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1: Nuclear Weapons Complex: Los Alamos National Laboratory

The U.S. Nuclear Weapons Complex: Major Facilities Although the United States stopped producing new nuclear weapons over 20 years ago in the aftermath of the Cold War, the nuclear weapons complex (NWC), administered by the National Nuclear Security Administration (NNSA), is still a very active sector of the U.S. national security system.

Nuclear weapon design The Trinity test of the Manhattan Project was the first detonation of a nuclear weapon, which lead J. Robert Oppenheimer to recall verses from the Hindu scripture Bhagavad Gita: Weapons whose explosive output is exclusively from fission reactions are commonly referred to as atomic bombs or atom bombs abbreviated as A-bombs. This has long been noted as something of a misnomer , as their energy comes from the nucleus of the atom, just as it does with fusion weapons. In fission weapons, a mass of fissile material enriched uranium or plutonium is forced into supercriticality â€”allowing an exponential growth of nuclear chain reactions â€”either by shooting one piece of sub-critical material into another the "gun" method or by compressing using explosive lenses a sub-critical sphere of material using chemical explosives to many times its original density the "implosion" method. The latter approach is considered more sophisticated than the former, and only the latter approach can be used if the fissile material is plutonium. The amount of energy released by fission bombs can range from the equivalent of just under a ton to upwards of , tons kilotons of TNT 4. Many fission products are either highly radioactive but short-lived or moderately radioactive but long-lived , and as such, they are a serious form of radioactive contamination if not fully contained. Fission products are the principal radioactive component of nuclear fallout. The most commonly used fissile materials for nuclear weapons applications have been uranium and plutonium Less commonly used has been uranium Neptunium and some isotopes of americium may be usable for nuclear explosives as well, but it is not clear that this has ever been implemented, and their plausible use in nuclear weapons is a matter of dispute. Thermonuclear weapon The basics of the Tellerâ€”Ulam design for a hydrogen bomb: The other basic type of nuclear weapon produces a large proportion of its energy in nuclear fusion reactions. Such fusion weapons are generally referred to as thermonuclear weapons or more colloquially as hydrogen bombs abbreviated as H-bombs , as they rely on fusion reactions between isotopes of hydrogen deuterium and tritium. All such weapons derive a significant portion of their energy from fission reactions used to "trigger" fusion reactions, and fusion reactions can themselves trigger additional fission reactions. Whether India has detonated a "true" multi-staged thermonuclear weapon is controversial. Almost all of the nuclear weapons deployed today use the thermonuclear design because it is more efficient. In the Teller-Ulam design , which accounts for all multi-megaton yield hydrogen bombs, this is accomplished by placing a fission bomb and fusion fuel tritium , deuterium , or lithium deuteride in proximity within a special, radiation-reflecting container. When the fission bomb is detonated, gamma rays and X-rays emitted first compress the fusion fuel, then heat it to thermonuclear temperatures. The ensuing fusion reaction creates enormous numbers of high-speed neutrons , which can then induce fission in materials not normally prone to it, such as depleted uranium. Each of these components is known as a "stage", with the fission bomb as the "primary" and the fusion capsule as the "secondary". In large, megaton-range hydrogen bombs, about half of the yield comes from the final fissioning of depleted uranium. This technique can be used to construct thermonuclear weapons of arbitrarily large yield, in contrast to fission bombs, which are limited in their explosive force. Most thermonuclear weapons are considerably smaller than this, due to practical constraints from missile warhead space and weight requirements. Other types Main articles: Boosted fission weapon , Neutron bomb , Radiological warfare , and Antimatter weapon There are other types of nuclear weapons as well. For example, a boosted fission weapon is a fission bomb that increases its explosive yield through a small number of fusion reactions, but it is not a fusion bomb. In the boosted bomb, the neutrons produced by the fusion reactions serve primarily to increase the efficiency of the fission bomb. There are two types of boosted fission bomb: Some nuclear weapons are designed for special purposes; a neutron bomb is a thermonuclear weapon that yields a relatively small explosion but a relatively large amount of neutron radiation ; such a device could theoretically be used to cause massive casualties while leaving infrastructure mostly intact and creating a minimal amount of fallout.

