DIRECTOR, NAVAL REACTORS

4 August 2017

Dear Chairwoman Svinicki,

Enclosed is the Executive Summary of the Naval Nuclear Propulsion Program's latest reports on environmental monitoring and radioactive waste disposal, radiation exposure, and occupational safety and health. The Executive Summary also contains a link for accessing the full reports online, as well as contact information for my office if you would like to receive paper copies.

The enclosed summary highlights the Program's continued commitment to maintaining the highest standards for protecting the public, the environment, and the workforce while employing an unforgiving and complex technology. These annual reports have long been a matter of public record and continue to show that:

- In over 60 years of operation, naval nuclear-powered ships and their support facilities have had no discernible effect on public health or the quality of the environment.
- Average occupational radiation exposure was much less than the yearly exposure received by the average U.S. citizen due to natural background radiation.
- All Program personnel received less than 40% of Federal radiation exposure limits.
- The recordable injury and illness incidence rate at Program Department of Energy facilities was significantly lower than the rate for general industry.

Our strict control of the Naval Nuclear Propulsion Program, our commitment to critical self-assessment and continual improvement, and our strong, centralized oversight continue to ensure the safe and effective operation of our nuclear-powered warships.

Very respectfully,

J. F. CALDWELL, JR.
Admiral, U.S. Navy

The Honorable Kristine L. Svinicki
Chairman
U.S. Nuclear Regulatory Commission
Mail Stop O-16G4
Washington DC 20555-0001

Enclosure

Naval Nuclear Propulsion Program Annual Reports on Environmental Monitoring and Radioactive Waste Disposal, Occupational Radiation Protection, and Occupational Safety and Health - 2017 Executive Summary

Introduction

The U.S. Naval Nuclear Propulsion Program (NNPP) is responsible for all aspects of naval nuclear propulsion, including research, design, construction, testing, operation, training of personnel, as well as decommissioning and disposal of propulsion plants. There has never been a nuclear accident or any release of radioactivity that would affect human health or had an adverse effect on marine life in the more than 60 years that the NNPP has been operating reactors. The Program currently covers 80 commissioned nuclear-powered warships and 101 operating reactors. Since 1955, U.S. Navy nuclear-powered ships have steamed over 160 million miles and amassed over 6,900 reactor-years of operating experience. These ships have visited more than 150 ports in over 50 foreign countries and dependencies. In addition to naval nuclear-powered ships and Navy support facilities, the NNPP includes four Department of Energy (DOE) sites in New York, Pennsylvania, and Idaho.

The NNPP is thoroughly committed to the protection of the environment and the health and safety of personnel. Each year, the NNPP issues the following reports on the topics of environmental monitoring and radioactive waste disposal, occupational radiation protection, and occupational safety and health:

- NT-17-1, *Environmental Monitoring and Disposal of Radioactive Wastes from U.S. Naval Nuclear-Powered Ships and Their Support Facilities.*
- NT-17-2, *Occupational Radiation Exposure from U.S. Naval Nuclear Power Plants and Their Support Facilities.*
- NT-17-3, *Occupational Radiation Exposure from Naval Reactors' Department of Energy Facilities.*
- NT-17-4, *Occupational Safety, Health, and Occupational Medicine Report.*

This Executive Summary provides the highlights of the four reports as well as directions for obtaining the complete reports in either electronic or paper formats. The key information from each of these reports is summarized below.

Highlights from the 2016 Reports

- In over 60 years of operation, naval nuclear-powered ships and their support facilities have had no discernible effect on public health or the quality of the environment.
- Average occupational radiation exposure was much less than the yearly exposure received by the average U.S. citizen due to natural background radiation.
- No NNPP personnel have exceeded 40 percent of the annual Federal limit from 1980 to 2016.
- The recordable injury and illness incidence rate at NNPP DOE facilities was significantly lower than the rate for general industry.

Obtaining the Complete Reports

There are two methods for easily obtaining either electronic or paper copies of the complete NNPP Annual Reports.

Electronic copies: PDF copies of the latest annual reports are available at the following web page:

