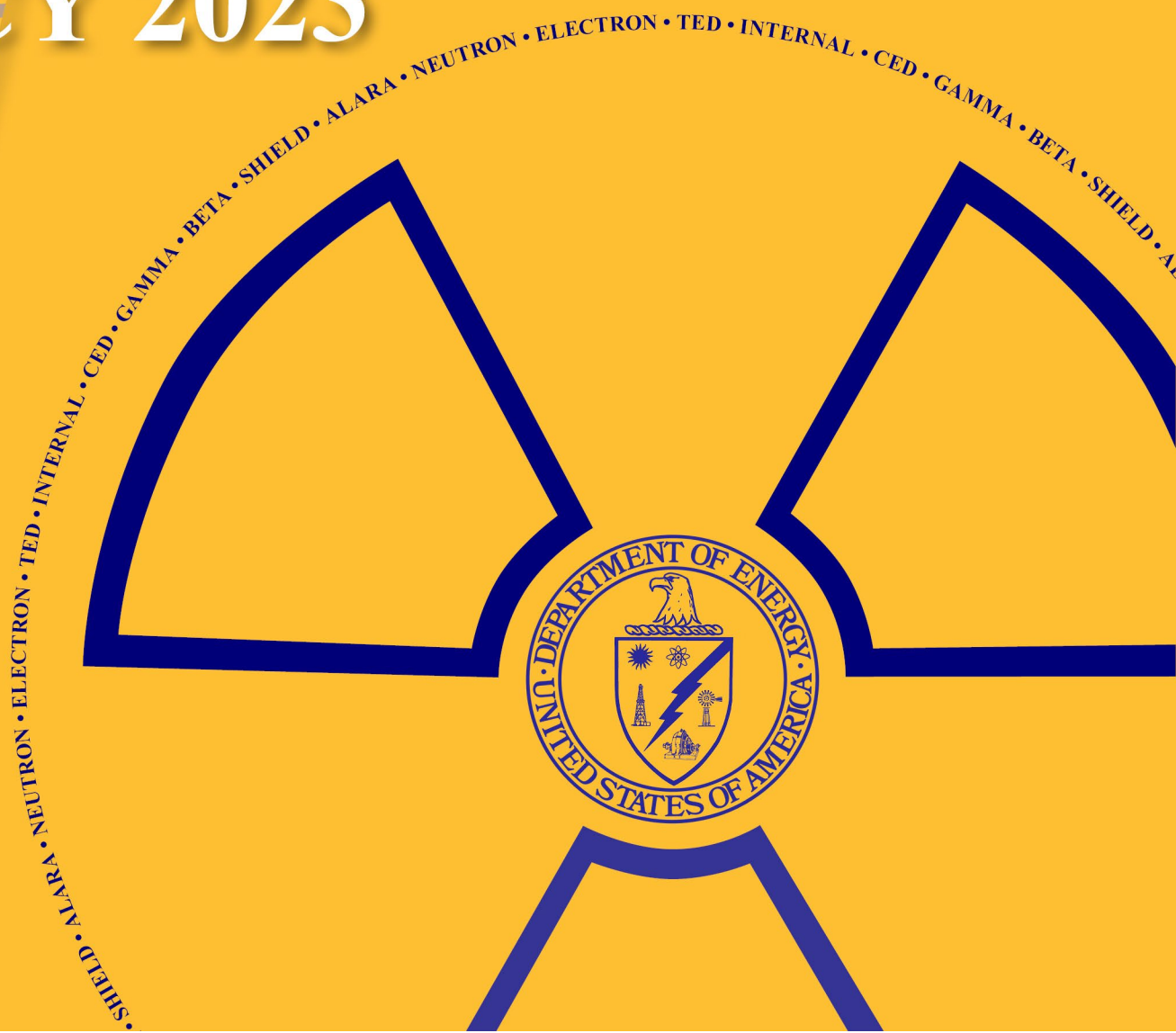


U.S. Department of Energy

# OCCUPATIONAL RADIATION EXPOSURE REPORT FOR CY 2023



This document is available on the U.S. Department of Energy  
Radiation Exposure Monitoring System Program Web Site at:  
<https://energy.gov/ehss/occupational-radiation-exposure>

# ***U.S. Department of Energy*** **Occupational Radiation Exposure Report for Calendar Year 2023**

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# Foreword

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The *U.S. Department of Energy Occupational Radiation Exposure Report for Calendar 2023* presents the results of analyses of occupational radiation exposures at the U.S. Department of Energy (DOE), including the National Nuclear Security Administration (NNSA) operations, during calendar year 2023. This report includes occupational radiation exposure data for over 80,000 DOE Federal employees, contractors, and subcontractors as well as members of the public who have worked in or entered controlled areas monitored for exposure to radiation.

DOE publishes this annual report to provide DOE Management, Program Offices, workers, health physicists, and other stakeholders an evaluation of DOE-wide performance regarding compliance with Title 10 of the *Code of Federal Regulations* (CFR) Part 835, *Occupational Radiation Protection* (10 CFR 835) radiation exposure limits and adherence to as low as reasonably achievable principles.

This report provides a discussion regarding radiation protection and exposure reporting requirements. It also includes calendar year (CY) 2023 information and analyses regarding aggregate, individual, site, DOE Program, transient individuals' dose, as well as a historical review of DOE exposure data. DOE continues to be diligent in protecting its workers and the public from exposure to radiation from DOE operations as illustrated by the results contained in this report.

As part of our continual improvement process, you, the reader, are encouraged to provide comments and suggestions regarding this report via the User Survey included at the end of this report.



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TODD N. LAPOINTE  
DIRECTOR FOR ENVIRONMENT,  
HEALTH, SAFETY AND SECURITY

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## LIST OF ABBREVIATIONS AND ACRONYMS

|           |                                                                |
|-----------|----------------------------------------------------------------|
| ACL       | Administrative Control Level                                   |
| AEC       | U.S. Atomic Energy Commission                                  |
| AEDE      | Annual Effective Dose Equivalent                               |
| ALARA     | As Low As Reasonably Achievable                                |
| AMWTP     | Advanced Mixed Waste Treatment Project                         |
| ANL       | Argonne National Laboratory                                    |
| ATR       | Advanced Test Reactor                                          |
| BNL       | Brookhaven National Laboratory                                 |
| CEBAF     | Continuous Electron Beam Accelerator Facility                  |
| CED       | Committed Effective Dose                                       |
| CEDE      | Committed Effective Dose Equivalent                            |
| CEqD      | Committed Equivalent Dose                                      |
| CEqD-SK   | Committed Equivalent Dose to the Skin                          |
| CFR       | Code of Federal Regulations                                    |
| CY        | Calendar Year                                                  |
| DAC       | Derived Air Concentration                                      |
| DDE       | Deep Dose Equivalent                                           |
| DOE       | U.S. Department of Energy                                      |
| ED        | Effective Dose                                                 |
| EqD       | Equivalent Dose                                                |
| EqD-Eye   | Equivalent Dose to the Lens of the Eye                         |
| EqD-Fetus | Equivalent Dose to the Fetus                                   |
| EqD-ME    | Equivalent Dose to the Skin of the Maximally Exposed Extremity |
| EqD-SKWB  | Equivalent Dose to the Skin of the Whole Body                  |
| EqD-WB    | Equivalent Dose to the Whole Body                              |
| EERE      | Office of Energy Efficiency and Renewable Energy               |
| EHSS      | Office of Environment, Health, Safety and Security             |
| EM        | Office of Environmental Management                             |
| EPA       | U.S. Environmental Protection Agency                           |
| ERDA      | Energy Research and Development Administration                 |
| ETEC      | Energy Technology Engineering Center                           |
| ETTP      | East Tennessee Technology Park                                 |
| Fermilab  | Fermi National Accelerator Laboratory                          |
| FTE       | Full-Time Equivalent                                           |
| ICP       | Idaho Cleanup Project                                          |
| ICRP      | International Commission on Radiological Protection            |
| INL       | Idaho National Laboratory                                      |
| KC-NSC    | Kansas City National Security Campus                           |
| LANL      | Los Alamos National Laboratory                                 |
| LBNL      | Lawrence Berkeley National Laboratory                          |
| LINAC     | Linear Accelerator                                             |
| LCLS      | LINAC Coherent Light Source                                    |
| LLNL      | Lawrence Livermore National Laboratory                         |
| LM        | Office of Legacy Management                                    |
| mSv       | Millisievert                                                   |

|         |                                                           |
|---------|-----------------------------------------------------------|
| NCRP    | National Council on Radiation Protection and Measurements |
| NE      | Office of Nuclear Energy                                  |
| NETL    | National Energy Technology Laboratory                     |
| NNSA    | National Nuclear Security Administration                  |
| NNSS    | Nevada National Security Site                             |
| NRC     | U.S. Nuclear Regulatory Commission                        |
| NREL    | National Renewable Energy Laboratory                      |
| NYSERDA | New York State Energy Research and Development Authority  |
| O       | Order                                                     |
| OpEx    | Operating Experience Program                              |
| ORISE   | Oak Ridge Institute for Science and Education             |
| ORNL    | Oak Ridge National Laboratory                             |
| ORP     | Office of River Protection                                |
| OST     | Office of Secure Transportation                           |
| PGDP    | Paducah Gaseous Diffusion Plant                           |
| PNNL    | Pacific Northwest National Laboratory                     |
| PORTS   | Portsmouth Gaseous Diffusion Plant                        |
| PPPL    | Princeton Plasma Physics Laboratory                       |
| rem     | Roentgen equivalent man                                   |
| REMS    | Radiation Exposure Monitoring System                      |
| Rh-102  | Rhodium-102                                               |
| Rh-102m | Rhodium-102m                                              |
| SC      | Office of Science                                         |
| SLAC    | SLAC National Accelerator Laboratory                      |
| SNM     | Special Nuclear Material                                  |
| SNL     | Sandia National Laboratories                              |
| SPRU    | Separations Process Research Unit                         |
| SPEAR3  | Stanford Positron-Electron Asymmetric Ring                |
| STD     | Standard                                                  |
| Sv      | Sievert                                                   |
| TED     | Total Effective Dose                                      |
| TJNAF   | Thomas Jefferson National Accelerator Facility            |
| TOD     | Total Organ Dose                                          |
| TRU     | Transuranic                                               |
| TSS     | Transportation Safeguards System                          |
| U       | Uranium                                                   |
| U-234   | Uranium-234                                               |
| UMTRA   | Uranium Mill Tailings Remedial Action Project             |
| USEC    | United States Enrichment Corporation                      |
| WIPP    | Waste Isolation Pilot Plant                               |
| WTP     | Waste Treatment Plant                                     |
| WVDP    | West Valley Demonstration Project                         |
| Y-12    | Y-12 National Security Complex                            |

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# Summary

## Executive Summary

## Executive Summary

The U.S. Department of Energy (DOE) Office of Environment, Health, Safety and Security (EHSS) publishes annual occupational radiation exposure reports to provide DOE Management, Program Offices, workers, health physicists, and other stakeholders an evaluation of DOE-wide performance regarding compliance with Title 10 of the *Code of Federal Regulations* (CFR) Part 835, *Occupational Radiation Protection* (10 CFR 835) radiation exposure limits and adherence to as low as reasonably achievable (ALARA) principles.

This report presents the results of analyses of occupational radiation exposures at DOE operations, including the National Nuclear Security Administration (NNSA), during calendar year (CY) 2023. The report includes occupational radiation exposure information for over 80,000 DOE Federal employees, contractors, and subcontractors, and members of the public monitored for radiation exposure. The 94 DOE organizations that submitted radiation exposure reports in CY 2023 have been grouped into 33 sites. The information has been analyzed to provide a measure of DOE's performance in protecting workers and individuals who have entered controlled areas.

Individuals who have the potential to be exposed to radiation at a DOE facility are required to be monitored in accordance with 10 CFR 835, Subpart E. The exposure monitoring data are used to determine the radiation dose received by the individual, which is reported to DOE through the DOE Radiation Exposure Monitoring System (REMS) in accordance with DOE Order 231.1B, *Environment, Safety and Health Reporting*.

Unless otherwise specified, the term “dose” used in this report refers to the total effective dose (TED) and is measured in units of “rem” (derived from the phrase Roentgen equivalent man). The sievert (Sv) is the international unit of effective dose where 1 Sv is equal to 100 rem and 1 rem is, therefore, equal to 10 millisieverts (mSv). The TED is the summation of the effective dose from sources of radiation that are external and internal to the body. The committed effective dose (CED) is the dose resulting from radioactive material taken into the body and is commonly referred to as internal dose. The term “collective dose” is the sum of the individual doses received by a group of individuals and is shown in units of “person-rem.”

Analysis of the collected exposure data for CY 2023 indicate that:

- ◆ DOE operations were compliant with regulatory radiation protection requirements as no exposures were reported to have exceeded the occupational dose limit of 5 rem (50 mSv) TED; and
- ◆ Only 22 percent of the monitored individuals received a measurable dose (a detectable dose greater than zero), and, of those, the average measurable dose received was 1 percent of the 5 rem (50 mSv) TED limit.

In addition, from CY 2022 to CY 2023:

- ◆ The collective TED increased by 6 percent to 949.4 person-rem (9,494 person-mSv);
- ◆ The number of individuals with measurable dose increased by 10 percent from 16,774 individuals to 18,469 individuals;
- ◆ Collective CED (internal exposure) decreased by 9 percent to 41.6 person-rem (416 person-mSv); and
- ◆ Collective TED for transient individuals decreased by 4 percent to 29.6 person-rem (296 person-mSv).

The collective dose at DOE facilities has decreased by 88 percent since CY 1986. This coincides with the end of the Cold War era, which shifted the DOE mission from weapons production to stabilization, waste management, and environmental remediation activities, along with the consolidation and remediation of facilities across the complex to meet the new mission.

In alignment with the change in mission, regulations and requirements have been modified (see Section 2) that reinforce DOE's focus on ALARA practices and risk reduction to lower occupational radiation dose.

Over the past 5 years, only one monitored individual, at Los Alamos National Laboratory (LANL), received a dose above the 2 rem (20 mSv) TED administrative control level. [1]

- ◆ In CY 2020, an individual received a TED of 3.0 rem (30 mSv) after an airborne release of radioactive material. The individual received an internal dose during the incident in which skin contamination and positive nasal smears were detected. The source of the contamination was determined to be a breach of a protective glove inside a glovebox.

Details of this incident are available in the occurrence report NA--LASO-LANL-TA55-2020.

This report and other information regarding DOE occupational radiation exposure may be accessed at:

<https://www.energy.gov/ehss/occupational-radiation-exposure>

# Section One

## Introduction

# 1

## Introduction

The *U.S. Department of Energy Occupational Radiation Exposure Report for Calendar Year 2023* presents the results of analyses of occupational radiation exposures at the U.S. Department of Energy (DOE), including the National Nuclear Security Administration (NNSA), operations during calendar year (CY) 2023. This report includes occupational radiation exposure information for DOE Federal employees, contractors, and subcontractors, and members of the public monitored for radiation exposure. The 94 DOE organizations that submitted radiation exposure reports for CY 2023 have been grouped into 33 sites.\* The information has been analyzed and trended to provide a measure of DOE's performance in protecting workers and individuals who have entered controlled areas.

This report is published by the DOE Office of Environment, Health, Safety and Security (EHSS). The purpose of this report is to provide DOE Management, Program Offices, workers, health physicists, and other stakeholders an evaluation of DOE-wide performance regarding compliance with Title 10 of the *Code of Federal Regulations* (CFR) Part 835, *Occupational Radiation Protection* (10 CFR 835) radiation exposure limits and adherence to as low as reasonably achievable (ALARA) principles.

Individuals who have the potential to be exposed to radiation at a DOE facility are required to be monitored in accordance with 10 CFR 835, Subpart E. The exposure monitoring data are used to determine the radiation dose received by those individuals, which is reported to DOE in accordance with DOE Order (O) 231.1B, *Environment, Safety and Health Reporting*. Unless otherwise specified, the term “dose” used in this report refers to the total effective dose (TED) and is measured in units of “rem” (derived from the phrase Roentgen equivalent man). The TED is the summation of the effective dose from sources of radiation that are external and internal to the body. The committed effective dose (CED) is the dose resulting from radioactive material taken into the body and is commonly referred to as internal dose.

The term “collective dose” is the sum of the individual doses received by a group of individuals and is shown in units of “person-rem.”

### 1.1 Report Organization

This report is organized into nine sections. Section 1 describes the content and organization of this report. Section 2 discusses radiation protection, radiation dose limits, and reporting requirements. Section 3 presents the CY 2023 occupational dose data along with trends over the past 5 years and includes information and analyses regarding aggregate, individual, site, DOE Program, and transient individual exposure data; a historical review; and a DOE occurrence report review. Section 4 provides instructions to submit successful ALARA projects, and Section 5 discusses conclusions. Sections 6, 7, and 8 contain the report glossary, references, and a user survey, respectively. Section 9 contains the appendices, which have additional detail and data associated with the information presented within the report.

### 1.2 Report Availability

This report, the appendices, and all other associated information are available on the DOE Radiation Exposure Monitoring System (REMS) web site at:

<https://www.energy.gov/ehss/occupational-radiation-exposure>

The REMS web site contains additional information on occupational radiation exposure, such as:

- ◆ Annual occupational radiation exposure reports and associated appendices in pdf since CY 1974;
- ◆ Guidance on reporting radiation exposure information to the DOE REMS;
- ◆ Updated REMS-Online Query Tool;

\* For the purposes of this report, the sites and facilities are grouped by geographic location. When reported separately, the data for individual facilities at the sites are provided separately. See Section 3.4 for more information.

- ◆ Guidance on how to request a dose history for an individual;
- ◆ Statistical data since CY 1987 for analysis;
- ◆ Applicable DOE orders and manuals for the recordkeeping and reporting of occupational radiation exposure at DOE;
- ◆ Occupational Exposure Dashboard—interactive data explorer;
- ◆ Ten Year Summary—graphical comprehensive overview of the past 10 years of radiation exposure data; and
- ◆ ALARA activities at DOE.

Requests for access to the data files, or for individual dose records used to compile this report, as well as suggestions and comments, should be directed to:

**Ms. Katharine McLellan**  
**DOE REMS Program Manager**  
**Office of Environment, Health, Safety and**  
**Security (EHSS)**  
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# Section Two

## Standards and Requirements

2

## Standards and Requirements

It is DOE's mission to provide a safe and healthy workplace for all DOE Federal employees, contractors, and subcontractors as well as members of the public that visit DOE facilities. To meet this mission, the EHSS establishes comprehensive and integrated programs for the protection of workers from hazards in the workplace, including ionizing radiation. The DOE standards for occupational radiation protection include radiation exposure limits to workers. In addition, DOE is required to maintain radiation exposures as far below the limits as is reasonable through application of the ALARA process, which incorporates pre-job planning, engineering controls, and worker training.

This section identifies the radiation protection standards and requirements applicable to DOE operations in CY 2023.

### 2.1 Radiation Protection Requirements

DOE radiation protection standards are based on Federal guidance for protection against occupational radiation exposure promulgated by the U.S. Environmental Protection Agency (EPA) in CY 1987 [2]. The guidance, initially implemented by DOE in CY 1989, was based on the CY 1977 recommendations of the International Commission on Radiological Protection (ICRP) Publication 26 [3] and the CY 1987 recommendations of the National Council on Radiation Protection and Measurements (NCRP) Publication 91 [4]. EPA recommends that

internal dose be added to the external whole-body dose to determine the TED equivalent. The laws and requirements for occupational radiation protection pertaining to the information collected and presented in this report are summarized in *Exhibit 2-1*.

### 2.2 Radiation Dose Limits

Radiation dose limits are codified in 10 CFR 835, Sections 202, 206, 207, and 208 [5] and are summarized in *Exhibit 2-2*.

### 2.3 Reporting Requirements

DOE O 231.1B, *Environment, Safety and Health Reporting* [6] contains the requirements for reporting annual individual radiation exposure records to the REMS repository. Exposure records for the monitoring year are required to be reported by March 31 of the following calendar year. Specific instructions for preparing occupational exposure data for submittal to the REMS repository are contained in the REMS Data Reporting Guide [7] available online at:

<https://www.energy.gov/ehss/downloads/radiation-exposure-monitoring-systems-data-reporting-guide>

***Exhibit 2-1: Regulations and Requirements Pertaining to the Collection and Reporting of Radiation Exposures.***

| Title                                                      | Date                                                                                                 | Description                                                                                                                                                                               |
|------------------------------------------------------------|------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 10 CFR 835, Occupational Radiation Protection [5]          | Issued 12/14/1993<br>Amended 11/4/1998<br>Amended 6/8/2007<br>Amended 4/13/2011<br>Amended 8/11/2017 | Establishes radiation protection standards, exposure limits, and program requirements for protecting individuals from ionizing radiation that results from the conduct of DOE activities. |
| DOE O 231.1B, Environment, Safety and Health Reporting [6] | Approved 6/27/2011<br>Amended 11/28/2012                                                             | Requires the annual reporting of occupational radiation exposure records to the DOE REMS repository.                                                                                      |
| REMS Reporting Guide [7]                                   | Issued 2/23/2012                                                                                     | Specifies the current format and content of the reports required by DOE O 231.1B.                                                                                                         |

**Exhibit 2-2: DOE Dose Limits from 10 CFR 835.**

| <b>Personnel Category</b>                  | <b>Section of 10 CFR 835</b> | <b>Type of Exposure</b>                                                                                                                                                                                                      | <b>Acronym</b>                          | <b>Annual Limit</b>                                      |
|--------------------------------------------|------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|----------------------------------------------------------|
| General employees                          | 835.202                      | Total effective dose. The sum of the effective dose (for external exposures) and the committed effective dose.                                                                                                               | TED                                     | 5 rem (50 mSv)                                           |
|                                            |                              | The sum of the equivalent dose to the whole body for external exposures and the committed equivalent dose to any organ or tissue other than the skin or the lens of the eye, also referred to as the total organ dose (TOD). | EqD-WB + CEqD (TOD)                     | 50 rem (500 mSv)                                         |
|                                            |                              | Equivalent dose to the lens of the eye                                                                                                                                                                                       | EqD-Eye                                 | 15 rem (150 mSv)                                         |
|                                            |                              | The sum of the equivalent dose to the skin or to any extremity for external exposures and the committed equivalent dose to the skin or to any extremity                                                                      | EqD-SkWB + CEqD-SK and EqD-ME + CEqD-SK | 50 rem (500 mSv)                                         |
| Declared pregnant workers*                 | 835.206                      | The equivalent dose to the embryo/fetus from the period of conception to birth as a result of occupational exposure of a declared pregnant worker.                                                                           | EqD-Fetus                               | 0.500 rem (5 mSv) from the period of conception to birth |
| Minors                                     | 835.207                      | Total effective dose                                                                                                                                                                                                         | TED                                     | 0.100 rem (1 mSv)                                        |
| Members of the public in a controlled area | 835.208                      | Total effective dose                                                                                                                                                                                                         | TED                                     | 0.100 rem (1 mSv)                                        |

\* Limit applies to the embryo/fetus.

## 2.4 Amendments to 10 CFR 835

In August 2006, DOE published a proposed amendment to 10 CFR 835 in the *Federal Register*, and, in June 2007, the amended rule was published. The amendment:

- ◆ Specified new dosimetric terminology and quantities based on ICRP 60/68 in place of ICRP 26/30;
- ◆ Specified ICRP 60 tissue weighting factors in place of ICRP 26 weighting factors;
- ◆ Specified ICRP 60 radiation weighting factors in place of ICRP 26 quality factors;
- ◆ Amended other parts of the regulation that changed as a result of adopting ICRP 60 dosimetry system;
- ◆ Used the ICRP 68 dose conversion factors to determine values for the derived air concentrations; and
- ◆ Adopted other changes intended to enhance radiation protection.

The amended rule became effective on July 9, 2007, and was required to be fully implemented by DOE sites by July 9, 2010. All terminology used in this annual report reflects that of the amendment. In addition, 10 CFR 835 was revised in April 2011 when Appendix C (Derived Air Concentration [DAC] for Workers) was updated. On August 11, 2017, Appendices C and E were amended. The amendment to Appendix C corrected the air immersion DAC for any single radionuclide not listed in the Appendix C table with a decay mode other than alpha emission or spontaneous fission and with radioactive half-life less than 2 hours, adjusted for an 8-hour workday. The amendment to Appendix E corrected the activity information of two radioisotopes of rhodium (Rh-102 and Rh-102m).

# Section Three

## Occupational Radiation Dose at DOE

3

### 3.1 Analysis of the Data

The following key indicators are analyzed to identify and correlate parameters that impact occupational radiation doses at DOE:

- ◆ Number of records for monitored individuals;
- ◆ Individuals who received a measurable dose;
- ◆ Collective dose;
- ◆ Average measurable dose; and
- ◆ Dose distribution.

The analysis of key indicators for individual dose data includes:

- ◆ Doses exceeding the 5 rem (50 millisievert [mSv]) DOE regulatory limit; and
- ◆ Doses exceeding the 2 rem (20 mSv) DOE administrative control level (ACL).

Additional information is provided in this report concerning activities at sites contributing to most of the collective dose.

The data for prior years contained in this report are subject to change as sites may submit corrections for previous years as required by DOE O 231.1-1B(1)(b). Corrected or updated records received after the annual March 31 deadline are included in the following year's annual report.

### 3.2 Analysis of Aggregate Data

#### 3.2.1 Number of Monitored Individuals

The data in the REMS repository are reported by each facility in the form of a record for a monitoring period for each individual. An individual may have been monitored more than once at the same facility (e.g., multiple short-term assignments) or may have been monitored at more than one facility during the year. This can result in more than one record for an individual during the year in the REMS repository. However, the impact of multiple records per person on the annual trends and aggregate analysis of the data in this report is

not significant as it occurs consistently from year to year. An analysis of the number of individuals who are monitored at more than one location during the year is provided in Section 3.5, which supports this assertion. The term “number of monitored individuals” will be used herein with the understanding that it is determined by the number of records for monitored individuals.

#### 3.2.2 Number of Individuals with Measurable Dose

DOE uses the number of individuals with measurable dose to represent the exposed workforce size. In this context, “with measurable dose” means that a detectable value was reported for the individual.

Over the past 5-year period, measurable doses to all monitored individuals were well below the annual DOE regulatory limit of 5 rem (50 mSv) TED; however, one monitored individual received a single dose of 3.0 rem (30 mSv) TED in CY 2020. This dose exceeded the 2 rem (20 mSv) DOE ACL.

*Exhibit 3-1a* and *Exhibit 3-1b* show the number of DOE Federal and contract workers, the total number of individuals monitored for radiation dose, the number of individuals with a measurable dose, and the relative percentages of individuals with measurable dose for the past 5 years. The number of DOE Federal and contract employees was calculated by dividing the total hours worked per year by the average number of work hours per year. It is, therefore, not a true count of individuals, but is a representation of the total size of the DOE workforce as full-time equivalents (FTEs) and is included here to compare it to the number of individuals monitored.

As shown in *Exhibit 3-1b*, the number of monitored individuals increased by 9 percent from a value of 75,348 in CY 2022 to a value of 82,412 in CY 2023. CY 2022 marked the first year since 2019 where the number of monitored individuals returned to pre-pandemic levels.

Exhibit 3-1a: Monitoring of the DOE Workforce, CY 2019 – 2023.

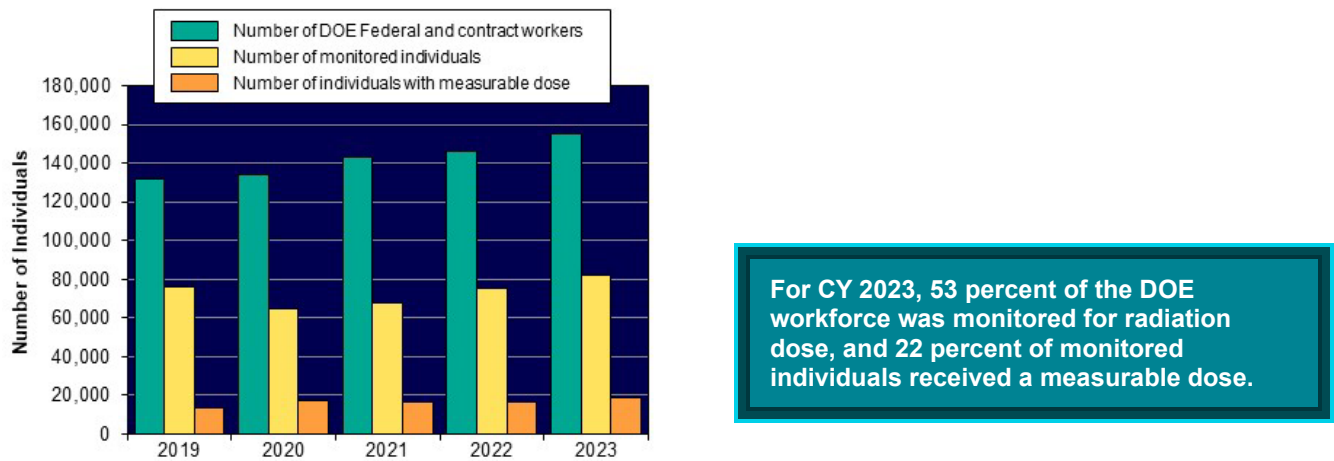


Exhibit 3-1b: Monitoring of the DOE Workforce, CY 2019 – 2023.

| Year           | DOE Federal & Contractor Workforce* | Number of Monitored Individuals | Percent of Monitored Individuals** | Number of Individuals with Measurable Dose | Percent of Individuals with Measurable Dose** |
|----------------|-------------------------------------|---------------------------------|------------------------------------|--------------------------------------------|-----------------------------------------------|
| 2019           | 131,822                             | 76,187                          | 58% ▼                              | 13,832                                     | 18%                                           |
| 2020           | 134,081                             | 64,728                          | 48% ▼                              | 17,258                                     | 27% ▲                                         |
| 2021           | 143,312                             | 67,793                          | 47% ▼                              | 16,903                                     | 25% ▼                                         |
| 2022           | 146,004                             | 75,348                          | 52% ▲                              | 16,774                                     | 22% ▼                                         |
| 2023           | 155,560                             | 82,412                          | 53% ▲                              | 18,469                                     | 22%                                           |
| 5-Year Average | 142,156                             | 73,294                          | 52%                                | 16,647                                     | 23%                                           |

\* The number of DOE and contract workers was determined from the total annual work hours at DOE [8] converted to FTEs.  
\*\* Up arrows indicate an increase from the previous year's value. Down arrows indicate a decrease from the previous year's value.

The number of individuals with measurable dose increased 10 percent from a value of 16,774 in CY 2022 to a value of 18,469 in CY 2023. Although the number of monitored individuals continued to increase post-COVID, the percentage of individuals with measurable dose remained the same at 22 percent from CY 2022 to CY 2023.

3.2.3 Collective Dose

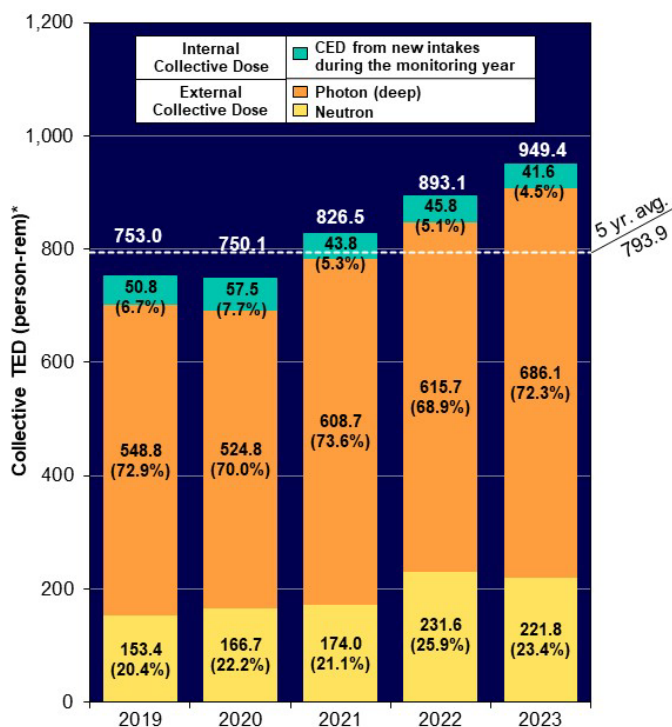
The collective dose is the sum of the dose received by all individuals with a measurable dose and is measured in units of person-rem and person-mSv. DOE monitors the collective dose as one measure of the overall performance of radiation protection

programs to keep individual exposures and collective exposures ALARA.

In this report, the term “collective dose” is also applied to various types of radiation dose, such as external or internal, and will be specified in conjunction with the term “collective” to clarify the intended meaning.

As shown in Exhibit 3-2, the collective TED increased at DOE by 6 percent from 893.1 person-rem (8,931 person-mSv) in CY 2022 to 949.4 person-rem (9,494 person-mSv) in CY 2023.

**Exhibit 3-2: Components of TED, CY 2019 – 2023.**



\* The percentages in parentheses represent the percentage of each dose component to the collective TED.

The collective TED increased by 6 percent at DOE from CY 2022 to 2023.

The collective internal dose decreased by 9 percent from CY 2022 to 2023.

The collective neutron dose decreased by 4 percent from CY 2022 to 2023.

The collective photon dose increased by 11 percent from CY 2022 to 2023.

Effective dose from photons—the component of external dose from gamma or x-ray electromagnetic radiation (also includes energetic betas)

Effective dose from neutrons—the component of external dose from neutrons ejected from the nucleus of an atom during nuclear reactions

Internal dose—radiation dose resulting from radioactive material taken into the body

The internal dose is based on the 50-year CED methodology. Under this methodology, the cumulative dose received from the intake of radioactive material over the next 50 years is assigned to the individual as a one-time dose in the year of intake.

The internal dose component of the collective TED decreased by 9 percent from 45.8 person-rem (458 person-mSv) in CY 2022 to 41.6 person-rem (416 person-mSv) in CY 2023 due to decreases at the Y-12 National Security Complex and Savannah River Site. The collective photon dose increased by 11 percent from 615.7 person-rem (6,157 person-mSv) in CY 2022 to 686.1 person-rem (6,861 person-mSv) in CY 2023 due to increases at Savannah River Site and Idaho.

The neutron component of the collective TED decreased by 4 percent from 231.6 person-rem (2,316 person-mSv) in CY 2022 to 221.8 person-rem (2,218 person-mSv). The decrease in CY 2023 resulted primarily from decreases in collective neutron dose at Los Alamos National Lab (LANL) and Oak Ridge National Lab (ORNL).

Five DOE sites contributed 86 percent of the collective TED in CY 2023. In descending order of collective TED, these were: LANL, Savannah River, Oak Ridge, Idaho, and Hanford. Savannah River and Idaho had increases in collective TED in CY 2023, while collective TED decreased at LANL, Oak Ridge, and Hanford. (See section 3.4.3.)

### 3.2.4 Average Measurable Dose

The average measurable dose to DOE monitored individuals, a key radiation dose indicator, is calculated by dividing the collective TED by the number of individuals with measurable dose. This is the average most commonly used by radiation exposure research organizations when examining trends and comparing doses received by individuals because it excludes those individuals that did not receive a measurable dose.

Exhibit 3-3 illustrates that the average measurable TED decreased by 4 percent from 0.053 rem (0.530 mSv) in CY 2022 to 0.051 rem (0.510 mSv) in CY 2023.

**Exhibit 3-3: Average Measurable TED, CY 2019 – 2023.**



While the collective dose and average measurable dose serve as measures of the magnitude of the dose accrued by DOE-monitored individuals, they do not depict the distribution of doses among the monitored individuals.

### 3.2.5 Dose Distribution

Exposure data are commonly analyzed in terms of dose intervals to depict the TED distribution among the monitored individuals. *Exhibit 3-4* shows the number of individuals in each of 11 different dose

ranges. The number of individuals receiving doses above 0.100 rem (1 mSv) is included to show the number of individuals with doses above the monitoring threshold specified in 10 CFR 835.402(a) and (c) [5].

The number of individuals in each dose range below 0.500 rem (5.0 mSv) increased, while the number of individuals in the ranges above 0.500 rem (5.0 mSv) decreased from CY 2022 to CY 2023. In the past 5 years (CY 2020), only one individual has received dose above 2.0 rem.

*Exhibit 3-5* presents the dose distribution of those individuals with measurable doses in terms of the percentage of individuals with measurable TED in each range. The doses received by the eighty-seven percent of monitored individuals who received a measurable dose were below the required monitoring threshold of 0.100 rem (1 mSv) specified in 10 CFR 835.402 (a) and (c).

These results reflect DOE's conservative practice of monitoring more individuals than are required. This ensures adequate protection of the individual and that ALARA principles are being effectively implemented to reduce radiation exposure.

**Exhibit 3-4: Distribution of TED by Dose Range, CY 2019 – 2023.**

| Number of Individuals in Each Dose Range          | TED Range (rem)*     | 2019    | 2020    | 2021    | 2022    | 2023    |
|---------------------------------------------------|----------------------|---------|---------|---------|---------|---------|
|                                                   | Less than measurable | 62,355  | 47,470  | 50,890  | 58,574  | 63,943  |
|                                                   | Measurable <0.100    | 11,953  | 15,683  | 14,937  | 14,728  | 16,137  |
|                                                   | 0.100–0.250          | 1,311   | 1,164   | 1,383   | 1,374   | 1,659   |
|                                                   | 0.250–0.500          | 425     | 310     | 443     | 453     | 523     |
|                                                   | 0.500–0.750          | 90      | 64      | 98      | 137     | 116     |
|                                                   | 0.750–1.000          | 42      | 24      | 29      | 60      | 28      |
|                                                   | 1–2                  | 11      | 12      | 13      | 22      | 6       |
|                                                   | 2–3                  | -       | -       | -       | -       | -       |
|                                                   | 3–4                  | -       | 1       | -       | -       | -       |
|                                                   | 4–5                  | -       | -       | -       | -       | -       |
|                                                   | >5                   | -       | -       | -       | -       | -       |
| Total number of records for monitored individuals |                      | 76,187  | 64,728  | 67,793  | 75,348  | 82,412  |
| Number with measurable dose                       |                      | 13,832  | 17,258  | 16,903  | 16,774  | 18,469  |
| Number with dose >0.100 rem                       |                      | 1,879   | 1,575   | 1,966   | 2,046   | 2,332   |
| Collective TED (person-rem)                       |                      | 752.982 | 750.096 | 826.474 | 893.125 | 949.395 |
| Average measurable TED (rem)                      |                      | 0.054   | 0.043   | 0.049   | 0.053   | 0.051   |

\* Individuals with doses equal to the dose value separating the dose ranges are included in the next higher dose range.

- Indicates dose ranges containing no individuals.

**Exhibit 3-5: Percentage of Individuals with Measurable TED by Dose Range, CY 2019 – 2023.**

| TED Range (rem)*                                 |                   | 2019   | 2020   | 2021   | 2022   | 2023   |
|--------------------------------------------------|-------------------|--------|--------|--------|--------|--------|
| Percentage of Individuals with Measurable TED    | Measurable <0.100 | 86.42% | 90.87% | 88.37% | 87.80% | 87.37% |
|                                                  | 0.100 – 0.250     | 9.48%  | 6.74%  | 8.18%  | 8.19%  | 8.98%  |
|                                                  | 0.250 – 0.500     | 3.07%  | 1.80%  | 2.62%  | 2.70%  | 2.83%  |
|                                                  | 0.500 – 0.750     | 0.65%  | 0.37%  | 0.58%  | 0.82%  | 0.63%  |
|                                                  | 0.750 – 1.000     | 0.30%  | 0.14%  | 0.17%  | 0.36%  | 0.15%  |
|                                                  | 1.0 – 2.0         | 0.08%  | 0.07%  | 0.08%  | 0.13%  | 0.03%  |
|                                                  | 2.0 – 3.0         | -      | -      | -      | -      | -      |
|                                                  | 3.0 – 4.0         | -      | 0.01%  | -      | -      | -      |
|                                                  | 4.0 – 5.0         | -      | -      | -      | -      | -      |
|                                                  | >5.0              | -      | -      | -      | -      | -      |
| % of monitored individuals with measurable dose  |                   | 18%    | 27%    | 25%    | 22%    | 22%    |
| % of monitored individuals with dose > 0.100 rem |                   | 2%     | 2%     | 3%     | 3%     | 3%     |

\* Individuals with doses equal to the dose value separating the dose ranges are included in the next higher dose range.  
 - Indicates dose ranges containing no individuals.

### 3.3 Analysis of Individual Dose Data

The previous section's analysis is based on aggregate data for DOE. From both the individual and regulatory perspectives, it is important to examine the doses received by individuals in the elevated dose ranges to understand the circumstances that led to these exposures and reduce or eliminate these types of exposures in the future.

#### 3.3.1 Doses in Excess of the Regulatory Limit

No individual was reported to have exceeded the TED regulatory limit (5 rem [50 mSv]) from CY 2019 – 2023.

Eighty-seven percent of monitored individuals who received a measurable dose in CY 2023 received doses below the required monitoring threshold of 0.100 rem (1 mSv) specified in 10 CFR 835.402 (a) and (c).

#### 3.3.2 Doses in Excess of the DOE Administrative Control Level

DOE Standard (STD)-1098-2017, *Radiological Control* [1] establishes a 2-rem (20-mSv) ACL for TED per year per person for all DOE activities.

The Standard states that each DOE site should establish an annual facility ACL based on historical and projected exposures and that no individual should be allowed to exceed this value without prior facility management approval.

One individual was reported to have exceeded the TED ACL (2 rem [20 mSv]) in CY 2020. In June of CY 2020, skin contamination and positive nasal smears were detected on one employee after an airborne release of radioactive material at LANL's Plutonium Processing and Handling Facility. The source of the contamination was determined to be a breach in a protective glove inside a glovebox. The individual received a CED of 2.4 rem (24 mSv) from plutonium-238, resulting in a TED of 3.0 rem (30 mSv) for the year. Details of the incident are available in the occurrence report NA--LASO-LANL-TA55-2020.