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The detonation of any nuclear weapon is accompanied by a blast of neutron radiation. Surrounding a nuclear weapon with suitable materials such as cobalt or gold creates a weapon known as a salted bomb. This device can produce exceptionally large quantities of long-lived radioactive contamination. It has been conjectured that such a device could serve as a "doomsday weapon" because such a large quantity of radioactivities with half-lives of decades, lifted into the stratosphere where winds would distribute it around the globe, would make all life on the planet extinct. In connection with the Strategic Defense Initiative , research into the nuclear pumped laser was conducted under the DOD program Project Excalibur but this did not result in a working weapon. The concept involves the tapping of the energy of an exploding nuclear bomb to power a single-shot laser which is directed at a distant target. During the Starfish Prime high-altitude nuclear test in , an unexpected effect was produced which is called a nuclear electromagnetic pulse. This flash of energy can permanently destroy or disrupt electronic equipment if insufficiently shielded. Because the effect is produced by high altitude nuclear detonations, it can produce damage to electronics over a wide, even continental, geographical area. Research has been done into the possibility of pure fusion bombs: Such a device might provide a simpler path to thermonuclear weapons than one that required development of fission weapons first, and pure fusion weapons would create significantly less nuclear fallout than other thermonuclear weapons, because they would not disperse fission products. Air Force funded studies of the physics of antimatter in the Cold War , and began considering its possible use in weapons, not just as a trigger, but as the explosive itself. Nuclear weapons delivery , Nuclear triad , Strategic bomber , Intercontinental ballistic missile , and Submarine-launched ballistic missile The first nuclear weapons were gravity bombs , such as this " Fat Man " weapon dropped on Nagasaki , Japan. Upon its first fielding in the late s, the SS remains the single highest throw weight missile delivery system ever built. The system used to deliver a nuclear weapon to its target is an important factor affecting both nuclear weapon design and nuclear strategy. This method places few restrictions on the size of the weapon. It does, however, limit attack range, response time to an impending attack, and the number of weapons that a country can field at the same time. With miniaturization, nuclear bombs can be delivered by both strategic bombers and tactical fighter-bombers. This method is the primary means of nuclear weapons delivery; the majority of U. Although even short-range missiles allow for a faster and less vulnerable attack, the development of long-range intercontinental ballistic missiles ICBMs and submarine-launched ballistic missiles SLBMs has given some nations the ability to plausibly deliver missiles anywhere on the globe with a high likelihood of success. More advanced systems, such as multiple independently targetable reentry vehicles MIRVs , can launch multiple warheads at different targets from one missile, reducing the chance of a successful missile defense. Today, missiles are most common among systems designed for delivery of nuclear weapons. Making a warhead small enough to fit onto a missile, though, can be difficult. An atomic mortar has been tested by the United States. Small, two-man portable tactical weapons somewhat misleadingly referred to as suitcase bombs , such as the Special Atomic Demolition Munition , have been developed, although the difficulty of combining sufficient yield with portability limits their military utility. The policy of trying to prevent an attack by a nuclear weapon from another country by threatening nuclear retaliation is known as the strategy of nuclear deterrence. During the Cold War, policy and military theorists considered the sorts of policies that might prevent a nuclear attack, and they developed game theory models that could lead to stable deterrence conditions. Each missile, like the heavier lift Russian SS Satan , could contain up to ten nuclear warheads shown in red , each of which could be aimed at a different target. A factor in the development of MIRVs was to make complete missile defense difficult for an enemy country. Different forms of nuclear weapons delivery see above allow for different types of nuclear strategies. The goals of any strategy are generally to make it difficult for an enemy to launch a pre-emptive strike against the weapon system and difficult to defend against the delivery of the weapon during a potential conflict. This can mean keeping weapon locations hidden, such as deploying them on submarines or land mobile transporter erector launchers whose locations are difficult to track, or it can mean protecting weapons by burying them in hardened missile silo bunkers. Other components of nuclear strategies included using missile defenses to destroy the missiles before they land, or implementing civil defense measures using early-warning systems to evacuate citizens to safe areas before an attack. Weapons designed to threaten large populations or to deter attacks are known as strategic weapons. Nuclear weapons for use on a battlefield in military situations are called tactical weapons. Critics of nuclear war strategy often suggest that a nuclear war between two nations would result in mutual annihilation. From this point of view, the significance of nuclear weapons is to deter war because any nuclear war would escalate out of mutual distrust and fear, resulting in mutually assured destruction. This threat of national, if not global, destruction has been a strong motivation for anti-nuclear weapons activism. Critics from the peace movement and within the military establishment[citation needed] have questioned the usefulness of such weapons in the current military climate. According to an advisory opinion issued by the International Court of Justice in , the use of or threat of use of such weapons would generally be contrary to the rules of international law applicable in armed conflict, but the court did not reach an opinion as to whether or not the threat or use would be lawful in specific extreme circumstances such as if the survival of the state were at stake. Another deterrence position is that nuclear proliferation can be desirable. In this case, it is argued that, unlike conventional weapons, nuclear weapons deter all-out war between states, and they succeeded in doing this during the Cold War between the U. Strategy for the Nuclear Age that mere possession of a nuclear arsenal was enough to ensure deterrence, and thus concluded that the spread of nuclear weapons could increase international stability. Some prominent neo-realist scholars, such as Kenneth Waltz and John Mearsheimer , have argued, along the lines of Gallois, that some forms of nuclear proliferation would decrease the likelihood of total war , especially in troubled regions of the world where there exists a single nuclear-weapon state. Aside from the public opinion that opposes proliferation in any form, there are two schools of thought on the matter: The prospect of mutually assured destruction might not deter an enemy who expects to die in the confrontation. Further, if the initial act is from a stateless terrorist instead of a sovereign nation, there might not be a nation or specific target to retaliate against. It has been argued, especially after the September 11, attacks , that this complication calls for a new nuclear strategy, one that is distinct from that which gave relative stability during the Cold War. By threatening retaliation against those states, the United States may be able to deter that which it cannot physically prevent. By identifying unique attributes of the fissile material, including its impurities and contaminants, one could trace the path back to its origin. Anti-nuclear movement The International Atomic Energy Agency was created in to encourage peaceful development of nuclear technology while providing international safeguards against nuclear proliferation. Because they are weapons of mass destruction, the proliferation and possible use of nuclear weapons are important issues in international relations and diplomacy. In most countries, the use of nuclear force can only be authorized by the head of government or head of state. It highlighted the dangers posed by nuclear weapons and called for world leaders to seek peaceful resolutions to international conflict. The signatories included eleven pre-eminent intellectuals and scientists, including Albert Einstein , who signed it just days before his death on April 18, A few days after the release, philanthropist Cyrus S. By the s, steps were taken to limit both the proliferation of nuclear weapons to other countries and the environmental effects of nuclear testing. The Partial Nuclear Test Ban Treaty restricted all nuclear testing to underground nuclear testing , to prevent contamination from nuclear fallout, whereas the Treaty on the Non-Proliferation of Nuclear Weapons attempted to place restrictions on the types of activities signatories could participate in, with the goal of allowing the transference of non-military nuclear technology to member countries without fear of proliferation. In , the International Atomic Energy Agency IAEA was established under the mandate of the United Nations to encourage development of peaceful applications of nuclear technology, provide international safeguards against its misuse, and facilitate the application of safety measures in its use. In , many nations signed the Comprehensive Nuclear-Test-Ban Treaty , [38] which prohibits all testing of nuclear weapons. A testing ban imposes a significant hindrance to nuclear arms development by any complying country. Nuclear weapons have also been opposed by agreements between countries. Many nations have been declared Nuclear-Weapon-Free Zones , areas where nuclear weapons production and deployment are prohibited, through the use of treaties. The Treaty of Tlatelolco prohibited any production or deployment of nuclear weapons in Latin America and the Caribbean , and the Treaty of Pelindaba prohibits nuclear weapons in many African countries. The court ruled that the use or threat of use of nuclear weapons would violate various articles of international law , including the Geneva Conventions , the Hague Conventions , the UN

