U.S. Department of Energy

Radionuclide Air Emissions Annual Report

Calendar Year 2002

Rocky Flats Environmental Technology Site

U.S. Department of Energy

Radionuclide Air Emissions Annual Report for Calendar Year 2002

Prepared in accordance with
40 CFR 61, Subpart H
and
CAQCC Regulation No. 8, Part A, Subpart H

Site Name: Rocky Flats Environmental Technology Site

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EXECUTIVE SUMMARY

As required by Title 40 of the Code of Federal Regulations (CFR), Part 61, Subpart H, and Colorado Air Quality Control Commission Regulation No. 8, Part A, Subpart H, the airborne radiation dose to the public from the Rocky Flats Environmental Technology Site (Site) is determined annually and reported to the U.S. Environmental Protection Agency (EPA) and the Colorado Department of Public Health and Environment (CDPHE). These regulations limit the air pathway dose from Site activities to any member of the public to an annual effective dose equivalent (EDE) of 10 millirem (mrem). The Site was in compliance with the 10-mrem standard during 2002.

To provide context for the 10-mrem annual limitation standard, the average annual EDE for residents of the Denver area from **all** sources of radiation is approximately 420 mrem. Over 80% of this average annual EDE is due to natural background radiation (Roberts, 1998). The health risk associated with 1 mrem of EDE from naturally occurring sources of background radiation (such as uranium or thorium in rock or soil, cosmic rays, and radon emitted from soil or bedrock) is the same as that produced from anthropogenic sources of radiation (such as Site activities or medical x-rays).

Compliance with the 10-mrem standard was determined by comparing environmental radionuclide air concentration measurements at the critical receptor location with the "Concentration Levels for Environmental Compliance" listed in Table 2 of Appendix E to 40 CFR 61. Compliance is demonstrated when each measured radionuclide air concentration is less than its corresponding compliance level in Table 2 and when the fractional sum of all radionuclides is less than 1. For 2002, each measured radionuclide air concentration was less than 1% of the corresponding concentration level for environmental compliance and the fractional sum of all radionuclides was less than 2% of the allowable level at the sampler with the highest fractional sum (the critical receptor). The highest fractional sum measured in 2002 corresponds to an annual dose of 0.156 mrem or 1.56% of the 10-mrem standard.

Airborne radionuclides appear to have been dominated by naturally occurring uranium isotopes in 2002. For example, at the critical receptor, uranium isotopes characteristic of naturally occurring uranium contributed more than 92% of the fractional sum. In addition, the location where the highest total radionuclide levels were measured in 2002 (northwest of the Site) was influenced by off-Site activities that generated dust, such as traffic, sand and gravel removal operations, or quarrying operations. These patterns are consistent with sampling results from 1997, 1998, 1999, 2000, and 2001.

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ABBREVIATIONS AND ACRONYMS

Am	Americium
ANSI	American National Standards Institute
Bq	Becquerel(s)
CAP88-PC	Clean Air Act Assessment Package-1988
CAQCC	Colorado Air Quality Control Commission
CDPHE	Colorado Department of Public Health and Environment
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
Ci	Curie(s)
Ci/m^3	Curies per cubic meter
Ci/yr	Curies per year
cm	Centimeter(s)
cm^2	Square centimeter(s)
DOE	U.S. Department Of Energy
dpm	Disintigrations per minute
DRCOG	Denver Regional Council of Governments
EDE	Effective dose equivalent
EIS	Effluent Information System
EPA	U.S. Environmental Protection Agency
HEPA	High efficiency particulate air (filter)
I&M	Inspection and maintenance
km	Kilometer(s)
km^2	Square kilometer(s)
l	Liter
m	Meter(s)
m^2	Square meter(s)
m^3	Cubic meters(s)
m^3/s	Cubic meters per second
mrem	Millirem(s)
m/s	Meters per second
mSv	MilliSievert(s)
ODIS	Off-Site Discharge Information System
Pu	Plutonium
RAAMP	Radioactive Ambient Air Monitoring Program
RCRA	Resource Conservation and Recovery Act
rem	Reference man
RFCA	Rocky Flats Cleanup Agreement
RFETS	Rocky Flats Environmental Technology Site
RFFO	Rocky Flats Field Office
Site	Rocky Flats Environmental Technology Site
SNM	Special nuclear material
Sv	Sievert(s)
TRU	Transuranic
TRM	Mixed TRU (waste)

U	Uranium
USC	United States Code
WIPP	Waste Isolation Pilot Plant
°C	Degrees Celsius
µCi	Microcurie(s)

