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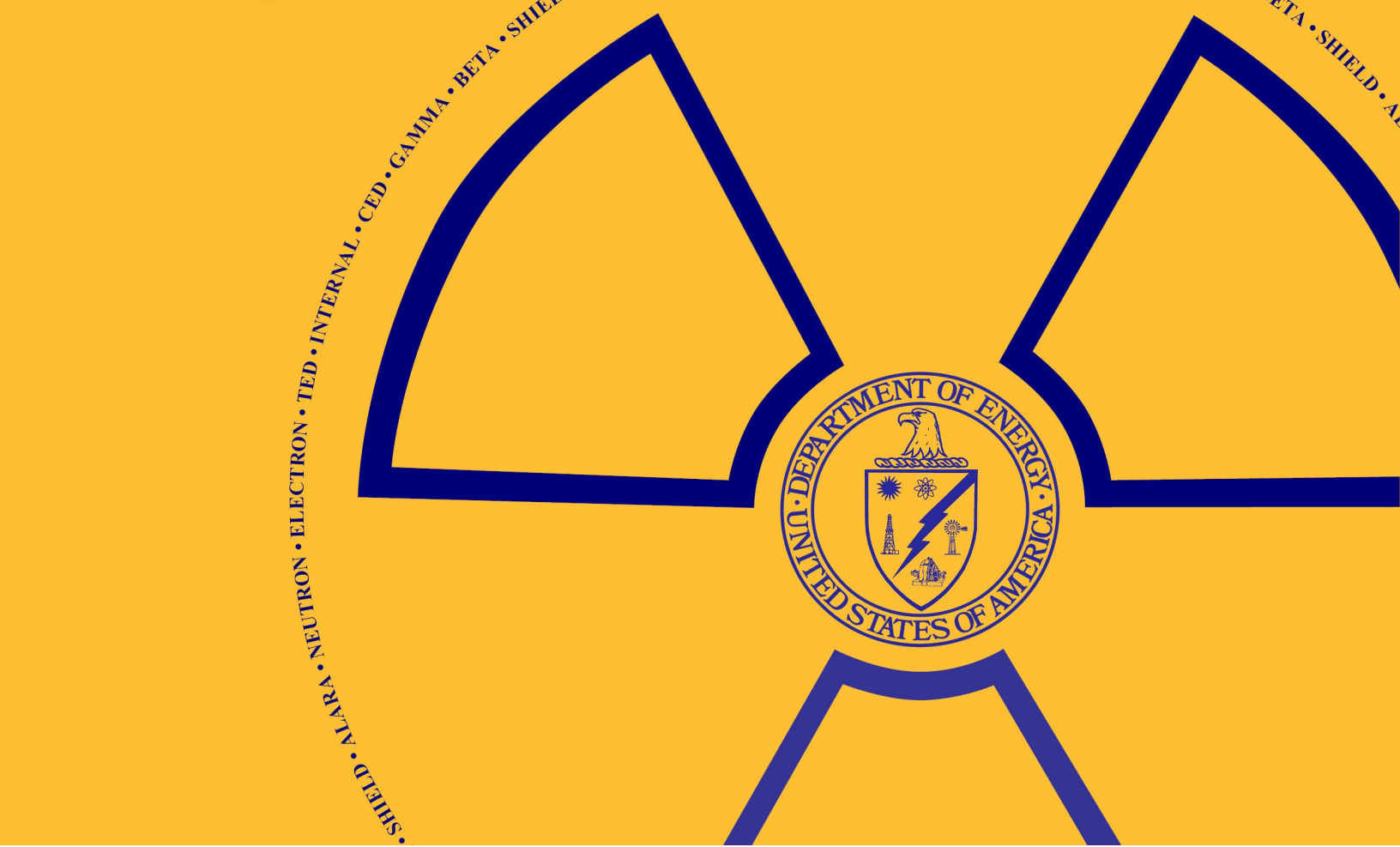
U.S. Department of Energy

OCCUPATIONAL RADIATION EXPOSURE REPORT FOR CY 2023



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Radiation Exposure Monitoring System Program Web Site at:
https://energy.gov/ehss/occupational-radiation-exposure

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Occupational Radiation Exposure Report for Calendar Year 2023

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Foreword

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.

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

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:

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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 Amended 11/4/1998 Amended 6/8/2007 Amended 4/13/2011 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 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.

Personnel Category	Section of 10 CFR 835	Type of Exposure	Acronym	Annual Limit
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).

Occupational Radiation Dose at DOE

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

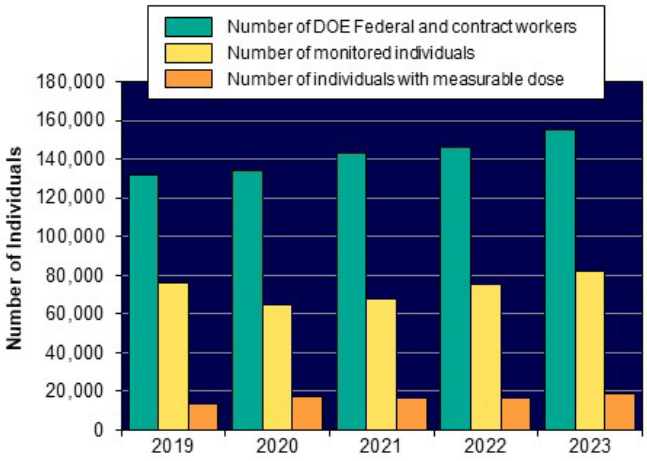
DOE uses the number of individuals with measurable dose to represent the exposed workforce size. In this context, "with measurable dose" means that a detectable value was reported for the individual.

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.



For CY 2023, 53 percent of the DOE workforce was monitored for radiation dose, and 22 percent of monitored individuals received a measurable dose.

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.

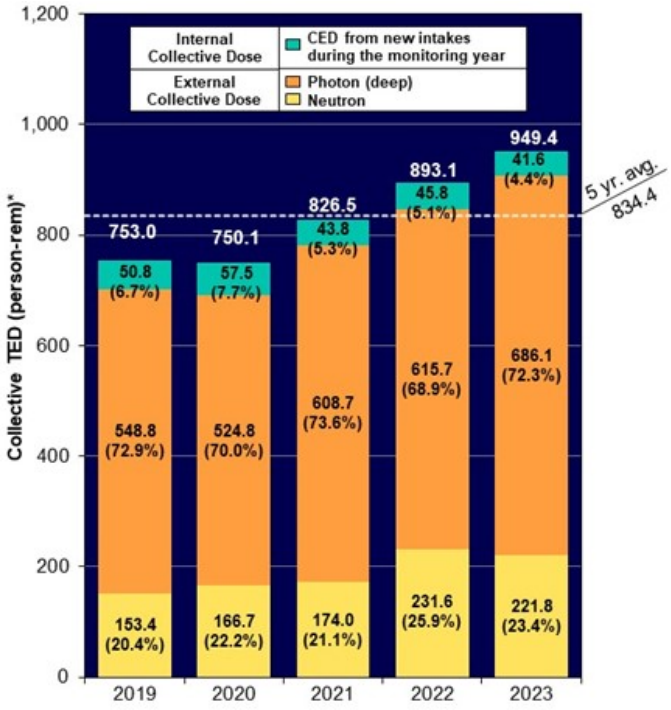
3.2.3 Collective Dose

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 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 electro-magnetic 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 percentages in parentheses represent the percentage of each dose component to the collective TED.

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).