Charter , and the Universal Declaration of Human Rights. Given the unique, destructive characteristics of nuclear weapons, the International Committee of the Red Cross calls on States to ensure that these weapons are never used, irrespective of whether they consider them lawful or not. In the wake of the tests by India and Pakistan in , economic sanctions were temporarily levied against both countries, though neither were signatories with the Nuclear Non-Proliferation Treaty. One of the stated casus belli for the initiation of the Iraq War was an accusation by the United States that Iraq was actively pursuing nuclear arms though this was soon discovered not to be the case as the program had been discontinued.

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2: Work to demolish Hanford nuke-weapons plant may resume in September | The Seattle Times

Interactive map guides to the current and historical United States nuclear weapons and naval nuclear propulsion complex are available courtesy of the Office of Environmental Management at the U.S.

This section does not cite any sources. Please help improve this section by adding citations to reliable sources. Unsourced material may be challenged and removed. August Early weapons models, such as the " Fat Man " bomb, were extremely large and difficult to use. Each modified bomber could only carry one such weapon and only within a limited range. After these initial weapons were developed, a considerable amount of money and research was conducted towards the goal of standardizing nuclear warheads so that they did not require highly specialized experts to assemble them before use, as in the case with the idiosyncratic wartime devices, and miniaturization of the warheads for use in more variable delivery systems. Through the aid of brainpower acquired through Operation Paperclip at the tail end of the European theater of World War II , the United States was able to embark on an ambitious program in rocketry. One of the first products of this was the development of rockets capable of holding nuclear warheads. Because of their limited range, their potential use was heavily constrained they could not, for example, threaten Moscow with an immediate strike. The Boeing B Stratofortress was able by the mids to carry a wide arsenal of nuclear bombs, each with different capabilities and potential use situations. Starting in , the U. This system was, however, tremendously expensive, both in terms of natural and human resources, and raised the possibility of an accidental nuclear war. During the s and s, elaborate computerized early warning systems such as Defense Support Program were developed to detect incoming Soviet attacks and to coordinate response strategies. During this same period, intercontinental ballistic missile ICBM systems were developed that could deliver a nuclear payload across vast distances, allowing the U. Shorter-range weapons, including small tactical weapons, were fielded in Europe as well, including nuclear artillery and man-portable Special Atomic Demolition Munition. The development of submarine-launched ballistic missile systems allowed for hidden nuclear submarines to covertly launch missiles at distant targets as well, making it virtually impossible for the Soviet Union to successfully launch a first strike attack against the United States without receiving a deadly response. Improvements in warhead miniaturization in the s and s allowed for the development of MIRVsâ€”missiles which could carry multiple warheads, each of which could be separately targeted. The question of whether these missiles should be based on constantly rotating train tracks to avoid being easily targeted by opposing Soviet missiles or based in heavily fortified silos to possibly withstand a Soviet attack was a major political controversy in the s eventually the silo deployment method was chosen. MIRVed systems enabled the U. Additional developments in weapons delivery included cruise missile systems, which allowed a plane to fire a long-distance, low-flying nuclear-tipped missile towards a target from a relatively comfortable distance. The current delivery systems of the U. Additionally, in-flight refueling of long-range bombers and the use of aircraft carriers extends the possible range virtually indefinitely. Command and control[edit] Command and control procedures in case of nuclear war were given by the Single Integrated Operational Plan SIOP until , when this was superseded by Operations Plan This arrangement was seen as necessary during the Cold War to present a credible nuclear deterrent ; if an attack was detected, the United States would have only minutes to launch a counterstrike before its nuclear capability was severely damaged, or national leaders killed. If the President has been killed, command authority follows the presidential line of succession. Changes to this policy have been proposed, but currently the only way to countermand such an order before the strike was launched would be for the Vice President and the majority of the Cabinet to relieve the President under Section 4 of the Twenty-fifth Amendment to the United States Constitution. The command would be carried out by a Nuclear and Missile Operations Officer a member of a missile combat crew , also called a "missileer" at a missile launch control center. A two-man rule applies to the launch of missiles, meaning that two officers must turn keys simultaneously far enough apart that this cannot be done by one man. When President Reagan was shot in there was confusion about where the "nuclear football" was, and who was in charge. In fact, the nuclear weapons were not placed under locks until decades later, so pilots or individual submarine commanders had the power, but not the authority, to launch nuclear weapons entirely on their own. The United States nuclear program since its inception has experienced accidents of varying forms, ranging from single-casualty research experiments such as that of Louis Slotin during the Manhattan Project , to the nuclear fallout dispersion of the Castle Bravo shot in , to the accidental dropping of nuclear weapons from aircraft broken arrows. How close any of these accidents came to being major nuclear disasters is a matter of technical and scholarly debate and interpretation. In some of these cases such as Palomares , the explosive system of the fission weapon discharged, but did not trigger a nuclear chain reaction safety features prevent this from easily happening , but did disperse hazardous nuclear materials across wide areas, necessitating expensive cleanup endeavors. Eleven American nuclear warheads are thought [9] to be lost and unrecovered, primarily in submarine accidents. The nuclear testing program resulted in a number of cases of fallout dispersion onto populated areas. There were also instances during the nuclear testing program in which soldiers were exposed to overly high levels of radiation, which grew into a major scandal in the s and s, as many soldiers later suffered from what were claimed to be diseases caused by their exposures. Many of the former nuclear facilities see next section produced significant environmental damages during their years of activity, and since the s have been Superfund sites of cleanup and environmental remediation. Deliberate attacks on weapons facilities[edit] Main article: Vulnerability of nuclear plants to attack In three hijackers took control of a domestic passenger flight along the east coast of the U. The National Nuclear Security Administration has acknowledged the seriousness of the Plowshares action. Its primary purpose was to delegate research and dispense funds. In June , the U. Army Corps of Engineers took over the project to develop atomic weapons, while the OSRD retained responsibility for scientific research. In after a long and protracted debate, the Atomic Energy Act of was passed, creating the Atomic Energy Commission AEC as a civilian agency that would be in charge of the production of nuclear weapons and research facilities, funded through Congress, with oversight provided by the Joint Committee on Atomic Energy. The AEC was given vast powers of control over secrecy, research, and money, and could seize lands with suspected uranium deposits. Along with its duties towards the production and regulation of nuclear weapons, it was also in charge of stimulating development and regulating civilian nuclear power. The full transference of activities was finalized in January Some functions were taken over or shared by the Department of Homeland Security in The already-built weapons themselves are in the control of the Strategic Command , which is part of the Department of Defense. In general, these agencies served to coordinate research and build sites. They generally operated their sites through contractors, however, both private and public for example, Union Carbide , a private company, ran Oak Ridge National Laboratory for many decades; the University of California , a public educational institution, has run the Los Alamos and Lawrence Livermore laboratories since their inception, and will jointly manage Los Alamos with the private company Bechtel as of its next contract. Funding was received both through these agencies directly, but also from additional outside agencies, such as the Department of Defense. Each branch of the military also maintained its own nuclear-related research agencies generally related to delivery systems. Weapons production complex[edit] This table is not comprehensive, as numerous facilities throughout the United States have contributed to its nuclear weapons program. It includes the major sites related to the U. Not listed are the many bases and facilities at which nuclear weapons have been deployed. In addition to deploying weapons on its own soil, during the Cold War , the United States also stationed nuclear weapons in 27 foreign countries and territories, including Okinawa which was US-controlled until , Japan during the occupation immediately following World War II , Greenland , Germany, Taiwan , and French Morocco then independent Morocco.

