The Sound of Silence Project™

Radiation: The undeclared enemy of U.S. Military Nuclear Weapons Technicians

Recognition and Compensation for America's Cold War Era Veteran Nuclear Weapons Technicians

Nuclear Weapons Ionizing Radiation and Toxic Substance Exposure

Inclusive dates: September 2, 1945 – December 26, 1991

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Project Introduction and Information Document v2.1.1, 26 July 2023

Replaces v1.6.2, 10 June 2023

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Contents

Prologue

U.S. Military Veteran Nuclear Weapons Technicians' Contributions to the Nation

> *Since World War II,* tens *of thousands of* military *men and women have served* our *Nation in* sustaining *its nuclear defense*. *In the course of their work, they overcame previously unimagined technical and* personal *challenges. Thousands of these courageous Americans, however, paid a high price for their service, developing disabling or fatal illnesses as a result of their exposure to ionizing radiation,* toxic chemicals, *and other hazards unique to nuclear weapons* maintenance *and testing. Too often, these* military veterans *were neither adequately protected from, nor informed of, the occupational* dangers *to which they were exposed.*
>
> *Existing* veterans' *compensation programs have failed to provide for the needs of these* veterans *and their families.* Veterans' *compensation programs have generally not included these* Nuclear Weapons Technicians from the Cold War period*. Further, because of long latency periods, the uniqueness of the* dangers *to which they were exposed, and inadequate exposure data, many of these individuals have been unable to obtain compensation benefits. This problem has been exacerbated by the policies of the Department of* Veterans Affairs that discourage many legitimate *claims of* veterans *who sought,* and continue to seek, *those benefits.*
>
> *While the Nation can never fully repay these* veterans *or their families, they deserve recognition and compensation for their sacrifices.* [1]

The preceding statement was adapted from an excerpt of United States Presidential Executive Order (EO) 13179, December 7, 2000, "*Providing Compensation to America's Nuclear Weapons Workers*", Section 1, Policy. The original wording from the EO is in italics. It is intended to demonstrate distinct similarities of dangers faced by military Nuclear Weapons Technicians and civilian Nuclear Weapons Workers—the subjects of the Executive Order—during the Cold War.

It includes few changes except related references to Nuclear Weapons Technicians (military veterans) in place of Nuclear Weapons Workers (civilian employees); maintenance replaced production; difficulties with Department of Veterans Affairs claims in lieu of Department of Energy (DOE) opposition to civilian claims; the number of veterans compared to civilian DOE workers and contractors; and added toxic chemicals.

Nuclear Weapons Technicians—U.S. military veterans—served our Nation during the Cold War period and helped maintain a strong, reliable nuclear weapons defense and deterrence.

While we kept "secrets" about our profession from our families, family members also served the Nation while providing support and enduring hardships that those conditions brought.

[1] The wording is adapted from an excerpt of Executive Order 13179, December 7, 2000, "*Providing Compensation to America's Nuclear Weapons Workers*", Section 1, Policy. Original wording is in italics. https://www.govinfo.gov/content/pkg/FR-2000-12-11/pdf/00-31692.pdf

National pride and dedication, with the critical nature of our military duties, masked the risks and dangers we encountered—on land, on the seas, and under the seas—*many of which we were never made aware of by those with whom we entrusted our safety, health, and our lives.*

Nuclear Weapons Technicians, by virtue of the immediate and sustained impact on national security, and secrecy requirements of the missions and duties, are literally an unknown group of thousands of U.S. military veterans, many of whom have already passed.

Our primary duties were to maintain, repair, disassemble, replace components, assemble, modify, test, calibrate, transport, and store live nuclear weapons in the care and custody of the U.S. Army, Navy, Marine Corps and Air Force. Those routine tasks exposed veterans to ionizing radiation every time we worked on or near a live nuclear warhead, weapon, or weapon system.

Nuclear Weapons Technicians also worked without adequate respiratory and other personal protection from toxic and carcinogenic chemicals, organic solvents, compounds and metals during nuclear weapons and associated equipment maintenance.

Based on current federal law, the Department of Veterans Affairs does not consider U.S. military veteran Nuclear Weapons Technicians' duties to be a "*Radiation-Risk Activity*", and we are not considered as having "*Exposure to Radiation during Military Service*". VA does not consider ionizing radiation and toxic substances as occupational causes of cancers, other diseases, or debilitating illnesses with Nuclear Weapons Technicians.

The Department of Defense defined occupational exposure to radiation as: "*Routine exposure of DoD personnel to radiation associated with DoD operations during performance of their official duties".* [2] This definition, standing alone or in other context, confirms U.S. military veteran Nuclear Weapons Technicians' duties as described in this document to be a "Radiation-Risk Activity" and "Exposure to Radiation during Military Service".

VA does not "*presume exposure*" to veteran Nuclear Weapons Technicians as it is presumed with several other categories of veterans and, through the Department of Labor, hundreds of thousands of Department of Energy "Nuclear Weapons Workers" and contractors under the Energy Employees Occupational Illness Compensation Program Act of 2000. We ask nothing more than others receive with respect to recognition, support, health care, and related benefits.

This document provides examples of the duties and risks of Nuclear Weapons Technicians. We are a proud group; however, many face a foreboding and uneasy sense of reality. A reminder of the dangers we were exposed to, but not warned about and not protected from. A reminder of the tragic and preventable medical and health effects that many suffer from, including those who died as a result.

We share the hope and expectation that Nuclear Weapons Technicians will receive recognition and certification as members of a category, class, cohort, or group of veterans with duties designated as "radiation-risk" and "toxic exposure risk" activities and include related "presumed exposure" for both. Time is running short for all of us.

[2] DODI 6055.8, Occupational Radiation Protection Program, 31 March 1989, Definition, Occupational Exposure

Introduction

The Sound of Silence Project was created to address decades of problems with veterans' exposure to nuclear weapons intrinsic radiation or INRAD [3] (ionizing radiation emitted through the nuclear weapon surface or directly from exposed weapon components), and our routine use of toxic and carcinogenic chemicals and other substances.[4] Those exposures resulted in illnesses, diseases, debilitating medical conditions, and death.

This document includes project goals and objectives, historical practices in nuclear weapons maintenance, evidence of decades of negligence regarding personnel ionizing radiation safety programs and practices, and unsafe work practices and conditions during routine use of toxic and carcinogenic chemicals, organic solvents, and compounds or metals such as chromium trioxide, cadmium, magnesium, and beryllium. It addresses shortcomings due to the Department of Veterans Affairs (VA) incomprehension of the radiation-risk activities in routine nuclear weapons maintenance procedures, and the absence of ionizing radiation dose data due to failure to adequately monitor and manage exposures. Significant VA misconceptions regarding the differences in dangers of ionizing radiation from live nuclear weapons, compared to hazards of medical x-rays, are also discussed. Note: This project does not apply to, nor include, exploded nuclear weapons in any manner or form.

Nuclear Weapons Technicians and Similar Job Classifications, Titles, Rating, MOS, Specialty, etc.

Thousands of Nuclear Weapons Technicians and those with synonymous military specialty titles in the U.S. Army, Navy, Marine Corps, and Air Force performed maintenance and other tasks with numerous series of live nuclear weapons and warheads during the Cold War period defined as September 2, 1945, through December 26, 1991.[5] For this project, and the formal processes to follow, those are our specific beginning and ending dates.

The term Nuclear Weapons Technician is used throughout this project to represent:

"*U.S. military veterans whose primary duties and responsibilities included operations working on, with, and in close physical proximity* [6] *to live nuclear weapons or exposed radioactive nuclear weapon components in the operational or custodial control of the Department of Defense. The term includes nuclear weapons technical inspectors, supervisors, and managers whose duties routinely required them to be in close physical proximity to live nuclear weapons and exposed to INRAD*." "Nuclear weapon" is synonymous with "nuclear warhead" herein.

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[3] Nuclear weapons emit intrinsic radiation (INRAD): "*Ionizing radiation emitted through the weapon surface or directly from exposed weapon components."* DOE-DTRA TP 4-1, Army TM 39-4-1, Navy SWOP 4-1, Air Force T.O. 11N-4-1 IC1 30 July 2016, Glossary of Nuclear Weapons Material and Related Terms.

[4] "Chemical" or "toxic chemical" may be used for brevity to include "toxic and carcinogenic organic solvents" or "toxic and carcinogenic compounds".

[5] The Cold War period was established as September 2, 1945, to December 26, 1991, by the 1998 National Defense Authorization Act.

[6] *Close physical proximity,* as used in this and related project documents, is specific to nuclear weapon maintenance bays, storage structures, compartments, rooms, torpedo rooms, vaults and other "Two-Person Rule" areas where live nuclear weapons were stored, maintained, tested, inspected, or transported.

Nuclear weapons operations included handling, transport, disassembly, limited life component exchange, assembly, test, repair, calibration, modification, storing, and other directly related hands-on maintenance or inspection tasks conducted primarily on land, ships, and submarines.

Nuclear Weapons Technicians routinely worked with toxic and carcinogenic chemicals, organic solvents, compounds, and metals during nuclear weapons operations and related maintenance of nuclear weapons test, handling, and support equipment.

This project scope does not apply to administrative staff whose duties did not require them to actively participate in the maintenance activities or to remain in intrinsic radiation-risk areas. It does not apply to work with nuclear weapon trainers; nor to missile launch crews, air crews and other job specialties, classes, MOS, ratings, AFSCs or other duties where ionizing radiation exposure from nuclear weapons and their components was both minimal and infrequent.

Project Goals

- Convince/compel federal government leaders to:
  - Presume that exposure to ionizing radiation from nuclear weapons "at least as likely as not" [7] caused or may cause the development of cancers, certain other diseases, mutagenic changes, and chronic or debilitating medical conditions.
  - Presume that the use of toxic and carcinogenic chemicals, organic solvents, compounds, and metals "at least as likely as not" caused or may cause the development of cancers, certain other diseases, mutagenic changes, and chronic or debilitating medical conditions.
  - Acknowledge ionizing neutron radiation continuously emitted through weapon cases—radiation that Nuclear Weapons Technicians were not made aware of nor protected from.
  - Acknowledge the risks to fertility and unborn children.
  - Set aside, without prejudice, previous denial(s) of related claims and appeals.
  - Accept/grant related claims and appeals submitted prior to, during, and after this process.
  - Provide all due respect, consideration, benefits, and compensation.
- Legislation passed including:
  - Identify Nuclear Weapons Technicians' primary duties as a "Radiation-Risk Activity" and that each Nuclear Weapons Technician is considered a "Radiation-Exposed Veteran".
  - Presumption of service-connection for ionizing radiation exposures.
  - Identify Nuclear Weapons Technicians' primary duties as a "Toxic Exposure Risk Activity."
  - Presumption of service-connection for exposure to toxic and carcinogenic chemicals, organic solvents, compounds, metals, and other substances.
  - Certification/recognition of "Nuclear Weapons Technician" as a radiation-exposed and toxic-exposed category, class, cohort, or group. Include Nuclear Weapons Technicians in screening programs for ionizing radiation and toxic substances, to include health examinations and related diagnostic procedures.