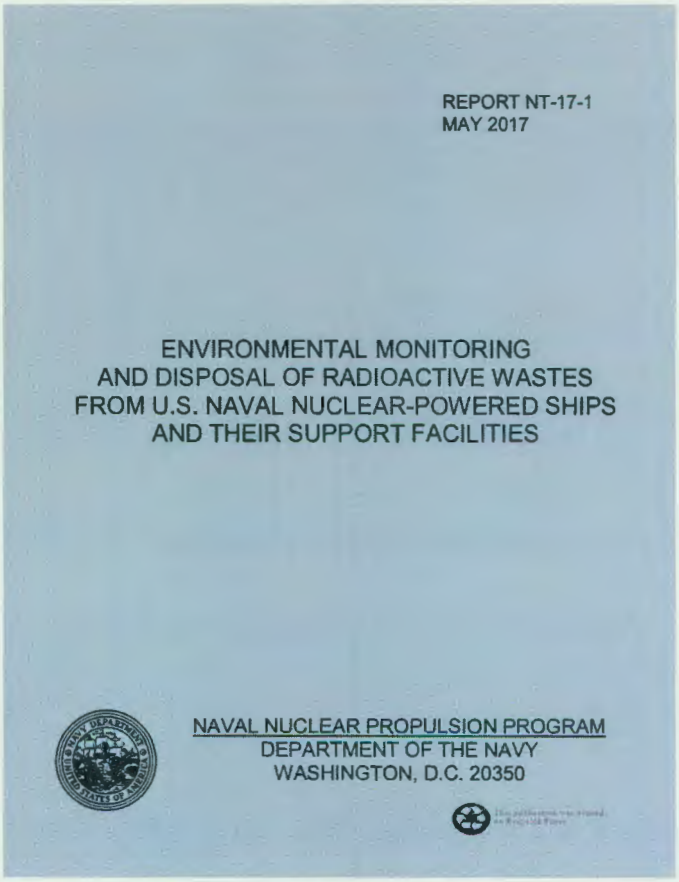
http://nnsa.energy.gov/ourmission/poweringnavy/annualreports

This web page can also be accessed by typing "Naval Reactors Annual Reports" into a search engine such as Google. The above web page will be one of the top links that is found. Additional information on the history and operation of the program can also be found on this web page.

Paper Copies: Paper copies of any or all of the annual reports may be requested by email to the following address: daniel.bonamer@navy.mil.

Report NT-17-1, May 2017

Environmental Monitoring and Disposal of Radioactive Wastes from U.S. Naval Nuclear-Powered Ships and Their Support Facilities



This report assesses the environmental effect of disposal of radioactive wastes originating from U.S. naval nuclear propulsion plants and their support facilities. As of the end of 2016, the U.S. Navy had 75 nuclear-powered submarines, 11 nuclear-powered aircraft carriers, and two moored training ships in operation. Support facilities include six shipyards, two tenders, and six naval bases.

This report describes disposal of radioactive liquid, transportation and disposal of solid wastes, and monitoring of the environment to determine the effect of radioactive releases, and updates previous reports on this subject issued by the Navy. Radioactivity associated with U.S. naval nuclear-powered ships has had no discernible effect on the quality of the environment. A summary of the radiological information supporting this conclusion follows:

- From the start of the NNPP, the policy of the U.S. Navy has been to reduce to the minimum practicable the amounts of radioactivity released into harbors. Since 1971, the total long-lived gamma radioactivity released each year within 12 miles of shore from all U.S. naval nuclear-powered ships and their support facilities has been less than 0.002 curie; this includes all harbors, both U.S. and foreign, entered by these ships.

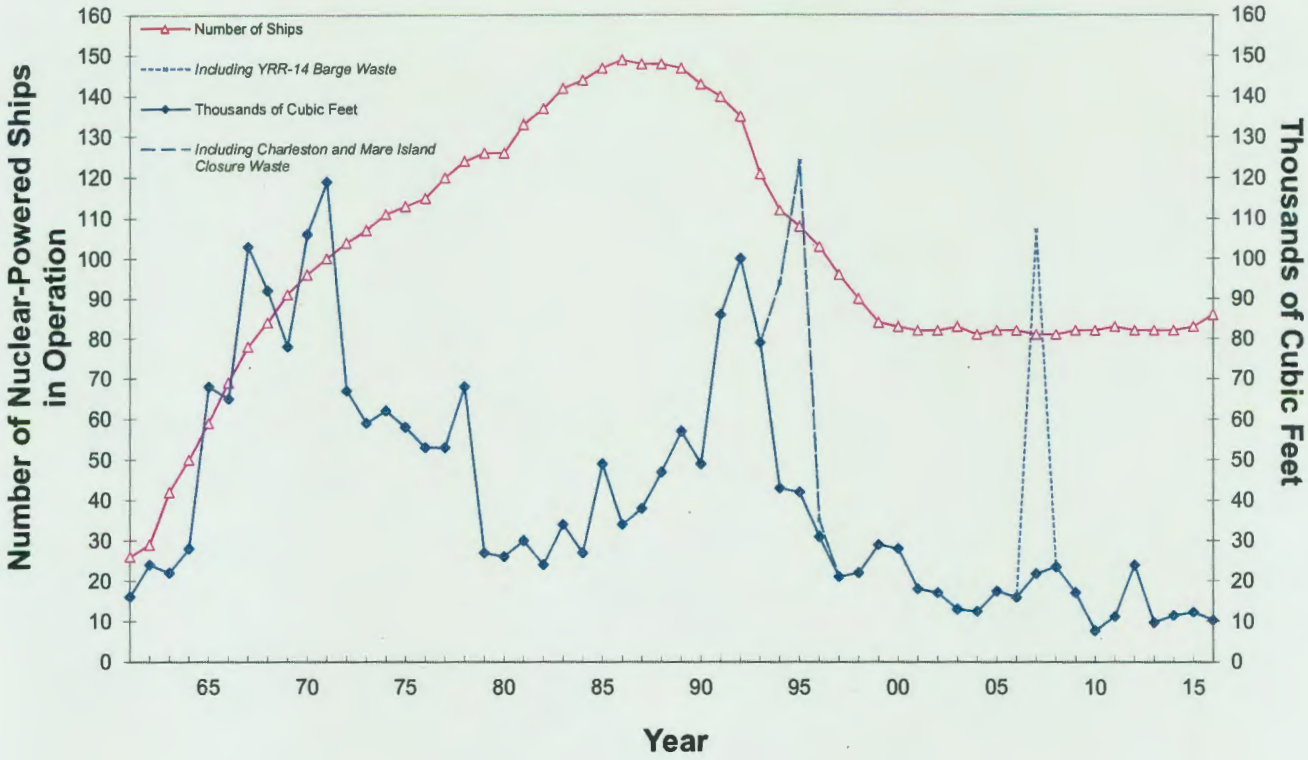
- The total quantity of long-lived radioactivity released within 12 miles of shore in any of the last 46 years is less than the quantity of naturally occurring radioactivity in the volume of saline harbor water occupied by a single nuclear-powered submarine, or the quantity of naturally occurring radioactivity in the top inch of soil on a half-acre lot. If one person were able to drink the entire amount of radioactivity discharged into any harbor in any of the last 46 years, that person would not exceed the annual radiation exposure permitted by the Nuclear Regulatory Commission for an individual nuclear worker.