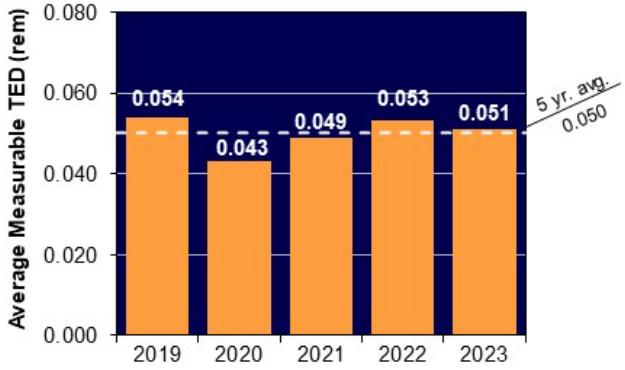
Five DOE sites contributed 86 percent of the collective TED in CY 2023. In descending order of collective TED, these were: LANL, Savannah River, Oak Ridge, Idaho, and Hanford. Savannah River and Idaho had increases in collective TED in CY 2023, while collective TED decreased at LANL, Oak Ridge, and Hanford.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

	TED Range (rem)*	2019	2020	2021	2022	2023
Number of Individuals in Each Dose Range	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.

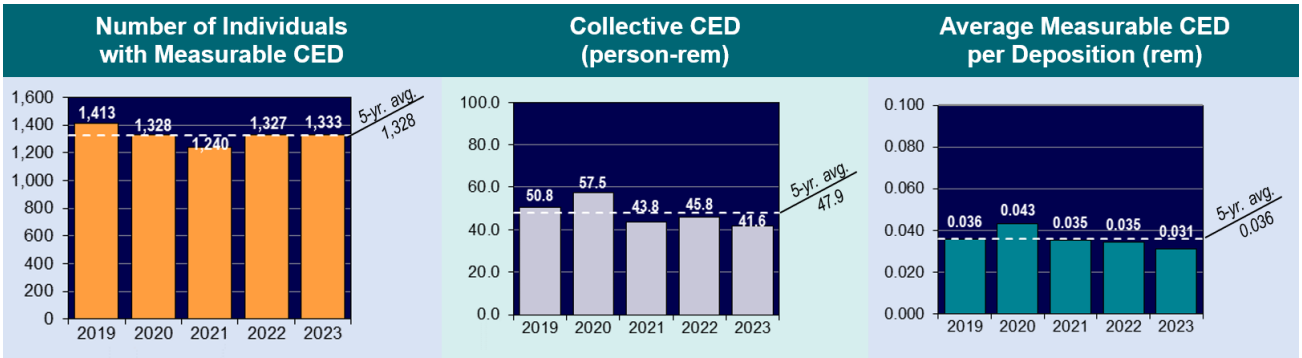
Exhibit 3-7 shows the distribution of the CED from CY 2019 – 2023. The total number of individuals with measurable CED in each dose range is the sum of the number of individuals receiving a CED in the dose range. Individuals may have had more than one intake of radioactive material, but the site would 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

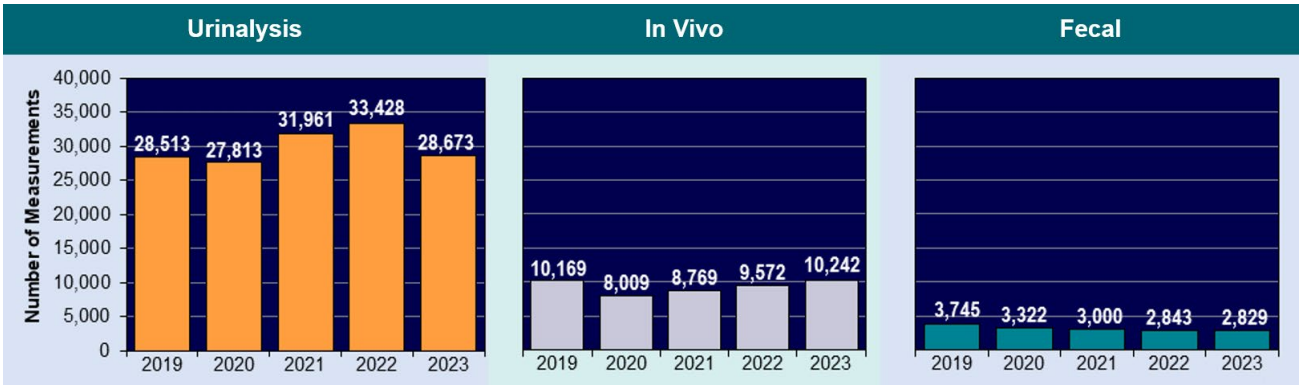
* Individuals with doses equal to the dose value separating the dose ranges are included in the next higher dose range.
- Indicates dose ranges containing no individuals.

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.

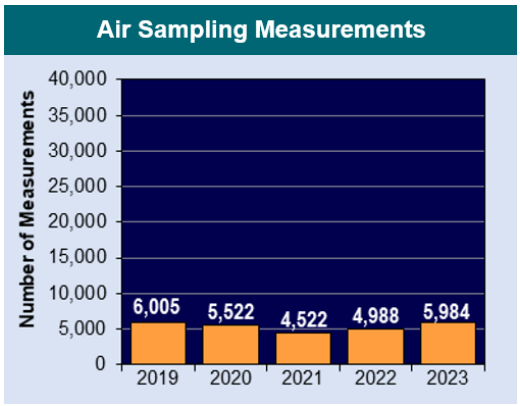
Nevada National Security Site, (NNSS), East Tennessee Technology Park (ETTP), and Idaho had the largest percentage increases in the number of "Urinalysis" measurements in CY 2023. Sixty-five percent of the "Urinalysis" measurements in CY 2023 were performed at four sites: LANL, Savannah River Site, Hanford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

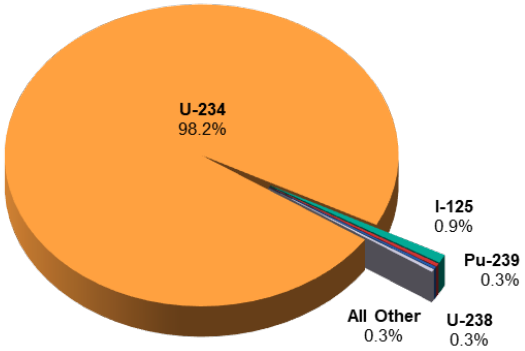


Savannah River Site performed the largest number of air sampling measurements, comprising 99 percent of the total air measurements taken in CY 2023.

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.