#### 3.3.3 Intakes of Radioactive Material

DOE tracks the number of radionuclide intakes as a performance measure in this report. DOE emphasizes the importance of implementing measures to avoid intakes and maintain doses as low as reasonable through the ALARA principle. Intakes involving certain radionuclides can take significant time to analyze and to determine final dose. This can result in changes to prior year dose totals if the updates are received after the March 31 annual reporting deadline.

*Exhibit 3-6* shows the number of individuals with measurable CED, collective CED, and average measurable CED for CY 2019 – 2023. The number of individuals with measurable CED increased less than 1 percent from 1,327 in CY 2022 to 1,333 in CY 2023, and the collective CED decreased by 9 percent. The average measurable CED per deposition decreased 11 percent from 0.035 rem (0.350 mSv) in CY 2022 to 0.031 rem (0.310 mSv) in CY 2023. Both the collective CED and the average measurable CED remained below the 5-year averages.

Ninety-three percent of the collective CED in CY 2023 was from uranium intakes at Y-12 during the operation and management of Enriched Uranium Operations facilities at the site. Compared with external doses, few individuals at DOE receive measurable internal doses. Larger fluctuations may occur from year to year in the number of individuals and the collective CED compared to other components of TED.

*Exhibit 3-7* shows the distribution of the CED from CY 2019 – 2023. The total number of individuals with measurable CED in each dose range is the sum of the

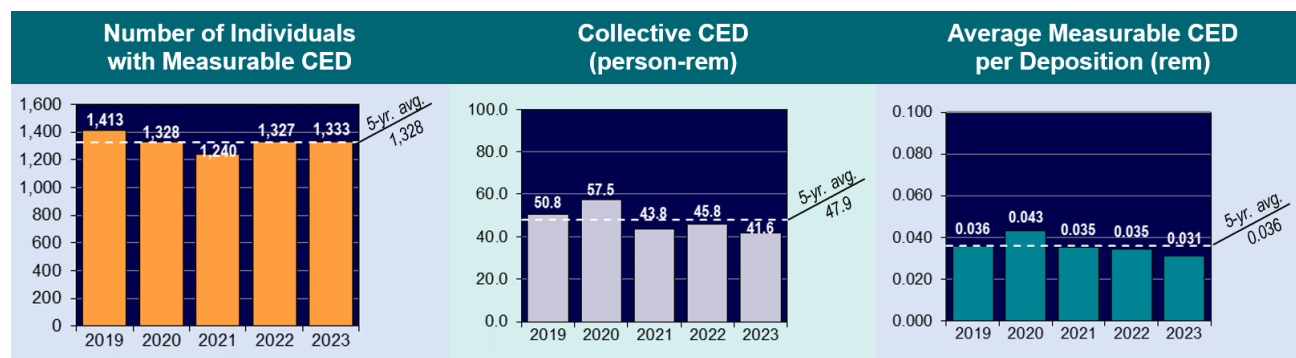
number of individuals receiving a CED in the dose range. Individuals may have had more than one intake of radioactive material, but the site would report one CED value from these intakes.

Doses below 0.020 rem (0.200 mSv) are shown as a separate dose range in order to show the large number of individuals in this low dose range.

The internal dose records indicate that the majority of the intakes resulted in very low doses.

In CY 2023, 53 percent of the internal dose records were for doses below 0.020 rem (0.200 mSv). Over the 5-year period, internal doses accounted for 6 percent of the collective TED; although only 5 percent of the individuals who received internal doses had estimated doses above the monitoring threshold (0.100 rem [1 mSv]) specified in 10 CFR 835.402(c) [5]. It is noted that the CED is a dose received over a 50-year period after the intake that is all credited to the individual in the year of intake, so the actual annual dose is lower.

***Exhibit 3-6: Number of Individuals with Measurable CED, Collective CED, and Average Measurable CED, CY 2019 – 2023.***



Note: The number of internal depositions represents the number of internal dose records with positive results reported for each individual.

***Exhibit 3-7: Internal Dose Distribution from Intakes, CY 2019 – 2023.***

| Year | Number of Individuals with CED in the Ranges (rem)* |             |             |             |             |             |         |         |         |         |      | Total No. of Indiv. | Total Collective CED (person-rem) |
|------|-----------------------------------------------------|-------------|-------------|-------------|-------------|-------------|---------|---------|---------|---------|------|---------------------|-----------------------------------|
|      | Meas. <0.020                                        | 0.020–0.100 | 0.100–0.250 | 0.250–0.500 | 0.500–0.750 | 0.750–1.000 | 1.0–2.0 | 2.0–3.0 | 3.0–4.0 | 4.0–5.0 | >5.0 |                     |                                   |
| 2019 | 683                                                 | 612         | 116         | 2           | -           | -           | -       | -       | -       | -       | -    | 1,413               | 50.761                            |
| 2020 | 586                                                 | 592         | 142         | 7           | -           | -           | -       | 1       | -       | -       | -    | 1,328               | 57.523                            |
| 2021 | 667                                                 | 456         | 113         | 4           | -           | -           | -       | -       | -       | -       | -    | 1,240               | 43.789                            |
| 2022 | 685                                                 | 537         | 104         | 1           | -           | -           | -       | -       | -       | -       | -    | 1,327               | 45.805                            |
| 2023 | 706                                                 | 558         | 66          | 3           | -           | -           | -       | -       | -       | -       | -    | 1,333               | 41.563                            |

\* Individuals with doses equal to the dose value separating the dose ranges are included in the next higher dose range.

- Indicates dose ranges containing no individuals.

### 3.3.4 Bioassay and Intake Summary Information

*Exhibit 3-8* shows the breakdown of bioassay measurements by type and number of measurements. Bioassay and intake summary information are required to be reported under the REMS Reporting Guide [7].

The values shown are based on the number of measurements taken and not the number of individuals monitored. Individuals may have measurements taken more than once during the year.

***Exhibit 3-8: Bioassay Measurements, CY 2019 – 2023.***



During the past 5 years, “Urinalysis” has been reported as the most common method of bioassay measurement used to determine internal doses to the individuals.

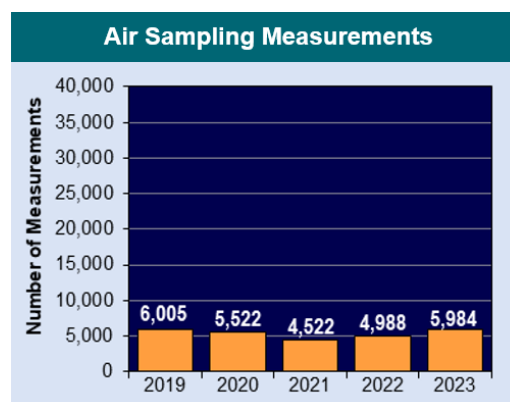
Nevada National Security Site, (NNSS), East Tennessee Technology Park (ETTP), and Idaho had the largest percentage increases in the number of “Urinalysis” measurements in CY 2023. Sixty-five percent of the “Urinalysis” measurements in CY 2023 were performed at four sites: LANL, Savannah River Site, Hanford Site, and Paducah Gaseous Diffusion Plant.

The measurements reported as “In Vivo” include direct measurements of the radioactive material in the body of the monitored person. Examples of “In Vivo” measurements include whole-body counts and lung or thyroid counts. Three sites—Hanford Site, Office of River Protection (ORP), and Savannah River Site—accounted for 67 percent of the “In Vivo” measurements.

*Exhibit 3.8* also indicates the number of “Fecal” bioassay measurements taken. Y-12 accounted for 93 percent of the measurements in CY 2023.

*Exhibit 3-9* shows the reported “Air Sampling” measurements, which are used to calculate the amount of airborne radioactive material taken into the body and the resultant internal dose.

***Exhibit 3-9: Air Sampling Measurements, CY 2019 – 2023.***

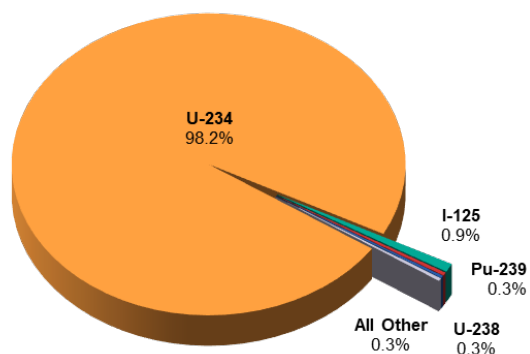


Savannah River Site performed the largest number of air sampling measurements, comprising 99 percent of the total air measurements taken in CY 2023.

LANL performed the largest number of bioassay and air sampling measurements combined, comprising 20 percent of the total measurements taken.

*Exhibit 3-10* shows the breakdown of the collective CED by radionuclide for CY 2023. Uranium-234 (U-234) accounted for the largest percentage of the collective CED, with 98 percent of this dose accrued at Y-12.

**Exhibit 3-10: Collective CED by Radionuclide from Internal Exposure, CY 2023.**



Appendix B contains additional information on intake data, such as Exhibits B-4, Internal Dose by Site; B-17, Internal Dose by Facility Type and Nuclide; B-19, Internal Dose by Labor Category; and B-21, Internal Dose Distribution by Site and Nuclide.

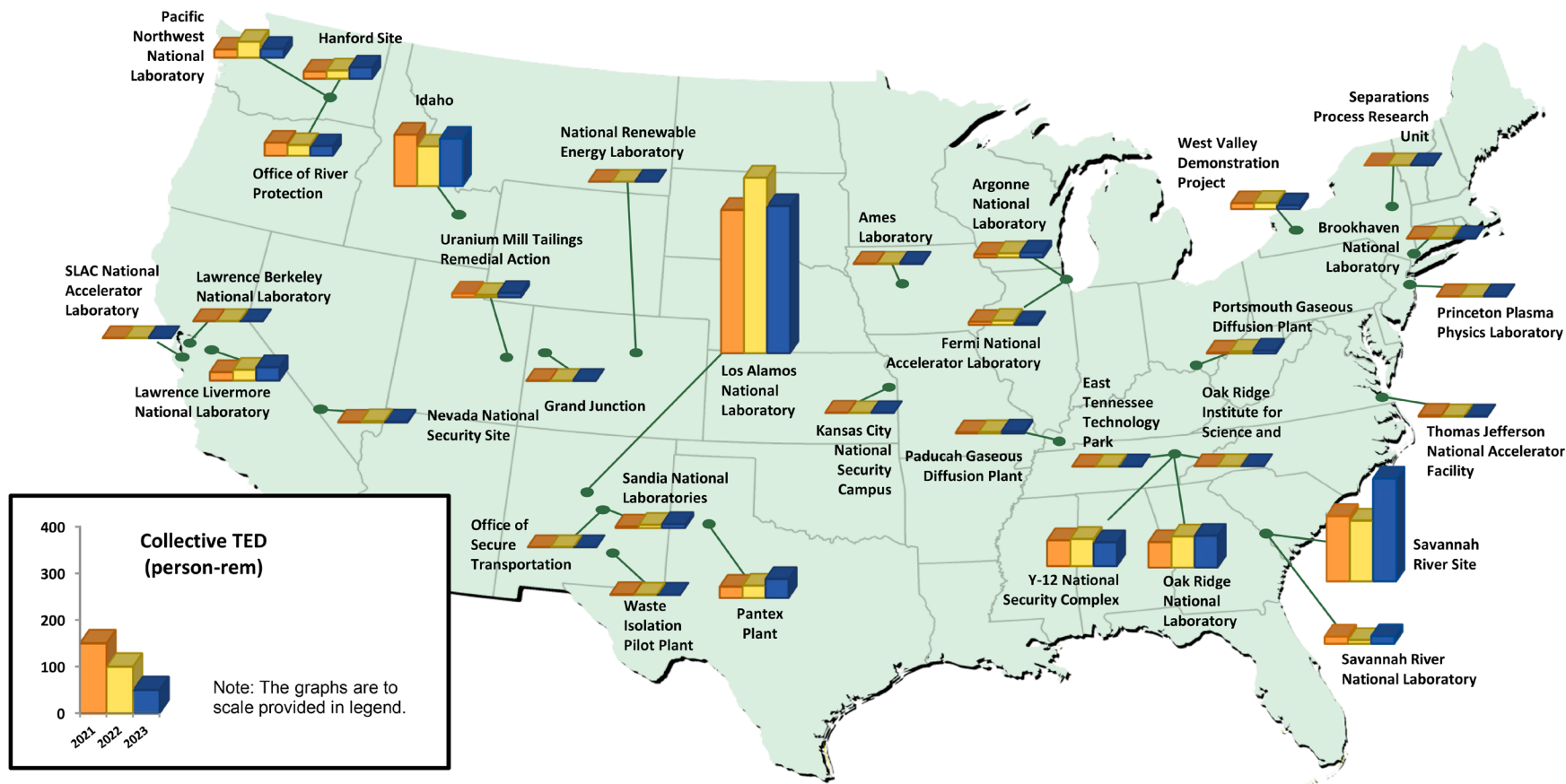
## 3.4 Analysis of Site Data

### 3.4.1 Collective TED by Site and Other Facilities

The collective TED values for CY 2021 – 2023 for the major DOE sites and operations/field offices are shown graphically in *Exhibit 3-11*. A list of the collective TED and number of individuals with measurable TED by DOE sites is shown in *Exhibit 3-12*. For the purposes of this report, the sites and facilities are grouped by geographic location as shown in these exhibits. When reported separately, the data for individual facilities at the sites are provided separately, such as at Hanford, Oak Ridge, and Savannah River. The data for Idaho is not provided separately and includes the Idaho National Laboratory (INL), Idaho Cleanup Project (ICP), and the Advanced Mixed Waste Treatment Project (AMWTP).

The collective TED increased by 6 percent from 893.125 person-rem (8,931 person-mSv) in CY 2022 to 949.395 person-rem (9,493 person-mSv) in CY 2023, with LANL, Savannah River, Oak Ridge, Idaho, and Hanford contributing 86 percent of the total DOE collective TED.

Exhibit 3-11: Collective TED by DOE Site for CY 2021 – 2023.



**Exhibit 3-12: Collective TED and Number of Individuals with Measurable TED by DOE Site, CY 2021 – 2023.**

| Site                                           | 2021                        |                       | 2022                        |                       | 2023                        |                       |
|------------------------------------------------|-----------------------------|-----------------------|-----------------------------|-----------------------|-----------------------------|-----------------------|
|                                                | Collective TED (person-rem) | Number with Meas. TED | Collective TED (person-rem) | Number with Meas. TED | Collective TED (person-rem) | Number with Meas. TED |
| Ames Laboratory                                | 0.710                       | 30                    | 0.565                       | 26                    | 0.778                       | 34                    |
| Argonne National Laboratory                    | 6.385                       | 96                    | 8.651                       | 115                   | 10.225                      | 261                   |
| Brookhaven National Laboratory                 | 0.977                       | 60                    | 1.976                       | 87                    | 1.611                       | 49                    |
| Fermi National Accelerator Laboratory          | 6.110                       | 195                   | 8.780                       | 143                   | 3.360                       | 86                    |
| Grand Junction Site                            | 0.158                       | 28                    | 0.013                       | 4                     | 0.003                       | 2                     |
| Hanford:                                       |                             |                       |                             |                       |                             |                       |
| Hanford Site                                   | 15.128                      | 534                   | 17.308                      | 555                   | 23.745                      | 503                   |
| Office of River Protection                     | 27.476                      | 706                   | 22.637                      | 562                   | 20.427                      | 523                   |
| Pacific Northwest National Laboratory          | 17.127                      | 533                   | 33.264                      | 537                   | 18.488                      | 671                   |
| <i>Hanford Totals:</i>                         | <b>59.731</b>               | <b>1,773</b>          | <b>73.209</b>               | <b>1,654</b>          | <b>62.660</b>               | <b>1,697</b>          |
| Idaho                                          | 108.728                     | 1,568                 | 83.730                      | 1,592                 | 100.208                     | 1,695                 |
| Kansas City National Security Campus           | 0.920                       | 68                    | 0.110                       | 33                    | 0.312                       | 68                    |
| Lawrence Berkeley National Laboratory          | 0.582                       | 13                    | 0.497                       | 12                    | 0.434                       | 10                    |
| Lawrence Livermore National Laboratory         | 17.680                      | 175                   | 22.621                      | 245                   | 27.907                      | 333                   |
| Los Alamos National Laboratory                 | <b>303.186</b>              | 4,206                 | <b>371.500</b>              | <b>4,467</b>          | <b>311.506</b>              | 3,764                 |
| National Renewable Energy Laboratory           | -                           | -                     | 0.005                       | 2                     | 0.003                       | 1                     |
| Nevada National Security Site                  | 1.821                       | 38                    | 2.876                       | 53                    | 2.351                       | 43                    |
| Oak Ridge:                                     |                             |                       |                             |                       |                             |                       |
| East Tennessee Technology Park                 | 0.468                       | 53                    | 0.701                       | 62                    | 0.577                       | 59                    |
| Oak Ridge Institute for Science and Education  | 0.025                       | 2                     | 0.129                       | 13                    | 0.098                       | 6                     |
| Oak Ridge National Laboratory                  | 53.455                      | 976                   | 65.393                      | 1,096                 | 66.688                      | 1,220                 |
| Y-12 National Security Complex                 | 54.186                      | 1,436                 | 57.144                      | 1,571                 | 50.006                      | 1,567                 |
| <i>Oak Ridge Totals:</i>                       | <b>108.134</b>              | <b>2,467</b>          | <b>123.367</b>              | <b>2,742</b>          | <b>117.369</b>              | <b>2,852</b>          |
| Office of Secure Transportation                | 0.084                       | 6                     | 0.157                       | 3                     | 0.048                       | 4                     |
| Paducah Gaseous Diffusion Plant                | 2.465                       | 92                    | 2.983                       | 83                    | 4.172                       | 96                    |
| Pantex Plant                                   | 23.755                      | 402                   | 25.909                      | 478                   | 40.176                      | 564                   |
| Portsmouth Gaseous Diffusion Plant             | 2.029                       | 69                    | 4.259                       | 133                   | 6.111                       | 157                   |
| Princeton Plasma Physics Laboratory            | 0.222                       | 42                    | 0.255                       | 47                    | 0.336                       | 48                    |
| Sandia National Laboratories                   | 3.092                       | 105                   | 6.477                       | 127                   | 7.959                       | 112                   |
| Savannah River:                                |                             |                       |                             |                       |                             |                       |
| Savannah River National Laboratory             | 14.896                      | 483                   | 7.665                       | 371                   | 15.793                      | 546                   |
| Savannah River Site                            | 137.840                     | <b>4,647</b>          | 128.062                     | 4,083                 | 216.973                     | <b>5,701</b>          |
| <i>Savannah River Totals:</i>                  | <b>152.736</b>              | <b>5,130</b>          | <b>135.727</b>              | <b>4,454</b>          | <b>232.766</b>              | <b>6,247</b>          |
| Separations Process Research Unit              | 0.012                       | 1                     | 0.016                       | 1                     | 0.013                       | 1                     |
| SLAC National Accelerator Laboratory           | -                           | -                     | -                           | -                     | 0.036                       | 2                     |
| Thomas Jefferson National Accelerator Facility | 1.974                       | 48                    | 0.854                       | 53                    | 0.612                       | 37                    |
| Uranium Mill Tailings Remedial Action Project  | 7.836                       | 65                    | 4.765                       | 61                    | 8.905                       | 125                   |
| Waste Isolation Pilot Plant                    | 1.283                       | 78                    | 0.449                       | 25                    | 0.163                       | 9                     |
| West Valley Demonstration Project              | 12.145                      | 108                   | 12.946                      | 119                   | 7.734                       | 130                   |
| Service Center Personnel *                     | 3.719                       | 40                    | 0.428                       | 15                    | 1.637                       | 42                    |
| <b>Totals</b>                                  | <b>826.474</b>              | <b>16,903</b>         | <b>893.125</b>              | <b>16,774</b>         | <b>949.395</b>              | <b>18,469</b>         |

Note: Bold and boxed values indicate the greatest value in each column. Dashes indicate no data reported for the year shown.

\* Includes personnel at National Energy Technology Laboratory (NETL), NNSA Albuquerque complex, Oak Ridge, and Waste Isolation Pilot Plant (WIPP) in addition to several smaller facilities not associated with a DOE site.

### 3.4.2 Changes by Site from CY 2022 to 2023

*Exhibit 3-13* shows the collective TED, the number monitored, the number with a measurable TED, and the average measurable TED as well as the percentage change in these values from the previous year. Some of the largest percentage changes occurred at relatively small facilities where conditions may fluctuate from year to year due to changes in workload and tasks conducted.

Changes that have the most impact in the overall values at DOE typically occur at sites with large collective TED. For example, the collective TED at LANL decreased from 371.500 person-rem (3,715 person-mSv) in CY 2022 to 311.506 person-rem (3,115 person-mSv) in CY 2023. (See *Exhibit 3-12* and section 3.4.3.)

Seventeen of the 33 DOE sites reported decreases in the collective TED from the CY 2022 values, and 16 of the 33 DOE sites reported increases in the collective TED from the CY 2022 values.

Seventeen of the 33 reporting sites experienced increases in the number of workers with a measurable TED from CY 2022 to 2023. The largest increase in total number of individuals with a measurable TED occurred at Savannah River Site, with an increase of 1,618 individuals or 40 percent (see *Exhibit 3-14*). The second largest increase in total number of individuals with a measurable TED occurred at Savannah River National Lab, with an increase of 175 individuals, or 47 percent.

Fifteen of the 33 reporting sites experienced decreases in the number of individuals with a measurable TED from CY 2022 to 2023. The largest decrease in the number of individuals receiving a measurable TED occurred at LANL, with a decrease of 703 individuals, or 16 percent. A discussion of activities at the highest dose facilities is included in section 3.4.3. One site, Separations Process Research Unit, had no change in the number of individuals with measurable TED from CY 2022 to CY 2023.

### 3.4.3 Activities Significantly Contributing to Collective Dose in CY 2023

In an effort to identify the reasons for changes in the collective dose at DOE, the sites provided information on activities that significantly contributed to the collective dose for CY 2023 as instructed in the REMS Reporting Guide, Item 1. In *Exhibit 3-14*, these sites are presented in descending order of collective TED with a dotted line representing the site's 5-year average TED. Sites that have reported less than 5 person-rem (50 person-mSv) for CY 2023 can be found in *Exhibit 3-15*. Due to the low doses and small number of individuals with measurable dose, wider variation can occur from year to year.

#### ***Site Listings of Exhibit 3-14 for > 5 Person-Rem***

|                                                           |      |
|-----------------------------------------------------------|------|
| Los Alamos National Laboratory (LANL) .....               | 3-13 |
| Savannah River Site .....                                 | 3-13 |
| Idaho .....                                               | 3-13 |
| Oak Ridge: Oak Ridge National Laboratory (ORNL).....      | 3-14 |
| Oak Ridge: Y-12 National Security Complex (Y-12) .....    | 3-14 |
| Pantex Plant (Pantex) .....                               | 3-14 |
| Lawrence Livermore National Laboratory (LLNL) .....       | 3-15 |
| Hanford: Hanford Site .....                               | 3-15 |
| Hanford: Office of River Protection (ORP).....            | 3-15 |
| Hanford: Pacific Northwest National Laboratory (PNNL).... | 3-16 |
| Savannah River National Laboratory .....                  | 3-16 |
| Argonne National Laboratory (ANL).....                    | 3-16 |
| Uranium Mill Tailings Remedial Action Project (UMTRA) .   | 3-17 |
| Sandia National Laboratories (SNL).....                   | 3-17 |
| West Valley Demonstration Project (WVDP).....             | 3-17 |
| Portsmouth Gaseous Diffusion Plant (PORTS) .....          | 3-18 |

#### ***Site Listings of Exhibit 3-15 for < 5 Person-Rem***

|                                                                          |      |
|--------------------------------------------------------------------------|------|
| Paducah Gaseous Diffusion Plant (PGDP) .....                             | 3-18 |
| Fermi National Accelerator Laboratory (Fermilab).....                    | 3-19 |
| Nevada National Security Site (NNSS).....                                | 3-19 |
| Brookhaven National Laboratory (BNL) .....                               | 3-19 |
| Ames Laboratory.....                                                     | 3-20 |
| Thomas Jefferson National Accelerator Facility (TJNAF) ....              | 3-20 |
| Oak Ridge: East Tennessee Technology Park (ETTP).....                    | 3-20 |
| Lawrence Berkeley National Laboratory (LBNL).....                        | 3-21 |
| Princeton Plasma Physics Laboratory (PPPL).....                          | 3-21 |
| Kansas City National Security Campus (KC-NSC) .....                      | 3-21 |
| Waste Isolation Pilot Plant (WIPP) .....                                 | 3-22 |
| Oak Ridge: Oak Ridge Institute for Science and Education<br>(ORISE)..... | 3-22 |
| Office of Secure Transportation (OST).....                               | 3-22 |
| SLAC National Accelerator Laboratory (SLAC) .....                        | 3-23 |
| Separations Process Research Unit (SPRU).....                            | 3-23 |
| Grand Junction Site .....                                                | 3-23 |
| National Renewable Energy Laboratory (NREL) .....                        | 3-24 |
| Energy Technology Engineering Center (ETEC) .....                        | 3-24 |

**Exhibit 3-13: Site Dose Data, CY 2023.**

| Site                                           | 2023                        |                          |                                 |                          |                       |                          |                             |                          |
|------------------------------------------------|-----------------------------|--------------------------|---------------------------------|--------------------------|-----------------------|--------------------------|-----------------------------|--------------------------|
|                                                | Collective TED (person-rem) | Percent Change from 2022 | Number of Monitored Individuals | Percent Change from 2022 | Number with Meas. TED | Percent Change from 2022 | Avg. Meas. TED (person-rem) | Percent Change from 2022 |
| Ames Laboratory                                | 0.778                       | ◇                        | 157                             | ◇                        | 34                    | ◇                        | 0.023                       | ◇                        |
| Argonne National Laboratory                    | 10.225                      | 18% ▲                    | 2,476                           | 40% ▲                    | 261                   | 127% ▲                   | 0.039                       | -48% ▼                   |
| Brookhaven National Laboratory                 | 1.611                       | -18% ▼                   | 2,599                           | 18% ▲                    | 49                    | -44% ▼                   | 0.033                       | ◇                        |
| Fermi National Accelerator Laboratory          | 3.360                       | -62% ▼                   | 1,447                           | 8% ▲                     | 86                    | -40% ▼                   | 0.039                       | -36% ▼                   |
| Grand Junction Site                            | 0.003                       | ◇                        | 30                              | ◇                        | 2                     | ◇                        | 0.002                       | ◇                        |
| Hanford:                                       |                             |                          |                                 |                          |                       |                          |                             |                          |
| Hanford Site                                   | 23.745                      | 37% ▲                    | 3,526                           | 2% ▲                     | 503                   | -9% ▼                    | 0.047                       | 51% ▲                    |
| Office of River Protection                     | 20.427                      | -10% ▼                   | 3,632                           | 6% ▲                     | 523                   | -7% ▼                    | 0.039                       | -3% ▼                    |
| Pacific Northwest National Laboratory          | 18.488                      | -44% ▼                   | 3,256                           | 27% ▲                    | 671                   | 25% ▲                    | 0.028                       | -56% ▼                   |
| <i>Hanford Totals:</i>                         | 62.660                      | -14% ▼                   | 10,414                          | 10% ▲                    | 1,697                 | 3% ▲                     | 0.037                       | -17% ▼                   |
| Idaho                                          | 100.208                     | 20% ▲                    | 7,213                           | 6% ▲                     | 1,695                 | 6% ▲                     | 0.059                       | 12% ▲                    |
| Kansas City National Security Campus           | 0.312                       | ◇                        | 224                             | ◇                        | 68                    | ◇                        | 0.005                       | ◇                        |
| Lawrence Berkeley National Laboratory          | 0.434                       | ◇                        | 619                             | ◇                        | 10                    | ◇                        | 0.043                       | ◇                        |
| Lawrence Livermore National Laboratory         | 27.907                      | 23% ▲                    | 4,433                           | 7% ▲                     | 333                   | 36% ▲                    | 0.084                       | -9% ▼                    |
| Los Alamos National Laboratory                 | 311.506                     | -16% ▼                   | 14,952                          | 15% ▲                    | 3,764                 | -16% ▼                   | 0.083                       | 0%                       |
| National Renewable Energy Laboratory           | 0.003                       | ◇                        | 6                               | ◇                        | 1                     | ◇                        | ◇                           | ◇                        |
| Nevada National Security Site                  | 2.351                       | -18% ▼                   | 783                             | 1% ▲                     | 43                    | -19% ▼                   | 0.055                       | 1% ▲                     |
| Oak Ridge:                                     |                             |                          |                                 |                          |                       |                          |                             |                          |
| East Tennessee Technology Park                 | 0.577                       | ◇                        | 245                             | ◇                        | 59                    | ◇                        | 0.010                       | ◇                        |
| Oak Ridge Institute for Science and Education  | 0.098                       | ◇                        | 89                              | ◇                        | 6                     | ◇                        | 0.016                       | ◇                        |
| Oak Ridge National Laboratory                  | 66.688                      | 2% ▲                     | 5,246                           | 6% ▲                     | 1,220                 | 11% ▲                    | 0.055                       | -8% ▼                    |
| Y-12 National Security Complex                 | 50.006                      | -12% ▼                   | 8,071                           | 13% ▲                    | 1,567                 | 0%                       | 0.032                       | -12% ▼                   |
| <i>Oak Ridge Totals:</i>                       | 117.369                     | -5% ▼                    | 13,651                          | 11% ▲                    | 2,852                 | 4% ▲                     | 0.041                       | -9% ▼                    |
| Office of Secure Transportation                | 0.048                       | ◇                        | 321                             | ◇                        | 4                     | ◇                        | 0.012                       | ◇                        |
| Paducah Gaseous Diffusion Plant                | 4.172                       | 40% ▲                    | 1,454                           | -6% ▼                    | 96                    | 16% ▲                    | 0.043                       | 21% ▲                    |
| Pantex Plant                                   | 40.176                      | 55% ▲                    | 4,701                           | 20% ▲                    | 564                   | 18% ▲                    | 0.071                       | 31% ▲                    |
| Portsmouth Gaseous Diffusion Plant             | 6.111                       | 43% ▲                    | 2,147                           | -9% ▼                    | 157                   | 18% ▲                    | 0.039                       | 22% ▲                    |
| Princeton Plasma Physics Laboratory            | 0.336                       | ◇                        | 343                             | ◇                        | 48                    | ◇                        | 0.007                       | ◇                        |
| Sandia National Laboratories                   | 7.959                       | 23% ▲                    | 2,094                           | 2% ▲                     | 112                   | -12% ▼                   | 0.071                       | 39% ▲                    |
| Savannah River:                                |                             |                          |                                 |                          |                       |                          |                             |                          |
| Savannah River National Laboratory             | 15.793                      | 106% ▲                   | 614                             | 23% ▲                    | 546                   | 47% ▲                    | 0.029                       | 40% ▲                    |
| Savannah River Site                            | 216.973                     | 69% ▲                    | 6,822                           | 5% ▲                     | 5,701                 | 40% ▲                    | 0.038                       | 21% ▲                    |
| <i>Savannah River Totals:</i>                  | 232.766                     | 71% ▲                    | 7,436                           | 6% ▲                     | 6,247                 | 40% ▲                    | 0.037                       | 22% ▲                    |
| Separations Process Research Unit              | 0.013                       | ◇                        | 11                              | ◇                        | 1                     | ◇                        | 0.013                       | ◇                        |
| SLAC National Accelerator Laboratory           | 0.036                       | ◇                        | 1,776                           | ◇                        | 2                     | ◇                        | ◇                           | ◇                        |
| Thomas Jefferson National Accelerator Facility | 0.612                       | ◇                        | 1,375                           | ◇                        | 37                    | ◇                        | 0.017                       | 3% ▲                     |
| Uranium Mill Tailings Remedial Action Project  | 8.905                       | 87% ▲                    | 171                             | 17% ▲                    | 125                   | 105% ▲                   | 0.071                       | -9% ▼                    |
| Waste Isolation Pilot Plant                    | 0.163                       | ◇                        | 833                             | ◇                        | 9                     | ◇                        | 0.018                       | 1% ▲                     |
| West Valley Demonstration Project              | 7.734                       | -40% ▼                   | 449                             | 6% ▲                     | 130                   | 9% ▲                     | 0.059                       | -45% ▼                   |
| Service Center Personnel*                      | 1.637                       | 282% ▲                   | 308                             | 7% ▲                     | 42                    | 180% ▲                   | 0.039                       | 37% ▲                    |
| <b>Totals</b>                                  | <b>949.395</b>              | <b>6% ▲</b>              | <b>82,412</b>                   | <b>9% ▲</b>              | <b>18,469</b>         | <b>10% ▲</b>             | <b>0.051</b>                | <b>-3% ▼</b>             |

Note: Bold and boxed values indicate the greatest value in each column.

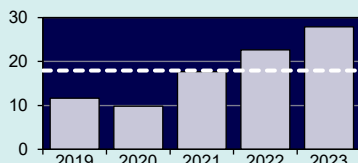
◇ The percentage change from the previous year is not shown because it is not meaningful when the site collective dose is less than 1 person-rem (10 person-mSv).

\* Includes personnel at NETL, NNSA Albuquerque complex, Oak Ridge, and WIPP in addition to several smaller facilities not associated with a DOE site.

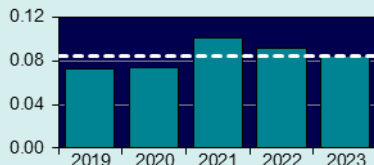
**Exhibit 3-14: Activities Significantly Contributing to Collective TED in CY 2023, for Sites Reporting Greater Than 5 Person-Rem, in Descending Order of Collective Dose.**

#### Los Alamos National Laboratory (LANL)

##### Collective TED (person-rem)



##### Average Measurable TED (rem)



##### Site Description

LANL conducts radiological operations in active facilities, storage facilities, and facilities with legacy radiological concerns, in addition to operations in inactive facilities and areas destined for decommissioning. Radiological activities include programmatic and production work; facility construction, modification, and maintenance; and research, development, and testing.

##### Activities Involving Radiation Exposure

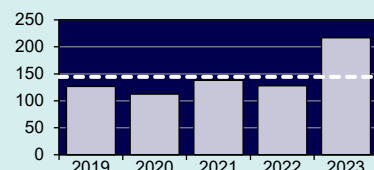
- Weapons manufacturing and related work at the TA-55 plutonium facility;
- Plutonium-238 work;
- Retrieval, repackaging, and shipping of radioactive waste; and
- Infrastructure support for radiological work and facility maintenance.

##### Changes in Dose

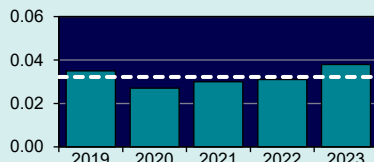
- In CY 2023, there was an atypical reduction in demand of programmatic heat source work, which contributed greatly to the observed reduction in dose; and
- There was a significant reduction in dose associated with craft labor performing construction activities at the plutonium facility.

#### Savannah River Site

##### Collective TED (person-rem)



##### Average Measurable TED (rem)



##### Site Description

Savannah River Site was constructed during the early 1950s to produce the basic materials used in the fabrication of nuclear weapons, primarily tritium and plutonium-239, in support of our nation's defense programs. Five reactors were built to produce these materials. Also built were several support facilities, including two chemical separations plants, a heavy water extraction plant, a nuclear fuel and target fabrication facility, a tritium extraction facility, and waste management facilities.

##### Activities Involving Radiation Exposure

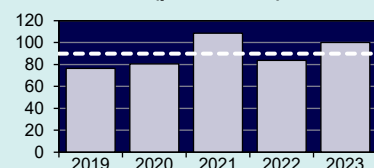
- The first shipment of down blended plutonium was sent from the site to the Waste Isolation Pilot Plant; and
- Employees reconfigured H Canyon dissolvers to maximize planned operations.

##### Changes in Dose

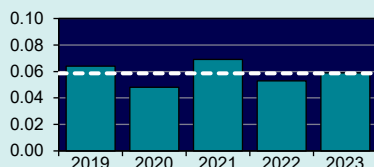
- The dose increased in CY 2023 as the site set a single-year record by processing nearly 3.2 million gallons of radioactive salt waste; and
- Two radioactive structures in the F Tank Farm were successfully closed and grouted.

#### Idaho

##### Collective TED (person-rem)



##### Average Measurable TED (rem)



##### Site Description

The primary focus of activities at the site is nuclear energy research and development at the Idaho National Laboratory. The DOE Idaho Operations Office oversees three major contracts to ensure that operations and research activities are carried out safely and in compliance with laws, regulations, and contract provisions. The Idaho Cleanup Project (ICP) focuses on addressing legacy wastes resulting from decades of widely varied work, including conventional weapons testing, government-owned research and power reactor development and testing, spent nuclear fuel reprocessing, laboratory research, and defense missions.

##### Activities Involving Radiation Exposure

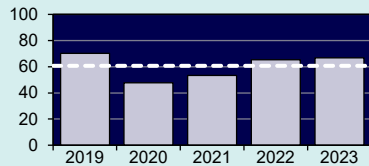
- Work at the Advanced Test Reactor (ATR) Complex, including preparations for installation of I-loop components, experiment modifications, maintenance, and operations, and research and development operations/laboratory support;
- Activities at the Materials and Fuel Complex, including maintenance and upgrades, treatment and storage for waste repackaging, benchtop and glovebox operations, and decontamination efforts; and
- Waste handling, consolidation and shipment, decontamination work, and radiography operations.

##### Changes in Dose

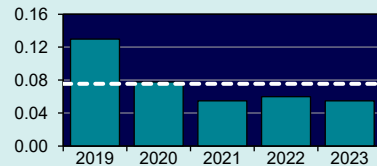
- The increased dose was a result of completing several significant tasks in high dose rate areas.

## Oak Ridge: Oak Ridge National Laboratory (ORNL)

### Collective TED (person-rem)



### Average Measurable TED (rem)



### Site Description

ORNL is a multiprogramming science and technology laboratory. ORNL's mission is to deliver scientific discoveries and technical breakthroughs that will accelerate the development and deployment of solutions in clean energy and global security, and, in doing so, create economic opportunity for the nation. ORNL also performs other work for DOE, including isotope production, information management, and technical program management, and provides research and technical assistance to other organizations.

### Activities Involving Radiation Exposure

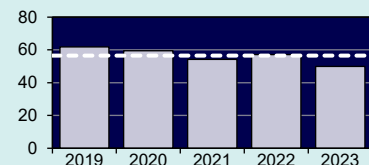
- Medical radioisotope production;
- Processing low-level and transuranic (TRU) waste at the TRU Waste Processing Center;
- Extracting thorium and down-blending uranium oxide at ISOTEK;
- Providing materials for National Aeronautics and Space Administration (NASA); and
- Facility maintenance.

### Changes in Dose

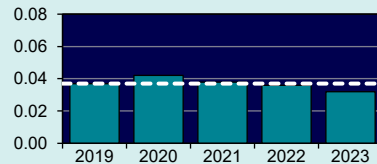
- The two percent increase in collective TED is primarily attributed to increases in operations activities and radioisotope production, particularly radioisotope production for industrial sponsors. Additionally, the number of ORNL monitored individuals increased by six percent over CY 2022, and;
- Radiation exposure increased when workers moved from processing in shielded gloveboxes to hot cells.

## Oak Ridge: Y-12 National Security Complex (Y-12)

### Collective TED (person-rem)



### Average Measurable TED (rem)



### Site Description

Y-12 is one of four production facilities in the National Nuclear Security Agency (NNSA) Nuclear Security Enterprise. The facility's emphasis is the processing and storage of uranium and development of technologies associated with those activities. Y-12 maintains the safety, security, and effectiveness of the U.S. nuclear weapons stockpile and processes highly enriched uranium for the Naval Nuclear Propulsion Program.

### Activities Involving Radiation Exposure

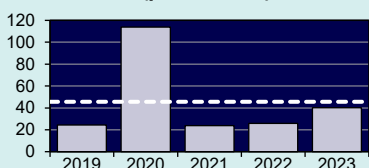
- Manufacture, processing, and storage of special nuclear materials;
- Characterization and hazardous waste removal at Y-12 Biology Complex; and
- Maintenance of equipment and facilities.

### Changes in Dose

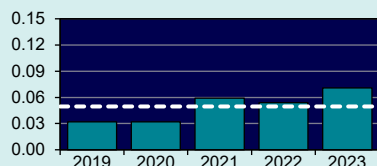
- Activities that affected the observed decrease in CY 2023 dose values include the continued cleaning efforts in radiological areas coupled with downsizing the removable contamination area footprint at the site.

## Pantex Plant (Pantex)

### Collective TED (person-rem)



### Average Measurable TED (rem)



### Site Description

Pantex is the nation's primary facility for the final assembly, disassembly, and maintenance of nuclear weapons. The last new nuclear weapon was completed in CY 1991. Since then, the plant has safely dismantled thousands of weapons retired from the stockpile by the military and placed the resulting plutonium pits in interim storage. Pantex has approximately 650 buildings, including specialized facilities in which maintenance, modification, disassembly, and assembly operations are conducted.

### Activities Involving Radiation Exposure

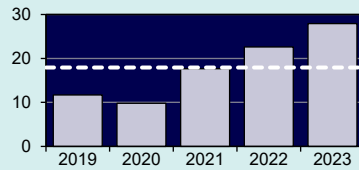
- Operations that expose individuals to large numbers of bare weapon pits containing significant quantities of special nuclear material (SNM); and
- Nuclear explosive assembly/disassembly operations, weapon dismantlement programs, life-extension programs, SNM Component Re-qualification, and SNM staging.

### Changes in Dose

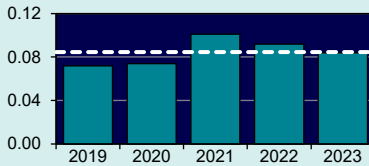
- The 55 percent dose increase in CY 2023 is the result of the continued increase in site personnel, increased production workloads, and other impacts that continue to evolve as goals for Pantex Production expand.