- Environmental monitoring is conducted by the U.S. Navy in U.S. and foreign harbors frequented by U.S. naval nuclear-powered ships. This monitoring consists of analyzing harbor sediment, water, and marine life samples for radioactivity associated with naval nuclear propulsion plants; radiation monitoring around the perimeter of support facilities; and effluent monitoring. Environmental samples from each of these harbors are also checked at least annually by a DOE laboratory to ensure analytical procedures are correct

and standardized. This monitoring confirmed radioactivity associated with U.S. naval nuclear-powered ships has no discernible effect on the quality of the environment.

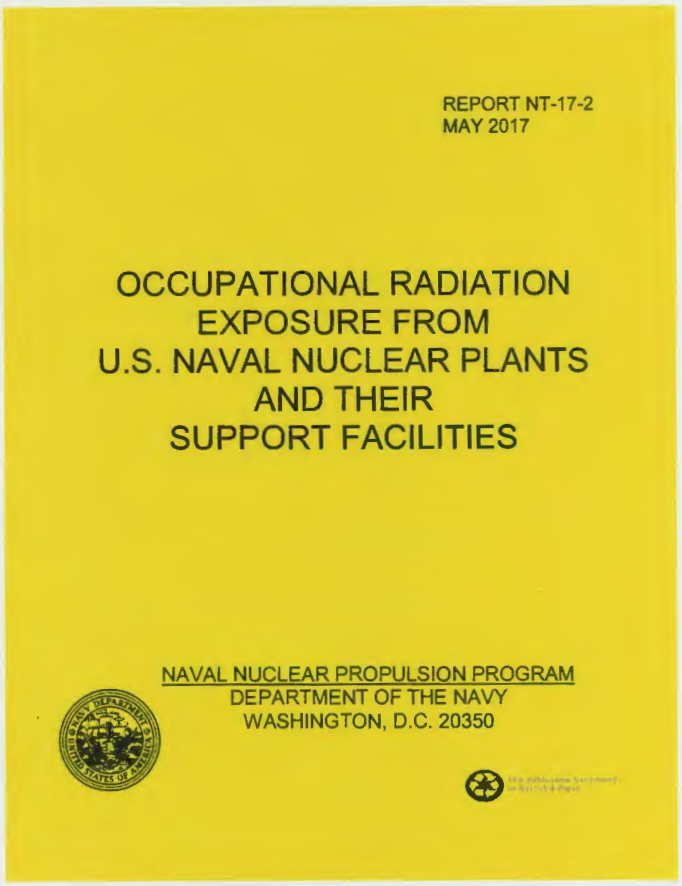
- The annual volume of solid low-level radioactive waste disposed of at commercial disposal sites in 2016 by the entire NNPP could be contained in a cube measuring less than 8 yards on a side. The total annual volume disposed of by the NNPP is about 1 percent of the total volume of solid low-level radioactive waste buried at disposal sites in the States of Washington, South Carolina, Utah, and Texas each year. The volume of radioactive waste generated by the NNPP is shown in the figure below for the past 56 years, along with the number of nuclear-powered ships in operation during each year. The volume of solid low-level radioactive waste produced per ship supported has decreased substantially over time.

