resulting dose factors on a mrem/Ci basis are provided in Table 3-1.

CAP-88, a U.S. Environmental Protection Agency-approved code package, has the capability to model both ground-level and elevated airborne releases from locations in the 100, 200, 300, and 400 Areas. The model calculates EDE to an individual member of the public using the Hanford Site meteorological data. The EDE that is derived receives the maximum dose from an area depending on the Hanford meteorological data.

Table 3-1. Unabated Dose from Decommissioning of the 190-D Complex.

Radionuclide	Annual release rate (Ci/yr)	CAP-88 Unit dose factor (mrem/Ci)	Annual unabated dose (mrem/yr)
^{40}K	9.71 E-05	1.13 E-01	1.10 E-05
^{60}Co	9.91 E-06	1.43 E-01	1.42 E-06
^{90}Sr	4.16 E-06	9.67 E-02	4.02 E-07
^{137}Cs	2.87 E-04	1.48 E-01	4.25 E-05
^{234}U	1.80 E-03	3.08 E+00	5.54 E-03
^{235}U	6.01 E-04	2.91 E+00	1.74 E-03
^{238}U	1.80 E-03	3.27 E+00	5.89 E-03
Total	N/A	N/A	1.32 E-02

4.0 CONTROL AND MONITORING SYSTEMS

A Euroclean model UZ948 (or similar) HEPA-filtered high-performance, portable hazardous and radiological materials collection system will be used.

A dustless mechanical method utilizing vacuum shrouded needle guns, a vacuum shrouded floor scarifier, or shot peening may be used for the concrete decontamination. By connecting a HEPA-filtered vacuum system to the tool, the dust and debris can be collected as it is generated.

The HEPA-filtered vacuum system shall have a minimum efficiency of 99.95% for the removal of airborne particulates. The basis for this is *The Nuclear Air Cleaning Handbook*, Section 8.2 (ERDA 1976), which states that by definition, a HEPA system must exhibit an installed decontamination factor of 2,000, which is an efficiency of 99.95% for the removal of aerosols having a nominal median diameter of less than 1 micrometer (WHC 1993).

The potential unabated emission, 1.32 E-02, is not greater than 0.1 mrem/yr; therefore, this air emissions source is not subject to the radionuclide National Emission Standards for Hazardous Air Pollutants for continuous monitoring systems as defined in 40 CFR 61.93(b). However, periodic confirmatory measurements will take place throughout the duration of the project.

5.0 ABATED RELEASE RATES

This section provides information regarding the emission release rates from the 190-D Complex decommissioning activities with the emission control system in place. Also included is the EDE to the MEI offsite resulting from abated emissions.

5.1 ABATED EMISSIONS

Table 5-1 presents the abated emissions resulting from the decommissioning activities. Since HEPA filtration is the control system used, a removal efficiency of 99.95% can be applied to the unabated emissions to calculate the abated emissions (WHC 1993).

Table 5-1. Annual Abated Radionuclide Airborne Emissions from Decommissioning of 190-D Complex.

Radionuclide	Annual unabated emissions (Ci/yr)	Control equipment efficiency (%)	Annual abated emissions (Ci/yr)
^{40}K	9.71 E-05	99.95	4.86 E-08
^{60}Co	9.90 E-06	99.95	4.95 E-09
^{90}Sr	4.16 E-06	99.95	2.08 E-09
^{137}Cs	2.87 E-04	99.95	1.44 E-07
^{235}U	6.01 E-04	99.95	3.01 E-07
^{238}U	1.80 E-03	99.95	9.00 E-07
^{234}U	1.80 E-03	99.95	9.00 E-07

5.2 ABATED DOSE

The abated dose to the MEI, located 16.2 km east (equivalent to the actual offsite location of 11.7 km west) of the 190-D Complex is shown in Table 5-2. The projected EDE to the MEI from abated emissions is 6.61 E-06 mrem/yr. The unit dose factors included in the table are described in Section 3.2.

