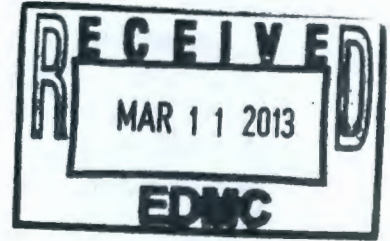


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**AIR MONITORING PLAN FOR  
THE 100-B/C AREA BURIAL GROUNDS  
AND REMAINING SITES  
REMEDIAL ACTION**



**1.0 INTRODUCTION**

Remedial action (i.e., cleanup) of the burial grounds and remaining sites in the 100-B/C Area has the potential to emit radioactive particulates. This activity is being conducted under the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA)* (DOE-RL 2000). Quantification of radioactive emissions, implementing best available radionuclide control technology (BARCT), and air monitoring have been identified as substantive requirements (i.e., applicable or relevant and appropriate requirements) for the remedial action. A BARCT compliance demonstration is determined by the regulatory agency on a case-by-case basis. These substantive requirements are in accordance with *Washington Administrative Code 246-247-040*. This plan presents compliance with those requirements.

**1.1 PLANNED ACTIVITIES**

This remedial action work scope is for the removal and disposal of waste material and associated soil from burial grounds and remaining waste sites located at the 100-B/C Area. Also included is test pitting and trenching to further characterize the buried waste and/or determine the limits of some of the burial grounds and remaining waste sites.

The work scope includes remediation of the following burial grounds in the 100-B/C Area: 118-B-1, 118-C-1, 118-C-2, 118-B-3, 118-B-4, 118-B-5, 118-B-6, 118-B-10, and 600-33. The scope of work also includes remediation of remaining waste sites. According to the Waste Information Data System (WIDS), the only remaining waste sites in the 100-B/C Area that are radioactively contaminated are the following: 100-B-3, 100-C-3, 100-B-5, 100-C-7, 116-C-3, 116-C-6, 116-B-15, 132-B-1, 132-C-1, 132-B-3, 132-C-3, 132-B-4, and 132-B-5. The scope of work also includes remediation of several other remaining waste sites in the 100-B/C Area, but they are not included in this air monitoring plan because according to WIDS no radioactive contamination is associated with them. The non-radioactive waste sites are: 100-B-1, 100-B-10, 120-B-1, 126-B-3, 128-B-2, 128-C-1, 1607-B2, 1607-B7, 1607-B8, 1607-B9, 1607-B10, 1607-B11, 116-B-7, and 128-B-3.

The general strategy for remediation of the 100-B/C burial grounds and remaining sites is to excavate the waste materials and soils contained in the burial grounds, sort out any dangerous waste that may be present, load the nondangerous (but radiologically contaminated) portion of soil and debris into containers, and haul the containers to the Environmental Restoration Disposal Facility (ERDF) for disposal. Dangerous waste that requires treatment will be staged

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within onsite areas approved by the U.S. Environmental Protection Agency and will either be treated and shipped to ERDF, shipped to ERDF for treatment, or shipped offsite to approved treatment and disposal facilities. Debris that exceeds size limits for shipment in ERDF containers or disposal at ERDF will be crushed or torch cut and shipped to ERDF.

Test pitting, trenching, and/or boring may begin before burial ground remediation starts and will continue for the life of the burial ground remediation project. Waste excavated as part of the test pitting/trenching/boring will either be reburied in the burial ground from which it was excavated or hauled to ERDF, depending on the time of the test pitting/trenching/boring with respect to actual remediation. Standard excavation equipment will be used for test pitting/trenching/boring.

The remaining waste sites are composed of two types of sites: remove/treat/and dispose (RTD) sites and confirmatory sampling effort (CSE) sites. RTD sites will be removed, treated (if necessary), and disposed. CSE sites will be sampled by test pitting, trenching, and/or boring and, depending on analytical results, will be left in place or will become RTD sites. For the purposes of this plan, it is assumed that all CSE sites will become RTD sites.

