CP-60091
Revision 2

Air Monitoring Plan for the ERDF

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

Contractor for the U.S. Department of Energy
under Contract DE-AC06-08RL14788

CH2MHILL
Plateau Remediation Company

P.O. Box 1600
Richland, Washington 99352

Approved for Public Release;
Further Dissemination Unlimited

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Contents

1 Introduction 1

1.1 Operational Activities 1

2 Airborne Source Information 2

2.1 Description of Work Activities and Source of Potential Emissions 2

2.1.1 Release Fractions 3

2.1.2 Inventory and Potential-to-Emit 3

2.1.3 Results 7

2.1.4 Annual Verification Total Effective Dose Equivalent Calculation 7

3 Best Available Radionuclide Control Technology 7

3.1 Dust Control 7

3.2 Open Working Face 8

3.3 Place-and-Cover Technique 8

3.4 Additional Evaluation 8

3.5 Routine Inspections 8

4 Monitoring 8

5 References 11

Figures

Figure 1. Air Monitoring Stations 9

Figure 2. ERDF Wind Rose 10

Table

Table 1. Maximum Annual Inventory and PTE 4

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Terms

AMP	air monitoring plan
BARCT	best available radionuclide control technology
CAP88	*Clean Air Act Assessment Package-1988*
EPA	U.S. Environmental Protection Agency
ERDF	Environmental Restoration Disposal Facility
HEPA	high-efficiency particulate air
MEI	maximally exposed individual
PRC-WMIS	Plateau Remediation Contractor Waste Management Information System
PTE	potential-to-emit
RF	release fraction
ROD	record of decision
TEDE	total effective dose equivalent

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1 Introduction

Operation of the Environmental Restoration Disposal Facility (ERDF) has the potential-to-emit (PTE) radioactive contaminants. ERDF is authorized to operate under a *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* Record of Decision (ROD) (EPA, 1995, *Record of Decision: U.S. DOE Hanford Environmental Restoration Disposal Facility, Hanford Site, Benton County, Washington*).

Quantification of emissions, implementing control technology, and air monitoring have been identified as substantive requirements (i.e., applicable or relevant and appropriate requirements) for operation of ERDF. This plan discusses how the substantive portions of these requirements are implemented.

Best available radionuclide control technology (BARCT) compliance demonstration is determined by the regulatory agency on a case-by-case basis. These substantive requirements are according to WAC 246-247-040(3), "Radiation Protection—Air Emissions," "General Standards." The original ROD (EPA, 1995) required that "air monitoring will be accomplished by placement at ERDF of real-time air monitors for radioactive contaminants and air monitoring stations for hazardous and radioactive constituents to detect any offsite migration of contaminants." However, when this requirement was restated in the ROD Amendment of 1997 (EPA/AMD/R10-97/101, *Record of Decision Amendment: U.S. Department of Energy Environmental Restoration Disposal Facility Hanford Site – 200 Area Benton County, Washington*), a statement was added that "the current air monitoring system satisfies this requirement." Thus, to reiterate and clarify this requirement, consistent with the Hanford Site practice for monitoring for diffuse and fugitive radionuclide air emissions, this air monitoring plan (AMP) requires continuously operated particulate air monitoring stations that are analyzed for radionuclides.

40 CFR 61.92, "National Emission Standards for Hazardous Air Pollutants," "Standard," sets limits on radionuclide emissions to the ambient air from U.S. Department of Energy facilities. Radionuclide emissions are not to exceed those amounts that would cause any member of the public to receive in any year an effective dose equivalent of 10 mrem/yr. Compliance with this standard is demonstrated on a sitewide basis and is documented annually in the radionuclide air emissions report for the Hanford Site.

In addition, WAC 173-400, "General Regulations for Air Pollution Sources" [with emphasis on WAC 173-400-040, (2), (4), "General Standards for Maximum Emissions," and (9)] was identified as an applicable or relevant and appropriate requirement in the 1995 ERDF ROD (EPA, 1995). Controls to mitigate visible emissions, fugitive emissions, and fugitive dust are addressed in this AMP.