## Lawrence Livermore National Laboratory (LLNL)

### Collective TED (person-rem)



### Average Measurable TED (rem)



### Site Description

LLNL is a DOE facility operated by the Lawrence Livermore National Security, LLC management team, which includes Bechtel, the University of California, BWX Technologies, Washington Group, and Battelle. The site serves as a national resource of scientific, technical, and engineering capability with a special focus on national security. LLNL's mission encompasses such areas as: strategic defense, energy, the environment, biomedicine, technology transfer, education, counterterrorism, and emergency response. The types of radioactive materials range from tritium to TRU; the quantities of each range from nanocuries (i.e., normal environmental background values) to kilocuries.

### Activities Involving Radiation Exposure

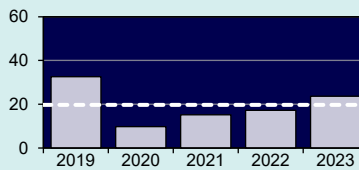
- Radiation-producing devices, such as x-ray machines, accelerators, and electron-beam welders; and
- Handling a wide range and quantity of radioactive materials.

### Changes in Dose

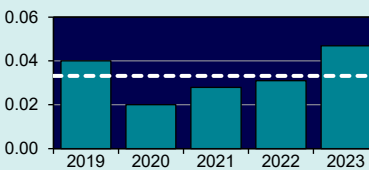
- The change in dose was due to 1) an increase in radiological work and/or dose to worker relative to last year and 2) several individuals with relatively high doses, and;
- There was a 9 percent increase in the monitored population from CY 2022 to CY 2023.

## Hanford: Hanford Site

### Collective TED (person-rem)



### Average Measurable TED (rem)



### Site Description

DOE's Hanford Site sits on 586 square miles in the desert of southeastern Washington State. The area is home to nine former nuclear reactors and their associated processing facilities that were built beginning in CY 1943. Hanford reactors produced plutonium from CY 1944 until 1987. Today, Hanford workers are involved in an environmental cleanup project and remediation of the site.

### Activities Involving Radiation Exposure

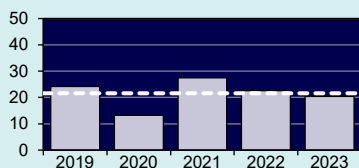
- Work activities at the plutonium finishing plant facility;
- Material handling and waste transfer; and
- Facility demolition and site remediation.

### Changes in Dose

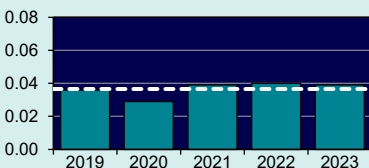
- The small increase in dose during CY 2023 stems mainly from an increase in personnel entries in the cell of building 324 and fire system maintenance at the Solid Waste Operations Complex.

## Hanford: Office of River Protection (ORP)

### Collective TED (person-rem)



### Average Measurable TED (rem)



### Site Description

The ORP's mission is to retrieve and treat Hanford's waste and close the tank farms to protect the Columbia River. Chemical and radioactive waste, resulting from more than four decades of plutonium production, is currently stored in 177 large underground tanks. ORP is responsible for the retrieval, treatment, and disposal of this waste. The cornerstone of the tank waste cleanup project is the Waste Treatment Plant (WTP). The WTP will use a technology called vitrification to immobilize chemical and radioactive waste in an exceptionally sturdy form of glass to isolate it from the environment.

### Activities Involving Radiation Exposure

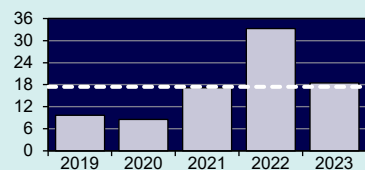
- Removal and transfer of waste from older single-shell tanks to newer, double-shell tanks;
- Maintenance and support of the evaporator, which reduces the volume of stored liquid waste by concentrating radioactive waste solutions;
- Work at the 222-S laboratory; and
- Well logging activities using an AmBe source.

### Changes in Dose

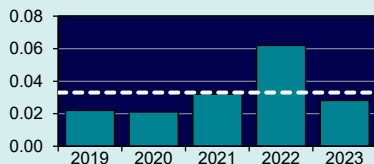
- The small dose reduction is due primarily to a technology change introduced in tank farm activities, continued efforts under the ALARA program, and changes in work scope.

## Hanford: Pacific Northwest National Laboratory (PNNL)

### Collective TED (person-rem)



### Average Measurable TED (rem)



### Site Description

Located in Richland, Washington, PNNL is 1 of 10 national laboratories managed by DOE's Office of Science (SC). The laboratory provides the facilities, unique scientific equipment, and world-renowned scientists and engineers to strengthen U.S. scientific foundations through fundamental research and innovation. The lab also supports Hanford site cleanup efforts by performing scientific and technical evaluations and reviews and developing and advancing new technologies to address site cleanup challenges.

### Activities Involving Radiation Exposure

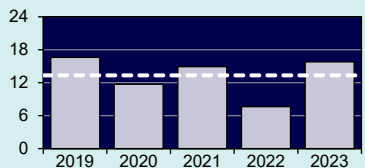
- Work at the Radiochemical Processing Laboratory;
- Radiation detection research; and
- Implementation of security measures for radiological materials of concern.

### Changes in Dose

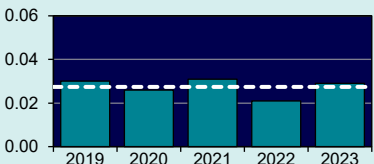
- The decrease in dose for CY 2023 is due to the completion of hot cell refurbishment work performed in CY 2022.

## Savannah River National Laboratory

### Collective TED (person-rem)



### Average Measurable TED (rem)



### Site Description

Savannah River National Laboratory began reporting separately from the Savannah River Site effective CY 2016. The laboratory supports DOE in its environmental management and nuclear security missions and applies its expertise in nuclear chemical manufacturing to assist DOE in meeting its objectives in areas, such as nuclear waste cleanup and defense nonproliferation.

### Activities Involving Radiation Exposure

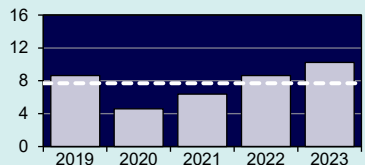
- Currently, most Savannah River National Laboratory programs support the Savannah River Site tritium mission. This includes applying hydrogen technologies used in processing tritium; extraction, purification, and storage of tritium; and
- Execution of the Mark-1A plutonium-244 recovery program.

### Changes in Dose

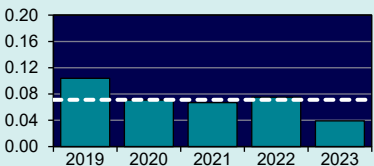
- The Salt Waste Processing Facility (SWPF) set a single-year record by processing nearly 3.2 million gallons of radioactive salt waste.

## Argonne National Laboratory (ANL)

### Collective TED (person-rem)



### Average Measurable TED (rem)



### Site Description

ANL is one of DOE's largest national laboratories for scientific and engineering research. ANL's mission is to apply a unique mix of world-class science, engineering, and user facilities to deliver innovative research and technologies. The principal radiological facilities at the laboratory are the Advanced Photon Source, a superconducting heavy-ion linear accelerator (LINAC), a 22-MeV pulsed electron LINAC, and several other charged-particle accelerators.

### Activities Involving Radiation Exposure

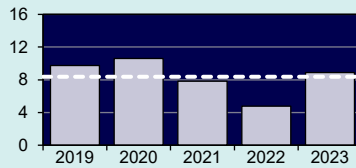
- Work supporting the lab's radiological facilities;
- Programmatic activities resulting primarily from research activities in the Irradiated Materials Laboratory; and
- Material handling, management, storage, and disposition activities associated with the Alpha Gamma Hot Cell Facility, the Waste Management Operations Facility, and the Radioactive Waste Storage Facility.

### Changes in Dose

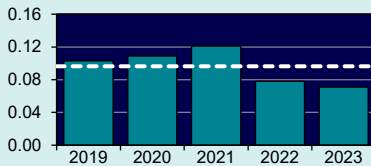
- The increase in dose can largely be attributed to the increased volume of workers being monitored.

## Uranium Mill Tailings Remedial Action Project (UMTRA)

### Collective TED (person-rem)



### Average Measurable TED (rem)



### Site Description

The UMTRA site is located approximately 3 miles northwest of Moab in Grand County, Utah, and includes a former uranium-ore processing facility. The site encompasses 480 acres, of which approximately 130 acres are covered by a uranium mill tailings pile. The UMTRA Project ships four trainloads of tailings to the Crescent Junction Disposal Site each week. The trains contain 152 containers of approximately 34 tons each, or a total of 20,672 tons of tailings per week. As of October 2023, more than 14.0 million tons of residual radioactive material has been moved offsite. Tailing shipments began in April 2009 and are expected to continue through CY 2034.

### Activities Involving Radiation Exposure

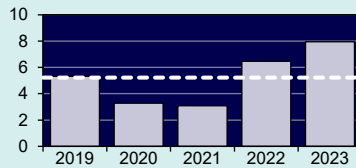
- Maintenance;
- Erosion control measures;
- Tailings excavation and conditioning;
- Loading tailings into containers and transporting to the rail beach;
- Ground water remediation; and
- Health and safety oversight.

### Changes in Dose

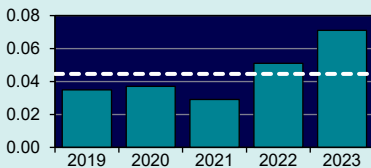
- The project continues to operate on a regular schedule of four trains per week.

## Sandia National Laboratories (SNL)

### Collective TED (person-rem)



### Average Measurable TED (rem)



### Site Description

SNL's primary mission is ensuring the U.S. nuclear arsenal is safe, secure, and reliable and can fully support our nation's deterrence policy. SNL is the engineering arm of the U.S. nuclear weapons enterprise. SNL's foundation is science-based engineering in which fundamental science, computer models, and unique experimental facilities come together so that researchers can understand, predict, and verify weapon systems performance.

### Activities Involving Radiation Exposure

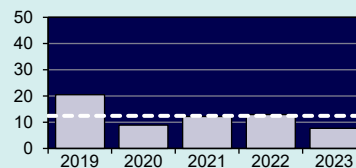
- Operation of a research reactor, gamma irradiation facilities, hot cell facilities, and several pulsed power accelerators;
- Conducting light laboratory work involving x-ray machines and tracer radionuclides; and
- Waste operations.

### Changes in Dose

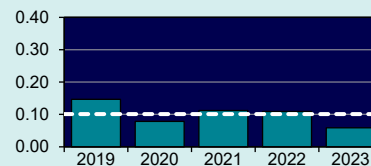
- The increase in dose in 2023 is attributable to the 30 percent increase in nuclear weapons development work at Sandia.

## West Valley Demonstration Project (WVDP)

### Collective TED (person-rem)



### Average Measurable TED (rem)



### Site Description

WVDP is a unique operation within DOE and came into being through the WVDP Act of 1980. The Act requires DOE to be responsible for solidifying the high-level waste and disposing of waste created by the solidification and decommissioning of the facilities used in the process. The land and facilities are not owned by DOE; rather, the project premises are the property of the New York State Energy Research and Development Authority (NYSERDA) and represent only 200 acres of the larger Western New York Service Center, which is approximately 3,300 acres, also owned by NYSERDA. After DOE's responsibilities under the Act are complete, the Act requires that the premises be returned to New York State.

### Activities Involving Radiation Exposure

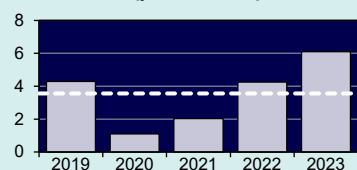
- Facility disposition;
- Waste container packaging and handling; and
- Demolition monitoring and support activities.

### Changes in Dose

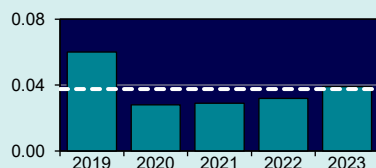
- Cessation of in-facility deactivation resulted in a reduction of doses to facility disposition and associated support groups, including Radiological Controls; and
- Waste operations exposure increases incurred due to the significant volume of demolition debris waste handling and processing of high activity legacy waste streams.

### Portsmouth Gaseous Diffusion Plant (PORTS)

#### Collective TED (person-rem)



#### Average Measurable TED (rem)



#### Site Description

PORTS is located in Pike County, Ohio. PORTS was one of three large gaseous diffusion plants initially constructed to produce enriched uranium to support the nation's nuclear weapons program and later enrich uranium for commercial nuclear reactors. The plant has been shut down and is currently undergoing decontamination and decommissioning.

#### Activities Involving Radiation Exposure

- Site deactivation, decommissioning, and demolition activities;
- Waste handling, processing, and shipment of uranium-bearing materials;
- Processing of uranium hexafluoride cylinders;
- Facility decontamination; and
- Uranium barter transfers.

#### Changes in Dose

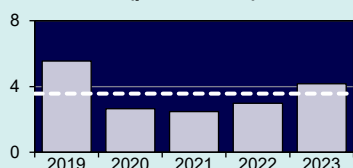
- The Portsmouth DUF6 facility resumed uranium hexafluoride processing in June 2022 with a graded restart from one operational line up to three during CY 2023 as operations returned to full production. The dose is as expected and typical for 3 lines operating.

As seen in *Exhibit 3-11*, most of the collective TED is associated with just a few DOE sites. For sites with relatively low collective dose or with fewer monitored individuals, wider variation can occur from year to year. These year-to-year variations are often due to changes in funding or mission priorities that can significantly impact the relatively small amount of work involving radiation exposure. In CY 2023, 18 DOE sites reported less than 5 person-rem (50 person-mSv) collective TED for their respective site. One of these sites, Energy Technology Engineering Center, ceased all work in radiological areas in CY 2020 and is no longer monitoring personnel for occupational exposure. These sites and the activities contributing to collective TED can be found in *Exhibit 3-15*.

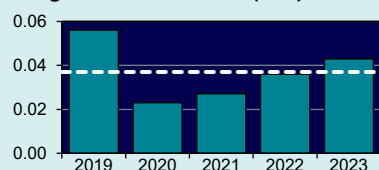
**Exhibit 3-15: Activities Significantly Contributing to Collective TED in CY 2023, for Sites Reporting Less Than 5 Person-Rem, in Descending Order of Collective Dose.**

### Paducah Gaseous Diffusion Plant (PGDP)

#### Collective TED (person-rem)



#### Average Measurable TED (rem)



#### Site Description

PGDP is located 3 miles south of the Ohio River and is 12 miles west of Paducah, Kentucky. The plant began enriching uranium in CY 1952, first for the nation's nuclear weapons program and then for nuclear fuel for commercial power plants. In CY 1994, the enrichment facilities were leased to United States Enrichment Corporation (USEC). In August 2013, USEC notified DOE that they were discontinuing enrichment operations and planning to de-lease the enrichment facilities.

#### Activities Involving Radiation Exposure

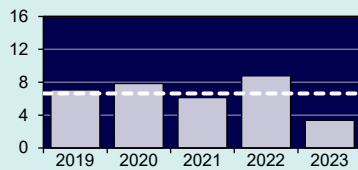
- Continued support of plant operations and maintenance of the Depleted Uranium Hexafluoride project as a nuclear facility;
- Environmental remediation and cleanup activities;
- Surveillance and maintenance activities;
- Waste disposition; and
- Decontamination and decommissioning of inactive facilities.

#### Changes in Dose

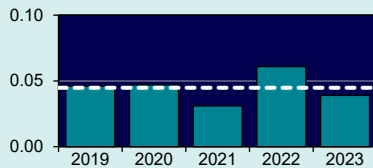
- In late 2022 the plant resumed uranium hexafluoride processing with a graded restart from one operational line up to three during CY 2023. This number is expected to remain consistent through the coming calendar year (2024).

## Fermi National Accelerator Laboratory (Fermilab)

### Collective TED (person-rem)



### Average Measurable TED (rem)



### Site Description

Fermilab provides leadership and resources for qualified researchers to conduct basic research at the frontiers of high-energy particle physics and related disciplines. The primary features of the site include the accelerator complex and associated building infrastructure, an interconnected industrial cooling water system, a housing complex for visiting researchers, row crop agriculture, and natural areas in various states of restoration.

### Activities Involving Radiation Exposure

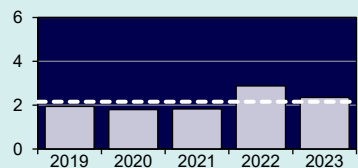
- Booster MP02 ion pump replacement;
- NuMI hadron monitor replacement, installation of rope hangers, and air filter changeout in NuMI chase;
- Inspection and replacement of MI-8 ion pump patch cables;
- Upgrade and repair activities of the accelerator complex; and
- LINAC tank 5 repairs.

### Changes in Dose

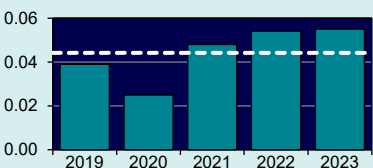
- The majority of dose to personnel resulted from work performed during the shutdown from July 17, 2023, through the end of the calendar year. Of the 838 planned jobs, 70 required Radiological Work Permits (RWPs), and completion of 12 ALARA jobs resulted in activities contributing to the collective dose during the shutdown.

## Nevada National Security Site (NNSS)

### Collective TED (person-rem)



### Average Measurable TED (rem)



### Site Description

NNSS is located approximately 65 miles northwest of Las Vegas. It is a remote facility that covers approximately 1,375 square miles of land. NNSS has been the primary location for testing nuclear experiments in the continental United States since CY 1951.

### Activities Involving Radiation Exposure

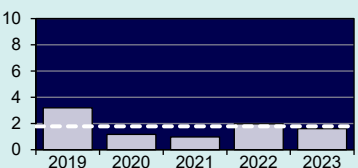
- Operation of low-level radioactive and mixed waste disposal facilities;
- Assembly and execution of subcritical experiments, confined critical experiments;
- Assembly/disassembly of special experiments;
- Operation of pulsed x-ray machines, linear accelerators, and neutron generators;
- Development, testing, and evaluation of radiation detectors;
- Surface cleanup and site characterization of contaminated land areas; and
- Managing environmental activity for the University of Nevada system.

### Changes in Dose

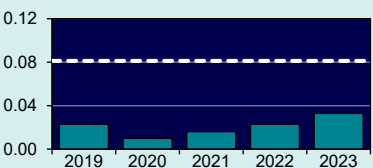
- Information for 2023 not received.

## Brookhaven National Laboratory (BNL)

### Collective TED (person-rem)



### Average Measurable TED (rem)



### Site Description

BNL conducts research in the physical, biomedical, and environmental sciences as well as in energy technologies and national security. BNL also builds and operates major scientific facilities that are available to university, industry, and government researchers.

### Activities Involving Radiation Exposure

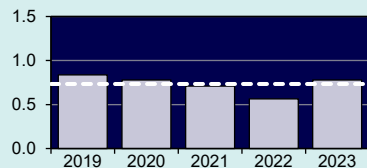
- Research involving nuclear and particle physics, accelerator science, and biological systems research;
- Facility maintenance and source replacement; and
- Support for the NASA Space Radiation Laboratory.

### Changes in Dose

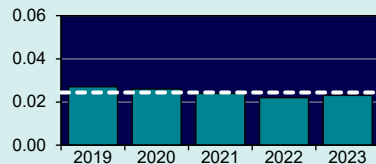
- The 23 percent decrease in dose for CY 2023 was primarily due to the implementation of effective radiological control activities.

## Ames Laboratory

### Collective TED (person-rem)



### Average Measurable TED (rem)



### Site Description

Ames Laboratory is a government-owned, contractor-operated research facility of the DOE. For over 65 years, the Ames Laboratory has sought solutions to energy-related problems through the exploration of chemical, engineering, materials, mathematical, and physical sciences.

### Activities Involving Radiation Exposure

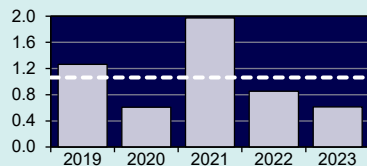
- Limited radioactive material work;
- Operation of 24 x-ray systems and 1 Mossbauer spectroscopy system; and
- Ongoing remediation of radiological legacy contamination.

### Changes in Dose

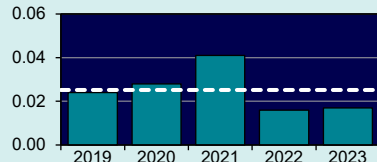
- The collective dose reflects normal routine operations and normal variations given the limited number of individuals with measurable dose and the very low doses.

## Thomas Jefferson National Accelerator Facility (TJNAF)

### Collective TED (person-rem)



### Average Measurable TED (rem)



### Site Description

TJNAF is one of 17 national laboratories funded by DOE. TJNAF's primary mission is to conduct basic research of the atom's nucleus using the unique particle accelerator known as the Continuous Electron Beam Accelerator Facility (CEBAF).

### Activities Involving Radiation Exposure

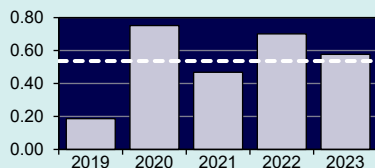
- Maintenance, modification, and repair of activated components associated with the CEBAF, Low Energy Recirculator Facility (LERF) and other ancillary activities (e.g., transport, storage, and disposal of radioactive materials). Typically, collective TED fluctuates up or down from year to year, depending on maintenance associated with unique experimental set-ups performed in radiological areas; and
- Maintenance activities and RCT surveys of Beam Enclosures.

### Changes in Dose

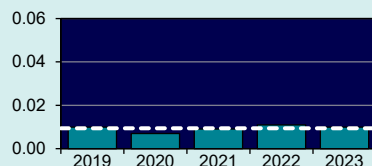
- The 2023 collective TED was primarily attributed to work in the vicinity of activated cryo-modules in the CEBAF and radiation surveys that supported experiments with significant residual radioactivity in experimental halls.

## Oak Ridge: East Tennessee Technology Park (ETTP)

### Collective TED (person-rem)



### Average Measurable TED (rem)



### Site Description

ETTP was originally named the Oak Ridge Gaseous Diffusion Plant. As part of the Manhattan Project, the plant was designed to produce enriched uranium for use in atomic weapons operations during World War II. After the war, the plant was renamed the Oak Ridge K-25 Site and produced enriched uranium for the commercial nuclear power industry from CY 1945 to 1985. In CY 1987, DOE renamed the site ETTP and began a major environmental cleanup project with the long-term goal of converting ETTP into a private industrial park.

### Activities Involving Radiation Exposure

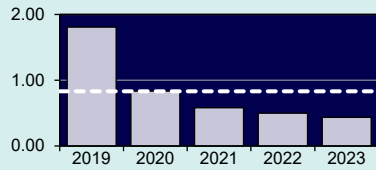
- Continuation of ongoing cleanup activities.

### Changes in Dose

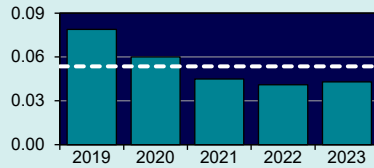
- The change in dose resulted from participation in routine cleanup and demolition activities.

## Lawrence Berkeley National Laboratory (LBNL)

### Collective TED (person-rem)



### Average Measurable TED (rem)



### Site Description

LBNL is a member of the national laboratory system supported by DOE through its SC and is charged with conducting unclassified research across a wide range of scientific disciplines. LBNL employs approximately 4,200 scientists, engineers, support staff, and students.

### Activities Involving Radiation Exposure

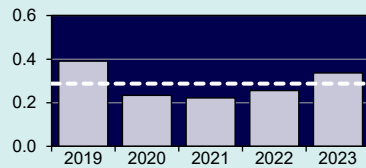
- Fluorine-18 research;
- Antineutrino research and experiments; and
- Site inventory of radioactive and nuclear material activities.

### Changes in Dose

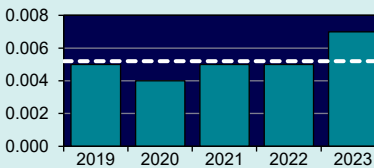
- The 13 percent decrease in the collective TED is due to staff at the building 56 medical cyclotron receiving less dose. Workers performing maintenance tasks at the 88-inch Cyclotron facility, isotope production work at the building 56 medical cyclotron, and radiochemistry work in building 70A received doses similar to those received during the previous year.

## Princeton Plasma Physics Laboratory (PPPL)

### Collective TED (person-rem)



### Average Measurable TED (rem)



### Site Description

PPPL is a collaborative national center for fusion energy research. The laboratory advances the coupled fields of fusion energy and plasma physics research and enhances the scientific understanding and key innovations needed to realize fusion as an energy source for the world. Additional focus is on next-generation computing and microelectronics while partnering with industries shaping these fields to accelerate the development of fusion energy.

### Activities Involving Radiation Exposure

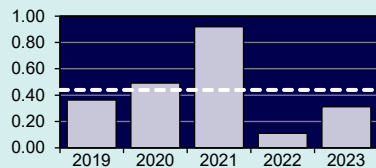
- Research work involving radioactive sources and x-ray generating devices; and
- Continued gradual increase in specific work focused on experimental machine upgrades while tritium system demolition and disposal activities are wrapping up.

### Changes in Dose

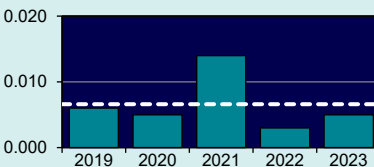
- Research work involving radioactive sources and x-ray generating devices experienced an increase in activity over the past year compared to the previous 2 years.

## Kansas City National Security Campus (KC-NSC)

### Collective TED (person-rem)



### Average Measurable TED (rem)



### Site Description

KC-NSC is responsible for manufacturing and procuring non-nuclear components for nuclear weapons, including electronic, mechanical, and engineered material components. It supports national laboratories, universities, and U.S. industry and is located in Kansas City, Missouri.

### Activities Involving Radiation Exposure

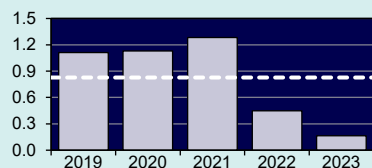
- Non-destructive testing and development projects;
- Telemetry component production and testing with neutron generators;
- Security operations, depleted uranium operations;
- Full production of weapons Life Extension Program; and
- Legacy part refurbishment and waste management.

### Changes in Dose

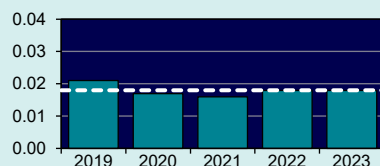
- This increase is attributed to an expansion of production capacity and the addition of three new permitted radiation processes.

## Waste Isolation Pilot Plant (WIPP)

### Collective TED (person-rem)



### Average Measurable TED (rem)



### Site Description

WIPP is located in the Chihuahuan Desert near Carlsbad, New Mexico. This DOE facility safely disposes of the nation's defense-related transuranic (TRU) radioactive waste. WIPP began disposal operations in March 1999.

### Activities Involving Radiation Exposure

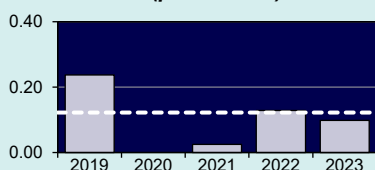
- Handling and processing of TRU waste for storage; and
- Managing long-term repository operations.

### Changes in Dose

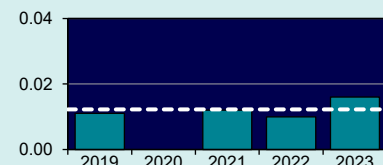
- The dose decreased 64 percent in CY 2023. All doses received were from routine activities associated with the disposal of TRU waste.

## Oak Ridge: Oak Ridge Institute for Science and Education (ORISE)

### Collective TED (person-rem)



### Average Measurable TED (rem)



### Site Description

ORISE is a DOE institute focusing on scientific initiatives to research health risks from occupational hazards, assess environmental cleanup, respond to radiation medical emergencies, support national security and emergency preparedness, and educate the next generation of scientists.

### Activities Involving Radiation Exposure

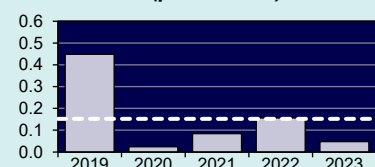
- Independent verification activities involving radiological surveys at sites undergoing decommissioning; and
- Environmental sample processing and radiological protection.

### Changes in Dose

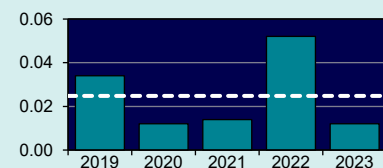
- Dose to radiological workers remained low in CY 2023. Only six individuals received a measurable dose in conjunction with health physics training activities.

## Office of Secure Transportation (OST)

### Collective TED (person-rem)



### Average Measurable TED (rem)



### Site Description

OST is the NNSA organization tasked to provide secure ground transportation of nuclear weapons, special nuclear material (SNM), nuclear weapon components, and nuclear explosive-like assemblies. OST operates both secure ground transporters and Federal aircraft, which make up the Transportation Safeguards System (TSS). The TSS Federal Agent and vehicle maintenance facilities are located in Oak Ridge, Tennessee; Amarillo, Texas; and Albuquerque, New Mexico. The OST Administrative Headquarters are located at Kirtland Air Force Base in Albuquerque, New Mexico.

### Activities Involving Radiation Exposure

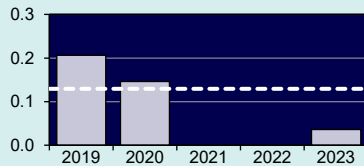
- Providing secure ground transportation of nuclear weapons, SNM, nuclear weapon components, and nuclear explosive-like assemblies; and
- Tracking and directing cargo loading revisions to minimize radiation exposure.

### Changes in Dose

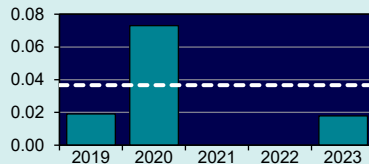
- Differences may be attributed to the small number of individuals (less than 10 for each year).

## SLAC National Accelerator Laboratory (SLAC)

### Collective TED (person-rem)



### Average Measurable TED (rem)



### Site Description

SLAC, which opened in CY 1962, is one of 10 DOE SC laboratories and is operated by Stanford University on behalf of DOE. Originally a premier, high-energy particle accelerator laboratory, SLAC has grown into a state-of-the-art photon science laboratory. SLAC's scientific mission has diversified from an original focus on particle physics and accelerator science to include cosmology, materials and environmental sciences, biology, chemistry, and alternative energy research.

### Activities Involving Radiation Exposure

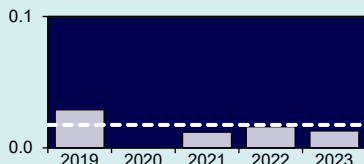
- Operation of the LINAC Coherent Light Source (LCLS) – the world's first hard x-ray free electron laser;
- Operation of the Stanford Synchrotron Radiation Lightsource – a pioneering synchrotron radiation facility;
- Operation of the Stanford Positron-Electron Asymmetric Ring (SPEAR3), and a separate, shorter linear accelerator (LINAC), and a booster ring for injecting accelerated beams of electrons into SPEAR3;
- Photon Science: Photon Ultrafast Laser Science and Engineering (PULSE), and Stanford Institute for Material and Energy Sciences (SIMES);
- Particle Physics and Astrophysics: Experimental Particle Physics, Kavli Institute for Particle Astrophysics and Cosmology (KIPAC), and Accelerator Research and Development;
- Facilities for Accelerator Science and Experimental Test Beams (FACET-II); and
- Test Facilities: Next Linear Collider Test Accelerator (NLCTA) and Accelerator Structure Test Area (ASTA).

### Changes in Dose

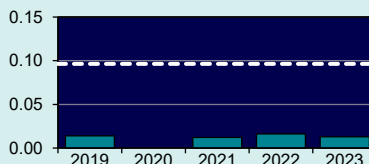
- The CY 2023 collective TED of 36.0 reflects the fact that no major radiological projects were conducted during CY 2023.

## Separations Process Research Unit (SPRU)

### Collective TED (person-rem)



### Average Measurable TED (rem)



### Site Description

SPRU is located at Knolls Atomic Power Laboratory based in upstate New York. Built in the 1940s, the buildings supported the SPRU mission to research the chemical process to extract plutonium from irradiated materials. Although the equipment was flushed and drained and bulk waste was removed following the shutdown of the facilities in CY 1953, residual materials are present in the tanks, buildings H2 and G2, and interconnecting pipe tunnels. The site is currently undergoing a variety of cleanup activities, including demolition, decontamination, and remediation.

### Activities Involving Radiation Exposure

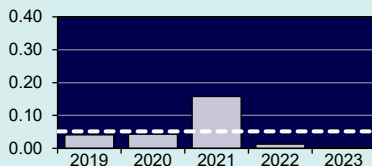
- Repackaging TRU waste;
- Processing and shipping low activity water and waste; and
- Surveillance and maintenance of site condition activities.

### Changes in Dose

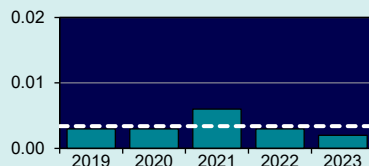
- Collective dose remained low due to maintaining proper ALARA controls during quarterly inspections of the TRU waste storage area.

## Grand Junction Site

### Collective TED (person-rem)



### Average Measurable TED (rem)



### Site Description

The Grand Junction Site was transferred to the Office of Legacy Management (LM) in CY 2003. LM manages the site according to a site-specific Long-Term Surveillance and Maintenance Plan.

### Activities Involving Radiation Exposure

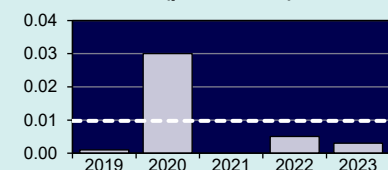
- Walk-over radiological surveys;
- Environmental/geological soil sampling;
- Abandoned mine site inspections; and
- Abandoned mine site reclamation construction activities.

### Changes in Dose

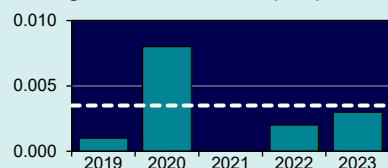
- All doses received were from routine field activities performed by LM personnel as they worked to develop a record of all locations and current conditions of legacy uranium mines under the Defense-Related Uranium Mines (DRUM) Program.
- There was a decrease in average worker dose combined with an increase in the number of monitored personnel in CY 2023.

### National Renewable Energy Laboratory (NREL)

#### Collective TED (person-rem)



#### Average Measurable TED (rem)



#### Site Description

NREL focuses on creative answers to today's energy challenges. From fundamental science and energy analysis to validating new products for the commercial market, NREL researchers are dedicated to transforming the way the world uses energy. With more than 35 years of successful innovation in energy efficiency and renewable energy, NREL discoveries provide sustainable alternatives for powering homes, businesses, and transportation systems.

#### Activities Involving Radiation Exposure

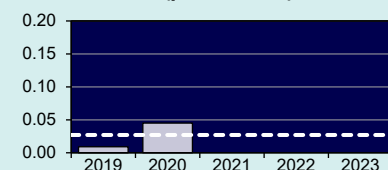
- Operation of analytical and process equipment containing sealed sources.

#### Changes in Dose

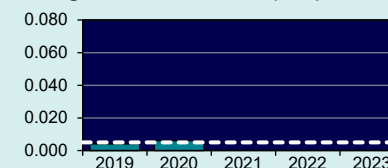
- The primary reason for the decrease in dose was a decrease in work time involving radiation exposure surrounding x-ray-generating equipment.

### Energy Technology Engineering Center (ETEC)

#### Collective TED (person-rem)



#### Average Measurable TED (rem)



#### Site Description

ETEC is located within Area IV of the Santa Susana Field Laboratory. The laboratory comprises four discrete operational areas with two adjacent undeveloped properties. In CY 1988, DOE decided to close the remaining ETEC operations. ETEC is currently in a safe shutdown mode, pending the completion of the Environmental Impact Statement.

#### Activities Involving Radiation Exposure

- ETEC eliminated personnel dosimeters in CY 2020 due to no accessible radiological areas present onsite.

### 3.4.4 Summary by Program Office

DOE has divided the responsibility of managing its missions among specific program offices. A site may include facilities or project areas that perform work in support of the mission of multiple program offices. In these cases, the dose records are separated by the reporting organization and assigned to the corresponding program office. For this reason, some sites will have portions of the collective dose shown under more than one program office.

*Exhibit 3-16* shows the collective TED, number of individuals with measurable TED, and the average

measurable TED by DOE program office. NNSA and the Office of Environmental Management (EM) account for 86 percent of the collective TED (53 and 33 percent, respectively).

The primary sites contributing to the collective TED within EM are Savannah River Site and Idaho. For NNSA, the primary contributors are LANL, Savannah River Site, and Y-12 National Security Complex.

A more detailed breakdown of the exposure information by site, program office, and contractor is included in the Appendices of this report.

**Exhibit 3-16: Program Office Dose Data, CY 2023.**

| Program Office                                                 | Collective TED<br>(person-rem) | Percent<br>Change<br>from 2022 | Number<br>with Meas.<br>Dose (TED) | Percent<br>Change<br>from 2022 | Avg. Meas.<br>TED (rem) | Percent<br>Change<br>from 2022 |
|----------------------------------------------------------------|--------------------------------|--------------------------------|------------------------------------|--------------------------------|-------------------------|--------------------------------|
| <b>Office of Energy Efficiency and Renewable Energy (EERE)</b> |                                |                                |                                    |                                |                         |                                |
| National Renewable Energy Laboratory                           | 0.003                          | ◇                              | 1                                  | ◇                              | 0.003                   | ◇                              |
| <b>EE Totals</b>                                               | <b>0.003</b>                   | ◇                              | <b>1</b>                           | ◇                              | <b>0.003</b>            | ◇                              |
| <b>Office of Environmental Management (EM)</b>                 |                                |                                |                                    |                                |                         |                                |
| <b>Total Monitored</b>                                         |                                |                                |                                    |                                |                         | <b>= 22,005*</b>               |
| East Tennessee Technology Park                                 | 0.577                          | ◇                              | 59                                 | ◇                              | 0.010                   | ◇                              |
| Hanford Site                                                   | 23.745                         | 37% ▲                          | 503                                | -9% ▼                          | 0.047                   | 51% ▲                          |
| Idaho (ICP, AMWTP and DOE IOO)                                 | 48.202                         | 22% ▲                          | 892                                | 22% ▲                          | 0.054                   | 0%                             |
| Los Alamos National Laboratory                                 | 1.864                          | -8% ▼                          | 76                                 | -22% ▼                         | 0.025                   | 19% ▲                          |
| Oak Ridge National Laboratory                                  | 20.006                         | 19% ▲                          | 766                                | 7% ▲                           | 0.026                   | 11% ▲                          |
| Office of River Protection                                     | 20.427                         | -10% ▼                         | 523                                | -7% ▼                          | 0.039                   | -3% ▼                          |
| Paducah Gaseous Diffusion Plant                                | 4.172                          | 40% ▲                          | 96                                 | 16% ▲                          | 0.043                   | 21% ▲                          |
| Portsmouth Gaseous Diffusion Plant                             | 6.111                          | 43% ▲                          | 157                                | 18% ▲                          | 0.039                   | 22% ▲                          |
| Savannah River National Laboratory                             | 15.793                         | 106% ▲                         | 546                                | 47% ▲                          | 0.029                   | 40% ▲                          |
| Savannah River Site                                            | 155.261                        | 77% ▲                          | 3,820                              | 40% ▲                          | 0.041                   | 26% ▲                          |
| Separations Process Research Unit                              | 0.013                          | ◇                              | 1                                  | ◇                              | 0.013                   | ◇                              |
| Service Center Personnel*                                      | 1.610                          | 276% ▲                         | 40                                 | 167% ▲                         | 0.040                   | 41% ▲                          |
| Uranium Mill Tailings Remedial Action Project                  | 8.905                          | 87% ▲                          | 125                                | 105% ▲                         | 0.071                   | -9% ▼                          |
| Waste Isolation Pilot Plant                                    | 0.163                          | ◇                              | 9                                  | ◇                              | 0.018                   | ◇                              |
| West Valley Demonstration Project                              | 7.734                          | -40% ▼                         | 130                                | 9% ▲                           | 0.059                   | -45% ▼                         |
| <b>EM Totals</b>                                               | <b>314.583</b>                 | <b>43% ▲</b>                   | <b>7,743</b>                       | <b>24% ▲</b>                   | <b>0.041</b>            | <b>15% ▲</b>                   |
| <b>Office of Fossil Energy (FE)</b>                            |                                |                                |                                    |                                |                         |                                |
| <b>Total Monitored</b>                                         |                                |                                |                                    |                                |                         | <b>= 85*</b>                   |
| Service Center Personnel*                                      | 0.000                          | ◇                              | 0                                  | ◇                              | 0.000                   | ◇                              |
| <b>FE Totals</b>                                               | <b>0.000</b>                   | ◇                              | <b>0</b>                           | ◇                              | <b>0.000</b>            | ◇                              |
| <b>Office of Legacy Management (LM)</b>                        |                                |                                |                                    |                                |                         |                                |
| <b>Total Monitored</b>                                         |                                |                                |                                    |                                |                         | <b>= 30*</b>                   |
| Grand Junction Site                                            | 0.003                          | ◇                              | 2                                  | ◇                              | 0.002                   | ◇                              |
| <b>LM Totals</b>                                               | <b>0.003</b>                   | ◇                              | <b>2</b>                           | ◇                              | <b>0.002</b>            | ◇                              |
| <b>National Nuclear Security Administration (NNSA)</b>         |                                |                                |                                    |                                |                         |                                |
| <b>Total Monitored</b>                                         |                                |                                |                                    |                                |                         | <b>= 37,306*</b>               |
| Kansas City National Security Campus                           | 0.312                          | ◇                              | 68                                 | ◇                              | 0.005                   | ◇                              |
| Lawrence Livermore National Laboratory                         | 27.907                         | 23% ▲                          | 333                                | 36% ▲                          | 0.084                   | -1% ▼                          |
| Los Alamos National Laboratory                                 | 309.642                        | -16% ▼                         | 3,688                              | -16% ▼                         | 0.085                   | -1% ▼                          |
| Nevada National Security Site                                  | 2.351                          | -18% ▼                         | 43                                 | -19% ▼                         | 0.055                   | 1% ▲                           |
| Office of Secure Transportation                                | 0.048                          | ◇                              | 4                                  | ◇                              | 0.012                   | ◇                              |
| Pantex Plant                                                   | 40.176                         | 55% ▲                          | 564                                | 18% ▲                          | 0.071                   | 31% ▲                          |
| Sandia National Laboratories                                   | 7.959                          | 23% ▲                          | 112                                | -12% ▼                         | 0.071                   | 39% ▲                          |
| Savannah River Site                                            | 61.712                         | 53% ▲                          | 1,881                              | 38% ▲                          | 0.033                   | 11% ▲                          |
| Service Center Personnel*                                      | 0.017                          | ◇                              | 1                                  | ◇                              | 0.017                   | ◇                              |
| Y-12 National Security Complex                                 | 50.006                         | -12% ▼                         | 1,567                              | 0%                             | 0.032                   | -12% ▼                         |
| <b>NNSA Totals</b>                                             | <b>500.130</b>                 | <b>-5% ▼</b>                   | <b>8,261</b>                       | <b>0%</b>                      | <b>0.061</b>            | <b>-5% ▼</b>                   |
| <b>Office of Nuclear Energy (NE)</b>                           |                                |                                |                                    |                                |                         |                                |
| <b>Total Monitored</b>                                         |                                |                                |                                    |                                |                         | <b>= 4,848*</b>                |
| Idaho National Laboratory                                      | 52.006                         | 17% ▲                          | 803                                | -7% ▼                          | 0.065                   | 26% ▲                          |
| <b>NE Totals</b>                                               | <b>52.006</b>                  | <b>17% ▲</b>                   | <b>803</b>                         | <b>-7% ▼</b>                   | <b>0.065</b>            | <b>26% ▲</b>                   |
| <b>Office of Science (SC)</b>                                  |                                |                                |                                    |                                |                         |                                |
| <b>Total Monitored</b>                                         |                                |                                |                                    |                                |                         | <b>= 18,114*</b>               |
| Ames Laboratory                                                | 0.778                          | ◇                              | 34                                 | ◇                              | 0.023                   | ◇                              |
| Argonne National Laboratory                                    | 10.225                         | 18% ▲                          | 261                                | 127% ▲                         | 0.039                   | -48% ▼                         |
| Brookhaven National Laboratory                                 | 1.611                          | -18% ▼                         | 49                                 | -44% ▼                         | 0.033                   | 45% ▲                          |
| Fermi National Accelerator Laboratory                          | 3.360                          | -62% ▼                         | 86                                 | -40% ▼                         | 0.039                   | -36% ▼                         |
| Lawrence Berkeley National Laboratory                          | 0.434                          | ◇                              | 10                                 | ◇                              | 0.043                   | ◇                              |
| Oak Ridge Institute for Science and Education                  | 0.098                          | ◇                              | 6                                  | ◇                              | 0.016                   | ◇                              |
| Oak Ridge National Laboratory                                  | 46.682                         | -4% ▼                          | 454                                | 19% ▲                          | 0.103                   | -19% ▼                         |
| Pacific Northwest National Laboratory                          | 18.488                         | -44% ▼                         | 671                                | 25% ▲                          | 0.028                   | -56% ▼                         |
| Princeton Plasma Physics Laboratory                            | 0.336                          | ◇                              | 48                                 | ◇                              | 0.007                   | ◇                              |
| Service Center Personnel*                                      | 0.010                          | ◇                              | 1                                  | ◇                              | 0.010                   | ◇                              |
| SLAC National Accelerator Laboratory                           | 0.036                          | ◇                              | 2                                  | ◇                              | 0.018                   | ◇                              |
| Thomas Jefferson National Accelerator Facility                 | 0.612                          | ◇                              | 37                                 | ◇                              | 0.017                   | ◇                              |
| <b>SC Totals</b>                                               | <b>82.670</b>                  | <b>-20% ▼</b>                  | <b>1,659</b>                       | <b>17% ▲</b>                   | <b>0.050</b>            | <b>-32% ▼</b>                  |

Note: Bold and boxed values indicate the greatest value in each category.