The equipment being used is considered standard equipment for excavation and hauling. The loading of contaminated soil and debris into waste containers may result in soil spilled on the waste containers and/or haul trucks. Haul trucks with loaded containers will enter a survey station where they will be surveyed to detect exterior contamination. A decontamination station will be established to decontaminate containers, haul trucks, and equipment, as required. Waste containers, haul trucks, and/or equipment will be decontaminated by conventional means such as brushing or wiping, or with high efficiency particulate air (HEPA)-filtered vacuum cleaners. The HEPA-filtered vacuum cleaners may also be used to decontaminate other equipment or to pick up other loose contaminated materials, as needed. More aggressive decontamination methods (such as grinding or wet grit blasting) may be used for decontamination if the other methods fail. Decontaminated trucks and containers will then proceed to the container staging area where the transportation subcontractor will pick up the containers for transport to ERDF.

## 2.0 AIRBORNE SOURCE INFORMATION

There is a potential for particulate radioactive airborne emissions to result from the 100-B/C Area burial grounds remediation. The primary radiological isotopes found within the burial grounds include tritium and cobalt-60. The concentrations of isotopes listed in Attachment 1 represent those that were determined to exist in the burial grounds and remaining sites. Other isotopes may also be encountered during remedial actions. However, it is expected that the isotopic concentrations listed in Attachment 1 represent the upper bound of what will actually be found during remedial actions and that the estimates provided here are conservative.

## 2.1 INVENTORY

The radionuclide annual possession quantities and subsequent potential emission calculations for the 100-B/C Area burial grounds and remaining sites are summarized in Attachments 1 and 2, respectively.

The CAP88-PC model was used to determine the annual total effective dose equivalent (TEDE) to the maximally exposed individual (MEI). The calculated potential-to-emit (curies per year) was the input to the computer model, and the model generated the annual unabated dose. The distance to the MEI used in the model was approximately 10 km (6.3 mi) to the west-northwest of the remediation sites. The CAP88-PC model summary and synopsis for burial grounds remediation and remaining sites remediation are presented in BHI Calculation Nos. 0100B-CA-V0095 and 0100B-CA-V0109, respectively (BHI 2001, 2002). The calculated total unabated annual TEDE to the MEI from the 100-B/C Area burial grounds and remaining sites remedial action is  $2.47 \times 10^{-1}$  mrem/yr and  $2.77 \times 10^{-2}$  mrem/yr, respectively, for a total of  $2.52 \times 10^{-1}$  mrem/yr.

## 3.0 BEST AVAILABLE RADIONUCLIDE CONTROL TECHNOLOGY (BARCT)

The following is the BARCT to be implemented during the 100-B/C Area burial grounds and remaining sites remedial action.

### 3.1 APPLICATION OF DUST SUPPRESSANTS

- Water will be applied during excavation, container loading, and backfilling processes to minimize airborne releases.
- Soil fixatives will be applied to any contaminated soils and debris that will be inactive for more than 24 hours.
- Fixatives will be applied to contaminated soils and debris that will be inactive less than 24 hours at the end of work operations, if the sustained wind speed is predicted overnight to be greater than 20 mph, based on the Hanford Meteorological Station morning forecast. This will allow the project enough time, if necessary, to prepare for the application of dust control measures. If a soil fixative has already been applied and the soil will remain undisturbed, further use of fixatives will not be needed. The fixatives or other controls will not be applied when the contaminated soils are frozen, or it is raining, snowing, or other freezing precipitation is falling at the end of work operations.

- An entry will be made in the project logbook when the forecasts predict sustained wind speeds of greater than 20 mph and dust control is to be applied at the end of the work shift.
- The haul trucks will be covered to contain the materials while in transit to ERDF.

#### 4.0 MONITORING

Monitoring activities will consist of establishing near-facility air monitoring stations and continued operations of the four existing thermoluminescent dosimeters (TLDs) in the 100-B/C Area. Three near-facility air monitors and one upwind monitor (Yakima Barricade) will be used for the 100-B/C burial grounds and remaining sites remedial action. The locations of the near-facility air monitors and TLDs are shown in Figure 1. The air monitors will be in locations that are the same or in the close vicinity to the air monitors that were located south of B Avenue to support the 100-B/C pipeline remedial actions beginning in 2001.