1.1 Operational Activities

ERDF covers an area of approximately 4.1 km^2 (1.6 m^2) in the center of the Hanford Site, southeast of the 200 West Area. ERDF is the receiving and disposal facility for waste generated from response actions where disposal is the selected cleanup remedy. Only wastes that originate in the Hanford Site will be placed in ERDF. Waste is transported to ERDF and is then placed into disposal cells. At the end of each day of operations, a fixative or operational cover will be applied to active areas of the landfill where waste has been placed. Some treatment activities may also take place at ERDF as required to meet ERDF's waste acceptance criteria, as identified in the applicable *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* decision document that applies to the remedial or removal action. Waste may also be staged at ERDF pending further treatment prior to disposal or shipment offsite. Some wastes are treated prior to being transported to ERDF.

2 Airborne Source Information

There is a potential for particulate radioactive airborne emissions to result from the operation of ERDF.

2.1 Description of Work Activities and Source of Potential Emissions

The principal activity performed is receipt and disposal of bulk contaminated soil and nonsoil debris, such as concrete, neutron irradiated metal, and rubble. ERDF also receives radioactive waste that is contained or packaged. Some of the waste may require treatment prior to disposal (e.g., grouting void spaces or encapsulating waste) in order to meet waste acceptance criteria. The waste may also be located in a staging area at ERDF or longer term storage while it awaits further treatment or shipment offsite.

Bulk soil and debris are transported to ERDF in covered containers or packaging and then placed into the currently operating disposal cell. At the end of each day of operations, a fixative or operational cover is applied to the active area of the landfill where the waste has been placed. The contaminated soil has the potential to be dispersible and constitutes the major source for potential offsite emissions at ERDF. The contamination associated with the nonsoil debris is in a more nondispersible form and has less potential for offsite emissions.

Waste may be staged at ERDF and includes all waste types and forms including contained waste, bulk waste, drummed waste, and waste in overpacks, etc. Air from overpack containers may be vented with a high-efficiency particulate air (HEPA) filter. Waste containers being staged may be subject to an annual inspection that may consist of opening overpack containers to evaluate the inner drum integrity. If the waste requires grouting or stabilization prior to disposal, then the containers may be opened to perform the activity or the grout may be injected through a port in the container. If an injection port is used for contamination control purposes, air is vented through a second port in the container, which is equipped with a HEPA filter. Radioactive waste received at ERDF is packaged, fixed, or encapsulated prior to shipment. Therefore, during transportation or awaiting disposal, waste has no potential for offsite emissions unless subjected to additional treatment.

Dust suppression will be used based on the extent of radiological contamination of the specific waste stream being placed into the ERDF cell and will primarily be managed by the Radiological Controls organization. The Radiological Controls organization performs radiological surveys, takes smears to assess removable contamination levels, and utilizes air monitors to ensure safe worker conditions and control the spread of contamination.

Dust-suppression techniques include the following:

- Application of water in the form of a misting nozzle, water truck, water cannon, or fire hose.
- After placement of highly contaminated waste into the ERDF cell, clean or low contamination soil may be placed over the highly contaminated waste. This is referred to as the "place-and-cover" technique.
  - When the waste stream includes nonsoil items (e.g., debris, filters, equipment), the debris may require additional downsizing and crushing within the ERDF cell prior to placing a soil cover over the waste stream. This is referred to as the "place, crush, and cover" technique.

- Surface fixatives and surfactants (e.g., Posi-Shell®) may be applied to soil surfaces to mitigate airborne dust.
- Heavy equipment that operates within the ERDF cell may be washed off with water to ensure contamination is not spread outside of the ERDF cell.
- Water will be placed on active soil surfaces and ramps within the ERDF cell to mitigate airborne dust from the operation of heavy equipment. Inactive areas within the ERDF cell are covered with clean soil or surface fixatives and surfactants (e.g., Posi-Shell) to mitigate airborne dust.