1.0 INTRODUCTION

The Rocky Flats Environmental Technology Site (RFETS or Site) is subject to *National Emission Standards for Emissions of Radionuclides Other Than Radon from Department of Energy Facilities* (Title 40 of the Code of Federal Regulations [CFR], Part 61, Subpart H). Regulation 40 CFR 61, Subpart H, applies to operations at any facility owned or operated by the U.S. Department of Energy (DOE) that emits radionuclides (other than radon-222 and radon-220) into the air. The standard requires that emissions of radionuclides to the ambient air from the Site not exceed those amounts that would cause any member of the public to receive in any year an effective dose equivalent (EDE) of 10 millirem (mrem) (0.1 milliSieverts [mSv]). Colorado has incorporated 40 CFR 61, Subpart H, by reference as Colorado Air Quality Control Commission (CAQCC) Regulation No. 8, Part A, Subpart H.

Regulation 40 CFR 61, Subpart H, Section 61.94, requires the Site to demonstrate compliance with the standard for the previous calendar year and to submit this information, along with other data, to the U.S. Environmental Protection Agency (EPA) in an annual report (CAQCC Regulation No. 8, Part A, Subpart H, requires submittal to the Colorado Department of Public Health and Environment [CDPHE]). This report fulfills the reporting requirements of 40 CFR 61.94 and CAQCC Regulation No. 8, Part A, Section 61.94, for the 2002 calendar year.

In 1997, DOE filed an application with EPA and CDPHE requesting approval of an alternative compliance demonstration method for 40 CFR 61, Subpart H (DOE, 1997). The alternative method is based on environmental measurements of radionuclide air concentrations at critical receptor locations, rather than the dispersion modeling approach outlined in the regulation itself. In cases where nonpoint sources of emissions are the primary contributors to dose, as has been the case at the Site since before 1995, such an alternative method based on environmental measurements is recommended by EPA (EPA, 1991).

The alternative compliance demonstration method was approved by CDPHE and EPA. The compliance sampling network, which consists of 14 samplers located around the perimeter of the Site, became fully operational in 1999. The samplers are part of the Site's Radioactive Ambient Air Monitoring Program (RAAMP) network. Compliance has been determined using the alternative method for this annual report.
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2.0 FACILITY INFORMATION

This section describes the Rocky Flats Environmental Technology Site, lists the radioactive materials used at the Site, and describes the handling and processing that the radioactive materials undergo. New construction or modifications in calendar year 2002 for which construction approval and startup notification were waived per 40 CFR 61.96 are also identified in this section. Construction approval and startup notification were not required for any new construction or modification in 2002.

2.1 Site Description

The Rocky Flats Environmental Technology Site is operated by Kaiser-Hill Company, L.L.C., with oversight by the Rocky Flats Field Office (RFFO) of the U.S. Department of Energy. Prior to 1989, the Site fabricated nuclear weapons components from plutonium, uranium, beryllium, and stainless steel. Production activities included metal fabrication and assembly, chemical recovery and purification of process-produced transuranic (TRU) radionuclides, and related quality control functions. Plutonium weapons operations were curtailed at the Site in 1989 due to safety concerns, and in February 1992, the Site's weapons production mission was discontinued. The Site is now undergoing decommissioning and cleanup, and is moving toward final closure.

The Site occupies an area of 26.5 square kilometers (km^2) in northern Jefferson County, Colorado, about 25.7 kilometers (km) northwest of Denver. The Site is located at approximately 1,829 meters (m) above mean sea level on the eastern edge of a geological bench known locally as Rocky Flats. This bench, about 8.1 km wide in an east-west direction, flanks the eastern edge of the Rocky Mountains.

Over 2.9 million people live within 80 km of the Site. Adjacent land use is a mixture of agriculture, open space, industry, and residential housing. Surrounding communities include the city of Golden to the south of the Site; the cities of Arvada, Broomfield, and Westminster to the east; and the city of Boulder to the north. An area map is shown in Figure 2-1.

The former production facilities are located near the center of the Site. The remaining Site area contains support facilities and serves as a buffer zone for former production facilities. A map of the Site is shown in Figure 2-2; a simplified map of the central portion of the Site (the "industrial area") showing the location of the former production facilities can be seen in Figure 2-3.

The central portion of the Site, which houses the former production facilities, can be roughly divided into halves. The northern half of the central area historically housed plutonium processing operations. The rest of the industrial area (south side) housed uranium, beryllium, and stainless steel operations. A portion of the northern half of the industrial area is surrounded by a security perimeter.