[7] "At least as likely as not" is a VA term for claims but carries less weight than "More likely than not" for disability status. VA Office of Inspector General, Report #19-00227-226, 10 September 2020. pp. ii, iii, 11.

Project Objectives and Related Facts

Provide federal government leaders with an awareness and comprehension of the substantial dangers of ionizing radiation exposure from live nuclear weapons during maintenance and other routine operations. Inform them that, in general, during the Cold War period:

- Nuclear Weapons Technicians routinely maintained, repaired, disassembled, assembled, modified, tested, transported, and conducted other hands-on tasks on the Nation's nuclear weapons stockpile. The tasks were completed with hands, arms, faces, and often heads in the weapons; and torsos pressed against the exterior; exposed to ionizing radiation.
- Nuclear Weapons Technicians worked without time or distance restrictions, nor adequate shielding from ionizing radiation sources during nuclear weapons operations.
- Nuclear Weapons Technicians worked without established ionizing radiation dose limits.
- Nuclear Weapons Technicians were not consistently, continuously, and accurately monitored for individual ionizing radiation doses, e.g., with personal dosimeters.
- Nuclear Weapons Technicians worked without knowledge of individual real-time or cumulative monthly, annual, or lifetime ionizing radiation doses.
- Nuclear Weapons Technicians' ionizing radiation exposure records are incomplete or nonexistent, due to the inconsistency or absence of personnel radiation dose monitoring.
- Nuclear Weapons Technicians were routinely exposed to ionizing radiation without personal safety restrictions such as current ALARA[8] and INRAD safety programs.
- A 1983 Department of Energy "*Intrinsic Radiation Intercomparison Workshop*" report acknowledged decades of problems with inconsistent and inaccurate radiation dose measurements, and measurement diversity that was not understood.
- Nuclear Weapons Technicians developed occupational chronic and debilitating medical conditions, cancers, other diseases, and lost lives due to ionizing radiation.
- Nuclear Weapons Technicians may have had offspring with health issues, diseases and chronic, debilitating, or fatal medical conditions due to ionizing radiation.

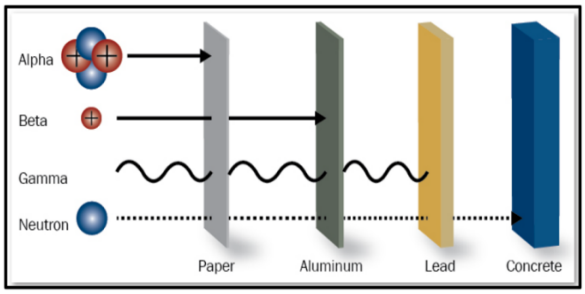
Provide government leaders with an awareness and comprehension of our routine and frequent use of toxic and carcinogenic substances during the Cold War period, for example:

- Nuclear Weapons Technicians routinely used toxic and carcinogenic chemicals, organic solvents, compounds, and metals during nuclear weapons tasks and related equipment maintenance without adequate personal protective equipment nor restrictions. Most of those substances are known toxins; carcinogens; mutagenic; harmful to the central nervous system, peripheral nervous system, and numerous other organs; and/or toxic to reproduction (fertility and unborn children) and offspring.
- Nuclear Weapons Technicians developed occupational health issues, chronic and debilitating medical conditions, cancers, and other diseases.
- Nuclear Weapons Technicians may have had offspring with medical/health issues due to use of toxic and carcinogenic chemicals, compounds, metals, and other substances.

[8] ALARA (As Low As Reasonably Achievable) via time, distance, and shielding. A philosophy of ionizing radiation protection practices in DOE Guide to ALARA, April 1980; adopted by DOD, Army, Navy, Air Force and Marine Corps, e.g., DODI 6055.08 C2, 8 Aug 2018; AR 40-14 15 Mar 1982; NAVMED P-5055 Feb 2011; AF PD 91-1 21 May 1993.

Ionizing Radiation

Live nuclear weapons (unexploded – for VA clarification [9]) in the custody of DOD during the Cold War period contained weapons-grade plutonium and/or uranium. They emitted four types of ionizing radiation: Alpha, Beta, Gamma, and Neutron. "*Ionizing activity can alter molecules within the cells of our body* [10] and damage DNA. Note: Neutron radiation was largely unknown to Nuclear Weapons Technicians throughout our time in service, and for decades later.



Penetrating Power of Various Types of Radiation
Source: DOD, The Nuclear Matters Handbook 2020 (revised), Chapter 11

Alpha particles have the least penetrating power and can be stopped by a sheet of paper or human skin. However, they can be inhaled, swallowed, or enter the body through a cut. In those situations, Alpha particles are extremely dangerous, can damage sensitive living tissue, and cause severe damage to cells and DNA. The radiation weighting factor (biological damage) is 20 times greater than gamma and beta.[11]

Beta particles are lighter than alpha particles and permeate more deeply, penetrating skin and traveling several feet in air, but are stopped by a fraction of an inch of metal or plastic.

Gamma and neutron radiation is continuously emitted through warhead exterior cases and endangers personnel during maintenance, disassembly, internal limited-life component exchange, handing, modification, transport, and storage. Gamma rays "*require a layer of dense material, such as lead, for shielding*".[12] *They are a radiation hazard for the entire body"* and *"can cause ionizations that damage tissue and DNA"*.[13] Neutron radiation also causes other items to become radioactive, including hardware and other materials inside or near the nuclear weapon. The radiation weighting factor [Wr] of ionizing neutron radiation is 5-20 times greater than gamma and beta, depending on neutron energy.[14] Shielding neutron radiation requires thick layers of materials rich in hydrogen, such as water or concrete.[15]

The emissions of the four types of nuclear radiation continue through a natural process of radioactive decay. The materials used in nuclear weapons generally range in half-life periods from 24,000 years to over 700 million years.[16]

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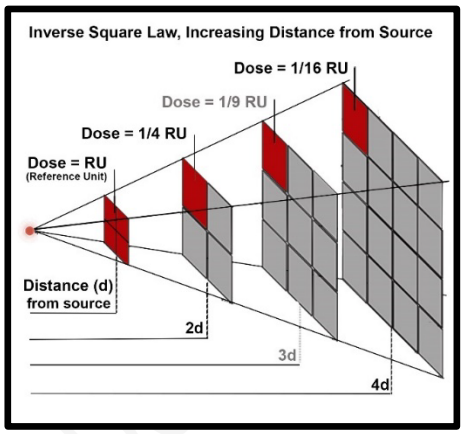
[9] A VA claim/appeal response included incorrect comments stating unexploded nuclear weapons were not radiation risks because they were "*sealed and shielded*". https://www.va.gov/vetapp20/Files7/20048516.txt
[10] https://www.cdc.gov/nceh/radiation/ionizing_radiation.html. Reviewed 7-16-23.
[11] Centers for Disease Control and Prevention (CDCP) (2015): European Nuclear Society, "Learning from Fukushima: Nuclear power in East Asia, 2017." https://press-files.anu.edu.au/downloads/press/n3873/pdf/ch08.pdf.
[12] DOD Nuclear Matters Handbook 2020 (revised), Ch 11, p. 134.
[13] EPA.gov/radiation/radiation-basics. Reviewed 7-16-23.
[14] Ibid. CDC (2015). Table 8-1, Radiation weighting factor. Note: https://www.nrc.gov/reading-rm/doc-collections/cfr/part020/part020-1004.html. Includes "Quality Factor" of 10 for "Neutrons of unknown energy"
[15] Ibid. DOD Nuclear Matters Handbook
[16] Nuclear Weapons Technology 101 for Policy Wonks, B. Goodwin, Lawrence Livermore National Lab, 2021.

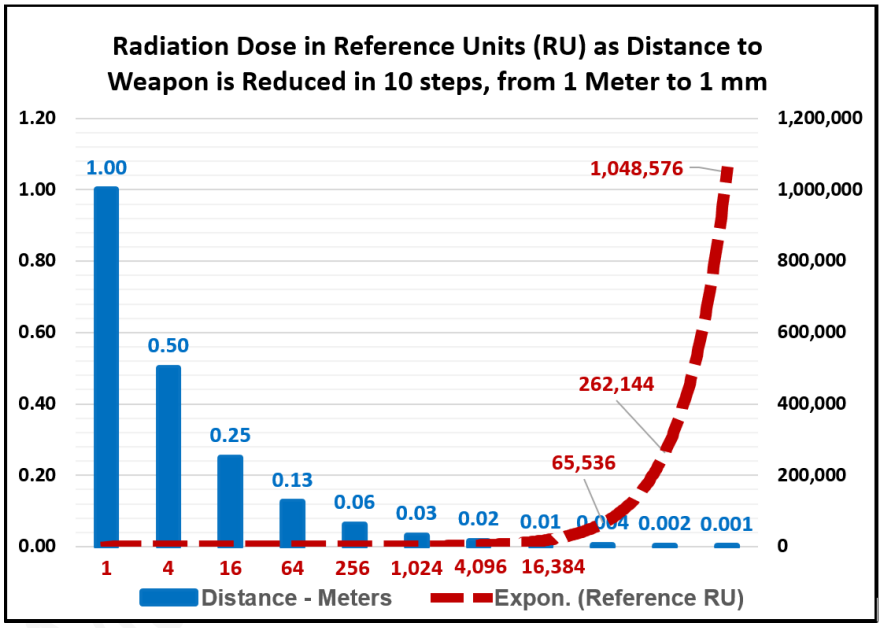
Inverse Square Law Applied to Intrinsic Radiation Exposure

Inverse Square Law – "*The law which states that when radiation (thermal or nuclear) from a point source is emitted uniformly in all directions, the amount received per unit area at any given distance from the source, assuming no absorption, is inversely proportional to the square of that distance"*.[17]



Consider a radiation level of 1 RU (reference unit) 1 meter from the exterior surface of a weapon. Doubling the distance, moving from 1 meter to 2 meters, the amount of energy received per unit area will be 1/4th that at the 1-meter distance, or 0.25 RU. Doubling the distance from the exterior surface again, to 4 meters, the energy received will be 1/16th the original amount (0.0625 RU), and so on. The relative amount of emitted radiation per unit area drops significantly after just a few meters.

Chart: Inverse Square Law, Decreasing Distance From Source



Conversely, reducing the distance from the source by half, moving from 1 meter to 0.5 meters from the source, radiation received will be 4 times greater per unit area (4 RU). Reducing the distance to the radiation source by half again, to 0.25 meters, the energy is 16 times that at the original 1-meter distance.

Continuing closer and reducing the distance by half four more times, to 0.02 meters [18] (2 cm), the inverse square rule indicates an increase in radiation by 4,096 times (4,096 RU); and so on, based on the inverse square law as described, assuming no absorption as DOE-DTRA Technical Procedure 4-1 states. Note: Some numbers have been rounded to two decimal places for spacing and legibility considerations on the chart.