2.1.1 Release Fractions

A release fraction (RF) of 1E-03 (WAC 246-247-030, "Definitions") will be applied to most of the ERDF radiological waste given that the majority of radiological waste material disposed is in the form of particulate, with exceptions noted in the following paragraphs. This RF will be used for waste forms and activities including bulk soil, neutron irradiated items (other than inventories assigned as activated materials), fixed contamination, volumetrically contaminated items, contaminated building debris, containerized waste, treated waste, and for waste treatment activities.

As discussed in ECF-ERDF-17-0197, *Total Effective Dose Calculation for the ERDF Air Monitoring Plan*, when activated inventories (i.e., C-14, Co-60, Ni-59, Ni-63, Nb-94) in the Plateau Remediation Contractor Waste Management Information System (PRC-WMIS) are present, they are assigned an RF of 1E-06 consistent with WAC 246-247 for solid material forms.

The form of tritium (H-3) is primarily in the form of tritiated water and present in the form of moisture within soil. One-half of the inventory will be assigned an RF of 1 (consistent with a gaseous form) and one-half of the inventory will conservatively be assigned an RF consistent with the remainder of the inventory (an RF of 1E-03). Of the tritium that may be released, a gaseous form was assigned to the inventory within the *Clean Air Act Assessment Package-1988* (CAP88) code. Kr-85, which technically can be found in the gaseous form at standard ambient temperatures, will also apply the same RF proportions.

2.1.2 Inventory and Potential-to-Emit

Table 1 of ECF-ERDF-17-0197 shows the actual inventories disposed at ERDF by calendar year from the beginning of ERDF operations in 1996 through the end of April 2018. The inventory is based upon characterization of actual waste receipts as reported by PRC-WMIS. PRC-WMIS is an automated waste and data management system with the generation and routing of waste-related forms consolidated into an integrated and retrievable format. The inventory and activities include the following:

- Bulk soil
- Neutron irradiated items
- Contaminated building rubble
- Containerized or packaged waste
- Waste treatment activities
- Grouted or stabilized waste packages

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To create a bounding inventory for waste disposed within ERDF in future years, the maximum inventory by nuclide and by year was taken and shown in the column titled "Max Inventory (Ci)" in Table 1 of ECF-ERDF-17-0197. The maximum year for each radionuclide was used as the basis within ECF-ERDF-17-0197 to account for potential future increases in waste disposed to ERDF.

The inventory and total effective dose equivalent (TEDE) calculation (ECF-ERDF-17-0197) is based on total curies and not volume disposed. Therefore, the waste volumes and waste forms may (and will) vary from year to year.

It should be noted that the nuclide inventory present is believed to include the majority of nuclides present in all waste that ERDF accepts. Other nuclides may be present, but the nuclides included represent the majority of inventory and also contribute the most potential dose to the offsite receptor.

The PTE associated with staged waste awaiting disposal or treatment will be accounted for once it is placed into the ERDF cell and the radiological inventory is placed into PRC-WMIS. The PTE are the radiological materials available for release. Table 1 shows the maximum annual ERDF inventory and PTE.

Table 1. Maximum Annual Inventory and PTE

Isotope	Maximum Annual Inventory (Ci)	Annual PTE (Ci/yr)	PTE (Ci/yr) Sum
Ac-227	5.608E-03	5.608E-06	--
Ag-108m	4.288E+02	4.288E-01	--
Am-241	3.103E+02	3.103E-01	--
Am-242m	5.948E-02	5.948E-05	--
cAm-243	4.400E-01	4.400E-04	--
Ba-133	6.632E+00	6.632E-03	--
Ba-137m	6.565E+03	6.565E+00	--
Be-7	2.756E-04	2.756E-07	--
Bi-207	5.493E-05	5.493E-08	--
C-14	3.289E+02	3.289E-01	7.682E-01
C-14 ACTIV. METAL	3.698E+01	3.698E-05	
C-14 I	4.393E+02	4.393E-01	
Ca-41	7.167E+00	7.167E-03	--
Cd-113m	2.779E+00	2.779E-03	--
Ce-144	3.948E-03	3.948E-06	--
Cf-249	8.867E-04	8.867E-07	--
Cf-252	1.573E-04	1.573E-07	--
Cl-36	3.719E-05	3.719E-08	--
Cm-242	1.456E+00	1.456E-03	--
Cm-243	1.637E+00	1.637E-03	--
Cm-244	2.563E+00	2.563E-03	--
Cm-245	1.333E-06	1.333E-09	--