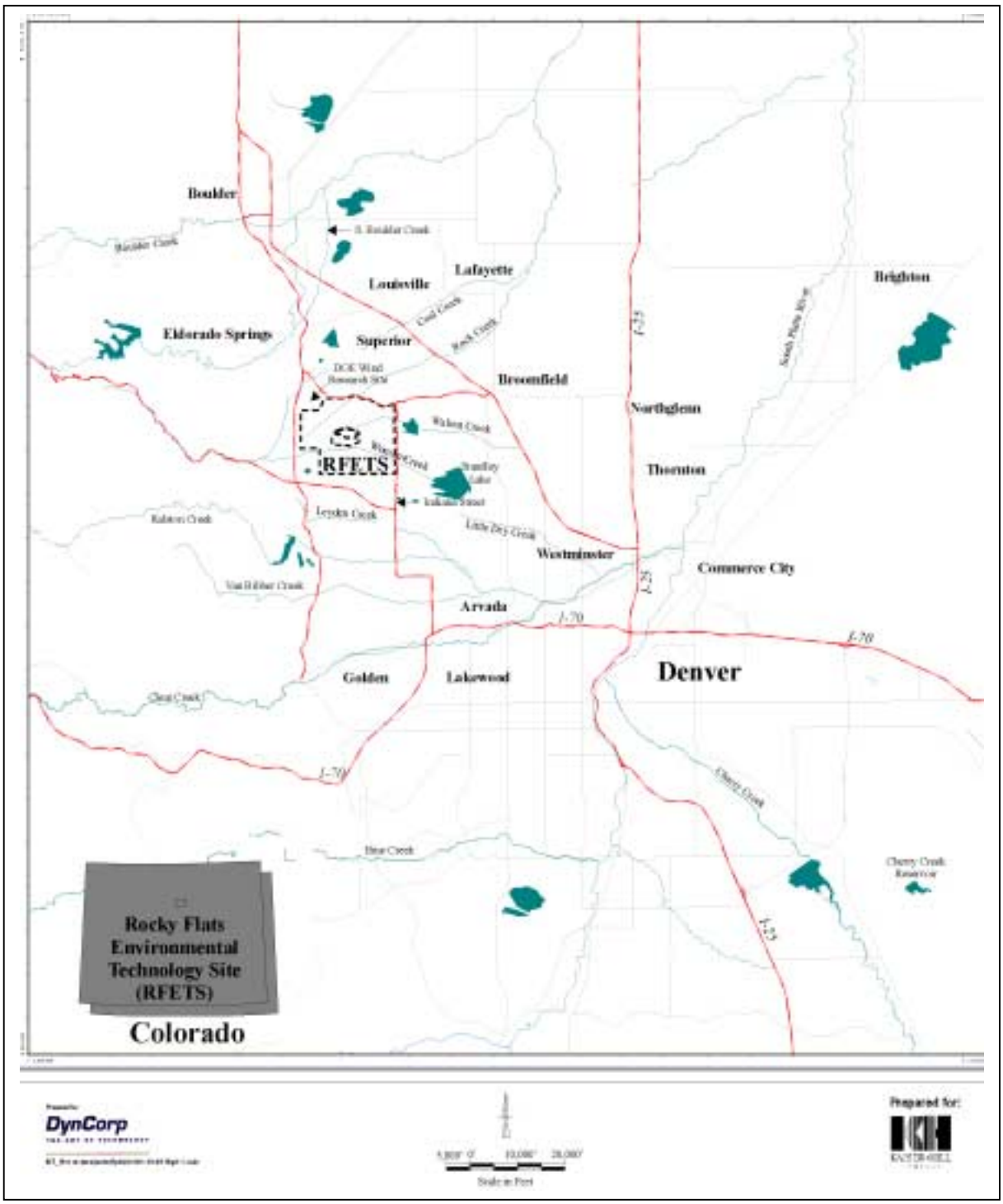

Figure 2-1. Area Map of the Rocky Flats Environmental Technology Site and Surrounding Communities