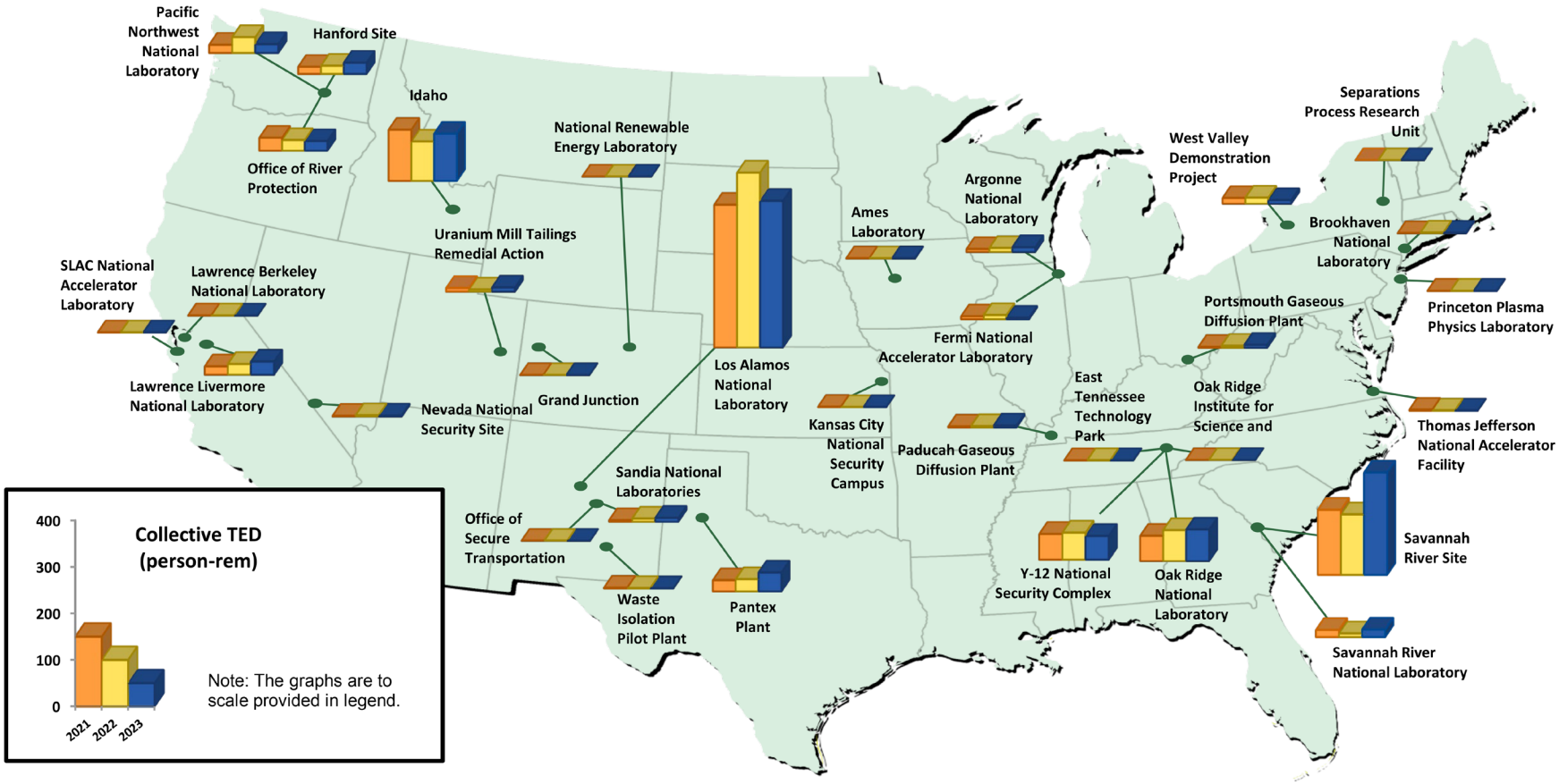


Exhibit 3-12: Collective TED and Number of Individuals with Measurable TED by DOE Site, CY 2021 – 2023.

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
Hanford Totals:	*59.731*	*1,773*	*73.209*	*1,654*	*62.660*	*1,697*
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	**303.186**	4,206	**371.500**	**4,467**	**311.506**	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
Oak Ridge Totals:	*108.134*	*2,467*	*123.367*	*2,742*	*117.369*	*2,852*
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	**4,647**	128.062	4,083	216.973	**5,701**
Savannah River Totals:	152.736	5,130	135.727	4,454	232.766	6,247
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
Totals	**826.474**	**16,903**	**893.125**	**16,774**	**949.395**	**18,469**

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

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

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

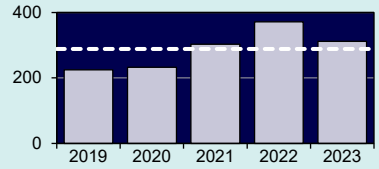
Site	2023							
	Collective TED (person-rem)	Percent Change from 2022	Number of Monitored Individuals	Percent Change from 2022	Number with Meas. TED	Percent Change from 2022	Avg. Meas. TED (person-rem)	Percent Change from 2022
Ames Laboratory	0.778	◊	157	◊	34	◊	0.023	◊
Argonne National Laboratory	10.225	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% ▼
Hanford Totals:	*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% ▼
Oak Ridge Totals:	*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% ▲
Savannah River Totals:	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% ▲
Totals	**949.395**	**6%** ▲	**82,412**	**9%** ▲	**18,469**	**10%** ▲	**0.051**	**-3%** ▼

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.

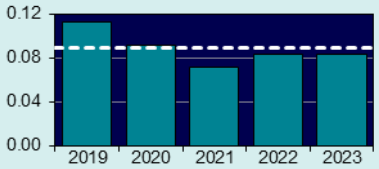
Exhibit 3-14: Activities Significantly Contributing to Collective TED in CY 2023, for Sites Reporting Greater Than 5 Person-Rem, in Descending Order of Collective Dose.

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

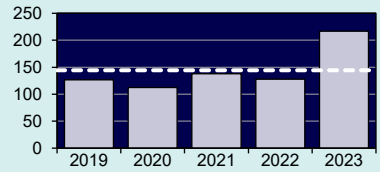
- Weapons manufacturing and related work at the TA-55 plutonium facility;
- Plutonium-238 work;
- Retrieval, repackaging, and shipping of radioactive waste; and
- Infrastructure support for radiological work and facility maintenance.

Changes in Dose

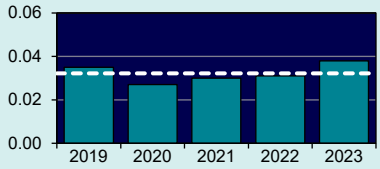
- In CY 2023, there was an atypical reduction in demand of programmatic heat source work, which contributed greatly to the observed reduction in dose; and
- There was a significant reduction in dose associated with craft labor performing construction activities at the plutonium facility.

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

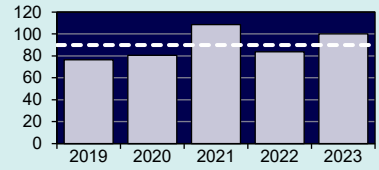
- The first shipment of down blended plutonium was sent from the site to the Waste Isolation Pilot Plant; and
- Employees reconfigured H Canyon dissolvers to maximize planned operations.

Changes in Dose

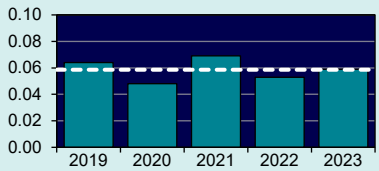
- The dose increased in CY 2023 as the site set a single-year record by processing nearly 3.2 million gallons of radioactive salt waste; and
- Two radioactive structures in the F Tank Farm were successfully closed and grouted.

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

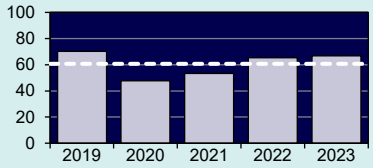
- Work at the Advanced Test Reactor (ATR) Complex, including preparations for installation of I-loop components, experiment modifications, maintenance, and operations, and research and development operations/laboratory support;
- Activities at the Materials and Fuel Complex, including maintenance and 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

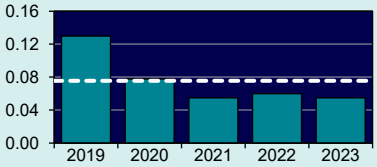
- The increased dose was a result of completing several significant tasks in high dose rate areas.

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

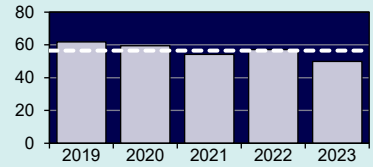
- Medical radioisotope production;
- Processing low-level and transuranic (TRU) waste at the TRU Waste Processing Center;
- Extracting thorium and down-blending uranium oxide at ISOTEK;
- Providing materials for National Aeronautics and Space Administration (NASA); and
- Facility maintenance.

Changes in Dose

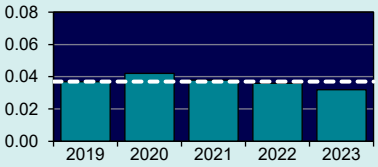
- The two percent increase in collective TED is primarily attributed to increases in operations activities and radioisotope production, particularly radioisotope production for industrial sponsors. Additionally, the number of ORNL monitored individuals increased by six percent over CY 2022, and;
- Radiation 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

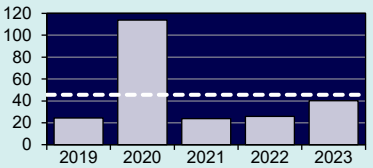
- Manufacture, processing, and storage of special nuclear materials;
- Characterization and hazardous waste removal at Y-12 Biology Complex; and
- Maintenance of equipment and facilities.