Table 1. Maximum Annual Inventory and PTE

Isotope	Maximum Annual Inventory (Ci)	Annual PTE (Ci/yr)	PTE (Ci/yr) Sum
Cm-246	5.887E-09	5.887E-12	--
Cm-247	2.805E-16	2.805E-19	--
Cm-248	2.914E-17	2.914E-20	--
Co-58	4.139E-01	4.139E-04	--
Co-60	2.255E+03	2.255E+00	2.255E+00
Co-60 ACTIV. METAL	1.406E-01	1.406E-07	
Cs-134	8.166E+00	8.166E-03	--
Cs-135	2.406E-01	2.406E-04	--
Cs-137	6.940E+03	6.940E+00	--
Eu-150	8.447E-03	8.447E-06	--
Eu-152	1.684E+03	1.684E+00	--
Eu-154	3.868E+02	3.868E-01	--
Eu-155	7.843E+01	7.843E-02	--
Fe-55	1.302E+01	1.302E-02	--
Fe-59	2.475E-03	2.475E-06	--
H-3	1.720E+04	8.609E+03	--
I-129	3.006E-02	3.006E-05	--
K-40	1.051E+02	1.051E-01	--
Kr-85	3.885E+00	1.944E+00	--
Mn-54	1.096E-01	1.096E-04	--
Mo-93	2.320E+00	2.320E-03	--
Na-22	1.324E-02	1.324E-05	--
Nb-93m	1.883E+01	1.883E-02	--
Nb-94	2.206E+00	2.206E-03	2.208E-03
Nb-94 ACTIV. METAL	2.032E+00	2.032E-06	
Ni-59	1.111E+02	1.111E-01	1.118E-01
Ni-59 ACTIV. METAL	7.414E+02	7.414E-04	
Ni-63	1.274E+04	1.274E+01	1.275E+01
Ni-63 ACTIV. METAL	6.857E+03	6.857E-03	
Np-237	1.571E-01	1.571E-04	--
Pa-231	9.213E-04	9.213E-07	--
Pb-210	6.368E-01	6.368E-04	--
Pd-107	1.705E-02	1.705E-05	--
Pm-147	1.196E+02	1.196E-01	--
Po-209	8.447E-03	8.447E-06	--

Table 1. Maximum Annual Inventory and PTE

Isotope	Maximum Annual Inventory (Ci)	Annual PTE (Ci/yr)	PTE (Ci/yr) Sum
Pu-238	2.060E+01	2.060E-02	--
Pu-239	1.266E+02	1.266E-01	--
Pu-240	6.212E+01	6.212E-02	--
Pu-241	2.811E+03	2.811E+00	--
Pu-242	8.074E-01	8.074E-04	--
Pu-244	2.590E-08	2.590E-11	--
Ra-226	8.049E+00	8.049E-03	--
Ra-228	3.342E+00	3.342E-03	--
Re-187	1.407E-07	1.407E-10	--
Ru-103	2.216E-03	2.216E-06	--
Ru-106	1.882E-02	1.882E-05	--
Sb-125	4.925E+01	4.925E-02	--
Se-79	5.955E-02	5.955E-05	--
Sm-151	3.327E+02	3.327E-01	--
Sn-113	2.173E-03	2.173E-06	--
Sn-121m	1.812E+01	1.812E-02	--
Sn-126	1.262E-01	1.262E-04	--
Sr-90	5.190E+03	5.190E+00	--
Tc-99	1.563E+01	1.563E-02	--
Th-228	3.311E+00	3.311E-03	--
Th-229	2.325E-01	2.325E-04	--
Th-230	1.930E-01	1.930E-04	--
Th-232	1.325E+01	1.325E-02	--
Th-234	1.430E-08	1.430E-11	--
Ti-44	2.516E-05	2.516E-08	--
U-232	1.335E-03	1.335E-06	--
U-233	3.301E+01	3.301E-02	--
U-234	8.269E+01	8.269E-02	--
U-235	1.276E+01	1.276E-02	--
U-236	6.418E-01	6.418E-04	--
U-238	1.945E+02	1.945E-01	--
Y-90	5.190E+03	5.190E+00	--
Zn-65	1.154E-03	1.154E-06	--
Zr-93	2.736E+01	2.736E-02	--

