Office of Environment, Health, Safety and Security
Operating Experience Level 3

OE-3: 2021-02 March 2021

DOE Occupational Radiation Exposure Monitoring for CY 2019

Purpose

This Operating Experience Level 3 (OE-3) document provides an overview of occupational radiation doses at Department of Energy (DOE) sites, including the National Nuclear Security Administration (NNSA), for the calendar year (CY) 2019. The *U.S. Department of Energy Occupational Radiation Exposure Report for CY 2019* provides an analysis of the collective total effective dose (TED), which includes the effective dose from external radiation sources and the committed effective dose from the intake of radioactive material into the body. The report contains a description of work activities in relation to occupational radiation doses for each DOE facility.

Background

DOE Order 231.1B, *Environment Safety and Health Reporting,* requires the Office of Environment, Safety and Health (ES&H) Reporting and Analysis to report annually on radiation exposure monitoring data to the Radiation Exposure Monitoring System (REMS) database before March 31st of the following year. The *U.S. Department of Energy Occupational Radiation Exposure Report for CY 2019* provides a detailed evaluation of DOE-wide performance in compliance with Title 10, Code of Federal Regulations, part 835, *Occupational Radiation Protection.* The regulation includes occupational dose limits, as well as the principle of reducing radiation doses to levels *as low as reasonably achievable* (ALARA). The report provides data to DOE organizations responsible for developing policies for protecting individuals from the adverse health effects of radiation. The occupational radiation dose information over the past 5-year period is analyzed in terms of dose to individuals, dose by site, and aggregate data. The data in this analysis represent the data reported to REMS as of July 31, 2020.

Discussion

The occupational radiation dose records show that in CY 2019, DOE facilities continued to comply with DOE dose limits and administrative control levels (ACLs) and worked to minimize doses to individuals.

Information on collective TED is an indicator of the overall amount of radiation dose received during the conduct of work activities at DOE. The TED is comprised of the effective dose from external sources (which includes neutron and photon radiation) and the internal committed effective dose (CED), which results from the intake of radioactive material into the body.

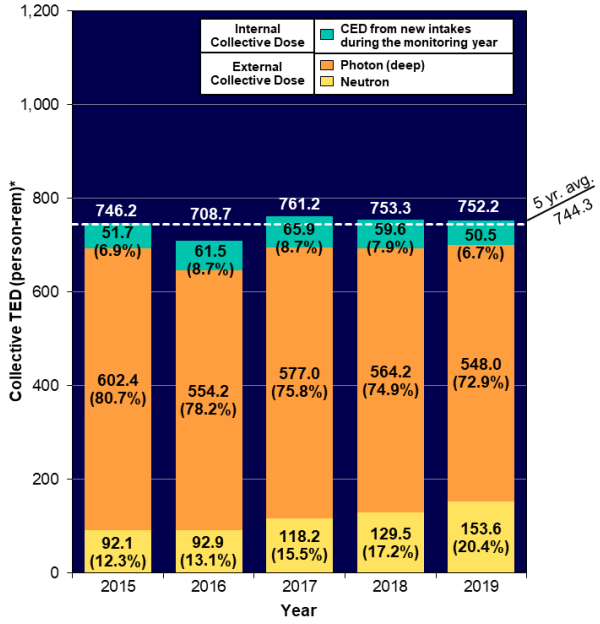
Highlights between CY 2018 and CY 2019:

- The collective TED decreased at DOE by less than 1 percent from 753.3 person-rem (7,533 person-mSv) in CY 2018 to 752.2 person-rem (7,522 person-mSv) in CY 2019.
- The number of workers with measurable TED increased by 4 percent from 13,335 in CY 2018 to 13,822 in CY 2019.
- The average measurable TED decreased by 4 percent from 0.056 rem (0.560 mSv) in CY 2018 to 0.054 rem (0.540 mSv) in CY 2019.

- The collective CED (internal dose from U-234) decreased by 15 percent from 59.6 person-rem (596 person-mSv) in CY 2018 to 50.5 person-rem (505 person-mSv) in CY 2019.
- The number of workers with measurable CED increased by 5 percent from 1345 in CY 2018 to 1412 in CY 2019.
- No individual exceeded the TED regulatory limit (5 rem [50 mSv]) from CY 2015 through 2019.
- No individual exceeded the TED ACL (2 rem [20 mSv]) in 2019. However, an accidental exposure resulted in the 3.6 rem (.36 mSv) dose in 2018 which was the only exceedance of the 2 rem in the past 5 years.
- The collective photon dose decreased by 3 percent from 564.2 person-rem (5,642 person-mSv) in CY 2018 to 548.0 person-rem (5,480 person-mSv) in CY 2019.
- The neutron component of the collective TED increased by 19 percent from 129.5 person-rem (1,295 person-mSv) in CY 2018 to 153.6 person-rem (1,536 person-mSv) in CY 2019.

Exhibit 1 shows the components of the collective TED from CY 2015–2019, including the external dose contributions from photon and neutron, as well as the internal dose from intakes.

