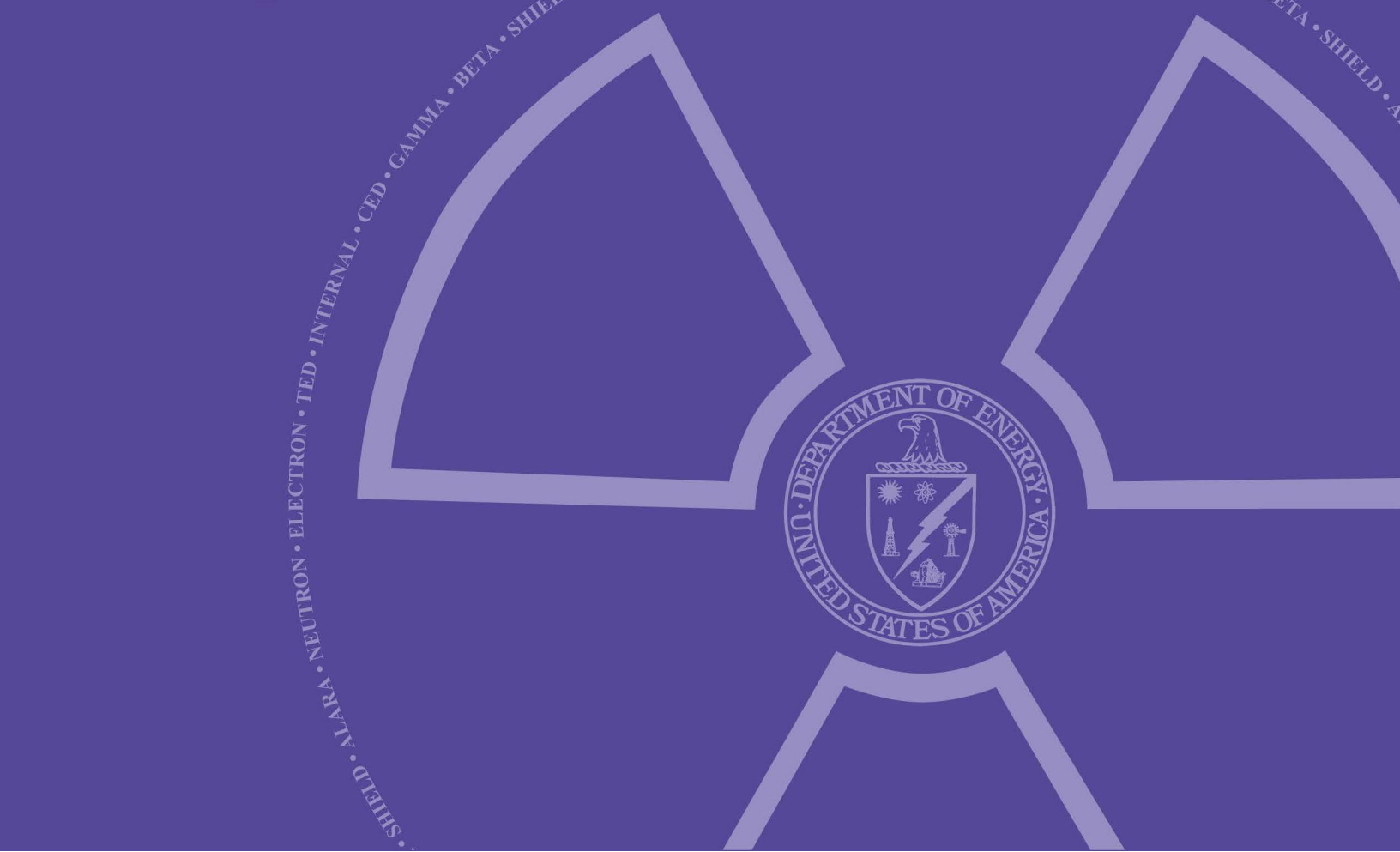
Office of Environment, Health, Safety and Security

U.S. Department of Energy

Occupational Radiation Exposure Report for CY 2022



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https://energy.gov/ehss/occupational-radiation-exposure

U.S. Department of Energy

Occupational Radiation Exposure Report for Calendar Year 2022

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Foreword

The *U.S. Department of Energy Occupational Radiation Exposure Report for Calendar 2022* presents the results of analyses of occupational radiation exposures at the Department of Energy (DOE), including the National Nuclear Security Administration (NNSA) operations, during calendar year 2022. This report includes occupational radiation exposure data for over 75,000 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) 2022 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 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
EE	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
MPPB	Main Plant Process Building
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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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) 2022. The report includes occupational radiation exposure information for over 75,000 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 2022 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 2022 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 less than 1 percent of the 5 rem (50 mSv) TED limit.

In addition, from CY 2021 to CY 2022:

- The number of individuals with measurable dose decreased by less than 1 percent; however, the collective TED increased by 8 percent;
- Collective CED (internal exposure to Uranium-234 (U-234)) increased by 5 percent to 45.8 person-rem (458 person-mSv); and
- Collective TED for transient individuals increased by 97.2 percent to 29.96 person-rem (299.6 person-mSv).

The collective dose at DOE facilities has decreased by 89 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 lowering occupational radiation dose.

Over the past 5 years, only two monitored individuals, both at Los Alamos National Laboratory (LANL), received a dose above the 2 rem (20 mSv) TED administrative control level.

- In CY 2018, an individual received a TED of 3.8 rem (38 mSv) when a technician breached his glove while performing glovebox maintenance. A survey of the worker detected alpha contamination on two fingers of the worker's hand, and the results of a diagnostic bioassay confirmed that an intake had occurred.
- In CY 2020, an individual received a TED of 3.0 rem (30 mSv) after an airborne release. 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 in a glovebox glove.
- Details of these incidents are available in the occurrence reports NA--LASO-LANL-TA55-2018-0013 and NA--LASO-LANL-TA55-2020, respectively.

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

https://energy.gov/ehss/occupational-radiation-exposure

Introduction

The *U.S. Department of Energy Occupational Radiation Exposure Report for Calendar Year 2022* presents the results of analyses of occupational radiation exposures at Department of Energy (DOE), including the National Nuclear Security Administration (NNSA), operations during calendar year (CY) 2022. 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 2022 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 2021 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 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 2022.

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 [1]. 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 [1] and the CY 1987 recommendations of the National Council on Radiation Protection and Measurements (NCRP) Publication 91 [3]. 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 [4] and are summarized in *Exhibit 2-2*.

2.3 Reporting Requirements

DOE O 231.1B, *Environment, Safety and Health Reporting* [5] 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 [6] 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 [4]	Issued 12/14/93 Amended 11/4/98 Amended 6/8/07 Amended 4/13/11 Amended 8/11/17	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 [5]	Approved 6/27/11 Amended 11/28/12	Requires the annual reporting of occupational radiation exposure records to the DOE REMS repository.
REMS Reporting Guide [6]	Issued 2/23/12	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

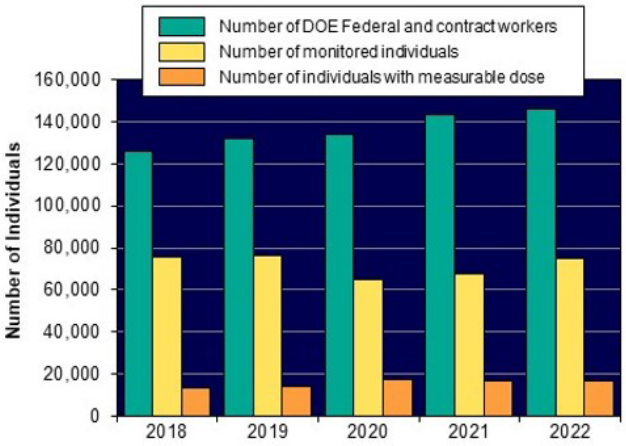
DOE uses the number of individuals with measurable dose to represent the exposed workforce size. In this context, "with measurable dose" means that a detectable value was reported for the individual.

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 an annual TED of 3.8 rem (38 mSv) in CY 2018, and another individual received a single dose of 3.0 rem (30 mSv) TED in CY 2020. Both doses 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 11 percent from a value of 67,779 in CY 2021 to a value of 75,292 in CY 2022. 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 2018 – 2022.



For CY 2022, 52 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 2018 – 2022.

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**
2018	125,969	75,654	60% ▼	13,337	18% ▲
2019	131,810	76,181	58% ▼	13,825	18%
2020	134,040	64,726	48% ▼	17,257	27% ▲
2021	143,277	67,779	47% ▼	16,883	25% ▼
2022	145,895	75,292	52% ▲	16,767	22% ▼
5-Year Average	**136,198**	**71,926**	**53%**	**15,614**	**22%**

* The number of DOE and contract workers was determined from the total annual work hours at DOE [7] 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 decreased by less than 1 percent from a value of 16,883 in CY 2021 to a value of 16,767 in CY 2022. With the increase in the number of monitored individuals post-COVID, the percentage of individuals with measurable dose decreased to 22 percent in CY 2022 from 25 percent in CY 2021.

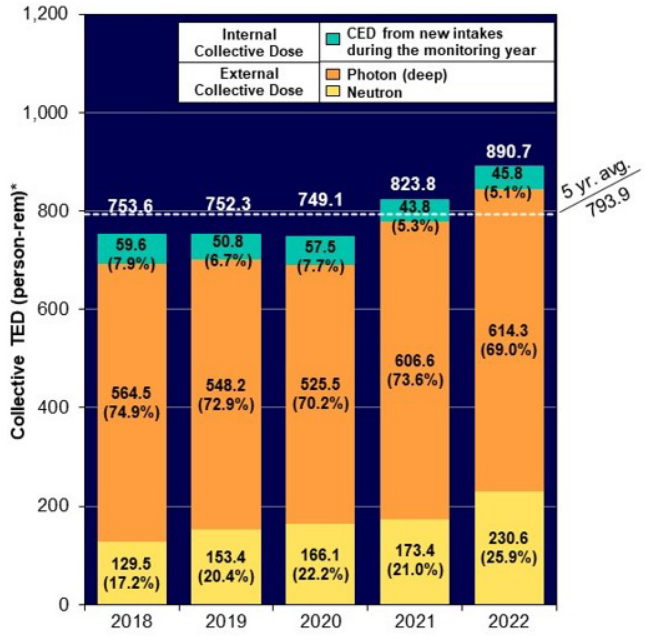
3.2.3 Collective Dose

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 8 percent from 823.833 person-rem (8,238 person-mSv) in CY 2021 to 890.673 person-rem (8,906 person-mSv) in CY 2022. The internal dose is based on the 50-year CED methodology.

Exhibit 3-2: Components of TED, CY 2018 – 2022.



The collective TED increased by 8 percent at DOE from CY 2021 to 2022.

The collective internal dose increased by 5 percent from CY 2021 to 2022.

The collective neutron dose increased by 33 percent from CY 2021 to 2022.

The collective photon dose increased by 1 percent from CY 2021 to 2022.

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

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

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

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

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. In other words, the CED is the effective dose from radionuclides taken into the body during the reporting year integrated over the next 50 years.

The internal dose component of the collective TED increased by 5 percent from 43.8 person-rem (438 person-mSv) in CY 2021 to 45.8 person-rem (458 person-mSv) in CY 2022 due to increases at Idaho and Savannah River Site. The collective photon dose increased by 1 percent from 606.6 person-rem (6,066 person-mSv) in CY 2021 to 614.3 person-rem (6,143 person-mSv) in CY 2022 due to increases at Oak Ridge, Sandia, Portsmouth, and Brookhaven.

The neutron component of the collective TED increased by 33 percent from 173.4 person-rem (1,734 person-mSv) in CY 2021 to 230.6 person-rem (2,306 person-mSv). The increase in CY 2022 resulted primarily from increases in collective neutron dose at Los Alamos National Laboratory (LANL).

Five DOE sites contributed 89 percent of the collective TED in CY 2022. In descending order of collective TED, these were: LANL, Savannah River, Oak Ridge, Idaho, and Hanford. LANL, Hanford and Oak Ridge had increases in collective TED in CY 2022, while collective TED decreased at Idaho and Savannah River. (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 increased by 9 percent from 0.048 rem (0.480 mSv) in CY 2021 to 0.053 rem (0.530 mSv) in CY 2022.

Exhibit 3-3: Average Measurable TED, CY 2018 – 2022.

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) [4].

The number of individuals in each dose range above 0.250 rem (2.5 mSv) increased from CY 2021 to CY2022. In the past 5 years, only two individuals have received doses above 2.0 rem—one in CY 2018, and one in CY 2020.

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 88 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 2018 – 2022.

	TED Range (rem)*	2018	2019	2020	2021	2022
Number of Individuals in Each Dose Range	Less than measurable	62,317	62,356	47,469	50,896	58,525
	Measurable to 0.100	11,419	11,947	15,683	14,927	14,722
	0.100 – 0.250	1,337	1,311	1,163	1,378	1,377
	0.250 – 0.500	429	424	311	438	449
	0.500 – 0.750	97	90	64	98	138
	0.750 – 1.000	39	42	24	29	62
	1.0 – 2.0	15	11	11	13	19
	2.0 – 3.0	-	-	-	-	-
	3.0 – 4.0	1	-	1	-	-
	4.0 – 5.0	-	-	-	-	-
	>5.0	-	-	-	-	-
Total number of records for monitored individuals		75,654	76,181	64,726	67,779	75,292
Number with measurable dose		13,337	13,825	17,257	16,883	16,767
Number with dose >0.100 rem		1,918	1,878	1,574	1,956	2,045
Collective TED (person-rem)		753.561	752.335	749.138	823.833	890.673
Average measurable TED (rem)		0.057	0.054	0.043	0.049	0.053

* 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 2018 – 2022.

	TED Range (rem)*	2018	2019	2020	2021	2022
Percentage of Individuals with Measurable TED	Measurable <0.100	85.62%	86.42%	90.88%	88.41%	87.80%
	0.100 – 0.250	10.02%	9.48%	6.74%	8.16%	8.21%
	0.250 – 0.500	3.22%	3.07%	1.80%	2.59%	2.68%
	0.500 – 0.750	0.73%	0.65%	0.37%	0.58%	0.82%
	0.750 – 1.000	0.29%	0.30%	0.14%	0.17%	0.37%
	1.0 – 2.0	0.11%	0.08%	0.06%	0.08%	0.11%
	2.0 – 3.0	-	-	-	-	-
	3.0 – 4.0	0.01%	-	0.01%	-	-
	4.0 – 5.0	-	-	-	-	-
	>5.0	-	-	-	-	-
% of monitored individuals with measurable dose		18%	18%	27%	25%	22%
% of monitored individuals with dose > 0.100 rem		3%	2%	2%	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 2018 – 2022.

In CY 2018, one individual exceeded the 10 CFR 835.202 total organ dose (TOD) limit of 50 rem (500 mSv) from a plutonium-238 intake at LANL, which resulted in a TOD to the bone surfaces of 118.5 rem (1,185 mSv). Details of the incident are available in the occurrence report NA--LASO-LANL-TA55-2018-0013.

Eighty-eight percent of monitored individuals who received a measurable dose in CY 2022, 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* [8] 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 at LANL's Plutonium Processing and Handling Facility. The source of the contamination was determined to be a breach in a glovebox glove. 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.

In CY 2018, an individual at LANL received a TED of 3.8 rem (38 mSv) when a technician breached his glove while performing glovebox maintenance. A survey of the worker detected alpha contamination on two fingers of the worker's hand, and the results of a diagnostic bioassay confirmed that an intake had occurred. Details of the incident are available in the occurrence report NA--LASO-LANL-TA55-2018-0013.

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 2018 – 2022. The number of individuals with measurable CED increased by 7 percent from 1,240 in CY 2021 to 1,327 in CY 2022, and the collective CED increased by 5 percent. The average measurable CED remained unchanged from CY 2021 to CY 2022 at 0.035 rem (0.350 mSv) and remained below the 5-year average measurable CED as well.

Ninety-five percent of the collective CED in CY 2022 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.

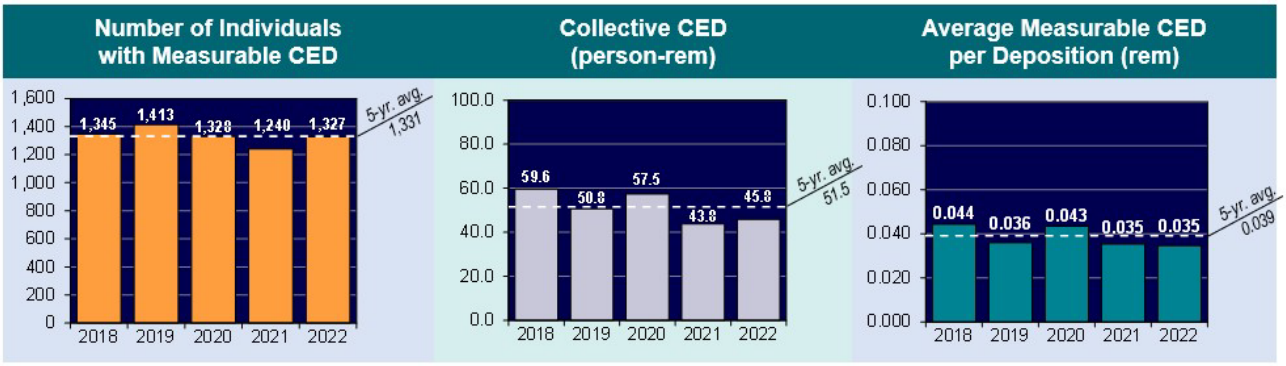
Exhibit 3-7 shows the distribution of the CED from CY 2018 – 2022. The total number of individuals with measurable CED in each dose range is the sum of the number of individuals receiving a CED in the dose range. Individuals may have had more than one intake of radioactive material, but the site would 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 2022, 52 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 5 percent of the collective TED; although only 8 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) [4]. 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 2018 – 2022.



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 2018 – 2022.

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		
2018	629	559	141	14	1	-	-	-	1	-	-	1,345	59.556
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

* 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 [6].

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.

Paducah Gaseous Diffusion Plant, Oak Ridge, and LLNL had the largest percentage increases in the number of "Urinalysis" measurements in CY 2022, with increases averaging about 16 percent between CY 2021 and CY 2022. Seventy-seven percent of the "Urinalysis" measurements in CY 2022 were performed at four sites: Y-12, LANL, Savannah River Site, and Hanford Site.

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, Savannah River Site, and Office of River Protection (ORP)—accounted for 72 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 2022.

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.

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.

Y-12 performed the largest number of bioassay and air sampling measurements combined, comprising 30 percent of the total measurements taken.

Exhibit 3-8: Bioassay Measurements, CY 2018 – 2022.