Changes in Dose

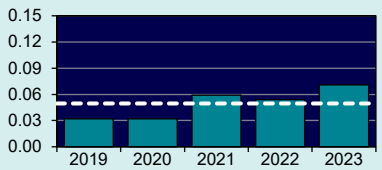
- Activities that affected the observed decrease in CY 2023 dose values include the continued cleaning efforts in radiological areas coupled with downsizing the removable contamination area footprint at the site.

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

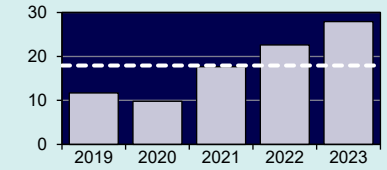
- Operations that expose individuals to large numbers of bare weapon pits containing significant quantities of special nuclear material (SNM); and
- Nuclear explosive assembly/disassembly operations, weapon dismantlement programs, life-extension programs, SNM Component Re-qualification, and SNM staging.

Changes in Dose

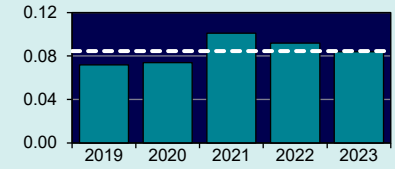
- The 55 percent dose increase in CY 2023 is the result of the continued increase in site personnel, increased production workloads, and other impacts that continue to evolve as goals for Pantex Production expand.

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

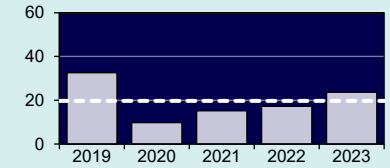
- Radiation-producing devices, such as x-ray machines, accelerators, and electron-beam welders; and
- Handling a wide range and quantity of radioactive materials.

Changes in Dose

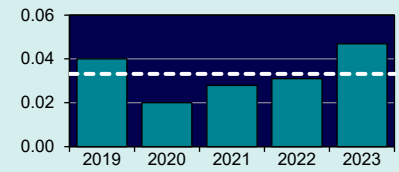
- The change in dose was due to 1) an increase in radiological work and/or dose to worker relative to last year and 2) several individuals with relatively high doses, and;
- There was a 9 percent increase in the monitored population from CY 2022 to CY 2023.

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

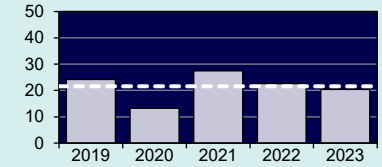
- Work activities at the plutonium finishing plant facility;
- Material handling and waste transfer; and
- Facility demolition and site remediation.

Changes in Dose

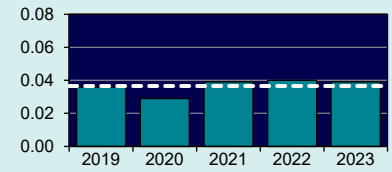
- The small increase in dose during CY 2023 stems mainly from an increase in personnel entries in the cell of building 324 and fire system maintenance at the Solid Waste Operations Complex.

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

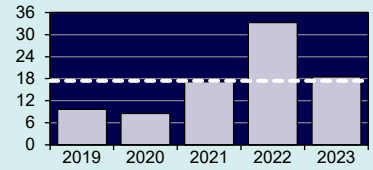
- Removal and transfer of waste from older single-shell tanks to newer, double-shell tanks;
- Maintenance and support of the evaporator, which reduces the volume of stored liquid waste by concentrating radioactive waste solutions;
- Work at the 222-S laboratory; and
- Well logging activities using an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

Changes in Dose

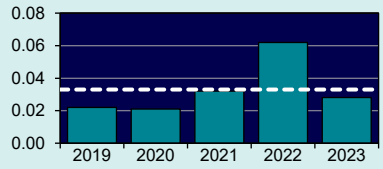
- The small dose reduction is due primarily to a technology change introduced in tank farm activities, continued efforts under the ALARA program, and changes in work scope.

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

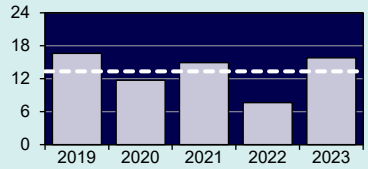
- Work at the Radiochemical Processing Laboratory;
- Radiation detection research; and
- Implementation of security measures for radiological materials of concern.

Changes in Dose

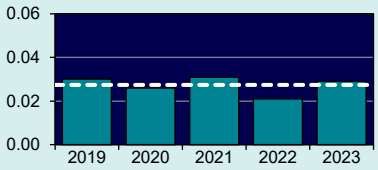
- The decrease in dose for CY 2023 is due to the completion of hot cell refurbishment work performed in CY 2022.

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

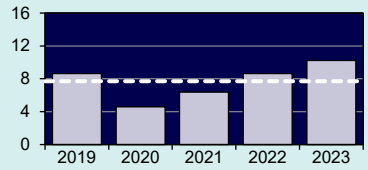
- Currently, most Savannah River National Laboratory programs support the Savannah River Site tritium mission. This includes applying hydrogen technologies used in processing tritium; extraction, purification, and storage of tritium; and
- Execution of the Mark-1A plutonium-244 recovery program.

Changes in Dose

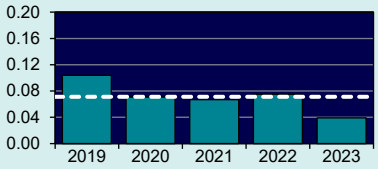
- The Salt Waste Processing Facility (SWPF) set a single-year record by processing nearly 3.2 million gallons of radioactive salt waste.

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

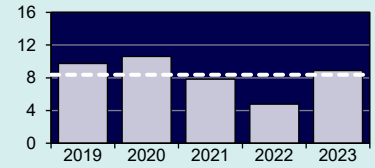
- Work supporting the lab's radiological facilities;
- Programmatic activities resulting primarily from research activities in the Irradiated Materials Laboratory; and
- Material handling, management, storage, and disposition activities associated with the Alpha Gamma Hot Cell Facility, the Waste Management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

Changes in Dose

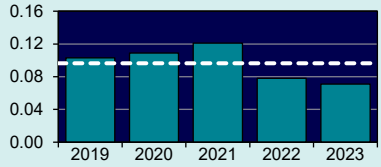
- The increase in dose can largely be attributed to the increased volume of workers being monitored.

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

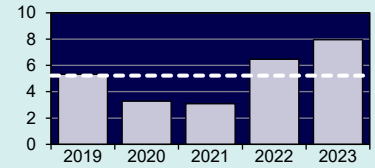
- Maintenance;
- Erosion control measures;
- Tailings excavation and conditioning;
- Loading tailings into containers and transporting to the rail beach;
- Ground water remediation; and
- Health and safety oversight.

Changes in Dose

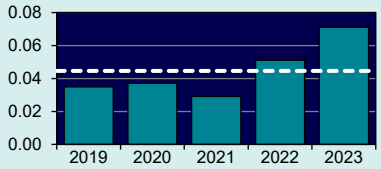
- The project continues to operate on a regular schedule of four trains per week.

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

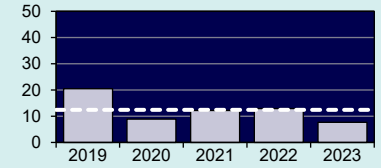
- Operation of a research reactor, gamma irradiation facilities, hot cell facilities, and several pulsed power accelerators;
- Conducting light laboratory work involving x-ray machines and tracer radionuclides; and
- Waste operations.

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)



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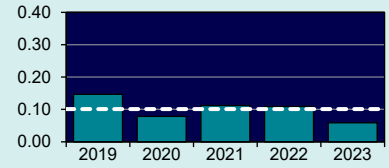


Site Description

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

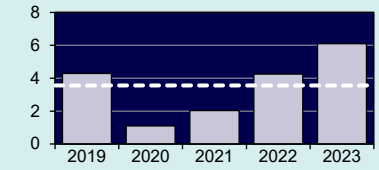
- Facility disposition;
- Waste container packaging and handling; and
- Demolition monitoring and support activities.