[17] DOE-DTRA TP 4-1/TM 39-4-1/SWOP 4-1/T.O. 11N-4-1, Glossary of Nuclear Weapons Material and Related Terms, 30 July 2016, IC 1-1 10 October 2018

[18] Rounded up from 0.0156 meters

Challenges to the Inverse Square Law, Considering Close Distances from Radiation Sources

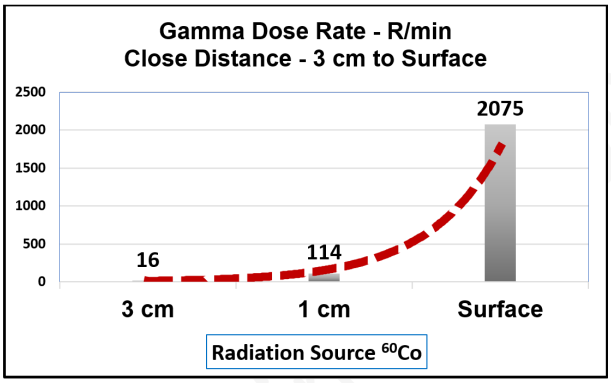
Studies, generally from other than nuclear weapons-specific research organizations, have challenged Inverse Square Law calculations for energy/radiation when the distances are 10 cm or less. Potential error rates of 5% to 25% in that range were addressed.

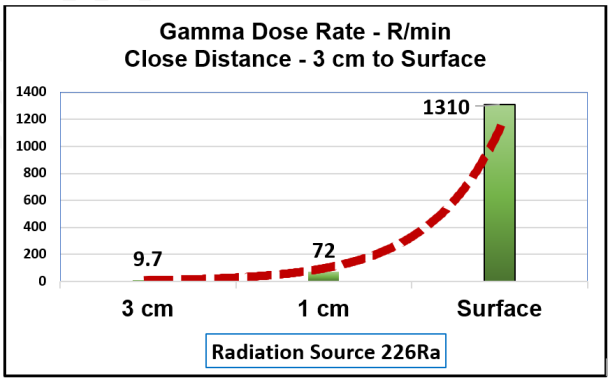
The Nuclear Regulatory Commission completed "3 cm-to-surface" radiation external dose calculations training for Health Physics radiology. It included training on the Inverse Square Law at "*Very small distances*" to provide "*Approximate gamma dose rate to the hand from a 1 Ci Sealed Source"*.[19] [20]

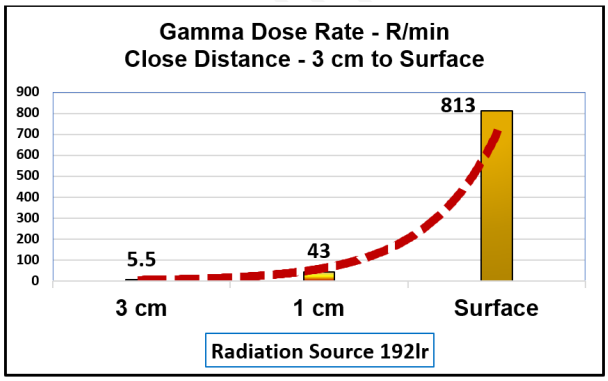
The training included four radioactive isotopes that produced gamma radiation. Those radioactive isotopes are typically used for medical radiation therapy, industrial gages, passive illumination of aircraft gauges, and to calibrate radiation-detection equipment. DOE used two of the four, ^{60}Co and ^{137}Cs, as the calibration sources for their problematic 1981 intrinsic radiation workshop (discussed later).

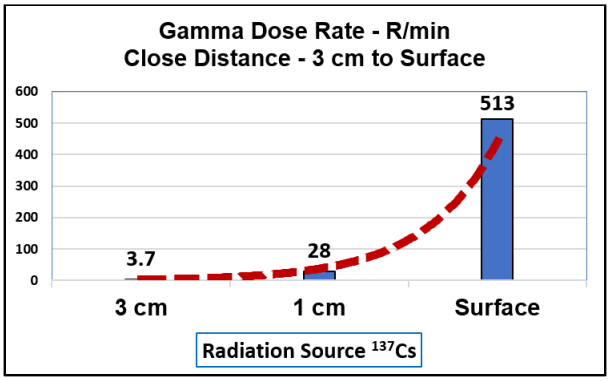
Nonetheless, in this project, the Nuclear Regulatory Commission demonstrated—by direct measurement and/or calculation—that radiation doses at the surface increased an average of 13,680 percent (136.8 times) from an initial distance of 3 cm to the surface. Providing an average dose rate of 8.7 R/min at 3 cm increased to an average of 1,177 R/min at the surface.

Results of the project using four different sources, with radiation doses at 3 cm, 1 cm, and the surface









[19] Nuclear Regulatory Commission, NRC Instruction H-117, Chapter 5 External Dose Calculations. https://www.nrc.gov/docs/ML1121/ML11210B521.pdf Reviewed 7-23-23

[20] Sealed source: "Radioactive material that is permanently bonded or fixed in a capsule or matrix designed to prevent release and dispersal of the radioactive material." https://ehs.unl.edu/sop/s-sealed_sources.pdf

Nuclear Weapons Intrinsic Radiation (INRAD) Exposures

One of the primary dangers that affected Nuclear Weapons Technicians was INRAD, officially described as "*Ionizing radiation emitted through the nuclear weapon surface or directly from exposed weapon components*".[21] Generally, Nuclear Weapons Technicians were not made aware of intrinsic radiation, nor informed of the actual dangers from neutron radiation that permeated nuclear weapon exterior cases and also passed through lead shielding.

Thousands of Nuclear Weapons Technicians worked on live nuclear weapons during the Cold War period with no pre-work ionizing radiation bioassays, no ionizing radiation dose monitoring, no established exposure dose measurements, and no radiation exposure limits.

Nuclear Weapons Technicians worked on, in, and in close physical proximity to nuclear weapons without training, requirements or restrictions related to time, distance, and shielding from intrinsic radiation sources, now known as ALARA (As Low As Reasonably Achievable). Specific training and personnel radiation safety requirements and restrictions—unique for each weapon series and configuration—were limited or not otherwise provided.

Most nuclear weapons tasks required direct physical contact. From leaning on and reaching over weapons, to the routine requirement and practice of having our hands, arms, face, and head inside the interior of "open" or disassembled weapons, and with our torso and legs frequently in direct contact with the nuclear weapon exterior surfaces.

Examples of ionizing radiation exposures (alpha, beta, gamma, and neutron) during routine, accepted, and authorized practices among U.S. military Nuclear Weapons Technicians during the Cold War period include:

- Nuclear weapons handling, maintenance and repair, disassembly, limited life component exchange, assembly, calibration, status checks, transport, storage, and other tasks.
- Nuclear Weapons Technicians removed and replaced critical components and radioactive hardware such as bolts, nuts, washers, and clamps. In some weapons, lead foil tape was temporarily placed over holes—where bolts had been removed near the physics package—and later disposed of in the trash. Neutron radiation is known to induce radioactivity in items, however; radioactive components, hardware, tape, cleaning materials, and other expendables were rarely handled or otherwise treated as radioactive materials/hazards.
- A multi-service technical manual used for all nuclear weapons maintenance stated: "*If a vacuum cleaner is used to clean components or areas where there are possible loose radioactive materials, monitor the bag of the cleaner periodically. If found to be contaminated, dispose of the bag in a paper bag labeled "Contaminated Waste"*.[22]
- Nuclear Weapons Technicians removed radioactive particles/spalling[23] material by vigorously rubbing the target and target rings for projectiles of gun-type weapons and

[21] DOE-DTRA TP 4-1, Army TM 39-4-1, Navy SWOP 4-1, Air Force T.O. 11N-4-1 IC1 30 July 2016, Glossary of Nuclear Weapons Material and Related Terms. Nuclear weapons emit intrinsic radiation (INRAD): "*Ionizing radiation emitted through the weapon surface or directly from exposed weapon components.*"

[22] AEC-DNA TP/Army TM-39/Navy SWOP/AF T.O. 11N-35-51, section 3-4.8, 26 Nov 1962, Change 6, 7 Jun 1972

[23] Ibid., DOE-DTRA TP 4-1. Spalling. "A process of flaking in which pieces of uranium oxide spontaneously separate themselves (pop off) from the surface of the oxidized nuclear material."

capsule balls, spheres, cores, etc., for early series of nuclear weapons. This created hazardous conditions for inhalation, and absorption through cuts and abrasions.

- Alpha particles are known to be 20 times more dangerous (biological damage) than beta and gamma radiation. Nuclear Weapons Technicians were often "dusted" with radioactive particles on their clothing and any unprotected areas of their head, face, etc. (particularly while removing spalling material). Uniforms were brushed off afterward (sometimes vacuumed) with the potential of leaving radioactive particles on clothing to take home to family members, the barracks, quarters, etc. Use of a portable Radiac meter, or similar, to scan the Technician with a wand to "ensure" all particles were removed was often met with skepticism. Nuclear Weapons Technicians stated that the decontamination procedure was typically rushed and not thorough, but few dared to question the conduct of the scans.
- Nuclear Weapons Technicians reported stacking sandbags between weapons in storage, as some later surmised, to increase weapons safety or allow for additional weapons to be stored in the same space. Many also reported transporting the radioactive capsule components in "bird cages" on every other seat in buses. Some units used a 4-foot rule, center-to-center for weapons, others a 1-meter edge-to-edge rule. <u>These procedures were not for personnel radiation safety; they were for nuclear weapons safety</u>. Those limitations were likely related to studies of separation distances for subcritical units, such as those conducted for a U.S. Atomic Energy Commission contract and documented in a 1962 Lawrence Livermore National Laboratory report: "*Interaction of Fissionable Units*". It read in part: "<u>*Although each unit, when isolated, may be subcritical by a substantial margin, the assemblage may be critical if the number of units is sufficiently large and if the units are sufficiently close to each other and to neutron-reflecting materials*</u>." [24] [underlined for emphasis]

Many Nuclear Weapons Technicians' tasks varied between multiple nuclear weapon series at the same location. We often worked on one or more of the many different series of warheads, bombs, artillery shells, atomic demolition munitions and associated rockets and missiles on any given day. Weapons widely ranged from 0.x kiloton to multiple megaton weapons depending on the location and mission of the organization. Many of the same weapon series/types were maintained by two or more services. For example, weapons maintained by Air Force units were transferred to, and maintained by, Navy units.

Individual Nuclear Weapons Technicians worked different series of nuclear weapons at varied intervals, and our exposures depended on what team member "position" was filled for a particular task on a given day. In a typical scenario, it was common for one person to stand adjacent to an open weapon, reading the checklist items and verifying completion of steps, while one or two others "operated" inside the open nuclear weapon. Another managed the tools and parts and inspected, cleaned, and prepped items in preparation for installation. Positions often rotated. Nuclear weapons maintenance supervisors/managers observed and monitored the operations, and quality control inspectors routinely participated.

Risks were not properly managed to keep exposures to ionizing radiation ALARA in context with modern-day requirements. Some Naval nuclear propulsion-related ionizing radiation dosimetry

[24] *Interaction of Fissionable Units*, H.K. Clark, Savannah River Laboratory, Aiken, South Carolina, 9 September 1962. https://ncsp.llnl.gov/sites/ncsp/files/2021-11/ref_121.pdf. Reviewed 7-16-23.

activities apparently evolved into limited weapons-related dosimetry programs. Arguably, many were improperly managed. Evidently, few fully-operational nuclear weapons-related ALARA and INRAD programs (which must co-exist to be effective) were established before 1991.