◇ The percentage change from the previous year is not shown because it is not meaningful when the site collective dose is less than 1 person-rem (10 person-mSv).

\* Individuals who worked at more than one program office are represented within each grouping; therefore, the total monitored values will not match the annual number of individuals monitored.

### 3.5 Transient Individuals

For this report, a DOE site is defined as a geographic location. Transient individuals, or transients, are defined as individuals who are monitored at more than one DOE site during the calendar year and, therefore, had more than one monitoring record reported to the REMS repository. This section presents information on transient individuals to determine the extent to which individuals traveled from site to site and to examine the doses received by these individuals.

The tracking and analysis of transient individuals are important aspects of the REMS Program. While each site is responsible for monitoring individuals during their work at that site, the REMS Program collects dose records from all sites and verifies that individuals do not exceed regulatory limits by accruing doses at multiple facilities. Although the number of transient individuals and average doses have been low, the examination of these records remains an important function in assessing performance of DOE radiation protection programs.

*Exhibit 3-17* shows the dose distribution and total number of transient individuals from CY 2019 to 2023. Over the past 5 years, the records of transient individuals have averaged between 1 and 4 percent of the total records for all monitored individuals.

These individuals received, on an average, 3 percent of the collective TED in CY 2023. The collective TED for transients decreased slightly from 30.81 person-rem (308.1 mSv) in CY 2022 to 29.61 person-rem (296.1 person-mSv) in CY 2023. The average measurable TED decreased from 0.050 person-rem (0.500 person-mSv) in CY 2022 to 0.041 person-rem (0.410 person-mSv) in CY 2023.

### 3.6 Historical Data

To provide historical context for radiation exposure data at DOE, it is useful to include information prior to the past 5 years. *Exhibit 3-18* and *Exhibit 3-19* show a summary of occupational exposures starting in CY 1974, when the Atomic Energy Commission (AEC) split into the U.S. Nuclear Regulatory Commission (NRC) and the Energy Research and Development Administration (ERDA), which subsequently became DOE. *Exhibit 3-18* and *Exhibit 3-19* show the collective dose, average measurable dose, and number of individuals with a measurable dose from CY 1974 to CY 2023. All three parameters decreased dramatically between CY 1986 and CY 1993 due to the shutdown of facilities within the weapons complex and the end of the Cold War era. After this time, the DOE mission shifted from weapons production to shutdown, stabilization, and decontamination and decommissioning activities.

***Exhibit 3-17: Dose Distribution of Transient Individuals, CY 2019 – 2023.***

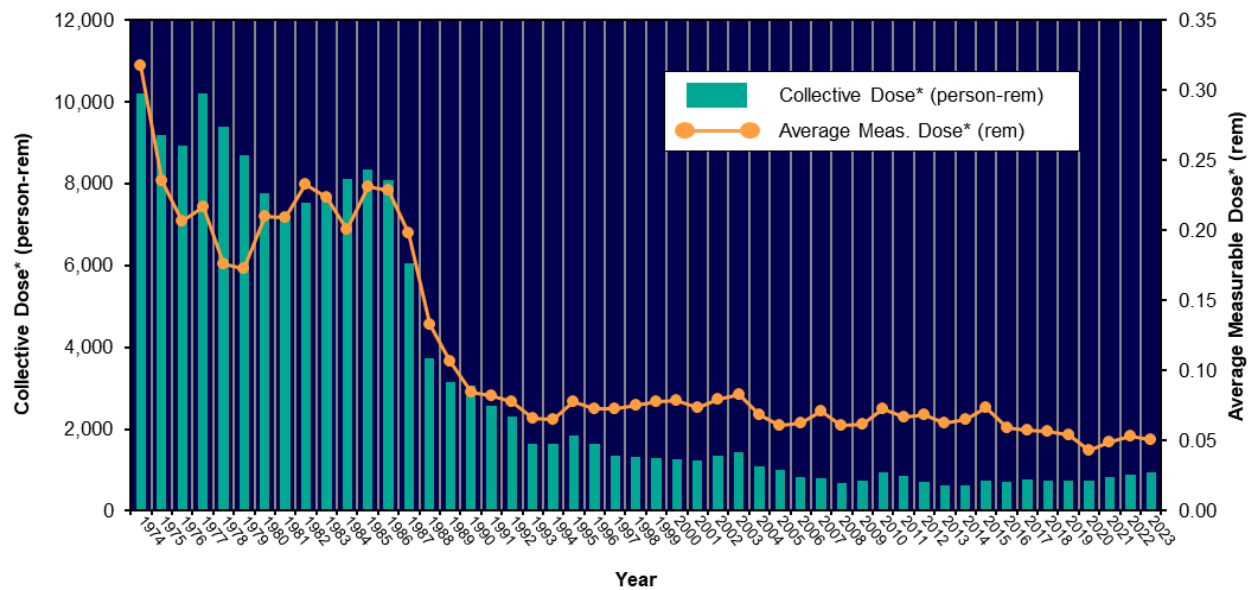
| Dose Ranges (TED in rem) * |                                                                       | 2019   | 2020   | 2021   | 2022   | 2023   |
|----------------------------|-----------------------------------------------------------------------|--------|--------|--------|--------|--------|
| Transients                 | Less than measurable                                                  | 2,144  | 523    | 1,044  | 1,712  | 2,174  |
|                            | Measurable <0.100                                                     | 480    | 324    | 404    | 562    | 648    |
|                            | 0.100 – 0.250                                                         | 31     | 13     | 18     | 34     | 47     |
|                            | 0.250 – 0.500                                                         | 12     | 2      | 4      | 9      | 19     |
|                            | 0.500 – 0.750                                                         | 2      | -      | 1      | 3      | 1      |
|                            | 0.750 – 1.000                                                         | 2      | -      | -      | 3      | 1      |
|                            | 1.0 – 2.0                                                             | -      | -      | 1      | 5      | 1      |
|                            | >2.0                                                                  | -      | -      | -      | -      | -      |
|                            | Total number of individuals monitored**                               | 2,671  | 862    | 1,472  | 2,328  | 2,891  |
|                            | Number with measurable dose                                           | 527    | 339    | 428    | 616    | 717    |
|                            | % with measurable dose                                                | 20%    | 39%    | 29%    | 26%    | 25%    |
| All DOE                    | Collective TED (person-rem)                                           | 22.535 | 10.605 | 15.316 | 30.809 | 29.613 |
|                            | Average measurable TED (rem)                                          | 0.043  | 0.031  | 0.036  | 0.050  | 0.041  |
|                            | Total number of records for monitored individuals                     | 76,187 | 64,728 | 67,793 | 75,348 | 82,412 |
|                            | Number of individuals with measurable dose                            | 13,832 | 17,258 | 16,903 | 16,774 | 18,469 |
|                            | % of total monitored individuals who are transient                    | 3.5%   | 1.3%   | 2.2%   | 3.1%   | 3.5%   |
|                            | % of the number of individuals with measurable dose who are transient | 3.8%   | 2.0%   | 2.5%   | 3.7%   | 3.9%   |

\* Individuals with doses equal to the dose value separating the dose ranges are included in the next higher dose range.

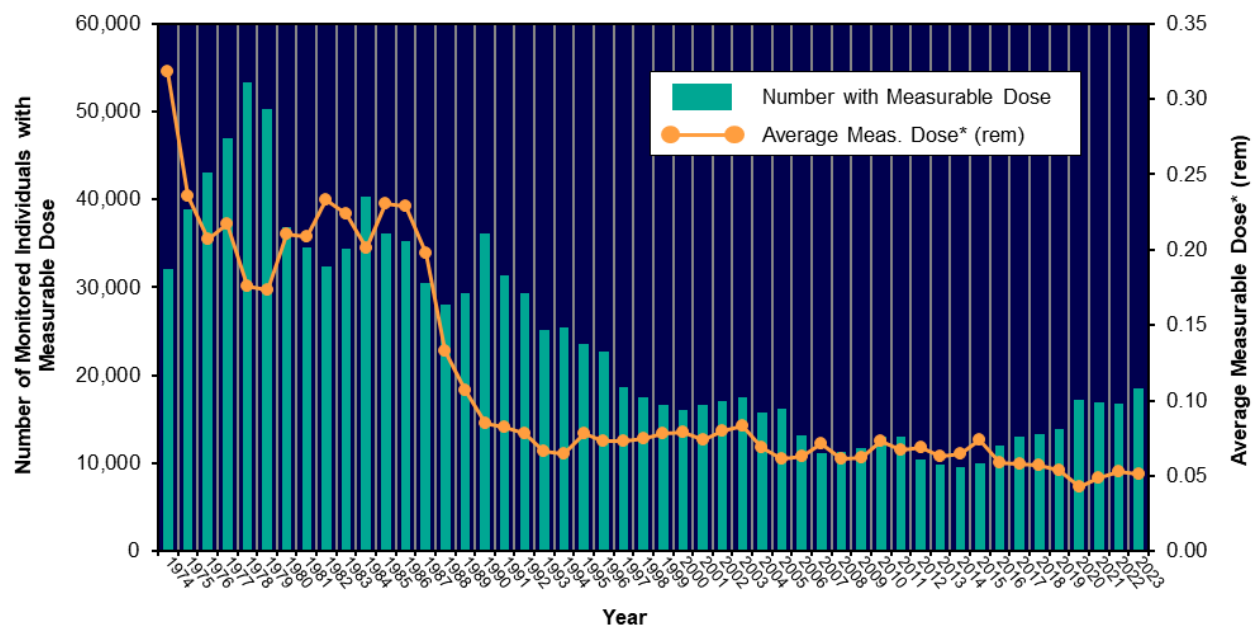
\*\* Total number of individuals represents the number of individuals monitored and not the number of records.

- Indicates dose ranges containing no individuals.

**Exhibit 3-18: Collective Dose and Average Measurable Dose, CY 1974 – 2023.**



**Exhibit 3-19: Number of Individuals with Measurable Dose and Average Measurable Dose, CY 1974 – 2023.**



**\* COLLECTIVE DOSE**

|                |                                                                                                |
|----------------|------------------------------------------------------------------------------------------------|
| 1974 – 1989    | collective dose = Deep Dose Equivalent (DDE)                                                   |
| 1990 – 1992    | collective dose = DDE + Annual Effective Dose Equivalent (AEDE)                                |
| 1993 – 2009    | collective dose = DDE + Committed Effective Dose Equivalent (CEDE)                             |
| 2010 – Present | collective dose = Effective Dose (from external sources) (ED) + Committed Effective Dose (CED) |

**AGENCIES**

|                |                                                       |
|----------------|-------------------------------------------------------|
| 1946 – 1974    | Atomic Energy Commission (AEC)                        |
| 1974 – 1977    | Energy Research and Development Administration (ERDA) |
| 1977 – Present | U.S. Department of Energy (DOE)                       |

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# Section Four

## ALARA and Operating Experience Programs

# 4

## ALARA Activities at DOE

Two DOE Office of Environment, Health, Safety and Security (EHSS) Programs that are closely related to the collection and analysis of occupational radiation exposure are the ALARA Program and the Operating Experience Program (OpEx). A description of these programs is provided here as well as access information.

### 4.1 ALARA Program

Descriptions of ALARA activities that have shown promise in reducing the radiation exposure at DOE are collected for the purpose of sharing strategies and techniques among DOE radiation protection managers. Project descriptions are voluntarily submitted from the sites and are not independently verified or endorsed by DOE. Program and site offices and contractors who are interested in benchmarks of success and continuous improvement in the context of integrated safety management and quality are encouraged to provide input.

Descriptions of ALARA activities are provided on the DOE web site:

<https://www.energy.gov/ehss/occupational-radiation-exposure-publications>

Individual project descriptions may be submitted to EHSS through the REMS web site. The submissions should describe the process in sufficient detail to provide a basic understanding of the project, the radiological concerns, and the activities initiated to reduce dose. The web site provides a form to collect the following information about the project:

- ◆ Mission statement;
- ◆ Project description;
- ◆ Radiological concerns;
- ◆ Total collective dose for the project;
- ◆ Dose rate to exposed workers before and after exposure controls were implemented;

- ◆ Information on how the process implemented ALARA techniques in an innovative or unique manner;
- ◆ Estimated dose avoided;
- ◆ Project staff involved;
- ◆ Approximate cost of the ALARA effort;
- ◆ Impact on work processes, in person-hours, if possible (may be negative or positive);
- ◆ Figures and/or photos of the project or equipment (electronic images if available); and
- ◆ Point of contact for follow-up by interested professionals.

The REMS web page for submitting ALARA project descriptions can be accessed at:

<https://www.energy.gov/ehss/downloads/line-alara-project-submittal-form-report-alara-project-descriptions-rems>

### 4.2 Operating Experience Program

DOE has a mature OpEx, which has been enhanced from the lessons learned program that was initially developed in CY 1994. The OpEx is described in DOE O 210.2A, *DOE Corporate Operating Experience Program* [9].

The objectives of the OpEx are to institute a DOE-wide program for the management of operating experience to prevent adverse operating incidents and to expand the sharing of good work practices among DOE sites. The program provides a systematic review, identification, collection, screening, evaluation, and dissemination of operating experience from U.S. and foreign government agencies and industry, professional societies, trade associations, national academies, universities, and DOE and its contractors. DOE Headquarters takes corporate responsibility for identifying, analyzing, and sharing operating experience information. Operating experience/lessons learned provided by DOE field sites optimize the

knowledge gained by communicating through various products, including a corporate database.

DOE posts operating experience information and links to other operating experience resources on the internet to disseminate information so that DOE and external entities may improve the health and safety aspects of operations within their facilities, including reducing the number of accidents and injuries.

For further information contact:

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**Office of Environment, Health, Safety and Security (EHSS)**  
**U.S. Department of Energy**  
**1000 Independence Avenue, SW**  
**Washington, D.C. 20585-1290**  
**E-mail: [Maria.Dikeakos@hq.doe.gov](mailto:Maria.Dikeakos@hq.doe.gov)**

**<https://www.energy.gov/ehss/corporate-operating-experience-program>**

# Section Five

## Conclusions

# 5

## Conclusions

Analysis of the collected exposure data for CY 2023 indicate that:

- ◆ DOE operations were in compliance with regulatory radiation protection requirements as no exposures were reported to have exceeded the occupational dose limit of 5 rem (50 mSv) TED; and
- ◆ Only 22 percent of the monitored individuals received a measurable dose, and, of those, the average measurable dose received was 1 percent of the 5 rem (50 mSv) TED limit.

In addition, from CY 2022 to CY 2023 the:

- ◆ The collective TED increased by 6 percent to 949.4 person-rem (9,494 person-mSv);
- ◆ Number of individuals with measurable dose increased by 10 percent from 16,774 individuals to 18,469 individuals;
- ◆ Collective CED (internal exposure) decreased by 9 percent to 41.6 person-rem (416 person-mSv); and
- ◆ Collective TED for transient individuals decreased by 4 percent to 29.6 person-rem (296 person-mSv)

The collective dose at DOE facilities has decreased by 88 percent since CY 1986. This coincides with the end of the Cold War era, which shifted the DOE mission from weapons production to stabilization, waste management, and environmental remediation activities, along with the consolidation and remediation of facilities across the complex to meet the new mission.

In alignment with the change in mission, regulations and requirements have been modified (see Section 2) that reinforce DOE's focus on ALARA practices and risk reduction to lower occupational radiation dose.

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# Section Six

## Glossary

# 6

## Glossary

### **Administrative Control Level (ACL)**

A dose level that is established below the DOE dose limit to administratively control exposures. ACLs are multi-tiered, with increasing levels of authority required to approve a higher level of exposure.

### **As Low As Reasonably Achievable (ALARA)**

The approach to radiation protection to manage and control exposures (both individual and collective) to the work force and to the general public to as low as is reasonable, taking into account social, technical, economic, practical, and public policy considerations. As used in this part, ALARA is not a dose limit but a process which has the objective of attaining doses as far below the applicable limits of this part as is reasonably achievable.

[10 CFR 835.2]

### **Average Measurable Dose**

The dose obtained by dividing the collective dose by the number of individuals who received a measurable dose. This is the average most commonly used when examining trends and comparing doses received by individuals because it reflects the exclusion of those individuals receiving a less than measurable dose. In this report, average measurable dose is calculated for total effective dose (TED) and committed effective dose (CED).

### **Bioassay Measurements**

As presented in Section 3.3.4, the number of bioassay measurements is the number of measurements taken to determine the kinds, quantities, or concentrations of radioactive material in the human body, whether by direct measurement or by analysis and evaluation of materials excreted or removed from the human body. Types of bioassay include:

- ◆ **In Vivo bioassay:** From the Latin for "in one that is living," occurring within the living. The direct measurement of radioactive material in the human body. The number of in vivo measurements represents the number of measurements performed for all individuals during the year.
- ◆ **Fecal bioassay:** The evaluation of radioactive material excreted in feces from the human body. The number of fecal bioassay measurements is the number of fecal samples analyzed for all individuals during the year.
- ◆ **Urinalysis bioassay:** The evaluation of radioactive material excreted in urine from the human body. The number of urinalysis bioassay measurements is the number of urine samples analyzed for all individuals during the year.

### **Collective Dose**

The sum of doses to all individuals in a population for a period of time and is used whenever the dose may refer to more than one type of dose. In cases where the type of dose is specified, the term "collective" is followed by the type of dose, such as the TED, CED, or photon. In all cases, the population is the group of DOE individuals that were monitored for occupational radiation exposure, and the period of time is the monitoring year. Collective dose is expressed in units of person-rem.

### **Committed Effective Dose (CED) or ( $E_{50}$ )**

Means the sum of the committed equivalent doses to various tissues or organs in the body ( $H_{T,50}$ ), each multiplied by the appropriate tissue weighting factor ( $w_T$ )—that is,  $E_{50} = \sum w_T H_{T,50} + w_{\text{Remainder}} H_{\text{Remainder},50}$ . Where  $w_{\text{Remainder}}$  is the tissue weighting factor assigned to the remainder organs and tissues and  $H_{\text{Remainder},50}$  is the committed equivalent dose to the remainder organs and tissues. Committed effective dose is expressed in units of rem (or Sv). [10 CFR 835.2]

**Committed Equivalent Dose (CEqD) or ( $H_{T,50}$ )**

Means the equivalent dose calculated to be received by a tissue or organ over a 50-year period after the intake of a radionuclide into the body. It does not include contributions from radiation sources external to the body. Committed equivalent dose is expressed in units of rem (or Sv). [10 CFR 835.2]

**Dose**

A general term for absorbed dose, equivalent dose, effective dose, committed equivalent dose, committed effective dose, or total effective dose as defined in this part. [10 CFR 835.2]

**Effective Dose**

Means the summation of the products of the equivalent dose received by specified tissues or organs of the body ( $H_T$ ) and the appropriate tissue weighting factor ( $w_T$ )—that is,  $E = \sum w_T H_T$ . It includes the dose from radiation sources internal and/or external to the body. For purposes of compliance with this part, equivalent dose to the whole body may be used as effective dose for external exposures. The effective dose is expressed in units of rem (or Sv). [10 CFR 835.2]

**Equivalent Dose (EqD)**

Means the product of average absorbed dose ( $D_{T,R}$ ) in rad (or gray) in a tissue or organ (T) and a radiation (R) weighting factor ( $w_R$ ). For external dose, the equivalent dose to the whole body is assessed at a depth of 1 cm in tissue; the equivalent dose to the lens of the eye is assessed at a depth of 0.3 cm in tissue, and the equivalent dose to the extremity and skin is assessed at a depth of 0.007 cm in tissue. Equivalent dose is expressed in units of rem (or Sv). [10 CFR 835.2]

**Measurable Dose**

A dose greater than zero rem (not including doses reported as “not detectable”).

**Member of the Public**

Means an individual who is not a general employee. An individual is not a “member of the public” during any period in which the individual receives an occupational dose. [10 CFR 835.2] The definition of general employee is specified in 10 CFR 835.

**Number of Individuals with Measurable Dose**

The subset of all monitored individuals who receive a measurable dose (greater than the limit of detection for the monitoring system). Many personnel are monitored as a matter of prudence and may not receive a measurable dose. For this reason, the number of individuals with measurable dose is presented in this report as a more accurate indicator of the exposed workforce. The number of individuals represents the number of dose records reported. Some individuals may be counted more than once if multiple dose records are reported for the individual during the year.

**Occupational Exposure**

An individual's exposure to ionizing radiation (external and internal) as a result of that individual's work assignment. Occupational exposure does not include planned special exposures, exposure received as a medical patient, background radiation, or voluntary participation in medical research programs.

**Person-rem**

The unit of measurement used for the collective dose to all DOE Federal, contractor, and subcontractor employees.

**Rem**

A unit of dose derived from the phrase Roentgen equivalent man. The rem is equal to 0.010 Sv, which is the international unit of measurement for radiation exposure.

**Total Effective Dose (TED)**

Means the sum of the effective dose (for external exposures) and the committed effective dose. [10 CFR 835.2]

**Total Organ Dose (TOD)**

The sum of the equivalent dose to the whole body for external exposures and the committed equivalent dose to any organ or tissue other than the skin or the lens of the eye.

**Transient Individual**

As used in this report, a transient individual is an individual monitored for radiation exposure at more than one DOE site during the calendar year.

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# Section Seven

## References

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References

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8. Computerized Accident Incident Reporting System (CAIRS), “DOE and Contractor Injury and Illness Data by Year by Quarter” report. Online at: <https://www.energy.gov/ehss/policy-guidance-reports/databases/computerized-accident-incident-reporting-system>.
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# Section Eight

## User Survey

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User Survey

### U.S. Department of Energy Occupational Radiation Exposure Report for Calendar Year 2023

DOE, striving to meet the needs of its stakeholders, is looking for suggestions on ways to improve the *U.S. Department of Energy Occupational Radiation Exposure Report for Calendar Year 2023*. **Your feedback is important.** Constructive feedback will ensure this report can continue to meet user needs. Please fill out the attached survey form and return it to:

Ms. Katharine McLellan  
Office of Environment, Health, Safety and Security (EHSS)  
DOE REMS Program Manager  
U.S. Department of Energy  
1000 Independence Avenue, SW  
Washington, D.C. 20585-1290  
[katharine.mclellan@hq.doe.gov](mailto:katharine.mclellan@hq.doe.gov)

Questions concerning this survey should be directed to Ms. McLellan at (202) 586-0183.

1. Identification:

Name: \_\_\_\_\_

Title: \_\_\_\_\_

Mailing Address: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

2. Distribution:

2.1 Do you wish to remain on the distribution for this report? \_\_\_\_ yes \_\_\_\_ no

2.2 Do you wish to be added to the distribution? \_\_\_\_ yes \_\_\_\_ no

(continued on back)

Please circle one.

|                                                    |            |   |   |   |             |
|----------------------------------------------------|------------|---|---|---|-------------|
|                                                    | Not Useful |   |   |   | Very Useful |
| Please rate the usefulness of this report overall: | 1          | 2 | 3 | 4 | 5           |

Please rate the usefulness of the analysis presented in the following sections:

|                                                          |   |   |   |   |   |
|----------------------------------------------------------|---|---|---|---|---|
| Executive Summary                                        | 1 | 2 | 3 | 4 | 5 |
| Analysis of Aggregate Data                               | 1 | 2 | 3 | 4 | 5 |
| Collective Dose                                          | 1 | 2 | 3 | 4 | 5 |
| Average Measurable Dose                                  | 1 | 2 | 3 | 4 | 5 |
| Dose Distribution                                        | 1 | 2 | 3 | 4 | 5 |
| Analysis of Individual Dose Data                         | 1 | 2 | 3 | 4 | 5 |
| Doses in Excess of DOE limit (5 rem)                     | 1 | 2 | 3 | 4 | 5 |
| Doses in Excess of ACL limit (2 rem)                     | 1 | 2 | 3 | 4 | 5 |
| Intakes of Radioactive Material                          | 1 | 2 | 3 | 4 | 5 |
| Bioassay and Intake Summary Information                  | 1 | 2 | 3 | 4 | 5 |
| Analysis of Site Data                                    | 1 | 2 | 3 | 4 | 5 |
| Collective TED by Site and Other Facilities              | 1 | 2 | 3 | 4 | 5 |
| Activities Significantly Contributing to Collective Dose | 1 | 2 | 3 | 4 | 5 |
| Additional Site Descriptions                             | 1 | 2 | 3 | 4 | 5 |
| Summary by Program Office                                | 1 | 2 | 3 | 4 | 5 |
| Transient Individuals                                    | 1 | 2 | 3 | 4 | 5 |
| Historical Data                                          | 1 | 2 | 3 | 4 | 5 |
| ALARA and Operating Experience Programs                  | 1 | 2 | 3 | 4 | 5 |
| Conclusions                                              | 1 | 2 | 3 | 4 | 5 |

Please rate the importance of the timeliness of the publication of this report as it relates to your professional need for the information on occupational radiation exposure at DOE:

Not important                      Critical

1            2            3            4            5

Please provide any additional input or comments on this report.

[illegible]

# Section Nine

## Appendices

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Appendices

### Appendix A: DOE Reporting Sites and Reporting Codes

The following is a list of the Occupation Codes that are reported with each individual's dose record to the DOE Radiation Exposure Monitoring System (REMS) in accordance with Order 231.1B. Occupation Codes are grouped into Labor Categories for the purposes of analysis and summary in this report. The occupation codes are listed in the REMS Reporting Guide, Table G-7, and represent a subset of the occupations listed in the Department of Commerce's Standard Occupational Classification (SOC) Manual (1980).

| <i>Exhibit A-1: Labor Categories and Occupation Codes.</i> |                 |                                 |
|------------------------------------------------------------|-----------------|---------------------------------|
| Labor Category                                             | Occupation Code | Occupation Name                 |
| Agriculture                                                | 562             | Groundskeepers                  |
|                                                            | 570             | Forest Workers                  |
|                                                            | 580             | Misc. Agriculture               |
| Construction/Repair                                        | 610             | Mechanics/Repairers             |
|                                                            | 641             | Masons                          |
|                                                            | 642             | Carpenters                      |
|                                                            | 643             | Electricians                    |
|                                                            | 644             | Painters                        |
|                                                            | 645             | Pipe Fitter                     |
|                                                            | 650             | Miners/Drillers                 |
|                                                            | 660             | Misc. Repair/Construction       |
| Laborers                                                   | 850             | Handlers/Laborers/Helpers       |
| Management                                                 | 110             | Manager - Administrator         |
|                                                            | 400             | Sales                           |
|                                                            | 450             | Admin. Support and Clerical     |
| Misc.                                                      | 910             | Military                        |
|                                                            | 990             | Miscellaneous                   |
| Production                                                 | 681             | Machinists                      |
|                                                            | 682             | Sheet Metal Workers             |
|                                                            | 690             | Operators, Plant/System/Utility |
|                                                            | 710             | Machine Setup/Operators         |
|                                                            | 771             | Welders and Solderers           |
|                                                            | 780             | Misc. Precision/Production      |
| Professional                                               | 160             | Engineer                        |
|                                                            | 170             | Scientist                       |
|                                                            | 184             | Health Physicist                |
|                                                            | 200             | Misc. Professional              |
|                                                            | 260             | Doctors and Nurses              |
| Service Workers                                            | 512             | Firefighters                    |
|                                                            | 513             | Security Guards                 |

**Exhibit A-1: Labor Categories and Occupation Codes.**

| Labor Category              | Occupation Code | Occupation Name           |
|-----------------------------|-----------------|---------------------------|
| Service Workers (continued) | 521             | Food Service Employees    |
|                             | 524             | Janitors                  |
|                             | 525             | Misc. Service             |
| Technicians                 | 350             | Technicians               |
|                             | 360             | Health Technicians        |
|                             | 370             | Engineering Technicians   |
|                             | 380             | Science Technicians       |
|                             | 383             | Radiation Monitors/Techs. |
|                             | 390             | Misc. Technicians         |
| Transport Workers           | 820             | Truck Drivers             |
|                             | 821             | Bus Drivers               |
|                             | 825             | Pilots                    |
|                             | 830             | Equipment Operators       |
|                             | 840             | Misc. Transport           |
| Unknown                     | 001             | Unknown                   |

The following is a list of all organizations reporting to the DOE REMS from CY 2019–2023. The list provides the Site groupings used in this report as well as the organization reporting code and name.

**Exhibit A-2: Organizations Reporting to DOE REMS, CY 2019–2023.**

| Site                                    | Org. Code | Organization Name                             | 2019 | 2020 | 2021 | 2022 | 2023 |
|-----------------------------------------|-----------|-----------------------------------------------|------|------|------|------|------|
| Albuquerque                             | OST3100   | Office of Secure Transportation               | •    | •    | •    | •    | •    |
| Ames Laboratory                         | 1000503   | Ames Laboratory (Iowa State)                  | •    | •    | •    | •    | •    |
| Argonne National Laboratory (ANL)       | 1000703   | Argonne National Laboratory                   | •    | •    | •    | •    | •    |
| Brookhaven National Laboratory (BNL)    | 1001003   | Brookhaven National Laboratory                | •    | •    | •    | •    | •    |
| Energy Technology Engineering Center    | 8002001   | Cabrera Services                              | •    | •    | –    | –    | –    |
| Fermi National Accelerator Lab. (FERMI) | 1002503   | Fermilab                                      | •    | •    | •    | •    | •    |
| Grand Junction Site                     | 3260615   | Navarro Research and Engineering              | •    | •    | •    | •    | •    |
| Hanford                                 | 4700805   | Bechtel National Corporation                  | •    | •    | •    | •    | •    |
|                                         | 4701001   | DOE, Office of River Protection               | •    | •    | •    | •    | •    |
|                                         | 4702005   | Wastren Advantage, Inc.                       | •    | •    | •    | –    | –    |
|                                         | 4706104   | Hanford Laboratory Management Integration     | –    | –    | •    | •    | •    |
|                                         | 4707104   | Washington River Protection Solutions, LLC    | •    | •    | •    | •    | •    |
|                                         | NA-2000   | NNSA - Visitors                               | •    | •    | –    | –    | •    |
|                                         | NA-2100   | NNSA - Management and Support Personnel       | •    | •    | •    | •    | •    |
|                                         | NA-2101   | NNSA - Mgmt. & Support Personnel: MELE Assoc. | •    | •    | •    | •    | •    |
|                                         | NA-2110   | NNSA - North and South America                | •    | •    | –    | –    | –    |
|                                         | NA-2120   | NNSA - Europe, Africa, and the Middle East    | •    | •    | –    | –    | •    |
|                                         | 7500503   | Battelle - PNNL                               | •    | •    | •    | •    | •    |
|                                         | 7500504   | Battelle -PNNL- Subs                          | •    | •    | •    | •    | •    |
|                                         | 7500521   | Pacific Northwest Site Office                 | •    | •    | •    | •    | •    |
|                                         | 7502504   | HPMC Occupational Medical Services            | •    | •    | •    | •    | •    |
|                                         | 7504204   | Hanford Mission Integration Solutions (HMIS)  | –    | –    | •    | •    | •    |

**Exhibit A-2: Organizations Reporting to DOE REMS, CY 2019–2023.**

| Site                                    | Org. Code | Organization Name                           | 2019 | 2020 | 2021 | 2022 | 2023 |
|-----------------------------------------|-----------|---------------------------------------------|------|------|------|------|------|
| Hanford (continued)                     | 7504304   | Central Plateau Cleanup Company             | —    | —    | ●    | ●    | ●    |
|                                         | 7505214   | Mission Support Alliance (MSA)              | ●    | ●    | ●    | —    | —    |
|                                         | 7505304   | CH2M Hill Plateau Remediation Company       | ●    | ●    | ●    | —    | —    |
|                                         | 7506001   | DOE-Richland Field Office                   | ●    | ●    | ●    | ●    | ●    |
| Idaho                                   | 3004001   | Idaho Field Office                          | ●    | ●    | ●    | ●    | ●    |
|                                         | 3005003   | INL - BEA, LLC - Research                   | ●    | ●    | ●    | ●    | ●    |
|                                         | 3005004   | INL - BEA, LLC - Services                   | ●    | ●    | ●    | ●    | ●    |
|                                         | 3005009   | INL - BEA, LLC - Security                   | ●    | ●    | ●    | ●    | ●    |
|                                         | 3005012   | INL - BEA, LLC - Production                 | ●    | ●    | ●    | ●    | ●    |
|                                         | 3006002   | INL - Fluor- Projects                       | ●    | ●    | ●    | ●    | ●    |
|                                         | 3006004   | ICP - Fluor - Subcontractors                | ●    | ●    | ●    | ●    | ●    |
|                                         | 3006005   | ICP - Fluor - Support                       | ●    | ●    | ●    | ●    | ●    |
| Kansas City National Security Campus    | 0531002   | Honeywell FM & T                            | ●    | ●    | ●    | ●    | ●    |
| Lawrence Berkeley National Lab. (LBNL)  | 8003003   | Lawrence Berkeley National Laboratory       | ●    | ●    | ●    | ●    | ●    |
| Lawrence Livermore National Lab. (LLNL) | 0580403   | Lawrence Livermore National Laboratory      | ●    | ●    | ●    | ●    | ●    |
|                                         | 0580414   | LLNL - Service Subcontractors               | —    | —    | ●    | ●    | ●    |
|                                         | 0580416   | LLNL - Construction Subcontractors          | ●    | ●    | —    | —    | —    |
|                                         | 0580503   | LLNL - Nevada                               | ●    | ●    | ●    | ●    | ●    |
|                                         | 0580701   | LLNL - DOE Site Office                      | ●    | ●    | —    | ●    | ●    |
| Los Alamos National Lab. (LANL)         | 0540001   | NNSA Los Alamos Site Office                 | ●    | ●    | ●    | ●    | ●    |
|                                         | 0544003   | Los Alamos National Laboratory              | ●    | ●    | ●    | ●    | ●    |
|                                         | 0544006   | Los Alamos National Lab Construction Subs   | ●    | ●    | ●    | ●    | ●    |
|                                         | 0544809   | Protection Technologies Los Alamos          | —    | —    | —    | —    | ●    |
|                                         | 0544904   | Johnson Controls, Inc.                      | —    | —    | —    | —    | ●    |
|                                         | 1530001   | Newport News Nuclear BWXT Los Alamos (N3B)  | ●    | ●    | ●    | ●    | ●    |
| National Renewable Energy Laboratory    | 2806003   | National Renewable Energy Laboratory        | ●    | ●    | ●    | ●    | ●    |
| Nevada National Security Site           | 0501001   | NNSA Service Center                         | —    | —    | —    | ●    | ●    |
|                                         | 0520001   | NNSA Nevada Site Office                     | ●    | ●    | ●    | ●    | —    |
|                                         | 0521104   | MSTS - Livermore Operations                 | ●    | ●    | —    | —    | ●    |
|                                         | 0521204   | MSTS - Las Vegas                            | ●    | ●    | ●    | ●    | —    |
|                                         | 0521304   | MSTS - Los Alamos                           | ●    | ●    | ●    | ●    | ●    |
|                                         | 0521314   | NSTec - Sandia                              | ●    | —    | —    | —    | —    |
|                                         | 0521405   | MSTS - NTS                                  | ●    | ●    | ●    | ●    | ●    |
|                                         | 0521416   | MSTS - NTS subcontractors                   | ●    | ●    | ●    | —    | —    |
|                                         | 0521503   | MSTS - Special Tech. Lab                    | ●    | ●    | ●    | ●    | ●    |
|                                         | 0529004   | Nevada                                      | ●    | —    | —    | —    | —    |
|                                         | 0529009   | Wackenhut Services Inc. - NV                | ●    | ●    | ●    | ●    | ●    |
|                                         | 3505104   | Navarro-Intera LLC                          | ●    | ●    | ●    | —    | —    |
|                                         | 3508004   | Nye County Sheriff - NSTec                  | —    | —    | —    | —    | —    |
|                                         | 3508703   | SAIC - NV                                   | —    | —    | —    | ●    | ●    |
| Oak Ridge Site                          | 4003602   | UT-Battelle: ORNL-Isotek                    | —    | —    | —    | —    | —    |
|                                         | 4004203   | Oak Ridge Inst. For Science & Educ. (ORISE) | ●    | ●    | ●    | ●    | ●    |
|                                         | 4004602   | Tru Waste Processing Center - ORNL          | ●    | ●    | ●    | ●    | ●    |
|                                         | 4006002   | UCOR - ETPP                                 | ●    | ●    | ●    | ●    | ●    |
|                                         | 4006503   | UT-Battelle - ORNL                          | ●    | ●    | ●    | ●    | ●    |
|                                         | 4006510   | UCOR - ORNL                                 | ●    | ●    | ●    | ●    | ●    |

**Exhibit A-2: Organizations Reporting to DOE REMS, CY 2019–2023.**

| Site                                   | Org. Code | Organization Name                        | 2019 | 2020 | 2021 | 2022 | 2023 |
|----------------------------------------|-----------|------------------------------------------|------|------|------|------|------|
| Oak Ridge Site (continued)             | 4008010   | UCOR- Y-12                               | •    | •    | •    | •    | •    |
|                                        | 4018102   | CNS, LLC, Y-12                           | •    | •    | •    | •    | •    |
| Paducah Gaseous Diff. Plant (PGDP)     | 4007002   | Swift & Staley Team                      | •    | •    | •    | •    | •    |
|                                        | 6203106   | DUF6 Paducah Construction Subs - MACS    | •    | •    | •    | •    | •    |
|                                        | 6503304   | Four Rivers Nuclear Partnership          | •    | •    | •    | •    | •    |
| Pantex Plant (PP)                      | 0510001   | CNS Pantex - NNSA and DOE Couriers       | •    | •    | –    | –    | –    |
|                                        | 0514004   | Battelle - Pantex                        | •    | •    | •    | •    | •    |
|                                        | 0515002   | CNS Pantex                               | •    | •    | •    | •    | •    |
|                                        | 0515006   | CNS Pantex - Construction Subs           | •    | •    | –    | –    | –    |
|                                        | 0515009   | CNS Pantex - Security                    | •    | –    | –    | –    | –    |
| Portsmouth Gaseous Diff. Plant (PORTS) | 6202106   | Mid-America Conversion Services (MCS)    | •    | •    | •    | –    | •    |
|                                        | 6202204   | Portsmouth Mission Alliance (PMA)        | •    | •    | •    | •    | •    |
|                                        | 6202304   | Fluor B & W Portsmouth                   | •    | •    | •    | •    | •    |
| Princeton Plasma Physics Laboratory    | 1005003   | Princeton Plasma Physics Laboratory      | •    | •    | •    | •    | •    |
| Sandia National Laboratories (SNL)     | 0578003   | Sandia National Laboratories             | •    | •    | •    | •    | •    |
| Savannah River                         | 0595112   | Tritium Extraction Facility              | •    | •    | •    | •    | •    |
|                                        | 8500000   | Savannah River Operations                | –    | –    | •    | •    | •    |
|                                        | 8505001   | SR Forest Station                        | –    | –    | –    | •    | –    |
|                                        | 8500505   | Bechtel Construction - SR                | –    | –    | •    | •    | •    |
|                                        | 8500516   | Miscellaneous SRS Construction Subs      | •    | •    | •    | •    | •    |
|                                        | 8501042   | SRR Operations                           | •    | •    | •    | •    | •    |
|                                        | 8501044   | SRR Service Subs                         | •    | •    | •    | •    | •    |
|                                        | 8502042   | SR Mission Completion Operations         | –    | –    | –    | •    | –    |
|                                        | 8505501   | Savannah River Field Office              | •    | •    | •    | •    | •    |
|                                        | 8505504   | Misc. DOE Contractors - SR               | •    | •    | •    | •    | •    |
|                                        | 8505525   | Savannah River Nuclear Solutions, Inc.   | •    | –    | •    | –    | •    |
|                                        | 8505526   | SR Construction - Parsons Subcontractors | •    | •    | •    | •    | –    |
|                                        | 8509003   | Univ. of Georgia Ecology Laboratories    | •    | •    | •    | •    | •    |
|                                        | 8509509   | Centerra - SR                            | •    | •    | •    | •    | •    |
|                                        | 8511002   | Savannah River Nuclear Solutions, Inc.   | •    | •    | •    | •    | •    |
|                                        | 8511003   | Savannah River National Laboratory       | •    | •    | –    | •    | •    |
|                                        | 8511004   | SRNS Service Subs                        | •    | •    | •    | •    | •    |
|                                        | 8511005   | SRNS Construction                        | •    | •    | •    | •    | •    |
|                                        | 8511006   | SRNS Construction Subs                   | •    | •    | •    | •    | •    |
|                                        | 8512003   | BSRA - SR National Laboratory            | –    | –    | •    | •    | •    |
|                                        | 8512004   | BSRA - Service Subs                      | –    | –    | •    | •    | •    |
| Separations Process Research Unit      | 1523016   | NY SPRU                                  | •    | •    | •    | •    | •    |
| Service Center Personnel               | 0501001   | NNSA Albuquerque Complex                 | •    | •    | –    | –    | •    |
|                                        | 0701001   | Carlsbad Field Office                    | •    | •    | •    | •    | •    |
|                                        | 0702003   | Los Alamos National Lab - WIPP           | •    | •    | •    | –    | –    |
|                                        | 1504001   | DOE Headquarters                         | •    | •    | •    | •    | •    |
|                                        | 2041001   | NETL Morgantown                          | –    | •    | •    | •    | •    |
|                                        | 2042001   | NETL Pittsburgh                          | –    | •    | •    | •    | •    |
|                                        | 2045001   | NETL Albany                              | –    | •    | •    | •    | •    |
|                                        | 4003602   | Isotek (Bldg. 3019)                      | •    | •    | •    | •    | •    |
|                                        | 9900002   | DOE Federal Employees                    | –    | –    | –    | –    | •    |

**Exhibit A-2: Organizations Reporting to DOE REMS, CY 2019–2023.**

| Site                                           | Org. Code | Organization Name                              | 2019 | 2020 | 2021 | 2022 | 2023 |
|------------------------------------------------|-----------|------------------------------------------------|------|------|------|------|------|
| SLAC National Accelerator Facility             | 8008003   | Stanford Linear Accelerator Center             | •    | •    | •    | •    | •    |
| Thomas Jefferson National Accelerator Facility | 1509503   | Thomas Jefferson National Accelerator Facility | •    | •    | •    | •    | •    |
|                                                | 1509521   | Jefferson Laboratory - DOE Employees           | •    | —    | •    | •    | •    |
| Uranium Mill Tailings Remed. Action Project    | 3260645   | Uranium Mill Tailings Remedial Action - Moab   | •    | •    | •    | •    | •    |
| Waste Isolation Pilot Plant                    | 0703104   | Washington TRU Solutions LLC-WIPP              | •    | •    | •    | •    | •    |
|                                                | 0703109   | Santa Fe Protective Services - WIPP            | •    | •    | •    | —    | —    |
|                                                | 0703114   | WTS Subcontractors - WIPP                      | •    | •    | •    | —    | —    |
| West Valley Project                            | 4539004   | West Valley Nuclear Services, Inc. (WVNS)      | •    | •    | •    | •    | •    |
| Pittsburg Naval Reactor Office                 | 6007504   | PNR - BAPL & BPMI-P                            | •    | •    | •    | •    | •    |
|                                                | 6008003   | PNR - BAPL & BPMI-P                            | •    | •    | •    | •    | •    |
|                                                | 6009003   | Naval Reactors - Idaho                         | •    | •    | •    | •    | •    |
| Schenectady Naval Reactor Office               | 9004003   | Knolls Atomic Power Laboratory                 | •    | •    | •    | •    | •    |
|                                                | 9005003   | Knolls Atomic Power Laboratory                 | •    | •    | •    | •    | •    |
|                                                | 9005004   | Knolls Atomic Power Laboratory                 | •    | •    | •    | •    | •    |

The following is a list of Facility Type Codes reported to REMS in accordance with the REMS Reporting Guide. A facility type code is reported with each individual's dose record and indicates the facility type where the majority of the individual's dose was accrued during the monitoring year.