The dose resulting from all Hanford Site operations in 1993 was determined to be .03 mrem/yr for an individual located at a farm on Sagemore Road directly across the Columbia River from the site boundary to the east of the 300 Area (PNL 1993). The emissions as a result of the decommissioning of 190-D Complex in conjunction with other operations at the Hanford Site will not result in a violation of the National Emission Standard of 10 mrem/yr.

Table 5-2. Annual Abated Dose from Decommissioning of the 190-D Complex.

Radionuclide	Annual abated emissions (Ci/yr)	CAP-88 Unit dose factor (mrem/Ci)	Annual abated dose (mrem/yr)
^{40}K	4.86 E-08	1.13 E-01	5.49 E-09
^{60}Co	4.95 E-09	1.93 E-01	7.08 E-10
^{90}Sr	2.08 E-09	9.67 E-02	2.01 E-10
^{137}Cs	1.44 E-07	1.48 E-01	2.13 E-08
^{234}U	9.00 E-07	3.08 E+00	2.77 E-06
^{235}U	3.01 E-07	2.91 E+00	8.76 E-07
^{238}U	9.00 E-07	3.27 E+00	2.94 E-06
Total	N/A	N/A	6.61 E-06

6.0 REFERENCES

DOE-RL, 1993, *Radioactive Air Emissions Program Notice of Construction, and the Rotary Mode Core-Sampling Truck and Exhauster*, DOE/RL-93-40, U.S. Department of Energy, Richland Operations Office, Richland,Washington.

DOE-RL, 1994, *Radioactive Air Emissions Notice of Construction for the 105-N Basin Stabilization*, DOE/RL-91-14, Rev 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

PNL 1993, *Hanford Site Environmental Report for Calendar Year 1992*, June 1993, PNL-8682, UC-602, Pacific Northwest Laboratory, Richland, Washington.

WHC 1993, *Environmental Compliance Manual*, WHC-CM-7-5, Section 2.5.5.2, "Testing and Performance Criteria," Westinghouse Hanford Company, Richland Washington.

APPENDIX A

DISCUSSION OF BEST AVAILABLE RADIONUCLIDE CONTROL TECHNOLOGY

It is proposed that the HEPA-filtered high-performance portable hazardous and radiological materials collection system as described in Section 4.0 be approved as Best Available Radionuclide Control Technology (BARCT) for the decommissioning of the 190-D Complex. This discussion of BARCT does not present a detailed evaluation of all of the available radionuclide control technologies nor does it rank the benefits with respect to the environmental, economical, and energy impacts of each technology. The DOH has provided guidance that HEPA filters are generally accepted as BARCT for particulate radionuclide air emissions. HEPA filtration systems are used extensively at the Hanford Site for the control of particulate radionuclide air emissions.

APPENDIX B

CAP88PC UNIT RELEASE DOSE FACTORS FOR 100-K AREA ANNUAL RELEASES FROM GROUND LEVEL

DON'T SAY IT -- Write It!

July 25, 1994

To: Ella T. Coenenberg
H6-25 376-5616

From: Paul D. Rittmann
H0-36 376-8715

Subject: **CAP88PC Unit Release Dose Factors for 100-K Area Annual Releases from Ground Level**

Attached is the CAP88PC output. The emissions of each isotope were assumed to be one curie. In some cases, progeny nuclides were assumed to be present in equilibrium amounts during the release. The list of input nuclides along with short-lived progeny is shown below. The CAP88PC program handles the decay chains in the course of its calculations.