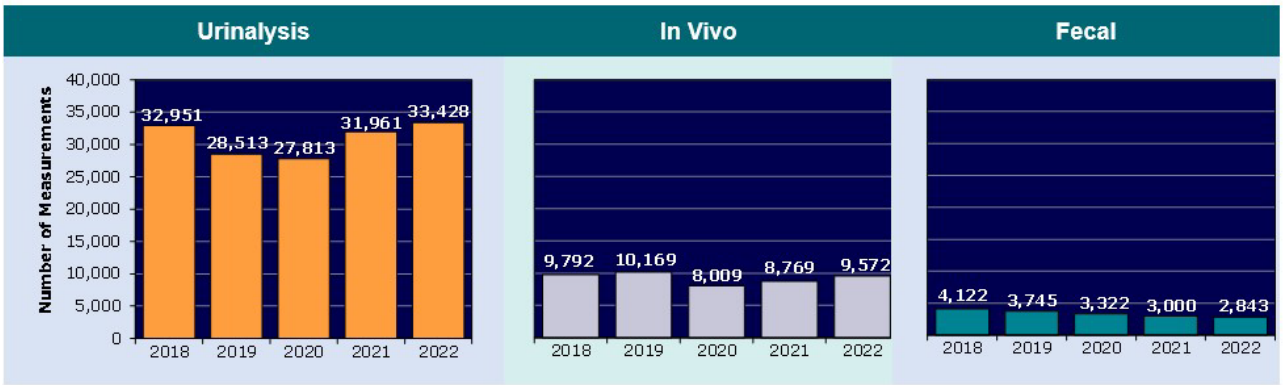


Exhibit 3-9: Air Sampling Measurements, CY 2018 – 2022.

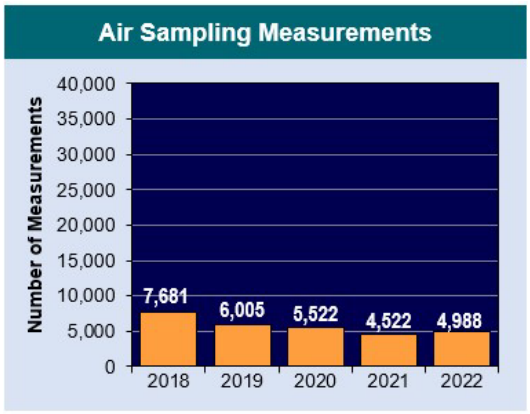
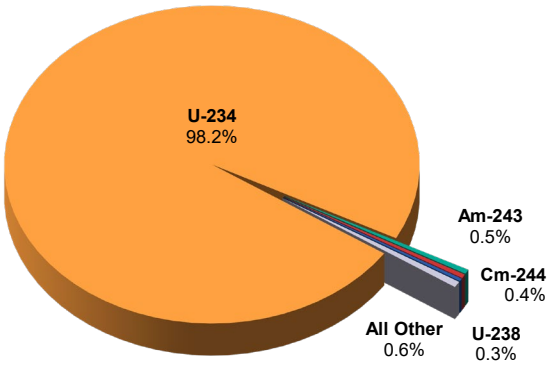


Exhibit 3-10 shows the breakdown of the collective CED by radionuclide for CY 2022. Uranium-234 (U-234) accounted for the largest percentage of the collective CED, with 98 percent of this dose accrued at Y-12.

"Air Sampling" accounted for 11 percent of the total measurements. Savannah River Site performed the largest number of air sampling measurements, comprising 99 percent of the total air measurements taken in CY 2022 (see *Exhibit 3-14* for additional information).

Exhibit 3-10: Collective CED by Radionuclide from Internal Exposure, CY 2022.



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 2020 – 2022 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 8 percent from 823.833 person-rem (8,238 person-mSv) in CY 2021 to 890.673 person-rem (8,906 person-mSv) in CY 2022, with LANL, Savannah River, Idaho, Oak Ridge, and Hanford contributing 89 percent of the total DOE collective TED.

Exhibit 3-11: Collective TED by DOE Site for CY 2020 – 2022.

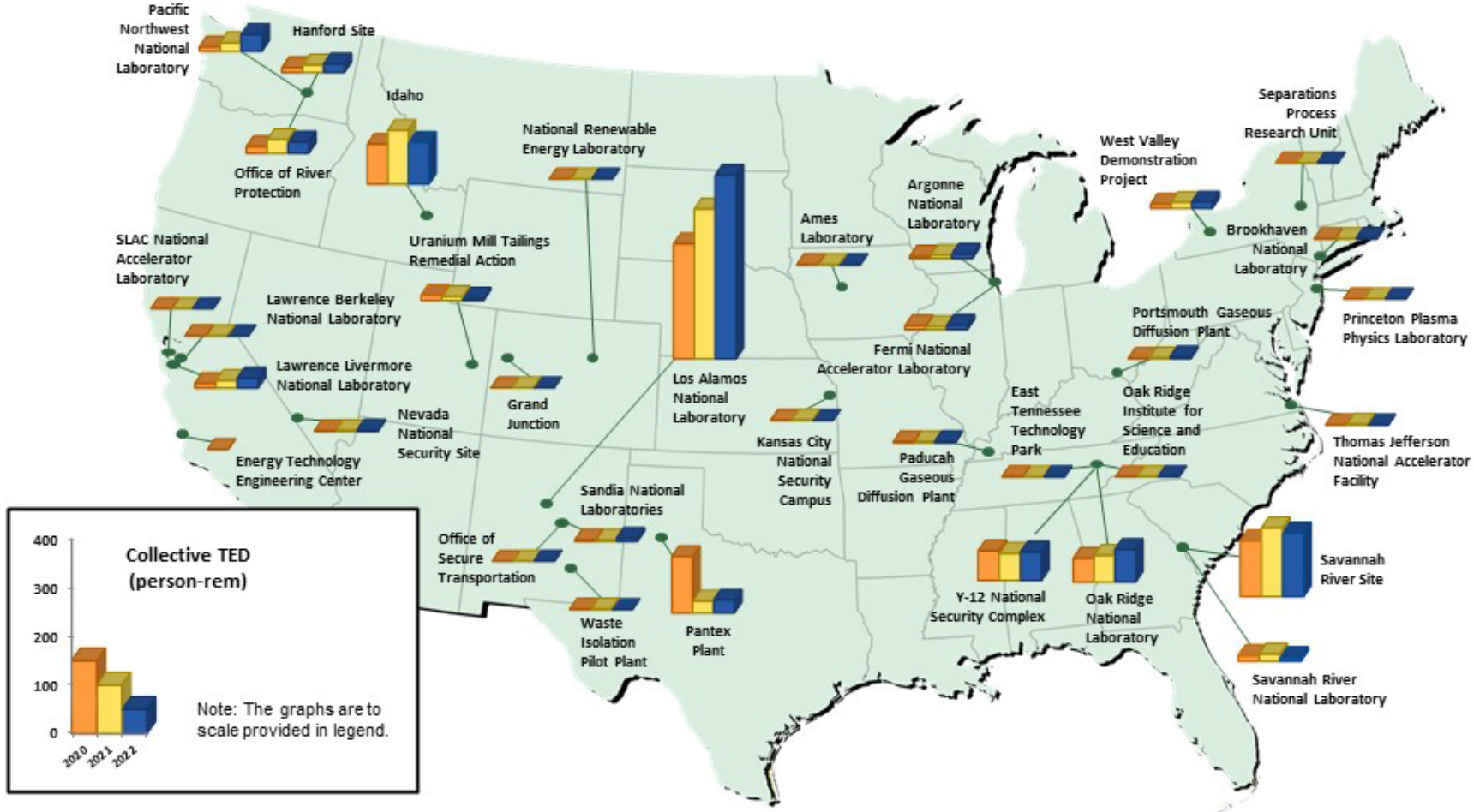


Exhibit 3-12: Collective TED and Number of Individuals with Measurable TED by DOE Site, CY 2020 – 2022.

Site	2020		2021		2022	
	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	0.777	30	0.710	30	0.565	26
Argonne National Laboratory	4.609	65	6.385	96	8.651	115
Brookhaven National Laboratory	1.161	111	0.977	60	1.976	87
Energy Technology Engineering Center *	0.045	8	-	-	-	-
Fermi National Accelerator Laboratory	7.850	168	6.110	195	8.780	143
Grand Junction Site	0.043	14	0.158	28	0.013	4
Hanford:						
Hanford Site	9.797	485	15.128	534	17.308	555
Office of River Protection	13.291	461	27.476	706	22.637	562
Pacific Northwest National Laboratory	8.523	408	17.127	533	33.264	537
Hanford Totals:	31.611	1,354	59.731	1,773	73.209	1,654
Idaho	80.614	1,667	108.728	1,568	84.569	1,602
Kansas City National Security Campus	0.493	93	0.920	68	0.110	33
Lawrence Berkeley National Laboratory	0.834	14	0.582	13	0.497	12
Lawrence Livermore National Laboratory	8.876	131	15.039	155	19.330	228
Los Alamos National Laboratory	**232.736**	2,523	**303.186**	4,206	**371.500**	**4,467**
National Renewable Energy Laboratory	0.030	4	0	0	0.005	2
Nevada National Security Site	1.800	72	1.821	38	2.876	53
Oak Ridge:						
East Tennessee Technology Park	0.751	102	0.468	53	0.701	62
Oak Ridge Institute for Science and Education	0	0	0.025	2	0.129	13
Oak Ridge National Laboratory	47.666	610	53.455	976	65.393	1,096
Y-12 National Security Complex	59.591	1,428	54.186	1,436	57.144	1,571
Oak Ridge Totals:	108.008	2,140	108.134	2,467	123.367	2,742
Office of Secure Transportation	0.025	2	0.084	6	0.157	3
Paducah Gaseous Diffusion Plant	2.654	116	2.465	92	2.983	83
Pantex Plant	113.909	3,563	23.755	402	25.909	478
Portsmouth Gaseous Diffusion Plant	1.107	40	2.029	69	4.259	133
Princeton Plasma Physics Laboratory	0.234	54	0.222	42	0.255	47
Sandia National Laboratories	3.287	89	3.092	105	6.477	127
Savannah River:						
Savannah River National Laboratory	11.717	445	14.896	483	7.665	371
Savannah River Site	112.247	4,220	137.840	4,647	128.062	4,083
Savannah River Totals:	123.964	**4,665**	152.736	**5,130**	135.727	4,454
Separations Process Research Unit	0	0	0.012	1	0.016	1
SLAC National Accelerator Laboratory	0.146	2	0	0	0	0
Thomas Jefferson National Accelerator Facility	0.607	22	1.974	48	0.854	53
Uranium Mill Tailings Remedial Action Project	10.604	97	7.836	65	4.765	61
Waste Isolation Pilot Plant	1.130	67	1.283	78	0.449	25
West Valley Demonstration Project	8.868	112	12.145	108	12.946	119
Service Center Personnel **	3.116	34	3.719	40	0.428	15
Totals	**749.138**	**17,257**	**823.833**	**16,883**	**890.673**	**16,767**

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

* Energy Technology Engineering Center (ETEC) eliminated personnel dosimeters in 2020 due to no accessible radiological areas present onsite; therefore, no individuals were monitored.

** 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 2021 to 2022

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 increased from 303.186 person-rem (3,031 person-mSv) in CY 2021 to 371.500 person-rem (3,715 person-mSv) in CY 2022. (See Exhibit 3-12 and section 3.4.3.)

Twelve of the 33 DOE sites reported decreases in the collective TED from the CY 2021 values, and 20 of the 33 DOE sites reported increases in the collective TED from the CY 2021 values. One site, SLAC National Accelerator Laboratory (SLAC), performed no radiological work activities in CY 2021 or CY 2022 and therefore had no change in their collective TED of zero.

Nineteen of the 33 reporting sites experienced increases in the number of workers with a measurable TED from CY 2021 to 2022. The largest increase in total number of individuals with a measurable TED occurred at Oak Ridge, with an increase of 275 individuals or 11 percent (see *Exhibit 3-14)*. The second largest increase in total number of individuals with a measurable TED occurred at LANL, with an increase of 261 individuals, or 6 percent.

Thirteen of the 33 reporting sites experienced decreases in the number of individuals with a measurable TED from CY 2021 to 2022. One site, Separations Process Research Unit had no change in number of individuals with measurable TED from CY 2021 to CY 2022. The largest decrease in the number of individuals receiving a measurable TED occurred at Savannah River, with a decrease of 676 individuals, or 13 percent. A discussion of activities at the highest dose facilities is included in section 3.4.3.

3.4.3 Activities Significantly Contributing to Collective Dose in CY 2022

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 2022 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 2022 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.

Exhibit 3-14 Site Listing > 5 Person-Rem

Los Alamos National Laboratory (LANL) 3-13
Savannah River Site 3-13
Idaho 3-13
Oak Ridge: Oak Ridge National Laboratory (ORNL) 3-14
Oak Ridge: Y-12 National Security Complex (Y-12) 3-14
Hanford: Pacific Northwest National Laboratory (PNNL) .. 3-14
Pantex Plant (Pantex) 3-15
Hanford: Office of River Protection (ORP) 3-15
Lawrence Livermore National Laboratory (LLNL) 3-15
Hanford: Hanford Site 3-16
West Valley Demonstration Project (WVDP) 3-16
Fermi National Accelerator Laboratory (Fermilab) 3-16
Argonne National Laboratory (ANL) 3-17
Savannah River National Laboratory 3-17
Sandia National Laboratories (SNL) 3-17

Exhibit 3-15 Site Listing < 5 Person-Rem

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

Exhibit 3-13: Site Dose Data, CY 2022.

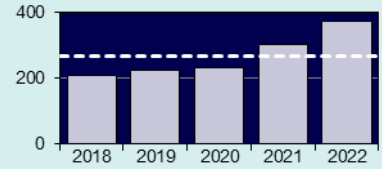
Site	2022							
	Collective TED (person-rem)	Percent Change from 2021	Number of Monitored Individuals	Percent Change from 2021	Number with Meas. TED	Percent Change from 2021	Avg. Meas. TED (person-rem)	Percent Change from 2021
Ames Laboratory	0.565	◊	139	◊	26	◊	0.022	◊
Argonne National Laboratory	8.651	35% ▲	1,765	6% ▲	115	20% ▲	0.075	13% ▲
Brookhaven National Laboratory	1.976	102% ▲	2,205	11% ▲	87	45% ▲	0.023	39% ▲
Fermi National Accelerator Laboratory	8.780	44% ▲	1,339	10% ▲	143	-27% ▼	0.061	**96%** ▲
Grand Junction Site	0.013	◊	27	◊	4	◊	0.003	◊
Hanford:								
Hanford Site	17.308	14% ▲	3,471	-14% ▼	555	4% ▲	0.031	10% ▲
Office of River Protection	22.637	-18% ▼	3,415	◊	562	-20% ▼	0.040	3% ▲
Pacific Northwest National Laboratory	33.264	94% ▲	2,568	**35%** ▲	537	1% ▲	0.062	93% ▲
Hanford Totals:	73.209	23% ▲	9,454	1% ▲	1,654	-7% ▼	0.044	31% ▲
Idaho	84.569	-22% ▼	6,813	11% ▲	1,602	2% ▲	0.053	-24% ▼
Kansas City National Security Campus	0.110	◊	201	◊	33	◊	0.003	◊
Lawrence Berkeley National Laboratory	0.497	◊	1,018	◊	12	◊	0.041	◊
Lawrence Livermore National Laboratory	19.330	29% ▲	4,085	15% ▲	228	47% ▲	0.085	-13% ▼
Los Alamos National Laboratory	**371.500**	23% ▲	**12,981**	19% ▲	**4,467**	6% ▲	0.083	15% ▲
National Renewable Energy Laboratory	0.005	◊	7	◊	2	◊	0.003	◊
Nevada National Security Site	2.876	58% ▲	778	6% ▲	53	39% ▲	0.054	13% ▲
Oak Ridge:								
East Tennessee Technology Park	0.701	◊	182	◊	62	◊	0.011	◊
Oak Ridge Institute for Science and Education	0.129	◊	88	◊	13	◊	0.010	◊
Oak Ridge National Laboratory	65.393	22% ▲	4,939	22% ▲	1,096	12% ▲	0.060	9% ▲
Y-12 National Security Complex	57.144	5% ▲	7,136	16% ▲	1,571	9% ▲	0.036	-4% ▼
Oak Ridge Totals:	123.367	14% ▲	12,345	19% ▲	2,742	11% ▲	0.045	3% ▲
Office of Secure Transportation	0.157	◊	336	◊	3	◊	0.052	◊
Paducah Gaseous Diffusion Plant	2.983	21% ▲	1,548	3% ▲	83	-10% ▼	0.036	34% ▲
Pantex Plant	25.909	9% ▲	3,931	15% ▲	478	19% ▲	0.054	-8% ▼
Portsmouth Gaseous Diffusion Plant	4.259	**110%** ▲	2,356	4% ▲	133	**93%** ▲	0.032	9% ▲
Princeton Plasma Physics Laboratory	0.255	◊	349	◊	47	◊	0.005	◊
Sandia National Laboratories	6.477	109% ▲	2,044	7% ▲	127	21% ▲	0.051	73% ▲
Savannah River:								
Savannah River National Laboratory	7.665	-49% ▼	501	-10% ▼	371	-23% ▼	0.021	-33% ▼
Savannah River Site	128.062	-7% ▼	6,521	6% ▲	4,083	-12% ▼	0.031	6% ▲
Savannah River Totals:	135.727	-11% ▼	7,022	5% ▲	4,454	-13% ▼	0.030	2% ▲
Separations Process Research Unit	0.016	◊	8	◊	1	◊	0.016	◊
SLAC National Accelerator Laboratory	0.000	◊	1,751	◊	0	◊	0.000	◊
Thomas Jefferson National Accelerator Facility	0.854	◊	1,222	◊	53	◊	0.016	◊
Uranium Mill Tailings Remedial Action Project	4.765	-39% ▼	146	-1% ▼	61	-6% ▼	0.078	-35% ▼
Waste Isolation Pilot Plant	0.449	◊	708	◊	25	◊	0.018	◊
West Valley Demonstration Project	12.946	7% ▲	425	5% ▲	119	10% ▲	**0.109**	-3% ▼
Service Center Personnel*	0.428	◊	289	◊	15	◊	0.029	◊
Totals	**890.673**	**8%** ▲	**75,292**	**11%** ▲	**16,767**	**-1%** ▼	**0.053**	**9%** ▲

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.

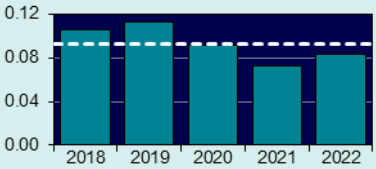
Exhibit 3-14: Activities Significantly Contributing to Collective TED in CY 2022, in Descending Order of Collective Dose.