RADIOACTIVE SOLID WASTE DISPOSAL IN THE NAVAL NUCLEAR PROPULSION PROGRAM 1961 – 2016



Report NT-17-2, May 2017

Occupational Radiation Exposure from U.S. Naval Nuclear Plants and Their Support Facilities



Radiation exposures to Navy and civilian personnel monitored for radiation associated with U.S. naval nuclear propulsion plants are summarized in this report. A summary of the conclusions of this report follows:

- Total shipyard personnel radiation exposure decreased slightly from 441 Rem in 2015 to 440 Rem in 2016 (shipyard average annual radiation exposure per person remained approximately the same from 2015 to 2016 at 0.017 Rem), while the number of ships in overhaul remained approximately constant from 2015 to 2016. The average radiation exposure to shipyard personnel in 2016 is less than one-third of the average annual dose received by commercial nuclear power plant personnel.

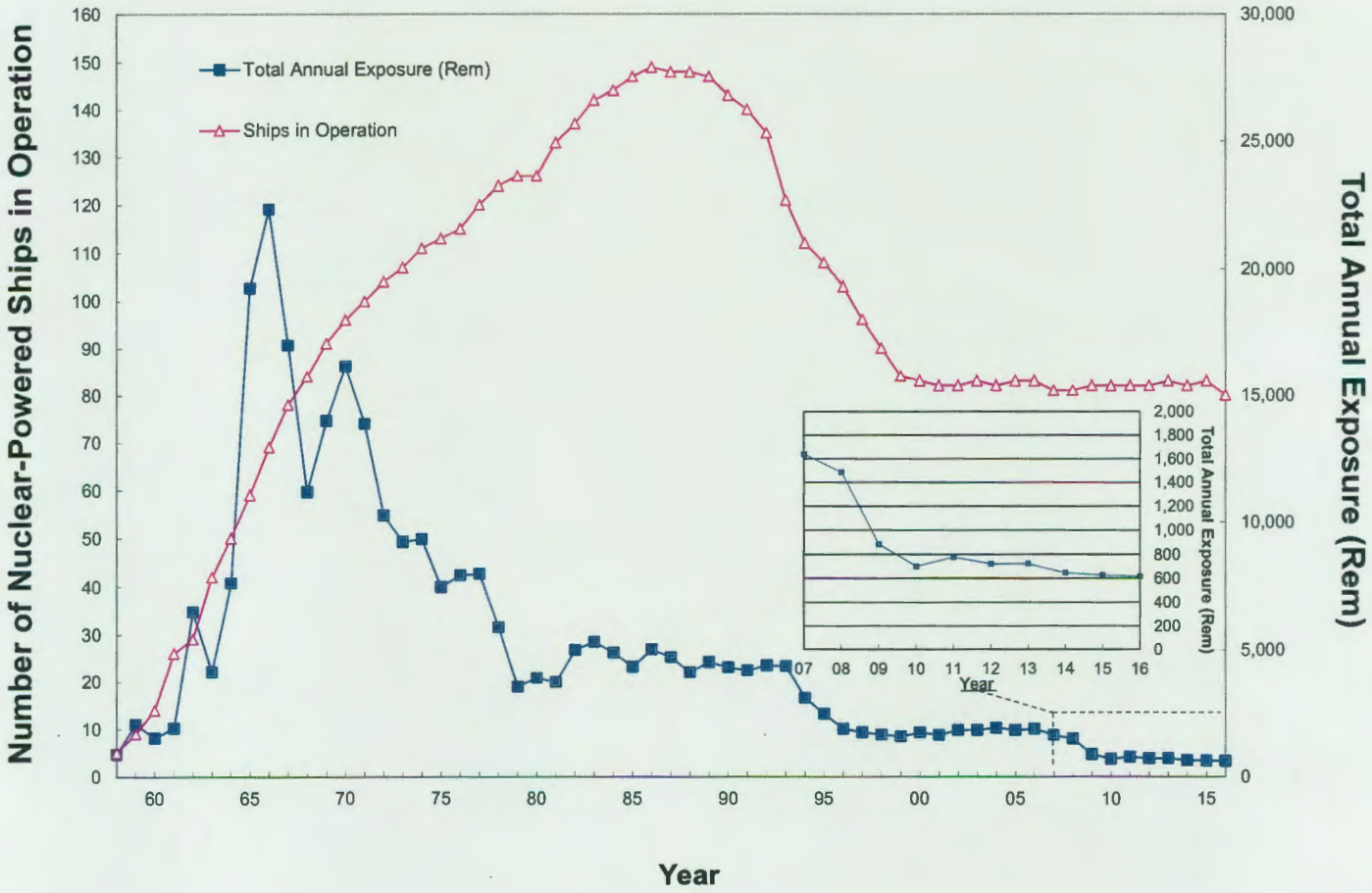
- Total Fleet personnel radiation exposure decreased from 186 Rem in 2015 to 176 Rem in 2016 (Fleet average annual radiation exposure per person decreased from 0.011 Rem in 2015 to 0.010 Rem in 2016). Personnel operating the Navy's nuclear-powered ships receive much less radiation exposure in a year than the average U.S. citizen does from natural background and medical radiation exposure. For example, the occupational exposure received by the average nuclear-trained sailor living onboard one of the Navy's nuclear-powered ships in 2016 was less than a twentieth of the average annual radiation exposure received by the average U.S. citizen from natural background sources and less than a tenth of the exposure received from common diagnostic medical procedures such as an x-ray of the back. This achievement is possible because of very conservative shielding designs on these ships (a tenet of the NNPP since it was founded in 1948).