Neither we nor our organizations knew what our actual ionizing radiation doses were; and we generally worked without restrictions in regard to distance, time, or shielding from the radiation sources (aka ALARA). The dangers were compounded by multiple factors as the radiation dose was directly related to the series of nuclear weapon(s) and the operation(s) completed. Primary factors included: assembled/disassembled status; time near, on, or in the weapon; distance; number of nuclear weapons in the same space; and shielding.

Other than limited or questionable Navy dosimetry programs, and few Army and Air Force short term or abbreviated studies or "experiments",[25] ionizing radiation exposure monitoring and management programs were unique exceptions to the norms. Many Nuclear Weapons Technicians rarely, if ever, wore a dosimeter during their careers. Initial programs with dosimeters were often cut short. Dosimeters were limited, ineffective, and/or inaccurate. Potentially thousands of exposure dose records, such as DD Form 1141 Record of Exposure to Ionizing Radiation, were misplaced, incomplete, error-ridden, falsified, and/or destroyed (in the 1973 National Personnel Records Center fire).[26]

Department of Energy and Military Services INRAD Research

Carter-Reagan Transition Briefing Book (U), December 1980, Defense Nuclear Agency[27]

"Intrinsic Radiation (INRAD) Study: A growing public awareness of and concern for the hazards of low level, intrinsic radiation inherent in nuclear weapons has been increasing. The number and size of legal claims based upon exposure to alleged radiation has risen sharply. Previous risk estimates were minimal for low level exposure to stored nuclear materials. While the general view remains that the effects are insignificant, DoD has decided to verify a variety of associated aspects. A joint DoD/DoE study has been initiated to review the impact of intrinsic radiation…" to include *"Identification of personnel who receive INRAD doses; INRAD output of current stockpile; Evaluation of Service programs, regulations, and procedures; INRAD implications to DoD (fiscal, manpower, operational, etc.); Impact on weapon design…" "The recommendations to be developed should be approved and implemented by September 1981".*

Intrinsic Radiation Intercomparison Workshop – DOE Acknowledged Decades of Radiation Measurement Data Problems, 1981 Workshop Practical Test Failures

On January 25, 1983, DOE published a report documenting an Intrinsic Radiation (INRAD) Intercomparison Workshop hosted by the Los Alamos National Laboratory (LANL) on March 24-26, 1981. Thirty-three attendees included representatives from DOE, LANL, Sandia NL, Lawrence Livermore NL, Air Force Weapons Lab, Air Force Occupational Environmental Health Laboratory, Naval Surface Weapons Center, Chief of Naval Operations,

[25] A scientific procedure undertaken to make a discovery, test a hypothesis, or demonstrate a known fact.
[26] National Personnel Records Center Fire: https://www.archives.gov/personnel-records-center/fire-1973
[27] Defense Nuclear Agency, Carter-Reagan Transition Briefing Book, December 1980, https://www.esd.whs.mil/Portals/54/Documents/FOID/Reading%20Room/Other/Carter_Reagan_Transition-6.pdf

Army Nuclear and Chemical Agency, Army DARCOM, HQ USMC, and FCDNA. A stated goal was "*…compiling the available INRAD data on stockpiled weapons*".

The group reported problems with previous data and—working in a carefully controlled laboratory environment—had difficulty consistently and reliably measuring one radiation source at a time. Measurements were taken one meter from the source.[28] Problems included:

- *"**A review of over 20 years of data showed that, in general, measurements made at different times on any particular weapon type could differ significantly**.* [emphasis added] *This workshop was seen as a first step in quantifying the measurement variability, identifying its probable causes where possible, and, where not, outlining the future work needed to clarify these causes of variability."*
- *"As this report shows, **all the causes underlying the measurement diversity are not yet clearly understood**,* [emphasis added] *and this provides a basis for future necessary action by the participating agencies."*
- *"A general comment applies to all of the gamma series: **an unknown portion of the measurement-range variability results in the various ways in which source energies and intensities are translated into dose rates.*** [emphasis added] *…Identifying the conversions used may explain some of this wide variability and reduce it significantly.*
- In regard to Neutron Sources – *"It is difficult to judge instrument quality because **the same type of instrument in the hands of different participants performed differently**. Without resolving the questions raised above, **it is impossible to decide whether better or poorer performance is due to the instrument or to the procedures and calibration techniques used**.* [emphasis added] *It is clear, however, that high-quality standardized calibration techniques will be needed to get close interagency agreement."*
- *"**The range of results was excessive for warhead measurements**."* [emphasis added]

Several agencies that participated in the workshop subsequently provided data, conclusions, and advice to VA for decisions on claims regarding cancers, other diseases, and death from ionizing radiation exposure to nuclear weapons. Ostensibly, they were also the ones expected to visit field units worldwide to determine INRAD levels or teach others how to do so.

The problems described in the workshop report beg questions about dose reconstruction for VA claims, and subsequent decisions on radiation exposures to Nuclear Weapons Technicians over a period of 46 years. The 2-year study was apparently used as a false premise to justify denial of veteran's claims. One example is listed later under "VA Claim and Appeal Denials".

Due to Nuclear Weapons Technicians' routine and prolonged close physical proximity and direct contact with various series and numbers of live nuclear warheads, most of which no longer exist, it is not possible to reconstruct nor otherwise determine our actual individual radiation exposure doses with sufficiently reliable accuracy. The reasonable and moral assumption regarding exposure dose is that: *"It is at least as likely as not, that each Nuclear Weapons*

[28] Summary Report by the Weapon and Environment Sub-Group of the Intrinsic Radiation Working Group, January 25, 1983, Lawrence Livermore National Laboratory, University of California, Livermore, CA.

Technician exceeded maximum monthly, annual and/or lifetime ionizing radiation doses allowed by an otherwise well-established and well-managed ionizing radiation safety program."

Nuclear Weapons Ionizing Radiation Safety Programs and Formal Requirements

There is substantial evidence through official regulations, manuals, instructions, meeting summaries, approved and accepted work practices, and shared knowledge to demonstrate that requirements for INRAD exposure safety education and procedures; and the concept now known as ALARA (As Low As Reasonably Achievable) via time, distance, and shielding; essentially did not exist during the Cold War period. Many who were aware of certain limited benefits of shielding gamma radiation with lead were not aware, until many years later, that lead was not effective for blocking neutron radiation.

Searches for formal requirements related specifically to Nuclear Weapons Technicians' ionizing radiation exposure safety during the Cold War period resulted in few publicly available documents. Generally, requirements that specifically addressed ALARA in relation to nuclear weapons, and INRAD, were first published in late 1990. Examples of search results include:

- Army FM 55-204, Air Transport of M454 Atomic Projectile, 30 September 1976, and December 1981 versions stated that *personnel dosimetry badges and exposure time records were not required* during the nuclear weapons transport operations.
- Army and Defense Logistics Agency Regulation AR 40-14/DLAR 1000.28, Medical Services, Control and Recording Procedures for Exposure to Ionizing Radiation and Radioactive Materials, 15 March 1982. The regulation discussed ALARA, personal dosimeters, radiation dose limits, and dose sources. *It was apparently intended for NRC licensed material and did not specifically address nuclear weapons except to exclude any Radiation Control Committee responsibilities for nuclear weapons.* It did not discuss INRAD.
- DOD Instruction 6055.8, Occupational Radiation Protection Program, 31 March 1989, included general information on ionizing radiation, personnel dosimetry, bioassay, and ALARA. It was not specifically for nuclear weapons and did not discuss INRAD. It included a definition for Occupational [radiation] Exposure: *"Routine exposure of DoD personnel to radiation associated with DoD operations during performance of their official duties."*
- AFR 122-28, Air Force Nuclear Weapons Intrinsic Radiation (INRAD) Safety Program, 29 October 1990,[29] implemented INRAD safety, including ALARA. The regulation "*…applies to units and personnel concerned with maintenance, loading, security, transport, or storage of nuclear weapons and associated nuclear material and components.*" The regulation described ALARA as: "*Keeping exposure of persons to ionizing radiation ALARA consistent with operational requirements and not intentionally exposing persons to INRAD levels exceeding the maximum permissible dose (MPD) specified in DODI 6055.8 and AFR 161-8, Control and Recording Procedures—Occupational Exposure to Radiation".* Introduced the use of personal dosimetry and listed exposure limits for pregnant females.

[29] Air Force Regulation 122-28, 29 October 1990, AF Nuclear Weapons Intrinsic Radiation (INRAD) Safety Program

- Air Force Policy Directive 91-1, Nuclear Weapons and Systems Surety, 21 May 1993. Addressed ALARA and INRAD.
- Air Force Instruction (AFI) 91-108, Air Force Nuclear Weapons Intrinsic Radiation (INRAD) Safety Program, 29 Nov 1993, replaced AFR 122-28, 29 Oct 1990 (listed above).
- Nuclear Task Force investigation report: *Reinvigorating the Air Force Nuclear Enterprise*, Air Force Nuclear Task Force, 24 October 2008. The report detailed failures in INRAD and ALARA safety programs (described below).
- AFI 91-108, Air Force Nuclear Weapons Intrinsic Radiation and 91(B) Radioactive Material Safety Program, 21 September 2010 [30], with change 1, 14 October 2011, replaced the 1993 version of AFI 91-108 and added the 91(B) Radioactive Material Safety program.
- DOE-DTRA TP 4-1, Glossary of Nuclear Weapons Material and Related Terms, 30 July 2016, ALARA: "*Refers to Service and DOE radiation protection programs to keep radiation doses as low as reasonably achievable.*" INRAD: *"Ionizing radiation emitted through the weapon surface or directly from exposed weapon components."*

Nuclear Task Force 2008 Report Cited Failures by the Air Force to Provide Adequate INRAD and ALARA Programs to Nuclear Weapons Personnel [31]

After Air Force incidents in 2006 and 2007, the Secretary of Defense ordered a Nuclear Task Force to examine numerous nuclear forces management and nuclear weapons-related problems. Among many deficiencies and recommendations, the 140-page, 2008 report cited inadequate INRAD and ALARA personnel radiation exposure and monitoring practices:

- ***"Inadequate Guidance"***
  - *"Air Force documentation was inadequate to demonstrate that current personnel and area radiation exposure and monitoring practices are sufficient to ensure exposure is less than Air Force requirements and maintained as low as reasonably achievable. No evidence or recent oversight of this program by authorities, either external or internal, was found.*"
- ***"Improve Weapons Maintenance and Storage Safety"***
  - *"Air Force will update and standardize the intrinsic radiation (INRAD) program guidance in AFI 91-108."*
  - *"Air Force Surgeon General as lead, with AF/SE and Air Force Inspection Agency, will develop an INRAD Safety Inspection Checklist and evaluate requirements, training practices, and assessment of intrinsic radiation monitoring programs to ensure that exposure levels are tracked and are as low as reasonably achievable* [ALARA]."