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

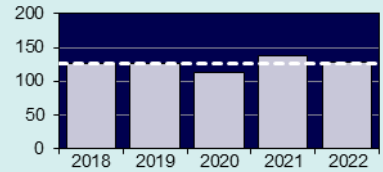
- Weapons manufacturing and related work at the TA-55 plutonium facility;
- Plutonium-238 work;
- Retrieval, repackaging, and shipping of radioactive waste; and
- Infrastructure support for radiological work and facility maintenance.

Changes in Dose

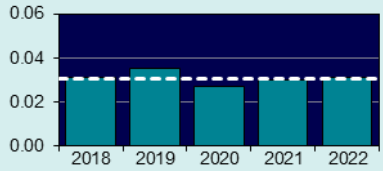
- A primary contributor to dose in CY 2022 was work with Pu-238, producing general purpose heat sources and other infrastructure support for radiological work at the TA-55 plutonium facility; and
- In CY 2022, there was an increase in work at TA-55, leading, to an increase in the number of personnel, and subsequently, an increase in collective dose.

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

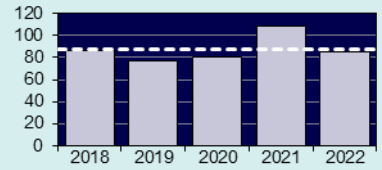
- Continued processing Canadian Target Residue Material;
- The deactivation of 235-F was completed, post-closure care activities performed at closed reactor facilities; and plutonium down blending in area K which was completed ahead of schedule in FY 2022.

Changes in Dose

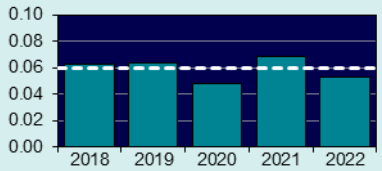
- The dose decreased in CY 2022 as deactivation work was completed, and
- The Solid Waste Management Facility (SWMF) completed the 10-year campaign to store and ship down blended transuranic (TRU) waste to the Waste Isolation Pilot Plant (WIPP).

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

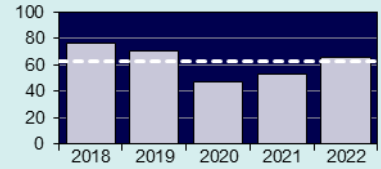
- Work at the Advanced Test Reactor (ATR) Complex, including experiment system operations, plant maintenance and modifications, routine ATR power and outage operations, and Research and Development Operations/Laboratory support;
- Activities at the Materials and Fuel Complex including maintenance and 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

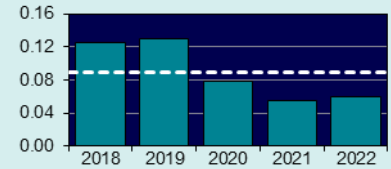
- Monitored individuals were primarily involved with contractor oversight in areas with minimal potential for occupational radiation exposure.

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

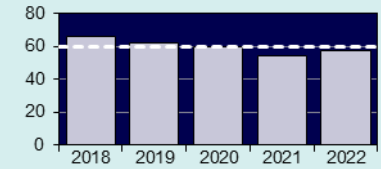
- Medical radioisotope production;
- Processing low-level and transuranic (TRU) waste at the TRU Waste Processing Center;
- Extracting Thorium and down-blending uranium oxide at ISOTEK.
- Providing materials for National Aeronautics and Space Administration (NASA); and
- Facility maintenance.

Changes in Dose

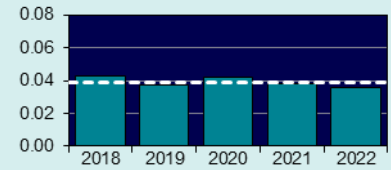
- The increase is primarily attributed to increases in operations activities and radioisotope production, particularly radioisotope production for industrial sponsors. Additionally, the number of ORNL monitored individuals increased by 28 percent over CY 2021.
- Radiation exposure increased when workers 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

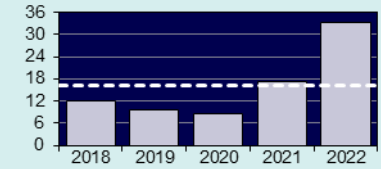
- Manufacture, processing, and storage of special nuclear materials;
- Characterization and hazardous waste removal at Y-12 Biology Complex; and
- Maintenance of equipment and facilities.

Changes in Dose

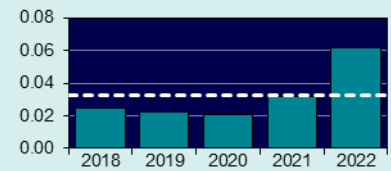
- The contributing factors that affected the observed increases in the 2022 dose values are a 16 percent increase in the number of individuals monitored coupled with a 3% increase in radiological work as evidenced by the number of entries on Radiological Work Permits (RWPs) in 2022.

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

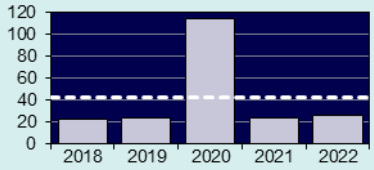
- Work at the Radiochemical Processing Laboratory;
- Radiation detection research; and
- Implementation of security measures for radiological materials of concern.

Changes in Dose

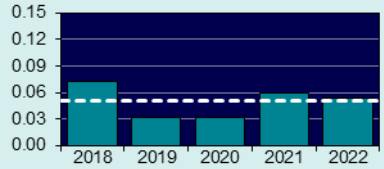
- The increase in dose is related to an increase in the volume of elevated risk high-dose radiological work performed during CY 2022.

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

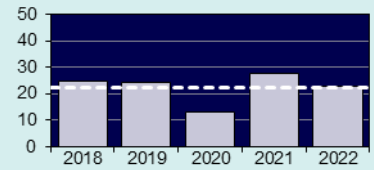
- Operations that expose individuals to large numbers of bare weapon pits containing significant quantities of special nuclear material (SNM); and
- Nuclear explosive assembly/disassembly operations, weapon dismantlement programs, life-extension programs, SNM Component Re-qualification, and SNM staging.

Changes in Dose

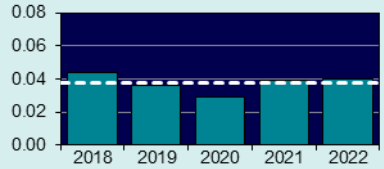
- The 9 percent dose increase in 2022 is the result of extensive hiring across the plant, double shift work, and other impacts that continue to evolve as goals for Pantex Production expand.

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

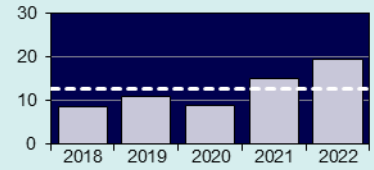
- Removal and transfer of waste from older single-shell tanks to newer, double-shell tanks;
- Maintenance and support of the evaporator, which reduces the volume of stored liquid waste by concentrating radioactive waste solutions;
- Work at the 222-S laboratory; and
- Well logging activities using an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

Changes in Dose

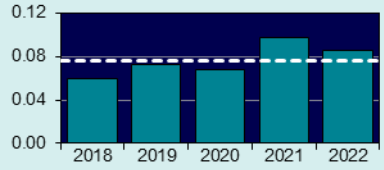
- The dose reduction is due primarily to a decrease in work activity due to some of the scope run to this year as well the continued efforts from the ALARA program.

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

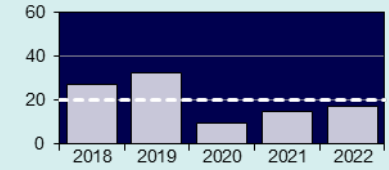
- Radiation-producing devices, such as x-ray machines, accelerators, and electron-beam welders; and
- Handling a wide range and quantity of radioactive materials.

Changes in Dose

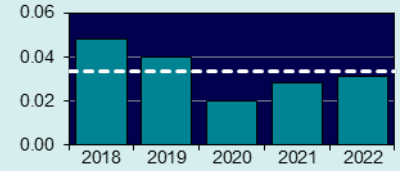
- The change in dose was due to 1) the higher amount of radiological work relative to the period of COVID restrictions and 2) a few individuals with relatively high doses. There was a 6.4 percent increase in the monitored population.

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

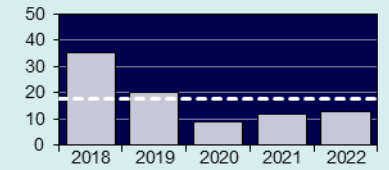
- Work activities at the plutonium finishing plant facility;
- Material handling and waste transfer; and
- Facility demolition and site remediation.

Changes in Dose

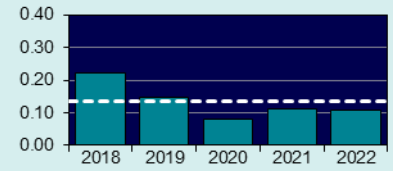
- The increase in collective TED was attributed to the resumption of operations in CY 2022 as compared with CY 2020 and CY2021 when radiological work was curtailed due to the COVID-19 pandemic.

West Valley Demonstration Project (WVDP)

Collective TED (person-rem)



Average Measurable TED (rem)



Site Description

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

Activities Involving Radiation Exposure

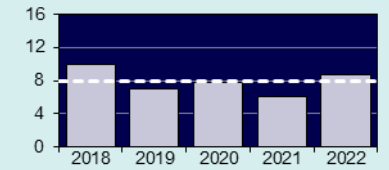
- Facility disposition;
- Deactivation work in the Main Plant Process Building (MPPB) and
- Radiological Control Technicians providing support for facility disposition activities.

Changes in Dose

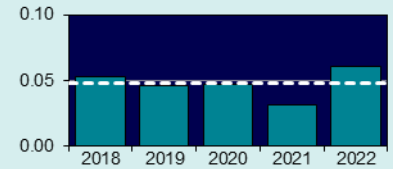
- Majority of dose was incurred during deactivation work in the MPPB; and
- Waste operations tasks conducted in lag storage and in the remote handled waste facility and
- The performance of complex hands-on work in an area exhibiting very high radiation levels that could not be reduced through conventional ALARA work strategies started in CY 2021, continued through most of CY 2022.

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

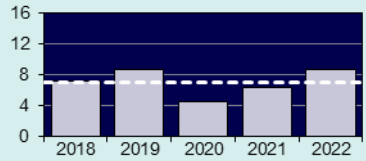
- Investigation of Muon Campus target rotation problems at AP-0, including removal of the shielding blocks over the target vault;
- Installation of new NuMi condensate pump and target;
- LCW hose replacement and ion pump cable repair in the MI-300 region of the Main Injector;
- Upgrade and repair activities of the accelerator complex; and
- Upgrade of the beam aperture in the RR-232 region of the Recycler.

Changes in Dose

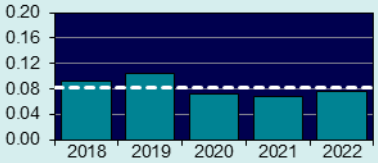
- The majority of dose to personnel resulted from work performed during the shutdown from June 11 to November 13 of CY 2022. Of the 763 planned jobs, 84 required Radiological Work Permits (RWPs), and completion of 10 ALARA jobs resulted in activities contributing significantly to the collective dose during the shutdown.

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

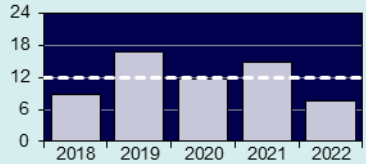
- Work supporting the lab's radiological facilities;
- Programmatic activities resulting primarily from research activities in the Irradiated Materials Laboratory; and
- Material handling, management, storage, and disposition activities associated with the Alpha Gamma Hot Cell Facility, the Waste Management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

Changes in Dose

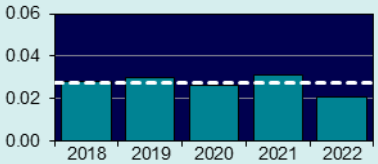
- Increased presence of workers on-site and work performed as the laboratory moved out of COVID-19 restrictions related to Minimum Safe Operations led to increased dose.

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

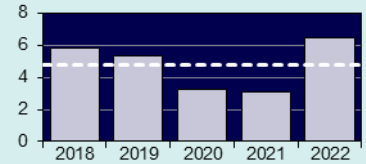
- Currently, most Savannah River National Laboratory programs support the Savannah River Site tritium mission. This includes applying hydrogen technologies used in processing tritium; extraction, purification, and storage of tritium; and
- Execution of the Mark-1A plutonium-244 recovery program.

Changes in Dose

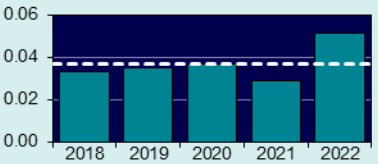
- The Salt Waste Processing Facility (SWPF) joined Savannah River Mission Completion (SRMC) in CY 2022.

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 facility, hot cell facility, and several pulsed power accelerators;
- Conducting light laboratory work involving x-ray machines and tracer radionuclides; and
- Waste operations.

Changes in Dose

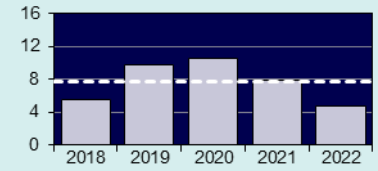
- The 2022 TED and ED increases are directly attributable to the return-to-work posture following the COVID-19 pandemic as well as the expected 30 percent increase in nuclear weapons development work at Sandia.

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 2022, 19 DOE sites reported less than 5 person-rem (50 person-mSv) collective TED for their respective site. One site, Energy Technology Engineering Center, ceased all work in radiological areas 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*.

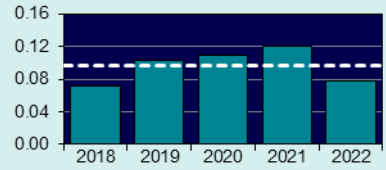
Exhibit 3-15: Activities Significantly Contributing to Collective TED in CY 2022, for Sites Reporting Less Than 5 Person-Rem, in Descending Order of Collective Dose.

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. Tailing shipments began in April 2009 and are expected to continue through CY 2034.

Activities Involving Radiation Exposure

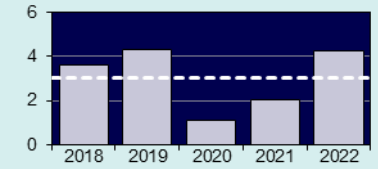
- Maintenance;
- Erosion control measures;
- Tailings excavation and conditioning;
- Loading tailings into containers and transporting to the rail beach;
- Ground water remediation; and
- Health and safety oversight.

Changes in Dose

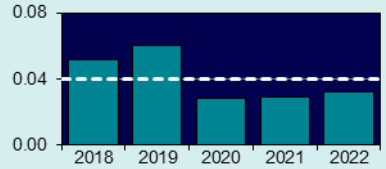
- The project continues to operate on a regular schedule of four trains per week.

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

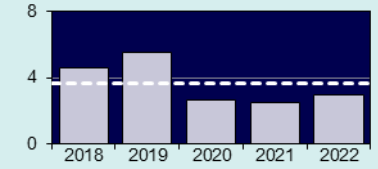
- Site deactivation, decommissioning, and demolition activities;
- Waste handling, processing, and shipment of uranium-bearing materials;
- Processing of uranium hexafluoride cylinders;
- Facility decontamination; and
- Uranium barter transfers.

Changes in Dose

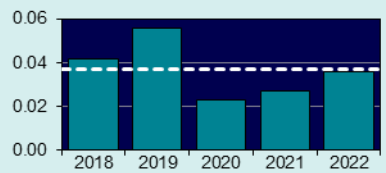
- The primary reason for this change was due to a return to full plant operational status in 2022.
- The Portsmouth facility restarted plant operations in June 2022 with a graded restart from one operational line up to three during this period. This number is expected to rise slightly in the coming calendar year 2023 as operations come into full production.

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

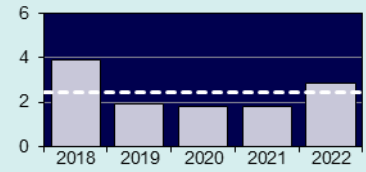
- Continued support of plant operations and maintenance of the Depleted Uranium Hexafluoride project as a nuclear facility;
- Environmental remediation and cleanup activities;
- Surveillance and maintenance activities;
- Waste disposition; and
- Decontamination and decommissioning of inactive facilities.

Changes in Dose

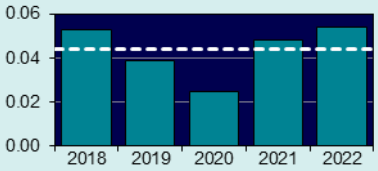
- The slight increase in CY 2022 was due to more deactivation work with individuals receiving measurable dose at low levels; and
- Plant operations resumed in late 2022 with a graded restart from one operational line up to three during this period. This number is expected to rise slightly in the coming CY 2023 as operations come into full production.

Nevada National Security Site (NNSS)

Collective TED (person-rem)



Average Measurable TED (rem)



Site Description

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

Activities Involving Radiation Exposure

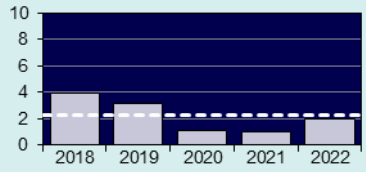
- Operation of low-level radioactive and mixed waste disposal facilities;
- Assembly and execution of subcritical experiments, confined critical experiments;
- Assembly/disassembly of special experiments;
- Operation of pulsed x-ray machines, linear accelerators, and neutron generators;
- Development,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

Changes in Dose

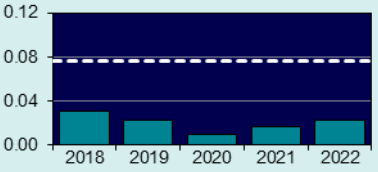
- The increase in dose was attributed to the increase in activities associated with critical and special National Laboratories experiments, the increase in emergency response training, and the increase in radiological work.

Brookhaven National Laboratory (BNL)

Collective TED (person-rem)



Average Measurable TED (rem)



Site Description

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

Activities Involving Radiation Exposure

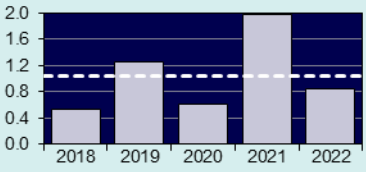
- Research involving nuclear and particle physics, accelerator science, and biological systems research;
- Facility maintenance and source replacement; and
- Support for the NASA Space Radiation Laboratory.

