DOWNLOAD PDF PUBLIC RADIATION EXPOSURE FROM NUCLEAR POWER GENERATION IN THE UNITED STATES

Chapter 1 : Three Mile Island accident - Wikipedia

Primary sources for this information are National Council on Radiation Protection and Measurements Reports: #92 Public Radiation Exposure from Nuclear Power Generation in the United States (); #93 Ionizing Radiation Exposure of the Population of the United States (); #94 Exposure of the Population in the United States and Canada from.

The initial cause of the accident happened eleven hours earlier, during an attempt by operators to fix a blockage in one of the eight condensate polishers , the sophisticated filters cleaning the secondary loop water. These filters are designed to stop minerals and impurities in the water from accumulating in the steam generators and increasing corrosion rates in the secondary side. Blockages are common with these resin filters and are usually fixed easily, but in this case the usual method of forcing the stuck resin out with compressed air did not succeed. The operators decided to blow the compressed air into the water and let the force of the water clear the resin. When they forced the resin out, a small amount of water forced its way past a stuck-open check valve and found its way into an instrument air line. This would eventually cause the feedwater pumps , condensate booster pumps, and condensate pumps to turn off around 4: Within eight seconds, control rods were inserted into the core to halt the nuclear chain reaction. However, because the valves had been closed for routine maintenance, the system was unable to pump any water. The closure of these valves was a violation of a key Nuclear Regulatory Commission NRC rule, according to which the reactor must be shut down if all auxiliary feed pumps are closed for maintenance. This was later singled out by NRC officials as a key failure. The relief valve should have closed when the excess pressure had been released, and electric power to the solenoid of the pilot was automatically cut, but the relief valve stuck open because of a mechanical fault. The open valve permitted coolant water to escape from the primary system, and was the principal mechanical cause of the primary coolant system depressurization and partial core disintegration that followed. Despite the valve being stuck open, a light on the control panel ostensibly indicated that the valve was closed. In fact the light did not indicate the position of the valve, only the status of the solenoid being powered or not, thus giving false evidence of a closed valve. The bulb was simply connected in parallel with the valve solenoid , thus implying that the pilot-operated relief valve was shut when it went dark, without actually verifying the real position of the valve. When everything was operating correctly, the indication was true and the operators became habituated to rely on it. However, when things went wrong and the main relief valve stuck open, the unlighted lamp was actually misleading the operators by implying that the valve was shut. This caused the operators considerable confusion, because the pressure, temperature and coolant levels in the primary circuit, so far as they could observe them via their instruments, were not behaving as they would have if the pilot-operated relief valve were shut. This confusion contributed to the severity of the accident because the operators were unable to break out of a cycle of assumptions that conflicted with what their instruments were telling them. The problem was not correctly diagnosed until a fresh shift came in who did not have the mindset of the first shift of operators. By this time major damage had occurred. There was a temperature indicator downstream of the pilot-operated relief valve in the tail pipe between the pilot-operated relief valve and the pressurizer relief tank that could have told them the valve was stuck open by showing that the temperature in the tail pipe remained higher than it should have been had the pilot-operated relief valve been shut. This temperature indicator, however, was not part of the "safety grade" suite of indicators designed to be used after an incident, and the operators had not been trained to use it. Its location on the back of the seven-foot-high instrument panel also meant that it was effectively out of sight of the operators. First, small bubbles of steam formed and immediately collapsed, known as nucleate boiling. As the system pressure decreased further, steam pockets began to form in the reactor coolant. This departure from nucleate boiling DNB into the regime of "film boiling" caused steam voids in coolant channels, blocking the flow of liquid coolant and greatly increasing the fuel cladding temperature. The overall water level inside the pressurizer was rising despite the loss of coolant through the open pilot-operated relief valve, as the volume of these steam voids increased