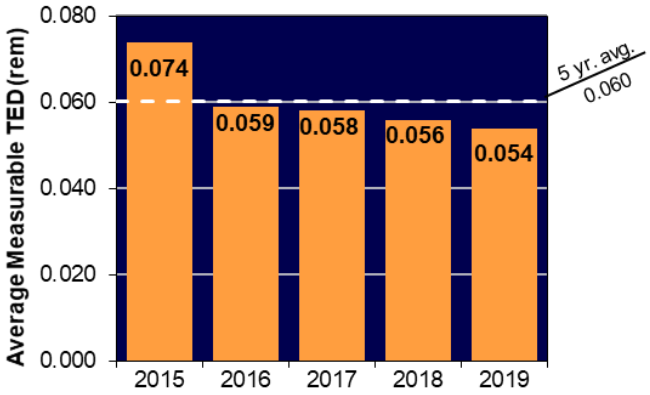
Exhibit 1: Components of TED, CY 2015–2019.



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

Exhibit 2 shows the average measurable TED, which normalizes the collective dose over the population of workers who received a measurable dose from CY 2015–2019. For the fourth year in a row, the average measurable TED has remained below the 5-year average of 0.060 rem (0.600 mSv).

Exhibit 2: Average Measurable TED, CY 2014–2018.



In CY 2019, the five sites that contributed significantly (86 percent) to the collective TED in decreasing order were Los Alamos National Laboratory (LANL), Savannah River, Oak Ridge, Idaho, and Hanford.

The collective TED increased at three of the five sites with the largest collective TED: LANL, Savannah River, and Hanford.

At LANL, the main increase in dose was due to the resumption of programmatic work at TA-55 following a 2013 shutdown. The increase at Savannah River was primarily due to the implementation of system upgrades. For Hanford, work restarted at the plutonium finishing plant.

The collective TED decreased at Idaho and Oak Ridge. Idaho decreased as the result of less work being conducted in radiological areas. Decreases at Oak Ridge were attributed to the research reactor and accelerator facilities at the Oak Ridge National Laboratory. At Y-12 decreases were attributed to specialized work scope and ALARA techniques utilized to characterize and clean up areas of higher radiological risk.

Exhibit 3 illustrates the collective TED at all DOE sites.

Exhibit 3: Collective TED by DOE Site for CY 2017 – 2019

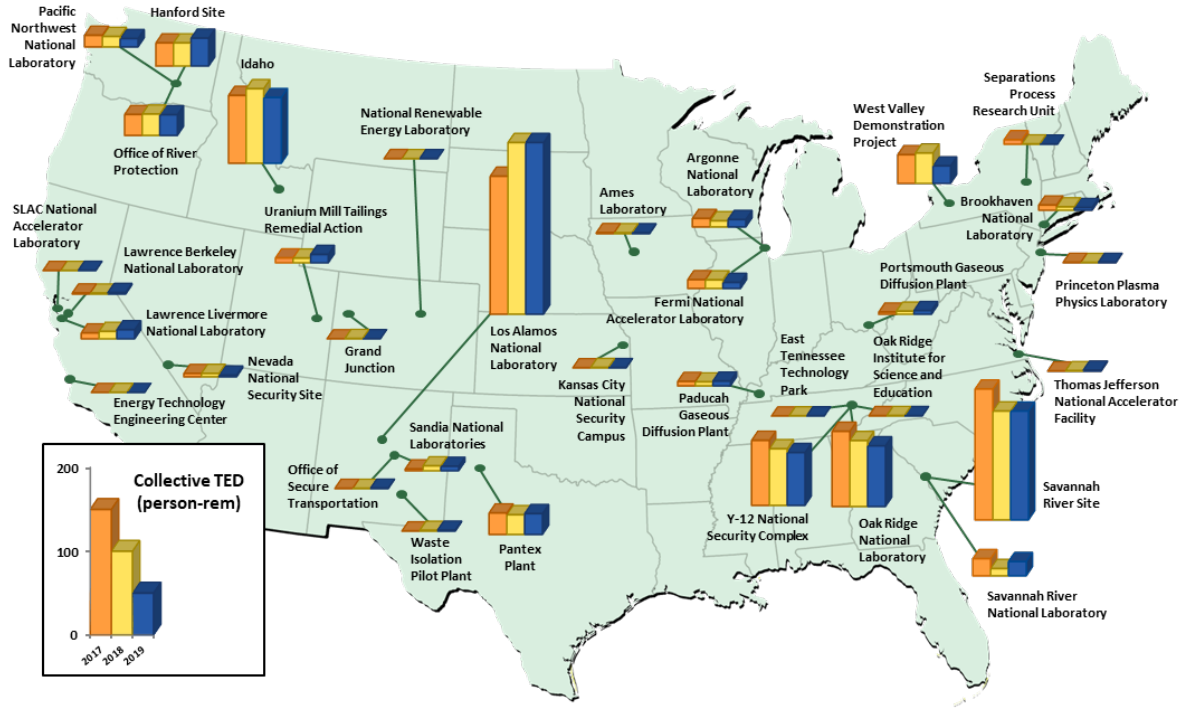
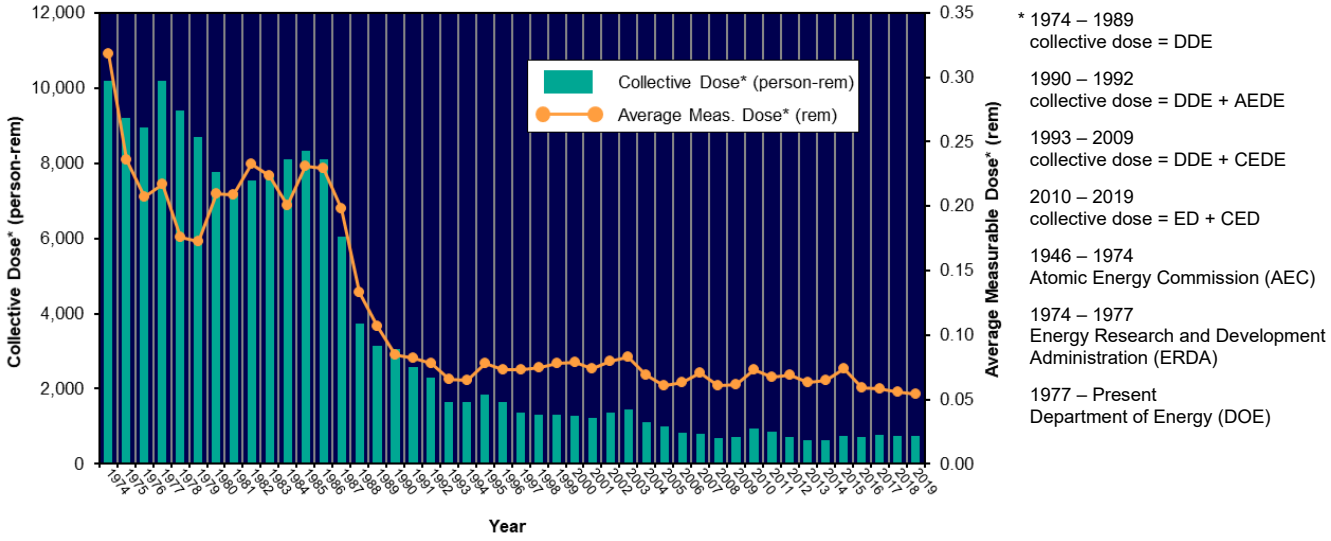