PTE = potential-to-emit

2.1.3 Results

The CAP88 model (Version 4) was used to calculate the potential unabated TEDE to the maximally exposed individual (MEI) for ERDF operations using the maximum annual inventory multiplied by the appropriate RF. The result was an annual dose of 6.63 mrem/yr, and the MEI was determined to be located at the Laser Interferometer Gravitational Wave Observatory, which is located 12.52 km (7.8 mi) in the east-southeast direction. Run conservatively, the model assumes that the MEI consumes food that is produced 100% locally. This is very conservative, given food is not produced on the Hanford Site.

The assumptions, calculations, and CAP88 model summary and synopsis are presented in the TEDE calculation (ECF-ERDF-17-0197).

2.1.4 Annual Verification Total Effective Dose Equivalent Calculation

An annual (calendar year) TEDE calculation will be developed to document that the actual ERDF inventory and activities from the prior year were within the TEDE (shown in Section 2.1.3) of the AMP. The actual radiological inventory will be acquired from PRC-WMIS.

HEPA filter vacuum logs will be evaluated. The radiological inventory will be estimated if readings above background are present. An RF of 1E-03 will be applied to this inventory.

Waste that has been stabilized (i.e., stabilized, immobilized, or filled with concrete or grout) prior to being received at ERDF will apply either an RF of 1E-06 (consistent with the solid form from WAC 246-247-030) or assume no PTE if completely encapsulated.

Given Hanford Site map boundary changes, the TEDE will be calculated based on the most current onsite and offsite hypothetical MEIs. The most updated version of CAP88 endorsed by the U.S. Environmental Protection Agency (EPA) should be used.

3 Best Available Radionuclide Control Technology

Controls to mitigate radiological air emissions from ERDF operations are discussed in the following sections.

3.1 Dust Control

Water or fixative will be applied to active waste facility areas to control dust emissions. Waste arrives at ERDF with residual moisture from dust-suppression activities at the waste generation sites. In-trench dust control will be accomplished by using water sprays during waste placement and compaction operations as necessary. By the end of each day of operations, a fixative and/or operational cover will be applied to active areas of the landfill where waste has been placed or where a previously placed fixative has become ineffective. If unusual circumstances arise that preclude end-of-day application of fixatives, they will be applied at the earliest opportunity. Waste is placed in approximately 4.6 to 7.6 m (15 to 25 ft) thick lifts; the waste lifts will be covered with clean fill whenever the waste reaches a finished gradient configuration. The clean fill is required to maintain operating surfaces. The combination of this cover and the use of dust-suppression techniques will prevent wind erosion and resulting resuspension of contaminated soils.

Standard operating ERDF procedures will be relied upon for stopping work during inclement weather, which primarily consists of high wind conditions.

3.2 Open Working Face

As required in ERDF-00012, *Final Hazard Categorization for the Environmental Restoration Disposal Facility*, the surface area of unprotected waste (i.e., noncontainerized waste that has not been covered with clean fill or immobilized with a fixative agent and is subject to wind dispersal) within the disposal cells, including bulk contaminated soil in open stockpiles, shall be controlled to less than 18,581 m^2 (200,000 ft^2). The average open working face will be estimated and documented for each day unprotected waste is disposed.