- No NNPP personnel have exceeded the current Federal annual occupational radiation exposure limit of 5 Rem (established in 1994) since 1967. In fact, no NNPP personnel have exceeded 40 percent of the annual limit from 1980 to 2016 (i.e., no personnel have exceeded 2 Rem in any year in the last 37 years). No civilian or military NNPP personnel have ever, in 60 years of operation, exceeded a Federal lifetime exposure limit.

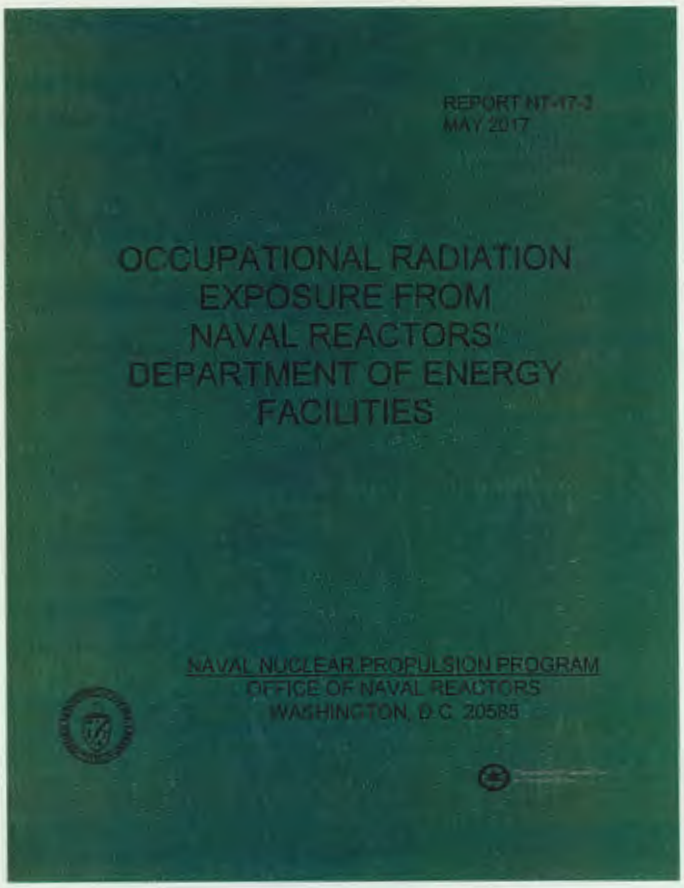
- According to the standard methods for estimating risk, the cancer risk to the group of personnel occupationally exposed to radiation associated with naval nuclear propulsion plants is less than the risk these same personnel have from exposure to natural background radiation. This risk is small in comparison to both the risks accepted in normal industrial activities and the risks regularly accepted in daily life outside of work.

- The figure below shows that the total personnel radiation exposure in 2016 is about 3 percent of the amount in the peak year of 1966, even though today there are about 24 percent more nuclear-powered ships in operation than in 1966.

TOTAL RADIATION EXPOSURE RECEIVED BY MILITARY AND CIVILIAN PERSONNEL IN THE NAVAL NUCLEAR PROPULSION PROGRAM 1958 - 2016



Report NT-17-3, May 2017



Occupational Radiation Exposure from Naval Reactors' Department of Energy Facilities

The NNPP operates two DOE laboratory sites; one DOE site with two operating and one inactive and defueled prototype naval nuclear propulsion plants; one DOE site that operates the Expended Core Facility and has three inactive and defueled prototype naval nuclear propulsion plants; and a nuclear component engineering and procurement organization. Naval Reactors' DOE facilities provide research and development, engineering, training, and supply support for the Navy's 75 nuclear-powered submarines and 11 nuclear-powered aircraft carriers (as of the end of 2016).