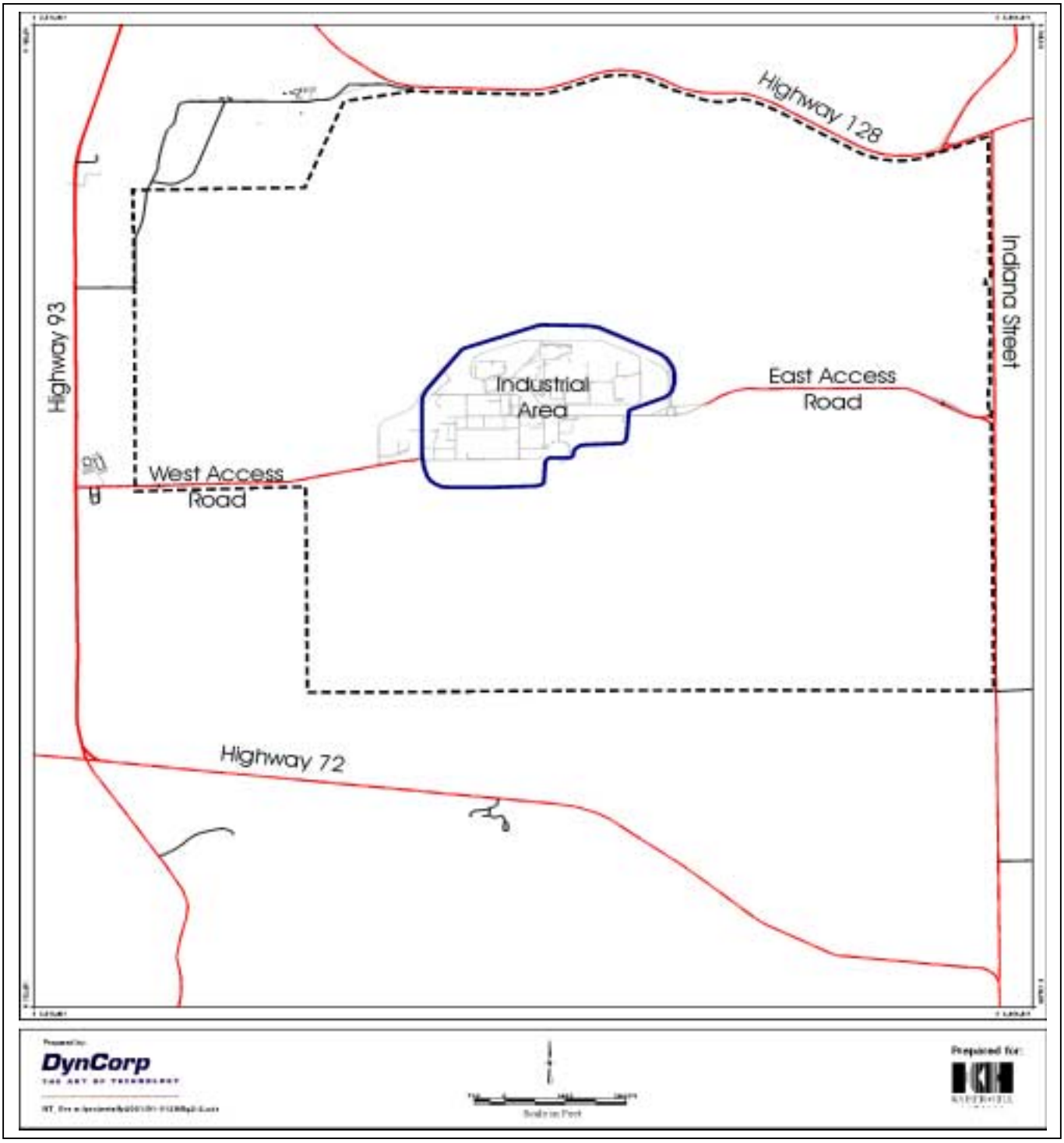

Figure 2-2. Rocky Flats Environmental Technology Site Location Map

Figure 2-3. Central Portion of the Rocky Flats Environmental Technology Site (Industrial Area)

2.2 Radionuclide Air Emissions Source Description

Radioactive material handling at the Site in 2002 was focused on material consolidation, environmental restoration, building decommissioning and demolition, waste processing, and analytical operations. Most of the radionuclide air emissions from the Site resulted from nonpoint (diffuse) sources, primarily mechanical and natural disturbances of contaminated soil. Soil contamination was caused by past radioactive material spills and other releases. In addition, the soils on and around the Site contain small quantities of naturally occurring radionuclides.

Radioactive material processing can result in radionuclides becoming entrained in ventilation air (effluent) that is released through vents or stacks (point sources). However, because no routine nuclear weapons-related processing has occurred at the Site since 1989, most radionuclide point source emissions in 2002 resulted from the resuspension of residual radioactive material in ventilation systems and from decontamination and deactivation activities taking place in process buildings.

Air exhausted from process buildings was cleaned prior to release by passing it through multiple stages of high efficiency particulate air (HEPA) filters. As a result, radionuclide point source emissions from the Site were very low in 2002.