Changes in Dose

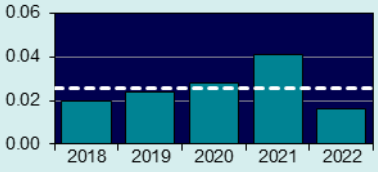
- The increase in total dose was primarily due to radiological work performed at the Collider Accelerator and Radiation Control activities.

Thomas Jefferson National Accelerator Facility (TJNAF)

Collective TED (person-rem)



Average Measurable TED (rem)



Site Description

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

Activities Involving Radiation Exposure

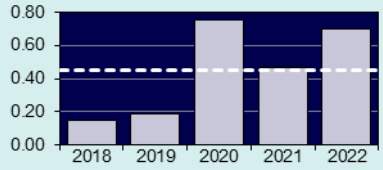
- Maintenance, modification, and repair of activated components associated with the Continuous Electron Beam Accelerator Facility (CEBAF), Low Energy Recirculator Facility (LERF) and other ancillary activities, e.g., transport, storage, and disposal of radioactive materials. Typically, collective TED 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

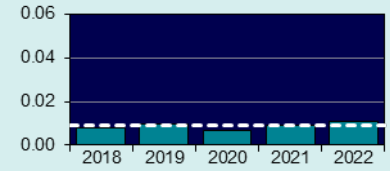
- The 2022 collective TED value is approximately one half of the historical average at Jefferson Lab for the last 10 years. Overall, the value is consistent with doses received during stable periods of accelerator operation with some maintenance and repair activities.

Oak Ridge: East Tennessee Technology Park (ETTP)

Collective TED (person-rem)



Average Measurable TED (rem)



Site Description

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

Activities Involving Radiation Exposure

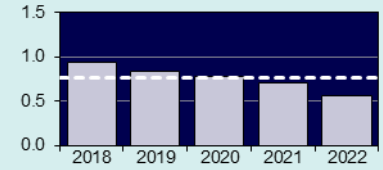
- Continuation of ongoing cleanup activities.

Changes in Dose

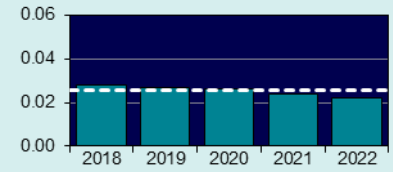
- The change in dose resulted from participation in cleanup and demolition activities.

Ames Laboratory

Collective TED (person-rem)



Average Measurable TED (rem)



Site Description

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

Activities Involving Radiation Exposure

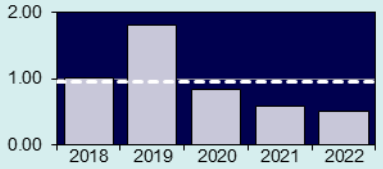
- Limited radioactive material work;
- Operation of 23 x-ray systems and 1 Mossbauer spectroscopy system; and
- Ongoing remediation of radiological legacy contamination.

Changes in Dose

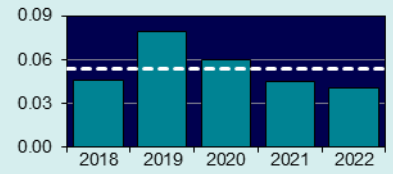
- The collective dose reflects normal routine operations and normal variations given the limited number of individuals with measurable dose and the very low doses.

Lawrence Berkeley National Laboratory (LBNL)

Collective TED (person-rem)



Average Measurable TED (rem)



Site Description

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

Activities Involving Radiation Exposure

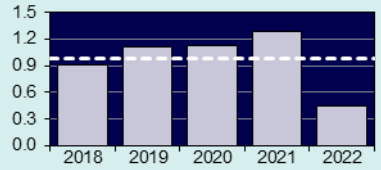
- Fluorine-18 research;
- Antineutrino research and experiments; and
- Site inventory of radioactive and nuclear material activities.

Changes in Dose

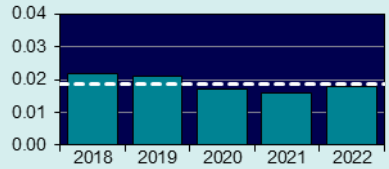
- The decrease in the collective TED is due to facilities personnel receiving slightly less dose while workers performed maintenance tasks at the 88-inch Cyclotron facility, isotope production work at the building 56 medical cyclotron, and radiochemistry work in building 70A.

Waste Isolation Pilot Plant (WIPP)

Collective TED (person-rem)



Average Measurable TED (rem)



Site Description

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

Activities Involving Radiation Exposure

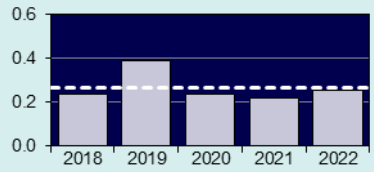
- Handling and processing of TRU waste for storage; and
- Managing long-term repository operations.

Changes in Dose

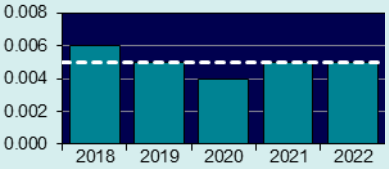
- The dose decreased 65 percent in CY 2022. All doses received were from routine activities associated with the disposal of TRU waste.

Princeton Plasma Physics Laboratory (PPPL)

Collective TED (person-rem)



Average Measurable TED (rem)



Site Description

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

Activities Involving Radiation Exposure

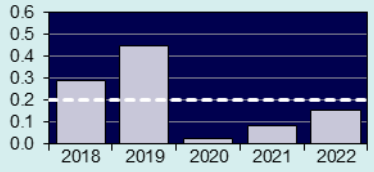
- The remaining tritium systems from the Tokamak Fusion Test Reactor (TFTR) were removed as part of the Tritium System Demolition and Disposal (TSDD) Project. Both internal and external monitoring were utilized for this project, which included removal of the residual tritium inventory within several molecular sieve dryer beds as well as tritium contaminated equipment, components, and piping. Monitoring continued as the project progressed from the Tritium Area within the basement of the research building to the TFTR Test Cell where removal of additional equipment and materials currently continues.
- 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.

Changes in Dose

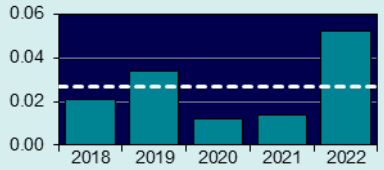
- The increase in dose represents a 15 percent increase from the previous monitoring year, which is attributable to the TSDD Project activities.

Office of Secure Transportation (OST)

Collective TED (person-rem)



Average Measurable TED (rem)



Site Description

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

Activities Involving Radiation Exposure

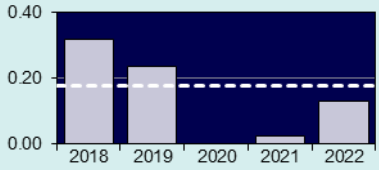
- Providing secure ground transportation of nuclear weapons, SNM, nuclear weapon components, and nuclear explosive-like assemblies; and
- Tracking and directing cargo loading revisions to minimize radiation exposure.

Changes in Dose

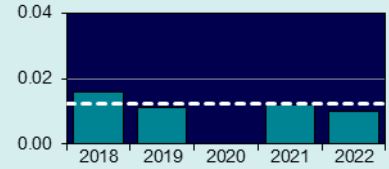
- Differences may be attributed to the small number of individuals (less than 10 for each year); and
- Increases in TED were directly attributable to the return-to-work posture following the COVID-19 pandemic.

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

Collective TED (person-rem)



Average Measurable TED (rem)



Site Description

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

Activities Involving Radiation Exposure

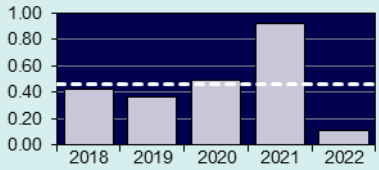
- Independent verification activities involving radiological surveys at sites undergoing decommissioning; and
- Environmental sample processing and radiological protection.

Changes in Dose

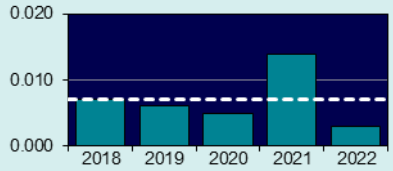
- Dose to radiological workers remained low in CY 2022. Only two individuals received a measurable dose in conjunction with health physics training activities.

Kansas City National Security Campus (KC-NSC)

Collective TED (person-rem)



Average Measurable TED (rem)



Site Description

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

Activities Involving Radiation Exposure

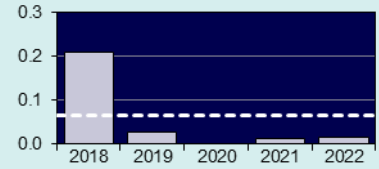
- Non-destructive testing and development projects,
- Telemetry component production and testing with neutron generators;
- Security operations, depleted uranium operations;
- Full production of weapons Life Extension Program; and
- Legacy part refurbishment and waste management.

Changes in Dose

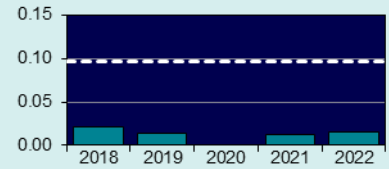
- This decrease is attributed to a production stabilization following a year of significantly increased production in 2021, likely attributed to production rebound following the pandemic;
- Further improvements are attributed to better dosimetry storage compliance among Emergency Response field workers who travel extensively; and
- No measured neutron dose was received in 2022 when compared to 120 mrem in 2021.

Separations Process Research Unit (SPRU)

Collective TED (person-rem)



Average Measurable TED (rem)



Site Description

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

Activities Involving Radiation Exposure

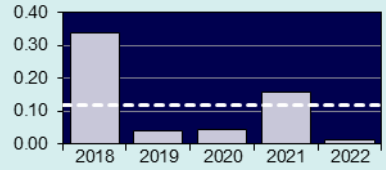
- Repackaging TRU waste;
- Processing and shipping low activity water and waste; and
- Surveillance and maintenance of site condition activities.

Changes in Dose

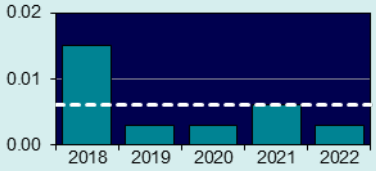
- Collective dose remained low due to maintaining proper as low as reasonably achievable controls during quarterly inspections of the TRU waste storage area.

Grand Junction Site

Collective TED (person-rem)



Average Measurable TED (rem)



Site Description

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

Activities Involving Radiation Exposure

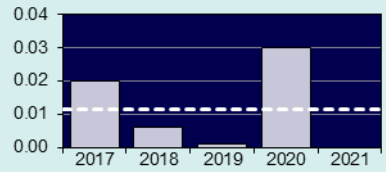
- Walk-over radiological surveys;
- Environmental / geological soil sampling;
- Abandoned mine site inspections; and
- Abandoned mine site reclamation construction activities.

Changes in Dose

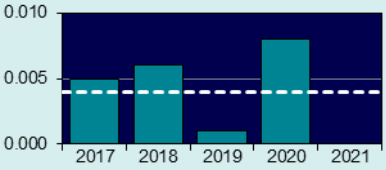
- All doses received were from routine field activities performed by Legacy Management personnel.as they worked to develop a record of all locations and current conditions of legacy uranium mines under the Defense-Related Uranium Mines (DRUM) Program.

National Renewable Energy Laboratory (NREL)

Collective TED (person-rem)



Average Measurable TED (rem)



Site Description

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

Activities Involving Radiation Exposure

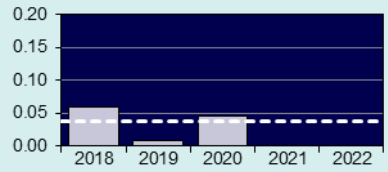
- Electron microscopy staining; and
- Operation of analytical and process equipment containing sealed sources.

Changes in Dose

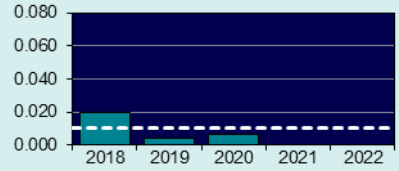
- The primary reason for the decrease in dose was a decrease in work time involving radiation exposure surrounding x-ray generating equipment.

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

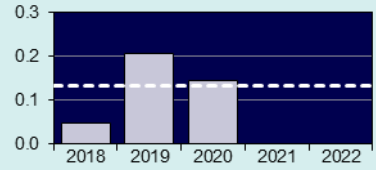
- Disposition of government property;
- Cleanup of facilities, demolition of facilities, and site restoration;
- Area IV is undergoing characterization for cleanup of the area; and
- Investigation and remediation of soil and groundwater.

Changes in Dose

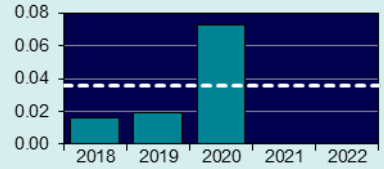
- ETEC eliminated personnel dosimeters in CY 2021 due to no accessible radiological areas present onsite.

SLAC National Accelerator Laboratory (SLAC)

Collective TED (person-rem)



Average Measurable TED (rem)



Site Description

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

Activities Involving Radiation Exposure

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

Changes in Dose

- The CY 2022 collective TED of 0.0 is a reflection of the fact that no major radiological projects were conducted during CY 2022.

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 83 percent of the collective TED (58 and 25 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, Y-12 National Security Complex, and Savannah River Site.

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 2022.

Program Office	Collective TED (person-rem)	Percent Change from 2021	Number with Meas. Dose (TED)	Percent Change from 2021	Avg. Meas. TED (rem)	Percent Change from 2021
Office of Energy Efficiency and Renewable Energy (EE)					**Total Monitored**	**= 7***
National Renewable Energy Laboratory	0.005	◊	2	◊	0.003	◊
EE Totals	**0.005**	◊	**2**	◊	**0.003**	◊
Office of Environmental Management (EM)					**Total Monitored**	**= 21,218***
East Tennessee Technology Park	0.701	◊	62	◊	0.011	◊
Hanford Site	17.308	14% ▲	555	4% ▲	0.031	10% ▲
Idaho (ICP, AMWTP and DOE IOO)	39.715	-1% ▼	743	12% ▲	0.053	-11% ▼
Los Alamos National Laboratory	2.016	-16% ▼	98	-13% ▼	0.021	-4% ▼
Nevada National Security Site	0.000	◊	0	◊	0.000	◊
Oak Ridge National Laboratory	16.759	17% ▲	713	13% ▲	0.024	4% ▲
Office of River Protection	22.637	-18% ▼	562	-20% ▼	0.040	3% ▲
Paducah Gaseous Diffusion Plant	2.983	21% ▲	83	-10% ▼	0.036	**34%** ▲
Portsmouth Gaseous Diffusion Plant	4.259	**110%** ▲	133	**93%** ▲	0.032	9% ▲
Savannah River National Laboratory	7.665	-49% ▼	371	-23% ▼	0.021	-33% ▼
Savannah River Site	**87.674**	5% ▲	**2,721**	-4% ▼	0.032	10% ▲
Separations Process Research Unit	0.016	◊	1	◊	0.016	◊
Service Center Personnel*	0.428	◊	15	◊	0.029	◊
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% ▼
EM Totals	**220.321**	**-3%** ▼	**6,262**	**-3%** ▼	**0.035**	**0%** ▲
Office of Fossil Energy (FE)					**Total Monitored**	**= 92***
Service Center Personnel*	0.000	◊	◊	◊	0.000	◊
FE Totals	**0.000**	◊	◊	◊	**0.000**	◊
Office of Legacy Management (LM)					**Total Monitored**	**= 27***
Grand Junction Site	0.013	◊	4	◊	0.003	◊
LM Totals	**0.013**	◊	**4**	◊	**0.003**	◊
National Nuclear Security Administration (NNSA)					**Total Monitored**	**= 33,344***
Kansas City National Security Campus	0.110	◊	33	◊	0.003	◊
Lawrence Livermore National Laboratory	19.330	29% ▲	228	**47%** ▲	**0.085**	-13% ▼
Los Alamos National Laboratory	**369.484**	23% ▲	**4,369**	7% ▲	0.085	15% ▲
Nevada National Security Site	2.876	58% ▲	53	39% ▲	0.054	13% ▲
Office of Secure Transportation	0.157	◊	3	◊	0.052	◊
Pantex Plant	25.909	9% ▲	478	19% ▲	0.054	-8% ▼
Sandia National Laboratories	6.477	**109%** ▲	127	21% ▲	0.051	**73%** ▲
Savannah River Site	40.388	-26% ▼	1,362	-25% ▼	0.030	-1% ▼
Y-12 National Security Complex	57.144	5% ▲	1,571	9% ▲	0.036	-4% ▼
NNSA Totals	**521.875**	**15%** ▲	**8,224**	**1%** ▲	**0.063**	**13%** ▲
Office of Nuclear Energy (NE)					**Total Monitored**	**= 4,540***
Idaho National Laboratory	44.854	-35% ▼	859	-5% ▼	0.052	-31% ▼
NE Totals	**44.854**	**-35%** ▼	**859**	**-5%** ▼	**0.052**	**-31%** ▼
Office of Science (SC)					**Total Monitored**	**= 16,048***
Ames Laboratory	0.565	◊	26	◊	0.022	◊
Argonne National Laboratory	8.651	35% ▲	115	20% ▲	0.075	13% ▲
Brookhaven National Laboratory	1.976	**102%** ▲	87	**45%** ▲	0.023	39% ▲
Fermi National Accelerator Laboratory	8.780	44% ▲	143	-27% ▼	0.061	**96%** ▲
Lawrence Berkeley National Laboratory	0.497	◊	12	◊	0.041	◊
Oak Ridge Institute for Science and Education	0.129	◊	13	◊	0.010	◊
Oak Ridge National Laboratory	**48.634**	24% ▲	383	11% ▲	**0.127**	12% ▲
Pacific Northwest National Laboratory	33.264	94% ▲	**537**	1% ▲	0.062	93% ▲
Princeton Plasma Physics Laboratory	0.255	◊	47	◊	0.005	◊
SLAC National Accelerator Laboratory	0.000	◊	0	◊	0.000	◊
Thomas Jefferson National Accelerator Facility	0.854	◊	53	◊	0.016	◊
SC Totals	**103.605**	**41%** ▲	**1,416**	**4%** ▲	**0.073**	**36%** ▲

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 2018 to 2022. Over the past 5 years, the records of transient individuals have averaged between 2 and 4 percent of the total records for all monitored individuals. These individuals received, on an average, 3 percent of the collective TED in CY2022. The collective TED for transients increased from 15.29 person-rem (152.9 person-mSv) in CY 2021 to 29.96 person-rem (299.6 person-mSv) in CY 2022. The average measurable TED increased from 0.036 rem (0.360 person-mSv) in CY 2021 to 0.049 person-rem (0.490 person-mSv) in CY 2022. The 97.2 percent increase in the collective TED in CY 2022 is the result of the resumption of travel to pre-COVID-19 pandemic levels.