The NNPP's radiation protection program and occupational radiation exposures to personnel monitored for radiation associated with Naval Reactors' DOE facilities are summarized in this report. A summary of the conclusions of this report follows:

- The figure on the following page shows the total personnel radiation exposure in 2016 at Naval Reactors' DOE facilities of 19 Rem, nearly 50% less than the total exposure of 37 Rem in 2015, continued the trend of maintaining the NNPP's low total radiation exposure. This significant decrease in radiation exposure from 2015 to 2016 was expected due to a reduction in prototype maintenance involving higher radiation exposures compared to 2015.

- Naval Reactors' DOE facilities average annual exposure in 2016 was 0.003 Rem per person, which is approximately equivalent to the radiation exposure received during a single one-way cross country airline flight. For perspective, the average radiation exposure received from NNPP sources by personnel at Naval Reactors' DOE facilities in 2016 was less than one-fifteenth the average annual exposure received by commercial nuclear power plant personnel and approximately one-hundredth of the average annual radiation exposure of individuals in the U.S. population due to natural background radiation.

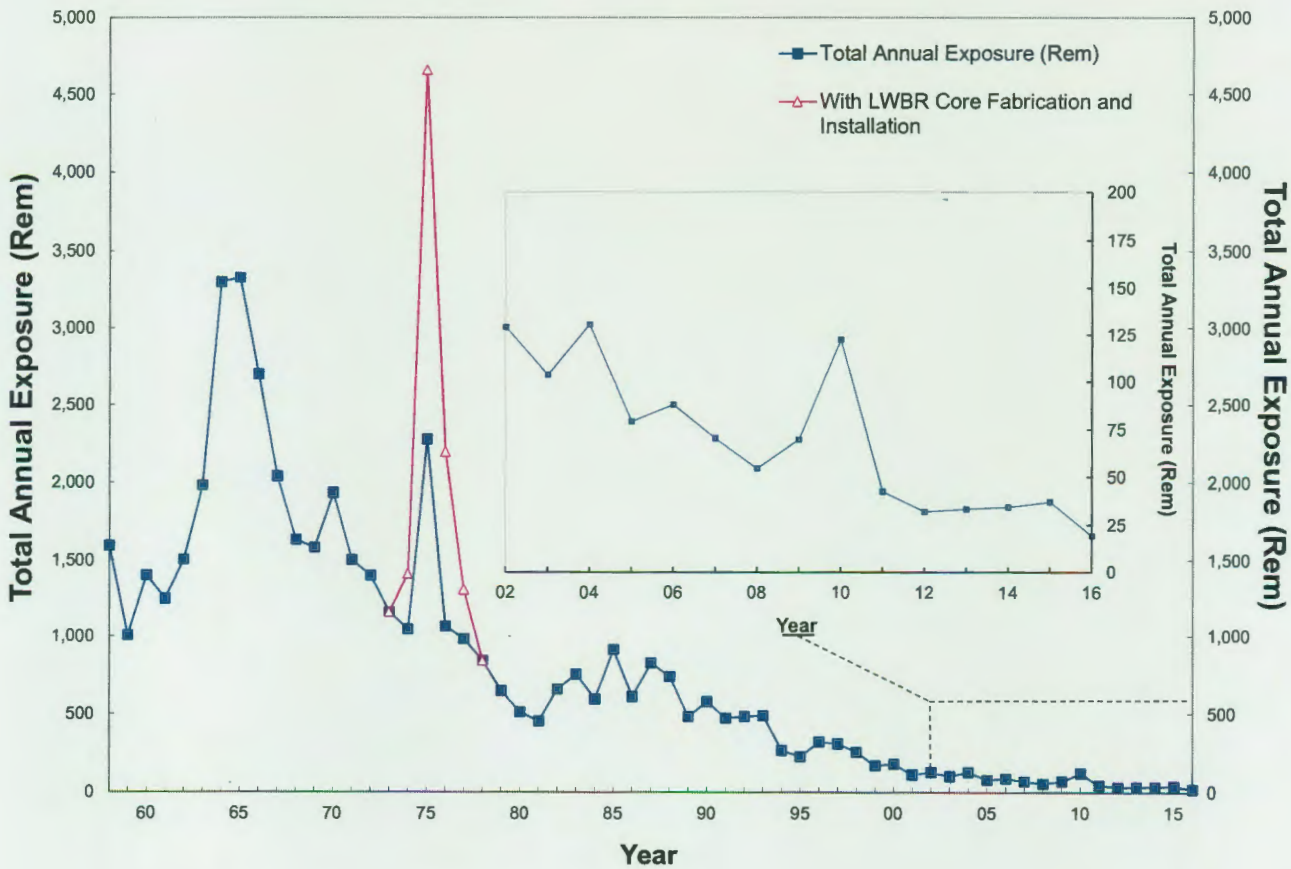
- No NNPP personnel have exceeded the current Federal annual occupational radiation exposure limit of 5 Rem (established in 1994) since 1967. In fact, no NNPP personnel have exceeded 40 percent of the annual limit from 1980 to 2016 (i.e., no personnel have exceeded 2 Rem in any year in the last 37 years). No civilian or military NNPP personnel have ever, in almost 60 years of operation, exceeded a Federal lifetime limit.