2.2.1 Radioactive Materials Handling and Processing in Calendar Year 2002

In 2002, radionuclide emissions from the Site occurred from several activities that either disturbed resident contamination in buildings or in soil, or that processed or used radionuclide-containing substances such that emissions to the atmosphere resulted. Appendix A lists radioactive materials associated with the Site. The list of radionuclides includes plutonium (Pu)-239/240, americium (Am)-241, uranium (U)-233/234, U-235, and U-238. The Site also has small quantities of beta- and gamma-emitting sealed sources and low activity analytical stock solutions, powders, and plated sources; emissions from these sources were negligible.

The major Site activities and sources that handled or processed radionuclides in calendar year 2002, with resulting radionuclide emissions, are described below.

Hold-up in Ducts

Radionuclide emissions were generated through disturbance of radionuclide-contaminated dust and other deposits on the surfaces of ventilation ducts exiting process areas. These materials were deposited on duct walls and in rapidly decreasing amounts on successive stages of HEPA filters during many years of weapons component production. Routine air movement and pressure changes in the ducts entrain a small amount of this contamination on an ongoing basis. In addition, decontamination and equipment removal or reconfiguration activities disturbed a portion of the hold-up in certain ducts in 2002, resulting in additional emissions to the atmosphere. Ducts containing hold-up were vented through multiple stages of HEPA filters.

Resident Contamination

In some process areas, contamination may be found on glovebox surfaces and floors, and, in limited cases, in the rooms themselves. This contamination has been surveyed and estimated using surface swipes in the areas. As with hold-up, resident contamination was emitted in 2002 due to routine exposure to ventilation air and due to active disturbance by project activities, particularly decontamination and equipment movement. Ducts venting areas with significant contamination were exhausted through multiple stages of HEPA filters.

Consolidation of Special Nuclear Material (SNM)

SNM is plutonium and enriched uranium contained in weapons components, metals, metal alloys, and oxides. SNM-related consolidation activities continued in calendar year 2002 and included metal brushing, size reduction of metal, thermal stabilization of oxide, and packaging and interim storage of SNM. These consolidation activities are defined as follows:

- Metal brushing: Mechanical removal of metal oxide from metal surfaces.
- Size reduction: Reduction of material size by breaking, cutting, sawing, or pressing to accommodate storage container requirements.
- Thermal stabilization of oxide: Treatment of unstable forms of metal oxides in furnaces operating in the range of 800 to 1,200 degrees Celsius (°C) to remove moisture and to fully oxidize the metal to stable form.
- Packaging and storage: Placement of material in approved, inert atmosphere, storage containers, which in turn are placed in storage vaults or vault-type rooms. Storage vaults are repositories of SNM materials that satisfy required safety and risk criteria.

Consolidation activities resulted in radionuclide emissions in 2002 through exposure of SNM to ventilation air, as well as through mechanical and thermal disturbance of SNM. Consolidation was performed in areas where ventilation air was exhausted through HEPA filters.

Waste Handling

Most of the low-level and TRU waste materials at the Site were generated during plutonium weapons component production and radionuclide recovery operations conducted prior to 1989. In 2002, solid waste, including contaminated gloveboxes and duct work, was segregated and size-reduced prior to packaging for storage and disposal. Such activities disturbed the radioactive contamination in the waste, resulting in radioactive particles in the room air.

Radioactive wastes were handled (segregated, size-reduced, and packaged) inside buildings or other structures. Venting the air through HEPA filters controlled emissions from these operations.

In addition to solid waste, liquid waste in tanks and pipes may also release radionuclides to the atmosphere, either through routine passive venting, or when liquid waste is exposed to the atmosphere when systems are drained or the materials treated. In addition to routine emissions from tank vents, liquid radioactive waste movement projects in several buildings contributed to emissions during 2002. These activities took place in areas that vented through HEPA filters.

Waste Storage

Packaged low-level and TRU wastes are commonly stored in drums at various locations on the Site. Drums are vented to prevent pressure buildup from hydrogen gas, which is generated by radiolytic activity affecting packaged materials. Radionuclide emissions would only occur from these drums during venting if the inner packaging failed. To minimize emissions should the inner packaging fail, the drums are equipped with small filter cartridges that function like HEPA filters. For purposes of estimating emission potential for compliance with 40 CFR 61, Subpart H, the packaged materials inside these drums are considered sealed sources (in accordance with Appendix D to 40 CFR 61).

