RADIATION: A SLOW DEATH

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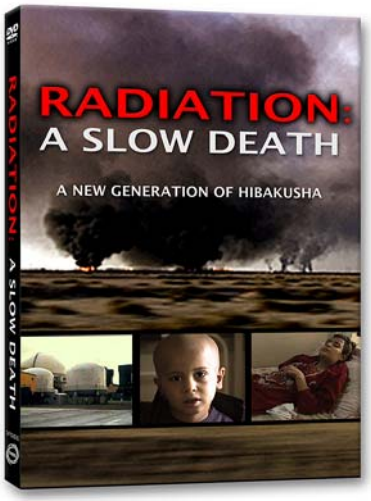
Guidebook



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Discussion Topics

What Is Radiation?

The word “radiation” simply means the emission and transmission of energy—either though space or through a solid medium. “Radiation” also refers to the energy that is transmitted. There are many forms of radiation. Electromagnetic radiation includes radio, microwave, infrared, visible-light, ultraviolet, X-ray, and gamma-ray radiation. Acoustic radiation is propagated as sound waves, and particle radiation consists of the rays found in radioactivity. Radioactivity is defined as the transformation of the atoms of one element into the atoms of another, a process that is accompanied by the liberation of energy.

Obviously, not all forms of radiation are dangerous. The heat that comes from a “radiator” is infrared radiation and keeps us warm when it’s cold outside. Particle radiation, or ionizing radiation, however, is a known cause of cancer and, according to the National Cancer Institute, may account for about 3 percent of all cancers. Exactly how radiation causes disease remains unclear, but it is known that ionizing radiation can remove electrons from atoms and change the molecular structures of cells. As a result, it is thought that the disturbance in cellular activity can cause cancer to develop. The DNA in the nucleus of the cell is believed to be the target for the damage. Some areas of the body are more sensitive to radiation than others—the breast, thyroid, spleen, lymph nodes, and bone marrow especially.

Radioactivity was discovered by the French physicist Antoine Becquerel in 1896. The German scientist Wilhelm Roentgen had discovered X-rays only a few months before, and Becquerel had decided to experiment with them. He found that one element, uranium, had an effect that no other element had. It could blacken a photographic plate even though it was separated from it by glass or black paper. Becquerel also realized that the uranium rays possessed an electric charge.

In 1898 Marie and Pierre Curie concluded that radioactivity was associated with atoms and that there must be other radioactive elements. After a tedious process of separating out the components of a uranium ore called pitchblende, they discovered the radioactive elements radium and polonium. The British physicist Ernest Rutherford then learned that radioactive radiations could be separated into two components: alpha particles and beta particles, and shortly afterward, Paul Villard, a French physicist, is discovered gamma rays. These discoveries led to the realization that the atom, which was previously thought to be indivisible, was made up of even smaller particles. The search inside the atom is a science that still keeps many physicists busy.

The signs that radioactivity could be harmful began to become evident very early. Radiation burns were first noticed within just a month of Roentgen's discovery of X-rays. In 1905, after years of exposure to X-rays, the Scottish researcher George A. Pirie began to experience "trouble" in his hands. Tumors then developed, and he eventually lost both his hands. Marie and Pierre Curie both developed leukemia. So widespread was disease among the pioneers of radiation that in 1936 a memorial was dedicated in Hamburg, Germany, to the scientists who suffered radiation injury or lost their lives because of their work.

It was not until after World War II, however, that scientists began to comprehend the details of the dangerous effects of radiation exposure. Some of the first incontrovertible evidence that radiation causes cancer came from studying people who had been treated with radiation for a spinal disorder known as ankylosing spondylitis. It was discovered that these patients had more leukemia and cancers of the lung, esophagus, bone, and other organs. Other sources of evidence began to accumulate. For example, it was learned that the children of mothers who were given abdominal x-rays during pregnancy had increased rates on leukemia. Also, researchers noted an increase in breast cancer among women with tuberculosis who had received repeated fluoroscopic examinations. In addition, many inhabitants of the Marshall Islands who were exposed to radioactive fallout from a nuclear bomb test were discovered to have thyroid cancer. The question is no longer whether radiation can cause cancer but how much it takes and how much time must elapse before symptoms develop.

Hiroshima: Legacy of Death

To this day, the best evidence for the cancer-causing power of radiation remains the survivors of Hiroshima and Nagasaki, the cities destroyed by U.S. atomic bombs in 1945. After the blasts, Japanese physicians observed symptoms of radiation sickness and were puzzled to find illnesses and other problems occurring in patients with no apparent injuries. They called what they saw the “atomic disease” or “radioactive contamination,” among other names.