- According to the standard methods for estimating risk, the lifetime risk to the group of personnel occupationally exposed to radiation associated with the NNPP is less than the

risk these same personnel have from exposure to natural background radiation. This risk is small compared to the risks accepted in normal industrial activities and to the risks regularly accepted in daily life outside of work.

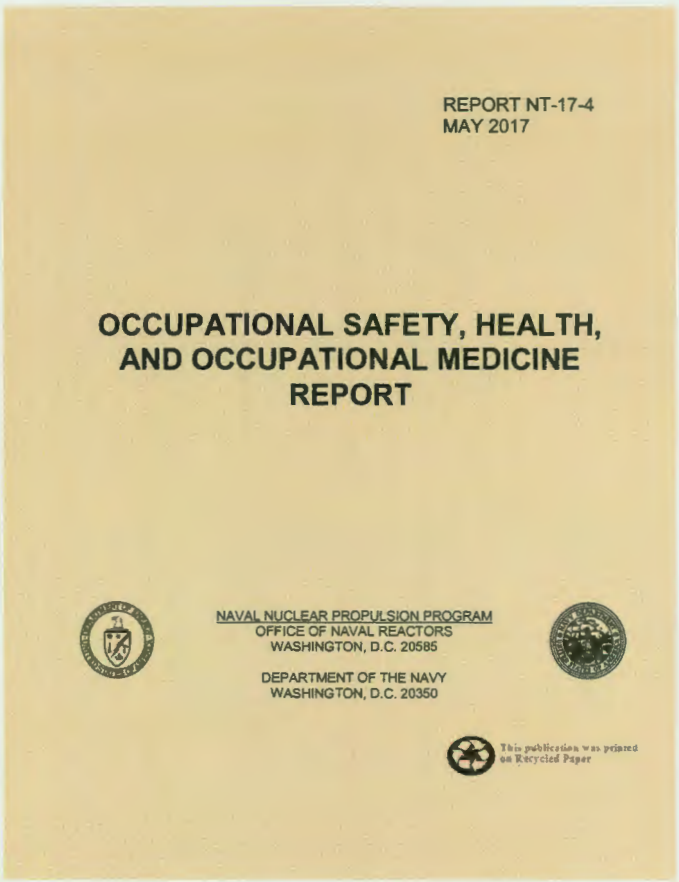
- The figure below shows how significantly the Program has decreased radiation exposure to personnel at Naval Reactors' DOE facilities over the past 59 years.

FIGURE 1
TOTAL RADIATION EXPOSURE RECEIVED BY PERSONNEL
AT NAVAL REACTORS' DEPARTMENT OF ENERGY FACILITIES
1958 - 2016



Report NT-17-4, May 2017

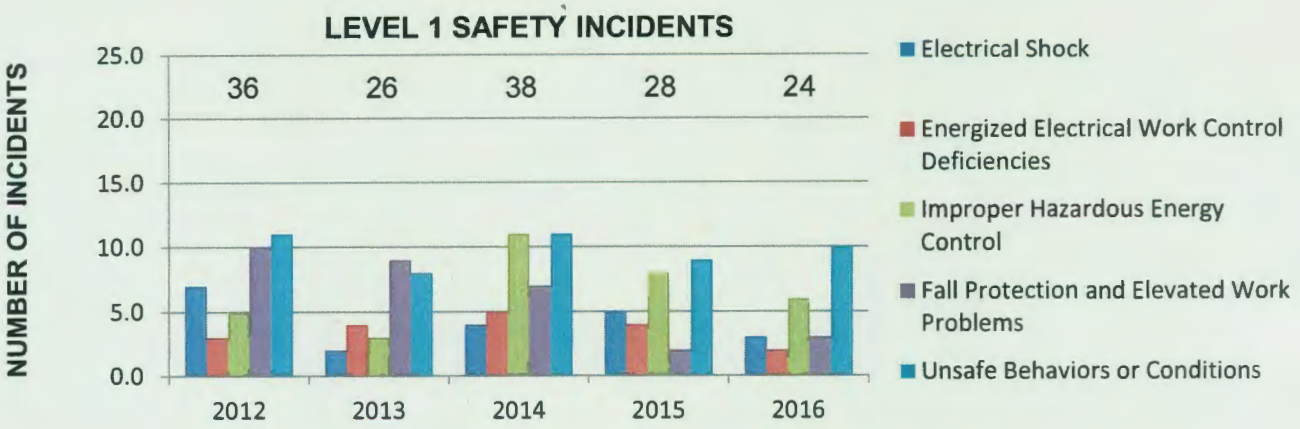
Occupational Safety, Health, and Occupational Medicine Report