Waste Repackaging

Radionuclide emissions were generated in 2002 from waste characterization and repackaging activities that support waste shipment activities. Shipment plans required the characterization and repackaging of various radionuclide-contaminated wastes and residues in preparation for shipment to the Nevada Test Site, Savannah River Site, the Waste Isolation Pilot Plant (WIPP), or other off-Site facilities. All of the waste repackaging activities that occurred in 2002 took place in areas that were vented through HEPA filters.

Building/Structure Demolition Projects

Demolition projects at the Site are performed in accordance with the Rocky Flats Cleanup Agreement (RFCA). RFCA is a negotiated, interagency agreement governing Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and Resource Conservation and Recovery Act (RCRA) cleanup activities at the Site. RFCA states that all unneeded buildings at the Site will be demolished. In most cases, contaminated systems are decontaminated and removed prior to demolition.

The following structures were demolished in 2002:

- Buildings 125, S125, 280, 381, 442L, 442W, 452, 662, 663, 709A, 828, 850, 864, 875, 880, 886, 932, 331A, 335, 367, S452, 666, 884, and 910;
- Trailers T452A-G, T760B, T886A-C, T891D-E, T891G, T891P-Q, T891V, T891T, T893A-B, T334B, T334D, and T760A; and
- Tents 07, 08, 09, and 14.

These structures were not radiologically contaminated above free-release criteria.

Miscellaneous Point Sources

In late 1997, several laboratory operations were transferred to a new modular laboratory. The modular analytical laboratory continued operations in 2002. Radionuclide emissions from the handling of contaminated media (such as filters) were negligible.

Two point sources were initiated in 2002: 1) installation and use of decontamination showers in Building 778, and 2) visual examination and repackaging of rejected TRU, and mixed hazardous and TRU (TRM), waste drums in Building 440, Room 123A. These operations are described in more detail in Section 2.2.2.

Miscellaneous point source operations that continued from the previous year included a drum crushing activity at the 750 Pad, Tent 5, which operated intermittently during 2002; operation of the spray dryer in Building 374 during the early part of 2002; repackaging of waste chemicals at the 904 Pad, Tent 11; and repackaging of ash and dry residues in Building 371 during the early portions of 2002.

Miscellaneous Nonpoint Sources

Another contributor to Site radionuclide emissions in 2002 was the resuspension of contaminated soils. Contaminated soils were resuspended by wind erosion, vehicle traffic, and other mechanical soil disturbances. Miscellaneous nonpoint sources that emitted radionuclides in 2002 included the 750 Pad Solar Pond sludge removal project, the Solar Ponds closure, 903 Pad remediation, Building 886 slab removal, Building 123 slab removal, Building 442 slab removal, Building 889 slab removal, Building 662/663 slab removal, 231 Tank System sludge removal, Building 707 loading dock modifications, and the Building 707 cargo pad construction (these sources are described in more detail in Section 2.2.2). Emissions generated by wind erosion were uncontrolled, while radionuclide emissions from vehicle traffic and mechanical disturbances were sometimes controlled using dust suppression techniques.

2.2.2 New Construction and Modifications in Calendar Year 2002

Thirteen new or modified activities that contributed to the Site air pathway dose in calendar year 2002 are described below. As part of the project evaluation process (prior to the startup of each project), the maximum annual (controlled) off-Site EDE that could result from each new or modified activity was calculated to determine approval and notification requirements. Maximum potential radionuclide emissions were estimated using emission and control factors from Appendix D to 40 CFR 61, combined with information regarding radionuclide contaminant levels and material forms, radionuclide release mechanisms, and the radionuclide emission controls employed. In cases where HEPA filters were employed, credit was taken for a maximum of two stages, although up to four stages may actually have been employed. Emissions were modeled using the Clean Air Act Assessment Package-1988 (CAP88-PC), and recent Site meteorological data to estimate annual EDEs at the most impacted off-Site residence and business locations.

To place the reported EDE values in context, it should be noted that the emission estimation and modeling methods used in this exercise are designed to generate "worst case" dose estimates. The emission factors, control device efficiencies, and modeling approach are mandated by 40 CFR 61, Appendix D, to ensure that project dose will not be underestimated when determining whether notification and approval are necessary under the regulation. In fact, actual emissions and dose will often be much lower than the estimates used to determine approval and notification requirements.

Detailed data and calculations used to develop emission estimates and resulting dose projections are maintained in Site files. The estimated EDE (shown below) for each new construction or modification was less than 1% of the 10-mrem (0.1-mSv) standard, and construction approval and startup notification were unnecessary under 40 CFR 61.96. The project- or process-specific EDEs used in making regulatory applicability decisions regarding approval requirements are discussed below.