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 2022. 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 2018 – 2022.

	Dose Ranges (TED in rem) *	2018	2019	2020	2021	2022
Transients	Less than measurable	2,291	2,146	523	1,043	1,712
	Measurable <0.100	404	478	324	405	558
	0.100 – 0.250	23	31	13	16	34
	0.250 – 0.500	13	12	2	4	9
	0.500 – 0.750	1	2	-	1	4
	0.750 – 1.000	2	2	-	-	4
	1.0 – 2.0	-	-	-	1	3
	>2.0	-	-	-	-	-
	Total number of individuals monitored**	2,734	2,671	862	1,470	2,324
	Number with measurable dose	443	525	339	427	612
	% with measurable dose	16%	20%	39%	29%	26%
	Collective TED (person-rem)	18.934	22.405	10.605	15.193	29.961
	Average measurable TED (rem)	0.043	0.043	0.031	0.036	0.049
All DOE	Total number of records for monitored individuals	75,654	76,181	64,726	67,779	75,292
	Number of individuals with measurable dose	13,337	13,825	17,257	16,883	16,767
	% of total monitored individuals who are transient	3.6%	3.5%	1.3%	2.2%	3.1%
	% of the number of individuals with measurable dose who are transient	3.3%	3.8%	2.0%	2.5%	3.7%

* 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 – 2022.

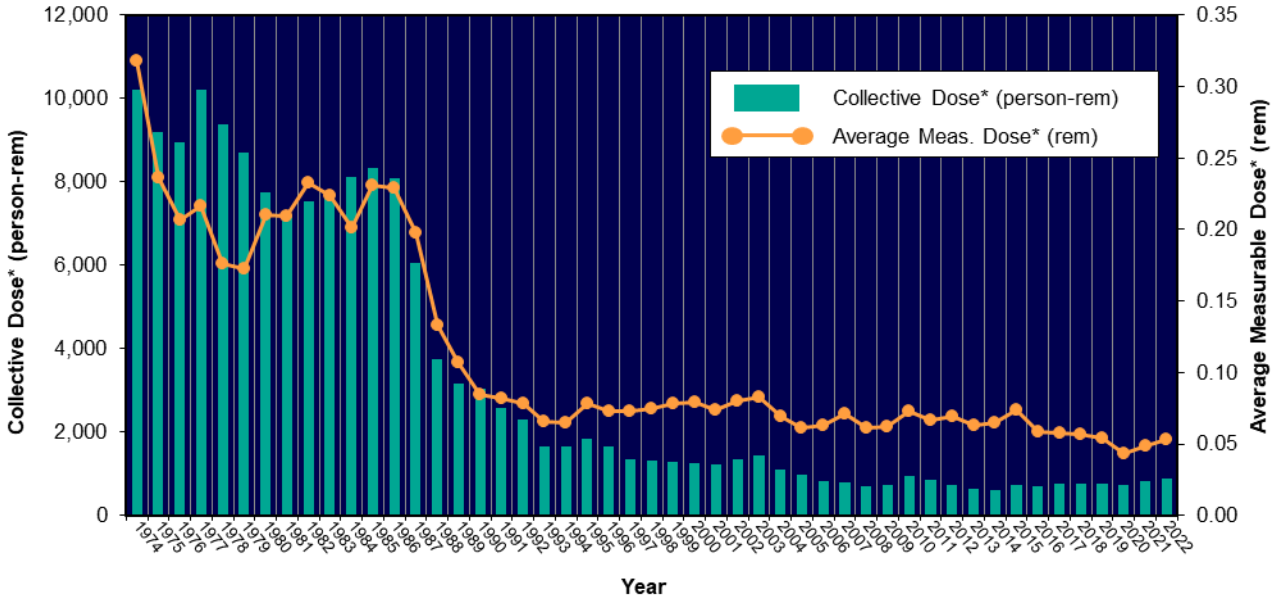
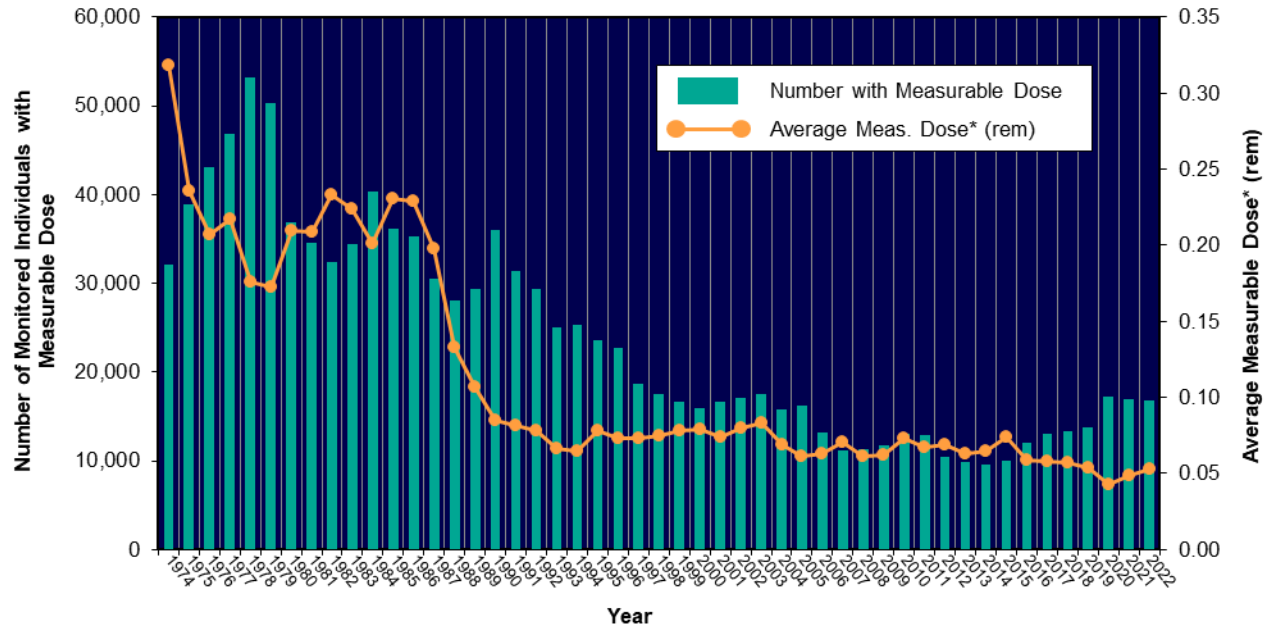


Exhibit 3-19: Number of Individuals with Measurable Dose and Average Measurable Dose, CY 1974 – 2022.



* 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	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/articles/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 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:

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

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

Conclusions

Analysis of the collected exposure data for CY 2022 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 less than 1 percent of the 5 rem (50 mSv) TED limit.

In addition, from CY 2021 to CY 2022 the:

- Number of individuals with measurable dose decreased by less than 1 percent; however, the collective TED increased by 8 percent;
- Collective CED (internal exposure to U-234) increased by 5 percent to 45.8 person-rem (458 person-mSv); and
- Collective TED for transient individuals increased by 97 percent to 29.96 person-rem (299.6 person-mSv) in part due to the resumption of travel to pre-COVID-19 pandemic levels.

The collective dose at DOE facilities has decreased by 89 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 lowering 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. 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.

2. 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).

3. 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.

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

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

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

7. 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.

8. 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.

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 2022

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 2022*. **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
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Questions concerning this survey should be directed to Ms. McLellan at (202) 586-0183.

1. Identification:

   Name: _____

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   Mailing Address: _____

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	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
	521	Food Service Employees

Exhibit A-1: Labor Categories and Occupation Codes.		
Labor Category	**Occupation Code**	**Occupation Name**
	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 2018–2022. 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 2018–2022.							
Site	**Org. Code**	**Organization Name**	**2018**	**2019**	**2020**	**2021**	**2022**
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	●	●	●	●	●
DOE Headquarters	1504001	DOE Headquarters	●	●	●	●	●
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)	–	–	–	●	●
	7504304	Central Plateau Cleanup Company	–	–	–	●	●

Exhibit A-2: Organizations Reporting to DOE REMS, CY 2018–2022.

Site	Org. Code	Organization Name	2018	2019	2020	2021	2022
	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	–	–	–	–	●
	9708001	USGS – Yucca	●	–	–	–	–
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 2018–2022.

Site	Org. Code	Organization Name	2018	2019	2020	2021	2022
	4007509	National Strategic Protective Services	●	–	–	–	–
	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)	●	●	●	●	●

Exhibit A-2: Organizations Reporting to DOE REMS, CY 2018–2022.							
Site	**Org. Code**	**Organization Name**	**2018**	**2019**	**2020**	**2021**	**2022**
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 Remediation Action Project	3260645	Uranium Mill Tailings Remedial Action – Moab	●	●	●	●	●
Waste Isolation Pilot Plant	0701001	Carlsbad Field Office	●	–	–	–	●
	0702003	LANL – WIPP	●	–	–	–	–
	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)	●	●	●	●	●
Pittsburgh 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 2020.

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	0.777	◊	30	◊	0.026	◊	–	◊
Argonne National Laboratory	4.609	–47% ▼	65	–22% ▼	0.071	–32% ▼	–	–
Brookhaven National Laboratory	1.161	–64% ▼	111	–19% ▼	0.010	–55% ▼	–	–
Energy Technology Engineering Center	0.045	◊	8	◊	0.006	◊	–	◊
Fermi National Accelerator Laboratory	7.850	11% ▲	168	9% ▲	0.047	2% ▲	6%	–
Grand Junction Site	0.043	◊	14	◊	0.003	◊	–	◊
Hanford: Hanford Site	9.797	–70% ▼	485	–41% ▼	0.020	–49% ▼	–	–
Hanford: Office of River Protection	13.291	–45% ▼	461	–31% ▼	0.029	–20% ▼	–	–
Hanford: Pacific Northwest National Laboratory	8.523	–12% ▼	408	–9% ▼	0.021	–4% ▼	–	–
Idaho	80.614	5% ▲	1,667	39% ▲	0.048	–24% ▼	4%	47% ▲
Kansas City National Security Campus	0.493	◊	93	◊	0.005	◊	–	◊
Lawrence Berkeley National Laboratory	0.834	◊	14	◊	0.060	◊	–	◊
Lawrence Livermore National Laboratory	8.876	–19% ▼	131	–14% ▼	0.068	–6% ▼	**33%**	**141%** ▲
Los Alamos National Laboratory	**232.736**	4% ▲	2,523	27% ▲	0.092	–19% ▼	25%	–21% ▼
National Renewable Energy Laboratory	0.030	◊	4	◊	0.008	◊	–	◊
Nevada National Security Site	1.800	–7% ▼	72	44% ▲	0.025	–36% ▼	–	–
Oak Ridge: East Tennessee Technology Park	0.751	◊	102	◊	0.007	◊	–	◊
Oak Ridge: Oak Ridge Institute for Science and Education	0.000	◊	0	◊	0.000	◊	–	◊
Oak Ridge: Oak Ridge National Laboratory	47.666	–32% ▼	610	13% ▲	0.078	–40% ▼	24%	–19% ▼
Oak Ridge: Y–12 National Security Complex	59.591	–3% ▼	1,428	–14% ▼	0.042	13% ▲	–	–
Office of Secure Transportation	0.025	◊	2	◊	0.012	◊	–	◊
Paducah Gaseous Diffusion Plant	2.654	–52% ▼	116	16% ▲	0.023	–59% ▼	–	–
Pantex Plant	113.909	**370%** ▲	3,563	**370%** ▲	0.032	0%	–	–
Portsmouth Gaseous Diffusion Plant	1.107	–74% ▼	40	–44% ▼	0.028	–54% ▼	–	–
Princeton Plasma Physics Laboratory	0.234	◊	54	◊	0.004	◊	–	◊
Sandia National Laboratories	3.287	–38% ▼	89	–42% ▼	0.037	7% ▲	–	–
Savannah River National Lab	11.717	–30% ▼	445	–19% ▼	0.026	–13% ▼	–	–
Savannah River Site	112.247	–11% ▼	**4,220**	16% ▲	0.027	–23% ▼	–	–
Separations Process Research Unit	0.000	◊	0	◊	0.000	◊	–	◊
SLAC National Accelerator Laboratory	0.146	◊	2	◊	0.073	◊	–	◊
Thomas Jefferson National Accelerator Facility	0.607	◊	22	◊	0.028	◊	–	◊
Uranium Mill Tailings Remedial Action Project	10.604	9% ▲	97	2% ▲	**0.109**	7% ▲	5%	–
Waste Isolation Pilot Plant	1.130	2% ▲	67	24% ▲	0.017	–18% ▼	–	–
West Valley Demonstration Project	8.868	–57% ▼	112	–19% ▼	0.079	–46% ▼	–	–
Service Center Personnel*	3.116	213% ▲	34	55% ▲	0.092	**102%** ▲	–	–
Totals	**749.138**	**0%**	**17,257**	**25%** ▲	**0.043**	**–20%** ▼	**10%**	**–26%** ▼

Note: Boxed values (gray background) 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 B-2: 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	15.039	69% ▲	155	18% ▲	0.097	43% ▲	42%	28% ▲
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 Technology 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	**823.833**	**10% ▲**	**16,883**	**–2% ▼**	**0.049**	**12% ▲**	**12%**	**16% ▲**

Note: Boxed values (gray background) 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 B-3: 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	84.569	–22% ▼	1,602	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	19.330	29% ▲	228	47% ▲	0.085	–13% ▼	28%	–32% ▼
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	**890.673**	**8%** ▲	**16,767**	**–1%** ▼	**0.053**	**9%** ▲	**18%**	**52%** ▲

Note: Boxed values (gray background) 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 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 2020–2022.

Site	No. of Individuals with Measurable CED* 2020	No. of Individuals with Measurable CED* 2021	No. of Individuals with Measurable CED* 2022	Collective CED Dose (person–rem) 2020	Collective CED Dose (person–rem) 2021	Collective CED Dose (person–rem) 2022	Average Measurable CED 2020	Average Measurable CED 2021	Average Measurable CED 2022
Hanford: Hanford Site	–	–	1	0.000	0.000	0.004	0.000	0.000	0.004
Hanford: Pacific Northwest National Laboratory	1	–	–	0.014	0.000	0.000	0.014	0.000	0.000
Idaho	4	1	1	0.059	0.012	0.032	0.015	0.012	0.032
Lawrence Livermore National Laboratory	1	3	2	0.056	0.152	0.062	0.056	**0.051**	0.031
Los Alamos National Laboratory	26	27	32	2.640	0.198	0.103	**0.102**	0.007	0.003
Oak Ridge: Oak Ridge National Laboratory	–	2	1	0.000	0.082	0.019	0.000	0.041	0.019
Oak Ridge: Y–12 National Security Complex	**1,222**	**1,130**	**1,201**	**51.644**	**41.680**	**43.806**	0.042	0.037	0.036
Paducah Gaseous Diffusion Plant	5	14	10	0.096	0.257	0.261	0.019	0.018	0.026
Princeton Plasma Physics Laboratory	–	–	14	0.000	0.000	0.035	0.000	0.000	0.003
Sandia National Laboratories	8	6	9	0.051	0.068	0.027	0.006	0.011	0.003
Savannah River National Laboratory	–	–	3	0.000	0.000	0.191	0.000	0.000	**0.064**
Savannah River Site	9	3	5	0.034	0.026	0.044	0.004	0.009	0.009
Uranium Mill Tailings Remedial Action Project	52	54	47	2.929	1.314	1.185	0.056	0.024	0.025
Service Center Personnel**	–	–	1	0.000	0.000	0.036	0.000	0.000	0.036
Totals	**1,328**	**1,240**	**1,327**	**57.523**	**43.789**	**45.805**	**0.043**	**0.035**	**0.035**

Note: Boxed values (gray background) indicate the greatest value in each column. Dashes indicate no individuals with measurable CED 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 2022.

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	139	–	–	–	–	–	–	–	139	–	–	–	–
Argonne National Laboratory	1,764	1	–	–	–	–	–	–	1,765	1	0%	–	–
Brookhaven National Laboratory	2,205	–	–	–	–	–	–	–	2,205	–	–	–	–
Fermi National Accelerator Laboratory	1,339	–	–	–	–	–	–	–	1,339	–	–	–	–
Grand Junction Site	27	–	–	–	–	–	–	–	27	–	–	–	–
Hanford: Hanford Site	3,276	195	–	–	–	–	–	–	3,471	195	6%	1.497	0.008
Hanford: Office of River Protection	3,403	12	–	–	–	–	–	–	3,415	12	0%	0.098	0.008
Hanford: Pacific Northwest National Laboratory	2,568	–	–	–	–	–	–	–	2,568	–	–	–	–
Idaho	6,757	56	–	–	–	–	–	–	6,813	56	1%	1.590	0.028
Kansas City Security Campus	201	–	–	–	–	–	–	–	201	–	–	–	–
Lawrence Berkeley National Laboratory	1,018	–	–	–	–	–	–	–	1,018	–	–	–	–
Lawrence Livermore National Laboratory	4,017	58	3	1	4	2	–	–	4,085	68	2%	6.973	**0.103**
Los Alamos National Laboratory	10,579	1,905	303	142	41	4	7	–	**12,981**	**2,402**	**19%**	**182.075**	0.076
National Renewable Energy Laboratory	7	–	–	–	–	–	–	–	7	–	–	–	–
Nevada National Security Site	777	1	–	–	–	–	–	–	778	1	0%	0.031	0.031
Oak Ridge: East Tennessee Technology Park	182	–	–	–	–	–	–	–	182	–	–	–	–
Oak Ridge: Oak Ridge Institute for Science and Education	88	–	–	–	–	–	–	–	88	–	–	–	–
Oak Ridge: Oak Ridge National Laboratory	4,785	103	37	14	–	–	–	–	4,939	154	3%	13.930	0.090
Oak Ridge: Y–12 National Security Complex	7,132	4	–	–	–	–	–	–	7,136	4	0%	0.057	0.014
Office of Secure Transportation	336	–	–	–	–	–	–	–	336	–	–	–	–
Paducah Gaseous Diffusion Plant	1,548	–	–	–	–	–	–	–	1,548	–	–	–	–
Pantex Plant	3,637	270	24	–	–	–	–	–	3,931	294	7%	12.631	0.043
Portsmouth Gaseous Diffusion Plant	2,350	6	–	–	–	–	–	–	2,356	6	0%	0.074	0.012
Princeton Plasma Physics Laboratory	349	–	–	–	–	–	–	–	349	–	–	–	–
Sandia National Laboratories	2,035	9	–	–	–	–	–	–	2,044	9	0%	0.155	0.017
Savannah River National Lab	497	4	–	–	–	–	–	–	501	4	1%	0.120	0.030
Savannah River Site	6,297	198	24	2	–	–	–	–	6,521	224	3%	11.320	0.051
Separations Process Research Unit	8	–	–	–	–	–	–	–	8	–	–	–	–

Exhibit B-5: Neutron Dose Distribution by Site, CY 2022.