Monitors N466, N496, and N497 will be used for burial ground and remaining site excavation activities. The near-facility air monitors/TLDs are the means/methods to measure emissions. The operation of these monitors/TLDs will follow the protocol established for near-field monitors/TLDs. The data from these monitors/TLDs will be included in the annual reports prepared for the Hanford Site.

Air monitor downtime will be minimized. If an air monitor station is out of operation for more than 48 hours during normal work operations (excluding weekends and holidays), the regulatory agencies will be notified. If two or more stations are out of operation for greater than 48 hours during normal work operations, excavation and loading activities shall be temporarily suspended until operation of at least two stations is restored or backup equipment is deployed.

Soil deposition samples (analyzed for  $\gamma$ -emitting radionuclides; plutonium-238, -239, and -240; strontium-90; and uranium) will be taken close to two air monitors (N496 and N497) before, during, and after the burial ground and remaining waste sites remediation. The soil samples will be taken to evaluate the long-term trends in the environmental accumulation of radioactivity. Depending on the relative timing of the 100-B/C Area process effluent pipeline remedial action and the 100-B/C burial grounds and remaining sites remedial action, "during" or "after" soil deposition samples from the pipeline project will be used as the "before" samples for the burial ground/remaining waste sites project.

The vacuum cleaners are equipped with HEPA filters that are considered BARCT for radioactive emissions at the Hanford Site. When the vacuum cleaners are used and emptied, the pounds and activity level will be entered onto the appropriate waste tracking form.

After completion of the burial grounds and remaining sites excavation, and collection of cleanup verification samples, project management will request regulator concurrence for termination of the air monitors.

## 5.0 REFERENCES

BHI, 2001, *Potential to Emit Calculation for the 100-B/C Burial Grounds Remediation*,  
Calculation No. 0100B-CA-V0095, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.


BHI, 2002, *Total Dose Equivalent Calculation for 100-B/C Remaining Site Remediation*,  
Calculation No. 0100B-CA-V0109, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.


*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*, 42 U.S.C.  
601, et seq.

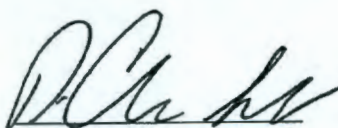
DOE-RL 2000, *Proposed Plan for the 100 Area Burial Grounds Interim Remedial Action*,  
DOE/RL-99-59, Rev. 1, U.S. Department of Energy, Richland Operations Office,  
Richland, Washington.

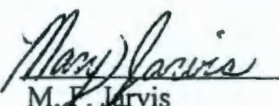
WAC 246-247-040, "Radiation Protection—Air Emissions," *Washington Administrative Code*,  
as amended.

Concurrence:

  
R.S. Acselrod  
Washington State Department of Health  
Date 11/15/02

  
Dennis Faulk  
U.S. Environmental Protection Agency  
Date 11-17-02

  
D. C. Smith  
U.S. Department of Energy,  
Richland Operations Office  
Date 11/1/02

  
M. F. Jarvis  
U.S. Department of Energy  
Richland Operations Office  
Date Nov. 13, 2002

**Total Effective Dose Equivalent from the 100-B/C Burial Grounds Remediation.**

Radionuclide	Annual Possession Quantity <sup>a</sup> (Ci/yr)				Potential to Emit (Ci/yr)					Unabated Total Effective Dose Equivalent to the Maximally Exposed Individual <sup>b</sup> (mrem/yr)
	Debris	Soil	Torch Cutting	HEPA-Filtered Vacuum Cleaners	Debris (1E-6 RF)	Soil (1E-3 RF)	Torch Cutting (1 RF)	HEPA-Filtered Vacuum Cleaners (1 RF)	Total (Ci/yr)	
H-3	6.42E+03	7.13E+02	9.38E-01	1.78E+00	6.42E+03	7.13E+02	9.38E-01	1.78E+00	7.14E+03	2.37E-01
C-14	1.38E+00	1.54E-01	2.02E-04	3.84E-04	1.38E-06	1.54E-04	2.02E-04	3.84E-04	7.42E-04	1.37E-06
Ca-41	1.80E-02	2.00E-03	2.63E-06	4.99E-06	1.80E-08	2.00E-06	2.63E-06	4.99E-06	9.64E-06	6.57E-11
Ni-59	1.44E+00	1.60E-01	2.10E-04	4.00E-04	1.44E-06	1.60E-04	2.10E-04	4.00E-04	7.72E-04	1.88E-07
Co-60	1.27E+02	1.41E+01	1.85E-02	3.52E-02	1.27E-04	1.41E-02	1.85E-02	3.52E-02	6.80E-02	8.88E-03
Ni-63	1.39E+03	1.55E+02	2.03E-01	3.87E-01	1.39E-03	1.55E-01	2.03E-01	3.87E-01	7.47E-01	2.00E-04
Sr-90	3.29E-01	3.66E-02	4.81E-05	1.47E-02	3.29E-07	3.66E-05	4.81E-05	9.14E-05	1.76E-04	1.55E-05
Y-90	3.29E-01	3.66E-02	4.81E-05	1.47E-02	3.29E-07	3.66E-05	4.81E-05	9.14E-05	1.76E-04	3.36E-08
Ag-108m <sup>(c)</sup>	1.15E+01	1.28E+00	1.68E-03	4.40E-01	1.15E-05	1.28E-03	1.68E-03	3.19E-03	6.16E-03	
Ba-133	2.68E-01	2.97E-02	3.91E-05	8.55E-03	2.68E-07	2.97E-05	3.91E-05	7.44E-05	1.43E-04	5.36E-06
Cs-137	4.00E-01	4.45E-02	5.85E-05	2.23E-02	4.00E-07	4.45E-05	5.85E-05	1.11E-04	2.15E-04	6.72E-06
Ba-137m	3.79E-01	4.21E-02	5.53E-05	2.11E-02	3.79E-07	4.21E-05	5.53E-05	1.05E-04	2.03E-04	8.07E-14
Eu-152	1.67E+00	1.85E-01	2.43E-04	6.72E-02	1.67E-06	1.85E-04	2.43E-04	4.63E-04	8.93E-04	1.12E-04
Eu-154	5.30E-01	5.89E-02	7.75E-05	2.95E-03	5.30E-07	5.89E-05	7.75E-05	1.47E-04	2.84E-04	2.87E-05
Pu-239	8.10E-02	9.00E-03	1.18E-05	4.51E-03	8.10E-08	9.00E-06	1.18E-05	2.25E-05	4.34E-05	3.23E-04
Total										2.47E-01

<sup>a</sup>Radionuclide annual possession quantities are presented in ERC Calculation 0100B-CA-V0095, *Potential to Emit Calculation for the 100-B/C Burial Grounds Remediation*, Rev. 0, April 2001.

<sup>b</sup>The annual unabated TEDF to the MEI was determined using the CAP88-PC, Version 2.0 model. The PTE (Ci/yr) was input to the model, and the model generated the annual unabated TEDF. The distance to the MEI for the 100-B/C Burial Ground Remedial Action is 10,164 m west northwest. The CAP88-PC model summary and synopsis are presented in ERC Calculation 0100B-CA-V0095, *Potential to Emit Calculation for the 100-B/C Burial Grounds Remediation*, Rev. 0, April 2001.

<sup>c</sup>Ag-108m is not included in the CAP88-PC database; therefore, no TEDE for Ag-108m was calculated.

