DOWNLOAD PDF NUCLEAR AND RADIOLOGICAL DISASTERS

Chapter 1 : Nuclear and Radiological Disaster â€" Vikaspedia

A nuclear and radiation accident is defined by the International Atomic Energy Agency (IAEA) as "an event that has led to significant consequences to people.

A sign warning of the radiation in Pripyat, Ukraine. Pripyat was the site of the worst nuclear disaster of all time. Few alternative energy sources can be considered dangerous for human and environmental health with the exception of nuclear energy. The biggest concern from using this type of energy comes from the potential for radiation poisoning and pollution. Nuclear technology produces radioactive waste that comes into contact with humans and the environment during reactor accidents and waste storage leaks. The Chernobyl disaster , the Fukushima disaster, and the Kyshtym disasters were among the worst nuclear disasters of all time. In the event of a nuclear disaster, humans may suffer from increased cancer rates and future generations may suffer from genetic defects. Radiation in the environment can result in significantly reduced plant growth and animal deaths. However, the number of deaths and illnesses that are caused by a nuclear disaster are hard to trace and are as a result often controversial. INES is a series of metrics that were created in as a way to measure the destruction caused by nuclear disasters and meltdowns. INES organizes nuclear disasters into the following categories: During testing, an explosion occurred that ended in 9 days of fires and radiation emissions. There were 31 immediate deaths and an estimated 4, premature deaths from the effects of the radiation leak. Today, around 5 million people live in radionuclide contaminated zones, and they still lack the information they need to live healthy lives. This zone includes lakes, forests, and eery abandoned buildings, including shows and shopping centers. Concerns regarding birth defects and food contamination among those who were exposed remain to this day. Mihama Nuclear Power Plant - Fukushima Prefecture, Japan Level 7 The Japan tsunami and earthquake devastated northeastern Japan, resulting in an outcome of around 15, deaths and thousands of injuries and missing people. The meltdown directly resulted in the deaths of two people. The handling of the disaster, which many in the public perceived to be slow and inadequate, caused a massive uproar both in Japan and abroad. Several countries around the world, such as Germany and Italy, vowed to either close their nuclear power plants or cease building any new ones. However, in some countries such as India and Russia, nuclear power still reigns strong. Kyshtym Disaster Level 6 Mayak, a major plutonium-producing site in Russia, was also the site of one of the worst nuclear disasters of all time. On September 29, , a nuclear waste storage container exploded, exposing 22 villages to dangerous radiation levels. Although more than 10, people were evacuated instantly, a full two years passed before all sites were evacuated. To make matters worse, the explosion was kept secret from the outside world by the USSR for three decades. This disaster left confirmed dead and contaminated the nearby rivers and soil. The incident occurred when a reactor, known as "Unit 1", caught fire. The fire continued to burn for three full days, releasing radiation as far away as Europe. The radiation contained idoine, an isotope known to cause thyroid cancer. Studies that have been conducted on the connection between the Windscale Fire and cancer rates have been mixed. It happened on March 28, The disaster occurred when large amounts of nuclear reactor coolant leaked from reactor number 2 at the Nuclear Generating Station near Harrisburg, Pennsylvania, United States. To make matters worse, the leak was not immediately identified as such, leaving to a lengthy problem-solving session and a delay in damage control. At the time of the disaster, a voluntary evacuation was called for anyone within a five mile radius of the plant. Reactor number 2 was so badly damaged that it was never used again, and was eventually commissioned. Reactor number 1 is still in operation but is soon to cease operations in The accident led to widespread panic throughout the eastern United States, and had an impact on the public perception of nuclear power. It was the first nuclear accident in the history of all nuclear energy. No deaths occurred as a result of the meltdown. However, the clean-up required was arduous and involved hundreds of volunteers and military personnel. In recent years, the nuclear power industry has improved reactor designs and performance. The amendments include such protection measures as nuclear power plants are to be designed with accident prevention in mind, periodic safety assessments are to be implemented, and national regulation agencies must take into account the IAEA Safety Standards.

Chapter 2 : Radiological and Nuclear Incidents

Radiation exposures in accidents - Annex C of UNSCEAR Report (Comprehensive list of accidents with details) "The world's worst nuclear power disasters". Power Technology. 7 October

Examples include lethal effects to individuals, large radioactivity release to the environment, or reactor core melt. On March 28, , in the wee hours of morning, the Three Mile Island nuclear generating station witnessed a nuclear meltdown of one secondary loop. This nuclear accident released 13 million curies of radioactive gases into the atmosphere and caused a loss of USD 2, Fortunately it led to no deaths or injuries. Goiania Accident â€" September 13, More than people were exposed to radiation when a junkyard dealer in Goiania, Brazil, broke open an abandoned radiation therapy machine and removed a small highly radioactive cake of cesium chloride. The accident occurred on September 13, The environment and surroundings were seriously contaminated. Many buildings had to be demolished. Many children got attracted to the bright blue of the radioactive material, touched it and rubbed it on their skin, resulting in the contamination of several city block. The radioactive contamination caused 33 cancer deaths. The fire released an estimated 20, curies of iodine, as well as curies of caesium and 24, curies of xenon, among other radionuclides. The incident produced around cancer cases. INES rated the incident as level 5. A series of hydrogen gas explosions hurled the four-ton gasholder dome four feet through the air where it jammed in the superstructure. The core of the NRX reactor could not be decontaminated; it had to be buried as radioactive waste. Young Jimmy Carter, later U. President, then a nuclear engineer in the U. Navy, was among the hundreds of Canadian and American servicemen who were ordered to participate in the NRX cleanup following the accident. Castle Bravo â€" March 1, Bikini Atoll, Micronesian Islands in the Pacific Ocean was the site of more than 20 nuclear weapons tests between and Castle Bravo was the code name given to the first U. When the weapon was detonated, an explosion took place, leaving a crater of 6, feet 2, m in diameter and feet 75 m in depth. Castle Bravo was the most powerful nuclear device ever detonated by the United States, with a yield of 15 Megatons which was far exceeding the expected yield of Megatons. This miscalculation led to a severe accidental radiological contamination ever caused by the United States. Moreover, the radiation cloud contaminated more than seven thousand square miles of the surrounding Pacific Ocean, including small islands like Rongerik, Rongelap and Utirik. These islands were evacuated, but generations to come where affected. Natives have since suffered from birth defects. A Japanese fishing boat, Daigo Fukuryu Maru, also came into contact with the nuclear fallout, causing illness to all crew members with one fatality. Fish, water and land were seriously contaminated, making Castle Bravo one of the worst nuclear accidents.