HEPA filters will be utilized wherever necessary to help control radioactive air emissions during grouting of closed waste containers and on vacuums. HEPA filters are considered BARCT for radioactive emissions at the Hanford Site.

HEPA filters (e.g., NucFil®) will be utilized on some of the drums or closed containers to control the potential for radioactive air emissions. These filters may also be used if other vented containers are staged at ERDF.

3.3 Place-and-Cover Technique

Some waste forms may require use of the place-and-cover technique to ensure the waste packaging remains intact throughout the disposal process, preventing any airborne release.

3.4 Additional Evaluation

Waste streams that comply with ERDF waste acceptance criteria but do not meet the supplemental criteria (ERDF-00003, *Supplemental Waste Acceptance Criteria for the Environmental Restoration Disposal Facility*) for radiological contamination limits will be evaluated on a case-by-case basis for additional controls. Prior to packaging and shipment to ERDF, hot cells or vessels may require grouting, soils and debris may require application of fixatives, and containerized waste may require installation of HEPA filters.

3.5 Routine Inspections

Routine inspections will be performed confirming fixatives or daily operating cover have been applied to exposed working surfaces and staging pile areas, when applicable, where waste has been placed.

4 Monitoring

Consistent with the Hanford Site practice for monitoring for diffuse and fugitive radionuclide air emissions, this AMP requires continuously operated particulate air monitoring stations that are analyzed for radionuclides at times when waste disposal operations are underway. Three air monitors are located downwind and two monitors are located upwind to monitor radioactive air emissions from ERDF. Figure 1 shows the locations and air monitor identification numbers for all of the upwind and downwind air monitors. Figure 1 also shows the thermoluminescent dosimeter locations and identification numbers present on all three downwind monitors. The air monitors will remain in their existing locations until construction activities require them to be relocated to new positions.

® NucFil is a registered trademark of NucFil, LLC dba NFT, Golden, Colorado.