RF = release fraction

**Total Effective Dose Equivalent from the 100-B/C Remaining Sites Remediation.**

Radionuclide	Annual Possession Quantity <sup>a</sup> (Ci/yr)			Potential to Emit (Ci/yr)				Unabated Total Effective Dose Equivalent to the Maximally Exposed Individual <sup>b</sup> (mrem/yr)
	Soil	Torch Cutting	HEPA-Filtered Vacuum Cleaners	Soil (1E-3 RF)	Torch Cutting (1 RF)	HEPA-Filtered Vacuum Cleaners (1 RF)	Total (Ci/yr)	
H-3	1.18E-01	0.00E+00	2.94E-04	1.18E-01	0.00E+00	2.94E-04	1.18E-01	3.92E-06
C-14	1.97E-06	0.00E+00	4.93E-09	1.97E-09	0.00E+00	4.93E-09	6.90E-09	1.27E-11
K-40	7.56E-01	0.00E+00	1.89E-03	7.56E-04	0.00E+00	1.89E-03	2.65E-03	2.73E-04
Co-60	2.30E+01	7.29E-02	5.75E-02	2.30E-02	7.29E-02	5.75E-02	1.53E-01	2.00E-02
Ni-63	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sr-90	2.70E-02	9.71E-05	6.76E-05	2.70E-05	9.71E-05	6.76E-05	1.92E-04	1.69E-05
Y-90	2.70E-02	9.71E-05	6.76E-05	2.70E-05	9.71E-05	6.76E-05	1.92E-04	3.71E-08
Cs-134	1.18E-06	0.00E+00	2.96E-09	1.18E-09	0.00E+00	2.96E-09	4.14E-09	2.96E-10
Cs-137	8.73E-01	2.70E-03	2.18E-03	8.73E-04	2.70E-03	2.18E-03	5.76E-03	1.80E-04
Ba-137m	8.26E-01	2.55E-03	2.07E-03	8.26E-04	2.55E-03	2.07E-03	5.44E-03	6.00E-04
Eu-152	1.43E+00	4.45E-03	3.58E-03	1.43E-03	4.45E-03	3.58E-03	9.46E-03	1.18E-03
Eu-154	1.41E+00	4.45E-03	3.53E-03	1.41E-03	4.45E-03	3.53E-03	9.40E-03	9.49E-04
Eu-155	1.42E-02	2.27E-05	3.54E-05	1.42E-05	2.27E-05	3.54E-05	7.22E-05	3.23E-07
Ra-226	6.42E-02	1.07E-04	1.61E-04	6.42E-05	1.07E-04	1.61E-04	3.32E-04	1.36E-04
Th-228	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Th-232	4.75E-02	0.00E+00	1.19E-04	4.75E-05	0.00E+00	1.19E-04	1.66E-04	1.20E-03
U-233/234	3.01E-02	9.06E-05	7.53E-05	3.01E-05	9.06E-05	7.53E-05	1.96E-04	5.56E-04
U-235	1.26E-02	8.90E-06	3.16E-05	1.26E-05	8.90E-06	3.16E-05	5.31E-05	1.41E-04
U-238	2.89E-02	8.19E-05	7.21E-05	2.89E-05	8.19E-05	7.21E-05	1.83E-04	4.57E-04
Pu-239/240	7.30E-04	2.62E-06	1.82E-06	7.30E-07	2.62E-06	1.82E-06	5.17E-06	3.85E-05
Am-241	3.40E-02	5.59E-05	8.50E-05	3.40E-05	5.59E-05	8.50E-05	1.75E-04	2.00E-03
Pu-238	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
<b>Total</b>								<b>2.77E-02</b>

<sup>a</sup>Radionuclide annual possession quantities are presented in ERC Calculation 0100B-CA-V0109, *Total Effective Dose Equivalent Calculation for 100-B/C Remaining Sites Remediation*, Rev. 0, August 2002.

<sup>b</sup>The annual unabated TEDE to the MEI was determined using the CAP88-PC, Version 2.0 model. The PTE (Ci/yr) was input to the model, and the model generated the annual unabated dose. The distance to the MEI for the 100-B/C remaining sites remedial action is 10,164 m west northwest. The CAP88-PC model summary and synopsis are presented in ERC Calculation 0100B-CA-V0109, *Total Effective Dose Equivalent Calculation for 100-B/C Remaining Sites Remediation*, Rev. 0, August 2002.