Chapter 3 : Historyâ€™s Worst Nuclear Disasters - HISTORY

Top 10 Nuclear Disasters Top 10 Nuclear Disasters. The long term effects of Nuclear disasters can often spread over thousands of years. It is estimated that Chernobyl wont be inhabited for at least another 20, years.

Taking the correct actions before and after an incident could significantly increase the chance of survival and reduce the medical consequences of the incident. Disclaimer Although the information in this circular is provided for general information, the Department of State is not the lead government agency on radiological or nuclear incidents and cannot make any warranty regarding the information. At present, there is no one government agency that has taken the lead responding to nuclear or radiological incidents. As always, we will share with U. Radiological Dispersal Devices Radiological dispersal devices RDDs may be improvised explosive devices, also called "dirty bombs," but can include non-explosive devices that could be used to spread radioactive material as well. It is not necessary to use a bomb to disperse radioactive materials; these materials come in solids, liquids, and powdered forms, which can be spread covertly. The major impact of a dirty bomb is produced by the blast and the fear and panic that will ensue. RDDs are not very effective means for exposing large numbers of people to lethal doses of radiation. Unlike a nuclear detonation, RDDs are likely to affect relatively small areas, and the most effective protection is to leave the affected area. Do not shelter-in place. If there is a possibility that the suspected device has explosives attached, it should be treated as a bomb. Do not reenter the contaminated area. Individuals evacuating a contaminated area should be decontaminated immediately and seek medical attention. Decontamination is most easily achieved by simply taking a shower, washing effectively, and changing into clean clothing. Do not use Potassium Iodide KI. Unfortunately radioactive materials can range from conventional weapons isotopes, to materials used in medical and industrial processes. KI should be administered only by health professionals and only if the radiation contamination is identified as being radioactive iodine. With the radioactive isotope unknown, KI administration is not recommended. Potassium iodide, without the presence of radioactive iodine, will cause negative health effects in certain groups of people. Radioactive iodine is very difficult to obtain, and is not considered a likely isotope to be used in an RDD incident. Food Safety As noted above, radioactive particles in food or water may be harmful if consumed. Food in tightly covered containers cans, bottles, plastic, and boxes will be safe to eat or drink if you dust or wipe off the containers. Be sure to wash fruit and vegetables and peel them carefully. Water will be safe if it is in covered containers, or if it has come from covered wells, or from undamaged and uncontaminated water systems. If exposure to an RDD is suspected, seek medical assistance as soon as possible. Radioactivity from an area of fallout may produce illness in the unprotected individual immediately or after a few days. Radiation illness cannot be spread to other people. A combination of loss of hair, loss of appetite, increasing paleness, weakness, diarrhea, sore throat, bleeding gums and easy bruising indicate that the individual requires medical attention for exposure to radiation. Nuclear Detonations A nuclear detonation, with the resultant radiation, blast and thermal injuries, would be a catastrophic event. In addition to the nuclear fallout and associated damage to structures, a nuclear detonation will severely disrupt civil authority and infrastructure, complicating evacuations and re-establishment of normal operations within a country. All nuclear detonations have four factors in common: Blast effects are dynamic winds and static overpressure. Dynamic winds are much like those experienced during a hurricane, although more localized and of higher velocity. In addition to blowing down structures, these winds can pick up debris that can damage other objects and persons due to their high velocity. Static overpressure is the increase in pressure when the blast wave surrounds an object. Static overpressure has a crushing effect on hollow objects and can crush buildings and damage internal organs. A kiloton nuclear surface detonation will create a crater feet in diameter, feet deep, and have serious destructive blast effects for 1. Thermal radiation is the intense heat and light released by a nuclear burst. It can cause temporary or permanent blindness, burns and fires. Burns can be related to the blast flash burns or a result of secondary fires. A kiloton surface nuclear detonation will generate serious skin burns for up to about 1. Severe eye injury leading to blindness can occur from looking directly at the blast many miles beyond the range at which all other immediate effects occur. Ionizing radiation is the