Nuclide	Progeny Nuclides	Dose Factor mrem/Ci
Am-241		12.6
Ce-144	Pr-144	0.0120
Co-60		0.143
Cs-134		0.0783
Cs-137	Ba-137m(0.946)	0.148
H-3		3.84E-05
K-40		0.113
Mn-54		0.00911
Pu-238		7.56
Pu-239		8.16
Pu-241		0.128
Ru-106	Rh-106	0.0156
Sb-125	Te-125m(0.245)	0.0146
Sr-90	Y-90	0.0967
U-235	Th-231	2.91
U-238	Th-234, Pa-234(0.0016)	3.27
U-234		3.08
Th-230		5.55
Ra-226		0.932
Pb-210	Bi-210, Po-210	1.87

The last column of the above table gives the unit release dose factors. To use these factors, simply multiply the activity released into the offsite air over the course of a year by the appropriate unit release dose factor. The result will be the CAP88PC dose, in mrem per year.

For general information on these unit release dose factors, the following should be noted:

(1) Wind data collected in the 100 N Area from 1983 to 1991 was used.
(2) Release height was at ground level, with no plume rise.
(3) The Hanford Site Boundary receptor location with the largest dose was 11.7 km West of the 100-K Area.
(4) The receptor distance input to CAP88PC was 16.2 km. This was necessary because CAP88PC determines the worst wind direction at this distance and bases the doses on this direction. The above dose values are for the East transport direction. The doses at 16.2 km East are the same as the doses at 11.7 km West.

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Clean Air Act Assessment Package - 1988

D O S E A N D R I S K E Q U I V A L E N T S U M M A R I E S

Non-Radon Individual Assessment
Jul 25, 1994 9:42 am

Facility: 100K Area - Ground Level - Individual Nuclides
Address: Westinghouse Hanford Company
P.O. Box 1970
City: Richland
State: WA Zip: 99352-1970

Source Category:
Source Type: Stack
Emission Year: 1994

Comments: 16.2 km E is equivalent to 11.7 km W
Wind data generated at 100N from 1983 to 1991

Dataset Name: 100K - DF
Dataset Date: Jul 25, 1994 9:42 am
Wind File: WNDFILES\JF10010.WND

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SUMMARY
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ORGAN DOSE EQUIVALENT SUMMARY
(RN-222 Working Level Calculations Excluded)

Organ	Selected Individual (mrem/y)
GONADS	7.09E+00
BREAST	2.53E+00
R MAR	4.16E+01
LUNGS	1.48E+02
THYROID	2.54E+00
ENDOST	4.96E+02
RMNDR	2.26E+01
EFFEC	4.66E+01

Radon Decay Product Concentration (working level)

0.00E+00

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY
(RN-222 Working Level Calculations Excluded)

Pathway	Selected Individual (mrem/y)
INGESTION	4.81E+00
INHALATION	4.04E+01
AIR IMMERSION	7.88E-05
GROUND SURFACE	1.44E+00
INTERNAL	4.52E+01
EXTERNAL	1.44E+00
TOTAL	4.66E+01

Radon Decay Product Concentration (working level)

0.00E+00

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SUMMARY
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NUCLIDE EFFECTIVE DOSE EQUIVALENT SUMMARY
(RN-222 Working Level Calculations Excluded)

Nuclide	Selected Individual (mrem/y)
AM-241	1.26E+01
CE-144	1.20E-02
PR-144	1.12E-07
CO-60	1.43E-01
CS-134	7.83E-02
CS-137	3.42E-02
BA-137M	1.14E-01
H-3	3.84E-05
K-40	1.13E-01
MN-54	9.11E-03
PU-238	7.56E+00
PU-239	8.16E+00
PU-241	1.28E-01
RU-106	1.56E-02
RH-106	9.34E-36
SB-125	1.44E-02
TE-125M	2.34E-04
SR-90	9.65E-02
Y-90	2.09E-04
U-235	2.91E+00
TH-231	2.07E-05
U-238	2.74E+00
TH-234	1.94E-03
PA-234	5.32E-01
U-234	3.08E+00
TH-230	5.55E+00
RA-226	4.50E-01
RN-222	0.00E+00
PO-218	0.00E+00
PB-214	7.66E-02
BI-214	4.05E-01
PO-214	0.00E+00
PB-210	1.37E+00
BI-210	4.25E-03
PO-210	4.91E-01
TOTAL	4.66E+01