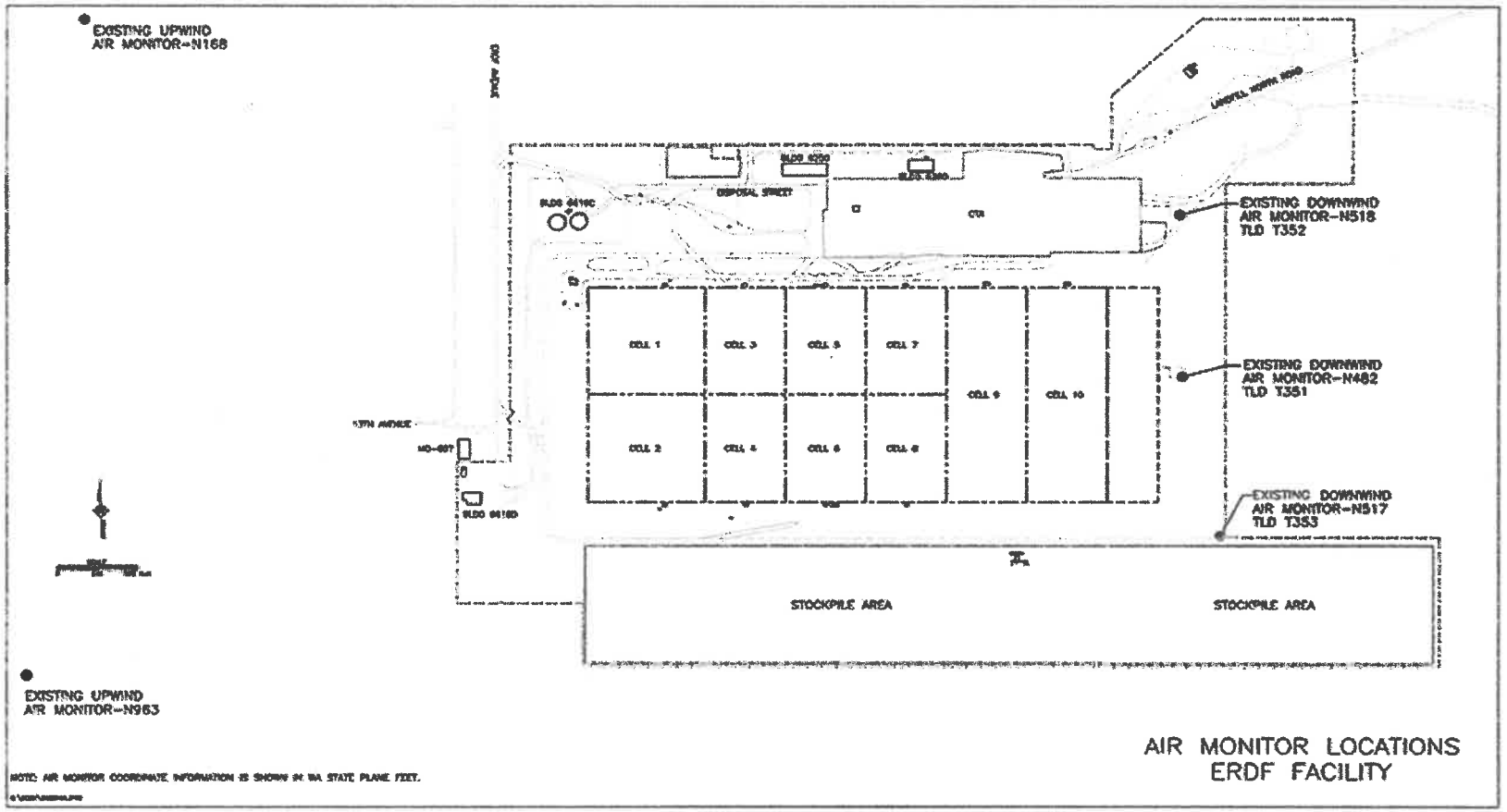

Figure 1. Air Monitoring Stations

Figure 2 shows the wind rose for ERDF. Weather data were obtained from the nearby Hanford Meteorological Station, Station #21, at a height of 10 m (32.8 ft), and used historical wind data from 2004 through 2013. Downtime of the air monitoring stations will be minimized. If one downwind near-facility air monitor is shut down for more than 48 hours during normal operations (e.g., Monday, 6 a.m. through Thursday, 4:30 p.m.), the regulatory agencies will be notified. If more than one downwind near-facility air monitor is shut down for more than 48 hours during normal work operations, contaminated material-handling operations will be suspended until at least two of the downwind monitors are returned to service. Excluded from normal work operations are weekends and contractor-designated holidays. Handling or operations of noncontaminated material is excluded from monitoring requirements.