radiation produced by a nuclear detonation. Outside of the detonation zone this is the most critical issue for survivors. Initially, there is an intense burst of gamma and neutron radiation that travels outward from ground zero with the thermal radiation. Soil below the fireball can also become radioactive. The material from the bomb that is not consumed in the explosion, as well as debris incorporated into the fireball and made radioactive, will return to earth as radioactive fallout. This fallout will emit gamma, alpha, and beta radiation. Amounts of radiation experienced with a detonation depend on the method of detonation air, surface or subsurface , what the components of the bomb are, and what type of bomb it is: Environmental conditions, weather patterns, rain, wind, and terrain can greatly influence the effects of the blast and the resultant fallout. Electro-magnetic pulse EMP is another effect of an aboveground or air nuclear detonation. A burst of EMP will disrupt and destroy communications equipment. EMP affects all modern electronic components. A strong EMP will nullify radio, television, cell phone, and telephone communications. Ground burst detonations may generate EMP up to 2 miles from the point of detonation. Preparation for and Response to Nuclear Detonations The two most important issues for survivors of a nuclear detonation are shelter and decontamination. The importance of sheltering in place, preferably inside a sealed room, for at least the first 48 hours after a nuclear detonation cannot be over-emphasized. The most lethal threat to persons in a contaminated area after a blast is exposure to and ingestion of radioactive fallout. Focus planning efforts on preparing shelter and supplies, and on understanding and providing for decontamination. Provision should be made for some form of immediate shelter. It is essential to put as much physical mass between yourself, the blast and the resultant radiation as possible. Identify locations in your residence and place of work which offer the greatest protection. Ideal places are basements and other reinforced underground space. As an alternative, windowless interior spaces should be considered, above ground to protect from surface radiation. A windowless room on a mid-level floor of a high-rise affords the most protection from radioactive fallout on the ground and on roof surfaces. In the event of a nuclear explosion, seek shelter immediately in a space that offers the most protection. It is anticipated sheltering will be needed for no less than 48 hours. The radioactivity in fallout weakens rapidly in the first hours after an explosion. This weakening is called "decay". Nevertheless, if the radiation at the beginning were high enough, the remaining 0. Ideally, plan to stay in the shelter until radiation has been measured and the appropriate authorities have announced that it is safe to come out. Radiation effects are cumulative; the effects depend on level and duration of exposure. Ensure emergency supplies are ready. You should prepare to remain sheltered for at least 48 hours, but if may be necessary to remain sheltered for up to 14 days and, therefore, have 14 days of food, water, medicines, first aid and personal supplies on-hand. Have a battery-powered radio available in order to monitor emergency frequencies often. Potentially contaminated clothing and other items should be removed or discarded prior to entering the shelter area. Simply taking a shower, washing effectively, and changing into clean clothes will generally decontaminate effectively. Bleach should not be used to decontaminate, and never used directly on skin or to scrub skin or wounds. Ideally, the water used for all purposes, including hygiene, should be stockpiled from safe sources and placed in sealed containers. The water used for decontamination must be contained and covered or drained outside of the shelter area to avoid shelter contamination. In a nuclear detonation, medical resources will be quickly overwhelmed. Traumatic injuries and burns are the most immediate consequences of a nuclear detonation and require conventional medical and surgical care. Critical points to remember are: The injured are not radioactive and pose no danger to first responders; stabilizing injuries are the first priority, decontamination comes second; injured personnel should have wounds decontaminated by medically trained personnel if possible. Vigorous scrubbing disrupts the skin, potentially embedding radioactive particles into tissue. Radiation sickness may also follow. Nausea and general weakness are the immediate effects of significant radiation exposure. Delayed effects can appear days to weeks later and may involve the central nervous, immune, and gastro-intestinal systems. Generally, no specific therapy for radiation exposure is immediately necessary, beyond routine supportive care for victims. There are few drugs available to counteract radiation from a nuclear detonation. These require sophisticated medical oversight and hospitalization, which are seldom available in an emergency setting, and will most likely be only available when evacuation is possible. Food in tightly covered containers cans, bottles, plastic, and boxes is safe to

consume if the containers are dusted or wiped off. Fruit and vegetables should be washed and peeled carefully. Reverse-osmosis water filtration systems will remove fallout contamination. If sheltering extends beyond 14 days, animal products, including milk and meat should not be consumed if they are from sources that may have been fed contaminated grains or grasses. Fresh fruits and vegetables picked from contaminated soils should not be consumed. KI is useful in response to a nuclear reactor mishap, where radioactive iodine release is a hazard. Radioactive iodine is not significantly present after a nuclear detonation, so KI is not useful in these circumstances. Nuclear Power Plant Release In general, the shelter preparedness and response recommendations for responding to a nuclear detonation also apply to the situation of an accidental or intentional release of radioactive material from a nuclear power plant with exceptions as noted below.

Chapter 4 : A Brief History of Nuclear Accidents Worldwide | Union of Concerned Scientists

As experts scramble to stem the mounting crisis in Japan, we take a look at four of the most devastating nuclear accidents to date. As experts scramble to stem the mounting crisis in Japan, we.

A Brief History of Nuclear Accidents Worldwide Serious nuclear accidents have been few and far betweenâ€”but their stories will help prevent future catastrophes. Fukushima Daiichi Fukushima, Japan, March The earthquake and tsunami that struck eastern Japan on March 11, , caused a serious accident at the Fukushima Dai-ichi nuclear power plant on the northeastern coast of Japan. How did it happen? The earthquake cut off external power to the reactors. Fuel in three of the reactor cores melted, and radiation releases from the damaged reactors contaminated a wide area surrounding the plant and forced the evacuation of nearly half a million residents. It occurred on April 26, , when a sudden surge in power during a reactor systems test resulted in an explosion and fire that destroyed Unit 4. Massive amounts of radiation escaped and spread across the western Soviet Union and Europe. As a result of the disaster, approximately , people had to be relocated from their homes. Unit 4 was to be shut down for routine maintenance. This lack of awareness led the operators to engage in actions that diverged from safety procedures. Consequently, a sudden power surge resulted in explosions and nearly complete destruction of the reactor. The fires that broke out in the building contributed to the extensive radioactive releases. The accident began with failures in the non-nuclear secondary system, followed by a human-operated relief valve in the primary system that stuck open, which allowed large amounts of nuclear reactor coolant to escape. In particular, a hidden indicator light led to an operator manually overriding the automatic emergency cooling system because he mistakenly believed that too much coolant water in the reactor had caused the steam pressure release. Eventually the reactor was brought under control, although the full extent of the accident was not understood until later. Workers did not notice what had occurred until core temperature alarms sounded. Several fuel rod subassemblies reached temperatures of up to degrees Fahrenheit, causing them to melt. After the reactor was shut down for repairs, it was returned to partial operation periodically until , but it was never again fully operational. It was officially decommissioned in SL-1 Idaho Falls, Idaho, USA, January 3, The withdrawal of a single control rod caused a catastrophic power surge and steam explosion at the SL-1 boiling water reactor that killed all the workers on duty at the time. On January 3, , workers were in the process of reattaching to their drive mechanisms control rods they had disconnected earlier that day to enable test equipment to be inserted in the reactor core. They lifted the central control rod 20 inches, instead of the four inches that was required. This error caused the reactor to go critical and its power to surge 6, times higher than its normal level in less than a second. As a result, nuclear fuel vaporized and a steam bubble was created. The steam bubble expanded so quickly that it pushed water above it against the reactor vessel, which caused it to jump out of its support structure. It hit an overhead crane and then returned to the reactor vessel. In the process, all of the water and some of the fuel was released from the reactor vessel. All three workers on duty received lethal doses of radiation, in addition to trauma from the explosion. The Sodium Reactor Experiment experienced extensive fuel damage during a power run. Thirteen of forty-three fuel elements overheated when the cooling flow provided by the liquid sodium was blocked by tetralin, an oil-like fluid which had leaked into the primary sodium loop during prior power runs. This overheating caused the reactor core to fail. Fission products were released from the damaged fuel into the primary sodium loop. Some of the fission products leaked from the primary sodium loop into the high bay area, a region inside the building housing the reactor. Other fission products flowed with the helium cover gas over the liquid sodium in the reactor pool to gaseous storage tanks. Fission products from the high bay area and from the gaseous storage tanks were processed through the filters of a ventilation system and discharged to the atmosphere. Before the accident, Unit 1 was activated to release built-up energy in the graphite of the core. The fuel was cooler than the normal operating temperature and was warming more slowly than expected. A second release led to a higher temperature than workers expected. Eventually the temperature was more than degrees Fahrenheit, so air was vented to cool it. The reactor caught fire, igniting an estimated 11 tons of uranium. Workers first used carbon dioxide to try to put out the fire, but that strategy failed. Next