**Exhibit A-3: Facility Type Codes.**

| Facility Type Code | Description                         |
|--------------------|-------------------------------------|
| 10                 | Accelerator                         |
| 21                 | Fuel/Uranium Enrichment             |
| 22                 | Fuel Fabrication                    |
| 23                 | Fuel Processing                     |
| 40                 | Maintenance and Support (Site-Wide) |
| 50                 | Reactor                             |
| 61                 | Research, General                   |
| 62                 | Research, Fusion                    |
| 70                 | Waste Processing/Mgmt.              |
| 80                 | Weapons Fab. and Testing            |
| 99                 | Other                               |

## Appendix B: Additional Data

**Exhibit B-1: Site Dose Data, CY 2021.**

| Site                                                     | Collective TED (person-rem) | Percent Change – Coll. TED | Number with Meas. Dose | Percent Change – # with Meas. Dose | Avg. Meas. TED (rem) | Percent Change – Avg. Meas. TED | Percentage of Coll. TED above 0.500 rem | Percent Change – Coll. TED above 0.500 rem |
|----------------------------------------------------------|-----------------------------|----------------------------|------------------------|------------------------------------|----------------------|---------------------------------|-----------------------------------------|--------------------------------------------|
| Ames Laboratory                                          | 0.710                       | ◇                          | 30                     | ◇                                  | 0.024                | ◇                               | –                                       | ◇                                          |
| Argonne National Laboratory                              | 6.385                       | 39% ▲                      | 96                     | 48% ▲                              | 0.067                | –6% ▼                           | 8%                                      | –                                          |
| Brookhaven National Laboratory                           | 0.977                       | ◇                          | 60                     | ◇                                  | 0.016                | ◇                               | –                                       | ◇                                          |
| Fermi National Accelerator Laboratory                    | 6.110                       | –22% ▼                     | 195                    | 16% ▲                              | 0.031                | –33% ▼                          | –                                       | –                                          |
| Grand Junction Site                                      | 0.158                       | ◇                          | 28                     | ◇                                  | 0.006                | ◇                               | –                                       | ◇                                          |
| Hanford: Hanford Site                                    | 15.128                      | 54% ▲                      | 534                    | 10% ▲                              | 0.028                | 40% ▲                           | –                                       | –                                          |
| Hanford: Office of River Protection                      | 27.476                      | 107% ▲                     | 706                    | 53% ▲                              | 0.039                | 35% ▲                           | –                                       | –                                          |
| Hanford: Pacific Northwest National Laboratory           | 17.127                      | 101% ▲                     | 533                    | 31% ▲                              | 0.032                | 54% ▲                           | –                                       | –                                          |
| Idaho                                                    | 108.728                     | 35% ▲                      | 1,568                  | –6% ▼                              | 0.069                | 43% ▲                           | 11%                                     | 167% ▲                                     |
| Kansas City National Security Campus                     | 0.920                       | ◇                          | 68                     | ◇                                  | 0.014                | ◇                               | –                                       | ◇                                          |
| Lawrence Berkeley National Laboratory                    | 0.582                       | ◇                          | 13                     | ◇                                  | 0.045                | ◇                               | –                                       | ◇                                          |
| Lawrence Livermore National Laboratory                   | 17.680                      | 99% ▲                      | 175                    | 34% ▲                              | 0.101                | 49% ▲                           | 36%                                     | 10% ▲                                      |
| Los Alamos National Laboratory                           | 303.186                     | 30% ▲                      | 4,206                  | 67% ▲                              | 0.072                | –22% ▼                          | 22%                                     | –9% ▼                                      |
| National Renewable Energy Laboratory                     | 0.000                       | ◇                          | 0                      | ◇                                  | 0.000                | ◇                               | –                                       | ◇                                          |
| Nevada National Security Site                            | 1.821                       | 1% ▲                       | 38                     | –47% ▼                             | 0.048                | 92% ▲                           | –                                       | –                                          |
| Oak Ridge: East Tennessee Tech. Park                     | 0.468                       | ◇                          | 53                     | ◇                                  | 0.009                | ◇                               | –                                       | ◇                                          |
| Oak Ridge: Oak Ridge Institute for Science and Education | 0.025                       | ◇                          | 2                      | ◇                                  | 0.012                | ◇                               | –                                       | ◇                                          |
| Oak Ridge: Oak Ridge National Laboratory                 | 53.455                      | 12% ▲                      | 976                    | 60% ▲                              | 0.055                | –30% ▼                          | 18%                                     | –26% ▼                                     |
| Oak Ridge: Y–12 National Security Complex                | 54.186                      | –9% ▼                      | 1,436                  | 1% ▲                               | 0.038                | –10% ▼                          | –                                       | –                                          |
| Office of Secure Transportation                          | 0.084                       | ◇                          | 6                      | ◇                                  | 0.014                | ◇                               | –                                       | ◇                                          |
| Paducah Gaseous Diffusion Plant                          | 2.465                       | –7% ▼                      | 92                     | –21% ▼                             | 0.027                | 17% ▲                           | –                                       | –                                          |
| Pantex Plant                                             | 23.755                      | –79% ▼                     | 402                    | –89% ▼                             | 0.059                | 85% ▲                           | –                                       | –                                          |
| Portsmouth Gaseous Diffusion Plant                       | 2.029                       | 83% ▲                      | 69                     | 72% ▲                              | 0.029                | 6% ▲                            | –                                       | –                                          |
| Princeton Plasma Physics Laboratory                      | 0.222                       | ◇                          | 42                     | ◇                                  | 0.005                | ◇                               | –                                       | ◇                                          |
| Sandia National Laboratories                             | 3.092                       | –6% ▼                      | 105                    | 18% ▲                              | 0.029                | –20% ▼                          | –                                       | –                                          |
| Savannah River National Lab                              | 14.896                      | 27% ▲                      | 483                    | 9% ▲                               | 0.031                | 17% ▲                           | –                                       | –                                          |
| Savannah River Site                                      | 137.840                     | 23% ▲                      | 4,647                  | 10% ▲                              | 0.030                | 12% ▲                           | –                                       | –                                          |
| Separations Process Research Unit                        | 0.012                       | ◇                          | 1                      | ◇                                  | 0.012                | ◇                               | –                                       | ◇                                          |
| SLAC National Accelerator Laboratory                     | 0.000                       | ◇                          | 0                      | ◇                                  | 0.000                | ◇                               | –                                       | ◇                                          |
| Thomas Jefferson National Accelerator Facility           | 1.974                       | 225% ▲                     | 48                     | 118% ▲                             | 0.041                | 49% ▲                           | –                                       | –                                          |
| Uranium Mill Tailings Remedial Action Project            | 7.836                       | –35% ▼                     | 65                     | –32% ▼                             | 0.121                | –5% ▼                           | 6%                                      | –65% ▼                                     |
| Waste Isolation Pilot Plant                              | 1.283                       | 14% ▲                      | 78                     | 16% ▲                              | 0.016                | –2% ▼                           | –                                       | –                                          |
| West Valley Demonstration Project                        | 12.145                      | 37% ▲                      | 108                    | –4% ▼                              | 0.112                | 42% ▲                           | –                                       | –                                          |
| Service Center Personnel*                                | 3.719                       | 19% ▲                      | 40                     | 18% ▲                              | 0.093                | 1% ▲                            | –                                       | –                                          |
| <b>Totals</b>                                            | <b>826.474</b>              | <b>10% ▲</b>               | <b>16,903</b>          | <b>–2% ▼</b>                       | <b>0.049</b>         | <b>13% ▲</b>                    | <b>12%</b>                              | <b>16% ▲</b>                               |

Note: Boxed values (gray background) indicate the greatest value in each column. Dashes indicate no data reported for the year shown.

◇ The percentage change from the previous year is not shown because it is not meaningful when the site collective dose is less than 1 person-rem (10 person-mSv).

\* Includes personnel at NETL, NNSA Albuquerque complex, Oak Ridge, and WIPP, in addition to several smaller facilities not associated with a DOE site.

**Exhibit B-2: Site Dose Data, CY 2022.**

| Site                                                     | Collective TED (person-rem) | Percent Change – Coll. TED | Number with Meas. Dose | Percent Change – # with Meas. Dose | Avg. Meas. TED (rem) | Percent Change – Avg. Meas. TED | Percentage of Coll. TED above 0.500 rem | Percent Change – Coll. TED above 0.500 rem |
|----------------------------------------------------------|-----------------------------|----------------------------|------------------------|------------------------------------|----------------------|---------------------------------|-----------------------------------------|--------------------------------------------|
| Ames Laboratory                                          | 0.565                       | ◇                          | 26                     | ◇                                  | 0.022                | ◇                               | –                                       | ◇                                          |
| Argonne National Laboratory                              | 8.651                       | 35% ▲                      | 115                    | 20% ▲                              | 0.075                | 13% ▲                           | 32%                                     | 295% ▲                                     |
| Brookhaven National Laboratory                           | 1.976                       | 102% ▲                     | 87                     | 45% ▲                              | 0.023                | 39% ▲                           | –                                       | –                                          |
| Fermi National Accelerator Laboratory                    | 8.780                       | 44% ▲                      | 143                    | –27% ▼                             | 0.061                | 96% ▲                           | 6%                                      | –                                          |
| Grand Junction Site                                      | 0.013                       | ◇                          | 4                      | ◇                                  | 0.003                | ◇                               | –                                       | ◇                                          |
| Hanford: Hanford Site                                    | 17.308                      | 14% ▲                      | 555                    | 4% ▲                               | 0.031                | 10% ▲                           | –                                       | –                                          |
| Hanford: Office of River Protection                      | 22.637                      | –18% ▼                     | 562                    | –20% ▼                             | 0.040                | 3% ▲                            | –                                       | –                                          |
| Hanford: Pacific Northwest National Laboratory           | 33.264                      | 94% ▲                      | 537                    | 1% ▲                               | 0.062                | 93% ▲                           | 50%                                     | –                                          |
| Idaho                                                    | 84.730                      | –23% ▼                     | 1,592                  | 2% ▲                               | 0.053                | –24% ▼                          | 1%                                      | –89% ▼                                     |
| Kansas City National Security Campus                     | 0.110                       | ◇                          | 33                     | ◇                                  | 0.003                | ◇                               | –                                       | ◇                                          |
| Lawrence Berkeley National Laboratory                    | 0.497                       | ◇                          | 12                     | ◇                                  | 0.041                | ◇                               | –                                       | ◇                                          |
| Lawrence Livermore National Laboratory                   | 22.621                      | 28% ▲                      | 245                    | 40% ▲                              | 0.092                | –9% ▼                           | 29%                                     | –20% ▼                                     |
| Los Alamos National Laboratory                           | 371.500                     | 23% ▲                      | 4,467                  | 6% ▲                               | 0.083                | 15% ▲                           | 31%                                     | 37% ▲                                      |
| National Renewable Energy Laboratory                     | 0.005                       | ◇                          | 2                      | ◇                                  | 0.002                | ◇                               | –                                       | ◇                                          |
| Nevada National Security Site                            | 2.876                       | 58% ▲                      | 53                     | 39% ▲                              | 0.054                | 13% ▲                           | –                                       | –                                          |
| Oak Ridge: East Tennessee Technology Park                | 0.701                       | ◇                          | 62                     | ◇                                  | 0.011                | ◇                               | –                                       | ◇                                          |
| Oak Ridge: Oak Ridge Institute for Science and Education | 0.129                       | ◇                          | 13                     | ◇                                  | 0.010                | ◇                               | –                                       | ◇                                          |
| Oak Ridge: Oak Ridge National Laboratory                 | 65.393                      | 22% ▲                      | 1,096                  | 12% ▲                              | 0.060                | 9% ▲                            | 24%                                     | 35% ▲                                      |
| Oak Ridge: Y–12 National Security Complex                | 57.144                      | 5% ▲                       | 1,571                  | 9% ▲                               | 0.036                | –4% ▼                           | –                                       | –                                          |
| Office of Secure Transportation                          | 0.157                       | ◇                          | 3                      | ◇                                  | 0.052                | ◇                               | –                                       | ◇                                          |
| Paducah Gaseous Diffusion Plant                          | 2.983                       | 21% ▲                      | 83                     | –10% ▼                             | 0.036                | 34% ▲                           | –                                       | –                                          |
| Pantex Plant                                             | 25.909                      | 9% ▲                       | 478                    | 19% ▲                              | 0.054                | –8% ▼                           | –                                       | –                                          |
| Portsmouth Gaseous Diffusion Plant                       | 4.259                       | 110% ▲                     | 133                    | 93% ▲                              | 0.032                | 9% ▲                            | –                                       | –                                          |
| Princeton Plasma Physics Laboratory                      | 0.255                       | ◇                          | 47                     | ◇                                  | 0.005                | ◇                               | –                                       | ◇                                          |
| Sandia National Laboratories                             | 6.477                       | 109% ▲                     | 127                    | 21% ▲                              | 0.051                | 73% ▲                           | –                                       | –                                          |
| Savannah River National Lab                              | 7.665                       | –49% ▼                     | 371                    | –23% ▼                             | 0.021                | –33% ▼                          | –                                       | –                                          |
| Savannah River Site                                      | 128.062                     | –7% ▼                      | 4,083                  | –12% ▼                             | 0.031                | 6% ▲                            | 3%                                      | –                                          |
| Separations Process Research Unit                        | 0.016                       | ◇                          | 1                      | ◇                                  | 0.016                | ◇                               | –                                       | ◇                                          |
| Thomas Jefferson National Accelerator Facility           | 0.854                       | ◇                          | 53                     | ◇                                  | 0.016                | ◇                               | –                                       | ◇                                          |
| Uranium Mill Tailings Remedial Action Project            | 4.765                       | –39% ▼                     | 61                     | –6% ▼                              | 0.078                | –35% ▼                          | –                                       | –                                          |
| Waste Isolation Pilot Plant                              | 0.449                       | ◇                          | 25                     | ◇                                  | 0.018                | ◇                               | –                                       | ◇                                          |
| West Valley Demonstration Project                        | 12.946                      | 7% ▲                       | 119                    | 10% ▲                              | 0.109                | –3% ▼                           | –                                       | –                                          |
| Service Center Personnel*                                | 0.428                       | ◇                          | 15                     | ◇                                  | 0.029                | ◇                               | –                                       | ◇                                          |
| <b>Totals</b>                                            | <b>893.125</b>              | <b>8% ▲</b>                | <b>16,774</b>          | <b>–1% ▼</b>                       | <b>0.053</b>         | <b>9% ▲</b>                     | <b>18%</b>                              | <b>53% ▲</b>                               |

Note: Boxed values (gray background) indicate the greatest value in each column. Dashes indicate no data reported for the year shown.

◇ The percentage change from the previous year is not shown because it is not meaningful when the site collective dose is less than 1 person-rem (10 person-mSv).

\* Includes personnel at NNSA Albuquerque complex, Oak Ridge, and WIPP, in addition to several smaller facilities not associated with a DOE site.

**Exhibit B-3: Site Dose Data, CY 2023.**

| Site                                                     | Collective TED (person-rem) | Percent Change – Coll. TED | Number with Meas. Dose | Percent Change – # with Meas. Dose | Avg. Meas. TED (rem) | Percent Change – Avg. Meas. TED | Percentage of Coll. TED above 0.500 rem | Percent Change – Coll. TED above 0.500 rem |
|----------------------------------------------------------|-----------------------------|----------------------------|------------------------|------------------------------------|----------------------|---------------------------------|-----------------------------------------|--------------------------------------------|
| Ames Laboratory                                          | 0.778                       | –                          | 34                     | –                                  | 0.023                | –                               | –                                       | –                                          |
| Argonne National Laboratory                              | 10.225                      | 18% ▲                      | 261                    | 127% ▲                             | 0.039                | –48% ▼                          | 17%                                     | –47% ▼                                     |
| Brookhaven National Laboratory                           | 1.611                       | –18% ▼                     | 49                     | –44% ▼                             | 0.033                | 45% ▲                           | –                                       | –                                          |
| Fermi National Accelerator Laboratory                    | 3.36                        | –62% ▼                     | 86                     | –40% ▼                             | 0.039                | –36% ▼                          | –                                       | –                                          |
| Grand Junction Site                                      | 0.003                       | –                          | 2                      | –                                  | 0.002                | –                               | –                                       | –                                          |
| Hanford: Hanford Site                                    | 23.745                      | 37% ▲                      | 503                    | –9% ▼                              | 0.047                | 51% ▲                           | –                                       | –                                          |
| Hanford: Office of River Protection                      | 20.427                      | –10% ▼                     | 523                    | –7% ▼                              | 0.039                | –3% ▼                           | –                                       | –                                          |
| Hanford: Pacific Northwest National Laboratory           | 18.488                      | –44% ▼                     | 671                    | 25% ▲                              | 0.028                | –56% ▼                          | 9%                                      | –82% ▼                                     |
| Idaho                                                    | 100.208                     | 20% ▲                      | 1,695                  | 6% ▲                               | 0.059                | 12% ▲                           | 3%                                      | 147% ▲                                     |
| Kansas City National Security Campus                     | 0.312                       | –                          | 68                     | –                                  | 0.005                | –                               | –                                       | –                                          |
| Lawrence Berkeley National Laboratory                    | 0.434                       | –                          | 10                     | –                                  | 0.043                | –                               | –                                       | –                                          |
| Lawrence Livermore National Laboratory                   | 27.907                      | 1% ▲                       | 333                    | 46% ▲                              | 0.084                | –1% ▼                           | 24%                                     | –15% ▼                                     |
| Los Alamos National Laboratory                           | 311.506                     | –1% ▼                      | 3,764                  | –16% ▼                             | 0.083                | 0%                              | 18%                                     | –41% ▼                                     |
| National Renewable Energy Laboratory                     | 0.003                       | –                          | 1                      | –                                  | 0.003                | –                               | –                                       | –                                          |
| Nevada National Security Site                            | 2.351                       | –1% ▼                      | 43                     | –19% ▼                             | 0.055                | 1% ▲                            | –                                       | –                                          |
| Oak Ridge: East Tennessee Technology Park                | 0.577                       | –                          | 59                     | –                                  | 0.010                | –                               | –                                       | –                                          |
| Oak Ridge: Oak Ridge Institute for Science and Education | 0.098                       | –                          | 6                      | –                                  | 0.016                | –                               | –                                       | –                                          |
| Oak Ridge: Oak Ridge National Laboratory                 | 66.688                      | 1% ▲                       | 1,220                  | 11% ▲                              | 0.055                | –8% ▼                           | 14%                                     | –41% ▼                                     |
| Oak Ridge: Y–12 National Security Complex                | 50.006                      | –12% ▼                     | 1,567                  | 0%                                 | 0.032                | –12% ▼                          | –                                       | –                                          |
| Office of Secure Transportation                          | 0.048                       | –                          | 4                      | –                                  | 0.012                | –                               | –                                       | –                                          |
| Paducah Gaseous Diffusion Plant                          | 4.172                       | 1% ▲                       | 96                     | 16% ▲                              | 0.043                | 21% ▲                           | –                                       | –                                          |
| Pantex Plant                                             | 40.176                      | 55% ▲                      | 564                    | 18% ▲                              | 0.071                | 31% ▲                           | –                                       | –                                          |
| Portsmouth Gaseous Diffusion Plant                       | 6.111                       | 43% ▲                      | 157                    | 18% ▲                              | 0.039                | 22% ▲                           | –                                       | –                                          |
| Princeton Plasma Physics Laboratory                      | 0.336                       | –                          | 48                     | –                                  | 0.007                | –                               | –                                       | –                                          |
| Sandia National Laboratories                             | 7.959                       | 1% ▲                       | 112                    | –12% ▼                             | 0.071                | 39% ▲                           | 10%                                     | 0%                                         |
| Savannah River National Lab                              | 15.793                      | 106% ▲                     | 546                    | 47% ▲                              | 0.029                | 40% ▲                           | –                                       | –                                          |
| Savannah River Site                                      | 216.973                     | 69% ▲                      | 5,701                  | 40% ▲                              | 0.038                | 21% ▲                           | 8%                                      | 154% ▲                                     |
| Separations Process Research Unit                        | 0.013                       | –                          | 1                      | –                                  | 0.013                | –                               | –                                       | –                                          |
| SLAC National Accelerator Laboratory                     | 0.036                       | –                          | 2                      | –                                  | 0.018                | –                               | –                                       | –                                          |
| Thomas Jefferson National Accelerator Facility           | 0.622                       | –                          | 38                     | –                                  | 0.016                | –                               | –                                       | –                                          |
| Uranium Mill Tailings Remedial Action Project            | 8.905                       | 1% ▲                       | 125                    | 105% ▲                             | 0.071                | –9% ▼                           | –                                       | –                                          |
| Waste Isolation Pilot Plant                              | 0.163                       | –                          | 9                      | –                                  | 0.018                | –                               | –                                       | –                                          |
| West Valley Demonstration Project                        | 7.734                       | –40% ▼                     | 130                    | 9% ▲                               | 0.059                | –45% ▼                          | –                                       | –                                          |
| Service Center Personnel*                                | 1.627                       | 280% ▲                     | 41                     | 173% ▲                             | 0.040                | 39% ▲                           | –                                       | –                                          |
| <b>Totals</b>                                            | <b>949.395</b>              | <b>6% ▲</b>                | <b>18,469</b>          | <b>10% ▲</b>                       | <b>0.051</b>         | <b>–3% ▼</b>                    | <b>10%</b>                              | <b>–43% ▼</b>                              |

Note: Boxed values (gray background) indicate the greatest value in each column. Dashes indicate no data reported for the year shown.

◇ The percentage change from the previous year is not shown because it is not meaningful when the site collective dose is less than 1 person-rem (10 person-mSv).

\* Includes personnel at NETL, NNSA Albuquerque complex, Oak Ridge, and WIPP, in addition to several smaller facilities not associated with a DOE site.

**Exhibit B-4: Internal Dose by Site, CY 2021–2023.**

| Site                                          | No. of<br>Individuals with<br>Measurable<br>CED* 2021 | No. of<br>Individuals with<br>Measurable<br>CED* 2022 | No. of<br>Individuals with<br>Measurable<br>CED* 2023 | Collective<br>CED Dose<br>(person–rem)<br>2021 | Collective<br>CED Dose<br>(person–rem)<br>2022 | Collective<br>CED Dose<br>(person–rem)<br>2023 | Average<br>Measurable<br>CED<br>2021 | Average<br>Measurable<br>CED<br>2022 | Average<br>Measurable<br>CED<br>2023 |
|-----------------------------------------------|-------------------------------------------------------|-------------------------------------------------------|-------------------------------------------------------|------------------------------------------------|------------------------------------------------|------------------------------------------------|--------------------------------------|--------------------------------------|--------------------------------------|
| Hanford: Hanford Site                         | –                                                     | 1                                                     | 5                                                     | –                                              | 0.004                                          | 0.008                                          | –                                    | 0.004                                | 0.016                                |
| Idaho                                         | 1                                                     | 1                                                     | –                                                     | 0.012                                          | 0.032                                          | –                                              | 0.012                                | 0.032                                | –                                    |
| Lawrence Livermore National Laboratory        | 3                                                     | 2                                                     | 1                                                     | 0.152                                          | 0.062                                          | 0.011                                          | <b>0.051</b>                         | 0.031                                | 0.011                                |
| Los Alamos National Laboratory                | 27                                                    | 32                                                    | 27                                                    | 0.198                                          | 0.103                                          | 0.117                                          | 0.007                                | 0.003                                | 0.004                                |
| Oak Ridge: Oak Ridge National Laboratory      | 2                                                     | 1                                                     | 2                                                     | 0.082                                          | 0.019                                          | 0.070                                          | 0.041                                | 0.019                                | <b>0.035</b>                         |
| Oak Ridge: Y–12 National Security Complex     | <b>1,130</b>                                          | <b>1,201</b>                                          | <b>1,226</b>                                          | <b>41.680</b>                                  | <b>43.806</b>                                  | <b>38.757</b>                                  | 0.037                                | 0.036                                | 0.003                                |
| Paducah Gaseous Diffusion Plant               | 14                                                    | 10                                                    | 10                                                    | 0.257                                          | 0.261                                          | 0.212                                          | 0.018                                | 0.026                                | 0.021                                |
| Princeton Plasma Physics Laboratory           | –                                                     | 14                                                    | –                                                     | –                                              | 0.035                                          | –                                              | –                                    | 0.003                                | –                                    |
| Sandia National Laboratories                  | 6                                                     | 9                                                     | 2                                                     | 0.068                                          | 0.027                                          | 0.024                                          | 0.011                                | 0.003                                | 0.012                                |
| Savannah River National Laboratory            | –                                                     | 3                                                     | –                                                     | –                                              | 0.191                                          | –                                              | –                                    | <b>0.064</b>                         | –                                    |
| Savannah River Site                           | 3                                                     | 5                                                     | 2                                                     | 0.026                                          | 0.044                                          | 0.018                                          | 0.009                                | 0.009                                | 0.009                                |
| Uranium Mill Tailings Remedial Action Project | 54                                                    | 47                                                    | 58                                                    | 1.314                                          | 1.185                                          | 2.346                                          | 0.024                                | 0.025                                | 0.004                                |
| Service Center Personnel**                    | –                                                     | 1                                                     | –                                                     | –                                              | 0.036                                          | –                                              | –                                    | 0.036                                | –                                    |
| <b>Totals</b>                                 | <b>1,240</b>                                          | <b>1,327</b>                                          | <b>1,333</b>                                          | <b>43.789</b>                                  | <b>45.805</b>                                  | <b>41.563</b>                                  | <b>0.035</b>                         | <b>0.035</b>                         | <b>0.031</b>                         |

Note: Boxed values (gray background) indicate the greatest value in each column. Dashes indicate no individuals with measurable CED for the year shown. Dashes indicate no data reported for the year shown.

\* The number of internal depositions represents the number of internal dose records with positive results reported for each individual.

\*\* Includes personnel at NETL, NNSA Albuquerque complex, Oak Ridge, and WIPP, in addition to several smaller facilities not associated with a DOE site.

**Exhibit B-5: Neutron Dose Distribution by Site, CY 2023.**

| Site                                                     | No Meas.<br>Dose | Meas. <<br>0.100 | 0.100 –<br>0.250 | 0.250 –<br>0.500 | 0.500 –<br>0.750 | 0.750 –<br>1.00 | 1.0 –<br>2.0 | > 2.0 | Total<br>Monitored* | No. of<br>Individuals<br>with Meas.<br>Dose | % of<br>Individuals<br>with Meas.<br>Dose | Collective<br>Neutron<br>Dose<br>(person–<br>rem) | Avg. Meas.<br>Neutron Dose<br>(rem) |
|----------------------------------------------------------|------------------|------------------|------------------|------------------|------------------|-----------------|--------------|-------|---------------------|---------------------------------------------|-------------------------------------------|---------------------------------------------------|-------------------------------------|
| Ames Laboratory                                          | 157              | –                | –                | –                | –                | –               | –            | –     | 157                 | –                                           | –                                         | –                                                 | –                                   |
| Argonne National Laboratory                              | 2,476            | –                | –                | –                | –                | –               | –            | –     | 2,476               | –                                           | –                                         | –                                                 | –                                   |
| Brookhaven National Laboratory                           | 2,598            | 1                | –                | –                | –                | –               | –            | –     | 2,599               | 1                                           | 0%                                        | 0.005                                             | 0.005                               |
| Fermi National Accelerator Laboratory                    | 1,447            | –                | –                | –                | –                | –               | –            | –     | 1,447               | –                                           | –                                         | –                                                 | –                                   |
| Grand Junction Site                                      | 30               | –                | –                | –                | –                | –               | –            | –     | 30                  | –                                           | –                                         | –                                                 | –                                   |
| Hanford: Hanford Site                                    | 3,336            | 190              | –                | –                | –                | –               | –            | –     | 3,526               | 190                                         | 5%                                        | 1.859                                             | 0.010                               |
| Hanford: Office of River Protection                      | 3,625            | 7                | –                | –                | –                | –               | –            | –     | 3,632               | 7                                           | 0%                                        | 0.061                                             | 0.009                               |
| Hanford: Pacific Northwest National Laboratory           | 3,256            | –                | –                | –                | –                | –               | –            | –     | 3,256               | –                                           | –                                         | –                                                 | –                                   |
| Idaho                                                    | 7,159            | 53               | 1                | –                | –                | –               | –            | –     | 7,213               | 54                                          | 1%                                        | 1.720                                             | 0.032                               |
| Kansas City National Security Campus                     | 224              | –                | –                | –                | –                | –               | –            | –     | 224                 | –                                           | –                                         | –                                                 | –                                   |
| Lawrence Berkeley National Laboratory                    | 619              | –                | –                | –                | –                | –               | –            | –     | 619                 | –                                           | –                                         | –                                                 | –                                   |
| Lawrence Livermore National Laboratory                   | 4,373            | 46               | 6                | 4                | 2                | –               | 2            | –     | 4,433               | 60                                          | 1%                                        | 7.095                                             | <b>0.118</b>                        |
| Los Alamos National Laboratory                           | 12,769           | 1,701            | 346              | 117              | 15               | 3               | 1            | –     | <b>14,952</b>       | <b>2,183</b>                                | <b>15%</b>                                | <b>158.763</b>                                    | 0.073                               |
| National Renewable Energy Laboratory                     | 6                | –                | –                | –                | –                | –               | –            | –     | 6                   | –                                           | –                                         | –                                                 | –                                   |
| Nevada National Security Site                            | 782              | 1                | –                | –                | –                | –               | –            | –     | 783                 | 1                                           | 0%                                        | 0.027                                             | 0.027                               |
| Oak Ridge: East Tennessee Technology Park                | 245              | –                | –                | –                | –                | –               | –            | –     | 245                 | –                                           | –                                         | –                                                 | –                                   |
| Oak Ridge: Oak Ridge Institute for Science and Education | 89               | –                | –                | –                | –                | –               | –            | –     | 89                  | –                                           | –                                         | –                                                 | –                                   |
| Oak Ridge: Oak Ridge National Laboratory                 | 5,120            | 87               | 33               | 5                | 1                | –               | –            | –     | 5,246               | 126                                         | 2%                                        | 10.704                                            | 0.085                               |
| Oak Ridge: Y-12 National Security Complex                | 8,068            | 3                | –                | –                | –                | –               | –            | –     | 8,071               | 3                                           | 0%                                        | 0.043                                             | 0.014                               |
| Office of Secure Transportation                          | 321              | –                | –                | –                | –                | –               | –            | –     | 321                 | –                                           | –                                         | –                                                 | –                                   |
| Paducah Gaseous Diffusion Plant                          | 1,454            | –                | –                | –                | –                | –               | –            | –     | 1,454               | –                                           | –                                         | –                                                 | –                                   |
| Pantex Plant                                             | 4,228            | 418              | 50               | 5                | –                | –               | –            | –     | 4,701               | 473                                         | 10%                                       | 23.635                                            | 0.050                               |
| Portsmouth Gaseous Diffusion Plant                       | 2,146            | 1                | –                | –                | –                | –               | –            | –     | 2,147               | 1                                           | 0%                                        | 0.020                                             | 0.020                               |
| Princeton Plasma Physics Laboratory                      | 343              | –                | –                | –                | –                | –               | –            | –     | 343                 | –                                           | –                                         | –                                                 | –                                   |
| Sandia National Laboratories                             | 2,082            | 10               | 1                | –                | –                | 1               | –            | –     | 2,094               | 12                                          | 1%                                        | 1.322                                             | 0.110                               |
| Savannah River National Laboratory                       | 599              | 15               | –                | –                | –                | –               | –            | –     | 614                 | 15                                          | 2%                                        | 0.480                                             | 0.032                               |
| Savannah River Site                                      | 6,491            | 293              | 37               | 1                | –                | –               | –            | –     | 6,822               | 331                                         | 5%                                        | 16.020                                            | 0.048                               |
| Separations Process Research Unit                        | 11               | –                | –                | –                | –                | –               | –            | –     | 11                  | –                                           | –                                         | –                                                 | –                                   |

**Exhibit B-5: Neutron Dose Distribution by Site, CY 2023.**

| Site                                           | No Meas. Dose | Meas. < 0.100 | 0.100 – 0.250 | 0.250 – 0.500 | 0.500 – 0.750 | 0.750 – 1.00 | 1.0 – 2.0 | > 2.0    | Total Monitored* | No. of Individuals with Meas. Dose | % of Individuals with Meas. Dose | Collective Neutron Dose (person-rem) | Avg. Meas. Neutron Dose (rem) |
|------------------------------------------------|---------------|---------------|---------------|---------------|---------------|--------------|-----------|----------|------------------|------------------------------------|----------------------------------|--------------------------------------|-------------------------------|
| SLAC National Accelerator Laboratory           | 1,776         | –             | –             | –             | –             | –            | –         | –        | 1,776            | –                                  | –                                | –                                    | –                             |
| Thomas Jefferson National Accelerator Facility | 1,384         | –             | –             | –             | –             | –            | –         | –        | 1,384            | –                                  | –                                | –                                    | –                             |
| Uranium Mill Tailings Remedial Action Project  | 171           | –             | –             | –             | –             | –            | –         | –        | 171              | –                                  | –                                | –                                    | –                             |
| Waste Isolation Pilot Plant                    | 833           | –             | –             | –             | –             | –            | –         | –        | 833              | –                                  | –                                | –                                    | –                             |
| West Valley Demonstration Project              | 449           | –             | –             | –             | –             | –            | –         | –        | 449              | –                                  | –                                | –                                    | –                             |
| Service Center Personnel*                      | 288           | –             | –             | –             | –             | –            | –         | –        | 288              | –                                  | –                                | –                                    | –                             |
| <b>Totals</b>                                  | <b>78,955</b> | <b>2,826</b>  | <b>474</b>    | <b>132</b>    | <b>18</b>     | <b>4</b>     | <b>3</b>  | <b>–</b> | <b>82,412</b>    | <b>3,457</b>                       | <b>4%</b>                        | <b>221.754</b>                       | <b>0.064</b>                  |

Note: Boxed values (gray background) indicate the greatest value in each column. Dashes indicate no data reported for the year shown.

\*Represents the total number of monitoring records. The number of individuals specifically monitored for neutron radiation cannot be determined.

\*\*Includes personnel at NETL, NNSA Albuquerque complex, Oak Ridge, and WIPP, in addition to several smaller facilities not associated with a DOE site.

**Exhibit B-6a: Distribution of TED by Facility Type, CY 2021.**

**TOTAL EFFECTIVE DOSE (TED)**

**Number of Individuals Receiving Radiation Doses in Each Dose Range (rem)**

| Facility Type                   | Less than Meas. | Meas. To 0.100 | 0.100 – 0.250 | 0.250 – 0.500 | 0.500 – 0.750 | 0.750 – 1.000 | 1.0 – 2.0 | 2.0 – 3.0 | 3.0 – 4.0 | 4.0 – 5.0 | >5.0     | Total Monitored | Percent of Monitored with Meas. TED | No. with Meas. TED | Collective TED (Person-rem) | Avg. Meas. TED (rem) |
|---------------------------------|-----------------|----------------|---------------|---------------|---------------|---------------|-----------|-----------|-----------|-----------|----------|-----------------|-------------------------------------|--------------------|-----------------------------|----------------------|
| Accelerator                     | 6,191           | 553            | 18            | 8             | 3             | –             | –         | –         | –         | –         | –        | 6,773           | 9%                                  | 582                | 20.139                      | 0.035                |
| Fuel Processing                 | 140             | 373            | 8             | 1             | –             | –             | –         | –         | –         | –         | –        | 522             | <b>73%</b>                          | 382                | 9.030                       | 0.024                |
| Fuel/Uranium Enrichment         | 2,278           | 120            | 2             | –             | –             | –             | –         | –         | –         | –         | –        | 2,400           | 5%                                  | 122                | 2.497                       | 0.020                |
| Maintenance and Support         | 5,648           | 914            | 39            | 8             | 2             | –             | –         | –         | –         | –         | –        | 6,611           | 15%                                 | 963                | 31.152                      | 0.032                |
| Other                           | 4,439           | 1,062          | 70            | 9             | 1             | –             | –         | –         | –         | –         | –        | 5,581           | 20%                                 | 1,142              | 37.205                      | 0.033                |
| Reactor                         | 116             | 15             | 2             | –             | –             | –             | –         | –         | –         | –         | –        | 133             | 13%                                 | 17                 | 0.719                       | 0.042                |
| Research, Fusion                | 385             | 43             | –             | –             | –             | –             | –         | –         | –         | –         | –        | 428             | 10%                                 | 43                 | 0.253                       | 0.006                |
| Research, General               | 18,157          | 4,989          | 434           | 151           | 30            | 12            | 4         | –         | –         | –         | –        | <b>23,777</b>   | 24%                                 | <b>5,620</b>       | 272.907                     | 0.049                |
| Waste Processing/Management     | 3,942           | 4,055          | 295           | 81            | 2             | –             | –         | –         | –         | –         | –        | 8,375           | 53%                                 | 4,433              | 168.990                     | 0.038                |
| Weapons Fabrication and Testing | 9,594           | 2,813          | 515           | 185           | 60            | 17            | 9         | –         | –         | –         | –        | 13,193          | 27%                                 | 3,599              | <b>283.582</b>              | <b>0.079</b>         |
| <b>Totals</b>                   | <b>50,890</b>   | <b>14,937</b>  | <b>1,383</b>  | <b>443</b>    | <b>98</b>     | <b>29</b>     | <b>13</b> | <b>–</b>  | <b>–</b>  | <b>–</b>  | <b>–</b> | <b>67,793</b>   | <b>25%</b>                          | <b>16,903</b>      | <b>826.474</b>              | <b>0.049</b>         |

Note: Boxed values (gray background) indicate the greatest value in each column. Dashes indicate no data reported for the year shown.