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3: The U.S. Nuclear Weapons Complex: Major Facilities | Union of Concerned Scientists

The United States was the first country to manufacture nuclear weapons and is the only country to have used them in combat, with the separate bombings of Hiroshima and Nagasaki in World War II.

Calendar Environment and nuclear weapons The nuclear Non-Proliferation Treaty is an important mechanism for halting the production of nuclear weapons and their resulting environmental impacts. The NPT, by constraining the continued development of nuclear weapons, can act as a means to prevent further radioactive contamination to the environment. The production of nuclear weapons has created not only the threat of nuclear destruction on an immediate level through nuclear war, but also on a continual and protracted level through the creation of nuclear waste. New technologies will need to be developed in order to retrieve radioactive materials which have been released into the environment either through accident or by design. From until , coolant waters from nuclear reactors at the Hanford Reservation in Washington State were routinely discharged into the Columbia River. In , the General Accounting Office published a document which stated that billion gallons of liquid radioactive wastes, from coolant waters to radioactive liquids, were discharged into the environment from the Hanford site alone. Approximately 50 of these tanks present an immediate threat of explosion due to a gaseous build-up of a variety of chemical constituents and their decay products. Some tanks have already ruptured and their radioactive contents have leaked into the ground. In Russia, the situation is equally distressing. Nuclear submarines, some still armed with nuclear warheads, are rusting away in the fjords of Murmansk. Elsewhere, rivers have been polluted and open reservoirs and lakes have been used to hold large quantities of liquid radioactive materials. In , a waste storage tank not unlike those at Hanford at the Chelyabinsk nuclear weapons site in Russia exploded and a radioactive cloud dispersed over more than square kilometers of an agricultural region containing numerous rivers and lakes. Nearly all the trees within the most radioactive zone were damaged or killed. The highest reading there, recorded near a discharge pipe, was approximately 6 grays per hour, enough radioactivity to give an adult human being a lethal dose in less than one hour. The environmental damage resulting from nuclear technology is not limited to the two largest nuclear weapons states. All nuclear weapons and nuclear energy producing nations have caused some level of environmental contamination, both in their own countries and abroad - such as, nuclear testing in the South Pacific, Nevada, Kazakhstan, China, India and Pakistan; water and airborne discharges from reprocessing plants in the UK and France; and uranium mining in Namibia, Canada, former East Germany and Australia. Moreover, the ongoing production of both nuclear weapons and nuclear power continues to create nuclear waste. The burial of these materials must not be confused with their safe containment and isolation from the environment. The production of nuclear weapons has polluted vast amounts of soil and water at hundreds of nuclear weapons facilities all over the world. Contaminants from nuclear weapons production and testing have often traveled far down wind and down stream. Radioactivity released from atmospheric nuclear testing â€” including plutonium, strontium, cesium, carbon, and radioactive iodine â€” has been widely dispersed throughout the world. Underground tests have contaminated soil and groundwater. A US government report called the soil contamination from underground testing at the Nevada Test Site "a threat to human health and the environment". Radioactive wastes created in the manufacture of a single nuclear bomb containing 4 kg of plutonium and 20 kg of uranium include: For an approximate picture of radioactive waste production to date, multiply the above by the estimated 70, nuclear warheads that have been manufactured on an international scale. Decommissioning nuclear weapons and nuclear power facilities will create an entirely new radioactive waste stream. Radioactive materials ought to be stored on-site in monitored, retrievable configurations, and isolated from the environment for manageable time frames, such as 50 year periods. These materials need to be vigilantly guarded and kept in safe containment until, eventually, the responsibility for our nuclear legacy will be passed to future generations. Currently at the Waste Isolation Pilot Plant, in Carlsbad, New Mexico , plutonium contaminated waste and plutonium residues are being buried in a salt flat formation, more than feet beneath the surface of the Earth. Although it has been argued that a subterranean salt formation is a safe place to store radioactive waste, it is more accurate to say that WIPP was chosen for political reasons, not geological reasons. The population surrounding the area are predominately Hispanic and Native American, who hold little or no political power in the United States.