Changes in Dose

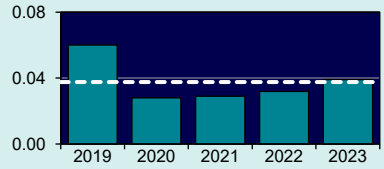
- Cessation of in-facility deactivation resulted in a reduction of doses to facility disposition and associated support groups, including Radiological Controls; and
- Waste operations exposure increases incurred due to the significant volume of demolition debris waste handling and processing of high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

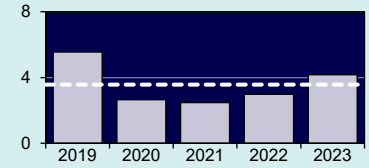
- The Portsmouth DUF6 facility resumed uranium hexaflouride processing in June 2022 with a graded restart from one operational line up to three during CY 2023 as operations returned to full production. The dose is as expected and typical for 3 lines operating.

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*.

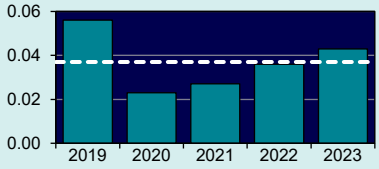
Exhibit 3-15: Activities Significantly Contributing to Collective TED in CY 2023, for Sites Reporting Less Than 5 Person-Rem, in Descending Order of Collective Dose.

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

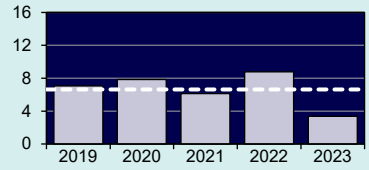
- Continued support of plant operations and maintenance of the Depleted Uranium Hexafluoride project as a nuclear facility;
- Environmental remediation and cleanup activities;
- Surveillance and maintenance activities;
- Waste disposition; and
- Decontamination and decommissioning of inactive facilities.

Changes in Dose

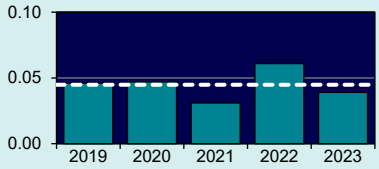
- In late 2022 the plant resumed uranium hexaflouride processing with a graded restart from one operational line up to three during CY 2023. This number is expected to remain consistent through the coming calendar year (2024).

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

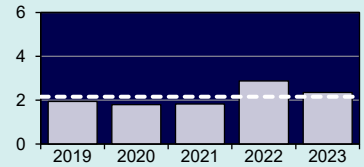
- Booster MP02 ion pump replacement;
- NuMi hadron monitor replacement, installation of rope hangers, and air filter changeout in NuMI chase;
- Inspection and replacement of MI-8 ion pump patch cables;
- Upgrade and repair activities of the accelerator complex; and
- LINAC tank 5 repairs.

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)



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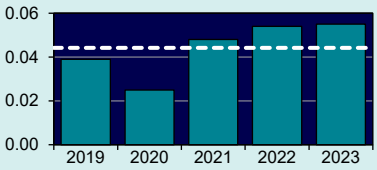


Site Description

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

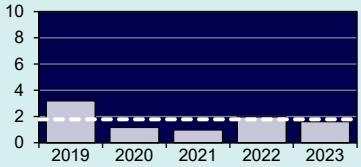
- Operation of low-level radioactive and mixed waste disposal facilities;
- Assembly and execution of subcritical experiments, confined critical experiments;
- Assembly/disassembly of special experiments;
- Operation of pulsed x-ray machines, linear accelerators, and neutron generators;
- Development, 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)



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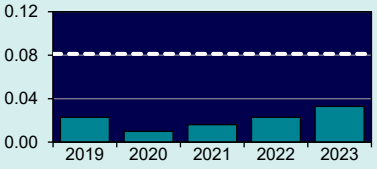


Site Description

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

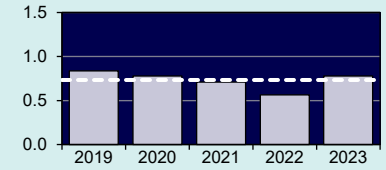
- Research involving nuclear and particle physics, accelerator science, and biological systems research;
- Facility maintenance and source replacement; and
- Support for the NASA Space Radiation Laboratory.

Changes in Dose

- The 18 percent decrease in dose for CY 2023 was primarily due to the implementation of effective radiological control activities.

Ames Laboratory

Collective TED (person-rem)



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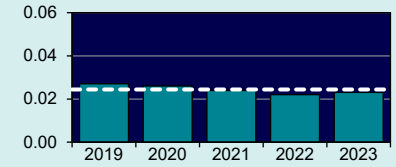


Site Description

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

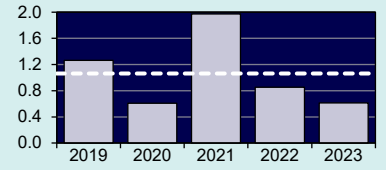
- Limited radioactive material work;
- Operation of 24 x-ray systems and 1 Mossbauer spectroscopy system; and
- Ongoing remediation of radiological legacy contamination.

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)



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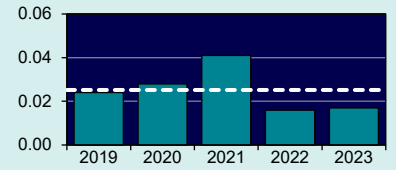


Site Description

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

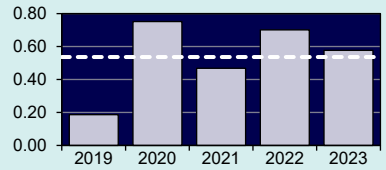
- Maintenance, modification, and repair of activated components associated with the CEBAF, Low Energy Recirculator Facility (LERF) and other ancillary activities (e.g., transport, storage, and disposal of radioactive materials). Typically, collective TED fluctuates up or down from year to year, depending 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)



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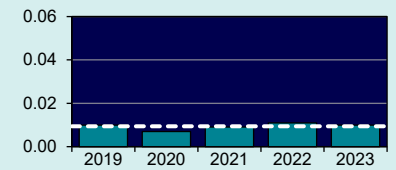


Site Description

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

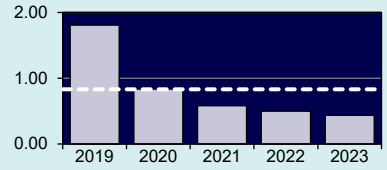
- Continuation of ongoing cleanup activities.

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)



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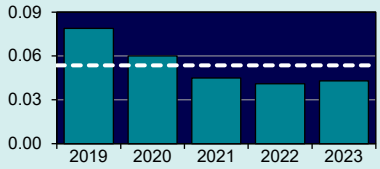


Site Description

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

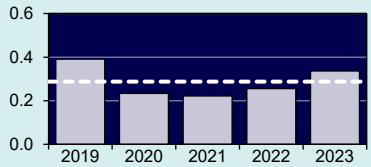
- Fluorine-18 research;
- Antineutrino research and experiments; and
- Site inventory of radioactive and nuclear material activities.

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)



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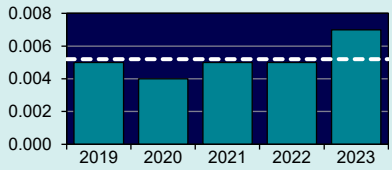


Site Description

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

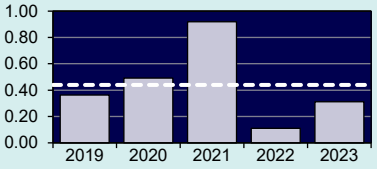
- Research work involving radioactive sources and x-ray generating devices; and
- Continued gradual increase in specific work focused on experimental machine upgrades while tritium system demolition and disposal activities are wrapping up.