they used water, which eventually succeeded. It took workers a total of three days to put out the fire. In the meantime, radiation escaped through the chimney and contaminated much of the surrounding area and reached as far as mainland Europe. More than cancer deaths are attributed to the disaster, which is considered to have been the worst to occur in the West. Your generous support helps develop science-based solutions for a healthy, safe, and sustainable future.

Chapter 5 : 10 Devastating Radiation Accidents They Never Tell You About - Listverse

Information. The growth in the application of nuclear science and technology in the fields of power generation, medicine, industry, agriculture, research and defence has led to an increase in the risk of occurrence of Nuclear and Radiological emergencies.

Whistleblowers have also come forward to expose the little-known catastrophe, which occurred north of Los Angeles in and leaked over times the allowable amount of radiation into surrounding neighborhoods. In â€" two years after the United States dropped nuclear bombs on Japan â€" the North American Aviation corporation opened a 2, acre nuclear test site in Ventura County, just miles from the San Fernando and Simi Valleys â€" two adjacent valleys located north and northwest of the city of Los Angeles. One of its expansions came in the form of building the Santa Susana Field Lab SSFL , where researchers would perform top-secret nuclear tests involving rocket engineering, missiles, and nuclear energy and power. Workers initiated a contamination cleanup and started and stopped the reactor for two weeks. On July 13, however, the situation grew far more dire: Whistleblower John Pace, now in his seventies, started working at the facility in January of and was present on the day of the partial meltdown. He says he has spoken out in recent years because of his guilty conscience. He was 20 years old. Some workers expressed concerns the wind would blow the radiation directly into the nearby neighborhoods â€" where their families lived â€" but with heavy hearts and upon orders , they opted to release the radiation to avoid a devastating explosion. Pace says the large door in the reactor was opened so they could vent the radiation from inside the building. He also remembers that the exhaust stack of the reactor was opened so that radiation could be released from inside the damaged reactor straight into the atmosphere. North American Aviation Knew This Was a Possibility In , North American Aviation chose the land overlooking Simi Valley for its new field office partly because it was sparsely populated and thus allowed for secrecy, but mostly because it was close to local research universities â€" where many of the scientists who worked at the lab taught. But it had a drawback: For twelve years, the secret site developed nuclear power for both military and civilian purposes. Though SSFL went on to operate for decades, during which time the area became more suburbanized and more densely populated, a modification to the facility in transferred partial ownership to the government. In that year, the Atomic Energy Commission supervised the addition of a new wing to the field office: This seemed inconsistent with the fact that when they restarted the reactor on the 15th of July, the radiation levels surpassed measurable amounts, denoting a second incidence of leaks that was even more concentrated. Citizens were unaware of these facts and the public announcement was accepted without suspicion. To this day, he is concerned about the remaining radiation: While a small-scale cleanup occurred in the months following the leak, it was not thorough, nor did it clear the radiation that had seeped into the atmosphere and environment. The reactor was shut down for investigation on July The reactor was cleaned and uranium, sodium, and other fuel materials were removed. The reactor was replaced by November, but the cleanup did not extend to the land surrounding it. Parks suspects the damages have not been remedied. That same year, NBC4 broke the news that a partial meltdown had occurred in , but reporters were unaware of the radiation. The news sparked concern and inspired concerned citizens to push for a full-scale clean up, which has yet to happen. By that time, two more nuclear accidents had transpired one in and another in A study found increased rates of cancer among SFFL employees. That study, however, suggested it was not affecting the health of residents nearby interestingly, the CDC grants compensation to people who worked at the SSFL before, during, and after the meltdown and developed cancer. The Seltzer family, which has no history of cancer, has been devastated by the disease: Three of three sisters have struggled with various cancers for years and their mother had her thyroid gland remove to remove pre-cancerous tumors. The daughters played in, swam in, and drank the water running down the hills from SSFL. Bonnie Klea, who worked at the facility as a lab secretary from to , developed bladder cancer and says people in 14 of 15 homes on her street also developed cancer. Slack is neither and her doctor suspects her illness is due to the fact that she grew up in Simi Valley. Her mother died of cancer last year. Arline Mathews lost her son to a rare brain cancer linked to exposure to radiation. When he was in high school, he ran through

the Santa Susana hills while training for cross country. He also worries he carried radioactive material into his home that caused his son to develop leukemia. He died at the age of eleven. There are more cases like these, but officials continue to downplay the health dangers. Moreover, studies have found more than just radiation leaked into the environment. The Brandeis-Bardin complaint implicated every company that came to be involved in the facility throughout the years due to acquisitions and mergers: Boeing would take ownership of SSFL in when it purchased Rocketdyne â€" after this suit was filed. Brandeis eventually settled with Rocketdyne in and now claims the land is safe. It told NBC4 in a written statement it regularly tests the land with optimal results but declined to provide any documentation. Instead, it claimed the EPA certified the premises as safe in â€" the same year Brandeis sued for indisputable contamination on the property. To read more about how Boeing evaded the truth, manipulated research, and paid off government officials to avoid resolving the disaster decades after it happened, read Part 2. Read Part 2 here. It has been updated to reflect that rates of certain types of cancer increased. It has been updated to reflect that she had her thyroid gland removed but is alive.