Building 440 Waste Repackaging and Visual Examination Activities: In 2002, rejected TRU/TRM waste drums were visually examined and repackaged in Building 440, Room 123A. The maximum process rate assumed was four drums per day, 5 days per week, 50 weeks per year (repackaging operations were actually initiated in September 2002).

Both visual examination and repackaging activities took place in a C-Cell and gloveboxes that exhausted through two stages of HEPA filters, and through a vent that was continuously sampled for radionuclide emissions. The off-Site EDE was calculated based on the maximum plutonium content in each drum (200 grams), the maximum process rate, and an emission factor from Appendix D to 40 CFR 61. The maximum annual (controlled) off-Site EDE from this activity was estimated to be 3.6×10^{-5} mrem (3.6×10^{-7} mSv).

Building 778 Decontamination Shower Installation: In 2002, temporary decontamination showers were installed in Building 778, Room 112. Each shower had a 114-liter (l) sump/reservoir and a directly piped sink. When a worker was decontaminated, a pump was activated, along with a 0.47 cubic meter per second (m^3/s) air mover that provided a negative pressure for the room. The room air was vented through a HEPA filter.

The off-Site EDE was calculated based on 20 visits to the showers per year (conservative estimate based on past experience), maximum possible skin and clothing contamination levels, and an emission factor from Appendix D to 40 CFR 61. The maximum annual (controlled) off-Site EDE from this activity was estimated to be 2.1×10^{-7} mrem (2.1×10^{-9} mSv).

750 Pad Solar Pond Sludge Removal: In 2002, the Site initiated a project to remove approximately 723,000 gallons of Solar Pond sludge and water mixture currently stored at the 750 Pad in Tents 3, 4, and 6. Removal operations included mixing stratified layers of pond sludge and water to form a homogenous mixture, pumping the mixture

through a conditioning process for absorption of water, and pumping the conditioned sludge into approved containers for shipment to an off-Site treatment/disposal facility.

The off-Site EDE was calculated based on the maximum radionuclide activity measured in sludge samples, the total amount of sludge to be pumped and dewatered, and emission factors for tank cleaning and from Appendix D to 40 CFR 61. The maximum annual (controlled) off-Site EDE from this activity was estimated to be 5.5×10^{-2} mrem (5.5×10^{-4} mSv).

Solar Ponds Closure: The Solar Ponds consisted of five surface impoundments. Closure involved removing standing water within the ponds, pushing the surrounding berms into the ponds, adding clean fill to create a level area, and grading and vegetating the area. Soils in the berms surrounding the ponds were slightly contaminated with americium, plutonium, and uranium.

Dose calculations from bulldozer activities associated with pushing in the berms were based on maximum measured radionuclide concentrations in the soil from surface soil screening, the volume of soil pushed into the berms, and emission factors from EPA's *Compilation of Air Pollutant Emission Factors*, AP-42 (EPA, 1995). The maximum annual off-Site EDE from these activities was estimated to be 2.9×10^{-3} mrem (2.9×10^{-5} mSv).

903 Pad Remediation: In November 2002, excavation began on the 903 Pad Remediation project. Soil excavation was conducted within a 27.4 m by 33.5 m tent that was used to protect the excavation from weather conditions. Three 2.83-m^3/s air movers were used to exhaust the air through HEPA filtration. The 903 Pad dimensions are 114 m by 120 m. The total volume of material to be excavated is approximately 9,939 cubic meters (m^3).

The EDE estimation used emission factors from EPA's *Compilation of Air Pollutant Emission Factors*, AP-42; the maximum soil excavation rate (82 m^3 per day); a radionuclide emission factor from Appendix D to 40 CFR 61; and the average isotopic contamination levels in the soil (Tier I soil footprint contamination data). RFCA defines Tier I and Tier II soil action levels based on concentrations of various contaminants in the soil, where contamination above the higher Tier I action levels suggests cleanup may be necessary, while contamination above Tier II represents contaminant concentrations that require further evaluation. (Contamination below Tier II soil action levels does not require further action.) The maximum annual off-Site EDE from the project was estimated to be 2.5×10^{-5} mrem (2.5×10^{-7} mSv).

Building 886 Slab Remediation: In 2002, Building 886 was demolished and the remaining building slab was remediated. During the slab remediation activities, concrete was size-reduced for transport, soil was removed, and the area was backfilled with clean soil.