Exhibit 4 shows a summary of occupational doses back to CY 1974 when the Atomic Energy Commission split into the U.S. Nuclear Regulatory Commission and the Energy Research and Development Administration, which subsequently became DOE. It shows the general decreasing trend for collective dose and average measurable dose from CY 1974–2019.

As can be seen from the graphs, both parameters decreased dramatically between CY 1986 and CY 1993. The main reasons for this large decrease were the shutdown of facilities within the weapons complex and the end of the Cold War era, which shifted the DOE mission from weapons production to shutdown, stabilization, and decontamination and decommissioning activities.

Exhibit 4: Number of Workers with Collective Dose and Average Measurable Dose, CY 1974 – 2019



Conclusion

Over the past 5-years, measurable doses to all monitored individuals were well below the annual DOE regulatory limit of 5 rem (50 mSv) TED; however, one monitored individual received a single dose of 3.6 rem (36 mSv) in 2018, exceeding the 2 rem (20 mSv) DOE ACL.

Reference

The *U.S. Department of Energy Occupational Radiation Exposure Report for CY 2019* contains a description of work activities in relation to occupational radiation dose for each DOE facility. The annual report is located at:

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

Additional Sources of Information

REMS System Tools: REMS includes a database with over 4 million dose records. REMS system tools below provide access to summary data for research and interactive data visualization products.

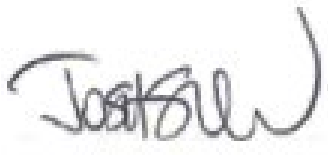
- Occupational Exposure Dashboard - Illustrated and Interactive Overview of Radiation Exposure at DOE Sites.
- REMS Query Tool - Provides access to REMS summary data for analysis.
- 10 Year Summary - Provides descriptions and trends of dose data over the last 10 years.

To access annual reports from CY 1974 to CY 2019, ALARA activities at DOE, REMS Query Tools, and other information on occupational radiation doses at DOE, visit the DOE ES&H website at:

https://www.energy.gov/ehss/policy-guidance-reports/databases/occupational-radiation-exposure

Questions regarding this OE-3 report can be directed to Nimi Rao at (301) 903-2297 or by email at nimi.rao@hq.doe.gov.

This OE-3 document requires no follow-up report or written response.



Josh Silverman
Director
Office of Environmental Protection and
ES&H Reporting
Office of Environment, Health, Safety and Security