Chapter 6 : The Worst Nuclear Disasters of All Time - www.nxgvision.com

Chemical, Biological, Radiological, and Nuclear (CBRN) emergencies are one involving CBRN agents (i.e., toxic and hazardous chemicals/materials, chemical and biological warfare agents, toxic radiological materials, etc.). CBRN emergencies occur as a result of occupational exposure, fire, explosion.

Chernobyl, Three Mile Island, and Fukushima are hardly the only times that people, power plants, or neighborhoods have been irradiated. It began operation in as part of a prototype nuclear power plant for the military and was used to train nuclear technicians. SL-1 was housed inside a large steel silo. On December 23, , SL-1 was shut down for maintenance. It was scheduled to resume operation on January 4. They arrived at around 4: Firefighters arrived with radiation detectors and found nothing amiss. The control room looked perfectly normal, though none of the three men were there. When the firefighters began to approach the stairs leading to the silo, however, their detectors indicated dangerous amounts of radiation. Soon, men equipped with radiation suits and better detectors arrived. Two of them reached the top of the stairs and finally got a look at the reactor. The inside of the silo was a nightmare. Water from SL-1 flooded the floor, which was also littered with debris. Byrnes lay dead in it, and McKinley lay nearby, moaning. Legg was still nowhere to be found. Four men ran in and carried McKinley out on a stretcher. They got him into an ambulance, but he died a few minutes later. No one knew what to do with his radioactive body, so they drove it out into the desert and covered it with lead blankets for the time being. Legg was found later that night, impaled against the ceiling of the silo by a control rod. It took six days to retrieve his body. The reaction went out of control instead. It was speculated that this was accidental; perhaps the rod was stuck, had to be yanked, and then slid out too far. Others believe that Byrnes intentionally lifted the rod to commit suicide, since his marriage was falling apart. It took months to dismantle SL-1 and decontaminate the pieces. Byrnes, McKinley, and Legg were buried in lead coffins. EPA Not counting nuclear bomb tests, what was the largest release of radioactive material in US history? That unenviable title belongs to a dam break in Church Rock, New Mexico. It was once a major uranium mining site. There are 20 abandoned uranium mines and processing mills in the area. Most of the uranium was mined for use in nuclear weapons. For every pound of concentrated uranium produced, thousands of pounds of tailings were also created. This radioactive byproduct was often dumped in tailings ponds. On the morning of July 16, , at a processing mill operated by the United Nuclear Corporation, a tailings dam broke, releasing 94 million gallons of contaminated wastewater and 1, tons of radioactive tailings into the Puerco River. The water released by the dam had a pH of 2 and was filled with radioactive uranium, radium, thorium, polonium, and many other metals, which were deposited in the riverbed. By noon, the waters had receded enough for people to wade across the arroyo to retrieve livestock. Those who did so developed blisters and sores on their legs and feet. Shortly after the dam was repaired, the river was 6, times more radioactive than acceptable levels. Some of the contaminants in the wastewater emit alpha radiation and can cause cancer. Thorium has a half-life of 80, years, for example. The reactor could have up to 12 control rods lowered into it. Seven were enough to completely stop any reaction. Four of them, referred to as the safeguard bank, were linked to lower simultaneously. The control rods were moved by magnets, meaning that if the magnets failed, the rods would automatically fall into the reactor and shut it down. A pneumatic air pressure system was used to raise the rods or even to quickly push them down faster than gravity could alone. Several rods began to rise out of the reactor. The supervisor ran down to the basement and closed them, which should have pushed the rods back down. The supervisor called the control room and told an operator which numbered buttons to push to make the pneumatic system force the rods down. However, he accidentally gave the number for the button that withdrew the safeguard bank. The supervisor realized his error right away, but the technician had already put the phone down and pressed the buttons. The technicians eventually managed to get it back down, but not before one or more explosions inside the reactor created several ruptures, leaking 1 million gallons of radioactive water and releasing radioactive gas into the atmosphere. The water had to be pumped out and dumped in shallow trenches not far from the Ottawa River. The NRX reactor had to be buried as radioactive waste. A new one was constructed. Future US president Jimmy Carter was involved in the cleanup. Chalk