Note: These failures were disclosed approximately eighteen years after detailed INRAD and ALARA programs were implemented by the Air Force, and with far fewer nuclear weapons maintenance personnel to train and monitor due to the nuclear weapons stockpile reductions.

[30] Air Force Instruction 91-108 21 September 2010 with Change 1, 14 October 2011, Air Force Nuclear Weapons Intrinsic Radiation and 91(B) Radioactive Material Safety Program.
[31] Reinvigorating the Air Force Nuclear Enterprise, AF Nuclear Task Force, 24 October 2008, pp 38-39, 43.

Those formal disclosures—from the highest levels of the Department of Defense—strongly reinforce many arguments and related facts presented throughout this project document.

Nuclear Weapons Maintenance and Storage Areas

- Nuclear Weapons maintenance spaces and storage locations in structures, ships, and submarines contributed to significant ionizing radiation risks. Typical land-based maintenance facilities varied in size and supported one to approximately 20 weapons.
- Storge facilities were constructed in different sizes and materials from earth-covered concrete and steel structures to small storage bays with a roll-up metal door similar in size to a one-car garage. They held from one to approximately 40 live nuclear weapons that were typically double stacked and placed side-by-side within inches of one another. Standing or kneeling between double stacks of weapons, being inches from several nuclear weapons at the same time (all emitting ionizing radiation) was routine, as storage locations were frequently filled to their physical capacity, often in violation of DOE/DOD Nuclear Safety Criteria.[32]
- Nuclear weapons were routinely stored in ship's magazines, to full capacity, and in many circumstances, personnel were authorized to sleep in the magazines with the weapons (in at least a two-person team), particularly on deployment in certain areas when the magazines were the coolest spaces on the ship.[33]
- Nuclear Weapons Technicians, working in nuclear weapons storage structures/magazines, drank fluids and ate snacks or lunch while sitting on bolsters (nuclear bomb carts with casters) with their butts over the warhead section, and leaned against various series and configurations of nuclear bombs. When conducting tasks with those weapons, it was often impractical to secure the structure and walk or drive back to the maintenance building for a break, so we improvised. Nuclear Weapons Technicians, supervisors and managers were not made aware of the actual intrinsic radiation dangers; and ionizing radiation safety programs and requirements were not promulgated nor enforced by the upper echelons.
- **Military services operated under increased plutonium storage limits from July 1977 to November 1980 without authorization** in the joint DOE/DOD Technical Publication 20-7, Nuclear Safety Criteria. Those critical nuclear weapon safety violations (also personnel radiation exposure dangers) were reported to the 1980 Carter-Reagan Transition team: [34]

  > *"Plutonium (Pu) Storage: In July 1977 the Military Liaison Committee approved a recommendation to increase storage limits for plutonium bearing weapons. The joint DoE/DoD Technical Publication, TP20-7, Nuclear Safety Criteria, still contains the original storage limits. DNA has agreed (18 Nov 80) to conduct a comprehensive study of the plutonium hazard…"*

[32] Defense Nuclear Agency, Carter-Reagan Transition Briefing Book, December 1980, https://www.esd.whs.mil/Portals/54/Documents/FOID/Reading%20Room/Other/Carter_Reagan_Transition-6.pdf
[33] James Little, CWO4, USN, Retired. Summary/excerpt from 19 July 2021 written statement.
[34] Ibid.: Defense Nuclear Agency, Carter-Reagan Transition Briefing Book.

"Current status: ***The Services are operating under the increased limits. TP20-7 must be changed to acknowledge current Service positions, or the practice discontinued****…"* [emphasis added] *"Alternatives/Rationale… Study: Long term (total evaluation of all aspects of Pu limits for both transportation and storage)."*

ALCMs and B83 bombs
Inside a maintenance facility

Photo: Paul Shambroom, 2009, https://spectrum.ieee.org

B61 bombs, double-stack configuration
inside a storage structure

Photo: fas.org, retrieved 3-31-23 from https://www.military.com

Nuclear weapons emit ionizing radiation in all directions at all times. Whenever two or more nuclear weapons were in the same location, and within close proximity to Nuclear Weapons Technicians, those personnel were bombarded with gamma—and neutron radiation in particular—from multiple sources at the same time.

Nuclear Weapons Technicians literally
worked in three-dimensional ionizing radiation fields

While Nuclear Weapons Technicians worked in these conditions, most were not informed of the intrinsic radiation that permeated the weapon case 24/7, and few were aware of the penetration power of neutron radiation nor of the neutron interaction in fissile assemblies.[35] We were familiar with alpha, beta and gamma (with the exception the 20 times higher level of biological damage with alpha, mentioned earlier) and were continuously led to believe that any potential personal safety and nuclear weapons safety concerns had been addressed, including any limitations related to studies of separation distances for subcritical units, such as those conducted for a U.S. Atomic Energy Commission contract and documented in a 1962 Lawrence Livermore National Laboratory report: "*Interaction of Fissionable Units*".[36]

[35] "*When two or more pieces of fissile material are brought near together, the neutron output of each piece exceeds its output in isolation due to neutron exchange and multiplication between the pieces*." Neutron Interaction in Fissile Assemblies, https://ncsp.llnl.gov/sites/ncsp/files/2021-11/ref_123.pdf.

[36] *Interaction of Fissionable Units*, H.K. Clark, Savannah River Laboratory, Aiken, South Carolina, 9 September 1962. https://ncsp.llnl.gov/sites/ncsp/files/2021-11/ref_121.pdf.

Nuclear Weapons Movement/Transport/Security

- Nuclear Weapons Technicians pushed live nuclear weapons on bolsters at many land-based locations, on aircraft, and ships. Some were lifted manually (e.g., nuclear artillery shells and small atomic demolition munitions) as a transport method. Nuclear weapons required unique handling during submarine on-load/off-load logistics procedures, and on ships during vertical replenishment (VERTREP) and underway replenishment (UNREP) operations.

- Nuclear Weapons Technicians loaded, flew with, and unloaded nuclear weapons transported by military helicopter and other aircraft. Army FM 55-204, Air Transport of M454 Atomic Projectile, 30 September 1976 [37] and the subsequent December 1981 version stated: **"*Personnel dosimetry (film badge) is not required for personnel engaged in operations prescribed in this manual nor do the operations require keeping a record of exposure times. However, do not stay within 1 meter of the M454 projectile any longer than is needed to accomplish each operation*."** [emphasis added]

  Personnel who participated in these operations stated that due to available space in the aircraft, the one-meter distance was not physically possible to maintain under most circumstances.

- Nuclear Weapons Technicians in overseas Theater Nuclear Forces (TNF) areas conducted frequent exercises to maintain proficiency in *"…violent Emergency Destruction (ED) to prevent terrorist or host nation seizure of nuclear weapons"*.[38] The ED exercises required handling every live nuclear weapon at each location (storage structures, alert aircraft hangars, and maintenance facilities). Urgency, time limits based on possible hostile force situations, and nuclear weapons security were the highest priorities before our personal safety, for obvious reasons. In many areas, protective MOPP [39] gear was not assigned to Nuclear Weapons Technicians. It would have slowed the process considerably and may have facilitated damage to the ED materials/devices and the live nuclear weapons. The Air Force prohibited wearing *"…complete chemical ensembles when handling war reserve nuclear weapons"* during peacetime.[40] Nuclear Weapons Technicians were trained and maintained proficiency in use of rifles, handguns, and small explosives (C-4, blasting caps, shaped charges, thermite incendiary devices, etc.), and carried firearms to provide "close-in" armed security at overseas nuclear weapons maintenance facilities and storage structures.

[37] *Army FM 55-204, Section 4 Note, Air Transport Procedures, Transport of M454 Atomic Projectile in M467 Container, 20 September 1976; and Army FM 55-204, Section 3-1a Note, Air Transport Procedures Transport of M454 Atomic Projectile by US Army Aircraft, 15 November 1980, with change 1, 1 December 1981.*

[38] Defense Nuclear Agency, Carter-Reagan Transition Briefing Book, December 1980 (U). Declass. package p.8.

[39] MOPP – Mission Oriented Protective Posture gear for use by U.S. military personnel in a chemical, biological, radiological, or nuclear environment.

[40] Air Force Instruction 91-101, Air Force Nuclear Weapons Surety Program, 1 March 1997.

THE SOUND OF SILENCE

Nuclear Weapons Technicians served our Nation in sustaining its nuclear defense and deterrence during the Cold War period. While routinely exposed to deadly radiation, toxic chemicals, and other substances; we were kept in the dark about the true dangers of radiation from the weapons we maintained; and generally, safety equipment, training, and precautions for toxic substances were minimal to non-existent.

For decades, information that directly affected the safety and lives of Nuclear Weapons Technicians was withheld from us. Thousands were not aware of the true dangers of alpha particles frequently handled with little more than gloves and no mask, nor of the intrinsic radiation dangers, especially neutron radiation. Comments or questions about potentially dangerous radiation exposures were quickly dismissed. We now know that alpha and neutron radiation are 20 times and 5-20 times more dangerous, respectively, than beta and gamma.[41]

The lack of radiation exposure data, failure to provide intrinsic radiation information and training, and absence of sustained and operational radiation exposure monitoring and management programs served as de facto methods to silence critical communications regarding the actual radiation dangers.

In the December 1980 Defense Nuclear Agency (DNA) Carter-Reagan Transition Briefing Book (U) (mentioned earlier), DNA revealed that plutonium storage exceeded DOE/DOD-authorized limits since at least July 1977. Violation of Nuclear Safety criteria for maximum radioactive material storage limits potentially increased the dangers regarding sub-critical components (interaction between two or more subcritical units)[42], and their corresponding increased ionizing radiation emissions to personnel. That information was not provided to Nuclear Weapons Technicians who worked in those structures and magazines.

Secrecy Hampered Ability to File VA Claims

Secrecy Agreements were signed and placed in permanent records. Some Nuclear Weapons Technicians referred to them as life-time oaths that meant life in prison for treason if violated,[43] others referred to them as the 20/20 rule (20 years in prison/20 thousand-dollar fine). Secrecy agreements, to the extent used in the Navy, were not equally pervasive in all military service branches, yet various levels of implied and inconsistent secrecy requirements were prevalent throughout. Many, arguably thousands, continue to live under the rules based on their individual understanding of those secrecy agreements and requirements to this day.

Nuclear Weapons Technicians remained silent about their duties in spite of the need to explain to VA their exposure to nuclear weapons ionizing radiation and the toxic chemicals we used. Most never learned of a 1996 Secretary of Defense memorandum releasing them from the secrecy agreements. Many died before the release of the letter. There are ambiguities and caveats within the memorandum that cause many to believe it does not apply to them.

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[41] Centers for Disease Control and Prevention (CDCP) (2015): European Nuclear Society; https://press-files.anu.edu.au/downloads/press/n3873/pdf/ch08.pdf, *Health implications of ionizing radiation*, p. 222, Table 8.1.
[42] https://ncsp.llnl.gov/sites/ncsp/files/2021-11/ref_123.pdf Neutron Interaction in Fissile Assemblies, 1960.
[43] Conversation w/ GMTC Maurice Cheek, USN Retired, 25 March 2023; and his letter to Pres. Biden, 5 March 2021.