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)



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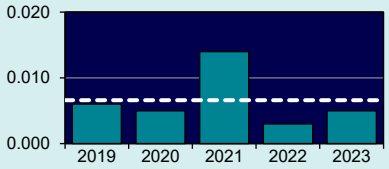


Site Description

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

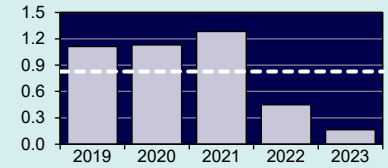
- Non-destructive testing and development projects,
- Telemetry component production and testing with neutron generators;
- Security operations, depleted uranium operations;
- Full production of weapons Life Extension Program; and
- Legacy part refurbishment and waste management.

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)



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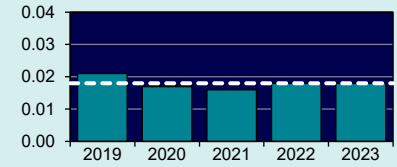


Site Description

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

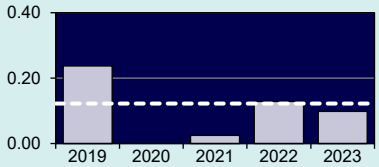
- Handling and processing of TRU waste for storage; and
- Managing long-term repository operations.

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)



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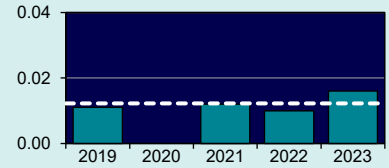


Site Description

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

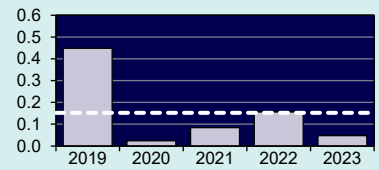
- Independent verification activities involving radiological surveys at sites undergoing decommissioning; and
- Environmental sample processing and radiological protection.

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)



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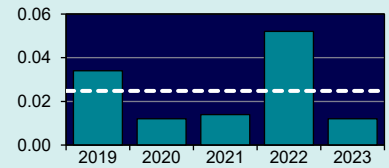


Site Description

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

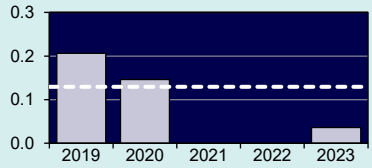
- Providing secure ground transportation of nuclear weapons, SNM, nuclear weapon components, and nuclear explosive-like assemblies; and
- Tracking and directing cargo loading revisions to minimize radiation exposure.

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)



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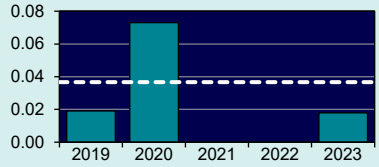


Site Description

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

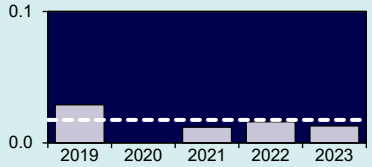
- Operation of the LINAC Coherent Light Source (LCLS) – the world's first hard x-ray free electron laser;
- Operation of the Stanford Synchrotron Radiation Lightsource – a pioneering synchrotron radiation facility;
- Operation of the Stanford Positron-Electron Asymmetric Ring (SPEAR3), and a separate, 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 0.036 reflects the fact that no major radiological projects were conducted during CY 2023.

Separations Process Research Unit (SPRU)

Collective TED (person-rem)



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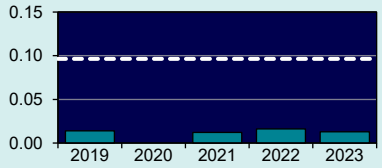


Site Description

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

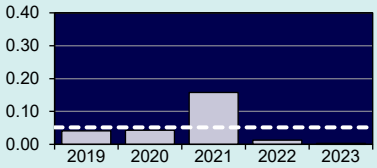
- Repackaging TRU waste;
- Processing and shipping low activity water and waste; and
- Surveillance and maintenance of site condition activities.

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)



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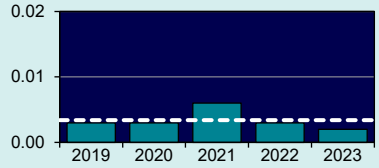


Site Description

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

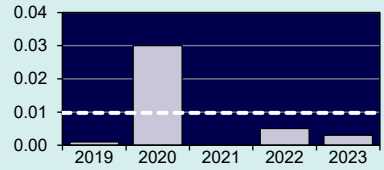
- Walk-over radiological surveys;
- Environmental/geological soil sampling;
- Abandoned mine site inspections; and
- Abandoned mine site reclamation construction activities.

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)



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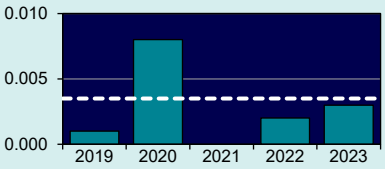


Site Description

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

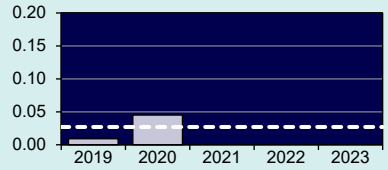
- Operation of analytical and process equipment containing sealed sources.

Changes in Dose

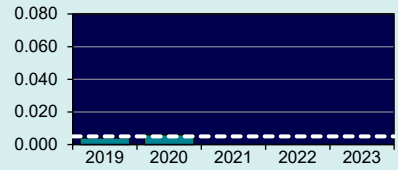
- The primary reason for the decrease in dose was a decrease in work time involving radiation exposure surrounding x-ray-generating equipment.

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 (person-rem)	Percent Change from 2022	Number with Meas. Dose (TED)	Percent Change from 2022	Avg. Meas. TED (rem)	Percent Change from 2022
Office of Energy Efficiency and Renewable Energy (EERE)					**Total Monitored**	**= 6***
National Renewable Energy Laboratory	0.003	◊	1	◊	0.003	◊
EE Totals	0.003	◊	**1**	◊	**0.003**	◊
Office of Environmental Management (EM)					**Total Monitored**	**= 22,005***
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% ▼
EM Totals	314.583	43% ▲	**7,743**	**24%** ▲	**0.041**	**15%** ▲
Office of Fossil Energy (FE)					**Total Monitored**	**= 85***
Service Center Personnel*	0.000	◊	0	◊	0.000	◊
FE Totals	**0.000**	◊	**0**	◊	**0.000**	◊
Office of Legacy Management (LM)					**Total Monitored**	**= 30***
Grand Junction Site	0.003	◊	2	◊	0.002	◊
LM Totals	**0.003**	◊	**2**	◊	**0.002**	◊
National Nuclear Security Administration (NNSA)					**Total Monitored**	**= 37,306***
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% ▼
NNSA Totals	**500.130**	**-5%** ▼	**8,261**	**0%**	**0.061**	**-5%** ▼
Office of Nuclear Energy (NE)					**Total Monitored**	**= 4,848***
Idaho National Laboratory	52.006	17% ▲	803	-7% ▼	0.065	26% ▲
NE Totals	**52.006**	**17%** ▲	**803**	**-7%** ▼	**0.065**	**26%** ▲
Office of Science (SC)					**Total Monitored**	**= 18,114***
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	◊
SC Totals	**82.670**	**-20%** ▼	**1,659**	**17%** ▲	**0.050**	**-32%** ▼

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%
	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
All DOE	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.