River Laboratories had another incident involving a different reactor in A fuel rod caught fire , spreading fission products throughout its building. The ventilation system was also jammed open, releasing gas downwind. Technicians had to repeatedly run by the fire and toss wet sand on it to extinguish it. National Nuclear Security Administration Baneberry was a kiloton nuclear bomb that was detonated meters ft underground at Yucca Flat, part of the Nevada Test Site, on December 18, Underground nuclear testing had been the norm since as a result of the Partial Test Ban Treaty, and such tests were certainly less hazardous than good, old-fashioned s mushroom clouds. A week before Christmas in , however, geology threw scientists a curveball. Baneberry was detonated at 7: It continued to do so even after the ground above the detonation collapsed. Such collapses are normal for underground detonations. Gas visibly vented for another 24 hours. The radioactive dust reached a height of 3, meters 9, ft and was carried into several adjoining states. Fallout from the unexpected plume rained down on 86 test site workers. Two of them died from leukemia four years later. Testing at the Nevada Test Site was suspended for six months while the cause of the Baneberry incident was investigated. It was determined that the ground into which the device was inserted had an abnormally high water content, causing the fissure to open. In May , a cesium source ended up at one of their scrap metal reprocessing plants, located in Los Barrios, Cadiz. Although the plant had monitoring equipment to catch dangers like this, the source made it through and was melted in one of the ovens. A radioactive cloud was promptly released into the atmosphere. Radioactivity was about 1, times greater than normal, and the ashes produced at the plant were radioactive enough to be dangerous. Six plant workers suffered minor cesium contamination. The plant had to be decontaminated, as did two other facilities that received its waste. The incident resulted in 40 cubic meters 1, ft3 of contaminated water, 2, metric tons of radioactive ash, and metric tons of contaminated equipment. As far as radiation incidents go, it was a happy ending. Since it became fully operational in , one scandal after another has repeatedly forced it to shut down some or all of its seven reactors. Examples include concealing evidence of stress cracks and covering up the fact that the plant was built near fault lines. That last bit came to light after the Chuetsu earthquake occurred on July 16, The shaking was greater than the plant was designed to withstand; it was built before Japan updated their earthquake standards in The Tokyo Electric Power Company acknowledged that 1, liters of slightly radioactive water leaked into the sea and that dozens of barrels of low-level nuclear waste broke open during the quake. An exhaust pipe leaking radioactive iodine was also reported. According to NIRS, the water that leaked into the sea came from the irradiated fuel pool of one of the reactors. Another reactor had been releasing radioactive steam since the earthquake. Leaks in the seal of the upper lid of one of its two reactors were being repaired. Both reactors had been refueled the day before. A boat passing by in the bay created a large wake, rocking the ship servicing K The explosion instantly killed 10 people. A radioactive plume rose 50 meters ft into the air and drifted to the nearby Dunai Peninsula, leaving a 3. The bay floor and adjacent waterfront were contaminated with cobalt Radiation levels reached 16, times normal. A fire started and took four hours to put out. Radioactive material was released from K for seven hours. Of the 2, people who responded to the accident and decontaminated the sub, received sizable doses of radiation, and 10 suffered acute radiation sickness. The damaged K was eventually tied up at a nearby submarine base but not dry-docked. The incident remained classified until Later that year, sediments from Chazhma Bay still had 2, times more radiation than normal.

Chapter 7 : The Worst Nuclear Disaster in US History That You've Never Heard About

Radiologists, radiation oncologistsradiation oncologists and medicaland medical physicists will play a vital role as responders and as sources for accurate information for patients, the public and the medical.

A dirty bomb is a mix of explosives, such as dynamite, with radioactive powder or pellets. It is also known as a radiological dispersal device RDD. A dirty bomb cannot create an atomic blast like an improvised nuclear device or nuclear weapon. When the dirty bomb explodes, the blast carries radioactive material into the surrounding area. What is the main danger of a dirty bomb? The main danger from a dirty bomb comes from the explosion, not the radiation. The explosion from a dirty bomb can cause serious injuries and property damage. Only people who are very close to the blast site would be exposed to enough radiation to cause immediate serious illness. However, the radioactive dust and smoke can spread farther away and could be dangerous to health if people breathe in the dust, eat contaminated food, or drink contaminated water. Radioactive material could be hidden from sight to expose people to radiation without their knowledge. REDs could be hidden from sight in a public place e. People who sit or pass close to the site of a RED could be exposed to radiation. What are the main dangers of an RED? The dangers of a Radiological Exposure Device depend on: The type and amount of radioactive material How long people were near the device What parts of their bodies were exposed People exposed to high levels of radiation could develop symptoms of acute radiation syndrome ARS , or could develop radiation burns. Health effects may take hours, days, or weeks to appear. These effects range from mild to severe effects, such as death or cancer. Some people may not experience any health effects. Report a suspected Radiological Exposure Device to law enforcement officials immediately. Stay as far away from the suspected RED as possible. If a RED is identified, and you believe you have been exposed, listen for instructions from emergency officials and contact your doctor. An accident at a nuclear power plant could release dangerous levels of radiation over an area called a plume. What are the main dangers of a nuclear power plant accident? Radioactive materials in the plume from the nuclear power plant can settle and contaminate people who are outdoors, buildings, food, water, and livestock. Radioactive materials can also get inside the body if people breathe it in, or eat or drink something that is contaminated. People living close to the nuclear power plant who are exposed to radiation could experience long-term health effects such as cancer. What should I do to protect myself? If you live near a nuclear power plant, you can get emergency information materials from the power company that operates your local nuclear power plant or your local emergency services office. If a nuclear power plant accident happens, the best thing to do is to Get Inside, Stay Inside, and Stay Tuned for instructions from emergency officials.

Chapter 8 : Radiological and Nuclear Disaster Preparedness | Public Health Grand Rounds | CDC

10 Worst Nuclear Accidents/Disasters in History Posted by Smashing Lists 2 Comments According to The International Atomic Energy Agency (INAEA), nuclear and radiation accident/ disaster is defined as "An event that has led to significant consequences to people, the environment or the facility.