The EDE estimation used emission factors from EPA's *Compilation of Air Pollutant Emission Factors*, AP-42; the volumes of soil excavated and concrete size-reduced; and maximum radionuclide contamination levels from data summaries. The maximum annual off-Site EDE from the project was estimated to be 8.5 x 10^{-6} mrem (8.5 x 10^{-8} mSv).

Building 123 Slab Remediation: In 2002, Building 123 was demolished and the remaining building slab was remediated. During the slab remediation activities, concrete was size-reduced for transport, soil was removed, and the area was backfilled with clean soil.

The EDE estimation used emission factors from EPA's *Compilation of Air Pollutant Emission Factors*, AP-42; the volumes of soil excavated and concrete size-reduced; and maximum radionuclide contamination levels from data summaries. The maximum annual off-Site EDE from the project was estimated to be 2.0 x 10^{-5} mrem (2.0 x 10^{-7} mSv).

Building 442 Slab Remediation: In 2002, Building 442 was demolished and the remaining building slab was remediated. During the slab remediation activities, concrete was size-reduced for transport, soil was removed, and the area was backfilled with clean soil.

The EDE estimation used emission factors from EPA's *Compilation of Air Pollutant Emission Factors*, AP-42; the volumes of soil excavated and concrete size-reduced; and conservative isotopic contamination levels in the soil (assumed maximum Tier II soil action levels). The maximum annual off-Site EDE from the project was estimated to be 4.3 x 10^{-5} mrem (4.3 x 10^{-7} mSv).

Building 889 Slab Remediation: In 2002, the Building 899 slab was remediated. During the slab remediation activities, concrete was size-reduced for transport, soil was removed, and the area was backfilled with clean soil.

The EDE estimation used emission factors from EPA's *Compilation of Air Pollutant Emission Factors*, AP-42; the volumes of soil excavated and concrete size-reduced; and maximum under-building contamination data. The maximum annual off-Site EDE from the project was estimated to be 1.1 x 10^{-6} mrem (1.1 x 10^{-8} mSv).

Building 662/663 Slab Remediation: In 2002, the Building 662/663 slab was remediated. During the slab remediation activities, concrete was size-reduced for transport, soil was removed, and the area was backfilled with clean soil.

The EDE estimation used emission factors from EPA's *Compilation of Air Pollutant Emission Factors*, AP-42; the volumes of soil excavated and concrete size-reduced; and the maximum allowable radionuclide contamination value for low-level waste (100 nanocuries per gram). The maximum annual off-Site EDE from the project was estimated to be 3.7 x 10^{-3} mrem (3.7 x 10^{-5} mSv).

231 Tank System Sludge Removal: The 231 Tank System consists of two storage tanks and associated transfer pumps. The tanks are designed to store low-level mixed waste prior to shipping off Site for treatment and disposal. In 2002, sludge from the tanks was pumped out of the tanks and into drums. The sludge was dewatered, and the water pumped back into the tanks. Approximately 200 drums were processed in January and February 2002.

The off-Site EDE was calculated based on the maximum plutonium and americium activity measured in sludge samples, the total amount of sludge to be pumped and dewatered, and an emission factor from Appendix D to 40 CFR 61. The maximum annual (controlled) off-Site EDE from this activity was estimated to be 3.8×10^{-4} mrem (3.8×10^{-6} mSv).

Building 707 Loading Dock Modifications: In 2002, the loading dock area at the southeast corner of Building 707 was lowered approximately 0.33 m. Existing asphalt and underlying soil were removed to a depth of 0.55 m; the area was then backfilled and capped with 0.2 m of concrete.

The EDE estimation used emission factors from EPA's *Compilation of Air Pollutant Emission Factors*, AP-42; the volumes of soil excavated; and conservative isotopic contamination levels in the soil (assumed maximum Tier II soil action levels). The maximum annual off-Site EDE from the project was estimated to be 1.9×10^{-5} mrem (1.9×10^{-7} mSv).

Building 707 Cargo Storage Pad Construction: In 2002, three concrete storage areas were constructed at Building 707. The top 18 centimeters (cm) of soil was removed from the areas and covered with the equivalent thickness of concrete. The maximum volume of soil excavated during the project was 336 m^3.

The EDE estimation used emission factors from EPA's *Compilation of Air Pollutant Emission Factors*, AP-42; the volume of soil excavated; and conservative isotopic contamination levels in the soil (assumed maximum Tier II soil action levels). The maximum annual off-Site EDE from the project was estimated to be 5.8×10^{-5} mrem (5.8×10^{-7} mSv).