much more quickly than coolant was lost. Because of the lack of a dedicated instrument to measure the level of water in the core, operators judged the level of water in the core solely by the level in the pressurizer. Since it was high, they assumed that the core was properly covered with coolant, unaware that because of steam forming in the reactor vessel, the indicator provided misleading readings. This confusion was a key contributor to the initial failure to recognize the accident as a loss-of-coolant accident , and led operators to turn off the emergency core cooling pumps, which had automatically started after the pilot-operated relief valve stuck and core coolant loss began, due to fears the system was being overfilled. This alarm, along with higher than normal temperatures on the pilot-operated relief valve discharge line and unusually high containment building temperatures and pressures, were clear indications that there was an ongoing loss-of-coolant accident, but these indications were initially ignored by operators. This radioactive coolant was pumped from the containment building sump to an auxiliary building, outside the main containment, until the sump pumps were stopped at 4: The pumps were shut down, and it was believed that natural circulation would continue the water movement. Steam in the system prevented flow through the core, and as the water stopped circulating it was converted to steam in increasing amounts. This reaction melted the nuclear fuel rod cladding and damaged the fuel pellets, which released radioactive isotopes to the reactor coolant, and produced hydrogen gas that is believed to have caused a small explosion in the containment building later that afternoon. Emergency declared[edit] At 6: Thornburgh and lieutenant governor William Scranton III , to whom Thornburgh assigned responsibility for collecting and reporting on information about the accident. Scranton held a press conference in which he was reassuring, yet confusing, about this possibility, stating that though there had been a "small release of radiation These were contradicted by another official, and by statements from Met Ed, who both claimed that no radioactivity had been released. However, the NRC faced the same problems in obtaining accurate information as the state, and was further hampered by being organizationally ill-prepared to deal with emergencies, as it lacked a clear command structure and the authority to tell the utility what to do, or to order an evacuation of the local area. A group of workers took manual readings from the thermocouples and obtained a sample of primary loop water. Seven hours into the emergency, new water was pumped into the primary loop and the backup relief valve was opened to reduce pressure so that the loop could be filled with water. A large part of the core had melted , and the system was still dangerously radioactive. A hydrogen explosion might not only breach the pressure vessel, but, depending on its magnitude, might compromise the integrity of the containment vessel leading to large-scale release of radioactive material. However, it was determined that there was no oxygen present in the pressure vessel, a prerequisite for hydrogen to burn or explode. Immediate steps were taken to reduce the hydrogen bubble, and by the following day it was significantly smaller. Over the next week, steam and hydrogen were removed from the reactor using a catalytic recombiner and, controversially, by venting straight to the atmosphere. Fission products were released into the reactor coolant. The auxiliary building was outside the containment boundary. This was evidenced by the radiation alarms that eventually sounded. However, since very little of the fission products released were solids at room temperature, very little radiological contamination was reported in the environment. According to the Rogovin report, the vast majority of the radioisotopes released were the noble gases xenon and krypton. The report stated, "During the course of the accident, approximately 2. Within hours of the accident, the United States Environmental Protection Agency EPA began daily sampling of the environment at the three stations closest to the plant. An inter-agency analysis concluded that the accident did not raise radioactivity far enough above background levels to cause even one additional cancer death among the people in the area, but measures of beta radiation were not included. The EPA found no contamination in water, soil, sediment or plant samples. Even then, the elevated levels were still below those seen in deer in other parts of the country during the height of atmospheric weapons testing. Yet elevated levels were not found. Gundersen also notes that the control room shook and doors were blown off hinges. However official NRC reports refer merely to a "hydrogen burn. Three Mile Island in background behind Harrisburg International Airport , a few weeks after the accident. Farmers were told to keep their animals under cover and