Radon Decay Product Concentration (working level)

0.00E+00

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SUMMARY
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CANCER RISK SUMMARY

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk
LEUKEMIA	3.95E-05
BONE	2.21E-05
THYROID	9.00E-07
BREAST	7.57E-06
LUNG	2.51E-04
STOMACH	4.82E-06
BOWEL	2.67E-06
LIVER	6.88E-05
PANCREAS	3.33E-06
URINARY	5.55E-06
OTHER	4.07E-06
TOTAL	4.11E-04

	Selected Individual Cancer Risk
Radon Decay Product Lung Exposure	0.00E+00
Total Fatal Risk All Exposures	4.11E-04

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk
INGESTION	3.04E-05
INHALATION	3.46E-04
AIR IMMERSION	1.89E-09
GROUND SURFACE	3.44E-05
INTERNAL	3.76E-04
EXTERNAL	3.44E-05
TOTAL	4.11E-04

	Selected Individual Cancer Risk
Radon Decay Product Lung Exposure	0.00E+00
Total Fatal Risk All Exposures	4.11E-04

NUCLIDE RISK SUMMARY

Nuclide	Selected Individual Total Lifetime Fatal Cancer Risk
AM-241	6.40E-05
CE-144	5.41E-07
PR-144	3.13E-12
CO-60	3.59E-06
CS-134	1.98E-06
CS-137	8.94E-07
BA-137M	2.73E-06
H-3	1.04E-09
K-40	2.85E-06
MN-54	2.19E-07
PU-238	6.41E-05
PU-239	6.36E-05
PU-241	4.88E-07
RU-106	7.02E-07
RH-106	0.00E+00
SB-125	3.45E-07
TE-125M	4.21E-09
SR-90	1.62E-06
Y-90	7.14E-09
U-235	3.79E-05
TH-231	6.03E-10
U-238	3.53E-05
TH-234	5.84E-08
PA-234	1.27E-05
U-234	3.93E-05
TH-230	4.54E-05
RA-226	5.65E-06
RN-222	0.00E+00
PO-218	0.00E+00
PB-214	1.81E-06
BI-214	9.81E-06
PO-214	0.00E+00
PB-210	9.76E-06
BI-210	1.14E-07
PO-210	5.25E-06
TOTAL	4.11E-04

	Selected Individual Cancer Risk
Radon Decay Product Lung Exposure	0.00E+00
Total Fatal Risk All Exposures	4.11E-04

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)
Direction	16200
N	1.3E+01
NNW	1.1E+01
NW	1.6E+01
WNW	1.9E+01
W	3.0E+01
WSW	1.6E+01
SW	1.2E+01
SSW	1.2E+01
S	1.8E+01
SSE	1.4E+01
SE	1.8E+01
ESE	2.6E+01
E	4.7E+01
ENE	2.8E+01
NE	1.7E+01
NNE	1.1E+01

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SUMMARY
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INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

	Distance (m)
Direction	16200
N	1.1E-04
NNW	9.5E-05
NW	1.4E-04
WNW	1.7E-04
W	2.7E-04
WSW	1.4E-04
SW	1.1E-04
SSW	1.1E-04
S	1.6E-04
SSE	1.3E-04
SE	1.6E-04
ESE	2.3E-04
E	4.1E-04
ENE	2.5E-04
NE	1.5E-04
NNE	9.7E-05

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S Y N O P S I S R E P O R T

Non-Radon Individual Assessment
Jul 25, 1994 9:42 am

Facility: 100K Area - Ground Level - Individual Nuclides
Address: Westinghouse Hanford Company
P.O. Box 1970
City: Richland
State: WA Zip: 99352-1970

Effective Dose Equivalent
(mrem/year)

4.66E+01

At This Location: 16200 Meters East

Source Category:
Source Type: Stack
Emission Year: 1994

Comments: 16.2 km E is equivalent to 11.7 km W
Wind data generated at 100N from 1983 to 1991