4: New Nuclear Policy Expands Arms Race | Washington Spectator

The U.S. nuclear weapons complex consists of a national industrial infrastructure for the physical production of nuclear weapons and their deployment systems, as well as the scientific-engineering workforces that are responsible for the research and design of nuclear weapons, and the bureaucratic workforce that integrates the nuclear weapons complex into U.S. military planning and operations.

Several hundred billion dollars may be needed to clean up leaking waste pits, groundwater contamination, growing accumulations of radioactive waste, and uncontrolled liquid discharges at DOE facilities. A major cost driver has been environmental regulations and cleanup schedules that the Department is required to meet, although DOE also has been accused of poorly managing many projects and allowing costs to escalate unnecessarily. Environmental restoration involves cleanup and mitigation of past environmental contamination and uncontained waste sites, including decontamination and decommissioning of permanently closed DOE facilities. Waste management, currently the largest category, involves disposing of stored and newly generated waste. Highly radioactive defense waste is to be disposed of in an underground repository proposed for civilian reactor spent fuel at Yucca Mountain, Nevada. Less-radioactive defense waste that is contaminated with long-lived plutonium is planned for disposal in a repository near Carlsbad, NM, called the Waste Isolation Pilot Plant. The nuclear materials stabilization program takes control of nuclear facilities no longer needed by DOE defense programs and other offices. Such surplus facilities may eventually be demolished or transferred to other uses. Waivers of sovereign immunity in those laws make nuclear defense plants and other federal facilities subject to state and federal environmental enforcement, including lawsuits by states and citizens. Environmental enforcement efforts to date have relied primarily on "federal facilities compliance agreements" among the Environmental Protection Agency, state regulators, and DOE. Some of those compliance agreements have been renegotiated to reflect unexpected technical obstacles and greater-than-anticipated contamination at some sites. In locations where complete cleanup is delayed, interim remedies may be implemented to alleviate near-term hazards to human health and the environment. The conference report for the bill was approved by House on August 1 and the Senate on September 10 H. The legislation includes provisions to establish greater authority by DOE site managers over cleanup activities and to speed the development of the Waste Isolation Pilot Plant WIPP , a planned New Mexico disposal facility for plutonium-contaminated transuranic waste from the nuclear weapons program. EPA is expected to rule on the application within one year. DOE on November 20 described plans for disposing of 6. Contaminated groundwater, radioactive air emissions, leaking nuclear waste tanks, and improper chemical waste disposal are among the environmental problems acknowledged by the Department of Energy DOE , which owns the weapons plants. Correcting the situation could cost several hundred billion dollars during the next 30 years. With the collapse of the Soviet Union, most production in the nuclear weapons complex has ended. Environmental cleanup and waste management has instead become the primary mission of many DOE installations, an effort driven largely by federal and state environmental laws. According to the report, 80 percent of contaminated DOE sites are to be cleaned up by Major factors affecting the estimate include assumptions about future land use, particularly whether land must be clean enough for unrestricted activities, and the pace of cleanup projects, according to the report. A growing task of the EM office is the maintenance of numerous weapons complex facilities that have become surplus with the end of the Cold War. Within the EM office, the Office of Nuclear Materials and Facilities Stabilization takes control of retired DOE facilities until plans for their disposition can be completed, such as conversion to another use or demolition. They contend that if the program were managed properly, DOE could meet its regulatory commitments with the lower funding growth that is expected in future years. DOE currently is planning to "privatize" many of its waste treatment activities, to make hazardous waste suitable for storage and disposal. Under that plan, private firms would build and operate waste treatment facilities, and DOE would pay fees based on the amount of its waste that the firms successfully treated. Those provisions require the Secretary of Energy to appoint a site manager for each defense nuclear facility. Each site manager would have authority to hire environmental contractors, modify existing contracts, request funding reprogramming, and negotiate amendments to site-related agreements with environmental regulators. Different numbers of facilities are sometimes cited, depending on what is counted as a "facility" and whether certain facilities are considered part of the defense complex. DOE Environmental Problems As a large-scale industrial enterprise, the DOE defense production complex faces a broad array of environmental problems, involving past disposal practices as well as continuing pollution. However, the degree of radioactivity involved in many nuclear weapons production processes creates a unique complication. DOE faces the enormous task of cleaning up previous environmental contamination, controlling ongoing pollution, and properly disposing of its waste. Environmental Restoration DOE estimates that 10, individual cases of contamination of soil, groundwater, and buildings currently exist throughout the nuclear weapons production complex and other Department facilities. A wide variety of contamination can be found at DOE sites, including high-level radioactive waste, transuranic waste, low-level radioactive waste, and nonradioactive hazardous chemicals. Conventional methods of environmental restoration include removal of contaminated material, pumping and treating of groundwater, and capping buried waste to reduce rainwater intrusion. Because many of those methods involve enormous expenses, DOE is investigating new technologies and treatment methods, such as the melting and solidification of underground waste with powerful electrodes. The highly radioactive liquid left over from reprocessing irradiated nuclear material to extract plutonium and other fissile elements is called "high level" waste. When tank storage was inadequate during the mids, some liquid high-level waste was discharged directly into the ground. But the high-level waste that has already leaked from the Hanford tanks or has been deliberately discharged will require an environmental restoration program that has yet to be designed. Large amounts of contaminated reactor cooling water have also leaked and will require cleanup. Leaks were discovered in , and construction of improved, double-shelled tanks began 9 years later. Some irradiated reactor material has been buried directly in the ground, according to a DOE report released December 7, Uranyl sulfate from an experimental reactor at Oak Ridge National Laboratory in Tennessee was placed in seven footdeep wells drilled at the site and covered with concrete in the mids. Sludge from spent fuel storage basins may have been buried at the Hanford site, according to the report. Those practices, the report warned, may result in "uncontrolled and undetected release of radioactive materials to the environment. After high-level waste, "transuranic waste" is the type of DOE radioactive waste that generally requires the strictest disposal precautions. Transuranic TRU waste is far less