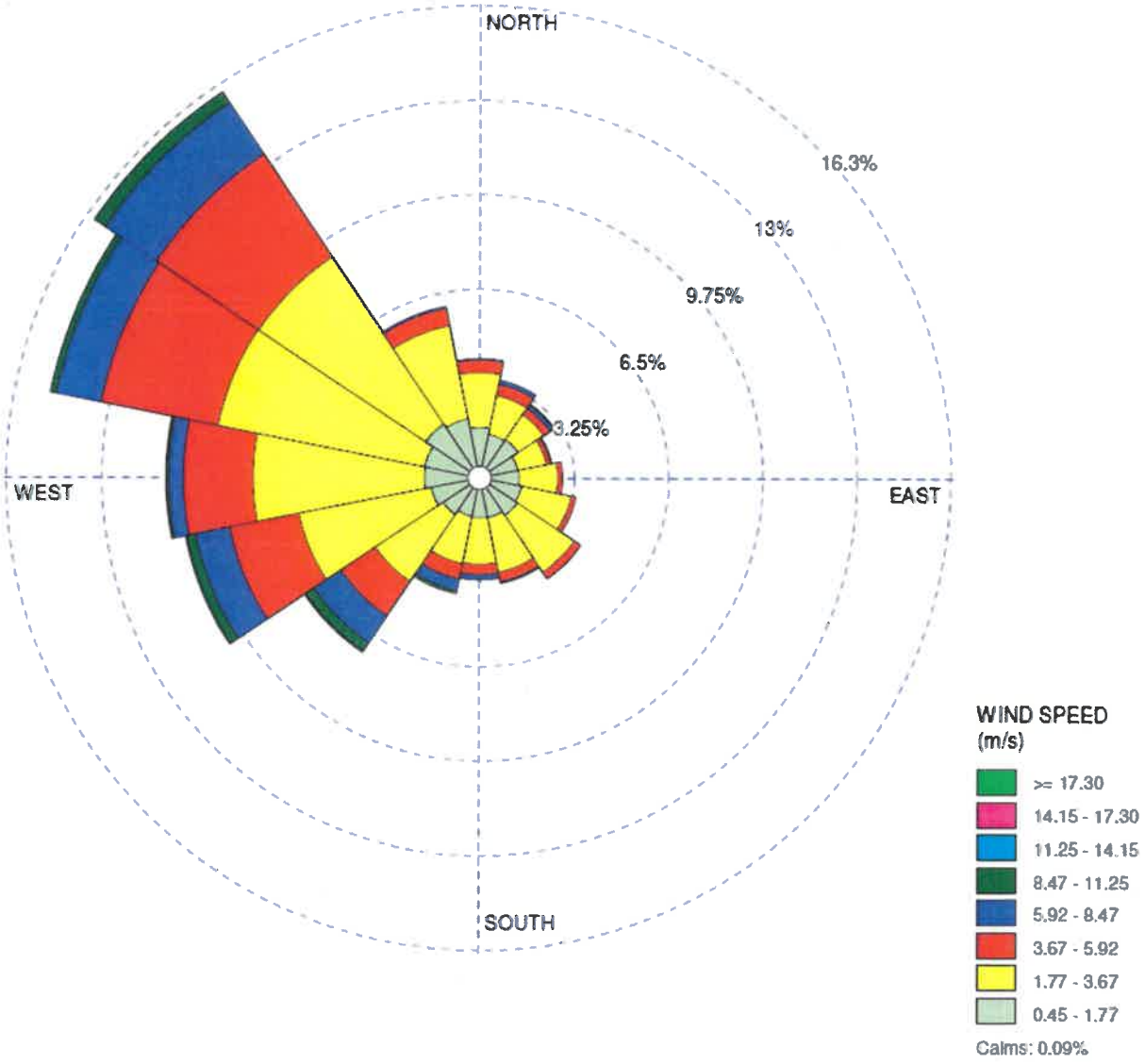

Figure 2. ERDF Wind Rose

In certain cases (i.e., during an electrical outage), air monitors may need to be powered by a portable generator. In these instances, air monitors will be powered during contaminated material-handling activities, but would not be powered when contaminated material-handling is completed and after normal work hours.

The downwind air monitors are used to verify that emissions from the operation of ERDF are low. The operation of these air monitoring stations and thermoluminescent dosimeters, sample collection, and analysis will follow the protocol and procedures established for the existing near-facility environmental monitoring program for the Hanford Site. The air samples are collected every 2 weeks and are analyzed for total alpha and total beta. The samples are then composited every 6 months for further analysis. The soil deposition and composite air samples are analyzed for strontium-90, isotopic plutonium, isotopic uranium, and gamma energy analysis.

Downwind composite sample analytical results that are greater than 10% of Appendix E, Table 2, "Concentration Levels for Environmental Compliance," in 40 CFR 61 will be investigated and EPA will be informed.

The exhaust port from HEPA-filtered vacuums will be monitored on a routine basis (e.g., smear survey) for potential radionuclide releases and the results recorded (e.g., post-survey results negative) during vacuuming operations. Any positive survey results will require appropriate maintenance of the unit to ensure that continued releases do not occur. Records of routine monitoring and necessary maintenance will be provided to EPA upon request.

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