on stored feed. Kemeny , president of Dartmouth College. It was instructed to produce a final report within six months, and after public hearings, depositions, and document collection, released a completed study on October 31, Although Babcock engineers recognized the problem, the company failed to clearly notify its customers of the valve issue. In , core samples and samples of debris were obtained from the corium layers on the bottom of the reactor vessel and analyzed. The Three Mile Island accident is one of the factors cited for the decline of new reactor construction. However, following the event, the number of reactors under construction in the U. Additionally, as a result of the earlier oil crisis and post-crisis analysis with conclusions of potential overcapacity in base load , forty planned nuclear power plants already had been canceled before the TMI accident. At the time of the TMI incident, nuclear power plants had been approved, but of those, only 53 which were not already operating were completed. During the lengthy review process, complicated by the Chernobyl Disaster seven years later, Federal requirements to correct safety issues and design deficiencies became more stringent, local opposition became more strident, construction times were significantly lengthened and costs skyrocketed. Globally, the end of the increase in nuclear power plant construction came with the more catastrophic Chernobyl disaster in see graph. Three Mile Island accident health effects In the aftermath of the accident, investigations focused on the amount of radioactivity released by the accident. In total approximately 2. A variety of epidemiology studies have concluded that the accident had no observable long term health effects. Steven Wing found a significant increase in cancers from â€” among people who lived within ten miles of TMI; [83] in Dr. A retrospective study of Pennsylvania Cancer Registry found an increased incidence of thyroid cancer in counties south of TMI and in high-risk age groups but did not draw a causal link with these incidences and to the accident. The TMI accident enhanced the credibility of anti-nuclear groups, who had predicted an accident, [85] and triggered protests around the world. District Court Judge Sylvia Rambo. The appeal of the decision to U. Third Circuit Court of Appeals also failed. TMI was an example of this type of accident because it was "unexpected, incomprehensible, uncontrollable and unavoidable. Such modern high-risk systems, he realized, were prone to failures however well they were managed. Therefore, he suggested, we might do better to contemplate a radical redesign, or if that was not possible, to abandon such technology entirely. Given the characteristic of the system involved, multiple failures which interact with each other will occur, despite efforts to avoid them. It made the case for examining technological failures as the product of highly interacting systems, and highlighted organizational and management factors as the main causes of failures. Technological disasters could no longer be ascribed to isolated equipment malfunction, operator error or acts of God. Rickover was asked to testify before Congress in the general context of answering the question as to why naval nuclear propulsion as used in submarines had succeeded in achieving a record of zero reactor-accidents as defined by the uncontrolled release of fission products to the environment resulting from damage to a reactor core as opposed to the dramatic one that had just taken place at Three Mile Island. In his testimony, he said: Over the years, many people have asked me how I run the Naval Reactors Program, so that they might find some benefit for their own work. I am always chagrined at the tendency of people to expect that I have a simple, easy gimmick that makes my program function. Any successful program functions as an integrated whole of many factors. Trying to select one aspect as the key one will not work. Each element depends on all the others. After the release of the film, Fonda began lobbying against nuclear power. In an attempt to counter her efforts, the then elderly Edward Teller , a nuclear physicist and long-time government science adviser best known for contributing to the Teller-Ulam design breakthrough that made hydrogen bombs possible, personally lobbied in favor of nuclear power. TMI-2, to the left, has not been used since the accident. TMI-2 as of February

Chapter 2 : Viewpoint: Demystifying radiation - the nemesis of nuclear energy? - World Nuclear News

This report provides detailed information on population exposures to radiation from nuclear power ge.