*Exhibit B-6b: Distribution of TED by Facility Type, CY 2022.*

**TOTAL EFFECTIVE DOSE (TED)**

**Number of Individuals Receiving Radiation Doses in Each Dose Range (rem)**

| Facility Type                   | Less than Meas. | Meas. To 0.100 | 0.100 – 0.250 | 0.250 – 0.500 | 0.500 – 0.750 | 0.750 – 1.000 | 1.0 – 2.0 | 2.0 – 3.0 | 3.0 – 4.0 | 4.0 – 5.0 | >5.0 | Total Monitored | Percent of Monitored with Meas. TED | No. with Meas. TED | Collective TED (Person-rem) | Avg. Meas. TED (rem) |
|---------------------------------|-----------------|----------------|---------------|---------------|---------------|---------------|-----------|-----------|-----------|-----------|------|-----------------|-------------------------------------|--------------------|-----------------------------|----------------------|
| Accelerator                     | 6,714           | 461            | 46            | 14            | 5             | 5             | –         | –         | –         | –         | –    | 7,245           | 7%                                  | 531                | 29.304                      | 0.055                |
| Fuel Processing                 | 285             | 301            | 7             | –             | –             | –             | –         | –         | –         | –         | –    | 593             | 52%                                 | 308                | 6.576                       | 0.021                |
| Fuel/Uranium Enrichment         | 2,343           | 190            | 5             | –             | –             | –             | –         | –         | –         | –         | –    | 2,538           | 8%                                  | 195                | 4.960                       | 0.025                |
| Maintenance and Support         | 5,486           | 868            | 64            | 15            | –             | –             | –         | –         | –         | –         | –    | 6,433           | 15%                                 | 947                | 34.392                      | 0.036                |
| Other                           | 5,277           | 959            | 57            | 15            | 1             | –             | –         | –         | –         | –         | –    | 6,309           | 16%                                 | 1,032              | 35.026                      | 0.034                |
| Reactor                         | 146             | 21             | 5             | –             | –             | –             | –         | –         | –         | –         | –    | 172             | 15%                                 | 26                 | 1.674                       | 0.064                |
| Research, Fusion                | 368             | 50             | –             | –             | –             | –             | –         | –         | –         | –         | –    | 418             | 12%                                 | 50                 | 0.357                       | 0.007                |
| Research, General               | 21,988          | 5,210          | 384           | 134           | 29            | 18            | 10        | –         | –         | –         | –    | 27,773          | 21%                                 | 5,785              | 278.012                     | 0.048                |
| Waste Processing/Management     | 4,975           | 3,660          | 275           | 81            | 10            | 2             | –         | –         | –         | –         | –    | 9,003           | 45%                                 | 4,028              | 161.913                     | 0.040                |
| Weapons Fabrication and Testing | 10,993          | 3,008          | 531           | 194           | 92            | 35            | 12        | –         | –         | –         | –    | 14,865          | 26%                                 | 3,872              | 340.911                     | 0.088                |
| <b>Totals</b>                   | <b>58,574</b>   | <b>14,728</b>  | <b>1,374</b>  | <b>453</b>    | <b>137</b>    | <b>60</b>     | <b>22</b> | –         | –         | –         | –    | <b>75,348</b>   | <b>22%</b>                          | <b>16,774</b>      | <b>893.125</b>              | <b>0.053</b>         |

Note: Boxed values (gray background) indicate the greatest value in each column. Dashes indicate no data reported for the year shown.

*Exhibit B-6c: Distribution of TED by Facility Type, CY 2023.*

**TOTAL EFFECTIVE DOSE (TED)**

**Number of Individuals Receiving Radiation Doses in Each Dose Range (rem)**

| Facility Type                   | Less than Meas. | Meas. To 0.100 | 0.100 – 0.250 | 0.250 – 0.500 | 0.500 – 0.750 | 0.750 – 1.000 | 1.0 – 2.0 | 2.0 – 3.0 | 3.0 – 4.0 | 4.0 – 5.0 | >5.0 | Total Monitored | Percent of Monitored with Meas. TED | No. with Meas. TED | Collective TED (Person–rem) | Avg. Meas. TED (rem) |
|---------------------------------|-----------------|----------------|---------------|---------------|---------------|---------------|-----------|-----------|-----------|-----------|------|-----------------|-------------------------------------|--------------------|-----------------------------|----------------------|
| Accelerator                     | 7,991           | 342            | 38            | 2             | –             | –             | –         | –         | –         | –         | –    | 8,373           | 5%                                  | 382                | 14.434                      | 0.038                |
| Fuel Processing                 | 110             | 499            | 16            | –             | –             | –             | –         | –         | –         | –         | –    | 625             | 82%                                 | 515                | 13.023                      | 0.025                |
| Fuel/Uranium Enrichment         | 2,176           | 201            | 15            | –             | –             | –             | –         | –         | –         | –         | –    | 2,392           | 9%                                  | 216                | 6.688                       | 0.031                |
| Maintenance and Support         | 5,595           | 746            | 91            | 16            | –             | –             | –         | –         | –         | –         | –    | 6,448           | 13%                                 | 853                | 37.795                      | 0.044                |
| Other                           | 6,223           | 891            | 59            | 8             | 1             | –             | –         | –         | –         | –         | –    | 7,182           | 13%                                 | 959                | 31.637                      | 0.033                |
| Reactor                         | 178             | 20             | 6             | 1             | –             | –             | –         | –         | –         | –         | –    | 205             | 13%                                 | 27                 | 2.188                       | 0.081                |
| Research, Fusion                | 359             | 50             | 1             | –             | –             | –             | –         | –         | –         | –         | –    | 410             | 12%                                 | 51                 | 0.588                       | 0.012                |
| Research, General               | 24,226          | 5,373          | 455           | 162           | 22            | 9             | 2         |           |           |           |      | 30,249          | 20%                                 | 6,023              | 281.000                     | 0.047                |
| Waste Processing/Management     | 4,236           | 4,814          | 384           | 91            | 29            | 2             | –         | –         | –         | –         | –    | 9,556           | 56%                                 | 5,320              | 236.665                     | 0.044                |
| Weapons Fabrication and Testing | 12,849          | 3,201          | 594           | 243           | 64            | 17            | 4         | –         | –         | –         | –    | 16,972          | 24%                                 | 4,123              | 325.377                     | 0.079                |
| <b>Totals</b>                   | <b>63,943</b>   | <b>16,137</b>  | <b>1,659</b>  | <b>523</b>    | <b>116</b>    | <b>28</b>     | <b>6</b>  | –         | –         | –         | –    | <b>82,412</b>   | <b>22%</b>                          | <b>18,469</b>      | <b>949.395</b>              | <b>0.051</b>         |

Note: Boxed values (gray background) indicate the greatest value in each column. Dashes indicate no data reported for the year shown.

**Exhibit B-7a: Collective TED by Site and Facility Type, CY 2021.**

| Site                                                     | Accelerator   | Fuel/<br>Uranium<br>Enrichment | Fuel<br>Processing | Maintenance<br>and Support | Reactor      | Research,<br>General | Research,<br>Fusion | Waste<br>Processing/<br>Management | Weapons<br>Fabrication<br>and Testing | Other         | Totals         |
|----------------------------------------------------------|---------------|--------------------------------|--------------------|----------------------------|--------------|----------------------|---------------------|------------------------------------|---------------------------------------|---------------|----------------|
| Ames Laboratory                                          | —             | —                              | —                  | —                          | —            | 0.710                | —                   | —                                  | —                                     | —             | 0.710          |
| Argonne National Laboratory                              | 0.562         | —                              | —                  | 0.413                      | —            | 2.236                | —                   | 2.983                              | —                                     | 0.191         | 6.385          |
| Brookhaven National Laboratory                           | 0.761         | —                              | —                  | 0.181                      | —            | —                    | —                   | 0.035                              | —                                     | —             | 0.977          |
| Fermi National Accelerator Laboratory                    | 6.110         | —                              | —                  | —                          | —            | —                    | —                   | —                                  | —                                     | —             | 6.110          |
| Grand Junction Site                                      | —             | —                              | —                  | —                          | —            | —                    | —                   | —                                  | —                                     | 0.158         | 0.158          |
| Hanford: Hanford Site                                    | —             | —                              | —                  | 12.680                     | —            | —                    | —                   | —                                  | —                                     | 2.448         | 15.128         |
| Hanford: Office of River Protection                      | —             | —                              | —                  | —                          | —            | —                    | —                   | 15.744                             | —                                     | 11.732        | 27.476         |
| Hanford: Pacific Northwest National Laboratory           | —             | —                              | —                  | —                          | —            | 17.127               | —                   | —                                  | —                                     | —             | 17.127         |
| Idaho                                                    | —             | —                              | —                  | —                          | —            | 108.728              | —                   | —                                  | —                                     | —             | 108.728        |
| Kansas City National Security Campus                     | —             | —                              | —                  | —                          | —            | —                    | —                   | —                                  | 0.920                                 | —             | 0.920          |
| Lawrence Berkeley National Laboratory                    | —             | —                              | —                  | —                          | —            | 0.582                | —                   | —                                  | —                                     | —             | 0.582          |
| Lawrence Livermore National Laboratory                   | —             | —                              | —                  | 1.924                      | —            | 15.756               | —                   | —                                  | —                                     | —             | 17.680         |
| Los Alamos National Laboratory                           | 10.158        | —                              | —                  | 9.365                      | —            | 58.609               | —                   | 8.897                              | 201.610                               | 14.547        | 303.186        |
| National Renewable Energy Laboratory                     | —             | —                              | —                  | —                          | —            | —                    | —                   | —                                  | —                                     | —             | —              |
| Nevada National Security Site                            | —             | —                              | —                  | 1.821                      | —            | —                    | —                   | —                                  | —                                     | —             | 1.821          |
| Oak Ridge: East Tennessee Technology Park                | —             | 0.468                          | —                  | —                          | —            | —                    | —                   | —                                  | —                                     | —             | 0.468          |
| Oak Ridge: Oak Ridge Institute for Science and Education | —             | —                              | —                  | —                          | —            | 0.025                | —                   | —                                  | —                                     | —             | 0.025          |
| Oak Ridge: Oak Ridge National Laboratory                 | —             | —                              | —                  | —                          | —            | 48.788               | —                   | 4.667                              | —                                     | —             | 53.455         |
| Oak Ridge: Y-12 National Security Complex                | —             | —                              | —                  | —                          | —            | —                    | —                   | —                                  | 54.186                                | —             | 54.186         |
| Office of Secure Transportation                          | —             | —                              | —                  | —                          | —            | —                    | —                   | —                                  | 0.084                                 | —             | 0.084          |
| Paducah Gaseous Diffusion Plant                          | —             | —                              | —                  | —                          | —            | 0.257                | —                   | 2.208                              | —                                     | —             | 2.465          |
| Pantex Plant                                             | —             | —                              | —                  | 0.020                      | —            | —                    | —                   | —                                  | 23.735                                | —             | 23.755         |
| Portsmouth Gaseous Diffusion Plant                       | —             | 2.029                          | —                  | —                          | —            | —                    | —                   | —                                  | —                                     | —             | 2.029          |
| Princeton Plasma Physics Laboratory                      | —             | —                              | —                  | —                          | —            | —                    | 0.222               | —                                  | —                                     | —             | 0.222          |
| Sandia National Laboratories                             | 0.574         | —                              | —                  | 0.161                      | 0.719        | 0.796                | 0.031               | 0.049                              | 0.173                                 | 0.589         | 3.092          |
| Savannah River National Laboratory                       | —             | —                              | 0.006              | 0.079                      | —            | 14.478               | —                   | 0.088                              | 0.025                                 | 0.052         | 14.896         |
| Savannah River Site                                      | —             | —                              | 9.024              | 4.433                      | —            | 4.815                | —                   | 113.023                            | 2.849                                 | 3.864         | 137.840        |
| Separations Process Research Unit                        | —             | —                              | —                  | —                          | —            | —                    | —                   | 0.012                              | —                                     | —             | 0.012          |
| SLAC National Accelerator Laboratory                     | —             | —                              | —                  | —                          | —            | —                    | —                   | —                                  | —                                     | —             | —              |
| Thomas Jefferson National Accelerator Facility           | 1.974         | —                              | —                  | —                          | —            | —                    | —                   | —                                  | —                                     | —             | 1.974          |
| Uranium Mill Tailings Remedial Action Project            | —             | —                              | —                  | —                          | —            | —                    | —                   | 7.836                              | —                                     | —             | 7.836          |
| Waste Isolation Pilot Plant                              | —             | —                              | —                  | —                          | —            | —                    | —                   | 1.283                              | —                                     | —             | 1.283          |
| West Valley Demonstration Project                        | —             | —                              | —                  | —                          | —            | —                    | —                   | 12.145                             | —                                     | —             | 12.145         |
| Service Center Personnel*                                | —             | —                              | —                  | —                          | —            | —                    | —                   | 0.020                              | —                                     | 3.624         | 3.719          |
| <b>Totals</b>                                            | <b>20.139</b> | <b>2.497</b>                   | <b>9.030</b>       | <b>31.152</b>              | <b>0.719</b> | <b>272.907</b>       | <b>0.253</b>        | <b>168.990</b>                     | <b>283.582</b>                        | <b>37.205</b> | <b>826.474</b> |

Note: Boxed values (gray background) indicate the greatest value in each column. Dashes indicate no data reported for the year shown.

\* Includes personnel at NETL, NNSA Albuquerque complex, Oak Ridge, and WIPP.

**Exhibit B-7b: Collective TED by Site and Facility Type, CY 2022.**

| Site                                                     | Accelerator   | Fuel/<br>Uranium<br>Enrichment | Fuel<br>Processing | Maintenance<br>and Support | Reactor      | Research,<br>General | Research,<br>Fusion | Waste<br>Processing/<br>Management | Weapons<br>Fabrication<br>and Testing | Other         | Totals         |
|----------------------------------------------------------|---------------|--------------------------------|--------------------|----------------------------|--------------|----------------------|---------------------|------------------------------------|---------------------------------------|---------------|----------------|
| Ames Laboratory                                          | —             | —                              | —                  | —                          | —            | 0.565                | —                   | —                                  | —                                     | —             | 0.565          |
| Argonne National Laboratory                              | 0.980         | —                              | —                  | 0.443                      | —            | 2.816                | —                   | 4.412                              | —                                     | —             | 8.651          |
| Brookhaven National Laboratory                           | 1.468         | —                              | —                  | 0.498                      | —            | —                    | —                   | 0.010                              | —                                     | —             | 1.976          |
| Fermi National Accelerator Laboratory                    | 8.780         | —                              | —                  | —                          | —            | —                    | —                   | —                                  | —                                     | —             | 8.780          |
| Grand Junction Site                                      | —             | —                              | —                  | —                          | —            | —                    | —                   | —                                  | —                                     | 0.013         | 0.013          |
| Hanford: Hanford Site                                    | —             | —                              | —                  | 14.186                     | —            | —                    | —                   | —                                  | —                                     | 3.122         | 17.308         |
| Hanford: Office of River Protection                      | —             | —                              | —                  | —                          | —            | —                    | —                   | 15.166                             | —                                     | 7.471         | 22.637         |
| Hanford: Pacific Northwest National Laboratory           | —             | —                              | —                  | 0.057                      | —            | 33.207               | —                   | —                                  | —                                     | —             | 33.264         |
| Idaho                                                    | —             | —                              | —                  | —                          | —            | 83.730               | —                   | —                                  | —                                     | —             | 83.730         |
| Kansas City National Security Campus                     | —             | —                              | —                  | —                          | —            | —                    | —                   | —                                  | 0.110                                 | —             | 0.110          |
| Lawrence Berkeley National Laboratory                    | —             | —                              | —                  | —                          | —            | 0.497                | —                   | —                                  | —                                     | —             | 0.497          |
| Lawrence Livermore National Laboratory                   | —             | —                              | —                  | 0.955                      | —            | 18.375               | —                   | —                                  | —                                     | —             | 19.330         |
| Los Alamos National Laboratory                           | 16.118        | —                              | —                  | 10.938                     | —            | 61.117               | —                   | 9.646                              | 254.802                               | 18.879        | 371.500        |
| National Renewable Energy Laboratory                     | —             | —                              | —                  | —                          | —            | 0.005                | —                   | —                                  | —                                     | —             | 0.005          |
| Nevada National Security Site                            | —             | —                              | —                  | 2.876                      | —            | —                    | —                   | —                                  | —                                     | —             | 2.876          |
| Oak Ridge: East Tennessee Technology Park                | —             | 0.701                          | —                  | —                          | —            | —                    | —                   | —                                  | —                                     | —             | 0.701          |
| Oak Ridge: Oak Ridge Institute for Science and Education | —             | —                              | —                  | —                          | —            | 0.129                | —                   | —                                  | —                                     | —             | 0.129          |
| Oak Ridge: Oak Ridge National Laboratory                 | —             | —                              | —                  | —                          | —            | 59.298               | —                   | 6.095                              | —                                     | —             | 65.393         |
| Oak Ridge: Y-12 National Security Complex                | —             | —                              | —                  | —                          | —            | —                    | —                   | —                                  | 57.144                                | —             | 57.144         |
| Office of Secure Transportation                          | —             | —                              | —                  | —                          | —            | —                    | —                   | —                                  | 0.157                                 | —             | 0.157          |
| Paducah Gaseous Diffusion Plant                          | —             | —                              | —                  | —                          | —            | 0.295                | —                   | 2.688                              | —                                     | —             | 2.983          |
| Pantex Plant                                             | —             | —                              | —                  | —                          | —            | —                    | —                   | —                                  | 25.909                                | —             | 25.909         |
| Portsmouth Gaseous Diffusion Plant                       | —             | 4.259                          | —                  | —                          | —            | —                    | —                   | —                                  | —                                     | —             | 4.259          |
| Princeton Plasma Physics Laboratory                      | —             | —                              | —                  | —                          | —            | —                    | 0.255               | —                                  | —                                     | —             | 0.255          |
| Sandia National Laboratories                             | 1.104         | —                              | —                  | 0.732                      | 1.674        | 1.491                | 0.102               | 0.078                              | 0.292                                 | 1.004         | 6.477          |
| Savannah River National Laboratory                       | —             | —                              | 0.010              | 0.020                      | —            | 7.381                | —                   | 0.191                              | 0.026                                 | 0.037         | 7.665          |
| Savannah River Site                                      | —             | —                              | 6.566              | 3.687                      | —            | 5.815                | —                   | 105.451                            | 2.471                                 | 4.072         | 128.062        |
| Separations Process Research Unit                        | —             | —                              | —                  | —                          | —            | —                    | —                   | 0.016                              | —                                     | —             | 0.016          |
| SLAC National Accelerator Laboratory                     | —             | —                              | —                  | —                          | —            | —                    | —                   | —                                  | —                                     | —             | —              |
| Thomas Jefferson National Accelerator Facility           | 0.854         | —                              | —                  | —                          | —            | —                    | —                   | —                                  | —                                     | —             | 0.854          |
| Uranium Mill Tailings Remedial Action Project            | —             | —                              | —                  | —                          | —            | —                    | —                   | 4.765                              | —                                     | —             | 4.765          |
| Waste Isolation Pilot Plant                              | —             | —                              | —                  | —                          | —            | —                    | —                   | 0.449                              | —                                     | —             | 0.449          |
| West Valley Demonstration Project                        | —             | —                              | —                  | —                          | —            | —                    | —                   | 12.946                             | —                                     | —             | 12.946         |
| Service Center Personnel*                                | —             | —                              | —                  | 0.017                      | —            | —                    | —                   | —                                  | —                                     | 1.610         | 1.627          |
| <b>Totals</b>                                            | <b>14.434</b> | <b>6.688</b>                   | <b>13.023</b>      | <b>37.795</b>              | <b>2.188</b> | <b>281.000</b>       | <b>0.588</b>        | <b>236.665</b>                     | <b>325.377</b>                        | <b>31.637</b> | <b>949.395</b> |

Note: Boxed values (gray background) indicate the greatest value in each column. Dashes indicate no data for this facility type.

\* Includes personnel at NNSA Albuquerque complex, Oak Ridge, and WIPP.

*Exhibit B-7c: Collective TED by Site and Facility Type, CY 2023.*

| Site                                                     | Accelerator   | Fuel/<br>Uranium<br>Enrichment | Fuel<br>Processing | Maintenance<br>and Support | Reactor      | Research,<br>General | Research,<br>Fusion | Waste<br>Processing/<br>Management | Weapons<br>Fabrication<br>and Testing | Other         | Totals         |
|----------------------------------------------------------|---------------|--------------------------------|--------------------|----------------------------|--------------|----------------------|---------------------|------------------------------------|---------------------------------------|---------------|----------------|
| Ames Laboratory                                          | —             | —                              | —                  | —                          | —            | 0.778                | —                   | —                                  | —                                     | —             | 0.778          |
| Argonne National Laboratory                              | 1.110         | —                              | —                  | 0.597                      | —            | 4.490                | —                   | 4.028                              | —                                     | —             | 10.225         |
| Brookhaven National Laboratory                           | 1.009         | —                              | —                  | 0.521                      | —            | —                    | —                   | 0.081                              | —                                     | —             | 1.611          |
| Fermi National Accelerator Laboratory                    | 3.360         | —                              | —                  | —                          | —            | —                    | —                   | —                                  | —                                     | —             | 3.360          |
| Grand Junction Site                                      | —             | —                              | —                  | —                          | —            | —                    | —                   | —                                  | —                                     | 0.003         | 0.003          |
| Hanford: Hanford Site                                    | —             | —                              | —                  | 17.837                     | —            | —                    | —                   | —                                  | —                                     | 5.908         | 23.745         |
| Hanford: Office of River Protection                      | —             | —                              | —                  | —                          | —            | —                    | —                   | 15.649                             | —                                     | 4.778         | 20.427         |
| Hanford: Pacific Northwest National Laboratory           | —             | —                              | —                  | —                          | —            | 18.488               | —                   | —                                  | —                                     | —             | 18.488         |
| Idaho                                                    | —             | —                              | —                  | —                          | —            | 100.208              | —                   | —                                  | —                                     | —             | 100.208        |
| Kansas City National Security Campus                     | —             | —                              | —                  | —                          | —            | —                    | —                   | —                                  | 0.312                                 | —             | 0.312          |
| Lawrence Berkeley National Laboratory                    | —             | —                              | —                  | —                          | —            | 0.434                | —                   | —                                  | —                                     | —             | 0.434          |
| Lawrence Livermore National Laboratory                   | —             | —                              | —                  | 0.935                      | —            | 26.972               | —                   | —                                  | —                                     | —             | 27.907         |
| Los Alamos National Laboratory                           | 6.981         | —                              | —                  | 8.124                      | —            | 46.482               | —                   | 9.507                              | 229.611                               | 10.801        | 311.506        |
| National Renewable Energy Laboratory                     | —             | —                              | —                  | —                          | —            | 0.003                | —                   | —                                  | —                                     | —             | 0.003          |
| Nevada National Security Site                            | —             | —                              | —                  | 2.351                      | —            | —                    | —                   | —                                  | —                                     | —             | 2.351          |
| Oak Ridge: East Tennessee Technology Park                | —             | 0.577                          | —                  | —                          | —            | —                    | —                   | —                                  | —                                     | —             | 0.577          |
| Oak Ridge: Oak Ridge Institute for Science and Education | —             | —                              | —                  | —                          | —            | 0.098                | —                   | —                                  | —                                     | —             | 0.098          |
| Oak Ridge: Oak Ridge National Laboratory                 | —             | —                              | —                  | —                          | —            | 58.491               | —                   | 8.197                              | —                                     | —             | 66.688         |
| Oak Ridge: Y-12 National Security Complex                | —             | —                              | —                  | —                          | —            | —                    | —                   | —                                  | 50.006                                | —             | 50.006         |
| Office of Secure Transportation                          | —             | —                              | —                  | —                          | —            | —                    | —                   | —                                  | 0.036                                 | 0.012         | 0.048          |
| Paducah Gaseous Diffusion Plant                          | —             | —                              | —                  | —                          | —            | 0.234                | —                   | 3.938                              | —                                     | —             | 4.172          |
| Pantex Plant                                             | —             | —                              | —                  | —                          | —            | —                    | —                   | —                                  | 40.176                                | —             | 40.176         |
| Portsmouth Gaseous Diffusion Plant                       | —             | 6.111                          | —                  | —                          | —            | —                    | —                   | —                                  | —                                     | —             | 6.111          |
| Princeton Plasma Physics Laboratory                      | —             | —                              | —                  | —                          | —            | —                    | 0.336               | —                                  | —                                     | —             | 0.336          |
| Sandia National Laboratories                             | 1.316         | —                              | —                  | 0.960                      | 2.188        | 1.355                | 0.252               | 0.065                              | 1.503                                 | 0.320         | 7.959          |
| Savannah River National Laboratory                       | —             | —                              | 0.032              | 0.030                      | —            | 15.371               | —                   | 0.279                              | 0.028                                 | 0.053         | 15.793         |
| Savannah River Site                                      | —             | —                              | 12.991             | 6.423                      | —            | 7.596                | —                   | 178.106                            | 3.705                                 | 8.152         | 216.973        |
| Separations Process Research Unit                        | —             | —                              | —                  | —                          | —            | —                    | —                   | 0.013                              | —                                     | —             | 0.013          |
| SLAC National Accelerator Laboratory                     | 0.036         | —                              | —                  | —                          | —            | —                    | —                   | —                                  | —                                     | —             | 0.036          |
| Thomas Jefferson National Accelerator Facility           | 0.622         | —                              | —                  | —                          | —            | —                    | —                   | —                                  | —                                     | —             | 0.622          |
| Uranium Mill Tailings Remedial Action Project            | —             | —                              | —                  | —                          | —            | —                    | —                   | 8.905                              | —                                     | —             | 8.905          |
| Waste Isolation Pilot Plant                              | —             | —                              | —                  | —                          | —            | —                    | —                   | 0.163                              | —                                     | —             | 0.163          |
| West Valley Demonstration Project                        | —             | —                              | —                  | —                          | —            | —                    | —                   | 7.734                              | —                                     | —             | 7.734          |
| Service Center Personnel*                                | —             | —                              | —                  | 0.019                      | 0.148        | 0.389                | —                   | —                                  | —                                     | 2.377         | 2.933          |
| <b>Totals</b>                                            | <b>14.434</b> | <b>6.688</b>                   | <b>13.023</b>      | <b>37.797</b>              | <b>2.336</b> | <b>281.389</b>       | <b>0.588</b>        | <b>236.665</b>                     | <b>325.377</b>                        | <b>32.404</b> | <b>950.701</b> |

Note: Boxed values (gray background) indicate the greatest value in each column. Dashes indicate no data for this facility type.

\* Includes personnel at NETL, NNSA Albuquerque complex, Oak Ridge, and WIPP.

*Exhibit B-8: Distribution of TED by Facility Type Listed in Descending Order of Average Measurable TED for Accelerator Facilities, CY 2023.*

**ACCELERATORS**

**Number of Individuals Receiving Radiation Doses in Each Dose Range (rem)**

| Site/Contractor                            | Less than Meas. | Meas. To 0.100 | 0.100 – 0.250 | 0.250 – 0.500 | 0.500 – 0.750 | 0.750 – 1.000 | 1.0 – 2.0 | 2.0 – 3.0 | 3.0 – 4.0 | 4.0 – 5.0 | >5.0 | Total Monitored | Percent of Monitored with Meas. TED | No. with Meas. TED | Collective TED (Person-rem) | Avg. Meas. TED (rem) |
|--------------------------------------------|-----------------|----------------|---------------|---------------|---------------|---------------|-----------|-----------|-----------|-----------|------|-----------------|-------------------------------------|--------------------|-----------------------------|----------------------|
| Sandia National Laboratories               | 465             | 20             | 2             | 1             | –             | –             | –         | –         | –         | –         | –    | 488             | 5%                                  | 23                 | 1.316                       | 0.057                |
| Los Alamos National Laboratory             | 518             | 146            | 18            | 1             | –             | –             | –         | –         | –         | –         | –    | 683             | 24%                                 | 165                | 6.955                       | 0.042                |
| Fermi National Accelerator Lab             | 1,361           | 75             | 11            | –             | –             | –             | –         | –         | –         | –         | –    | 1,447           | 6%                                  | 86                 | 3.360                       | 0.039                |
| Brookhaven National Laboratory             | 1,737           | 25             | 4             | –             | –             | –             | –         | –         | –         | –         | –    | 1,766           | 2%                                  | 29                 | 1.009                       | 0.035                |
| Argonne National Laboratory                | 789             | 35             | 3             | –             | –             | –             | –         | –         | –         | –         | –    | 827             | 5%                                  | 38                 | 1.110                       | 0.029                |
| NNSA Los Alamos Site Office                | –               | 1              | –             | –             | –             | –             | –         | –         | –         | –         | –    | 1               | 100%                                | 1                  | 0.026                       | 0.026                |
| SLAC National Accelerator Laboratory       | 1,774           | 2              | –             | –             | –             | –             | –         | –         | –         | –         | –    | 1,776           | 0%                                  | 2                  | 0.036                       | 0.018                |
| Thomas Jefferson Natl. Accel. Facil.       | 1,338           | 37             | –             | –             | –             | –             | –         | –         | –         | –         | –    | 1,375           | 3%                                  | 37                 | 0.612                       | 0.017                |
| Thomas Jefferson Site Office-DOE Employees | 8               | 1              | –             | –             | –             | –             | –         | –         | –         | –         | –    | 9               | 11%                                 | 1                  | 0.010                       | 0.010                |
| N3B                                        | 1               | –              | –             | –             | –             | –             | –         | –         | –         | –         | –    | 1               | 0%                                  | 0                  | 0.000                       | 0.000                |
| <b>Totals</b>                              | <b>7,991</b>    | <b>342</b>     | <b>38</b>     | <b>2</b>      | –             | –             | –         | –         | –         | –         | –    | <b>8,373</b>    | <b>5%</b>                           | <b>382</b>         | <b>14.434</b>               | <b>0.038</b>         |

Note: Boxed values (gray background) indicate the greatest value in each column. Dashes indicate no data reported for the year shown.

**Exhibit B-9: Distribution of TED by Facility Type Listed in Descending Order of Average Measurable TED for Fuel Facilities, CY 2023.**

**FUEL FACILITIES**

**Number of Individuals Receiving Radiation Doses in Each Dose Range (rem)**

| Site/Contractor                       | Less than Meas. | Meas. To 0.100 | 0.100 – 0.250 | 0.250 – 0.500 | 0.500 – 0.750 | 0.750 – 1.000 | 1.0 – 2.0 | 2.0 – 3.0 | 3.0 – 4.0 | 4.0 – 5.0 | >5.0 | Total Monitored | Percent of Monitored with Meas. TED | No. with Meas. TED | Collective TED (Person–rem) | Avg. Meas. TED (rem) |
|---------------------------------------|-----------------|----------------|---------------|---------------|---------------|---------------|-----------|-----------|-----------|-----------|------|-----------------|-------------------------------------|--------------------|-----------------------------|----------------------|
| <b>ENRICHMENT</b>                     |                 |                |               |               |               |               |           |           |           |           |      |                 |                                     |                    |                             |                      |
| Mid-America Conversion Services (MCS) | 159             | 73             | 15            | –             | –             | –             | –         | –         | –         | –         | –    | 247             | 36%                                 | 88                 | 4.873                       | 0.055                |
| Fluor/B&W - Portsmouth                | 1,723           | 66             | –             | –             | –             | –             | –         | –         | –         | –         | –    | 1,789           | 4%                                  | 66                 | 1.184                       | 0.018                |
| Portsmouth Mission Alliance (PMA)     | 108             | 3              | –             | –             | –             | –             | –         | –         | –         | –         | –    | 111             | 3%                                  | 3                  | 0.054                       | 0.018                |
| URS/CH2MHill - Oak Ridge (UCOR): ETP  | 186             | 59             | –             | –             | –             | –             | –         | –         | –         | –         | –    | 245             | 24%                                 | 59                 | 0.577                       | 0.010                |
| <b>Totals</b>                         | <b>2,176</b>    | <b>201</b>     | <b>15</b>     | –             | –             | –             | –         | –         | –         | –         | –    | <b>2,392</b>    | <b>9%</b>                           | <b>216</b>         | <b>6.688</b>                | <b>0.031</b>         |
| <b>PROCESSING</b>                     |                 |                |               |               |               |               |           |           |           |           |      |                 |                                     |                    |                             |                      |
| Savannah River Nuclear Solutions      | 80              | 389            | 16            | –             | –             | –             | –         | –         | –         | –         | –    | 485             | 84%                                 | 405                | 11.455                      | 0.028                |
| SRNS Service Subs                     | 1               | 3              | –             | –             | –             | –             | –         | –         | –         | –         | –    | 4               | 75%                                 | 3                  | 0.085                       | 0.028                |
| Centerra Services Inc. - SR           | 12              | 43             | –             | –             | –             | –             | –         | –         | –         | –         | –    | 55              | 78%                                 | 43                 | 0.654                       | 0.015                |
| SRNS Construction                     | 13              | 51             | –             | –             | –             | –             | –         | –         | –         | –         | –    | 64              | 80%                                 | 51                 | 0.700                       | 0.014                |
| Savannah River Field Office           | 2               | 4              | –             | –             | –             | –             | –         | –         | –         | –         | –    | 6               | 67%                                 | 4                  | 0.049                       | 0.012                |
| BSRA - SR National Laboratory         | 1               | 3              | –             | –             | –             | –             | –         | –         | –         | –         | –    | 4               | 75%                                 | 3                  | 0.032                       | 0.011                |
| SRR Operations                        | 1               | 3              | –             | –             | –             | –             | –         | –         | –         | –         | –    | 4               | 75%                                 | 3                  | 0.031                       | 0.010                |
| SRNS Construction Subs                | –               | 3              | –             | –             | –             | –             | –         | –         | –         | –         | –    | 3               | 100%                                | 3                  | 0.017                       | 0.006                |
| <b>Totals</b>                         | <b>110</b>      | <b>499</b>     | <b>16</b>     | –             | –             | –             | –         | –         | –         | –         | –    | <b>625</b>      | <b>82%</b>                          | <b>515</b>         | <b>13.023</b>               | <b>0.025</b>         |

Note: Boxed values (gray background) indicate the greatest value in each column. Dashes indicate no data reported for the year shown.

**Exhibit B-10: Distribution of TED by Facility Type Listed in Descending Order of Average Measurable TED for Maintenance and Support, CY 2023.**

**MAINTENANCE AND SUPPORT**

Number of Individuals Receiving Radiation Doses in Each Dose Range (rem)

| Site/Contractor                               | Less than Meas. | Meas. To 0.100 | 0.100 – 0.250 | 0.250 – 0.500 | 0.500 – 0.750 | 0.750 – 1.000 | 1.0 – 2.0 | 2.0 – 3.0 | 3.0 – 4.0 | 4.0 – 5.0 | >5.0 | Total Monitored | Percent of Monitored with Meas. TED | No. with Meas. TED | Collective TED (Person–rem) | Avg. Meas. TED (rem) |
|-----------------------------------------------|-----------------|----------------|---------------|---------------|---------------|---------------|-----------|-----------|-----------|-----------|------|-----------------|-------------------------------------|--------------------|-----------------------------|----------------------|
| SRR Operations                                | –               | 12             | 13            | 3             | –             | –             | –         | –         | –         | –         | –    | 28              | 100%                                | 28                 | 3.232                       | 0.115                |
| Sandia National Laboratories                  | 363             | 10             | 3             | –             | –             | –             | –         | –         | –         | –         | –    | 376             | 3%                                  | 13                 | 0.960                       | 0.074                |
| Lawrence Livermore National Laboratory Nevada | 117             | 12             | 2             | 1             | –             | –             | –         | –         | –         | –         | –    | 132             | 11%                                 | 15                 | 0.935                       | 0.062                |
| MSTS - Las Vegas                              | 147             | 14             | 1             | –             | –             | –             | –         | –         | –         | –         | –    | 162             | 9%                                  | 15                 | 0.886                       | 0.059                |
| MSTS - NTS                                    | 482             | 22             | 5             | –             | –             | –             | –         | –         | –         | –         | –    | 509             | 5%                                  | 27                 | 1.450                       | 0.054                |
| Central Plateau Cleanup Company               | 1,159           | 222            | 41            | 6             | –             | –             | –         | –         | –         | –         | –    | 1,428           | 19%                                 | 269                | 14.220                      | 0.053                |
| Los Alamos National Laboratory                | 848             | 152            | 13            | 4             | –             | –             | –         | –         | –         | –         | –    | 1,017           | 17%                                 | 169                | 8.124                       | 0.048                |
| SRNS Construction                             | 2               | 7              | 1             | –             | –             | –             | –         | –         | –         | –         | –    | 10              | 80%                                 | 8                  | 0.321                       | 0.040                |
| Argonne National Laboratory                   | 209             | 17             | –             | 1             | –             | –             | –         | –         | –         | –         | –    | 227             | 8%                                  | 18                 | 0.597                       | 0.033                |
| Savannah River National Laboratory            | –               | 1              | –             | –             | –             | –             | –         | –         | –         | –         | –    | 1               | 100%                                | 1                  | 0.030                       | 0.030                |
| Brookhaven National Laboratory                | 771             | 18             | 1             | –             | –             | –             | –         | –         | –         | –         | –    | 790             | 2%                                  | 19                 | 0.521                       | 0.027                |
| Savannah River Nuclear Solutions              | 16              | 92             | 2             | –             | –             | –             | –         | –         | –         | –         | –    | 110             | 85%                                 | 94                 | 2.423                       | 0.026                |
| Hanford Mission Integration Solutions         | 1,087           | 135            | 9             | 1             | –             | –             | –         | –         | –         | –         | –    | 1,232           | 12%                                 | 145                | 3.617                       | 0.025                |
| NNSA Albuquerque Complex                      | 1               | 1              | –             | –             | –             | –             | –         | –         | –         | –         | –    | 2               | 50%                                 | 1                  | 0.017                       | 0.017                |
| Univ. of Georgia Ecology Laboratory           | 2               | 23             | –             | –             | –             | –             | –         | –         | –         | –         | –    | 25              | 92%                                 | 23                 | 0.369                       | 0.016                |
| Science Applications Intl Corp. - NV          | 49              | 1              | –             | –             | –             | –             | –         | –         | –         | –         | –    | 50              | 2%                                  | 1                  | 0.015                       | 0.015                |
| SRR Service Subs                              | –               | 1              | –             | –             | –             | –             | –         | –         | –         | –         | –    | 1               | 100%                                | 1                  | 0.013                       | 0.013                |
| SRNS Service Subs                             | 1               | 5              | –             | –             | –             | –             | –         | –         | –         | –         | –    | 6               | 83%                                 | 5                  | 0.060                       | 0.012                |
| Savannah River Field Office                   | –               | 1              | –             | –             | –             | –             | –         | –         | –         | –         | –    | 1               | 100%                                | 1                  | 0.005                       | 0.005                |
| Battelle - Pantex                             | 18              | –              | –             | –             | –             | –             | –         | –         | –         | –         | –    | 18              | 0%                                  | 0                  | 0.000                       | 0.000                |
| Battelle - PNNL                               | 23              | –              | –             | –             | –             | –             | –         | –         | –         | –         | –    | 23              | 0%                                  | 0                  | 0.000                       | 0.000                |
| DOE Headquarters                              | 18              | –              | –             | –             | –             | –             | –         | –         | –         | –         | –    | 18              | 0%                                  | 0                  | 0.000                       | 0.000                |
| DOE-Richland Field Office                     | 2               | –              | –             | –             | –             | –             | –         | –         | –         | –         | –    | 2               | 0%                                  | 0                  | 0.000                       | 0.000                |
| Hanford Laboratory Management Integration     | 1               | –              | –             | –             | –             | –             | –         | –         | –         | –         | –    | 1               | 0%                                  | 0                  | 0.000                       | 0.000                |
| LLNL Service Subcontractors                   | 1               | –              | –             | –             | –             | –             | –         | –         | –         | –         | –    | 1               | 0%                                  | 0                  | 0.000                       | 0.000                |
| Los Alamos National Lab Construction Subs     | 4               | –              | –             | –             | –             | –             | –         | –         | –         | –         | –    | 4               | 0%                                  | 0                  | 0.000                       | 0.000                |
| MSTS - Los Alamos                             | 4               | –              | –             | –             | –             | –             | –         | –         | –         | –         | –    | 4               | 0%                                  | 0                  | 0.000                       | 0.000                |

**Exhibit B-10: Distribution of TED by Facility Type Listed in Descending Order of Average Measurable TED for Maintenance and Support, CY 2023.**

**MAINTENANCE AND SUPPORT**

Number of Individuals Receiving Radiation Doses in Each Dose Range (rem)

| Site/Contractor                           | Less than Meas. | Meas. To 0.100 | 0.100 – 0.250 | 0.250 – 0.500 | 0.500 – 0.750 | 0.750 – 1.000 | 1.0 – 2.0 | 2.0 – 3.0 | 3.0 – 4.0 | 4.0 – 5.0 | >5.0 | Total Monitored | Percent of Monitored with Meas. TED | No. with Meas. TED | Collective TED (Person–rem) | Avg. Meas. TED (rem) |
|-------------------------------------------|-----------------|----------------|---------------|---------------|---------------|---------------|-----------|-----------|-----------|-----------|------|-----------------|-------------------------------------|--------------------|-----------------------------|----------------------|
| MSTS - Special Tech. Lab                  | 3               | –              | –             | –             | –             | –             | –         | –         | –         | –         | –    | 3               | 0%                                  | 0                  | 0.000                       | 0.000                |
| N3B                                       | 2               | –              | –             | –             | –             | –             | –         | –         | –         | –         | –    | 2               | 0%                                  | 0                  | 0.000                       | 0.000                |
| NNSA Nevada Site Office                   | 52              | –              | –             | –             | –             | –             | –         | –         | –         | –         | –    | 52              | 0%                                  | 0                  | 0.000                       | 0.000                |
| Office of River Protection                | 1               | –              | –             | –             | –             | –             | –         | –         | –         | –         | –    | 1               | 0%                                  | 0                  | 0.000                       | 0.000                |
| Office of Secure Transportation           | 1               | –              | –             | –             | –             | –             | –         | –         | –         | –         | –    | 1               | 0%                                  | 0                  | 0.000                       | 0.000                |
| Savannah River Operations                 | 3               | –              | –             | –             | –             | –             | –         | –         | –         | –         | –    | 3               | 0%                                  | 0                  | 0.000                       | 0.000                |
| Swift and Staley Team                     | 197             | –              | –             | –             | –             | –             | –         | –         | –         | –         | –    | 197             | 0%                                  | 0                  | 0.000                       | 0.000                |
| UT-Batelle ORNL                           | 7               | –              | –             | –             | –             | –             | –         | –         | –         | –         | –    | 7               | 0%                                  | 0                  | 0.000                       | 0.000                |
| Wackenhut Services Inc. - NV              | 3               | –              | –             | –             | –             | –             | –         | –         | –         | –         | –    | 3               | 0%                                  | 0                  | 0.000                       | 0.000                |
| Washington River Protection Solutions LLC | 1               | –              | –             | –             | –             | –             | –         | –         | –         | –         | –    | 1               | 0%                                  | 0                  | 0.000                       | 0.000                |
| <b>Totals</b>                             | <b>5,595</b>    | <b>746</b>     | <b>91</b>     | <b>16</b>     | –             | –             | –         | –         | –         | –         | –    | <b>6,448</b>    | <b>13%</b>                          | <b>853</b>         | <b>37.795</b>               | <b>0.044</b>         |

Note: Boxed values (gray background) indicate the greatest value in each column. Dashes indicate no data reported for the year shown.