RF = release fraction

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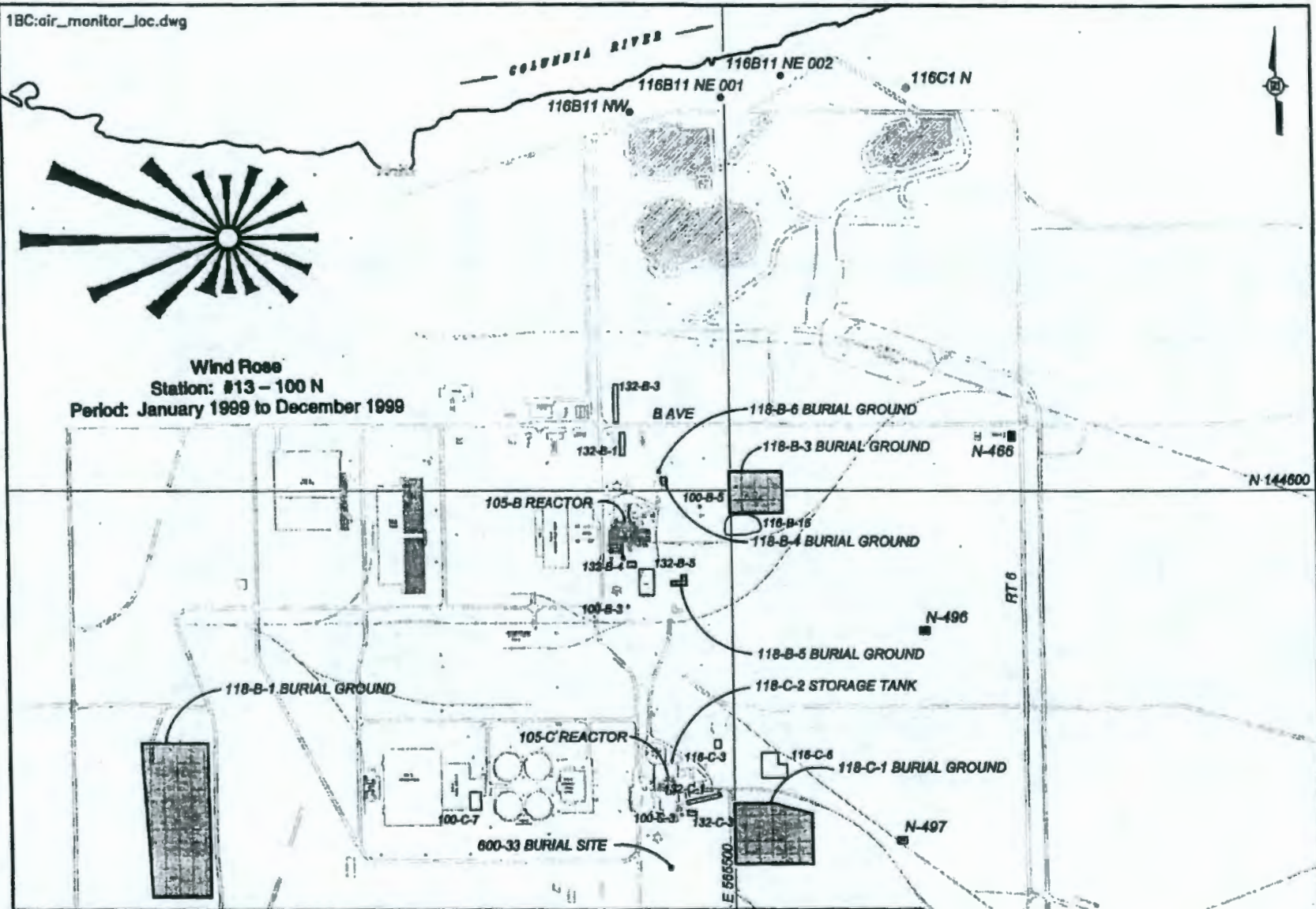
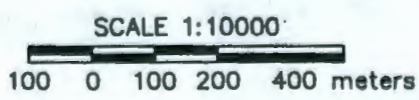


Figure 1. 100-B/C Area Air Monitor and Thermoluminescent Dosimeter Locations

**FIGURE 1**  
**100-B/C AREA**  
**AIR MONITOR & THERMOLUMINESCENT**  
**DOSIMETER LOCATIONS**



**LEGEND**

- AIR MONITORS
- TLD'S



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