radioactive than high-level waste but contains extremely long-lived radioactive elements -- particularly plutonium -- that must be permanently isolated from the environment. Some contains enough radioactivity to require special shielding and remote handling. TRU waste includes discarded protective clothing and other equipment, and hazardous liquids contaminated with plutonium. Since , DOE has stored its TRU waste at various sites around the country in preparation for permanent underground disposal see waste management, below. Before , transuranic waste was buried in trenches - - sites that now are expected to require extensive remedial action. Much of the post "retrievably stored" TRU waste may also have caused environmental contamination. Generally the least hazardous type of radioactive waste generated by DOE defense activities is "low-level" waste -- trash and other solid waste contaminated with relatively short-lived, or extremely low concentrations of long-lived, radioactive particles. Because the vast majority of its radioactivity decays to background levels within a few hundred years, low-level waste that is securely packaged in solid form is allowed to be buried in properly constructed trenches. DOE estimates that nearly 2. Much of the danger from DOE low-level waste as well as TRU and high-level waste is posed not just by its radioactivity, but by nonradioactive chemical waste mixed with it. The large amounts of such "mixed waste" are a unique DOE problem. In fact, land disposal of several types of hazardous waste is banned altogether. Residual radioactive contamination has been found at dozens of non-federal sites, typically former industrial facilities, that were used during the early years of the U. Like other large industrial operations, the nuclear weapons production complex creates vast quantities of nonradioactive hazardous waste, much of which has been disposed of improperly, producing a wide variety of chemical contamination of the environment. Examples cited by DOE are acids, nitrates, oils, heavy metals, fluorides, and explosives. Much of the environmental contamination found by DOE to pose the greatest hazard to public health and the environment comes from nonradioactive waste. Mercury was used at the plant beginning in the early s to enrich lithium for nuclear weapons. But as part of a declassification initiative, DOE revealed on December 7, , that 24 million pounds of mercury was used at the Y plant. Based on that data, it has been estimated that about , pounds was released into the environment, much of it into a nearby creek. Waste Management Since the beginning of the nuclear weapons program, the primary method of handling the most dangerous types of radioactive waste has been interim storage. As a result, large amounts of stored radioactive and other hazardous waste have accumulated at many DOE facilities. Large quantities of hazardous and sanitary waste produced by the nuclear weapons production complex, as well as waste generated by environmental restoration projects, also require proper treatment and disposal. Major facilities planned or under construction for the handling of high-level waste include at least three vitrification plants, in which the highly radioactive liquid is dissolved in molten glass and poured into stainless steel canisters. Similar treatment facilities may be required at INEL, where powdered high-level waste currently is stored in bins. Once the highlevel waste is treated and solidified, it is to be placed in a geologic repository planned at Yucca Mountain, Nevada, a facility being developed by a separate DOE office. The PEIS examines alternative management strategies ranging from leaving waste at the locations where it is generated and currently stored, establishing regional waste facilities, and centralizing waste management at one or two national sites. Designed as a disposal site for defense-related TRU waste that is currently in interim storage, the WIPP facility is to consist of a grid of caverns and tunnels excavated in a thick salt bed 2, feet underground. One of eight planned repository sections has been excavated so far, along with experimental areas and four vertical shafts. Prerequisites for beginning waste disposal at WIPP are simplified and a congressional notification period reduced. DOE received greater authority to determine whether the disposal system, including natural and engineered barriers to waste leakage, would comply with environmental requirements. Future human disturbance of the WIPP site was found to be the only credible mechanism for releasing radioactivity, and the report concluded that the repository could be constructed to reduce such releases. A DOE study released December 7, , described major problems at many aging Department facilities that store spent nuclear fuel and other irradiated nuclear materials. Much of the material is stored in pools of water, but a wide variety also has been placed in dry storage and in buried containers. Corroding spent fuel in the Hanford pool is releasing plutonium and other radioactive materials into the pool water, some of which has leaked into the environment. Corrosion in the other pools is causing similar problems, the report found. DOE announced May 30, , that spent fuel storage would be consolidated at three sites: DOE revealed in December the total amount of plutonium stored within the weapons complex, excluding plutonium in nuclear warheads and components. The plutonium exists in a variety of forms, including in mixtures with waste material. Storage of the plutonium is generally in facilities separate from the irradiated material storage facilities described above. The stored plutonium includes Altogether, DOE has produced 89 metric tons of weapons-grade plutonium and 13 metric tons of reactor-grade plutonium, much of which is expected to be declared surplus. A study by the National Academy of Sciences recommended that surplus DOE plutonium be mixed with high-level waste for disposal or turned into nuclear reactor fuel. Compliance With Environmental Laws As a general rule, DOE and other federal agencies are subject to environmental standards and procedural requirements such as disposal permits established by local, state and federal law. Environmental enforcement against federal facilities is made possible by broad waivers of sovereign immunity contained in most major federal environmental statutes. Management and disposal of radioactive DOE waste, including the radioactive constituents of mixed waste, are also regulated by the Department, except for planned high-level waste storage and disposal sites to be licensed by the Nuclear Regulatory Commission NRC. Legislation was proposed in the rd Congress H. A prospective issue is whether federal facilities could be held responsible for environmental violations if sufficient funding for the necessary cleanup and pollution control measures was not appropriated. For the nuclear weapons complex, several hundred billion dollars may ultimately be required to achieve full compliance. Most major environmental laws requiring federal compliance allow an exemption if Congress does not provide sufficient appropriations, but such exemptions have never been invoked. At least seven federal environmental statutes contain explicit provisions covering federal facilities. Most contain similar language to make federal agencies and employees subject to administrative and judicial environmental enforcement -- not just of federal law but of related state and local requirements as well. Another significant environmental law that applies to DOE is the National Environmental Policy Act NEPA , which requires federal agencies to consider the environmental ramifications of their actions and prepare environmental impact statements on those that may significantly affect the environment.