Secretary of Defense Releases Veterans From Secrecy Agreements

On 13 February 1996, the Secretary of Defense (SECDEF) issued a memorandum to the Joint Chiefs of Staff, Under Secretaries of Defense, Assistant Secretaries of Defense, General Counsel, Inspector General of the DoD, Operational Test and Evaluation Director, Assistants to the SECDEF, Administration and Management Directors, and Directors of the Defense Agencies.

> ***SUBJECT: Exposure to Nuclear Radiation and Secrecy Agreements***
>
> *Inquiries continue to be received regarding the appropriate action that should be taken to release veterans from secrecy obligations so they may justify medical treatment for conditions allegedly arising from exposure to nuclear radiation. Congressman Bill Richardson has specifically requested a public statement be issued announcing personnel are relieved of any security obligation they may have incurred in connection with their military involvement in* ***nuclear testing*** [emphasis added] *to establish the validity of a service-connected disability.*
>
> *In the interest of fairness to the many veterans who have so honorably served our country, in coordination with the Department of Energy, I hereby authorize veterans seeking to establish a medical disability in connection with* ***exposure to nuclear radiation*** [44] [emphasis added, see footnote] *to divulge to the Department of Veterans Affairs the name and location of their command* [45]*, duties performed, dates of service, and related information necessary to validate exposure to nuclear radiation. This authorization does not relieve veterans of responsibility for continuing to protect specific technical information* [46] *that could contribute to the development of a weapon of mass destruction or the application of nuclear technology."*

The Secretary of Defense (SECDEF) memorandum was seen by few veterans. DoD did not reach out to us. After a veteran Nuclear Weapons Technician group saw the memo in early 2023, many expressed their distrust of it. Others believe the release does not apply to former Nuclear Weapons Technicians because of the emphasis on *"Nuclear Testing", a term that* is generally related to atmospheric and other nuclear weapon development tests, such as the exposures to "Atomic Veterans".

Essentially, many believe the "code of silence" still applies to an unknown extent after decades. Nuclear Weapons Technicians have expressed years of living in fear of saying the wrong thing to the wrong person.

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[44] Per U.S.C. Title 38, VA does not consider Nuclear Weapons Technicians' duties to be a "Radiation-Risk Activity", nor that a Nuclear Weapons Technician is a "Radiation Exposed Veteran".

[45] VA acknowledged the SECDEF letter in VA Regulation M21.VIII.iii.4.B.6.a. However, VA Regulation, M21-1, VIII.iii.4.B – *Developing Claims for Service Connection for Disabilities Resulting from Ionizing Radiation Exposure Under 38 CFR 3.311* states: "*Veterans must refrain from divulging information relative to military bases where nuclear weapons:* ***were*** [emphasis added]*…located outside the continental U.S., which is classified "Secret*"."

[46] *"…technical information…*" is an ambiguous term to many, especially in regard to the potential consequences.

Federal Laws, Executive Orders, and Programs that Exclude Veteran Nuclear Weapons Technicians

- **Atomic Veterans** [47] – An unofficial term used by VA. Per VA, this includes veterans who:
  - Participated in atmospheric and certain underground nuclear tests;
  - Took part in the American occupation of Hiroshima and Nagasaki, Japan;
  - Certain veterans who were POWs in Hiroshima and Nagasaki; or,
  - Served at gaseous diffusion plants in Paducah, KY., Portsmouth, OH, and area K25 at Oak Ridge, Tenn.

- **VA Ionizing Radiation Registry Examination Program.** Veterans who participated in these radiation-risk activities listed under Atomic Veterans above, plus those who received nasopharyngeal radium irradiation treatments while in service, are eligible to take part in the VA ionizing radiation registry examination program.

- **Honoring our PACT Act of 2022** – *The PACT Act "…*e*xpands VA health care and benefits for Veterans exposed to burn pits, Agent Orange, and other toxic substances*. *The PACT Act adds to the list of health conditions that we* [VA] *assume (or "presume") are caused by exposure to these substances. This law helps us provide generations of Veterans—and their survivors—with the care and benefits they've earned and deserve*… *VA will not rest until every Veteran gets the toxic exposure-related care and benefits they deserve"*.[48]
  [emphasis added to point out the gross contradiction]

  The PACT Act also includes:
  - Cleanup of Enewetak Atoll, from January 1, 1977, through December 31, 1980.
  - Cleanup of the Air Force B-52 bomber carrying nuclear weapons off the coast of Palomares, Spain, from January 17, 1966, through March 31, 1967.
  - Response to the fire onboard an Air Force B-52 carrying nuclear weapons near Thule Air Force Base in Greenland from January 21, 1968, to September 25, 1968.

  Note: The PACT Act replaced *"who was exposed to a toxic substance,* ***radiation*** *[emph], or other conditions…*" with "*who is a toxic-exposed veteran…*" in 38 U.S.C. 1710(a)(2)(F).

- **Executive Order 13179, December 7, 2000, Providing Compensation to America's Nuclear Weapons Workers** (does not apply to U.S. military veterans)

  Excerpt: "…to *compensate DOE nuclear weapons workers who suffered occupational illness as a result of exposure to the unique hazards…"; "Thousands of these courageous Americans, however, paid a high price for their service, developing disabling or fatal illnesses as a result of exposure to beryllium, ionizing radiation, and other hazards unique to nuclear weapons production and testing….these workers were neither adequately protected from, nor informed of, the occupational hazards to which they were exposed…While the Nation can never fully repay these workers or their families, they deserve recognition and compensation for their sacrifices"*.[49]

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[47] Source: VA Fact Sheet, September 2002, *VA Programs for Veterans Exposed to Radiation*
[48] https://www.accesstocare.va.gov/healthcare/pactact, reviewed/confirmed statement 7-25-23.
[49] Executive Order 13179, December 7, 2000, Providing Compensation to America's Nuclear Weapons Workers. *https://www.govinfo.gov/content/pkg/FR-2000-12-11/pdf/00-31692.pdf* reviewed 7-22-23.

- **Energy Employees Occupational Illness Compensation Program Act of 2000 (EEOICPA). Cancer from ionizing radiation is "presumed" for DOE employees and contractor employees called "Special Exposure Cohorts"** [50]
  - Covers civilian DOE employees, contractors, and subcontractors. *"The Act was passed on October 30, 2000, and became effective on July 31, 2001. The Department of Labor (DOL) manages claims filed under the Act."*
  - Specific exposures at those locations are not required criteria for compensation, radiation dose reconstruction is not required, and a determination of the probability of causation is not required. "*…a covered employee must have at least one of 22 specified cancers and worked for a specific period of time at one of the SEC work sites".*[51] The Secretary of Health and Human Services is authorized to add other groups and classes to the Special Exposure Cohort list.

- **Radiation Exposure Compensation Act (RECA)**

  "*The Radiation Exposure Compensation Act ("the Act" or "RECA"), 42 U.S.C. § 2210 note, established an administrative program for claims relating to atmospheric nuclear testing and uranium industry employment. The Act delegated authority to the Attorney General to establish procedures and make determinations regarding whether claims satisfy statutory eligibility criteria.*" RECA also covers "Downwinders" who had a "physical presence in the Downwinder area for at least two years during the period January 21, 1951, through October 31, 1958.[52]

Department of Veterans Affairs (VA)

VA Does Not Consider Nuclear Weapons Technicians' Duties a "Radiation-Risk Activity"

In spite of the significant exposures to ionizing radiation, a primary reason frequently used in denied VA claims and appeals is because the duties of Nuclear Weapons Technicians are not considered a "radiation-risk activity". That is a false premise. VA is well aware of our dilemma, having reviewed claims for ionizing radiation and toxic-exposure for decades, rejected due to lack of the necessary language in Title 38, United States Code. VA and DoD did not step forward to correct the laws as necessary to support radiation-exposed and toxic-exposed military veteran Nuclear Weapons Technicians. The primary purpose of this project is to do just that.

VA regulations and procedures discourage many legitimate claims and appeals, require individual claims, and discourage group or class certification when large numbers of veterans were subjected to similar dangers. *E.g.*, "*Eligibility for disability compensation or survivors' benefits are based on radiation type, radiation dose, and timing of the onset of illness. VA decides these claims* ***on a case-by-case basis"***.[53] [Bold emphasis is included in the VA site]

[50] https://www.cdc.gov/niosh/ocas/ocaseeoi.html Reviewed 7-22-23
[51] https://www.dol.gov/agencies/owcp/energy/regs/compliance/law/SEC-Employees Reviewed 7-25-23 oh
[52] https://www.justice.gov/civil/common/reca Reviewed 7-22-23 oh
[53] https://www.publichealth.va.gov/exposures/radiation/diseases.asp Reviewed 7-22-23 oh

These policies are in direct contrast to the treatment of other veteran groups and civilian DOE employee/contractor cohort groups described in this document.

Ionizing radiation exposures occurred every time Nuclear Weapons Technicians worked on a nuclear weapon or were in areas containing nuclear weapons. In spite of that, VA does not "presume" occupational ionizing radiation causation for Nuclear Weapons Technicians.

VA has several misconceptions regarding ionizing radiation dangers to Nuclear Weapons Technicians; one states: "*Various military occupations, such as nuclear weapons technicians and dental technicians, include routine and usually safe exposure to radiation*".[54] X-rays generally emit energy from 100 eV (electron volts) to 10^6 eV. Gamma (y-rays) emit energy from 10^5 eV to over 10^{11} eV. Nuclear weapons emit alpha, beta, gamma, and neutron radiation. Nuclear weapons do not have an on/off switch. They emit ionizing radiation 24/7.

VA Claim and Appeal Denials

Numerous individual veterans' claims have been denied due to lack of ionizing radiation exposure dose data. For significant numbers of Nuclear Weapons Technicians, such monitoring programs did not exist or were limited at best. Consequently, military service branches reported to VA that specific radiation dose data did not exist in the records, while in most cases, individuals had not been consistently and continuously monitored for those exposures.

That tactic forces veterans to provide evidence of actual exposure dose assessment/estimate; or leave it to a VA military partner, lab, or consultant to develop an assumed level of exposure i.e., malinformed opinion based on "assumed facts not in evidence". The veteran must then provide their own arguments and defensible, accepted estimates in a battle seldom won.

Thousands of Nuclear Weapons Technicians worked large portions of their careers, or all, without wearing a personal dosimeter. Several groups wore them for short periods without being given the results after a "test program" or "experiment" was suddenly and inexplicably cancelled, often within a few months of the start. Questions were typically addressed with nonsensical answers or silence. Some received their DD Form 1141 only after leaving the assignment, some did not receive them until separation or retirement, or not at all.

Many Nuclear Weapons Technicians who wore dosimeters stated that their military service records—when requested by VA—did not include a DD Form 1141, the form included little to no exposures, or recorded exposure data had blatantly obvious errors. Those errors were evident when work was conducted with frequent and consistent activities on the same nuclear weapons series with short periods containing dose data; while substantially longer periods with similar duties contained multiple recorded readings of zero ionizing radiation exposure.