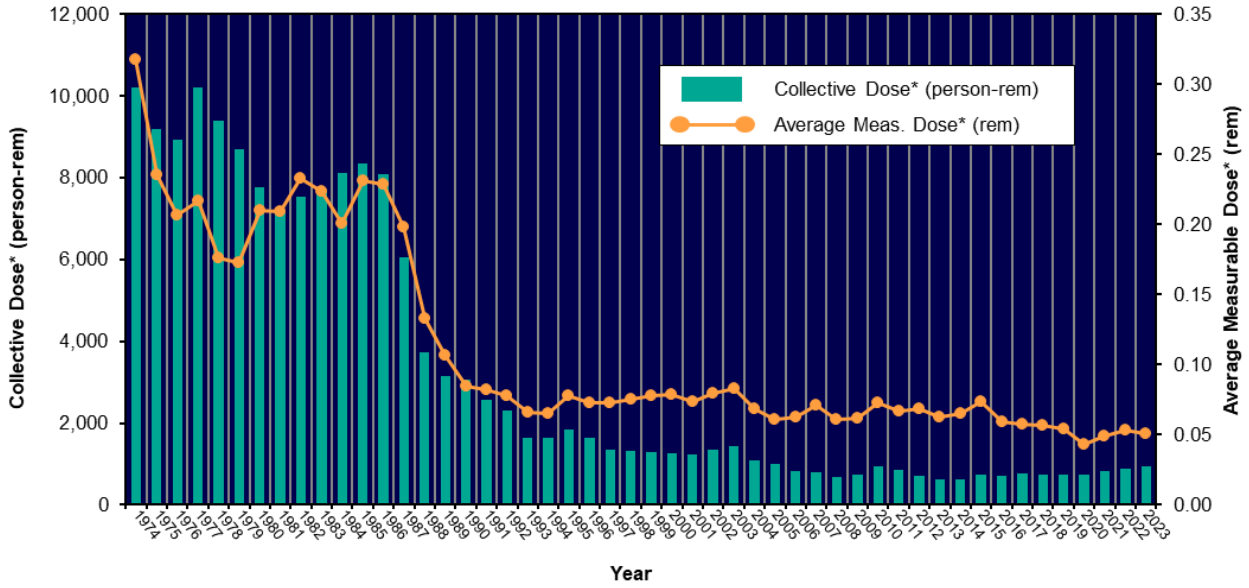
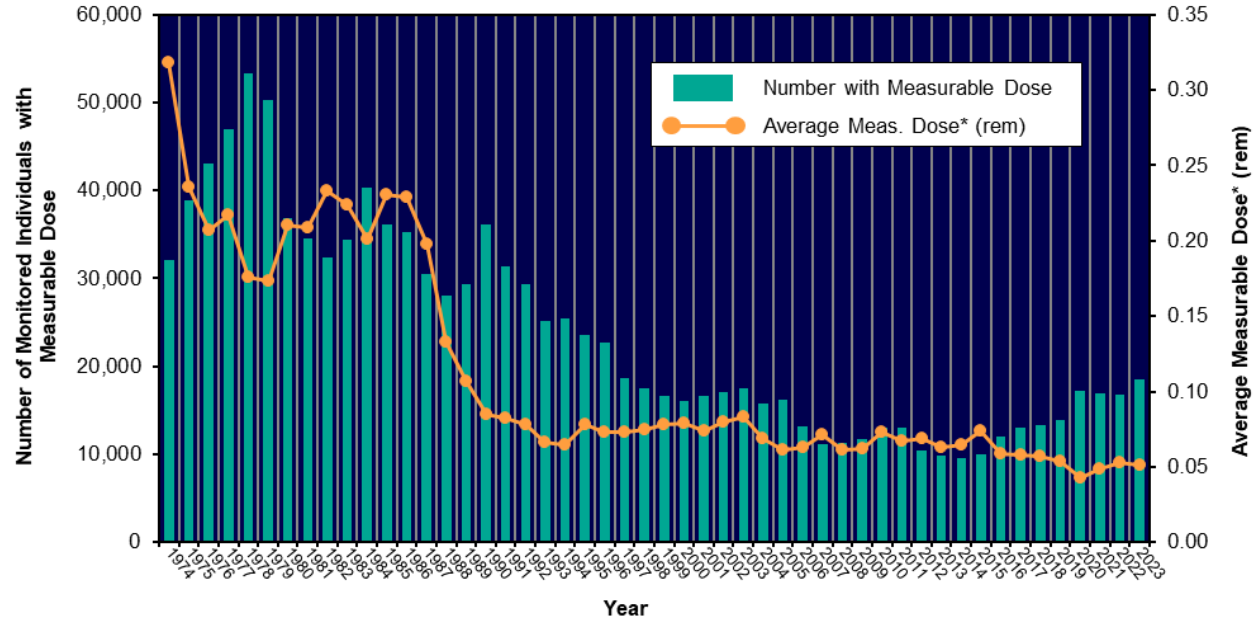


Exhibit 3-19: Number of Individuals with Measurable Dose and Average Measurable Dose, CY 1974 – 2023.



* 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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ALARA and Operating Experience Programs

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

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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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, $E_{50} = \Sigma w_T H_{T,50} + w_{Remainder} H_{Remainder,50}$. Where $w_{Remainder}$ is the tissue weighting factor assigned to the remainder organs and tissues and $H_{Remainder,50}$ 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, $E = \Sigma w_T H_T$. 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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References

1. DOE Standard, DOE-STD-1098-2017, "Radiological Control," January 2017. Online at: https://www.standards.doe.gov/standards-documents/1000/1098-AStd-2017/@@images/file.

2. EPA (U.S. Environmental Protection Agency), 1987. "Radiation Protection Guidance to Federal Agencies for Occupational Exposure," *Federal Register* 52, No. 17, 2822; with corrections published in the *Federal Registers* of Friday, January 30, and Wednesday, February 4, 1987.

3. ICRP (International Commission on Radiological Protection), 1977. "Recommendations of the International Commission on Radiological Protection," ICRP Publication 26, *Annals of the ICRP, Vol. 1, No. 3* (Pergamon Press, New York).

4. NCRP (National Council on Radiation Protection and Measurements), 1987. "Recommendations on Limits for Exposure to Ionizing Radiation," NCRP 91; superseded by NCRP Report No. 116.

5. 10 CFR 835, 1998, "Occupational Radiation Protection." Rule; DOE *Federal Register*, November 4, 1998. Amended August 11, 2017.

6. DOE O 231.1B, 2011, "Environment, Safety and Health Reporting," June 27, 2011.

7. REMS Data Reporting Guide, issued January 23, 2023. Online at: https://www.energy.gov/ehss/downloads/radiation-exposure-monitoring-systems-data-reporting-guide.

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.

9. DOE O 210.2A, "DOE Corporate Operating Experience Program," April 8, 2011. Online at: https://www.directives.doe.gov/directives-documents/200-series/0210.2-BOrder-a/@@images/file.

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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

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

1. Identification:

   Name: _____

   Title: _____

   Mailing Address: _____

   _____

   _____

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2. Distribution:

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

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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.

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).

Exhibit A-1: Labor Categories and Occupation Codes.

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 - ETTP	●	●	●	●	●
	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% ▲	–	–
Totals	**826.474**	**10% ▲**	**16,903**	**–2% ▼**	**0.049**	**13% ▲**	**12%**	**16% ▲**

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	◊	–	◊
Totals	**893.125**	**8%** ▲	**16,774**	**–1%** ▼	**0.053**	**9%** ▲	**18%**	**53%** ▲

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%** ▲	–	–
Totals	**949.395**	**6%** ▲	**18,469**	**10%** ▲	**0.051**	**–3%** ▼	**10%**	**–43%** ▼

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 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 2021	Average Measurable CED 2022	Average Measurable CED 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	**0.051**	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	**0.035**
Oak Ridge: Y–12 National Security Complex	**1,130**	**1,201**	**1,226**	**41.680**	**43.806**	**38.757**	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	–	–	**0.064**	–
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	–
Totals	**1,240**	**1,327**	**1,333**	**43.789**	**45.805**	**41.563**	**0.035**	**0.035**	**0.031**

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. 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)
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	**0.118**
Los Alamos National Laboratory	12,769	1,701	346	117	15	3	1	–	**14,952**	**2,183**	**15%**	**158.763**	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	–	–	–	–
Totals	**78,955**	**2,826**	**474**	**132**	**18**	**4**	**3**	**–**	**82,412**	**3,457**	**4%**	**221.754**	**0.064**

