

OE-3: 2020-01

February 2020

## DOE Occupational Radiation Exposures for 2018

### PURPOSE

This Operating Experience Level 3 (OE-3) document provides an overview of the status of occupational radiation exposures at the Department of Energy (DOE), including the National Nuclear Security Administration (NNSA), for the calendar year 2018.

### BACKGROUND

The Office of Environment, Health, Safety and Security (AU) provides the corporate-level leadership and strategic vision necessary to establish clear expectations and provide policy and assistance regarding health, safety, environment, and security programs. In support of this mission, the Office of Environment, Safety and Health (ES&H) Reporting and Analysis (AU-23) provides for the collection, analysis, and dissemination of data and performance indicators, such as occupational radiation exposure information.

DOE Order 231.1B, *Environment Safety and Health Reporting*, requires the reporting of radiation exposure data to the Radiation Exposure Monitoring System (REMS). The DOE annual report on occupational exposure provides a detailed evaluation of DOE-wide performance regarding compliance with Title 10, Code of Federal Regulations (CFR), Part 835, *Occupational Radiation Protection*, which includes requirements on occupational dose limits, as well as the principle of reducing radiation exposure to levels as low as reasonably achievable (ALARA). In addition, the report provides data to DOE organizations responsible for developing policies for protection of individuals from the adverse health effects of radiation. The occupational radiation exposure

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 May 31, 2019.

### DISCUSSION

The occupational radiation exposure records show that in 2018, DOE facilities continued to comply with DOE occupational dose limits and Administrative Control Levels, and worked to effectively minimize exposure to individuals.

Information on collective total effective dose (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.

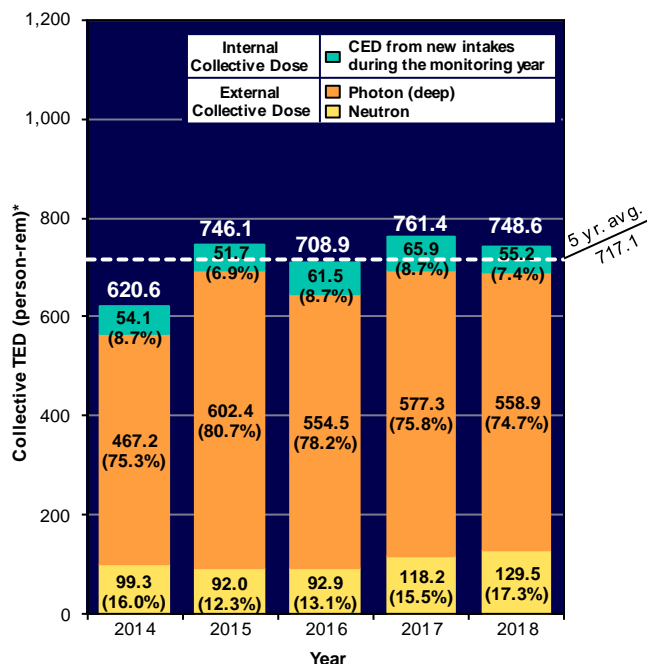
Highlights between 2017 and 2018 data include:

- The collective TED decreased 2 percent from 761 person-rem (7,610 person-mSv) in 2017 to 749 person-rem (7,490 person-mSv) in 2018.
- The collective CED (internal exposure) decreased by 16 percent from 65.9 person-rem (659 person-mSv) in 2017 to 55.2 person-rem (552 person-mSv) in 2018.
- The number of individuals with measurable CED increased by 4 percent from 1,287 in 2017 to 1,333 in 2018.
- The collective photon dose decreased by 3 percent from 577.3 person-rem (5,773 person-mSv) in 2017 to 558.9 person-rem (5,589 person-mSv) in 2018.

- The neutron component of the collective TED increased by 10 percent from 118.2 person-rem (1,182 person-mSv) in 2017 to 129.5 person-rem (1,295 person-mSv) in 2018.
- The average measurable TED decreased by 3 percent from 0.058 rem (0.580 mSv) in 2017 to 0.056 rem (0.560 mSv) in 2018.
- The number of workers with measurable TED increased by 2 percent from 13,024 in 2017 to 13,320 in 2018.

Exhibit 1 shows the components of the collective TED from 2014-2018 including the external dose contributions from photons and neutrons, as well as the internal dose from intakes.

**Exhibit 1:**  
Components of TED, 2014-2018.



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 actually received a measurable dose from 2014-2018. This value has remained within 16 percent of the 5-year average of 0.062 rem (0.62 mSv) over this time period.

In 2018, the five sites that contributed significantly (84 percent) to the collective TED are: Los Alamos National Laboratory (LANL), Oak Ridge National Laboratory (ORNL), Savannah River Site (SRS), Idaho, and Hanford.