Medical scientists were interested in the effect of radiation upon the fast-growing cells of cancer, and materials were given to them, while the military services led research into other peaceful uses. The Atomic Energy Act of encouraged private corporations to build nuclear reactors and a significant learning phase followed with many early partial core meltdowns and accidents at experimental reactors and research facilities. No other technology in the history of American industry has enjoyed such continuing blanket protection. Between then and the turn of the 21st century, Argonne designed, built, and operated fourteen reactors [16] at its site southwest of Chicago, and another fourteen reactors [16] at the National Reactors Testing Station in Idaho. Two were never operated; except for the Neutron Radiography Facility, all the other reactors were shut down by In the early afternoon of December 20, , Argonne director Walter Zinn and fifteen other Argonne staff members witnessed a row of four light bulbs light up in a nondescript brick building in the eastern Idaho desert. This was the first time that a usable amount of electrical power had ever been generated from nuclear fission. Only days afterward, the reactor produced all the electricity needed for the entire EBR complex. In , tests verified that this was the case. So, the Navy sent their "man in Engineering", then Captain Hyman Rickover , well known for his great technical talents in electrical engineering and propulsion systems in addition to his skill in project management, to the AEC to start the Naval Reactors project. This made the boat capable of operating under water full-time â€" demonstrating this ability by reaching the North Pole and surfacing through the Polar ice cap. Start of commercial nuclear power[edit] From the successful naval reactor program, plans were quickly developed for the use of reactors to generate steam to drive turbines turning generators. Eisenhower as part of his Atoms for Peace program. As nuclear power continued to grow throughout the s, the Atomic Energy Commission anticipated that more than 1, reactors would be operating in the United States by Opposition to nuclear power[edit] There has been considerable opposition to the use of nuclear power in the U. It was built approximately 30 miles from Detroit and there was opposition from the United Auto Workers Union. The proposal was controversial and conflict with local citizens began in Historian Thomas Wellock traces the birth of the anti-nuclear movement to the controversy over Bodega Bay. Samuel Walker , in his book Three Mile Island: A Nuclear Crisis in Historical Perspective , explains that the growth of the nuclear industry in the U. Environmentalists saw the advantages of nuclear power in reducing air pollution, but were critical of nuclear technology on other grounds. Other large protests followed the Three Mile Island accident. Cost overruns were sometimes a factor of ten above original industry estimates, and became a major problem. For the 75 nuclear power reactors built from to , cost overruns averaged percent. Opposition and problems were galvanized by the Three Mile Island accident in By , cost overruns and delays, along with a slowing of electricity demand growth, led to cancellation of two WPPSS plants and a construction halt on two others. The court case that followed took nearly a decade to resolve. Al Gore has commented on the historical record and reliability of nuclear power in the United States: Of the nuclear power reactors originally ordered in the United States from to , 48 percent were canceled, 11 percent were prematurely shut down, 14 percent experienced at least a one-year-or-more outage, and 27 percent are operating without having a year-plus outage. Thus, only about one fourth of those ordered, or about half of those completed, are still operating and have proved relatively reliable. Of all U. Even reliably operating nuclear plants must shut down, on average, for 39 days every 17 months for refueling and maintenance, and unexpected failures do occur too. The failure of the U. It is a defeat for the U. The most recent was a year study on 32, people. None has found any adverse health effects such as cancers which might be linked to the accident. The radioactivity released as a result of the accident was almost entirely confined within the reinforced concrete containment structure. These containment structures, found at all nuclear power plants, were designed to successfully trap radioactive material in the event of a melt down or accident. At Three Mile

Island, the containment structures operated exactly as it was designed to do, emerging successful in containing any radioactive energy. The low levels of radioactivity released post incident is considered harmless, resulting in zero injuries and deaths of residents living in proximity to the plant. Despite many technical studies which asserted that the probability of a severe nuclear accident was low, numerous surveys showed that the public remained "very deeply distrustful and uneasy about nuclear power". Nuclear energy was conceived in secrecy, born of war, and first revealed to the world in horror. Shoreham Nuclear Power Plant was completed but never operated commercially as an authorized Emergency Evacuation Plan could not be agreed on due the political climate after the Three Mile Island accident and Chernobyl disaster. The last permanent closure of a US nuclear power plant was in In the s, the NRC determined that there were no technical issues that would preclude longer service. Many permitted reactors were never built, or the projects were abandoned. Those that were completed after Three Mile island experienced a much longer time lag from construction permit to starting of operations. The Nuclear Regulatory Commission itself described its regulatory oversight of the long-delayed Seabrook Nuclear Power Plant as "a paradigm of fragmented and uncoordinated government decision making," and "a system strangling itself and the economy in red tape. By the number of working reactors declined to , where it remains as of The loss of electrical generation from the eight fewer reactors since has been offset by power uprates of generating capacity at existing reactors. Another cause was a large increase in the capacity factor over that period. Performance suffered even further during and after Three Mile Island, as a series of new safety regulations from through the mids forced operators to repeatedly shut down reactors for required retrofits. The capacity factor continued to rise, until Effects of Fukushima[edit] Following the Japanese nuclear accidents , the U. Nuclear Regulatory Commission has announced it will launch a comprehensive safety review of the nuclear power reactors across the United States, at the request of President Obama. A total of 45 groups and individuals had formally asked the NRC to suspend all licensing and other activities at 21 proposed nuclear reactor projects in 15 states until the NRC had completed a thorough post- Fukushima reactor crisis examination. The petitioners also asked the NRC to supplement its own investigation by establishing an independent commission comparable to that set up in the wake of the serious, though less severe, Three Mile Island accident. On-site storage, consolidated long-term storage, and geological disposal of spent fuel is "likely to be reevaluated in a new light because of the Fukushima storage pool experience". Thus we expect the clean energy standard under discussion in US legislative chambers will see a far greater emphasis on gas and renewables plus efficiency ". The projects responsible for this loss are mostly the construction of four AP reactors at Vogtle in Georgia and V. Summer in South Carolina. Bradford , former Nuclear Regulatory Commission member, commented "They placed a big bet on this hallucination of a nuclear renaissance".