A B Stratofortress carrying two Mark 39 nuclear bombs broke up in mid-air, dropping its nuclear payload in the process. Eight fatalities and more than 30 people were over-exposed to radiation. The crisis is generally regarded as the moment in which the Cold War came closest to turning into a nuclear conflict [60] and is also the first documented instance of mutual assured destruction MAD being discussed as a determining factor in a major international arms agreement. Wood River Junction criticality accident. Resulted in 1 fatality , The KC was completely destroyed when its fuel load ignited, killing all four crew members. The BG broke apart, killing three of the seven crew members aboard. The non-nuclear explosives in two of the weapons detonated upon impact with the ground, resulting in the contamination of a 2-square-kilometer acre 0. The aircraft was carrying four hydrogen bombs when a cabin fire forced the crew to abandon the aircraft. Six crew members ejected safely, but one who did not have an ejection seat was killed while trying to bail out. The bomber crashed onto sea ice in Greenland , causing the nuclear payload to rupture and disperse, which resulted in widespread radioactive contamination. Soviet submarine K reactor near meltdown. One of the reactors started up automatically when the control rods were raised to a higher position. Power increased to 18 times its normal amount, while pressure and temperature levels in the reactor increased to four times the normal amount. The automatic start-up of the reactor was caused by the incorrect installation of the control rod electrical cables and by operator error. Radiation levels aboard the vessel deteriorated. Plutonium solution was poured into a cylindrical container with dangerous geometry. One person died, another took a high dose of radiation and radiation sickness, after which he had two legs and his right arm amputated. Lucens reactor in Switzerland undergoes partial core meltdown leading to massive radioactive contamination of a cavern. Columbus radiotherapy accident, 10 fatalities, 88 injuries from cobalt source. Anatoli Bugorski was working on U , the largest Soviet particle accelerator , when he accidentally exposed his head directly to the proton beam. He survived, despite suffering some long-term damage. Over 1, tons of radioactive mill waste and millions of gallons of mine effluent flowed into the Puerco River , and contaminants traveled downstream. In , a small capsule containing highly radioactive caesium was found inside the concrete wall of an apartment building. The accident was detected only after the residents called in a health physicist. Houston radiotherapy accident, 7 fatalities. Radiation accident in Morocco , eight fatalities from overexposure to radiation from a lost iridium source. Fernald Feed Materials Production Center gained notoriety when it was learned that the plant was releasing millions of pounds of uranium dust into the atmosphere, causing major radioactive contamination of the surrounding areas. Eventually, his remains were discovered inside a uranium processing furnace located in Plant 6. Soviet submarine K accident. Ten fatalities and 49 other people suffered radiation injuries. Soviet submarine K reactor almost had a meltdown. Sergei Preminin died after he manually lowered the control rods, and stopped the explosion. The submarine sank three days later. Four fatalities, and following radiological screening of more than , people, it was ascertained that people received serious radiation contamination from exposure to caesium All the objects from within those houses were removed and examined. San Salvador, El Salvador; one fatality due to violation of safety rules at cobalt irradiation facility. Soreq, Israel; one fatality due to violation of safety rules at cobalt irradiation facility. Eleven fatalities and 27 other patients were injured. Neswizh, Belarus; one fatality due to violation of safety rules at cobalt irradiation facility. Jilin, China; three fatalities at cobalt irradiation facility. The explosion released a cloud of radioactive gas. Tammiku, Estonia; one fatality from disposed caesium source. Radiotherapy accident in Costa Rica. Thirteen fatalities and other patients received an overdose of radiation. Harold Daniels and several others die from cancers and radiation burns related to the exposure. Sarov, Russia; one fatality due to violation of safety rules. The Acerinox accident was an incident of radioactive contamination in Southern Spain. A caesium source managed to pass through the monitoring equipment in an Acerinox scrap metal reprocessing plant.

When melted, the caesium caused the release of a radioactive cloud. Samut Prakan radiation accident: Meet Halfa, Egypt; two fatalities due to radiography accident. Instituto Oncologico Nacional of Panama, 17 fatalities. Patients receiving treatment for prostate cancer and cancer of the cervix receive lethal doses of radiation. Mihama Nuclear Power Plant accident, 4 fatalities. Hot water and steam leaked from a broken pipe not actually a radiation accident. Mayapuri radiological accident , India, one fatality after a cobalt research irradiator was sold to a scrap metal dealer and dismantled. Thirteen of these tested positive for internal radioactive contamination increasing their risk for future cancers or health issues. A second leak at the plant occurred shortly after the first, releasing plutonium and other radiotoxins causing concern to nearby communities. The source of the drum rupture has been traced to the use of organic kitty litter at the WCRRF packaging facility at Los Alamos National Laboratory, where the drum was packaged and prepared for shipment. Between 16 July and 23 September , the United States maintained a program of vigorous nuclear testing , with the exception of a moratorium between November and September By official count, a total of 1, nuclear tests and two nuclear attacks were conducted, with over of them taking place at sites in the Pacific Ocean , over of them at the Nevada Test Site , and ten on miscellaneous sites in the United States Alaska , Colorado , Mississippi , and New Mexico. Estimating exact numbers, and the exact consequences, of people exposed has been medically very difficult, with the exception of the high exposures of Marshall Islanders and Japanese fishers in the case of the Castle Bravo incident in A number of groups of U. The passage of the Radiation Exposure Compensation Act of allowed for a systematic filing of compensation claims in relation to testing as well as those employed at nuclear weapons facilities. Scenes such as this were typical during the s. From to the government conducted atmospheric tests at the nearby Nevada Test Site. This handbill was distributed 16 days before the first nuclear device was detonated at the Nevada Test Site. Trafficking and thefts[edit] See also: Vulnerability of nuclear plants to attack The International Atomic Energy Agency says there is "a persistent problem with the illicit trafficking in nuclear and other radioactive materials, thefts, losses and other unauthorized activities". The burglars escaped without acquiring any of the uranium held at the facility.

Chapter 9 : Nuclear and radiation accidents - Simple English Wikipedia, the free encyclopedia

Chernobyl. Chernobyl, Ukraine (former Soviet Union), April 26, Chernobyl is considered the world's worst nuclear disaster to date. It occurred on April 26, , when a sudden surge in power during a reactor systems test resulted in an explosion and fire that destroyed Unit 4.