5: Nuclear Weapons Complex: Sandia National Laboratories

It was part of a larger complex linking facilities across the nation. A plant at Oak Ridge, Tennessee, enriched uranium and operated a prototype nuclear reactor.

For decades following World War II, the United States and the Soviet Union built grossly oversized nuclear arsenals and never envisioned having to stop. The perverse logic of this nuclear rivalry reached a point of ultimate absurdity during the first Reagan administrationâ€"when the notion that the winner of a nuclear war would be the one with the most weapons left over was baked into U. After churning out tens of thousands of nukes, toward the end of the s the U. The demise of the Soviet Union in and a voluntary moratorium on nuclear testing led to a major downsizing of U. Since , no new U. Over the past 32 years, U. According to the Federation of American Scientists, the U. This decline in absolute numbers, however, has not slowed the pace of nuclear weapons modernization, a process that has led to increased accuracy and ongoing strategic reliance on these weapons well into the 21st century. Make no mistakeâ€"the end of the Cold War has had little impact on the catastrophes these weapons of mass destruction can inflict. Currently, Russia and the United States each have roughly 1,â€"1, nuclear warheads in high alert, with the genocidal potential of nearly times the total explosive power of all weapons used during World War II. Much of the Trump nuclear strategy document mirrors those of the Obama and G. Bush administrations, most notably the goal to achieve a very costly modernization of the U. For instance, the Nuclear Posture Review issued in during the G. Like the Trump strategy, it also called for the development of low-yield weapons to destroy underground tunnels and bunkers. During his tenure, he presided over one of the largest unilateral nuclear weapons cutsâ€"retiring more than 5, warheads. Bush took the inventory down to half its sizeâ€"a level not seen since the Eisenhower administration. Bush fared less well in his quest for new nuclear warhead designs, which were rejected by a Republican-controlled Congress. Usable, low-yield nuclear weapons are key assets in dealing with the dangerous world envisioned by Trump, as they were in the Bush doctrine. Left at the end of the Cold War with large-yield strategic nuclear weapons designed to destroy Soviet missile silos, government nuclear analysts raised the alarm that the U. Small-yield nuclear weapons for use on the battlefield are nothing new. Between the late s and the late s, the United States fielded hundreds of low-yield tactical weapons in Europe and South Korea. They all proved to be unwieldy and are long gone. Obscured in the promotion of low-yield nukes is the basic fact that they are also lethal radiological weapons capable of poisoning large areas with radioactive fallout. This has been known since the first nuclear test in New Mexico on July 16, , when the device exploded feet above the ground and then contaminated thousands of square miles with highly radioactive soil that was lifted into the bomb cloud. Pakistan is producing new nuclear weapons at a faster pace than any country in the world. Over the next five to ten years, it is estimated that Pakistan will have nearly nuclear warheads, mostly of the low-yield classification. By placing nuclear-tipped cruise missiles on submarines, the Trump proposal seeks to reverse a year effort that removed of all tactical nukes from U. Naval vessels by Some experts say that navy officials were glad to be rid of them because of both their cost and cumbersome requirements. Alarmingly however, Russia and several other nations such as China, Pakistan and India are preparing to step up deployment of their own submarine launched nuclear cruise missiles. Defenses against these weapons are extraordinarily expensive and tenuous at best. They are extremely accurate and fly low enough to evade radar systems. News about this new and extremely dubious weapon was leaked under suspicious circumstances by Russia in With a yield as large as megatons, and salted with highly radioactive cobalt, the torpedo is touted to be able to destroy an entire coastal zone, while leaving behind an enormous swath of deadly radiological contamination that would last for centuries. Setting aside the technical obstacles of traveling 6, miles underwater, a distance that can much more easily be accomplished by an airborne intercontinental ballistic missile, this is a very heavy, noisy, and untested torpedo that will take several days to reach its target while maneuvering the mountainous underwater terrain. For these reasons, the United States abandoned long-range nuclear torpedoes decades ago. It harkens back to the most absurd moments of the Cold War, when nuclear strategists followed the logic of deterrence over the cliff and into the abyss. This is fast becoming a budgetary millstone, which threatens to grow even larger, consuming funds that impact the conventional military requirements. Even though the U. Apparently, shrinkage of the U. In the summer of , after being shown a slide tracking the reduction of the nuclear stockpile since the Cold War at a Pentagon briefing, Trump was reported to be upset and, according to NBC news, demanded a tenfold increase in the size of the U. Moreover, because of the decline of the U. In , a Defense Department advisory committee succinctly described this situation, stating: Human skills are among the most important factors necessary to meet nuclear weapons production goals. And because making the most dangerous weapons in the world involves working with some of the most dangerous materials, these are jobs that require a very high degree of protection against exposure to one-of-a-kind, high-hazard technologies. The United States is already paying a stiff price for the harm caused to the workforce that made nuclear weapons through the early s. The environmental legacy of nuclear weapons is an issue conspicuously absent from any strategic nuclear policy discussion. The environmental cleanup effort is the most costly, complex, and risky ever undertaken. After that, long-term stewardship of profoundly contaminated areas will pose a challenge spanning hundreds of centuries. But this much is certain: Bush failed to meet key policy goals of his review, though ultimately he made deep cuts in the size of the nuclear arsenal.