Dataset Name: 100K - DF
Dataset Date: Jul 25, 1994 9:42 am
Wind File: WNDFILES\JF10010.WND

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SYNOPSIS
Page 1

MAXIMALLY EXPOSED INDIVIDUAL
(RN-222 Working Level Calculations Excluded)

Location Of The Individual: 16200 Meters East
Lifetime Fatal Cancer Risk: 4.11E-04

ORGAN DOSE EQUIVALENT SUMMARY
(RN-222 Working Level Calculations Excluded)

Organ	Dose Equivalent (mrem/y)
GONADS	7.09E+00
BREAST	2.53E+00
R MAR	4.16E+01
LUNGS	1.48E+02
THYROID	2.54E+00
ENDOST	4.96E+02
RMNDR	2.26E+01
EFFEC	4.66E+01

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SYNOPSIS
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RADIONUCLIDE EMISSIONS DURING THE YEAR 1994

Nuclide	Class	Size	Source #1 Ci/y	TOTAL Ci/y
AM-241	W	1.00	1.0E+00	1.0E+00
CE-144	Y	1.00	1.0E+00	1.0E+00
PR-144	Y	1.00	1.0E+00	1.0E+00
CO-60	Y	1.00	1.0E+00	1.0E+00
CS-134	D	1.00	1.0E+00	1.0E+00
CS-137	D	1.00	1.0E+00	1.0E+00
BA-137M	D	1.00	9.5E-01	9.5E-01
H-3	*	0.00	1.0E+00	1.0E+00
K-40	D	1.00	1.0E+00	1.0E+00
MN-54	W	1.00	1.0E+00	1.0E+00
PU-238	Y	1.00	1.0E+00	1.0E+00
PU-239	Y	1.00	1.0E+00	1.0E+00
PU-241	Y	1.00	1.0E+00	1.0E+00
RU-106	Y	1.00	1.0E+00	1.0E+00
RH-106	Y	1.00	1.0E+00	1.0E+00
SB-125	W	1.00	1.0E+00	1.0E+00
TE-125M	W	1.00	2.5E-01	2.5E-01
SR-90	D	1.00	1.0E+00	1.0E+00
Y-90	Y	1.00	1.0E+00	1.0E+00
U-235	Y	1.00	1.0E+00	1.0E+00
TH-231	Y	1.00	1.0E+00	1.0E+00
U-238	Y	1.00	1.0E+00	1.0E+00
TH-234	Y	1.00	1.0E+00	1.0E+00
PA-234	Y	1.00	1.6E-03	1.6E-03
U-234	Y	1.00	1.0E+00	1.0E+00
TH-230	Y	1.00	1.0E+00	1.0E+00
RA-226	W	1.00	1.0E+00	1.0E+00
RN-222	*	0.00	0.0E+00	0.0E+00
PO-218	W	1.00	0.0E+00	0.0E+00
PB-214	D	1.00	0.0E+00	0.0E+00
BI-214	W	1.00	0.0E+00	0.0E+00
PO-214	W	1.00	0.0E+00	0.0E+00
PB-210	D	1.00	1.0E+00	1.0E+00
BI-210	W	1.00	1.0E+00	1.0E+00
PO-210	W	1.00	1.0E+00	1.0E+00

SITE INFORMATION

Temperature: 12 degrees C
Precipitation: 16 cm/y
Mixing Height: 1000 m

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SYNOPSIS
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SOURCE INFORMATION

Source Number: 1

Stack Height (m): 0.00
Diameter (m): 2.50

Plume Rise Pasquill Cat:	A	B	C	D	E	F	G
Fixed (m): (Fixed Rise)	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	1.000	1.000	1.000
Fraction From Assessment Area:	0.000	0.000	0.000
Fraction Imported:	0.000	0.000	0.000

Food Arrays were not generated for this run.
Default Values used.

DISTANCES USED FOR MAXIMUM INDIVIDUAL ASSESSMENT

16200