Chapter 3 : UNSCEAR studies radiation exposure from electricity - World Nuclear News

Public radiation exposure from nuclear power generation in the United States: recommendations of the National Council on Radiation Protection and Measurements.

A No, there is no need for concern. The information we have now tells us that no harmful levels1 of radioactivity have arrived in the United States from the failed Japanese nuclear power plants. Radioactive plumes2 that are being generated are dissipating with time as they cross the vastness of the Pacific Ocean. In spite of this reassurance, thousands of people purchased potassium iodide KI , a substance that blocks radioactive iodine which was present in the airborne plumes and is a potential cause of cancer from accumulating in the thyroid gland. Medical experts state that there is no need for that in the United States. In fact, use of KI could have an adverse medical effect on people with specific allergies and other ailments. The ocean plume was expected to reach the west coast of the United States in Some dire predictions have been made over this. However, the testing that has been done shows little or no Fukushima fallout in the ocean or on the shore. The testing does show the natural radioactive minerals that are in all oceans. That is, the oceans are already naturally radioactive. Testing up and down the west coast is continuing. For more information on radiation, see Radiation Answers. Q What types of radioactivity are being released from the nuclear plants and why is that of concern? A Radioactivity or radioactive material comes from the nuclear fuel in the plants. We call the radioactive compounds that are being released fission products. They include a number of radioactive noble gases, radioactive isotopes of iodine, and radioactive isotopes of other elements such as cesium. Some of these materials emit radiation gamma and beta rays and, if in the surrounding air or deposited on the ground or other surface, can irradiate our bodies from the outside externally. In addition, if these materials are taken into the body by breathing or in food they have the potential of exposing body cells internally. Q Are the amounts of radiation that are being released from the plant enough to cause radiation exposures to people? A Geiger counters and other radiation-detection instruments are sensitive enough to detect radiation if you have as few as 50 to several hundred radioactive atoms on your skin. We know from detector readings that some of the evacuated residents and plant workers had some radioactive contamination on their clothing, but we do not yet have validated data on the level of radiation exposure to the individuals wearing the clothing. A Yes, from many sources. Our bodies contain some naturally radioactive potassium; our environment contains some naturally occurring radioactivity like uranium, radium, and radon; and there are consumer products containing radioactive materials, including smoke detectors, antique pottery called Fiesta ware, and some lantern mantles typically used in lanterns when camping. If you want more information on radioactivity in consumer products, take a look at http: The information posted on this web page is intended as general reference information only. Specific facts and circumstances may affect the applicability of concepts, materials, and information described herein. The information provided is not a substitute for professional advice and should not be relied upon in the absence of such professional advice. To the best of our knowledge, answers are correct at the time they are posted. Be advised that over time, requirements could change, new data could be made available, and Internet links could change, affecting the correctness of the answers. Answers are the professional opinions of the expert responding to each question; they do not necessarily represent the position of the Health Physics Society.