*Exhibit B-11: Distribution of TED by Facility Type Listed in Descending Order of Average Measurable TED for Reactor Facilities, CY 2023.*

**REACTOR FACILITIES**

Number of Individuals Receiving Radiation Doses in Each Dose Range (rem)

| Site/Contractor                | Less<br>than<br>Meas. | Meas.<br>To<br>0.100 | 0.100 –<br>0.250 | 0.250 –<br>0.500 | 0.500 –<br>0.750 | 0.750 –<br>1.000 | 1.0 –<br>2.0 | 2.0 –<br>3.0 | 3.0 –<br>4.0 | 4.0 –<br>5.0 | >5.0 | Total<br>Monitored | Percent of<br>Monitored<br>with Meas.<br>TED | No.<br>with<br>Meas.<br>TED | Collective<br>TED<br>(Person–<br>rem) | Avg.<br>Meas.<br>TED<br>(rem) |
|--------------------------------|-----------------------|----------------------|------------------|------------------|------------------|------------------|--------------|--------------|--------------|--------------|------|--------------------|----------------------------------------------|-----------------------------|---------------------------------------|-------------------------------|
| Sandia National Laboratories   | 172                   | 20                   | 6                | 1                | –                | –                | –            | –            | –            | –            | –    | 199                | 14%                                          | 27                          | 2.188                                 | 0.081                         |
| Brookhaven National Laboratory | 6                     | –                    | –                | –                | –                | –                | –            | –            | –            | –            | –    | 6                  | 0%                                           | 0                           | 0.000                                 | 0.000                         |
| <b>Totals</b>                  | <b>178</b>            | <b>20</b>            | <b>6</b>         | <b>1</b>         | –                | –                | –            | –            | –            | –            | –    | <b>205</b>         | <b>13%</b>                                   | <b>27</b>                   | <b>2.188</b>                          | <b>0.081</b>                  |

Note: Boxed values (gray background) indicate the greatest value in each column. Dashes indicate no data reported for the year shown.

**Exhibit B-12: Distribution of TED by Facility Type Listed in Descending Order of Average Measurable TED for Research, General, CY 2023.**

**RESEARCH, GENERAL**

**Number of Individuals Receiving Radiation Doses in Each Dose Range (rem)**

| Site/Contractor                                 | Less than Meas. | Meas. To 0.100 | 0.100 – 0.250 | 0.250 – 0.500 | 0.500 – 0.750 | 0.750 – 1.000 | 1.0 – 2.0 | 2.0 – 3.0 | 3.0 – 4.0 | 4.0 – 5.0 | >5.0 | Total Monitored | Percent of Monitored with Meas. TED | No. with Meas. TED | Collective TED (Person–rem) | Avg. Meas. TED (rem) |
|-------------------------------------------------|-----------------|----------------|---------------|---------------|---------------|---------------|-----------|-----------|-----------|-----------|------|-----------------|-------------------------------------|--------------------|-----------------------------|----------------------|
| UT-Batelle ORNL                                 | 3,507           | 326            | 71            | 43            | 9             | 5             | –         | –         | –         | –         | –    | 3,961           | 11%                                 | 454                | 46.682                      | <b>0.103</b>         |
| Lawrence Livermore National Laboratory          | 3,881           | 253            | 46            | 6             | 4             | 2             | 2         | –         | –         | –         | –    | 4,194           | 7%                                  | 313                | 26.576                      | 0.085                |
| INL - BEA LLC - Research                        | 176             | 24             | 2             | 2             | 1             | –             | –         | –         | –         | –         | –    | 205             | 14%                                 | 29                 | 2.306                       | 0.080                |
| Lawrence Livermore National Laboratories        | 101             | 4              | 1             | –             | –             | –             | –         | –         | –         | –         | –    | 106             | 5%                                  | 5                  | 0.396                       | 0.079                |
| INL - BEA LLC - Production                      | 274             | 32             | 3             | 1             | 1             | –             | –         | –         | –         | –         | –    | 311             | 12%                                 | 37                 | 2.409                       | 0.065                |
| INL - BEA LLC - Services                        | 3,557           | 605            | 70            | 53            | 2             | 1             | –         | –         | –         | –         | –    | 4,288           | 17%                                 | 731                | <b>46.920</b>               | 0.064                |
| INL - BEA LLC - Security                        | 38              | 5              | –             | 1             | –             | –             | –         | –         | –         | –         | –    | 44              | 14%                                 | 6                  | 0.371                       | 0.062                |
| ICP - Fluor Projects (ICP and AMWTP)            | 295             | 150            | 18            | 7             | –             | –             | –         | –         | –         | –         | –    | 470             | 37%                                 | 175                | 9.643                       | 0.055                |
| ICP - Fluor Service Subcontractors<br>ICP/AMWTP | 972             | 592            | 80            | 21            | –             | –             | –         | –         | –         | –         | –    | 1,665           | 42%                                 | 693                | 37.471                      | 0.054                |
| Sandia National Laboratories                    | 407             | 22             | 4             | –             | –             | –             | –         | –         | –         | –         | –    | 433             | 6%                                  | 26                 | 1.355                       | 0.052                |
| ICP - Fluor - Support                           | 18              | 17             | 2             | –             | –             | –             | –         | –         | –         | –         | –    | 37              | 51%                                 | 19                 | 0.963                       | 0.051                |
| Lawrence Berkeley Laboratory                    | 609             | 9              | 1             | –             | –             | –             | –         | –         | –         | –         | –    | 619             | 2%                                  | 10                 | 0.434                       | 0.043                |
| SRNL                                            | 7               | 76             | 6             | 1             | –             | –             | –         | –         | –         | –         | –    | 90              | 92%                                 | 83                 | 3.200                       | 0.039                |
| Los Alamos National Laboratory                  | 4,385           | 1,116          | 81            | 11            | 2             | –             | –         | –         | –         | –         | –    | <b>5,595</b>    | 22%                                 | <b>1,210</b>       | 45.511                      | 0.038                |
| Savannah River Nuclear Solutions                | 11              | 112            | 9             | 1             | –             | –             | –         | –         | –         | –         | –    | 133             | 92%                                 | 122                | 4.485                       | 0.037                |
| Savannah River Field Office                     | –               | 4              | –             | –             | –             | –             | –         | –         | –         | –         | –    | 4               | <b>100%</b>                         | 4                  | 0.121                       | 0.030                |
| BATTELLE - PNNL                                 | 2,320           | 577            | 25            | 11            | 3             | –             | –         | –         | –         | –         | –    | 2,936           | 21%                                 | 616                | 17.927                      | 0.029                |
| BSRA - SR National Laboratory                   | 38              | 423            | 14            | 1             | –             | –             | –         | –         | –         | –         | –    | 476             | 92%                                 | 438                | 12.171                      | 0.028                |
| N3B                                             | 172             | 19             | 1             | –             | –             | –             | –         | –         | –         | –         | –    | 192             | 10%                                 | 20                 | 0.526                       | 0.026                |
| SRNS Construction                               | 8               | 57             | 4             | –             | –             | –             | –         | –         | –         | –         | –    | 69              | 88%                                 | 61                 | 1.595                       | 0.026                |
| Argonne National Laboratory                     | 1,176           | 172            | 4             | 1             | –             | 1             | –         | –         | –         | –         | –    | 1,354           | 13%                                 | 178                | 4.490                       | 0.025                |
| Idaho Field Office                              | 188             | 5              | –             | –             | –             | –             | –         | –         | –         | –         | –    | 193             | 3%                                  | 5                  | 0.125                       | 0.025                |
| Ames Laboratory (Iowa State)                    | 123             | 34             | –             | –             | –             | –             | –         | –         | –         | –         | –    | 157             | 22%                                 | 34                 | 0.778                       | 0.023                |
| Four Rivers Nuclear Partnership (FRNP)          | 988             | 11             | –             | –             | –             | –             | –         | –         | –         | –         | –    | 999             | 1%                                  | 11                 | 0.234                       | 0.021                |
| UCOR: ORNL                                      | 477             | 539            | 13            | 2             | –             | –             | –         | –         | –         | –         | –    | 1,031           | 54%                                 | 554                | 11.809                      | 0.021                |
| SRNS Construction Subs                          | –               | 1              | –             | –             | –             | –             | –         | –         | –         | –         | –    | 1               | <b>100%</b>                         | 1                  | 0.019                       | 0.019                |
| NNSA Los Alamos Site Office                     | 67              | 25             | –             | –             | –             | –             | –         | –         | –         | –         | –    | 92              | 27%                                 | 25                 | 0.445                       | 0.018                |

**Exhibit B-12: Distribution of TED by Facility Type Listed in Descending Order of Average Measurable TED for Research, General, CY 2023.**

**RESEARCH, GENERAL**

**Number of Individuals Receiving Radiation Doses in Each Dose Range (rem)**

| Site/Contractor                             | Less than Meas. | Meas. To 0.100 | 0.100 – 0.250 | 0.250 – 0.500 | 0.500 – 0.750 | 0.750 – 1.000 | 1.0 – 2.0 | 2.0 – 3.0 | 3.0 – 4.0 | 4.0 – 5.0 | >5.0     | Total Monitored | Percent of Monitored with Meas. TED | No. with Meas. TED | Collective TED (Person–rem) | Avg. Meas. TED (rem) |
|---------------------------------------------|-----------------|----------------|---------------|---------------|---------------|---------------|-----------|-----------|-----------|-----------|----------|-----------------|-------------------------------------|--------------------|-----------------------------|----------------------|
| Centerra Services Inc. - SR                 | 13              | 44             | –             | –             | –             | –             | –         | –         | –         | –         | –        | 57              | 77%                                 | 44                 | 0.741                       | 0.017                |
| Oak Ridge Institute for Science & Education | 83              | 6              | –             | –             | –             | –             | –         | –         | –         | –         | –        | 89              | 7%                                  | 6                  | 0.098                       | 0.016                |
| SR Mission Completion Operations - Other    | –               | 1              | –             | –             | –             | –             | –         | –         | –         | –         | –        | 1               | 100%                                | 1                  | 0.012                       | 0.012                |
| Misc. DOE Contractors - SR                  | –               | 3              | –             | –             | –             | –             | –         | –         | –         | –         | –        | 3               | 100%                                | 3                  | 0.032                       | 0.011                |
| SRNS Service Subs                           | 4               | 50             | –             | –             | –             | –             | –         | –         | –         | –         | –        | 54              | 93%                                 | 50                 | 0.572                       | 0.011                |
| Battelle -PNNL- Subs                        | 227             | 40             | –             | –             | –             | –             | –         | –         | –         | –         | –        | 267             | 15%                                 | 40                 | 0.405                       | 0.010                |
| Pacific Northwest Site Office               | 12              | 15             | –             | –             | –             | –             | –         | –         | –         | –         | –        | 27              | 56%                                 | 15                 | 0.156                       | 0.010                |
| SRR Operations                              | 1               | 3              | –             | –             | –             | –             | –         | –         | –         | –         | –        | 4               | 75%                                 | 3                  | 0.019                       | 0.006                |
| National Renewable Energy Laboratory        | 5               | 1              | –             | –             | –             | –             | –         | –         | –         | –         | –        | 6               | 17%                                 | 1                  | 0.003                       | 0.003                |
| Brookhaven National Laboratory              | 1               | –              | –             | –             | –             | –             | –         | –         | –         | –         | –        | 1               | 0%                                  | 0                  | 0.000                       | 0.000                |
| NETL Albany                                 | 33              | –              | –             | –             | –             | –             | –         | –         | –         | –         | –        | 33              | 0%                                  | 0                  | 0.000                       | 0.000                |
| NETL Morgantown                             | 23              | –              | –             | –             | –             | –             | –         | –         | –         | –         | –        | 23              | 0%                                  | 0                  | 0.000                       | 0.000                |
| NETL Pittsburgh                             | 29              | –              | –             | –             | –             | –             | –         | –         | –         | –         | –        | 29              | 0%                                  | 0                  | 0.000                       | 0.000                |
| <b>Totals</b>                               | <b>24,226</b>   | <b>5,373</b>   | <b>455</b>    | <b>162</b>    | <b>22</b>     | <b>9</b>      | <b>2</b>  | <b>–</b>  | <b>–</b>  | <b>–</b>  | <b>–</b> | <b>30,249</b>   | <b>20%</b>                          | <b>6,023</b>       | <b>281.000</b>              | <b>0.047</b>         |

Note: Boxed values (gray background) indicate the greatest value in each column. Dashes indicate no data reported for the year shown.

**Exhibit B-13: Distribution of TED by Facility Type Listed in Descending Order of Average Measurable TED for Research, Fusion, CY 2023.**

**RESEARCH, FUSION**

| Site/Contractor                     | Less than Meas. | Meas. To 0.100 | 0.100 – 0.250 | 0.250 – 0.500 | 0.500 – 0.750 | 0.750 – 1.000 | 1.0 – 2.0 | 2.0 – 3.0 | 3.0 – 4.0 | 4.0 – 5.0 | >5.0     | Total Monitored | Percent of Monitored with Meas. TED | No. with Meas. TED | Collective TED (Person–rem) | Avg. Meas. TED (rem) |
|-------------------------------------|-----------------|----------------|---------------|---------------|---------------|---------------|-----------|-----------|-----------|-----------|----------|-----------------|-------------------------------------|--------------------|-----------------------------|----------------------|
| Sandia National Laboratories        | 64              | 2              | 1             | –             | –             | –             | –         | –         | –         | –         | –        | 67              | 4%                                  | 3                  | 0.252                       | 0.084                |
| Princeton Plasma Physics Laboratory | 295             | 48             | –             | –             | –             | –             | –         | –         | –         | –         | –        | 343             | 14%                                 | 48                 | 0.336                       | 0.007                |
| <b>Totals</b>                       | <b>359</b>      | <b>50</b>      | <b>1</b>      | <b>–</b>      | <b>–</b>      | <b>–</b>      | <b>–</b>  | <b>–</b>  | <b>–</b>  | <b>–</b>  | <b>–</b> | <b>410</b>      | <b>12%</b>                          | <b>51</b>          | <b>0.588</b>                | <b>0.012</b>         |

Note: Boxed values (gray background) indicate the greatest value in each column. Dashes indicate no data reported for the year shown.

*Exhibit B-14: Distribution of TED by Facility Type Listed in Descending Order of Average Measurable TED for Waste Processing, CY 2023.*

**WASTE PROCESSING**

Number of Individuals Receiving Radiation Doses in Each Dose Range (rem)

| Site/Contractor                           | Less than Meas. | Meas. To 0.100 | 0.100 – 0.250 | 0.250 – 0.500 | 0.500 – 0.750 | 0.750 – 1.000 | 1.0 – 2.0 | 2.0 – 3.0 | 3.0 – 4.0 | 4.0 – 5.0 | >5.0 | Total Monitored | Percent of Monitored with Meas. TED | No. with Meas. TED | Collective TED (Person–rem) | Avg. Meas. TED (rem) |
|-------------------------------------------|-----------------|----------------|---------------|---------------|---------------|---------------|-----------|-----------|-----------|-----------|------|-----------------|-------------------------------------|--------------------|-----------------------------|----------------------|
| Argonne National Laboratory               | 41              | 14             | 8             | 4             | –             | 1             | –         | –         | –         | –         | –    | 68              | 0.40                                | 27                 | 4.028                       | <b>0.149</b>         |
| Brookhaven National Laboratory            | 35              | 1              | –             | –             | –             | –             | –         | –         | –         | –         | –    | 36              | 0.03                                | 1                  | 0.081                       | 0.081                |
| Northwind Portage - UMTRA Project - Moab  | 46              | 95             | 20            | 10            | –             | –             | –         | –         | –         | –         | –    | 171             | 0.73                                | 125                | 8.905                       | 0.071                |
| SR Mission Completion Operations - Other  | 63              | 530            | 50            | 27            | 15            | –             | –         | –         | –         | –         | –    | 685             | 0.91                                | 622                | 40.195                      | 0.065                |
| West Valley Nuclear Services Inc.         | 319             | 107            | 16            | 7             | –             | –             | –         | –         | –         | –         | –    | 449             | 0.29                                | 130                | 7.734                       | 0.059                |
| Hanford Laboratory Management Integration | 198             | 85             | 17            | 1             | –             | –             | –         | –         | –         | –         | –    | 301             | 0.34                                | 103                | 5.249                       | 0.051                |
| Los Alamos National Laboratory            | 275             | 181            | 17            | 2             | –             | –             | –         | –         | –         | –         | –    | 475             | 0.42                                | 200                | 9.507                       | 0.048                |
| DUF6 Conversion Project - Paducah Subs    | 173             | 79             | 6             | –             | –             | –             | –         | –         | –         | –         | –    | 258             | 0.33                                | 85                 | 3.938                       | 0.046                |
| Savannah River Nuclear Solutions          | 129             | 673            | 52            | 15            | 7             | –             | –         | –         | –         | –         | –    | 876             | 0.85                                | 747                | 34.392                      | 0.046                |
| SRR Operations                            | 198             | 1835           | 164           | 22            | 7             | 1             | –         | –         | –         | –         | –    | <b>2,227</b>    | 0.91                                | <b>2,029</b>       | <b>89.895</b>               | 0.044                |
| TRU WASTE PROCESSING CENTER - ORNL        | 35              | 194            | 16            | 2             | –             | –             | –         | –         | –         | –         | –    | 247             | 0.86                                | 212                | 8.197                       | 0.039                |
| Savannah River National Laboratory        | 3               | 1              | –             | –             | –             | –             | –         | –         | –         | –         | –    | 4               | 0.25                                | 1                  | 0.038                       | 0.038                |
| Washington River Protection Solutions LLC | 1,686           | 303            | 15            | –             | –             | –             | –         | –         | –         | –         | –    | 2,004           | 0.16                                | 318                | 10.400                      | 0.033                |
| SRR Service Subs                          | 4               | 12             | 1             | –             | –             | –             | –         | –         | –         | –         | –    | 17              | 0.76                                | 13                 | 0.369                       | 0.028                |
| Centerra Services Inc. - SR               | 42              | 220            | –             | –             | –             | –             | –         | –         | –         | –         | –    | 262             | 0.84                                | 220                | 4.962                       | 0.023                |
| SRNS Construction                         | 65              | 238            | 2             | 1             | –             | –             | –         | –         | –         | –         | –    | 306             | 0.79                                | 241                | 5.057                       | 0.021                |
| BSRA - SR National Laboratory             | 3               | 13             | –             | –             | –             | –             | –         | –         | –         | –         | –    | 16              | 0.81                                | 13                 | 0.241                       | 0.019                |
| Misc. S.R.S. Const. Subcontractors        | 1               | 11             | –             | –             | –             | –             | –         | –         | –         | –         | –    | 12              | 0.92                                | 11                 | 0.195                       | 0.018                |
| Washington TRU Solutions LLC-WIPP         | 824             | 9              | –             | –             | –             | –             | –         | –         | –         | –         | –    | 833             | 0.01                                | 9                  | 0.163                       | 0.018                |
| Savannah River Field Office               | 11              | 49             | –             | –             | –             | –             | –         | –         | –         | –         | –    | 60              | 0.82                                | 49                 | 0.857                       | 0.017                |
| Sandia National Laboratories              | 25              | 4              | –             | –             | –             | –             | –         | –         | –         | –         | –    | 29              | 0.14                                | 4                  | 0.065                       | 0.016                |
| Misc. DOE Contractors - SR                | 2               | 49             | –             | –             | –             | –             | –         | –         | –         | –         | –    | 51              | 0.96                                | 49                 | 0.730                       | 0.015                |
| SRNS Service Subs                         | 30              | 92             | –             | –             | –             | –             | –         | –         | –         | –         | –    | 122             | 0.75                                | 92                 | 1.286                       | 0.014                |
| SPRU-NY (Building remediation)            | 10              | 1              | –             | –             | –             | –             | –         | –         | –         | –         | –    | 11              | 0.09                                | 1                  | 0.013                       | 0.013                |
| Bechtel Construction - SR                 | –               | 1              | –             | –             | –             | –             | –         | –         | –         | –         | –    | 1               | <b>1.00</b>                         | 1                  | 0.011                       | 0.011                |
| SRS Tritium Facilities                    | 3               | 16             | –             | –             | –             | –             | –         | –         | –         | –         | –    | 19              | 0.84                                | 16                 | 0.150                       | 0.009                |

**Exhibit B-14: Distribution of TED by Facility Type Listed in Descending Order of Average Measurable TED for Waste Processing, CY 2023.**

**WASTE PROCESSING**

Number of Individuals Receiving Radiation Doses in Each Dose Range (rem)

| Site/Contractor                              | Less than Meas. | Meas. To 0.100 | 0.100 – 0.250 | 0.250 – 0.500 | 0.500 – 0.750 | 0.750 – 1.000 | 1.0 – 2.0 | 2.0 – 3.0 | 3.0 – 4.0 | 4.0 – 5.0 | >5.0 | Total Monitored | Percent of Monitored with Meas. TED | No. with Meas. TED | Collective TED (Person–rem) | Avg. Meas. TED (rem) |
|----------------------------------------------|-----------------|----------------|---------------|---------------|---------------|---------------|-----------|-----------|-----------|-----------|------|-----------------|-------------------------------------|--------------------|-----------------------------|----------------------|
| Parsons                                      | –               | 1              | –             | –             | –             | –             | –         | –         | –         | –         | –    | 1               | 1.00                                | 1                  | 0.007                       | 0.007                |
| Carlsbad Field Office                        | 11              | –              | –             | –             | –             | –             | –         | –         | –         | –         | –    | 11              | 0.00                                | 0                  | 0.000                       | 0.000                |
| Central Plateau Cleanup Company              | 1               | –              | –             | –             | –             | –             | –         | –         | –         | –         | –    | 1               | 0.00                                | 0                  | 0.000                       | 0.000                |
| Hanford Mission Integration Solutions (HMIS) | 1               | –              | –             | –             | –             | –             | –         | –         | –         | –         | –    | 1               | 0.00                                | 0                  | 0.000                       | 0.000                |
| N3B                                          | 2               | –              | –             | –             | –             | –             | –         | –         | –         | –         | –    | 2               | 0.00                                | 0                  | 0.000                       | 0.000                |
| <b>Totals</b>                                | <b>4,236</b>    | <b>4,814</b>   | <b>384</b>    | <b>91</b>     | <b>29</b>     | <b>2</b>      | –         | –         | –         | –         | –    | <b>9,556</b>    | <b>0.56</b>                         | <b>5,320</b>       | <b>236.665</b>              | <b>0.044</b>         |

Note: Boxed values (gray background) indicate the greatest value in each column. Dashes indicate no data reported for the year shown.

**Exhibit B-15: Distribution of TED by Facility Type Listed in Descending Order of Average Measurable TED for Weapons Fabrication, CY 2023.**

**WEAPONS FABRICATION**

Number of Individuals Receiving Radiation Doses in Each Dose Range (rem)

| Site/Contractor                       | Less than Meas. | Meas. To 0.100 | 0.100 – 0.250 | 0.250 – 0.500 | 0.500 – 0.750 | 0.750 – 1.000 | 1.0 – 2.0 | 2.0 – 3.0 | 3.0 – 4.0 | 4.0 – 5.0 | >5.0 | Total Monitored | Percent of Monitored with Meas. TED | No. with Meas. TED | Collective TED (Person–rem) | Avg. Meas. TED (rem) |
|---------------------------------------|-----------------|----------------|---------------|---------------|---------------|---------------|-----------|-----------|-----------|-----------|------|-----------------|-------------------------------------|--------------------|-----------------------------|----------------------|
| Sandia National Laboratories          | 149             | 3              | 2             | 1             | –             | 1             | –         | –         | –         | –         | –    | 156             | 4%                                  | 7                  | 1.503                       | 0.215                |
| Los Alamos National Laboratory        | 1,527           | 959            | 405           | 213           | 64            | 16            | 4         | –         | –         | –         | –    | 3,188           | 52%                                 | 1,661              | 229.492                     | 0.138                |
| CNS, LLC - Pantex                     | 4,119           | 430            | 108           | 26            | –             | –             | –         | –         | –         | –         | –    | 4,683           | 12%                                 | 564                | 40.176                      | 0.071                |
| CNS, LLC - Y-12                       | 6,358           | 1,436          | 77            | 3             | –             | –             | –         | –         | –         | –         | –    | 7,874           | 19%                                 | 1,516              | 49.468                      | 0.033                |
| NNSA Los Alamos Site Office           | 2               | 4              | –             | –             | –             | –             | –         | –         | –         | –         | –    | 6               | 67%                                 | 4                  | 0.097                       | 0.024                |
| Savannah River Nuclear Solutions      | 149             | 208            | 2             | –             | –             | –             | –         | –         | –         | –         | –    | 359             | 58%                                 | 210                | 3.241                       | 0.015                |
| SRR Operations                        | –               | 2              | –             | –             | –             | –             | –         | –         | –         | –         | –    | 2               | 100%                                | 2                  | 0.029                       | 0.015                |
| BSRA - SR National Laboratory         | 14              | 2              | –             | –             | –             | –             | –         | –         | –         | –         | –    | 16              | 13%                                 | 2                  | 0.028                       | 0.014                |
| SRNS Construction                     | 12              | 23             | –             | –             | –             | –             | –         | –         | –         | –         | –    | 35              | 66%                                 | 23                 | 0.313                       | 0.014                |
| SRS Tritium Facilities                | 1               | 8              | –             | –             | –             | –             | –         | –         | –         | –         | –    | 9               | 89%                                 | 8                  | 0.106                       | 0.013                |
| OFFICE OF SECURE TRANSPORTATION       | 200             | 3              | –             | –             | –             | –             | –         | –         | –         | –         | –    | 203             | 1%                                  | 3                  | 0.036                       | 0.012                |
| N3B                                   | 15              | 2              | –             | –             | –             | –             | –         | –         | –         | –         | –    | 17              | 12%                                 | 2                  | 0.022                       | 0.011                |
| URS/CH2MHill - Oak Ridge (UCOR): Y-12 | 146             | 51             | –             | –             | –             | –             | –         | –         | –         | –         | –    | 197             | 26%                                 | 51                 | 0.538                       | 0.011                |

**Exhibit B-15: Distribution of TED by Facility Type Listed in Descending Order of Average Measurable TED for Weapons Fabrication, CY 2023.**

**WEAPONS FABRICATION**

**Number of Individuals Receiving Radiation Doses in Each Dose Range (rem)**

| Site/Contractor                      | Less than Meas. | Meas. To 0.100 | 0.100 – 0.250 | 0.250 – 0.500 | 0.500 – 0.750 | 0.750 – 1.000 | 1.0 – 2.0 | 2.0 – 3.0 | 3.0 – 4.0 | 4.0 – 5.0 | >5.0 | Total Monitored | Percent of Monitored with Meas. TED | No. with Meas. TED | Collective TED (Person–rem) | Avg. Meas. TED (rem) |
|--------------------------------------|-----------------|----------------|---------------|---------------|---------------|---------------|-----------|-----------|-----------|-----------|------|-----------------|-------------------------------------|--------------------|-----------------------------|----------------------|
| SRNS Service Subs                    | 1               | 2              | –             | –             | –             | –             | –         | –         | –         | –         | –    | 3               | 67%                                 | 2                  | 0.016                       | 0.008                |
| Kansas City National Security Campus | 156             | 68             | –             | –             | –             | –             | –         | –         | –         | –         | –    | 224             | 30%                                 | 68                 | 0.312                       | 0.005                |
| <b>Totals</b>                        | <b>12,849</b>   | <b>3,201</b>   | <b>594</b>    | <b>243</b>    | <b>64</b>     | <b>17</b>     | <b>4</b>  | –         | –         | –         | –    | <b>16,972</b>   | <b>24%</b>                          | <b>4,123</b>       | <b>325.377</b>              | <b>0.079</b>         |

Note: Boxed values (gray background) indicate the greatest value in each column. Dashes indicate no data reported for the year shown.

**Exhibit B-16: Distribution of TED by Facility Type Listed in Descending Order of Average Measurable TED for Other, CY 2023.**

**OTHER**

**Number of Individuals Receiving Radiation Doses in Each Dose Range (rem)**

| Site/Contractor                              | Less than Meas. | Meas. To 0.100 | 0.100 – 0.250 | 0.250 – 0.500 | 0.500 – 0.750 | 0.750 – 1.000 | 1.0 – 2.0 | 2.0 – 3.0 | 3.0 – 4.0 | 4.0 – 5.0 | >5.0 | Total Monitored | Percent of Monitored with Meas. TED | No. with Meas. TED | Collective TED (Person–rem) | Avg. Meas. TED (rem) |
|----------------------------------------------|-----------------|----------------|---------------|---------------|---------------|---------------|-----------|-----------|-----------|-----------|------|-----------------|-------------------------------------|--------------------|-----------------------------|----------------------|
| Central Plateau Cleanup Company              | 355             | 44             | 22            | 1             | –             | –             | –         | –         | –         | –         | –    | 422             | 16%                                 | 67                 | 5.175                       | <b>0.077</b>         |
| Office of River Protection                   | 100             | 3              | 2             | –             | –             | –             | –         | –         | –         | –         | –    | 105             | 5%                                  | 5                  | 0.376                       | 0.075                |
| Hanford Mission Integration Solutions (HMIS) | 98              | 3              | 1             | –             | –             | –             | –         | –         | –         | –         | –    | 102             | 4%                                  | 4                  | 0.214                       | 0.054                |
| Washington River Protection Solutions LLC    | 413             | 71             | 13            | –             | –             | –             | –         | –         | –         | –         | –    | 497             | 17%                                 | 84                 | 4.188                       | 0.050                |
| Isotek (Bldg. 3019)                          | 132             | 39             | 1             | –             | –             | –             | –         | –         | –         | –         | –    | 172             | 23%                                 | 40                 | 1.610                       | 0.040                |
| Los Alamos National Laboratory               | 2,950           | 234            | 10            | 6             | 1             | –             | –         | –         | –         | –         | –    | <b>3,201</b>    | 8%                                  | 251                | 9.441                       | 0.038                |
| Sandia National Laboratories                 | 337             | 8              | 1             | –             | –             | –             | –         | –         | –         | –         | –    | 346             | 3%                                  | 9                  | 0.320                       | 0.036                |
| SRNS Service Subs                            | 45              | 40             | 4             | –             | –             | –             | –         | –         | –         | –         | –    | 89              | 49%                                 | 44                 | 1.518                       | 0.035                |
| Savannah River Field Office                  | 2               | 4              | –             | –             | –             | –             | –         | –         | –         | –         | –    | 6               | 67%                                 | 4                  | 0.125                       | 0.031                |
| DOE-Richland Field Office                    | 314             | 17             | –             | –             | –             | –             | –         | –         | –         | –         | –    | 331             | 5%                                  | 17                 | 0.498                       | 0.029                |
| SRR Service Subs                             | 1               | 2              | –             | –             | –             | –             | –         | –         | –         | –         | –    | 3               | 67%                                 | 2                  | 0.049                       | 0.025                |
| N3B                                          | 378             | 53             | 1             | –             | –             | –             | –         | –         | –         | –         | –    | 432             | 13%                                 | 54                 | 1.316                       | 0.024                |
| NNSA Los Alamos Site Office                  | 42              | 2              | –             | –             | –             | –             | –         | –         | –         | –         | –    | 44              | 5%                                  | 2                  | 0.044                       | 0.022                |
| HPMC Occupational Medical Services           | 6               | 1              | –             | –             | –             | –             | –         | –         | –         | –         | –    | 7               | 14%                                 | 1                  | 0.021                       | 0.021                |
| Savannah River Nuclear Solutions             | 117             | 273            | 4             | 1             | –             | –             | –         | –         | –         | –         | –    | 395             | 70%                                 | <b>278</b>         | <b>5.444</b>                | 0.020                |
| SRNS Construction                            | 6               | 17             | –             | –             | –             | –             | –         | –         | –         | –         | –    | 23              | 74%                                 | 17                 | 0.281                       | 0.017                |
| BECHTEL NATIONAL CORPORATION                 | 631             | 13             | –             | –             | –             | –             | –         | –         | –         | –         | –    | 644             | 2%                                  | 13                 | 0.214                       | 0.016                |
| Centerra Services Inc. - SR                  | 24              | 29             | –             | –             | –             | –             | –         | –         | –         | –         | –    | 53              | 55%                                 | 29                 | 0.456                       | 0.016                |

**Exhibit B-16: Distribution of TED by Facility Type Listed in Descending Order of Average Measurable TED for Other, CY 2023.**

**OTHER**

Number of Individuals Receiving Radiation Doses in Each Dose Range (rem)

| Site/Contractor                           | Less than Meas. | Meas. To 0.100 | 0.100 – 0.250 | 0.250 – 0.500 | 0.500 – 0.750 | 0.750 – 1.000 | 1.0 – 2.0 | 2.0 – 3.0 | 3.0 – 4.0 | 4.0 – 5.0 | >5.0 | Total Monitored | Percent of Monitored with Meas. TED | No. with Meas. TED | Collective TED (Person–rem) | Avg. Meas. TED (rem) |
|-------------------------------------------|-----------------|----------------|---------------|---------------|---------------|---------------|-----------|-----------|-----------|-----------|------|-----------------|-------------------------------------|--------------------|-----------------------------|----------------------|
| SRR Operations                            | 1               | 6              | –             | –             | –             | –             | –         | –         | –         | –         | –    | 7               | 86%                                 | 6                  | 0.094                       | 0.016                |
| SRS Tritium Facilities                    | 2               | 1              | –             | –             | –             | –             | –         | –         | –         | –         | –    | 3               | 33%                                 | 1                  | 0.016                       | 0.016                |
| Univ. of Georgia Ecology Laboratory       | 1               | 3              | –             | –             | –             | –             | –         | –         | –         | –         | –    | 4               | 75%                                 | 3                  | 0.040                       | 0.013                |
| BSRA - SR National Laboratory             | 2               | 4              | –             | –             | –             | –             | –         | –         | –         | –         | –    | 6               | 67%                                 | 4                  | 0.046                       | 0.012                |
| OFFICE OF SECURE TRANSPORTATION           | 116             | 1              | –             | –             | –             | –             | –         | –         | –         | –         | –    | 117             | 1%                                  | 1                  | 0.012                       | 0.012                |
| SR Mission Completion Operations - Other  | –               | 2              | –             | –             | –             | –             | –         | –         | –         | –         | –    | 2               | 100%                                | 2                  | 0.023                       | 0.012                |
| SRNS Construction Subs                    | 4               | 2              | –             | –             | –             | –             | –         | –         | –         | –         | –    | 6               | 33%                                 | 2                  | 0.017                       | 0.009                |
| Savannah River National Laboratory        | –               | 1              | –             | –             | –             | –             | –         | –         | –         | –         | –    | 1               | 100%                                | 1                  | 0.007                       | 0.007                |
| BSRA - Service Subs                       | 8               | 15             | –             | –             | –             | –             | –         | –         | –         | –         | –    | 23              | 65%                                 | 15                 | 0.084                       | 0.006                |
| Misc. DOE Contractors - SR                | 29              | 1              | –             | –             | –             | –             | –         | –         | –         | –         | –    | 30              | 3%                                  | 1                  | 0.005                       | 0.005                |
| Navarro Research & Engineering            | 28              | 2              | –             | –             | –             | –             | –         | –         | –         | –         | –    | 30              | 7%                                  | 2                  | 0.003                       | 0.002                |
| BATTELLE - PNNL                           | 3               | –              | –             | –             | –             | –             | –         | –         | –         | –         | –    | 3               | 0%                                  | 0                  | 0.000                       | 0.000                |
| Hanford Laboratory Management Integration | 78              | –              | –             | –             | –             | –             | –         | –         | –         | –         | –    | 78              | 0%                                  | 0                  | 0.000                       | 0.000                |
| <b>Totals</b>                             | <b>6,223</b>    | <b>891</b>     | <b>59</b>     | <b>8</b>      | <b>1</b>      | –             | –         | –         | –         | –         | –    | <b>7,182</b>    | <b>13%</b>                          | <b>959</b>         | <b>31.637</b>               | <b>0.033</b>         |

Note: Boxed values (gray background) indicate the greatest value in each column. Dashes indicate no data reported for the year shown.