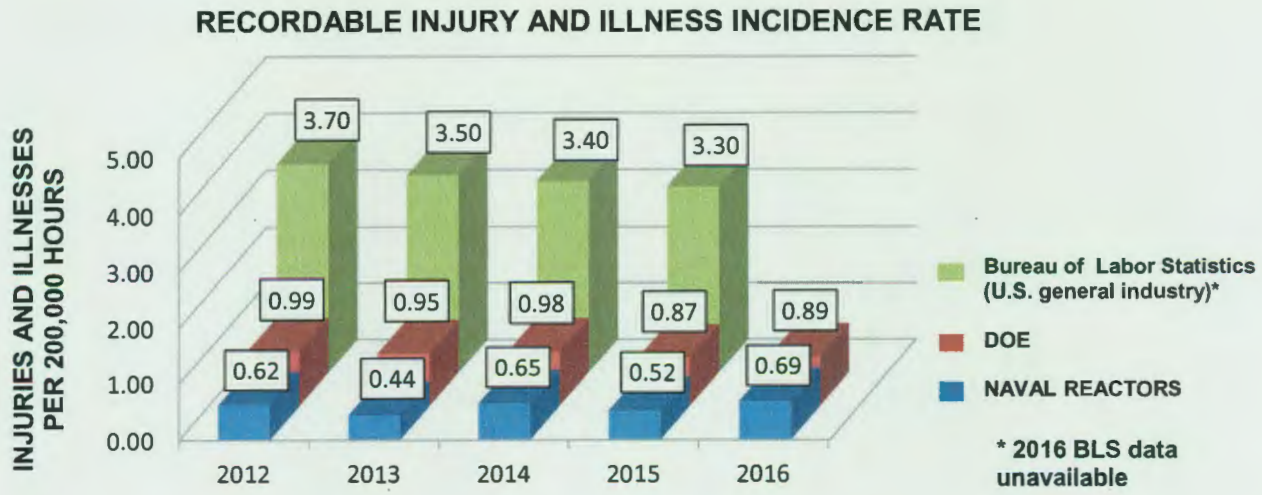
The NNPP is responsible for occupational safety, health, and occupational medicine at two DOE laboratory sites; one DOE facility with two prototype naval nuclear propulsion plants; one DOE facility which operates the Expended Core Facility; and one naval training facility with two nuclear-powered moored training ships. The NNPP is founded on the principle of risk reduction through the identification, assessment, and mitigation of hazards when planning for site operations, developing procedures, and designing systems and facilities. The following summarizes the NNPP's performance in worker protection:

- Robust Safety Culture: The NNPP maintains a robust safety culture through the implementation of several key principles, including a proactive management stance towards safety, peer-to-peer ownership of safety, engineering efforts to eliminate high-risk work, and commitment to continuous improvement. Primary responsibility for employee safety and health resides with line management and the workers themselves, with assistance and oversight from industrial hygiene, safety, and medical professionals. Inspection, oversight, and feedback systems are designed to provide continuous improvement. The NNPP also focuses on eliminating hazards that put workers in high-risk environments through detailed engineering, worker involvement in planning, and by requiring management approval to do high-risk work, when necessary.

- Correcting Small Problems to Prevent More Significant Problems: The NNPP maintains an impeccable reactor safety record due to the identification and correction of small problems in and around the facilities. Similarly, for worker safety, focusing on near-miss incidents that do not result in personnel injury minimizes the occurrence of more serious injuries or fatalities. The key to a safer workforce is identifying and addressing underlying causes of the near-miss incidents and applying lessons learned before they grow into larger problems. Over the past five years, there has been an overall downward trend in the number of near-miss incidents, indicating that the NNPP's efforts to identify and fix small problems are reducing the frequency and severity of safety issues.



- Healthy and Productive Workforce: The number of occupational injuries experienced continues to remain low as a result of ongoing efforts to further strengthen the safety culture. In 2016, the NNPP's recordable injury and illness rate (as defined by the Occupational Safety and Health Administration) was 0.69 injuries per 200,000 hours worked. This rate is slightly higher than the NNPP's five year average injury rate of 0.58, but almost five times lower than the injury rate U.S. general industry experienced in 2015. The NNPP has experienced no occupationally related fatalities at its DOE or moored training ship facilities in over 30 years.



DEPARTMENT OF THE NAVY
NAVAL SEA SYSTEMS COMMAND
1333 ISAAC HULL AVENUE SE
WASHINGTON NAVY YARD DC 20376-0001
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THE HONORABLE KRISTINE L. SVINICKI
CHAIRMAN
U.S. NUCLEAR REGULATORY COMMISSION
MAIL STOP: O-16G4
WASHINGTON, DC 20555-0001

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