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 Facility	1,751	–	–	–	–	–	–	–	1,751	–	–	–	–
Thomas Jefferson National Accelerator Facility	1,230	–	–	–	–	–	–	–	1,230	–	–	–	–
Uranium Mill Tailings Remediation Action Project	146	–	–	–	–	–	–	–	146	–	–	–	–
Waste Isolation Pilot Plant	708	–	–	–	–	–	–	–	708	–	–	–	–
West Valley Project	425	–	–	–	–	–	–	–	425	–	–	–	–
Service Center Personnel**	281	–	–	–	–	–	–	–	281	–	–	–	–
Totals	**71,862**	**2,822**	**391**	**159**	**45**	**6**	**7**	**–**	**75,292**	**3,430**	**5%**	**230.581**	**0.067**

Note: Boxed values (gray background) indicate the greatest value in each column.
*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 2020.

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	6,785	386	34	7	1	–	–	–	–	–	–	7,213	6%	428	16.819	0.039
Fuel Processing	238	385	9	1	–	–	–	–	–	–	–	633	**62%**	395	11.052	0.028
Fuel/Uranium Enrichment	2,423	142	–	–	–	–	–	–	–	–	–	2,565	6%	142	1.858	0.013
Maintenance and Support	5,008	889	25	3	–	–	–	–	–	–	–	5,925	15%	917	23.633	0.026
Other	3,920	722	38	3	1	–	–	–	–	–	–	4,684	16%	764	23.608	0.031
Reactor	115	10	2	–	–	–	–	–	–	–	–	127	9%	12	0.497	0.041
Research, Fusion	366	54	–	1	–	–	–	–	–	–	–	421	13%	55	0.497	0.009
Research, General	17,904	3,816	320	90	15	6	3	–	–	–	–	**22,154**	19%	4,250	191.476	0.045
Waste Processing/Management	4,271	3,637	167	46	2	–	–	–	–	–	–	8,123	47%	3,852	128.290	0.033
Weapons Fabrication and Testing	6,439	5,642	568	160	45	18	8	–	1	–	–	12,881	50%	**6,442**	**351.408**	**0.055**
Totals	**47,469**	**15,683**	**1,163**	**311**	**64**	**24**	**11**	**–**	**1**	**–**	**–**	**64,726**	**27%**	**17,257**	**749.138**	**0.043**

Note: Boxed values (gray background) indicate the greatest value in each column.

Exhibit B-6b: 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	18,163	4,979	429	146	30	12	4	–	–	–	–	**23,763**	24%	**5,600**	270.266	0.048
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	**50,896**	**14,927**	**1,378**	**438**	**98**	**29**	**13**	**–**	**–**	**–**	**–**	**67,779**	**25%**	**16,883**	**823.833**	**0.049**

Note: Boxed values (gray background) indicate the greatest value in each column.

Exhibit B-6c: 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	21,938	5,204	387	130	30	20	7	–	–	–	–	**27,716**	21%	**5,778**	275.560	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	**58,525**	**14,722**	**1,377**	**449**	**138**	**62**	**19**	**–**	**–**	**–**	**–**	**75,292**	**22%**	**16,767**	**890.673**	**0.053**

Note: Boxed values (gray background) indicate the greatest value in each column.

Exhibit B-7a: Collective TED by Site and Facility Type, CY 2020.

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	–	–	–	–	–	0.777	–	–	–	–	0.777
Argonne National Laboratory	0.246	–	–	0.383	–	2.047	–	1.851	–	0.082	4.609
Brookhaven National Laboratory	0.806	–	–	0.282	–	–	–	0.073	–	–	1.161
Energy Technology Engineering Center	–	–	–	–	–	0.045	–	–	–	–	0.045
Fermi National Accelerator Laboratory	**7.850**	–	–	–	–	–	–	–	–	–	7.850
Grand Junction Site	–	–	–	–	–	–	–	–	–	0.043	0.043
Hanford: Hanford Site	–	–	–	**8.071**	–	–	–	–	–	1.726	9.797
Hanford: Office of River Protection	–	–	–	0.015	–	–	–	8.099	–	5.177	13.291
Hanford: Pacific Northwest National Laboratory	–	–	–	–	–	8.523	–	–	–	–	8.523
Idaho	–	–	–	–	–	**80.614**	–	–	–	–	80.614
Kansas City National Security Campus	–	–	–	–	–	–	–	–	0.493	–	0.493
Lawrence Berkeley National Laboratory	–	–	–	–	–	0.834	–	–	–	–	0.834
Lawrence Livermore National Laboratory	–	–	–	0.608	–	8.268	–	–	–	–	8.876
Los Alamos National Laboratory	6.819	–	–	4.231	–	31.775	–	6.981	**175.509**	**7.421**	**232.736**
National Renewable Energy Laboratory	–	–	–	–	–	0.030	–	–	–	–	0.030
Nevada National Security Site	–	–	–	1.800	–	–	–	–	–	–	1.800
Oak Ridge: East Tennessee Technology Park	–	0.751	–	–	–	–	–	–	–	–	0.751
Oak Ridge: Oak Ridge Institute for Science and Education	–	–	–	–	–	–	–	–	–	–	–
Oak Ridge: Oak Ridge National Laboratory	–	–	–	–	–	45.162	–	2.504	–	–	47.666
Oak Ridge: Y–12 National Security Complex	–	–	–	–	–	–	–	–	59.591	–	59.591
Office of Secure Transportation	–	–	–	–	–	–	–	–	0.014	0.011	0.025
Paducah Gaseous Diffusion Plant	–	–	–	0.011	–	0.096	–	2.547	–	–	2.654
Pantex Plant	–	–	–	0.100	–	–	–	–	113.809	–	113.909
Portsmouth Gaseous Diffusion Plant	–	**1.107**	–	–	–	–	–	–	–	–	1.107
Princeton Plasma Physics Laboratory	–	–	–	–	–	–	0.234	–	–	–	0.234
Sandia National Laboratories	0.345	–	–	0.787	**0.497**	0.766	**0.263**	0.271	0.143	0.215	3.287
Savannah River National Laboratory	–	–	0.104	2.575	–	8.679	–	0.169	0.183	0.007	11.717
Savannah River Site	–	–	**10.948**	4.770	–	3.840	–	**85.193**	1.666	5.830	112.247
Separations Process Research Unit	–	–	–	–	–	–	–	–	–	–	–
SLAC National Accelerator Laboratory	0.146	–	–	–	–	–	–	–	–	–	0.146
Thomas Jefferson National Accelerator Facility	0.607	–	–	–	–	–	–	–	–	–	0.607
Uranium Mill Tailings Remedial Action Project	–	–	–	–	–	–	–	10.604	–	–	10.604
Waste Isolation Pilot Plant	–	–	–	–	–	–	–	1.130	–	–	1.130
West Valley Demonstration Project	–	–	–	–	–	–	–	8.868	–	–	8.868
Service Center Personnel*	–	–	–	–	–	0.020	–	–	–	3.096	3.116
Totals	**16.819**	**1.858**	**11.052**	**23.633**	**0.497**	**191.476**	**0.497**	**128.290**	**351.408**	**23.608**	**749.138**

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-7b: 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	–	13.115	–	–	–	–	15.039
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	–	–	–	–	–	–	–	–	–	–	–

Exhibit B-7b: 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
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**	**270.266**	**0.253**	**168.990**	**283.582**	**37.205**	**823.833**

Note: Boxed values (gray background) indicate the greatest value in each column.
* Includes personnel at NETL, NNSA Albuquerque complex, Oak Ridge, and WIPP.
- Dashes indicate no data for this facility type.

Exhibit B-7c: 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	–	–	–	–	–	**84.569**	–	–	–	–	84.569
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*	–	–	–	–	–	–	–	–	–	0.428	0.428
Totals	**29.304**	**4.960**	**6.576**	**34.392**	**1.674**	**275.560**	**0.357**	**161.913**	**340.911**	**35.026**	**890.673**

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-8: Distribution of TED by Facility Type Listed in Descending Order of Average Measurable TED for Accelerator Facilities, CY 2022.

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)
Argonne National Laboratory	341	6	3	1	–	–	–	–	–	–	–	351	3%	10	0.980	**0.098**
Thomas Jefferson Natl. Accel. Facil.	373	200	18	4	4	5	–	–	–	–	–	604	38%	**231**	**16.078**	0.070
Los Alamos National Laboratory	1,196	115	18	9	1	–	–	–	–	–	–	1,339	11%	143	8.780	0.061
Sandia National Laboratories	463	20	1	–	–	–	–	–	–	–	–	484	4%	21	1.104	0.053
Fermi National Accelerator Lab	–	1		–	–	–	–	–	–	–	–	1	**100%**	1	0.032	0.032
Brookhaven National Laboratory	1,411	65	6	–	–	–	–	–	–	–	–	1,482	5%	71	1.468	0.021
Central Plateau Cleanup Company	1,169	53	–	–	–	–	–	–	–	–	–	1,222	4%	53	0.854	0.016
N3B (LANL)	2	1	–	–	–	–	–	–	–	–	–	3	33%	1	0.008	0.008
SLAC National Accelerator Laboratory	1,751	–	–	–	–	–	–	–	–	–	–	**1,751**	0%	–	–	–
Thomas Jefferson Site Office–DOE Employees	8	–	–	–	–	–	–	–	–	–	–	8	0%	–	–	–
Totals	**6,714**	**461**	**46**	**14**	**5**	**5**	**–**	**–**	**–**	**–**	**–**	**7,245**	**7%**	**531**	**29.304**	**0.055**

Note: Boxed values (gray background) indicate the greatest value in each column.

Exhibit B-9: Distribution of TED by Facility Type Listed in Descending Order of Average Measurable TED for Fuel Facilities, CY 2022.

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)	192	52	5	–	–	–	–	–	–	–	–	249	23%	57	**3.048**	**0.053**
Portsmouth Mission Alliance (PMA)	121	1	–	–	–	–	–	–	–	–	–	122	1%	1	0.039	0.039
Fluor/B&W – Portsmouth	1,910	75	–	–	–	–	–	–	–	–	–	**1,985**	4%	**75**	1.172	0.016
URS/CH2MHill – Oak Ridge (UCOR): ETTP	120	62	–	–	–	–	–	–	–	–	–	182	**34%**	62	0.701	0.011
Totals	**2,343**	**190**	**5**	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**2,538**	**8%**	**195**	**4.96**	**0.025**
PROCESSING																
Savannah River Nuclear Solutions	218	252	7	–	–	–	–	–	–	–	–	**477**	54%	**259**	**6.062**	**0.023**
SRNS Construction	43	23	–	–	–	–	–	–	–	–	–	66	35%	23	0.250	0.011
Savannah River Field Office	–	7	–	–	–	–	–	–	–	–	–	7	**100%**	7	0.079	0.011
Centerra Services Inc. – SR	18	13	–	–	–	–	–	–	–	–	–	31	42%	13	0.149	0.011
SRNS Service Subs	2	1	–	–	–	–	–	–	–	–	–	3	33%	1	0.008	0.008
Misc. DOE Contractors – SR	–	1	–	–	–	–	–	–	–	–	–	1	**100%**	1	0.007	0.007
SRS Tritium Facilities	–	1	–	–	–	–	–	–	–	–	–	1	**100%**	1	0.006	0.006
SRR Operations	1	1	–	–	–	–	–	–	–	–	–	2	50%	1	0.005	0.005
SRNL	–	1	–	–	–	–	–	–	–	–	–	1	**100%**	1	0.005	0.005
BSRA – SR National Laboratory	2	1	–	–	–	–	–	–	–	–	–	3	33%	1	0.005	0.005
SRNS Construction Subs	1	–	–	–	–	–	–	–	–	–	–	1	0%	–	–	–
Totals	**285**	**301**	**7**	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**593**	**52%**	**308**	**6.576**	**0.021**

Note: Boxed values (gray background) indicate the greatest value in each column.

Exhibit B-10: Distribution of TED by Facility Type Listed in Descending Order of Average Measurable TED for Maintenance and Support, CY 2022.

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)
Los Alamos National Lab Construction Subs	4	1	–	–	–	–	–	–	–	–	–	5	20%	1	0.086	**0.086**
Lawrence Livermore National Laboratory Nevada	126	8	3	1	–	–	–	–	–	–	–	138	9%	12	0.955	0.080
Wackenhut Services Inc – NV	15	1	–	–	–	–	–	–	–	–	–	16	6%	1	0.079	0.079
SRR Operations	4	22	8	–	–	–	–	–	–	–	–	34	88%	30	2.156	0.072
Argonne National Laboratory	235	6	–	1	–	–	–	–	–	–	–	242	3%	7	0.443	0.063
MSTS – NTS	468	33	2	2	–	–	–	–	–	–	–	505	7%	37	2.135	0.058
Battelle – PNNL	32	1	–	–	–	–	–	–	–	–	–	33	3%	1	0.057	0.057
Sandia National Laboratories	349	14	1	–	–	–	–	–	–	–	–	364	4%	15	0.732	0.049
Los Alamos National Laboratory	661	214	13	11	–	–	–	–	–	–	–	899	26%	238	10.852	0.046
MSTS – Las Vegas	125	14	–	–	–	–	–	–	–	–	–	139	10%	14	0.644	0.046
Central Plateau Cleanup Company	1,142	264	34	–	–	–	–	–	–	–	–	**1,440**	21%	**298**	**11.959**	0.040
SRNS Service Subs	4	2	–	–	–	–	–	–	–	–	–	6	33%	2	0.067	0.034
Brookhaven National Laboratory	671	13	2	–	–	–	–	–	–	–	–	686	2%	15	0.498	0.033
NNSA Nevada Site Office	57	1	–	–	–	–	–	–	–	–	–	58	2%	1	0.018	0.018
BSRA – SR National Laboratory	1	1	–	–	–	–	–	–	–	–	–	2	50%	1	0.015	0.015
Savannah River Field Office	–	1	–	–	–	–	–	–	–	–	–	1	**100%**	1	0.015	0.015
Hanford Mission Integration Solutions	1,107	159	1	–	–	–	–	–	–	–	–	1,267	13%	160	2.227	0.014
Savannah River Nuclear Solutions	102	80	–	–	–	–	–	–	–	–	–	182	44%	80	1.087	0.014
SRNS Construction	22	12	–	–	–	–	–	–	–	–	–	34	35%	12	0.173	0.014
Univ of Georgia Ecology Laboratory	12	19	–	–	–	–	–	–	–	–	–	31	61%	19	0.182	0.010
SRS Tritium Facilities	–	1	–	–	–	–	–	–	–	–	–	1	**100%**	1	0.007	0.007
SRNL	–	1	–	–	–	–	–	–	–	–	–	1	**100%**	1	0.005	0.005
Battelle – Pantex	20	–	–	–	–	–	–	–	–	–	–	20	0%	–	–	–
DOE Headquarters	16	–	–	–	–	–	–	–	–	–	–	16	0%	–	–	–
DOE–Richland Field Office	2	–	–	–	–	–	–	–	–	–	–	2	0%	–	–	–
Hanford Laboratory Management Integration	2	–	–	–	–	–	–	–	–	–	–	2	0%	–	–	–

Exhibit B-10: Distribution of TED by Facility Type Listed in Descending Order of Average Measurable TED for Maintenance and Support, CY 2022.

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)
LLNL Service Subcontractors	1	–	–	–	–	–	–	–	–	–	–	1	0%	–	–	–
MSTS – Los Alamos	6	–	–	–	–	–	–	–	–	–	–	6	0%	–	–	–
MSTS – Special Tech. Lab	4	–	–	–	–	–	–	–	–	–	–	4	0%	–	–	–
N3B (LANL)	5	–	–	–	–	–	–	–	–	–	–	5	0%	–	–	–
NETL Pittsburgh	10	–	–	–	–	–	–	–	–	–	–	10	0%	–	–	–
NNSA Albuquerque Complex	3	–	–	–	–	–	–	–	–	–	–	3	0%	–	–	–
Office of Secure Transportation	1	–	–	–	–	–	–	–	–	–	–	1	0%	–	–	–
Savannah River Operations	2	–	–	–	–	–	–	–	–	–	–	2	0%	–	–	–
Science Applications Intl Corp. –NV	50	–	–	–	–	–	–	–	–	–	–	50	0%	–	–	–
SR Mission Completion Operations – Other	1	–	–	–	–	–	–	–	–	–	–	1	0%	–	–	–
SRR Service Subs	1	–	–	–	–	–	–	–	–	–	–	1	0%	–	–	–
Swift and Staley Team	208	–	–	–	–	–	–	–	–	–	–	208	0%	–	–	–
UT–Batelle ORNL	14	–	–	–	–	–	–	–	–	–	–	14	0%	–	–	–
Washington River Protection Solutions LLC	3	–	–	–	–	–	–	–	–	–	–	3	0%	–	–	–
Totals	**5,486**	**868**	**64**	**15**	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**6,433**	**15%**	**947**	**34.392**	**0.036**

Note: Boxed values (gray background) indicate the greatest value in each column.

Exhibit B-11: Distribution of TED by Facility Type Listed in Descending Order of Average Measurable TED for Reactor Facilities, CY 2022.

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	140	21	5	–	–	–	–	–	–	–	–	**166**	**16%**	**26**	**1.674**	**0.064**
Brookhaven National Laboratory	6	–	–	–	–	–	–	–	–	–	–	6	0%	–	–	–
Totals	**146**	**21**	**5**	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**172**	**15%**	**26**	**1.674**	**0.064**

Note: Boxed values (gray background) indicate the greatest value in each column.

Exhibit B-12: Distribution of TED by Facility Type Listed in Descending Order of Average Measurable TED for Research, General, CY 2022.