**Exhibit 2:**  
Average Measurable TED, 2014-2018.

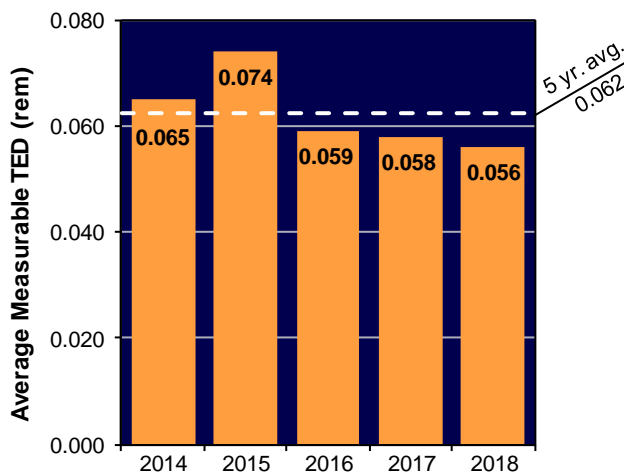


Exhibit 3 illustrates the collective TED at all DOE sites.

Based on the data reported, the collective TED increased at two of the five sites with the largest collective TED (LANL and Idaho).

As reported by LANL, the main increase in dose was due to the resumption of programmatic work at Technical Area 55 following a 2013 shutdown. The increase at Idaho was attributed to the maintenance, upgrade, and replacement of equipment in higher radiation areas.

The collective TED decreased at SRS, ORNL and Y-12. The SRS decrease was associated with a change in work activities such as the reduction in material in the HB-Line. As reported by ORNL, dose decreased at the research reactor and other hot cell facilities. Y-12 decreases were attributed to the decontamination of work areas and pauses in production.