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	**73%**	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	–	–	–	–	**23,777**	24%	**5,620**	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	**283.582**	**0.079**
Totals	**50,890**	**14,937**	**1,383**	**443**	**98**	**29**	**13**	**–**	**–**	**–**	**–**	**67,793**	**25%**	**16,903**	**826.474**	**0.049**

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**
Totals	**58,574**	**14,728**	**1,374**	**453**	**137**	**60**	**22**	–	–	–	–	**75,348**	**22%**	**16,774**	**893.125**	**0.053**

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
Totals	**63,943**	**16,137**	**1,659**	**523**	**116**	**28**	**6**	**–**	**–**	**–**	**–**	**82,412**	**22%**	**18,469**	**949.395**	**0.051**

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/ Uranium Enrichment	Fuel Processing	Maintenance and Support	Reactor	Research, General	Research, Fusion	Waste Processing/ Management	Weapons Fabrication 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
Totals	**20.139**	**2.497**	**9.030**	**31.152**	**0.719**	**272.907**	**0.253**	**168.990**	**283.582**	**37.205**	**826.474**

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/ Uranium Enrichment	Fuel Processing	Maintenance and Support	Reactor	Research, General	Research, Fusion	Waste Processing/ Management	Weapons Fabrication 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
Totals	**14.434**	**6.688**	**13.023**	**37.795**	**2.188**	**281.000**	**0.588**	**236.665**	**325.377**	**31.637**	**949.395**

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/ Uranium Enrichment	Fuel Processing	Maintenance and Support	Reactor	Research, General	Research, Fusion	Waste Processing/ Management	Weapons Fabrication 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
Totals	**14.434**	**6.688**	**13.023**	**37.797**	**2.336**	**281.389**	**0.588**	**236.665**	**325.377**	**32.404**	**950.701**

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
Totals	**7,991**	**342**	**38**	**2**	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**8,373**	**5%**	**382**	**14.434**	**0.038**

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)
ENRICHMENT																
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): ETTP	186	59	–	–	–	–	–	–	–	–	–	245	24%	59	0.577	0.010
Totals	**2,176**	**201**	**15**	–	–	–	–	–	–	–	–	**2,392**	**9%**	**216**	**6.688**	**0.031**
PROCESSING																
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
Totals	**110**	**499**	**16**	–	–	–	–	–	–	–	–	**625**	**82%**	**515**	**13.023**	**0.025**

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
Totals	**5,595**	**746**	**91**	**16**	–	–	–	–	–	–	–	**6,448**	**13%**	**853**	**37.795**	**0.044**

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 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	172	20	6	1	–	–	–	–	–	–	–	**199**	14%	**27**	**2.188**	0.081
Brookhaven National Laboratory	6	–	–	–	–	–	–	–	–	–	–	6	0%	0	0.000	0.000
Totals	**178**	**20**	**6**	**1**	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**205**	**13%**	**27**	**2.188**	**0.081**

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	**0.103**
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	**46.920**	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 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	–	–	–	–	–	–	**5,595**	22%	**1,210**	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	**100%**	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	**100%**	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
Totals	**24,226**	**5,373**	**455**	**162**	**22**	**9**	**2**	**–**	**–**	**–**	**–**	**30,249**	**20%**	**6,023**	**281.000**	**0.047**

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
Totals	**359**	**50**	**1**	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**410**	**12%**	**51**	**0.588**	**0.012**

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	**0.149**
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	–	–	–	–	–	**2,227**	0.91	**2,029**	**89.895**	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	**1.00**	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
Totals	**4,236**	**4,814**	**384**	**91**	**29**	**2**	**–**	**–**	**–**	**–**	**–**	**9,556**	**0.56**	**5,320**	**236.665**	**0.044**

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
Totals	**12,849**	**3,201**	**594**	**243**	**64**	**17**	**4**	–	–	–	–	**16,972**	**24%**	**4,123**	**325.377**	**0.079**

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	**0.077**
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	–	–	–	–	–	–	**3,201**	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%	**278**	**5.444**	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
Totals	**6,223**	**891**	**59**	**8**	**1**	**–**	**–**	**–**	**–**	**–**	**–**	**7,182**	**13%**	**959**	**31.637**	**0.033**

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 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
Accelerator	Total	–	–	–	–	–	–	–	–	–
Fuel Fabrication	Total	–	–	–	–	–	–	–	–	–
Fuel Processing	Plutonium	–	1	–	–	0.031	–	–	0.031	–
	Total	**–**	**1**	**–**	**–**	**0.031**	**–**	**–**	**0.031**	**–**
Fuel/Uranium Enrichment	**Total**	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**–**
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
	Total	**2**	**1**	**5**	**0.017**	**0.004**	**0.008**	**0.009**	**0.004**	**0.002**
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	–	–	**0.081**	–	–
	Total	**5**	**6**	**2**	**0.130**	**0.057**	**0.024**	**0.026**	**0.010**	**0.012**
Reactor	Hydrogen-3	–	2	–	–	0.003	–	–	0.002	–
	Other	–	–	1	–	–	0.148	–	–	**0.148**
	Total	**–**	**2**	**1**	**–**	**0.003**	**0.148**	**–**	**0.002**	**0.148**
Research, Fusion	Hydrogen-3	–	14	–	–	0.035	–	–	0.003	–
	Total	**–**	**14**	**–**	**–**	**0.035**	**–**	**–**	**0.003**	**–**
Research, General	Americium	1	2	–	0.012	0.214	–	0.012	**0.107**	–
	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
	Total	**25**	**25**	**25**	**0.462**	**0.609**	**0.742**	**0.018**	**0.024**	**0.017**
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
	Total	**55**	**50**	**58**	**1.382**	**1.199**	**2.346**	**0.025**	**0.024**	**0.040**

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
	Total	**1,153**	**1,228**	**1,246**	**41.798**	**43.867**	**38.803**	**0.036**	**0.036**	**0.031**
	Totals	**1,240**	**1,326**	**1,246**	**43.789**	**45.768**	**38.803**	**0.035**	**0.035**	**0.031**

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
Totals	**50,890**	**14,937**	**1,383**	**443**	**98**	**29**	**13**	–	–	–	–	**67,793**	**25%**	**16,903**	**826.474**	**0.049**

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
Totals	**58,574**	**14,728**	**1,374**	**453**	**137**	**60**	**22**	–	–	–	–	**75,348**	**22%**	**16,774**	**893.125**	**0.053**

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
Totals	**63,943**	**16,137**	**1,659**	**523**	**116**	**28**	**6**	–	–	–	–	**82,412**	**22%**	**18,469**	**949.395**	**0.051**

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 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
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	**0.051**	**0.040**	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	**324**	**349**	**390**	**12.022**	**12.296**	**11.145**	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	**0.069**
Unknown	126	111	120	3.833	3.538	3.096	0.030	0.032	0.026
Totals	**1,240**	**1,327**	**1,333**	**43.789**	**45.805**	**41.563**	**0.035**	**0.035**	**0.031**

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
	Sales	15	–	–	–	–	–	–	–	–	–	–	15				
Miscellaneous	Military	26	1	–	–	–	–	–	–	–	–	–	27	4%	1	0.015	0.015
	Miscellaneous	6,834	843	47	14	2	1	–	–	–	–	–	7,741	12%	907	33.168	0.037
Production	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	v	–	–	–	–	–	–	–	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
Totals		**63,943**	**16,137**	**1,659**	**523**	**116**	**28**	**6**	–	–	–	–	**82,412**	**22%**	**18,469**	**949.395**	**0.051**

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. To 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	Total Indiv. With Meas. CED	Collective CED (person–rem)	Avg. CED (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	**0.059**
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	–	–	–	–	–	–	–	**1,223**	**38.722**	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
Totals		**706**	**558**	**66**	**3**	–	–	–	–	–	–	–	**1,333**	**41.563**	**0.031**

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 rems)**	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
Totals	**73,070**	**6,133**	**2,615**	**533**	**55**	**6**	–	–	**82,412**	**9,342**	**61**	**2,481.373**	**0.266**

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.

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