NUCLEAR WEAPONS PRODUCTION COMPLEX pdf

6: Nuclear weapon - Wikipedia

The U.S. nuclear weapons complex: Pushing for a new production capability By Greg Mello, March 20, On January 15, the Wall Street Journal published an op-ed by former secretaries of state George Shultz and Henry Kissinger, former Defense Secretary William Perry, and former Georgia Democratic Sen. Sam Nunn, which 37 other national security.

Since then, Russia has implemented arms control agreements and participated in threat reduction programs that have dismantled and downsized substantial parts of its arsenals and made inventory numbers more transparent. At present, Russia is modernizing and recapitalizing its entire arsenal of strategic nuclear weapons and delivery systems. Although the retirement of aging Soviet-era capabilities provides much of the impetus for these efforts, Russia also views modernization as a means to counteract the conventional superiority of the North Atlantic Treaty Organization NATO , as well as a way to retain its status as a major military power. Russian President Vladimir Putin met with U. President Donald Trump in July , but no substantive agenda has emerged from the summit. Nuclear The Soviet nuclear weapons program began during World War II and culminated in a successful nuclear test in Russia has 1, warheads on deployed intercontinental ballistic missiles ICBM , submarine-launched ballistic missiles SLBM , and warheads designated for heavy bombers. However, since June the Russian government has allowed many of these cooperative agreements to expire, due in part to deteriorating relations with the United States. The post Soviet offensive anti-personnel BW program, codenamed Ferment, sought to employ genetic engineering techniques to develop enhanced pathogens for use against humans. Russia is currently developing two new ICBMs: Development of a third, rail-mobile ICBM, called Barguzin, was suspended in December in order to focus resources on the Sarmat and Rubezh programs. To replace the oldest submarines, Russia is building new Borey-class submarines. SS-NX , suffered a difficult and protracted development period, with problems surfacing even after its de facto entry into service in Recent tests, however, have been generally successful. This SVC meeting, the first since , was held in November ; no information is available regarding what was discussed, and it is not known if the issue was resolved. Norris and Thomas B. National Resources Defense Council, , p. Norris, "Russian nuclear forces, ," Bulletin of the Atomic Scientists Sanger and William J. Dmitry Solovyov and Christian Lowe, "Putin suspends nuclear pact, raising stakes in row with Washington," Reuters, 3 October , www. Lidia Kelly, "Russia suspends nuclear agreement, ends uranium research pact with United States," Reuters, 5 October , www. Research, Development, and Use from the Middle Ages to , eds. Stockholm International Peace Research Institute, Columbia University Press, , p. Harvard University Press, , p. Milton Leitenberg and Raymond A. Doubleday, , p. Department of State, Press Release, 16 November , www.

7: Nuclear weapons of the United States - Wikipedia

There are three major nuclear weapons laboratories in the National Nuclear Security Administration's (NNSA's) nuclear weapons complex, Los Alamos (LANL), Lawrence Livermore, and Sandia National Laboratories (SNL).

8: Demolition of Hanford nuclear-weapons plant may resume in September | The Seattle Times

The Y complex, for example, stopped production of nuclear weapons decades ago. Yet its annual budgets have more than doubled in order to maintain antiquated, oversized facilities that now handle a small number of weapons parts, store growing amounts highly enriched uranium from dismantled weapons, and process a large backlog of unstable HEU compounds.

9: Los Alamos Study Group: Sites within the US Nuclear Weapons Complex

A nuclear weapon is an explosive device that derives its destructive force from nuclear reactions, either fission (fission bomb) or from a combination of fission and fusion reactions (thermonuclear bomb).

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Richard Hittlemans 30 day yoga meditation plan SHRM 2004-2005 Workplace Forecast Nutrition and metabolism NRSV Standard Catholic Ed Bible Anglicized (Tan/Red) Chivalry of chauvinism? Know your alpha beta Just when I needed you Fiala and Harens New sectional map of the State of Missouri Ideas About Single Malt Scotch Whisky Fox Terriers (Complete Pet Owners Manuals) Learn german language through tamil Equality on the Oregon frontier Kangaroo Notebook Introduction To Poetry Sixth Edition With Trimmer Mla Document The taboo against being your own best friend From the pope to the council Inculturation of the Jesus tradition Little Miss Splendid and the Princess Through the stage door Food for the World (Science World) Excel at interviews Probate and administration in Singapore and Malaysia 2016 mitsubishi triton manual Sammys siren (Magic sounds) Psychoanalysis and personality Fancy Nancy Loves! Loves! Loves! (Fancy Nancy) Myths That Every Child Should Know (A Selection of the Classic Myths of All Times for Young People) Fresenius AG and Casemark Limited Manual of plastics analysis Paupers : the bottom of the social ladder Queer Stories for Boys The gorgons gaze For those who work Intercourse Between India the Western World After-words : what follows post-development? The relation between mathematics and physics Family-focused care Linux Certification Study Guide (Certification Press) Reel 577. May 17-23, 1901 Nanostructured materials for solar energy conversion