VA relied on incomplete, incorrect, and illogical information to deny service connection to ionizing radiation. Examples of denied claims or related appeals include:

- VA (2005): *"DD Forms 214 reflect that he worked as Nuclear Weapons Mechanical Specialist and a Nuclear Weapons Supervisor during service."* [active 1950-1970] *"There was no*

[54] https://www.publichealth.va.gov/exposures/radiation/sources/index.asp Reviewed 7-21-23

evidence showing that the veteran was exposed to ionizing radiation or chemicals during service." [55]

- VA (2020): "*It was unknown whether he was exposed to ionizing radiation from handling these warheads to a degree that would have increased his risk for any disease, since the warheads were sealed and shielded, and no public information exists about whether there is an increased medical risk from handling unexploded shielded nuclear warheads in such a manner".*[56] [underline added] This was arguably an uninformed opinion from a person or persons, without applicable experience, and not familiar with warhead designs nor sources of ionizing radiation.
- VA (1996) denied an appeal [57] from an Army Nuclear Weapons Technician who was verified as having conducted "*hands-on assembly and maintenance of the 8-inch howitzer atomic projectile (M422)*" and worked nuclear weapons 1957-1965 and 1970-1973. VA: "*The U.S. Army Ionizing Radiation Dosimetry Radiation Center* [IRDRC] *reported: All film badge measurements were reported as 000.000 rem*." "*His total exposure recorded within the Army was "000.000 rem*." VA: Per IRDRC, he was monitored for exposure only from September 1958 to February 1959 (6 months).

  Also Per IRDRC *"...dose assessment was based on the results of a 2-year study (1981-1983) in which the various services and the Department of Energy conducted exhaustive measurements of ionizing radiation emanating from storing, handling, and maintaining nuclear weapons, excluding radiation exposure from detonation or accident. This ionizing radiation from nuclear weapons was otherwise known as the intrinsic radiation (INRAD) program. This program also included extensive time motion studies and direct personnel monitoring as a part of their assessment of personnel exposures for the most hazardous of these systems*."

  This VA statement was apparently a reference to the 1981 Intrinsic Radiation Intercomparison Workshop, part of the study promised in the 1980 DNA Carter-Reagan Briefing Book, documented in the related January 25, 1983, DOE report described earlier.

  In the 1983 report, DOE acknowledged previous decades of unreliable data; and documented many unreliable, confusing, and questionable data that resulted during the 1981 workshop. Based on the results, many would consider the workshop a failure. Arguably, unless proven to be a different study than that discussed in the DOE report, the claim and appeal denials based on a "*2-year study*" were ill-advised, misguided, and incorrect. It is also highly probable that most weapons series maintained during the Cold War period were no longer available for direct radiation exposure measurements.

[55] VA initial claim text cited (and remanded) by Board of Appeals Judge, Citation: 0500302 Decision Date: 01/06/05
[56] A VA Claims Examiner's response included incorrect comments stating unexploded nuclear weapons were not radiation risks because they were "*sealed and shielded*", Citation 20048516, 7-20-20, 1956-59 exposure window.
[57] Appeal denied by VA, Citation NR: 9607194, 19 March 1996.

Groups and Events VA Considers "Exposure to Radiation During Military Service"

The following groups of Veterans participated in what is called a "Radiation-Risk Activity".[58]

- Participated in the occupation of Hiroshima and Nagasaki, Japan, 1945-1946.
- Were prisoners of war in Japan during World War II.
- Participated in atmospheric nuclear weapons tests between 1945 and 1962.
- Participated in underground nuclear weapons testing at Amchitka Island, AK.
- Worked in gaseous diffusion plants at Paducah, Kentucky; Portsmouth, Ohio; or K25 in Oak Ridge, Tennessee for at least 250 days before Feb. 1, 1992.

"Veterans who served in any of the following situations or circumstances may have been exposed to radiation".[59]

- U.S. Air Force plutonium cleanup mission near Palomares, Spain (1966), "*VA presumes exposure to radiation*". [Added as the result of a court order in 2020.] The cleanup included approximately 1,418 Air Force, 107 Army, 37 Navy and 38 other individuals.
- Radiological cleanup of Enewetak Atoll. VA presumes exposure to radiation.
- Thule Air Force Base in Greenland, response to fire onboard a B-52 carrying nuclear weapons. VA presumes exposure to radiation.
- Fukushima, Japan nuclear accident.
- *"Various military occupations, such as **nuclear weapons technicians** and dental technicians, include **routine and usually safe exposure to radiation**."* [emphasis added] VA does not presume exposure to radiation.

VA Ionizing Radiation Registry Health Exam – Excludes Nuclear Weapons Technicians[60]

"*Veterans who meet any of the following criteria are eligible:*

- *On-site participation in a test involving the atmospheric detonation of a nuclear device, whether or not the testing nation was the United States*
- *Participation in the occupation of Hiroshima or Nagasaki from August 6, 1945, through July 1, 1946*
- *Internment as a prisoner of war in Japan during World War II*
- *Receipt of nasopharyngeal (NP)—nose and throat—radium irradiation treatments while in the active military, naval, or air service*
- *Involved in the following "radiation-risk activities":*
  - *Service at Department of Energy gaseous diffusion plants at Paducah, KY, Portsmouth, OH, or the K25 area at Oak Ridge, TN, for at least 250 days before February 1, 1992 under certain conditions*
  - *Proximity to 'Longshot', 'Milrow', or 'Cannikin' underground nuclear tests at Amchitka Island, AK, before January 1, 1974*"

Note: Nuclear Weapons Technicians are not specifically included because our primary duties are not considered a "Radiation-Risk Activity", and we are not considered "Radiation-Exposed" veterans.

[58] https://www.publichealth.va.gov/exposures/radiation/sources/radiation-risk-activity.asp Reviewed 7-22-23 oh
[59] https://www.publichealth.va.gov/exposures/radiation/sources/index.asp Reviewed 7-22-23 oh
[60] https://www.publichealth.va.gov/exposures/radiation/benefits/registry-exam.asp Reviewed 7-22-23 oh

Toxic and Carcinogenic Chemicals, Organic Solvents, and Other Substances

Nuclear Weapons Technicians worked without adequate respiratory and other personal protection, and little facility safety equipment, from toxic and carcinogenic chemicals, organic solvents, metals, and other substances during nuclear weapons and associated-equipment maintenance. Fuming hoods were exceptionally rare, and exhaust fans had limited use if installed. It is now known that most substances were carcinogens; harmful to central and peripheral nervous systems, numerous other organs, reproductive system, and unborn children; toxicologically synergistic with other chemicals and solvents; and caused or may cause other health problems, diseases, debilitating medical conditions, or death.

Nuclear Weapons Technicians used "splash cans" to place parts on a spring-loaded metal screen, push the screen down into the chemicals/solvents with a gloved hand, and immerse the parts (and fingers/hands) in the solution. In minutes, the latex rubber or "surgical" gloves broke down during nuclear weapons maintenance operations, exposing hands to toxic chemicals. Bulky/thick rubber gloves were seldom used and discouraged during nuclear weapons operations due to dexterity problems. Their use could easily result in dropping (on or inside a weapon), losing or damaging fasteners, connectors, straps, hardware, etc. Air Force Instruction 91-101, Air Force Nuclear Weapons Surety Program, prohibited the use of *"…cumbersome gloves (to ensure weapons are not inadvertently damaged)"*. [61]

Toxic chemicals, organic solvents, volatile organic compounds, paint strippers, primers, etc.—many of which are listed below—were specifically authorized by the Atomic Energy Commission (AEC) and the Defense Atomic Support Agency (DASA), later renamed Department of Energy (DOE) and Defense Nuclear Agency (DNA), respectively, for use on nuclear weapons and related nuclear weapons support equipment. Each had an AEC or DOE part number or specification.

They were listed in one of two joint manuals, for required use with nuclear weapons: AEC/DOE-DASA/DNA TP 35-51, Army TM 39-35-51, Navy SWOP (Special Weapons Operations Procedures) 35-51, Air Force T.O. 11N-35-51, "*Technical Manual, General Instructions for Cleaning, Preservation, Packaging and Identification Marking"; and AEC-DASA (later DNA) TP 40-54, et. al., "Technical Manual, General Maintenance Instructions"*. Each item included an AEC or DOE part number or specification. Detailed procedures for use on specific nuclear weapon series may be referenced in related classified joint-AEC/DOE, DASA/DNA, Army, Navy, and Air Force technical procedures. Additional technical publications were used for maintenance of nuclear weapons handling equipment, e.g. bomb clip-in assemblies, etc.

Based on assigned weapon systems, substances were stocked for daily nuclear weapons maintenance use. One example of a typical group of minimum essential chemicals/organic solvents for a bomb-shop included (non-exhaustive list): Acetone, Alodine, enamel and lacquer paints and thinners, epoxy polyamide coatings, Freon, Methyl Ethyl Ketone (MEK), Naptha, resins, Stoddard Drycleaning Solvent, Toluene, Trichloroethane, Trichloroethylene (TCE), Chromium Trioxide, Zinc Chromate (and other Chromates), and Xylene. A substantial number of the hazardous substances commonly used on or otherwise associated with various nuclear weapons and their related support equipment/hardware are listed below.

[61] Air Force Instruction 91-101, Air Force Nuclear Weapons Surety Program, 1 March 1997, Section A, 3.3.2.

Toxic/Carcinogenic Substances Used During the Cold War Period; Related Effects[62] [63]

- **Acetone, Technical (Dimethyl ketone), O-A-0051e –** Volatile organic compound. Toxicity: dermal, eyes, inhalation. Target organs: Central nervous system, kidney, liver, spleen, blood. Possible risk of Progressive Supranuclear Palsy. Toxicologically synergistic with 1,1,2-Trichloroethane, Trichloroethylene, Carbon Tetrachloride, Chloroform, Bromodichloromethane, Dibromochloromethane, N-nitroso dimethylamine, 2.5 Hexanedione, 1,2-Dichlorobenzene.
- **Alodine, Aluminum Coating Compound, MIL-C-5541/A –** Contains Chromium Trioxide (a carcinogen), Hydrofluoric Acid, and Nitric Acid (all listed below).
- **Benzene** – Aromatic hydrocarbon, volatile organic compound. Component of other listed solvents. Carcinogen with risk of acute myelogenous leukemia, chromosome aberrations, lymphatic and hematopoietic cancers, neurotoxin, germ cell mutagenicity, bone marrow aplastic anemia, immune system damage. Progressive Supranuclear Palsy risk. Possible Chronic lymphocytic leukemia (CLL) risk.
- **Beryllium** – Carcinogen, chronic granulomatous lung disease, Chronic Beryllium Disease or Berylliosis. Inflammation and scarring of the respiratory tract. Acute toxicity, oral and inhalation; reproductive toxicity (fertility and unborn child). Skin irritation and serious eye irritation. Toxic dust or residue result of sanding or filing, and cleaning with solvents.
- **Cadmium/Cadmium dust and residue –** Carcinogen 1B. Germ cell mutagenicity, acute toxicity from inhalation Cat 2, reproductive toxicity Cat 2. Repeated exposure, target organ toxicity Cat 1. Causes mutations and chromosomal deletions. May be fatal if inhaled. Inhibits activity of antioxidant enzymes. Cadmium bone and Itai-itai disease. Causes skeletal demineralization, inhibits collagen production. Osteoporosis. Toxic dust or residue result of sanding or filing rough/chipped edges, and cleaning with solvents. Cadmium uses: Typical use in corrosion-resistant alloys, coating, and pigments. Extensive use as plating for hardware and hand tools used for weapons and weapons-related equipment maintenance. Plated surfaces of tools often became chipped or flaked off, creating sharp, jagged surfaces.
- **Carbon Tetrachloride (Tetrachloromethane)–** A Chlorinated Hydrocarbon solvent. Genetic carcinogen, acts directly on DNA, liver cancer (per DOE). Inhalation Cat 1 – liver, kidney.
- **Chromium Trioxide, Technical, O-C-303c** (aka Chromic Acid, Chromium Hexavalent Compound, Chromic Anhydride) – Mixed with water to repair magnesium parts and cadmium and zinc-plated parts, also an Alodine component. Carcinogen Cat 1A, paranasal sinus and nasal cavity cancer, lung cancer, germ cell mutagenicity Cat 1B, reproductive toxicity Cat 2, serious eye damage, damages gastrointestinal tract. Targets: respiratory system, liver, kidney, blood. Causes lung ulcerations, pneumonia, kidney failure. Can be fatal in contact with skin or if inhaled.