Contribute Overview Radiological emergencies occur when there is, or is perceived to be, a hazard due to radiation exposure from radioactive sources. Such sources are most commonly used in research, medicine, industry and agriculture. In the past most emergencies have happened when sources have strayed or been stolen without those possessing them understanding what they are and the dangers associated with them. Nuclear emergencies occur when there is, or is perceived to be, a hazard due to radiation exposure from nuclear reactor cores. Such cores are primarily used in nuclear power plants, research institutions and military installations, and in the past most emergencies have been the result of accidents at nuclear power plants. The gravest emergencies arose from the power spike and subsequent explosions during a stress test at the Chernobyl Nuclear Power Plant in and the failure of cooling systems and meltdown of several nuclear reactors in Fukushima Daiichi Nuclear Power Plant in , after a tsunami flooded the plant. Although nuclear and radiological emergencies are quite rare occurrences, the impact of these emergencies can potentially be very high, and the response and recovery can be lengthy. It is therefore vital that communities and emergency responders are prepared for such characteristic situations. Nuclear and radiological events differ from most other emergencies in several ways: It is difficult to identify radioactive material and determine radiation levels without specialized equipment, which may cause delays in the wariness of the public. Symptoms of exposure may not immediately be noticeable. Victims may therefore not seek treatment right away, and this can deteriorate their chances of recovery. The psychosocial effects of nuclear and radiological events can be substantial, with possible intense fear in the population and stigma surrounding the victims. How do I prepare? Household Radioactive material can be hazardous because it emits ionizing radiation that can penetrate and damage the body by killing cells or causing mutations to DNA. In situations where there is risk of exposure to such radiation, it is important to remain calm, pay attention to public information channels such as internet, radio and TV, and follow advice from the authorities with regards to safe shelter. Depending on contamination levels, size of affected area and available emergency shelter, it may be safer to shelter in place for shorter or longer time than to evacuate. If this is the case, you should proceed in the following manner: Close and lock windows and doors, and if possible seal with duct tape. Turn off air condition and heating systems, and close ventilation shafts etc. Go to an interior room without windows or doors if possible. It is recommended to shield below ground level as a first choice. In larger buildings, you should opt for the middle floors if it is not possible to shield below ground level, as portrayed in the graphic below. Bring everyone in the building into the room, including any pets you may have. Bring bottled water and packaged foods with you into the room, including baby food, pet food etc. Bring enough for at least three days, including minimum three litres of water per person per day. Bring medications that family members may be dependent on, as well as a first aid kit. Follow the advice of the authorities with regards to taking potassium iodide pills. In some countries this is distributed for households to stash before a nuclear emergency, and in others it is distributed at the onset of an emergency. Familiarize yourself with the procedures in your country before an emergency happens. Seal vents and door cracks inside the room with duct tape, heavy plastic sheeting or clothes etc. If you are outside and believe you have already been exposed or contaminated, it is important to get away from the source s of ionizing radiation while shielding your mouth and nose for instance with a cloth. You should look for a safe location to take shelter. This should be the largest concrete building easily accessible to you, but any building will be better than staying outside for a longer period. Once inside, it will be necessary to decontaminate, even if you are not sure whether you have been in contact with radioactive particles. Remove clothing, preferably without touching the outside of the items, seal in plastic bags and remove yourself from the bags if possible. Remove contamination from your body by washing skin and hair thoroughly with soap if possible, rinsing eyes and ears with water preferably bottled water and blowing your nose. If you do not have access to water,

scraping or wiping contamination off your skin is the next best option. Extra care should be made to clean around the mouth, nose, eyes and ears. Make sure to help people that are without shelter. If others join you in the building after you have arrived, ensure they decontaminate following the same procedure you did, leaving any outer layers of clothes by the entrance or in sealed bags out of site. It will then be safe to share the shelter. Take care of each other. Once someone has successfully decontaminated following the procedures described, the radiation dose they have received cannot be transmitted to others. It is therefore not dangerous to touch them, provide first aid etc. Seek medical attention as soon as you can, even if you do not initially show symptoms of contamination. Common symptoms in the weeks after exposure include nausea, vomiting, diarrhoea, gastrointestinal pain, flu-like sensation, radiation burns and hair loss. What do I need to know? Basics Nuclear and radiological emergencies can pose a threat to life and health as the result of spread of radionuclides, or radioisotopes as they are sometimes called. These are atoms that spontaneously emit ionizing radiation. There are thousands of different radionuclides known to us, and exposure or contamination calls for targeted medical countermeasures to the specific radionuclides where possible, and treatment according to the radiation dosage received and symptoms showed. Ionizing radiation can travel in the form of particles or electromagnetic waves, with ability to penetrate human skin and tissue and other materials to variable degree. One distinguishes between alpha particles, beta particles, gamma rays and neutrons. Alpha particles can penetrate and burn only the outer layer of skin, whereas beta particles can penetrate further into the skin and also affect tissue if ingested. Gamma rays are able to penetrate a whole person. Neutron radiation can result in a combination of gamma rays and beta radiation, alongside emission of protons and more neutrons, and can penetrate even deeper than gamma rays. The illustration below shows what is needed to protect against these different types of ionizing radiation. In nuclear and radiological emergencies, a combination of several of these types of ionizing radiation may be spread, and the recommendations for safe shelter are therefore based on the assumption that gamma and neutron radiation may be part of the mix. There are several ways one can be exposed to or contaminated by ionizing radiation. External contamination happens when airborne radioactive materials such as dust and aerosols land on skin or clothes. This type of contamination can be countered by finding shelter, removing clothes and washing skin and hair. Internal exposure to ionizing radiation happens when a radionuclide is inhaled, ingested or otherwise enters into the bloodstream, for instance through tears in the skin. Internal exposure can to some extent be countered with medical treatment. External irradiation happens when the body is exposed to penetrating rays from an external source, such as those used in medical radiation therapy and x-ray machines. The only way to counter this is to block the rays with strong materials, as portrayed in the graphic above. Following a nuclear or radiological emergency, a combination of somatic and psychological effects may be seen, calling for immediate decontamination, diagnostics and treatment, but also longer term follow-up with cancer screenings and psycho-social support. In some cases, there are measures that can be taken at the onset of a nuclear or radiological emergency to limit contamination by certain radionuclides. One example of this is administering potassium iodide pills. Radioactive iodine Iodine is known to be a carcinogen, and was released in power plant accidents such as in Chernobyl in and Fukushima in Iodine is stored in the thyroid of the body, and if this gland is not already filled with non-radioactive iodine before being exposed to Iodine, it will absorb the radionuclide. A precautionary measure is therefore to ingest potassium iodide pills prior to exposure to avoid such absorption. The distribution of these pills, either before or during the emergency, is coordinated by the authorities in most countries. It should be taken only when advised specifically to do so by the authorities at the onset of a nuclear or radiological emergency.