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)
Battelle –PNNL– Subs	217	39	3	1	1	1	4	–	–	–	–	266	18%	49	7.376	**0.151**
UT–Batelle ORNL	3,199	257	69	35	15	6	1	–	–	–	–	3,582	11%	383	48.634	0.127
Lawrence Livermore National Laboratory	3,609	175	26	3	1	4	1	–	–	–	–	3,819	5%	210	17.963	0.086
Lawrence Livermore National Laboratories	121	6	–	–	–	–	–	–	–	–	–	127	5%	6	0.412	0.069
INL – BEA LLC – Security	38	11	–	1	–	–	–	–	–	–	–	50	24%	12	0.720	0.060
ICP – Fluor Service Subcontractors ICP/AMWTP	957	456	44	22	1	–	–	–	–	–	–	1,480	35%	523	28.635	0.055
BATTELLE – PNNL	1,774	421	27	9	7	6	1	–	–	–	–	2,245	21%	471	25.669	0.054
ICP – Fluor Projects (ICP and AMWTP)	353	166	14	9	–	–	–	–	–	–	–	542	35%	189	9.941	0.053
INL – BEA LLC – Services	3,177	662	79	32	1	–	–	–	–	–	–	3,951	20%	774	40.890	0.053
Sandia National Laboratories	400	25	2	1	–	–	–	–	–	–	–	428	7%	28	1.491	0.053
INL – BEA LLC – Production	288	42	5	2	–	–	–	–	–	–	–	337	15%	49	2.288	0.047
Lawrence Berkeley Laboratory	1,006	11	1	–	–	–	–	–	–	–	–	1,018	1%	12	0.497	0.041
Argonne National Laboratory	1,026	63	7	–	1	–	–	–	–	–	–	1,097	6%	71	2.816	0.040
INL – BEA LLC – Research	178	22	2	–	–	–	–	–	–	–	–	202	12%	24	0.956	0.040
ICP – Fluor – Support	31	24	3	–	–	–	–	–	–	–	–	58	47%	27	1.035	0.038
Los Alamos National Laboratory	3,183	1,478	87	15	3	3	–	–	–	–	–	**4,769**	33%	**1,586**	**59.733**	0.038
SRS Tritium Facilities	–	3	–	–	–	–	–	–	–	–	–	3	**100%**	3	0.097	0.032
Savannah River Nuclear Solutions	51	131	8	–	–	–	–	–	–	–	–	190	73%	139	4.196	0.030
Four Rivers Nuclear Partnership (FRNP)	1,055	11	–	–	–	–	–	–	–	–	–	1,066	1%	11	0.295	0.027
Idaho Field Office	189	4	–	–	–	–	–	–	–	–	–	193	2%	4	0.104	0.026
BSRA – SR National Laboratory	55	233	5	–	–	–	–	–	–	–	–	293	81%	238	5.411	0.023
NNSA Los Alamos Site Office	49	35	1	–	–	–	–	–	–	–	–	85	42%	36	0.818	0.023
Ames Laboratory (Iowa State)	113	26	–	–	–	–	–	–	–	–	–	139	19%	26	0.565	0.022
N3B	127	31	–	–	–	–	–	–	–	–	–	158	20%	31	0.566	0.018
SRNL	41	106	1	–	–	–	–	–	–	–	–	148	72%	107	1.970	0.018
UCOR: ORNL	449	627	3	–	–	–	–	–	–	–	–	1,079	58%	630	10.664	0.017
SRNS Construction	41	38	–	–	–	–	–	–	–	–	–	79	48%	38	0.608	0.016
Savannah River Field Office	–	4	–	–	–	–	–	–	–	–	–	4	**100%**	4	0.061	0.015

Exhibit B-12: Distribution of TED by Facility Type Listed in Descending Order of Average Measurable TED for Research, General, CY 2022.

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	31	25	–	–	–	–	–	–	–	–	–	56	45%	25	0.318	0.013
SRNS Service Subs	5	39	–	–	–	–	–	–	–	–	–	44	89%	39	0.517	0.013
Oak Ridge Institute for Science & Education	75	13	–	–	–	–	–	–	–	–	–	88	15%	13	0.129	0.010
Pacific Northwest Site Office	8	16	–	–	–	–	–	–	–	–	–	24	67%	16	0.162	0.010
SR Mission Completion Operations – Other	–	2	–	–	–	–	–	–	–	–	–	2	**100%**	2	0.018	0.009
National Renewable Energy Laboratory	5	2	–	–	–	–	–	–	–	–	–	7	29%	2	0.005	0.003
Brookhaven National Laboratory	1	–	–	–	–	–	–	–	–	–	–	1	0%	–	–	–
NETL Albany	37	–	–	–	–	–	–	–	–	–	–	37	0%	–	–	–
NETL Morgantown	25	–	–	–	–	–	–	–	–	–	–	25	0%	–	–	–
NETL Pittsburgh	20	–	–	–	–	–	–	–	–	–	–	20	0%	–	–	–
SRNS Construction Subs	4	–	–	–	–	–	–	–	–	–	–	4	0%	–	–	–
Totals	**21,938**	**5,204**	**387**	**130**	**30**	**20**	**7**	–	–	–	–	**27,716**	**21%**	**5,778**	**275.560**	**0.048**

Note: Boxed values (gray background) indicate the greatest value in each column.

Exhibit B-13: Distribution of TED by Facility Type Listed in Descending Order of Average Measurable TED for Research, Fusion, CY 2022.

RESEARCH, FUSION
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	66	3	–	–	–	–	–	–	–	–	–	69	4%	3	0.102	**0.034**
Princeton Plasma Physics Laboratory	302	47	–	–	–	–	–	–	–	–	–	**349**	**13%**	**47**	**0.255**	0.005
Totals	**368**	**50**	–	–	–	–	–	–	–	–	–	**418**	**12%**	**50**	**0.357**	**0.007**

Note: Boxed values (gray background) indicate the greatest value in each column.

Exhibit B-14: Distribution of TED by Facility Type Listed in Descending Order of Average Measurable TED for Waste Processing, CY 2022.

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	47	18	3	3	1	2	–	–	–	–	–	74	36%	27	4.412	**0.163**
West Valley Nuclear Services Inc.	306	81	18	20	–	–	–	–	–	–	–	425	28%	119	12.946	0.109
Northwind Portage – UMTRA Project – Moab	85	39	18	4	–	–	–	–	–	–	–	146	42%	61	4.765	0.078
TRU Waste Processing Center – ORNL	181	64	12	6	1	–	–	–	–	–	–	264	31%	83	6.095	0.073
SR Mission Completion Operations – Other	105	300	44	14	1	–	–	–	–	–	–	464	77%	359	18.598	0.052
Los Alamos National Laboratory	221	188	26	–	–	–	–	–	–	–	–	435	49%	214	9.646	0.045
Savannah River Nuclear Solutions	223	471	32	18	7	–	–	–	–	–	–	751	70%	528	23.239	0.044
Hanford Laboratory Management Integration	191	99	6	1	–	–	–	–	–	–	–	297	36%	106	4.404	0.042
DUF6 Conversion Project – Paducah Subs	202	70	2	–	–	–	–	–	–	–	–	274	26%	72	2.688	0.037
Washington River Protection Solutions LLC	1,645	290	16	1	–	–	–	–	–	–	–	1,952	16%	307	10.762	0.035
SRR Operations	671	1,500	94	14	–	–	–	–	–	–	–	**2,279**	71%	**1,608**	**55.440**	0.034
SRNS Construction	104	107	2	–	–	–	–	–	–	–	–	213	51%	109	2.625	0.024
Washington TRU Solutions LLC–WIPP	683	25	–	–	–	–	–	–	–	–	–	708	4%	25	0.449	0.018
Centerra Services Inc. – SR	96	181	–	–	–	–	–	–	–	–	–	277	65%	181	3.026	0.017
SRS Tritium Facilities	13	31	1	–	–	–	–	–	–	–	–	45	71%	32	0.528	0.017
BSRA – SR National Laboratory	3	7	–	–	–	–	–	–	–	–	–	10	70%	7	0.115	0.016
SPRU–NY (Building remediation)	7	1	–	–	–	–	–	–	–	–	–	8	13%	1	0.016	0.016
Misc. DOE Contractors – SR	28	42	1	–	–	–	–	–	–	–	–	71	61%	43	0.632	0.015
SRNL	4	6	–	–	–	–	–	–	–	–	–	10	60%	6	0.076	0.013
Sandia National Laboratories	28	7	–	–	–	–	–	–	–	–	–	35	20%	7	0.078	0.011
Savannah River Field Office	17	35	–	–	–	–	–	–	–	–	–	52	67%	35	0.393	0.011
SRNS Service Subs	52	70	–	–	–	–	–	–	–	–	–	122	57%	70	0.756	0.011
Brookhaven National Laboratory	29	1	–	–	–	–	–	–	–	–	–	30	3%	1	0.010	0.010
SRR Service Subs	8	9	–	–	–	–	–	–	–	–	–	17	53%	9	0.077	0.009
Misc. S.R.S. Const. Subcontractors	3	7	–	–	–	–	–	–	–	–	–	10	70%	7	0.053	0.008
Parsons Subcontractors	2	5	–	–	–	–	–	–	–	–	–	7	71%	5	0.041	0.008
Bechtel Construction – SR	–	5	–	–	–	–	–	–	–	–	–	5	**100%**	5	0.036	0.007
SRNS Construction Subs	1	1	–	–	–	–	–	–	–	–	–	2	50%	1	0.007	0.007
Carlsbad Field Office	13	–	–	–	–	–	–	–	–	–	–	13	0%	–	–	–

Exhibit B-14: Distribution of TED by Facility Type Listed in Descending Order of Average Measurable TED for Waste Processing, CY 2022.

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)
Central Plateau Cleanup Company	2	–	–	–	–	–	–	–	–	–	–	2	0%	–	–	–
N3B	4	–	–	–	–	–	–	–	–	–	–	4	0%	–	–	–
S.R. Forest Station	1	–	–	–	–	–	–	–	–	–	–	1	0%	–	–	–
Totals	**4,975**	**3,660**	**275**	**81**	**10**	**2**	**–**	**–**	**–**	**–**	**–**	**9,003**	**45%**	**4028**	**161.913**	**0.040**

Note: Boxed values (gray background) indicate the greatest value in each column.

Exhibit B-15: Distribution of TED by Facility Type Listed in Descending Order of Average Measurable TED for Weapons Fabrication, CY 2022.

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)
Los Alamos National Laboratory	1,153	932	339	183	92	35	12	–	–	–	–	2,746	58%	**1,593**	**254.449**	**0.160**
CNS, LLC – Pantex	3,433	399	69	10	–	–	–	–	–	–	–	3,911	12%	478	25.909	0.054
NNSA Los Alamos Site Office	2	4	–	–	–	–	–	–	–	–	–	6	67%	4	0.208	0.052
Office of Secure Transportation	235	3	–	–	–	–	–	–	–	–	–	238	1%	3	0.157	0.052
N3B (LANL)	6	2	1	–	–	–	–	–	–	–	–	9	33%	3	0.145	0.048
CNS, LLC – Y–12	5,455	1,378	117	1	–	–	–	–	–	–	–	**6,951**	22%	1,496	56.285	0.038
Sandia National Laboratories	145	8	1	–	–	–	–	–	–	–	–	154	6%	9	0.292	0.032
Savannah River Nuclear Solutions	132	102	4	–	–	–	–	–	–	–	–	238	45%	106	1.840	0.017
URS/CH2MHill – Oak Ridge (UCOR): Y–12	110	75	–	–	–	–	–	–	–	–	–	185	41%	75	0.859	0.011
Centerra Services Inc. – SR	–	1	–	–	–	–	–	–	–	–	–	1	**100%**	1	0.010	0.010
SRNS Construction	23	23	–	–	–	–	–	–	–	–	–	46	50%	23	0.227	0.010
SRNL	16	3	–	–	–	–	–	–	–	–	–	19	16%	3	0.026	0.009
SRS Tritium Facilities	115	44	–	–	–	–	–	–	–	–	–	159	28%	44	0.389	0.009
Misc. S.R.S. Const. Subcontractors	–	1	–	–	–	–	–	–	–	–	–	1	**100%**	1	0.005	0.005
Kansas City National Security Campus	168	33	–	–	–	–	–	–	–	–	–	201	16%	33	0.110	0.003
Totals	**10,993**	**3,008**	**531**	**194**	**92**	**35**	**12**	**–**	**–**	**–**	**–**	**14,865**	**26%**	**3872**	**340.911**	**0.088**

Note: Boxed values (gray background) indicate the greatest value in each column.

Exhibit B-16: Distribution of TED by Facility Type Listed in Descending Order of Average Measurable TED for Other, CY 2022.

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)
Hanford Laboratory Management Integration	37	–	2	–	–	–	–	–	–	–	–	39	5%	2	0.310	**0.155**
Office of River Protection	86	8	3	–	–	–	–	–	–	–	–	97	11%	11	0.985	0.090
Sandia National Laboratories	326	16	1	1	–	–	–	–	–	–	–	344	5%	18	1.004	0.056
Washington River Protection Solutions LLC	417	107	16	2	–	–	–	–	–	–	–	542	23%	125	6.074	0.049
NNSA Los Alamos Site Office	51	6	1	–	–	–	–	–	–	–	–	58	12%	7	0.324	0.046
Central Plateau Cleanup Company	332	49	7	–	–	–	–	–	–	–	–	388	14%	56	2.179	0.039
Los Alamos National Laboratory	2,370	425	20	12	1	–	–	–	–	–	–	**2,828**	16%	**458**	**17.258**	0.038
SRNS Service Subs	37	22	2	–	–	–	–	–	–	–	–	61	39%	24	0.802	0.033
SRR Operations	2	4	–	–	–	–	–	–	–	–	–	6	**67%**	4	0.132	0.033
IsoTek (Bldg 3019)	142	14	1	–	–	–	–	–	–	–	–	157	10%	15	0.428	0.029
Univ. of Georgia Ecology Laboratory	3	3	–	–	–	–	–	–	–	–	–	6	50%	3	0.080	0.027
DOE–Richland Field Office	289	39	1	–	–	–	–	–	–	–	–	329	12%	40	0.931	0.023
N3B (LANL)	303	62	1	–	–	–	–	–	–	–	–	366	17%	63	1.297	0.021
Savannah River Nuclear Solutions	196	166	2	–	–	–	–	–	–	–	–	364	46%	168	2.932	0.017
Hanford Mission Integration Solutions	33	1	–	–	–	–	–	–	–	–	–	34	3%	1	0.012	0.012
Bechtel National Corporation	472	11	–	–	–	–	–	–	–	–	–	483	2%	11	0.102	0.009
Savannah River Field Office	7	7	–	–	–	–	–	–	–	–	–	14	50%	7	0.063	0.009
BSRA – SR National Laboratory	6	2	–	–	–	–	–	–	–	–	–	8	25%	2	0.015	0.008
Centerra Services Inc. – SR	12	4	–	–	–	–	–	–	–	–	–	16	25%	4	0.033	0.008
SRNS Construction Subs	4	2	–	–	–	–	–	–	–	–	–	6	33%	2	0.015	0.008
SRNL	2	4	–	–	–	–	–	–	–	–	–	6	**67%**	4	0.022	0.006
SRNS Construction	10	2	–	–	–	–	–	–	–	–	–	12	17%	2	0.010	0.005
SRS Tritium Facilities	2	1	–	–	–	–	–	–	–	–	–	3	33%	1	0.005	0.005
Navarro Research & Engineering	23	4	–	–	–	–	–	–	–	–	–	27	15%	4	0.013	0.003
Argonne National Laboratory	1	–	–	–	–	–	–	–	–	–	–	1	0%	–	–	–
BSRA–Service Subs	4	–	–	–	–	–	–	–	–	–	–	4	0%	–	–	–
HPMC Occupational Medical Services	9	–	–	–	–	–	–	–	–	–	–	9	0%	–	–	–
Office of Secure Transportation	97	–	–	–	–	–	–	–	–	–	–	97	0%	–	–	–
SRR Service Subs	4	–	–	–	–	–	–	–	–	–	–	4	0%	–	–	–
Totals	**5,277**	**959**	**57**	**15**	**1**	**–**	**–**	**–**	**–**	**–**	**–**	**6,309**	**16%**	**1,032**	**35.026**	**0.034**

Note: Boxed values (gray background) indicate the greatest value in each column.

Exhibit B-17: Internal Dose by Facility Type and Nuclide, CY 2020–2022.

Facility	Nuclide*	No. of Individuals with Measurable CED** 2020	No. of Individuals with Measurable CED** 2021	No. of Individuals with Measurable CED** 2022	Collective CED Dose (person–rem) 2020	Collective CED Dose (person–rem) 2021	Collective CED Dose (person–rem) 2022	Average Measurable CED (rem) 2020	Average Measurable CED (rem) 2021	Average Measurable CED (rem) 2022
Accelerator	**Total**	–	–	–	–	–	–	–	–	–
Fuel Fabrication	**Total**	–	–	–	–	–	–	–	–	–
Fuel Processing	Hydrogen–3	1	–	–	0.004	–	–	0.004	–	–
	Plutonium	–	–	1	–	–	0.031	–	–	0.031
	Total	1	–	1	0.004	–	0.031	0.004	–	0.031
Fuel/Uranium Enrichment	**Total**	–	–	–	–	–	–	–	–	–
Maintenance and Support	Hydrogen–3	–	1	–	–	0.003	–	–	0.003	–
	Other	3	1	–	0.007	0.014	–	0.002	0.014	–
	Plutonium	–	–	1	–	–	0.004	–	–	0.004
	Total	**3**	**2**	**1**	**0.007**	**0.017**	**0.004**	**0.002**	**0.009**	**0.004**
Other	Americium	–	–	1	–	–	0.036	–	–	0.036
	Hydrogen–3	–	–	5	–	–	0.021	–	–	0.004
	Other	4	4	–	0.043	0.049	–	0.011	0.012	–
	Plutonium	–	1	–	–	0.081	–	–	0.081	–
	Total	**4**	**5**	**6**	**0.043**	**0.130**	**0.057**	**0.011**	**0.026**	**0.010**
Reactor	Hydrogen–3	–	–	2	–	–	0.003	–	–	0.002
	Total	–	–	**2**	–	–	**0.003**	–	–	**0.002**
Research, Fusion	Hydrogen–3	–	–	14	–	–	0.035	–	–	0.003
	Total	–	–	**14**	–	–	**0.035**	–	–	**0.003**
Research, General	Americium	4	1	2	0.062	0.012	0.214	0.016	0.012	**0.107**
	Hydrogen–3	–	3	1	–	0.152	0.002	–	0.051	0.002
	Mixed	1	–	1	0.056	–	0.019	0.056	–	0.019
	Other	–	1	1	–	0.005	0.025	–	0.005	0.025
	Plutonium	2	–	–	0.019	–	–	0.010	–	–
	Uranium	10	20	19	0.106	0.293	0.312	0.011	0.015	0.016
	Total	**17**	**25**	**25**	**0.243**	**0.462**	**0.609**	**0.014**	**0.018**	**0.024**
Waste Processing/Mgmt.	Americium	–	1	–	–	0.068	–	–	**0.068**	–
	Hydrogen–3	–	–	1	–	–	0.001	–	–	0.001
	Mixed	–	–	1	–	–	0.002	–	–	0.002
	Uranium	52	54	48	2.929	1.314	1.196	0.056	0.024	0.025
	Total	**52**	**55**	**50**	**2.929**	**1.382**	**1.199**	**0.056**	**0.025**	**0.024**

Exhibit B-17: Internal Dose by Facility Type and Nuclide, CY 2020–2022.