[62] Toxic chemicals and organic solvents were listed in AEC-DNA TP/TM/SWOP/11N-TO 35-51, 26 Nov 1962, Change 6, 7 Jun 1972; and TP/TM/SWOP/TO 11N-40-54, 20 Aug 1962, Change 16, 6 Feb 1973. Not all-inclusive.
[63] Substances listed as carcinogens are named in various U.S. federal organization documents (example: DHHS/NIH 15th Report on Carcinogens), CDC, DOL/OSHA, EPA; U.S. states; Material Safety Data Sheets (MSDS) and Safety Data Sheets (SDS); International and World cancer research organizations; others.

- **Cleaning Compound, Phosphoric acid based, MIL-C-5410B Type 1 –** Skin corrosion Cat 1B. Burns by all exposure routes, Target organs: respiratory system, gastrointestinal system, eyes, skin. Irreversible eye damage Cat 1.
- **Dry Cleaning Solvent, Stoddard, Type I (P-D-680)** – Aspiration toxicity Cat 1, organ kidney toxicity Cat 1, skin corrosion Cat 2, serious eye damage Cat 2A. Volatile organic compound.
- **Epoxy and Vinyl Resins, 837994-00 –** Carcinogen Cat 2, skin sensitization Cat 1, target organ toxicity Cat 2.
- **Ethylbenzene –** Carcinogen Cat 2. Neurotoxin - central nervous system. Volatile organic compound. Component of Naptha. Possible Chronic lymphocytic leukemia risk.
- **Hydrofluoric acid** (Alodine component) – Dermal Cat 1, serious eye damage Cat 1.
- **Kerosine, VV-K-211d –** Contains hydrocarbons. Carcinogen Cat 1A, aspiration toxicity Cat 1, germ cell mutagenicity Cat 1B, neurotoxin. Genetic defects, renal tubular acidosis, hypokalemic paralysis. Reversible dermal toxicity.
- **Magnesium-Thorium Alloy/Magnesium parts, TP35-51 –** Toxic by inhalation or ingestion. Radioactive.
- **Methanol, ACS, Technical Grade –** Poison. Nervous system depression. Organ toxicity: eyes Cat 1, central nervous system Cat 1.
- **Methyl Ethyl Ketone (MEK), Technical, TT-M-261b** (also known as **Methyl isobutyl Ketone and Isobutyl Methyl Ketone)** – Carcinogen Cat 2. Toxicity: reproductive, developmental effects, central nervous system Cat 3, developmental effects, endocrine disrupter.
- **Methyl Isobutyl Ketone, TT-M-268b –** Carcinogen Cat 2, Toxicity Central nervous system Cat 3. Mixed 1-to-1 with toluene for a thinner.
- **Naptha, Aliphatic Type II, TT-N-95b –** Carcinogen. May cause reproduction or birth defects. Contains N-Hexane, Xylene, Toluene, Cyclohexane, Pentane, Heptane, Ethylbenzene, Benzene , and 1,2,4-Trimethylbenzene Sulfur. Possible Chronic lymphocytic leukemia risk.
- **N-Hexane –**Neurotoxin, reproductive toxicity, specific organ toxicity. Naptha component. Volatile organic compound.
- **Nitric Acid** (Alodine component) **–** Serious eye damage Cat 1, Severe skin burns Cat 1A, inhalation toxicity Cat 3.
- **Nitric Oxide** (compressed gas) – Acute toxicity, inhalation Cat 1, serious eye damage Cat 1, may be fatal if inhaled. Also known as Nitrogen Monoxide, Nitrosyl Radical, Amidogen.
- **Resin-Acid, MIL-P-15328C –** Carcinogen Cat 1A, toxic to reproduction/unborn child Cat 2.
- **Tetrachloroethylene (PCE, PEC or PERC), 830264-00** [64] – Carcinogen. Toxic to the nervous system, liver, kidneys, reproductive system, unborn. Bladder cancer, multiple myeloma, non-Hodgkin's lymphoma, and Parkinson's disease. Germ cell mutagenicity Cat 2, drowsiness, dizziness, narcotic effects. Suspected link to Progressive Supranuclear Palsy. Aka Perchloroethylene, Perchloro, Tetrachloroethene. Associated occupational diseases per

[64] Tetrachloroethylene [perchloroethylene] (PCE or PERC), Trichloroethylene (TCE) and Benzene were listed in the Camp Lejeune toxic water contamination case, recognized by VA as a "presumptive service connection" for certain diseases. Review 2-25-23

NIH.gov: Kidney cancer, acute toxic poisoning, toxic encephalopathy/chronic poisoning. Latency: years to decades.

- **Tetrahydrofuran** – Carcinogen, Neurotoxin. Targets liver, kidneys, central nervous system. Compounded with vinyl resin adhesive (TP 40-54).
- **Thinner, Dope and Lacquer, Acrylic/Nitrocellulose –** Target organ toxicity, respiratory tract irritation, narcosis, Cat 2; skin sensitization Cat 1; skin corrosion Cat 2.
- **Toluene, Toluene-2,4-Diisocyanate, TT-Y-548c –** Carcinogen, aromatic hydrocarbon. Nerve damage, liver, kidney damage, cardiac arrest, reproductive toxicity, renal tubular acidosis, hypokalemic paralysis. Neurotoxin. Mixed 1-to-1 with Methyl Isobutyl Ketone (MIBK) to thin Zinc Chromate. Inhalation/dermal toxicity. Volatile organic compound.
- **Trichloroethane, Technical, O-T-620c (Methyl Chloroform)** – Volatile organic compound. Carcinogen. Toxicity: Oral, inhalation, dermal. Also known as Xythene.
- **Trichloroethylene (TCE)** [65] **Technical, O-T-634b, Type I –** A chlorinated hydrocarbon solvent. Carcinogen by all routes of exposure. Neurotoxin. Targets: central nervous system, heart, liver, lungs. Parkinson's Disease. Suggested link to Progressive Supranuclear Palsy.
- **Triethylenetetramine, 837824-00 –** Acute dermal toxicity Cat 4, inhalation toxicity Cat 2, severe skin burns and eye damage, pulmonary edema after exposure to high concentrations, asthma.
- **Varnish, Phenolic Resin Base, TT-V-119b –** Contains Acetone, Methyl n-Amyl Ketone, Acetone, Naptha.
- **Vinyl Resin Adhesive (Vinyl Ester Resin) –** Carcinogen Cat 2, skin corrosion Cat 2, eye damage Cat 2A.
- **Xylene, Technical, TT-X-916b (Ethylbenzene 20-30%)** – Carcinogen Cat 2. Skin/eyes Cat 2/2A. Toxic to reproduction; toxic to blood, kidneys, liver, mucous membranes, bone marrow, central nervous system, hearing organs; death from exposure in high doses; brain, lung, or other organ injury if inhaled/dermal. Volatile organic compound. Possible CLL risk.
- **Xythene**, **Solvent, Chlorinated O-T-620c), see Trichloroethane (Technical)** – Carcinogen. Toxic to reproduction (fertility and unborn child), organ toxicity, liver Cat 2, eyes Cat 2, skin Cat 2. Possible risk of Progressive Supranuclear Palsy.[66]
- **Zinc Chromate Primer, MIL-P-8585A –** Carcinogen Cat 1. Reproduction toxicity Cat 1A, mutagenicity, central nervous system depression, harms gastrointestinal tract, liver, kidneys, immune system. Severe skin burns, serious eye damage.
- **Zinc Potassium Chromate** (commonly mistaken for and called Zinc Chromate) **–** Carcinogen. Can cause a hole in the septum. Irritation of nasal passages and respiratory tract, bronchitis. Eye and skin irritation. Irritation or corrosion of alimentary tract, circulatory collapse and toxic nephritis (kidney).

[65] Ibid. re. Tetrachloroethylene [perchloroethylene] (PCE or PERC), Trichloroethylene (TCE), and Benzene.
[66] https://pubmed.ncbi.nlm.nih.gov/2611760/, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4861658/

Epilogue

Throughout the Cold War period, tens of thousands of unknown, uncelebrated veteran Nuclear Weapons Technicians quietly helped maintain our Nation's strong nuclear weapons deterrence and defense capabilities.

Thousands of these courageous Americans, however, paid a high price for their service, developing disabling or fatal illnesses as a result of their exposure to ionizing radiation, toxic chemicals, and other hazards unique to nuclear weapons maintenance. Too often, these military veterans were neither adequately protected from, nor informed of, the occupational dangers to which they were exposed.

Through The Sound of Silence Project, we intend to work with congressional leaders to pass changes to existing federal laws, or new laws, if necessary, that will require the Department of Veterans Affairs and other applicable departments and agencies to formally recognize the duties that Nuclear Weapons Technicians performed, and the related dangers.

We share the hope and expectation that Nuclear Weapons Technicians will receive certification and recognition as members of a category, class, cohort, or group of veterans with duties designated as a "Radiation-Risk Activity" and a "Toxic Exposure Risk Activity", and include service-connection presumption for radiation exposure and toxic exposure.

Such consideration is provided to other categories of veterans and hundreds of thousands of civilian Nuclear Weapons Workers as described in this document. We ask for nothing more and nothing less than others receive with respect to recognition, support, health care, and related benefits.

Similar to related statements in the December 7, 2000, U.S. Presidential Executive Order regarding civilian Nuclear Weapons Workers, existing policies opposing medical care and compensation for veteran Nuclear Weapons Technicians' sacrifices must be reversed.

Time is running short for all of us. It is time for the leaders of the Nation we served to act.

IF NOT NOW, WHEN?

Silence is powerful — for many — Silence is not golden

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