Chapter 4 : Power Generation | Radiation Information and Answers

*Public Radiation Exposure from Nuclear Power Generation in the United States (Ncrp Report: No. 92) [National Council on Radiation Protection and Measurements] on theinnatdunvilla.com *FREE* shipping on qualifying offers.*

Demystifying radiation - the nemesis of nuclear energy? World Nuclear Association Many people and their political representatives seem to be generally sensitive about radiation attributable to nuclear power. These include its contribution to a climate change solution. However, they usually fall silent when challenged about the issue of radiation and thus the sense that radiation is the archenemy of nuclear energy is being propagated around the world. Radiation exposure from nuclear power is several orders of magnitude lower than the exposures people normally experience from natural radiation sources, such as cosmic radiation and emissions from the many natural radioactive elements present in Earth since primordial times. Radiology and nuclear medicine used in hospitals expose patients to relatively high levels of radiation in comparison with nuclear power. Following these estimates and in response to theoretical calculations of the health effects caused by low radiation exposures, UNSCEAR considered the attribution of health effects to different levels of exposure to ionizing radiation and reached, inter alia, the following conclusions: Increases in the incidence of health effects cannot be attributed reliably to chronic exposure to radiation at levels that are typical of the global average background levels of radiation. Increases in the incidence of hereditary effects among the human population cannot be attributed to radiation exposure. Finally, while recognising that public health bodies need to allocate resources appropriately and that this may involve making projections of numbers of health effects for comparative purposes, UNSCEAR emphasised that: More recently, UNSCEAR has estimated radiation exposures attributable to the generation of electricity through different technologies to show the differences resulting from each technology. It concluded, inter alia, that: Notwithstanding, the larger radiation exposures due to electrical energy generation are not delivered by nuclear energy but mainly by coal and geothermal plants. Surprisingly, the larger exposures due to the installation of electrical power plants are caused by the installation of solar and wind plants, which results from the use of rare earth minerals and estimates of occupational exposures for their mining. What about waste and accidents, people might retort! As for accidents, the variability of potential scenarios makes any estimates contentious and neither UNSCEAR, nor any other UN body, has a mandate to estimate and compare the consequences of accidents arising from the production of electricity. If the main concern is the number of casualties that an accident may produce among members of the public, hydroelectricity is far ahead as a source of electricity - collapsed dams have had catastrophic consequences for human life. If the main consideration is the lives of workers, then coal mining accidents predominate. If the major worry is impact, then oil and gas spills are the major culprits. But if the salient apprehension is the presence of radiation, then nuclear accidents are certainly the first to be considered. UNSCEAR has produced comprehensive ad hoc reports on two of the three accidents that have occurred in the nuclear industry with radiation consequences. For Chernobyl, UNSCEAR reported that the major radiation impact was on the emergency workers responding to the accident and on children who were fed contaminated milk, but among the general public to date there has been no consistent evidence of any other health effect that can be attributed to radiation exposure. The realities of radiation I have described are not speculation by the nuclear industry, but are based on the scientific findings of UNSCEAR, which have been commended in formal resolutions from the UN General Assembly, whose members comprise sovereign states. The time is therefore ripe to ask: Are policymakers aware of the facts about radiation?

Chapter 5 : Safety of Nuclear Reactors - World Nuclear Association

from Nuclear Power Generation in the United States (); #93 Ionizing Radiation Exposure of the Population of the United States (); #94 Exposure of the Population in the United States and Canada.

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Chapter 6 : ANS / Public Information / Resources / Radiation Dose Calculator

The nuclear fuel cycle does not give rise to significant radiation exposure for members of the public, and even in two major nuclear accidents - Three Mile Island and Fukushima - exposure to radiation has caused no harm to the public.

Chapter 7 : Radioactivity in the United States From Japanese Nuclear Plants

Radiation exposure from nuclear power is several orders of magnitude lower than the exposures people normally experience from natural radiation sources, such as cosmic radiation and emissions from the many natural radioactive elements present on Earth since primordial times.

Chapter 8 : Nuclear power in the United States - Wikipedia

WASHINGTON â€" In an early version of a story Oct. 2 about EPA regulation of radiation, The Associated Press reported erroneously in a headline that EPA says a little radiation may be good for you.

Chapter 9 : Canadian Radiation Dose Calculator

The U.S. Nuclear Regulatory Commission (NRC) is the Federal agency responsible protecting the health and safety of the public and the environment by licensing and regulating civilian uses of the following radioactive materials in medical, academic, research, and industrial applications (including the generation of nuclear power).