Facility	Nuclide*	No. of Individuals with Measurable CED** 2020	No. of Individuals with Measurable CED** 2021	No. of Individuals with Measurable CED** 2022	Collective CED Dose (person–rem) 2020	Collective CED Dose (person–rem) 2021	Collective CED Dose (person–rem) 2022	Average Measurable CED (rem) 2020	Average Measurable CED (rem) 2021	Average Measurable CED (rem) 2022
Weapons Fab. and Testing	Hydrogen–3	20	21	27	0.067	0.096	0.061	0.003	0.005	0.002
	Mixed	–	7	–	–	0.404	–	–	0.058	–
	Other	1	–	–	0.001	–	–	0.001	–	–
	Plutonium	8	1	–	2.585	0.020	–	**0.323**	0.020	–
	Uranium	**1,222**	**1,124**	**1,201**	**51.644**	**41.278**	**43.806**	0.042	0.037	0.036
	Total	**1,251**	**1,153**	**1,228**	**54.297**	**41.798**	**43.867**	**0.043**	**0.036**	**0.036**
	Totals	**1,328**	**1,240**	**1,326**	**57.523**	**43.789**	**45.768**	**0.043**	**0.035**	**0.035**

Note: Boxed values (gray background) indicate the greatest value in each column. Dashes indicate no data reported for this facility type and nuclide.
*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 2020.

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	37	5	–	–	–	–	–	–	–	–	–	42	12%	5	0.043	0.009
Construction/Repair	3,179	1,810	135	26	2	–	–	–	–	–	–	5,152	38%	1,973	76.377	0.039
Laborers	995	393	44	4	–	–	–	–	–	–	–	1,436	31%	441	20.041	0.045
Management	4,571	1,646	51	8	1	–	–	–	–	–	–	6,277	27%	1,706	47.247	0.028
Miscellaneous	4,232	767	59	5	–	–	–	–	–	–	–	5,063	16%	831	28.347	0.034
Production	1,942	1,636	234	43	1	–	–	–	–	–	–	3,856	**50%**	1,914	104.333	0.055
Professional/Scientists	15,281	4,385	225	48	11	8	2	–	–	–	–	**19,960**	23%	**4,679**	161.482	0.035
Service	3,319	1,738	61	20	3	1	–	–	–	–	–	5,142	35%	1,823	53.999	0.030
Technicians	5,728	2,252	320	142	45	15	9	–	1	–	–	8,512	33%	2,784	**223.337**	**0.080**
Transport	796	139	11	14	1	–	–	–	–	–	–	961	17%	165	11.114	0.067
Unknown	7,389	912	23	1	–	–	–	–	–	–	–	8,325	11%	936	22.818	0.024
Totals	**47,469**	**15,683**	**1,163**	**311**	**64**	**24**	11	–	1	–	–	**64,726**	**27%**	**17,257**	**749.138**	**0.043**

Note: Boxed values (gray background) indicate the greatest value in each column.

Exhibit B-18b: 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	2,342	1,585	226	76	8	–	–	–	–	–	–	4,237	**45%**	1,895	112.726	0.059
Professional/Scientists	15,940	4,338	268	63	10	2	3	–	–	–	–	**20,624**	23%	**4,684**	166.512	0.036
Service	4,059	1,097	109	39	10	2	–	–	–	–	–	5,316	24%	1,257	63.029	0.050
Technicians	6,012	2,209	359	154	58	24	10	–	1	–	–	8,826	32%	2,814	**241.727**	**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	**50,896**	**14,927**	**1,378**	**438**	**98**	**29**	**13**	**–**	**1**	**–**	**–**	**67,779**	**25%**	**16,883**	**823.833**	**0.049**

Note: Boxed values (gray background) indicate the greatest value in each column.

Exhibit B-18c: 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	5,742	905	38	17	2	–	–	–	–	–	–	6,704	14%	962	34.298	0.036
Production	2,610	1,505	213	68	20	2	–	–	–	–	–	4,418	**41%**	1,808	114.414	0.063
Professional/Scientists	17,968	4,258	307	82	14	12	2	–	–	–	–	**22,643**	21%	**4,675**	188.592	0.040
Service	4,801	1,233	84	31	3	–	–	–	–	–	–	6,152	22%	1,351	54.053	0.040
Technicians	6,258	2,146	369	160	78	45	10	–	–	–	–	9,066	31%	2,808	**277.687**	**0.099**
Transport	786	119	20	4	–	–	–	–	–	–	–	929	15%	143	6.388	0.045
Unknown	10,361	802	30	4	–	–	–	–	–	–	–	11,197	7%	836	25.767	0.031
Totals	**58,525**	**14,722**	**1,377**	**449**	**138**	**62**	**19**	**–**	**–**	**–**	**–**	**75,292**	**22%**	**16,767**	**890.673**	**0.053**

Note: Boxed values (gray background) indicate the greatest value in each column.

Exhibit B-19: Internal Dose by Labor Category, CY 2020–2022.

Labor Category	No. of Individuals with Measurable CED* 2020	No. of Individuals with Measurable CED* 2021	No. of Individuals with Measurable CED* 2022	Collective CED Dose (person–rem) 2020	Collective CED Dose (person–rem) 2021	Collective CED Dose (person–rem) 2022	Average Measurable CED (rem) 2020	Average Measurable CED (rem) 2021	Average Measurable CED (rem) 2022
Construction	269	273	268	12.282	9.181	9.458	0.046	0.034	0.035
Laborers	68	80	74	3.292	4.048	2.931	0.048	**0.051**	**0.040**
Management	104	71	110	4.246	3.352	4.191	0.041	0.047	0.038
Miscellaneous	7	3	8	0.197	0.056	0.153	0.028	0.019	0.019
Production	**357**	**324**	**349**	**15.357**	**12.022**	**12.296**	0.043	0.037	0.035
Scientists	196	182	217	6.701	5.495	7.139	0.034	0.030	0.033
Service	35	31	36	1.239	1.209	1.335	0.035	0.039	0.037
Technicians	119	120	130	6.618	3.857	3.992	**0.056**	0.032	0.031
Transport	36	30	24	1.836	0.736	0.772	0.051	0.025	0.032
Unknown	137	126	111	5.755	3.833	3.538	0.042	0.030	0.032
Totals	**1,328**	**1,240**	**1,327**	**57.523**	**43.789**	**45.805**	**0.043**	**0.035**	**0.035**

Note: Boxed values (gray background) indicate the greatest value in each column.
*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 2022.

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	Forest Workers	1	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–
	Groundskeepers	25	6	–	–	–	–	–	–	–	–	–	31	19%	6	0.121	0.020
	Misc. Agriculture	2	–	–	–	–	–	–	–	–	–	–	2	–	–	–	–
Construction/Repair	Carpenters	276	186	29	14	1	1	–	–	–	–	–	507	46%	231	15.897	0.069
	Electricians	1,132	491	31	30	5	1	–	–	–	–	–	1,690	33%	558	31.075	0.056
	Masons	26	19	–	–	–	–	–	–	–	–	–	45	42%	19	0.536	0.028
	Mechanics/Repairers	488	222	31	5	1	–	–	–	–	–	–	747	35%	259	12.531	0.048
	Miners/Drillers	29	6	–	1	–	–	–	–	–	–	–	36	19%	7	0.305	0.044
	Misc. Repair/Construction	779	499	31	1	1	–	3	–	–	–	–	1,314	41%	535	21.009	0.039
	Painters	135	65	5	2	–	–	–	–	–	–	–	207	35%	72	3.090	0.043
	Pipe Fitter	448	277	39	3	3	–	–	–	–	–	–	770	42%	322	16.951	0.053
Laborers	Handlers/Laborers/Helpers	937	405	45	9	–	–	–	–	–	–	–	1,396	33%	459	19.745	0.043
Management	Admin. Support & Clerical Sec.	557	83	2	–	–	–	–	–	–	–	–	642	13%	85	1.672	0.020
	Manager – Administrator	5,146	1,495	103	18	10	1	4	–	–	–	–	6,777	24%	1,631	66.542	0.041
	Sales	18	–	–	–	–	–	–	–	–	–	–	18	–	–	–	–
Miscellaneous	Military	59	–	–	–	–	–	–	–	–	–	–	59	–	–	–	–
	Miscellaneous	5,683	905	38	17	2	–	–	–	–	–	–	6,645	14%	962	34.298	0.036
Production	Machine Setup/Operators	458	369	50	6	–	–	–	–	–	–	–	883	48%	425	22.496	0.053
	Machinists	99	26	6	9	6	–	–	–	–	–	–	146	32%	47	8.690	**0.185**
	Misc. Precision/Production	521	269	38	5	1	–	–	–	–	–	–	834	38%	313	16.249	0.052
	Operators, Plant/ System/Util.	1,231	737	89	45	12	2	–	–	–	–	–	2,116	42%	885	57.578	0.065
	Sheet Metal Workers	278	98	30	3	1	–	–	–	–	–	–	410	32%	132	9.329	0.071
	Welders and Solderers	23	6	–	–	–	–	–	–	–	–	–	29	21%	6	0.072	0.012
Professional/Scientists	Doctors and Nurses	16	–	–	–	–	–	–	–	–	–	–	16	–	–	–	–
	Engineer	6,131	1,193	119	26	6	8	–	–	–	–	–	7,483	18%	1,352	65.571	0.048
	Health Physicist	371	83	6	2	–	–	–	–	–	–	–	462	20%	91	3.431	0.038
	Misc. Professional	7,540	2,230	126	43	5	1	–	–	–	–	–	9,945	24%	**2,405**	81.672	0.034
	Scientist	3,910	752	56	11	3	3	2	–	–	–	–	4,737	17%	827	37.918	0.046
Service Workers	Firefighters	406	36	1	–	1	–	–	–	–	–	–	444	9%	38	1.521	0.040
	Food Service Employees	–	–	1	–	–	–	–	–	–	–	–	1	**100%**	1	0.117	0.117
	Janitors	270	12	1	–	–	–	–	–	–	–	–	283	5%	13	0.493	0.038
	Misc. Service	3,079	846	79	31	2	–	–	–	–	–	–	4,037	24%	958	46.210	0.048
	Security Guards	1,046	339	2	–	–	–	–	–	–	–	–	1,387	25%	341	5.712	0.017
Technicians	Engineering Technicians	1,646	272	32	16	4	2	–	–	–	–	–	1,972	17%	326	23.765	0.073
	Health Technicians	116	28	5	1	–	–	–	–	–	–	–	150	23%	34	1.910	0.056
	Misc. Technicians	1,772	385	64	19	7	5	2	–	–	–	–	2,254	21%	482	36.915	0.077
	Radiation Monitors/Techs.	1,142	895	159	55	14	11	–	–	–	–	–	2,276	50%	1,134	91.261	0.080
	Science Technicians	575	428	97	64	51	25	7	–	–	–	–	1,247	54%	672	**113.742**	0.169
	Technicians	1,007	138	12	5	2	2	1	–	–	–	–	1,167	14%	160	10.094	0.063
Transport Workers	Bus Drivers	1	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–
	Equipment Operators	94	43	10	3	–	–	–	–	–	–	–	150	37%	56	3.241	0.058
	Misc. Transport	336	13	3	–	–	–	–	–	–	–	–	352	5%	16	0.859	0.054
	Truck Drivers	355	63	7	1	–	–	–	–	–	–	–	426	17%	71	2.288	0.032
Unknown	Unknown	10,361	802	30	4	–	–	–	–	–	–	–	**11,197**	7%	836	25.767	0.031
Totals		**58,525**	**14,722**	**1,377**	**449**	**138**	**62**	**19**	**–**	**–**	**–**	**–**	**75,292**	**22%**	**16,767**	**890.673**	**0.053**

Note: Boxed values (gray background) indicate the greatest value in each column.

Exhibit B-21: Internal Dose Distribution by Site and Nuclide, CY 2022.

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	1	–	–	–	–	–	–	–	–	–	–	1	0.004	0.004
Idaho	Americium	–	1	–	–	–	–	–	–	–	–	–	1	0.032	0.032
Lawrence Livermore National Laboratory	Other	–	2	–	–	–	–	–	–	–	–	–	2	0.062	0.031
Los Alamos National Laboratory	Hydrogen–3	22	–	–	–	–	–	–	–	–	–	–	22	0.041	0.002
Los Alamos National Laboratory	Uranium	10	–	–	–	–	–	–	–	–	–	–	10	0.062	0.006
Oak Ridge: Oak Ridge National Laboratory	Mixed	1	–	–	–	–	–	–	–	–	–	–	1	0.019	0.019
Oak Ridge: Y–12 National Security Complex	Uranium	593	504	103	1	–	–	–	–	–	–	–	**1,201**	**43.806**	0.036
Paducah Gaseous Diffusion Plant	Uranium	3	7	–	–	–	–	–	–	–	–	–	10	0.261	0.026
Princeton Plasma Physics Laboratory	Hydrogen–3	14	–	–	–	–	–	–	–	–	–	–	14	0.035	0.002
Sandia National Laboratories	Mixed	1	–	–	–	–	–	–	–	–	–	–	1	0.002	0.002
Sandia National Laboratories	Hydrogen–3	8	–	–	–	–	–	–	–	–	–	–	8	0.025	0.003
Savannah River National Laboratory	Americium	–	–	1	–	–	–	–	–	–	–	–	1	0.182	**0.182**
Savannah River National Laboratory	Hydrogen–3	2	–	–	–	–	–	–	–	–	–	–	2	0.009	0.004
Savannah River Site	Hydrogen–3	4	–	–	–	–	–	–	–	–	–	–	4	0.013	0.003
Savannah River Site	Plutonium	–	1	–	–	–	–	–	–	–	–	–	1	0.031	0.031
Service Center Personnel*	Americium	–	1	–	–	–	–	–	–	–	–	–	1	0.036	0.036
Uranium Mill Tailings Remedial Action Project	Uranium	26	21	–	–	–	–	–	–	–	–	–	47	1.185	0.025
Totals		**685**	**537**	**104**	**1**	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**1,327**	**45.805**	**0.035**

Note: Boxed values (gray background) indicate the greatest value in each column.
*Intakes grouped by nuclide. Intakes involving multiple nuclides were grouped into "mixed." Nuclides where fewer than 10 individuals had intakes were grouped as "other."

Exhibit B-22: Extremity Dose Distribution by Site, CY 2022.

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	55	84	–	–	–	–	–	–	139	84	–	2.268	0.027
Argonne National Laboratory	1,652	82	28	3	–	–	–	–	1,765	113	–	21.117	0.187
Brookhaven National Laboratory	2,180	15	9	1	–	–	–	–	2,205	25	–	7.105	0.284
Fermi National Accelerator Laboratory	1,331	8	–	–	–	–	–	–	1,339	8	–	0.220	0.028
Grand Junction Site	27	–	–	–	–	–	–	–	27	–	–	–	–
Hanford: Hanford Site	3,372	45	54	–	–	–	–	–	3,471	99	–	23.458	0.237
Hanford: Office of River Protection	3,075	140	187	13	–	–	–	–	3,415	340	–	81.891	0.241
Hanford: Pacific Northwest National Laboratory	1,952	503	71	27	8	7	–	–	2,568	616	15	256.405	0.416
Idaho National Laboratory	5,044	1,374	341	52	2	–	–	–	6,813	1,769	2	262.700	0.149
Kansas City National Security Plant	136	64	1	–	–	–	–	–	201	65	–	3.133	0.048
Lawrence Berkeley National Laboratory	977	19	21	1	–	–	–	–	1,018	41	–	12.47	0.304
Lawrence Livermore National Laboratory	4,031	17	30	6	1	–	–	–	4,085	54	1	34.710	0.643
Los Alamos National Laboratory	8,451	3,506	796	212	12	4	–	–	**12,981**	**4,530**	**16**	**965.038**	0.213
National Renewable Energy Laboratory	6	1	–	–	–	–	–	–	7	1	–	0.012	0.012
Nevada National Security Site	773	4	1	–	–	–	–	–	778	5	–	0.25	0.050
Oak Ridge: East Tennessee Technology Park	181	1	–	–	–	–	–	–	182	1	–	0.081	0.081
Oak Ridge: Oak Ridge Institute for Science and Education	88	–	–	–	–	–	–	–	88	–	–	–	–
Oak Ridge: Oak Ridge National Laboratory	4,762	56	71	36	12	2	–	–	4,939	177	14	230.734	**1.304**
Oak Ridge: Y–12 National Security Complex	7,068	11	39	17	1	–	–	–	7,136	68	1	51.194	0.753
Office of Secure Transportation	336	–	–	–	–	–	–	–	336	–	–	–	–
Paducah Gaseous Diffusion Plant	1,548	–	–	–	–	–	–	–	1,548	–	–	–	–
Pantex Plant	3,520	178	177	56	–	–	–	–	3,931	411	–	175.229	0.426
Portsmouth Gaseous Diffusion Plant	2,356	–	–	–	–	–	–	–	2,356	–	–	–	–
Princeton Plasma Physics Laboratory	348	1	–	–	–	–	–	–	349	1	–	0.013	0.013
Sandia National Laboratories	1,975	40	23	6	–	–	–	–	2,044	69	–	16.469	0.239

Exhibit B-22: Extremity Dose Distribution by Site, CY 2022.

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	413	51	36	1	–	–	–	–	501	88	–	14.677	0.167
Savannah River Site	5,695	424	356	31	13	2	–	–	6,521	826	15	311.159	0.377
Separations Process Research Unit	8	–	–	–	–	–	–	–	8	–	–	–	–
SLAC National Accelerator Laboratory	1,751	–	–	–	–	–	–	–	1,751	–	–	–	–
Thomas Jefferson National Accelerator Facility	1,228	2	–	–	–	–	–	–	1,230	2	–	0.173	0.086
Uranium Mill Tailings Remedial Action Project	146	–	–	–	–	–	–	–	146	–	–	–	–
Waste Isolation Pilot Plant	708	–	–	–	–	–	–	–	708	–	–	–	–
West Valley Demonstration Project	417	4	4	–	–	–	–	–	425	8	–	0.738	0.092
Service Center Personnel***	244	32	5	–	–	–	–	–	281	37	–	1.695	0.046
Totals	**65,854**	**6,662**	**2,250**	**462**	**49**	**15**	**–**	**–**	**75,292**	**9,438**	**64**	**2,472.939**	**0.262**

Note: Boxed values (gray background) indicate the greatest value in each column.
* 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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