**Exhibit 3:**  
Collective TED by DOE Site for 2016-2018

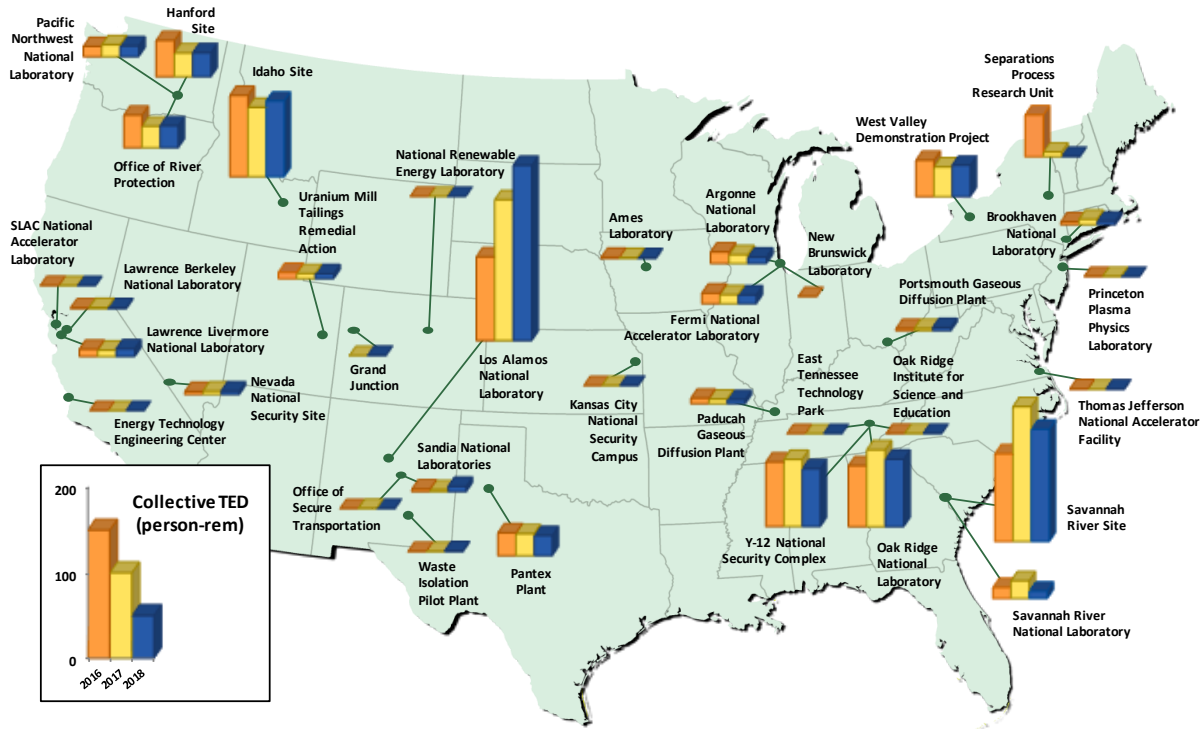
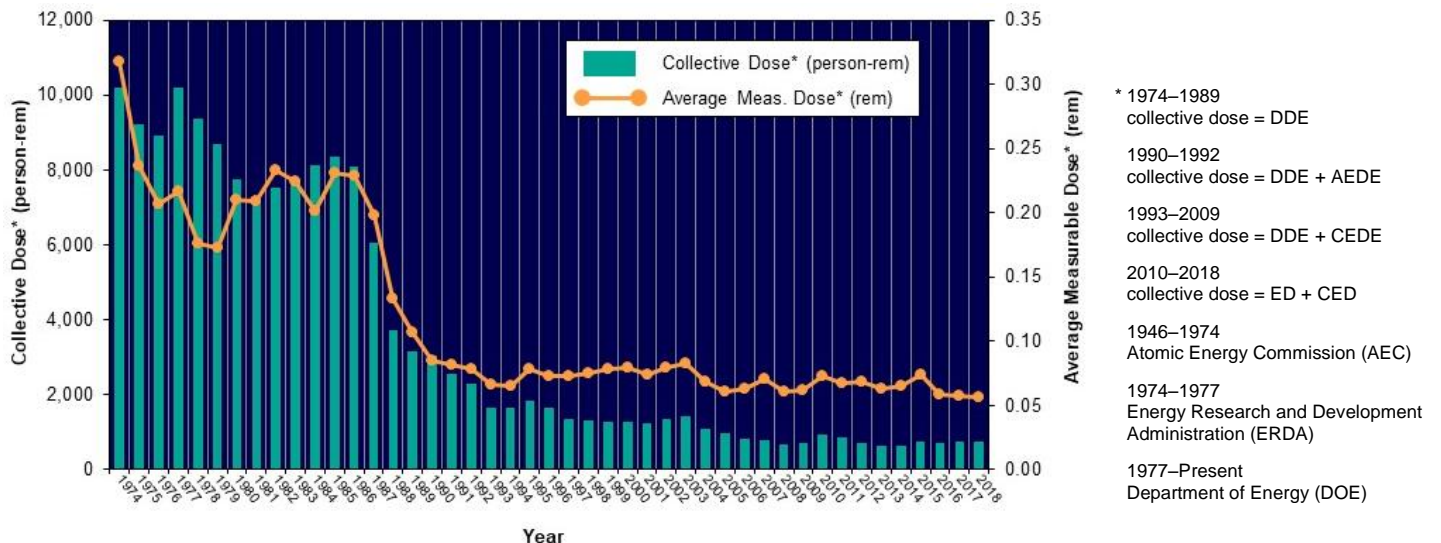


Exhibit 4 shows a summary of occupational exposures back to 1974, when the Atomic Energy Commission split into the U.S. Nuclear Regulatory Commission (NRC) and the Energy Research and Development Administration (ERDA), which subsequently became DOE. Exhibit 4 shows the collective dose and average measurable dose from 1974 to 2018. As can be seen from the graphs,

both parameters decreased dramatically between 1986 and 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 largely 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, 1974–2018



## CONCLUSION

Over the past 5-year period from 2014-2018, measurable doses to all monitored individuals were below the 2 rem (20 mSv) DOE TED ACL, and hence well below the DOE regulatory limit of 5 rem (50 mSv) TED in a year.

*Exhibit 4* illustrates the general decreasing trend for collective dose and average measurable dose from 1974 through 2018. This reflects the shift in DOE mission from weapons production to stabilization, waste management and environmental remediation activities, along with the consolidation and decontamination of facilities across the DOE complex to meet the new mission during this time period.

DOE continues to be diligent in protecting its workers and the public from exposure to radiation as proven by the results contained in this report.

## REFERENCE

The *DOE 2018 Occupational Radiation Exposure Report* contains a description of work activities in relation to occupational radiation exposure for each DOE facility. The annual report is located at:

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

## ADDITIONAL SOURCES OF INFORMATION

In addition, descriptions of ALARA activities at DOE are [voluntarily submitted](#) and compiled to illustrate improvement in radiation exposure reduction. DOE emphasizes the importance to maintain doses ALARA.

REMS System Tools: The Radiation Exposure Monitoring System (REMS) includes a database with over 4 million exposure 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 exposure data over the last 10 years.


To access annual reports since 1974 to 2018, ALARA activities at DOE, REMS Query Tools, and other information on occupational radiation exposure at DOE, visit the DOE AU web site 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 e-mail [nimi.rao@hq.doe.gov](mailto: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