**Exhibit B-17: Internal Dose by Facility Type and Nuclide, CY 2021–2023.**

| Facility                | Nuclide*     | No. of<br>Individuals with<br>Measurable<br>CED**<br>2021 | No. of<br>Individuals with<br>Measurable<br>CED**<br>2022 | No. of<br>Individuals with<br>Measurable<br>CED**<br>2023 | Collective<br>CED Dose<br>(person–rem)<br>2021 | Collective<br>CED Dose<br>(person–rem)<br>2022 | Collective<br>CED Dose<br>(person–rem)<br>2023 | Average<br>Measurable<br>CED (rem)<br>2021 | Average<br>Measurable<br>CED (rem)<br>2022 | Average<br>Measurable<br>CED (rem)<br>2023 |
|-------------------------|--------------|-----------------------------------------------------------|-----------------------------------------------------------|-----------------------------------------------------------|------------------------------------------------|------------------------------------------------|------------------------------------------------|--------------------------------------------|--------------------------------------------|--------------------------------------------|
| Accelerator             | Total        | –                                                         | –                                                         | –                                                         | –                                              | –                                              | –                                              | –                                          | –                                          | –                                          |
| Fuel Fabrication        | Total        | –                                                         | –                                                         | –                                                         | –                                              | –                                              | –                                              | –                                          | –                                          | –                                          |
| Fuel Processing         | Plutonium    | –                                                         | 1                                                         | –                                                         | –                                              | 0.031                                          | –                                              | –                                          | 0.031                                      | –                                          |
|                         | <b>Total</b> | –                                                         | <b>1</b>                                                  | –                                                         | –                                              | <b>0.031</b>                                   | –                                              | –                                          | <b>0.031</b>                               | –                                          |
| Fuel/Uranium Enrichment | <b>Total</b> | –                                                         | –                                                         | –                                                         | –                                              | –                                              | –                                              | –                                          | –                                          | –                                          |
| Maintenance and Support | Hydrogen-3   | 1                                                         | –                                                         | –                                                         | 0.003                                          | –                                              | –                                              | 0.003                                      | –                                          | –                                          |
|                         | Other        | 1                                                         | –                                                         | –                                                         | 0.014                                          | –                                              | –                                              | 0.014                                      | –                                          | –                                          |
|                         | Plutonium    | –                                                         | 1                                                         | 5                                                         | –                                              | 0.004                                          | 0.008                                          | –                                          | 0.004                                      | 0.002                                      |
|                         | <b>Total</b> | <b>2</b>                                                  | <b>1</b>                                                  | <b>5</b>                                                  | <b>0.017</b>                                   | <b>0.004</b>                                   | <b>0.008</b>                                   | <b>0.009</b>                               | <b>0.004</b>                               | <b>0.002</b>                               |
| Other                   | Americium    | –                                                         | 1                                                         | –                                                         | –                                              | 0.036                                          | –                                              | –                                          | 0.036                                      | –                                          |
|                         | Hydrogen-3   | –                                                         | 5                                                         | –                                                         | –                                              | 0.021                                          | –                                              | –                                          | 0.004                                      | –                                          |
|                         | Other        | 4                                                         | –                                                         | 2                                                         | 0.049                                          | –                                              | 0.024                                          | 0.012                                      | –                                          | 0.012                                      |
|                         | Plutonium    | 1                                                         | –                                                         | –                                                         | 0.081                                          | –                                              | –                                              | <b>0.081</b>                               | –                                          | –                                          |
|                         | <b>Total</b> | <b>5</b>                                                  | <b>6</b>                                                  | <b>2</b>                                                  | <b>0.130</b>                                   | <b>0.057</b>                                   | <b>0.024</b>                                   | <b>0.026</b>                               | <b>0.010</b>                               | <b>0.012</b>                               |
| Reactor                 | Hydrogen-3   | –                                                         | 2                                                         | –                                                         | –                                              | 0.003                                          | –                                              | –                                          | 0.002                                      | –                                          |
|                         | Other        | –                                                         | –                                                         | 1                                                         | –                                              | –                                              | 0.148                                          | –                                          | –                                          | <b>0.148</b>                               |
|                         | <b>Total</b> | –                                                         | <b>2</b>                                                  | <b>1</b>                                                  | –                                              | <b>0.003</b>                                   | <b>0.148</b>                                   | –                                          | <b>0.002</b>                               | <b>0.148</b>                               |
| Research, Fusion        | Hydrogen-3   | –                                                         | 14                                                        | –                                                         | –                                              | 0.035                                          | –                                              | –                                          | 0.003                                      | –                                          |
|                         | <b>Total</b> | –                                                         | <b>14</b>                                                 | –                                                         | –                                              | <b>0.035</b>                                   | –                                              | –                                          | <b>0.003</b>                               | –                                          |
| Research, General       | Americium    | 1                                                         | 2                                                         | –                                                         | 0.012                                          | 0.214                                          | –                                              | 0.012                                      | <b>0.107</b>                               | –                                          |
|                         | Hydrogen-3   | 3                                                         | 1                                                         | 3                                                         | 0.152                                          | 0.002                                          | 0.013                                          | 0.051                                      | 0.002                                      | 0.004                                      |
|                         | Mixed        | –                                                         | 1                                                         | 1                                                         | –                                              | 0.019                                          | 0.059                                          | –                                          | 0.019                                      | 0.059                                      |
|                         | Other        | 1                                                         | 1                                                         | –                                                         | 0.005                                          | 0.025                                          | –                                              | 0.005                                      | 0.025                                      | –                                          |
|                         | Plutonium    | –                                                         | –                                                         | 2                                                         | –                                              | –                                              | 0.078                                          | –                                          | –                                          | 0.039                                      |
|                         | Uranium      | 20                                                        | 19                                                        | 16                                                        | 0.293                                          | 0.312                                          | 0.232                                          | 0.015                                      | 0.016                                      | 0.015                                      |
|                         | <b>Total</b> | <b>25</b>                                                 | <b>25</b>                                                 | <b>25</b>                                                 | <b>0.462</b>                                   | <b>0.609</b>                                   | <b>0.742</b>                                   | <b>0.018</b>                               | <b>0.024</b>                               | <b>0.017</b>                               |
| Waste Processing/Mgmt   | Americium    | 1                                                         | –                                                         | –                                                         | 0.068                                          | –                                              | –                                              | 0.068                                      | –                                          | –                                          |
|                         | Hydrogen-3   | –                                                         | 1                                                         | –                                                         | –                                              | 0.001                                          | –                                              | –                                          | 0.001                                      | –                                          |
|                         | Mixed        | –                                                         | 1                                                         | –                                                         | –                                              | 0.002                                          | –                                              | –                                          | 0.002                                      | –                                          |
|                         | Uranium      | 54                                                        | 48                                                        | 58                                                        | 1.314                                          | 1.196                                          | 2.346                                          | 0.024                                      | 0.025                                      | 0.040                                      |
|                         | <b>Total</b> | <b>55</b>                                                 | <b>50</b>                                                 | <b>58</b>                                                 | <b>1.382</b>                                   | <b>1.199</b>                                   | <b>2.346</b>                                   | <b>0.025</b>                               | <b>0.024</b>                               | <b>0.040</b>                               |

**Exhibit B-17: Internal Dose by Facility Type and Nuclide, CY 2021–2023.**

| Facility                 | Nuclide*     | No. of Individuals with Measurable CED** 2021 | No. of Individuals with Measurable CED** 2022 | No. of Individuals with Measurable CED** 2023 | Collective CED Dose (person–rem) 2021 | Collective CED Dose (person–rem) 2022 | Collective CED Dose (person–rem) 2023 | Average Measurable CED (rem) 2021 | Average Measurable CED (rem) 2022 | Average Measurable CED (rem) 2023 |
|--------------------------|--------------|-----------------------------------------------|-----------------------------------------------|-----------------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|
| Weapons Fab. and Testing | Hydrogen-3   | 21                                            | 27                                            | 20                                            | 0.096                                 | 0.061                                 | 0.046                                 | 0.005                             | 0.002                             | 0.002                             |
|                          | Mixed        | 7                                             | –                                             | 3                                             | 0.404                                 | –                                     | 0.035                                 | 0.058                             | –                                 | 0.012                             |
|                          | Plutonium    | 1                                             | –                                             | –                                             | 0.020                                 | –                                     | –                                     | 0.020                             | –                                 | –                                 |
|                          | Uranium      | 1,124                                         | 1,201                                         | 1,223                                         | 41.278                                | 43.806                                | 38.722                                | 0.037                             | 0.036                             | 0.032                             |
|                          | <b>Total</b> | <b>1,153</b>                                  | <b>1,228</b>                                  | <b>1,246</b>                                  | <b>41.798</b>                         | <b>43.867</b>                         | <b>38.803</b>                         | <b>0.036</b>                      | <b>0.036</b>                      | <b>0.031</b>                      |
| <b>Totals</b>            |              | <b>1,240</b>                                  | <b>1,326</b>                                  | <b>1,246</b>                                  | <b>43.789</b>                         | <b>45.768</b>                         | <b>38.803</b>                         | <b>0.035</b>                      | <b>0.035</b>                      | <b>0.031</b>                      |

Note: Boxed values (gray background) indicate the greatest value in each column. Dashes indicate no data reported for this facility type and nuclide. Dashes indicate no data reported for the year shown.

\*Intakes grouped by nuclide. Intakes involving multiple nuclides were grouped into "mixed." Nuclides where fewer than 10 individuals had intakes were grouped as "other."

\*\*The number of internal depositions represents the number of internal dose records with positive results reported for each individual.

**Exhibit B-18a: Distribution of TED by Labor Category, CY 2021.**

**TOTAL EFFECTIVE DOSE (TED)**

**Number of Individuals Receiving Radiation Doses in Each Dose Range (rem)**

| Site/Contractor         | Less than Meas. | Meas. To 0.100 | 0.100 – 0.250 | 0.250 – 0.500 | 0.500 – 0.750 | 0.750 – 1.000 | 1.0 – 2.0 | 2.0 – 3.0 | 3.0 – 4.0 | 4.0 – 5.0 | >5.0     | Total Monitored | Percent of Monitored with Meas. TED | No. with Meas. TED | Collective TED (Person–rem) | Avg. Meas. TED (rem) |
|-------------------------|-----------------|----------------|---------------|---------------|---------------|---------------|-----------|-----------|-----------|-----------|----------|-----------------|-------------------------------------|--------------------|-----------------------------|----------------------|
| Agriculture             | 28              | 6              | –             | –             | –             | –             | –         | –         | –         | –         | –        | 34              | 18%                                 | 6                  | 0.098                       | 0.016                |
| Construction/Repair     | 3,181           | 1,856          | 173           | 43            | 6             | 1             | –         | –         | –         | –         | –        | 5,260           | 40%                                 | 2,079              | 90.827                      | 0.044                |
| Laborers                | 1,090           | 478            | 57            | 10            | 1             | –             | –         | –         | –         | –         | –        | 1,636           | 33%                                 | 546                | 24.947                      | 0.046                |
| Management              | 5,062           | 1,558          | 65            | 18            | 2             | –             | –         | –         | –         | –         | –        | 6,705           | 25%                                 | 1,643              | 51.117                      | 0.031                |
| Miscellaneous           | 4,399           | 1,137          | 84            | 18            | 1             | –             | –         | –         | –         | –         | –        | 5,639           | 22%                                 | 1,240              | 45.568                      | 0.037                |
| Production              | 2,341           | 1,585          | 226           | 77            | 8             | –             | –         | –         | –         | –         | –        | 4,237           | 45%                                 | 1,896              | 113.065                     | 0.060                |
| Professional/Scientists | 15,937          | 4,340          | 269           | 63            | 10            | 2             | 3         | –         | –         | –         | –        | 20,624          | 23%                                 | 4,687              | 166.763                     | 0.036                |
| Service                 | 4,058           | 1,097          | 110           | 39            | 10            | 2             | –         | –         | –         | –         | –        | 5,316           | 24%                                 | 1,258              | 63.190                      | 0.050                |
| Technicians             | 6,011           | 2,206          | 361           | 156           | 58            | 24            | 10        | –         | –         | –         | –        | 8,826           | 32%                                 | 2,815              | 242.334                     | 0.086                |
| Transport               | 829             | 157            | 14            | 10            | 1             | –             | –         | –         | –         | –         | –        | 1,011           | 18%                                 | 182                | 9.966                       | 0.055                |
| Unknown                 | 7,954           | 506            | 23            | 7             | 1             | –             | –         | –         | –         | –         | –        | 8,491           | 6%                                  | 537                | 17.316                      | 0.032                |
| <b>Totals</b>           | <b>50,890</b>   | <b>14,937</b>  | <b>1,383</b>  | <b>443</b>    | <b>98</b>     | <b>29</b>     | <b>13</b> | <b>–</b>  | <b>–</b>  | <b>–</b>  | <b>–</b> | <b>67,793</b>   | <b>25%</b>                          | <b>16,903</b>      | <b>826.474</b>              | <b>0.049</b>         |

Note: Boxed values (gray background) indicate the greatest value in each column. Dashes indicate no data reported for the year shown.

**Exhibit B-18b: Distribution of TED by Labor Category, CY 2022.**

**TOTAL EFFECTIVE DOSE (TED)**

**Number of Individuals Receiving Radiation Doses in Each Dose Range (rem)**

| Site/Contractor         | Less than Meas. | Meas. To 0.100 | 0.100 – 0.250 | 0.250 – 0.500 | 0.500 – 0.750 | 0.750 – 1.000 | 1.0 – 2.0 | 2.0 – 3.0 | 3.0 – 4.0 | 4.0 – 5.0 | >5.0 | Total Monitored | Percent of Monitored with Meas. TED | No. with Meas. TED | Collective TED (Person–rem) | Avg. Meas. TED (rem) |
|-------------------------|-----------------|----------------|---------------|---------------|---------------|---------------|-----------|-----------|-----------|-----------|------|-----------------|-------------------------------------|--------------------|-----------------------------|----------------------|
| Agriculture             | 28              | 6              | –             | –             | –             | –             | –         | –         | –         | –         | –    | 34              | 18%                                 | 6                  | 0.121                       | 0.020                |
| Construction/Repair     | 3,313           | 1,765          | 166           | 56            | 11            | 2             | 3         | –         | –         | –         | –    | 5,316           | 38%                                 | 2,003              | 101.394                     | 0.051                |
| Laborers                | 937             | 405            | 45            | 9             | –             | –             | –         | –         | –         | –         | –    | 1,396           | 33%                                 | 459                | 19.745                      | 0.043                |
| Management              | 5,721           | 1,578          | 105           | 18            | 10            | 1             | 4         | –         | –         | –         | –    | 7,437           | 23%                                 | 1,716              | 68.214                      | 0.040                |
| Miscellaneous           | 5,796           | 906            | 38            | 17            | 2             | –             | –         | –         | –         | –         | –    | 6,759           | 14%                                 | 963                | 34.512                      | 0.036                |
| Production              | 2,613           | 1,504          | 213           | 68            | 20            | 2             | –         | –         | –         | –         | –    | 4,420           | 41%                                 | 1,807              | 114.404                     | 0.063                |
| Professional/Scientists | 17,965          | 4,262          | 307           | 83            | 13            | 10            | 5         | –         | –         | –         | –    | 22,645          | 21%                                 | 4,680              | 190.264                     | 0.041                |
| Service                 | 4,803           | 1,231          | 83            | 31            | 3             | –             | –         | –         | –         | –         | –    | 6,151           | 22%                                 | 1,348              | 53.679                      | 0.040                |
| Technicians             | 6,249           | 2,151          | 367           | 162           | 78            | 45            | 10        | –         | –         | –         | –    | 9,062           | 31%                                 | 2,813              | 278.279                     | 0.099                |
| Transport               | 786             | 119            | 20            | 4             | –             | –             | –         | –         | –         | –         | –    | 929             | 15%                                 | 143                | 6.388                       | 0.045                |
| Unknown                 | 10,360          | 802            | 30            | 4             | –             | –             | –         | –         | –         | –         | –    | 11,196          | 7%                                  | 836                | 25.767                      | 0.031                |
| <b>Totals</b>           | <b>58,574</b>   | <b>14,728</b>  | <b>1,374</b>  | <b>453</b>    | <b>137</b>    | <b>60</b>     | <b>22</b> | –         | –         | –         | –    | <b>75,348</b>   | <b>22%</b>                          | <b>16,774</b>      | <b>893.125</b>              | <b>0.053</b>         |

Note: Boxed values (gray background) indicate the greatest value in each column. Dashes indicate no data reported for the year shown.

**Exhibit B-18c: Distribution of TED by Labor Category, CY 2023.**

**TOTAL EFFECTIVE DOSE (TED)**

**Number of Individuals Receiving Radiation Doses in Each Dose Range (rem)**

| Site/Contractor | Less than Meas. | Meas. To 0.100 | 0.100 – 0.250 | 0.250 – 0.500 | 0.500 – 0.750 | 0.750 – 1.000 | 1.0 – 2.0 | 2.0 – 3.0 | 3.0 – 4.0 | 4.0 – 5.0 | >5.0 | Total Monitored | Percent of Monitored with Meas. TED | No. with Meas. TED | Collective TED (Person-rem) | Avg. Meas. TED (rem) |
|-----------------|-----------------|----------------|---------------|---------------|---------------|---------------|-----------|-----------|-----------|-----------|------|-----------------|-------------------------------------|--------------------|-----------------------------|----------------------|
| Agriculture     | 26              | 5              | –             | –             | –             | –             | –         | –         | –         | –         | –    | 31              | 16%                                 | 5                  | 0.083                       | 0.017                |
| Construction    | 3,357           | 2,107          | 232           | 57            | 11            | 1             | –         | –         | –         | –         | –    | 5,765           | 42%                                 | 2,408              | 119,508                     | 0.050                |
| Laborers        | 1,044           | 369            | 63            | 6             | –             | 1             | –         | –         | –         | –         | –    | 1,483           | 30%                                 | 439                | 22,738                      | 0.052                |
| Management      | 6,110           | 1,746          | 104           | 31            | 9             | 2             | 2         | –         | –         | –         | –    | 8,004           | 24%                                 | 1,894              | 73,147                      | 0.039                |
| Miscellaneous   | 6,860           | 844            | 47            | 14            | 2             | 1             | –         | –         | –         | –         | –    | 7,768           | 12%                                 | 908                | 33,183                      | 0.037                |
| Production      | 2,558           | 1,837          | 259           | 80            | 15            | –             | –         | –         | –         | –         | –    | 4,749           | 46%                                 | 2,191              | 131,779                     | 0.060                |
| Scientists      | 19,517          | 4,593          | 318           | 79            | 13            | 4             | 2         | –         | –         | –         | –    | 24,526          | 20%                                 | 5,009              | 193,504                     | 0.039                |
| Service         | 5,106           | 1,402          | 117           | 51            | 1             | –             | –         | –         | –         | –         | –    | 6,677           | 24%                                 | 1,571              | 70,107                      | 0.045                |
| Technicians     | 6,598           | 2,295          | 447           | 185           | 64            | 19            | 2         | –         | –         | –         | –    | 9,610           | 31%                                 | 3,012              | 262,614                     | 0.087                |
| Transport       | 847             | 85             | 14            | 13            | –             | –             | –         | –         | –         | –         | –    | 959             | 12%                                 | 112                | 8,576                       | 0.077                |
| Unknown         | 11,920          | 854            | 58            | 7             | 1             | –             | –         | –         | –         | –         | –    | 12,840          | 7%                                  | 920                | 34,156                      | 0.037                |
| <b>Totals</b>   | <b>63,943</b>   | <b>16,137</b>  | <b>1,659</b>  | <b>523</b>    | <b>116</b>    | <b>28</b>     | <b>6</b>  | –         | –         | –         | –    | <b>82,412</b>   | <b>22%</b>                          | <b>18,469</b>      | <b>949,395</b>              | <b>0.051</b>         |

Note: Boxed values (gray background) indicate the greatest value in each column. Dashes indicate no data reported for the year shown.

**Exhibit B-19: Internal Dose by Labor Category, CY 2021–2023.**

| Labor Category | No. of<br>Individuals with<br>Measurable<br>CED*<br>2021 | No. of<br>Individuals with<br>Measurable<br>CED*<br>2022 | No. of<br>Individuals with<br>Measurable<br>CED*<br>2023 | Collective<br>CED Dose<br>(person–rem)<br>2021 | Collective<br>CED Dose<br>(person–rem)<br>2022 | Collective<br>CED Dose<br>(person–rem)<br>2023 | Average<br>Measurable<br>CED (rem)<br>2021 | Average<br>Measurable<br>CED (rem)<br>2022 | Average<br>Measurable<br>CED (rem)<br>2023 |
|----------------|----------------------------------------------------------|----------------------------------------------------------|----------------------------------------------------------|------------------------------------------------|------------------------------------------------|------------------------------------------------|--------------------------------------------|--------------------------------------------|--------------------------------------------|
| Construction   | 273                                                      | 268                                                      | 236                                                      | 9.181                                          | 9.458                                          | 7.576                                          | 0.034                                      | 0.035                                      | 0.032                                      |
| Laborers       | 80                                                       | 74                                                       | 78                                                       | 4.048                                          | 2.931                                          | 3.125                                          | <b>0.051</b>                               | <b>0.040</b>                               | 0.040                                      |
| Management     | 71                                                       | 110                                                      | 114                                                      | 3.352                                          | 4.191                                          | 3.600                                          | 0.047                                      | 0.038                                      | 0.032                                      |
| Miscellaneous  | 3                                                        | 8                                                        | 7                                                        | 0.056                                          | 0.153                                          | 0.197                                          | 0.019                                      | 0.019                                      | 0.028                                      |
| Production     | <b>324</b>                                               | <b>349</b>                                               | <b>390</b>                                               | <b>12.022</b>                                  | <b>12.296</b>                                  | <b>11.145</b>                                  | 0.037                                      | 0.035                                      | 0.029                                      |
| Scientists     | 182                                                      | 217                                                      | 219                                                      | 5.495                                          | 7.139                                          | 6.782                                          | 0.030                                      | 0.033                                      | 0.031                                      |
| Service        | 31                                                       | 36                                                       | 21                                                       | 1.209                                          | 1.335                                          | 0.494                                          | 0.039                                      | 0.037                                      | 0.024                                      |
| Technicians    | 120                                                      | 130                                                      | 127                                                      | 3.857                                          | 3.992                                          | 4.096                                          | 0.032                                      | 0.031                                      | 0.032                                      |
| Transport      | 30                                                       | 24                                                       | 21                                                       | 0.736                                          | 0.772                                          | 1.452                                          | 0.025                                      | 0.032                                      | <b>0.069</b>                               |
| Unknown        | 126                                                      | 111                                                      | 120                                                      | 3.833                                          | 3.538                                          | 3.096                                          | 0.030                                      | 0.032                                      | 0.026                                      |
| <b>Totals</b>  | <b>1,240</b>                                             | <b>1,327</b>                                             | <b>1,333</b>                                             | <b>43.789</b>                                  | <b>45.805</b>                                  | <b>41.563</b>                                  | <b>0.035</b>                               | <b>0.035</b>                               | <b>0.031</b>                               |

Note: Boxed values (gray background) indicate the greatest value in each column. Dashes indicate no data reported for the year shown.

\*The number of internal depositions represents the number of internal dose records with positive results reported for each individual.

**Exhibit B-20: Dose Distribution by Labor Category and Occupation, CY 2023.**

| Labor Category | Occupation                     | Less than Meas. | Meas. To 0.100 | 0.100 – 0.250 | 0.250 – 0.500 | 0.500 – 0.750 | 0.750 – 1.000 | 1.0 – 2.0 | 2.0 – 3.0 | 3.0 – 4.0 | 4.0 – 5.0 | >5.0     | Total Monitored | Percent of Monitored with Meas. TED | No. with Meas. TED | Collective TED (Person–rem) | Avg. Meas. TED (rem) |
|----------------|--------------------------------|-----------------|----------------|---------------|---------------|---------------|---------------|-----------|-----------|-----------|-----------|----------|-----------------|-------------------------------------|--------------------|-----------------------------|----------------------|
| Agriculture    | Groundskeepers                 | 25              | 5              | –             | –             | –             | –             | –         | –         | –         | –         | –        | 30              | 17%                                 | 5                  | 0.083                       | 0.017                |
|                | Misc. Agriculture              | 1               | –              | –             | –             | –             | –             | –         | –         | –         | –         | –        | 1               | –                                   | –                  | –                           | –                    |
| Construction   | Carpenters                     | 311             | 227            | 53            | 9             | –             | –             | –         | –         | –         | –         | –        | 600             | 48%                                 | 289                | 18.517                      | 0.064                |
|                | Electricians                   | 1,296           | 561            | 46            | 20            | 2             | –             | –         | –         | –         | –         | –        | 1,925           | 33%                                 | 629                | 28.164                      | 0.045                |
|                | Masons                         | 22              | 31             | –             | –             | –             | –             | –         | –         | –         | –         | –        | 53              | 58%                                 | 31                 | 0.571                       | 0.018                |
|                | Mechanics/Repairers            | 429             | 293            | 33            | 11            | 4             | –             | –         | –         | –         | –         | –        | 770             | 44%                                 | 341                | 19.846                      | 0.058                |
|                | Miners/Drillers                | 53              | 4              | 1             | –             | –             | –             | –         | –         | –         | –         | –        | 58              | 9%                                  | 5                  | 0.275                       | 0.055                |
|                | Misc. Repair/Construction      | 696             | 599            | 49            | 8             | –             | 1             | –         | –         | –         | –         | –        | 1,353           | 49%                                 | 657                | 27.096                      | 0.041                |
|                | Painters                       | 120             | 93             | 3             | 2             | –             | –             | –         | –         | –         | –         | –        | 218             | 45%                                 | 98                 | 3.408                       | 0.035                |
|                | Pipe Fitter                    | 430             | 299            | 47            | 7             | 5             | –             | –         | –         | –         | –         | –        | 788             | 45%                                 | 358                | 21.631                      | 0.060                |
| Laborers       | Handlers/Laborers/Helpers      | 1,044           | 369            | 63            | 6             | –             | 1             | –         | –         | –         | –         | –        | 1,483           | 30%                                 | 439                | 22.738                      | 0.052                |
| Management     | Admin. Support & Clerical Sec. | 610             | 86             | 3             | –             | –             | –             | –         | –         | –         | –         | –        | 699             | 13%                                 | 89                 | 2.138                       | 0.024                |
|                | Manager - Administrator        | 5,485           | 1,660          | 101           | 31            | 9             | 2             | 2         | –         | –         | –         | –        | 7,290           | 25%                                 | 1,805              | 71.009                      | 0.039                |
| Miscellaneous  | Sales                          | 15              | –              | –             | –             | –             | –             | –         | –         | –         | –         | –        | 15              | –                                   | –                  | –                           | –                    |
|                | Military                       | 26              | 1              | –             | –             | –             | –             | –         | –         | –         | –         | –        | 27              | 4%                                  | 1                  | 0.015                       | 0.015                |
| Production     | Miscellaneous                  | 6,834           | 843            | 47            | 14            | 2             | 1             | –         | –         | –         | –         | –        | 7,741           | 12%                                 | 907                | 33.168                      | 0.037                |
|                | Machine Setup/Operators        | 498             | 454            | 77            | 19            | –             | –             | –         | –         | –         | –         | –        | 1,048           | 52%                                 | 550                | 32.659                      | 0.059                |
|                | Machinists                     | 97              | 20             | 8             | 11            | 2             | –             | –         | –         | –         | –         | –        | 138             | 30%                                 | 41                 | 7.418                       | 0.181                |
|                | Misc. Precision/Production     | 607             | 261            | 35            | 5             | 1             | –             | –         | –         | –         | –         | –        | 909             | 33%                                 | 302                | 15.252                      | 0.051                |
|                | Operators, Plant/ System/Util. | 1,058           | 964            | 109           | 39            | 12            | –             | –         | –         | –         | –         | –        | 2,182           | 52%                                 | 1,124              | 65.866                      | 0.059                |
|                | Sheet Metal Workers            | 273             | 132            | 30            | 6             | –             | –             | –         | –         | –         | –         | –        | 441             | 38%                                 | 168                | 10.528                      | 0.063                |
|                | Welders and Solderers          | 25              | 6              | –             | –             | –             | –             | –         | –         | –         | –         | –        | 31              | 19%                                 | 6                  | 0.056                       | 0.009                |
| Scientists     | Doctors and Nurses             | 13              | 3              | –             | –             | –             | –             | –         | –         | –         | –         | –        | 16              | 19%                                 | 3                  | 0.022                       | 0.007                |
|                | Engineer                       | 6,594           | 1,195          | 97            | 29            | 1             | 3             | –         | –         | –         | –         | –        | 7,919           | 17%                                 | 1,325              | 55.866                      | 0.042                |
|                | Health Physicist               | 322             | 88             | 7             | 1             | –             | –             | –         | –         | –         | –         | –        | 418             | 23%                                 | 96                 | 3.420                       | 0.036                |
|                | Misc. Professional             | 8,491           | 2,531          | 155           | 36            | 8             | –             | –         | –         | –         | –         | –        | 11,221          | 24%                                 | 2,730              | 95.745                      | 0.035                |
|                | Scientist                      | 4,097           | 776            | 59            | 13            | 4             | 1             | 2         | –         | –         | –         | –        | 4,952           | 17%                                 | 855                | 38.451                      | 0.045                |
| Service        | Firefighters                   | 379             | 35             | –             | –             | –             | –             | –         | –         | –         | –         | –        | 414             | 8%                                  | 35                 | 0.392                       | 0.011                |
|                | Food Service Employees         | –               | 1              | –             | –             | –             | –             | –         | –         | –         | –         | –        | 1               | 100%                                | 1                  | 0.092                       | 0.092                |
|                | Janitors                       | 239             | 28             | –             | –             | –             | –             | –         | –         | –         | –         | –        | 267             | 10%                                 | 28                 | 0.357                       | 0.013                |
|                | Misc. Service                  | 3,442           | 921            | 113           | 51            | 1             | –             | –         | –         | –         | –         | –        | 4,528           | 24%                                 | 1,086              | 60.929                      | 0.056                |
|                | Security Guards                | 1,046           | 417            | 4             | –             | –             | –             | –         | –         | –         | –         | –        | 1,467           | 29%                                 | 421                | 8.337                       | 0.020                |
| Technicians    | Engineering Technicians        | 1,707           | 285            | 33            | 4             | –             | –             | –         | –         | –         | –         | –        | 2,029           | 16%                                 | 322                | 15.398                      | 0.048                |
|                | Health Technicians             | 144             | 17             | 2             | 1             | –             | –             | –         | –         | –         | –         | –        | 164             | 12%                                 | 20                 | 1.243                       | 0.062                |
|                | Misc. Technicians              | 1,846           | 442            | 67            | 27            | 8             | 4             | –         | –         | –         | –         | –        | 2,394           | 23%                                 | 548                | 39.275                      | 0.072                |
|                | Radiation Monitors/Techs.      | 1,102           | 927            | 200           | 58            | 20            | 2             | –         | –         | –         | –         | –        | 2,309           | 52%                                 | 1,207              | 98.497                      | 0.082                |
|                | Science Technicians            | 730             | 458            | 135           | 87            | 35            | 12            | 2         | –         | –         | –         | –        | 1,459           | 50%                                 | 729                | 99.172                      | 0.136                |
|                | Technicians                    | 1,069           | 166            | 11            | 8             | 1             | 1             | –         | –         | –         | –         | –        | 1,256           | 15%                                 | 187                | 9.177                       | 0.049                |
| Transport      | Bus Drivers                    | 1               | –              | –             | –             | –             | –             | –         | –         | –         | –         | –        | 1               | –                                   | –                  | –                           | –                    |
|                | Equipment Operators            | 105             | 25             | 8             | 10            | –             | –             | –         | –         | –         | –         | –        | 148             | 29%                                 | 43                 | 5.538                       | 0.129                |
|                | Misc. Transport                | 347             | 10             | 1             | –             | –             | –             | –         | –         | –         | –         | –        | 358             | 3%                                  | 11                 | 0.272                       | 0.025                |
|                | Truck Drivers                  | 394             | 50             | 5             | 3             | –             | –             | –         | –         | –         | –         | –        | 452             | 13%                                 | 58                 | 2.766                       | 0.048                |
| Unknown        | Unknown                        | 11,920          | 854            | 58            | 7             | 1             | –             | –         | –         | –         | –         | –        | 12,840          | 7%                                  | 920                | 34.156                      | 0.037                |
| <b>Totals</b>  |                                | <b>63,943</b>   | <b>16,137</b>  | <b>1,659</b>  | <b>523</b>    | <b>116</b>    | <b>28</b>     | <b>6</b>  | <b>–</b>  | <b>–</b>  | <b>–</b>  | <b>–</b> | <b>82,412</b>   | <b>22%</b>                          | <b>18,469</b>      | <b>949.395</b>              | <b>0.051</b>         |

Note: Boxed values (gray background) indicate the greatest value in each column. Dashes indicate no data reported for the year shown.

**Exhibit B-21: Internal Dose Distribution by Site and Nuclide, CY 2023.**

*Number of Individuals Receiving Radiation Doses in Each Dose Range (rem)*

| Site                                          | Nuclide*   | Meas.<br>To 0.020 | 0.020 –<br>0.100 | 0.100 –<br>0.250 | 0.250 –<br>0.500 | 0.500 –<br>0.750 | 0.750 –<br>1.000 | 1.0 –<br>2.0 | 2.0 –<br>3.0 | 3.0 –<br>4.0 | 4.0 –<br>5.0 | >5.0 | Total Indiv.<br>With Meas.<br>CED | Collective<br>CED<br>(person–<br>rem) | Avg.<br>CED<br>(rem) |
|-----------------------------------------------|------------|-------------------|------------------|------------------|------------------|------------------|------------------|--------------|--------------|--------------|--------------|------|-----------------------------------|---------------------------------------|----------------------|
| Hanford: Hanford Site                         | Plutonium  | 5                 | –                | –                | –                | –                | –                | –            | –            | –            | –            | –    | 5                                 | 0.008                                 | 0.002                |
| Lawrence Livermore National Laboratory        | Hydrogen-3 | 1                 | –                | –                | –                | –                | –                | –            | –            | –            | –            | –    | 1                                 | 0.011                                 | 0.011                |
| Los Alamos National Laboratory                | Hydrogen-3 | 20                | –                | –                | –                | –                | –                | –            | –            | –            | –            | –    | 20                                | 0.030                                 | 0.002                |
| Los Alamos National Laboratory                | Plutonium  | 1                 | 1                | –                | –                | –                | –                | –            | –            | –            | –            | –    | 2                                 | 0.078                                 | 0.039                |
| Los Alamos National Laboratory                | Uranium    | 5                 | –                | –                | –                | –                | –                | –            | –            | –            | –            | –    | 5                                 | 0.009                                 | 0.002                |
| Oak Ridge: Oak Ridge National Laboratory      | Mixed      | –                 | 1                | –                | –                | –                | –                | –            | –            | –            | –            | –    | 1                                 | 0.059                                 | <b>0.059</b>         |
| Oak Ridge: Oak Ridge National Laboratory      | Uranium    | 1                 | –                | –                | –                | –                | –                | –            | –            | –            | –            | –    | 1                                 | 0.011                                 | 0.011                |
| Oak Ridge: Y-12 National Security Complex     | Mixed      | 3                 | –                | –                | –                | –                | –                | –            | –            | –            | –            | –    | 3                                 | 0.035                                 | 0.012                |
| Oak Ridge: Y-12 National Security Complex     | Uranium    | 635               | 526              | 59               | 3                | –                | –                | –            | –            | –            | –            | –    | <b>1,223</b>                      | <b>38.722</b>                         | 0.032                |
| Paducah Gaseous Diffusion Plant               | Uranium    | 7                 | 3                | –                | –                | –                | –                | –            | –            | –            | –            | –    | 10                                | 0.212                                 | 0.021                |
| Sandia National Laboratories                  | Other      | 1                 | 1                | –                | –                | –                | –                | –            | –            | –            | –            | –    | 2                                 | 0.024                                 | 0.012                |
| Savannah River Site                           | Hydrogen-3 | 2                 | –                | –                | –                | –                | –                | –            | –            | –            | –            | –    | 2                                 | 0.018                                 | 0.009                |
| Uranium Mill Tailings Remedial Action Project | Uranium    | 25                | 26               | 7                | –                | –                | –                | –            | –            | –            | –            | –    | 58                                | 2.346                                 | 0.040                |
| <b>Totals</b>                                 |            | <b>706</b>        | <b>558</b>       | <b>66</b>        | <b>3</b>         | –                | –                | –            | –            | –            | –            | –    | <b>1,333</b>                      | <b>41.563</b>                         | <b>0.031</b>         |

Note: Boxed values (gray background) indicate the greatest value in each column. Dashes indicate no data reported for the year shown.

**Exhibit B-22: Extremity Dose Distribution by Site, CY 2023.**

| Site                                                     | No. Meas. Dose | Meas. to 0.100 | 0.100 – 1.0 | 1.0 – 5.0 | 5.0 – 10.0 | 10.0 – 20.0 | 20.0 – 30.0 | >30.0 | Total Monitored* | No. with Meas. | No. Above Monitoring Threshold (5 rem)** | Collective Extremity Dose (person–rem) | Avg. Meas. Extremity Dose (rem) |
|----------------------------------------------------------|----------------|----------------|-------------|-----------|------------|-------------|-------------|-------|------------------|----------------|------------------------------------------|----------------------------------------|---------------------------------|
| Ames Laboratory                                          | 45             | 110            | 2           | –         | –          | –           | –           | –     | 157              | 112            | –                                        | 5.022                                  | 0.045                           |
| Argonne National Laboratory                              | 2,355          | 91             | 25          | 4         | 1          | –           | –           | –     | 2,476            | 121            | 1                                        | 25.322                                 | 0.209                           |
| Brookhaven National Laboratory                           | 2,565          | 17             | 17          | –         | –          | –           | –           | –     | 2,599            | 34             | –                                        | 5.611                                  | 0.165                           |
| Fermi National Accelerator Laboratory                    | 1,436          | 8              | 3           | –         | –          | –           | –           | –     | 1,447            | 11             | –                                        | 0.590                                  | 0.054                           |
| Grand Junction Site                                      | 30             | –              | –           | –         | –          | –           | –           | –     | 30               | –              | –                                        | –                                      | –                               |
| Hanford: Hanford Site                                    | 3,439          | 30             | 42          | 15        | –          | –           | –           | –     | 3,526            | 87             | –                                        | 38.659                                 | 0.444                           |
| Hanford: Office of River Protection                      | 3,253          | 134            | 231         | 14        | –          | –           | –           | –     | 3,632            | 379            | –                                        | 95.708                                 | 0.253                           |
| Hanford: Pacific Northwest National Laboratory           | 2,532          | 639            | 66          | 18        | 1          | –           | –           | –     | 3,256            | 724            | 1                                        | 74.377                                 | 0.103                           |
| Idaho                                                    | 5,304          | 1,352          | 469         | 70        | 18         | –           | –           | –     | 7,213            | 1,909          | 18                                       | 439.120                                | 0.230                           |
| Kansas City National Security Campus                     | 153            | 68             | 3           | –         | –          | –           | –           | –     | 224              | 71             | –                                        | 3.988                                  | 0.056                           |
| Lawrence Berkeley National Laboratory                    | 555            | 46             | 15          | 3         | –          | –           | –           | –     | 619              | 64             | –                                        | 12.399                                 | 0.194                           |
| Lawrence Livermore National Laboratory                   | 4,359          | 21             | 46          | 6         | 1          | –           | –           | –     | 4,433            | 74             | 1                                        | 38.505                                 | 0.520                           |
| Los Alamos National Laboratory                           | 11,170         | 2,734          | 851         | 188       | 9          | –           | –           | –     | 14,952           | 3,782          | 9                                        | 759.921                                | 0.201                           |
| National Renewable Energy Laboratory                     | 3              | 3              | –           | –         | –          | –           | –           | –     | 6                | 3              | –                                        | 0.033                                  | 0.011                           |
| Nevada National Security Site                            | 779            | 4              | –           | –         | –          | –           | –           | –     | 783              | 4              | –                                        | 0.063                                  | 0.016                           |
| Oak Ridge: East Tennessee Technology Park                | 245            | –              | –           | –         | –          | –           | –           | –     | 245              | –              | –                                        | –                                      | –                               |
| Oak Ridge: Oak Ridge Institute for Science and Education | 89             | –              | –           | –         | –          | –           | –           | –     | 89               | –              | –                                        | –                                      | –                               |
| Oak Ridge: Oak Ridge National Laboratory                 | 5,020          | 97             | 82          | 36        | 8          | 3           | –           | –     | 5,246            | 226            | 11                                       | 218.979                                | 0.969                           |
| Oak Ridge: Y-12 National Security Complex                | 7,998          | 20             | 31          | 21        | 1          | –           | –           | –     | 8,071            | 73             | 1                                        | 52.317                                 | 0.717                           |
| Office of Secure Transportation                          | 321            | –              | –           | –         | –          | –           | –           | –     | 321              | –              | –                                        | –                                      | –                               |
| Paducah Gaseous Diffusion Plant                          | 1,454          | –              | –           | –         | –          | –           | –           | –     | 1,454            | –              | –                                        | –                                      | –                               |
| Pantex Plant                                             | 4,163          | 207            | 243         | 86        | 2          | –           | –           | –     | 4,701            | 538            | 2                                        | 277.030                                | 0.515                           |
| Portsmouth Gaseous Diffusion Plant                       | 2,147          | –              | –           | –         | –          | –           | –           | –     | 2,147            | –              | –                                        | –                                      | –                               |
| Princeton Plasma Physics Laboratory                      | 341            | 2              | –           | –         | –          | –           | –           | –     | 343              | 2              | –                                        | 0.026                                  | 0.013                           |
| Sandia National Laboratories                             | 2,032          | 37             | 21          | 4         | –          | –           | –           | –     | 2,094            | 62             | –                                        | 12.843                                 | 0.207                           |

**Exhibit B-22: Extremity Dose Distribution by Site, CY 2023.**

| Site                                           | No. Meas. Dose | Meas. to 0.100 | 0.100 – 1.0  | 1.0 – 5.0  | 5.0 – 10.0 | 10.0 – 20.0 | 20.0 – 30.0 | >30.0 | Total Monitored* | No. with Meas. | No. Above Monitoring Threshold (5 rems)** | Collective Extremity Dose (person–rem) | Avg. Meas. Extremity Dose (rem) |
|------------------------------------------------|----------------|----------------|--------------|------------|------------|-------------|-------------|-------|------------------|----------------|-------------------------------------------|----------------------------------------|---------------------------------|
| Savannah River National Laboratory             | 518            | 48             | 40           | 8          | –          | –           | –           | –     | 614              | 96             | –                                         | 29.476                                 | 0.307                           |
| Savannah River Site                            | 5,921          | 411            | 413          | 60         | 14         | 3           | –           | –     | 6,822            | 901            | 17                                        | 386.757                                | 0.429                           |
| Separations Process Research Unit              | 11             | –              | –            | –          | –          | –           | –           | –     | 11               | –              | –                                         | –                                      | –                               |
| Service Center Personnel*                      | 227            | 46             | 15           | –          | –          | –           | –           | –     | 288              | 61             | –                                         | 4.497                                  | 0.074                           |
| SLAC National Accelerator Laboratory           | 1,776          | –              | –            | –          | –          | –           | –           | –     | 1,776            | –              | –                                         | –                                      | –                               |
| Thomas Jefferson National Accelerator Facility | 1,384          | –              | –            | –          | –          | –           | –           | –     | 1,384            | –              | –                                         | –                                      | –                               |
| Uranium Mill Tailings Remedial Action Project  | 171            | –              | –            | –          | –          | –           | –           | –     | 171              | –              | –                                         | –                                      | –                               |
| Waste Isolation Pilot Plant                    | 833            | –              | –            | –          | –          | –           | –           | –     | 833              | –              | –                                         | –                                      | –                               |
| West Valley Demonstration Project              | 441            | 8              | –            | –          | –          | –           | –           | –     | 449              | 8              | –                                         | 0.130                                  | 0.016                           |
| <b>Totals</b>                                  | <b>73,070</b>  | <b>6,133</b>   | <b>2,615</b> | <b>533</b> | <b>55</b>  | <b>6</b>    | –           | –     | <b>82,412</b>    | <b>9,342</b>   | <b>61</b>                                 | <b>2,481.373</b>                       | <b>0.266</b>                    |

Note: Boxed values (gray background) indicate the greatest value in each column. Dashes indicate no data reported for the year shown.

\* Represents the total number of monitoring records. The number of individuals provided extremity monitoring cannot be determined.

\*\* All extremity doses above 5 rems were for the upper extremities (hands and forearms). DOE annual limit for extremities is 50 rems.

10 CFR 835.402(a)(1)(ii) requires extremity monitoring for a shallow dose equivalent to the skin or extremity of 5 rems or more in a year.

\*\*\* Includes personnel at NETL, NNSA Albuquerque complex, Oak Ridge, and WIPP.