The first western journalist to witness the effects of the Hiroshima bomb was an Australian reporter named Wilfred Burchett, who visited the ruined city just weeks after the blast and on September 5, 1945, published an article in the *London Daily Express* entitled "The Atomic Plague." In it, he described visiting a hospital where he saw patients with fever, nausea, gangrene, hair loss, and purple skin hemorrhages. Outraged, General Douglas MacArthur, head of the U.S. occupation forces in Japan, expelled Burchett from the country, and U.S. officials said Burchett had been taken in by Japanese propaganda. Shortly afterward, Major General Leslie R. Groves, director of the atomic bomb project, invited reporters to the site of the first atomic test in New Mexico to downplay the idea of an “atomic sickness.” One of them, William L. Laurence of the *New York Times*, published a story on September 12 that said that it was the explosion, and not the radiation, that was the cause of all the injuries at Hiroshima. The article’s first sentence made it clear: "This historic ground in New Mexico, scene of the first atomic explosion on earth and cradle of a new era in civilization, gave the most effective answer today to Japanese propaganda that radiations were responsible for deaths even after the day of the explosion… and that persons entering Hiroshima had contracted mysterious maladies due to persistent radioactivity." The piece also quoted Groves as saying, "The Japanese claim that people died from radiation. If this is true, the number was very small."

But as the years passed, the denials grew increasingly less convincing. A study completed in 1998 found that survivors had significantly higher risks of just about all cancers except that of the pharynx. In a study that appeared in October 2002 in the *Journal of the National Cancer Institute*, researchers examined the medical histories of 80,160 survivors and discovered that the survivors had a 6 percent greater chance than other people of developing tumors of the brain or spinal cord. For schwannomas, a rare type of nonmalignant, but dangerous, tumor, the risk was 40 percent.[1] An article published in the journal *Military Medicine* in 2000 reported a correlation between mental retardation in children and radiation exposure and “a significant increase in autoimmune disease among survivors of Nagasaki.” It also went on to say that “numerous studies exist regarding the survivors of Hiroshima and Nagasaki, with notable linkage between the thyroid gland and radiation.”[2] The most recent analysis done in Japan has counted 176 deaths from leukemia and 4,687 deaths from other types of cancer among atomic bomb survivors between 1950 and 1990, although deaths are still occurring regularly.

[1] http://www.findarticles.com/p/articles/mi_qn4187/is_200210/ai_n9877275
[2] http://www.findarticles.com/p/articles/mi_qa3912/is_200004/ai_n8899516

Iraq and Depleted Uranium

On March 20, 2003, the United States, supported by several allies, launched an assault upon Iraq in order to topple the regime of Iraqi leader Saddam Hussein. The phrase used to describe the initial attack was “shock and awe”—in other words, the U.S. military would use such overwhelming force that it would have not only a material, but also a psychological, impact.

Among the weapons in the U.S. arsenal was one called “depleted uranium,” or “DU,” which is a dense metal that is the byproduct of the procedure used to process uranium for the manufacture of nuclear bombs and reactor fuel. DU is extremely durable stuff. When used in artillery shells, it can pierce the toughest armor, and when used as protection, conventional shells bounce off it.

However, DU, which is mildly radioactive, carries one huge question mark. Can it, like some other sources of radiation, cause cancer? In 2000 the U.S. military reported that DU is "40 percent less radioactive than natural uranium” and added that exposures to depleted uranium “have not to date produced any observable adverse health effects attributable to DU's chemical toxicity or low-level radiation." However, skeptics began wondering after reports of rising cancer rates began coming in from Iraq. For example, it has been reported that in southern Iraq 34 people died of cancer in 1988, 450 died of cancer in 1998, and 603 died in 2001. Also, a hospital in Basra in southern Iraq reported that there were 11 birth defects per 100,000 births in 1989, but 116 per 100,000 births in 2001, although the doctors admitted that their equipment was unable to confirm the presence of uranium in tissue or urine. It’s also notable that in 1999 a United Nations subcommission called for a global ban on the use of DU, although the measure has never been passed. There are also concerns for the safety of U.S. troops. Some soldiers who took part in the Gulf War of 1991 reported a series of mysterious illnesses that became known as “Gulf War Syndrome,” and since then several studies have suggested a link between the high rates of illness and radiation poisoning from weapons made with DU. In May 2003 a reporter for the *Christian Science Monitor* took Geiger counter readings at several sites in Baghdad, the Iraqi capital. Near the Republican Palace where U.S. troops stood guard and U.S. personnel constantly entered and left, the radiation readings were nearly 1,900 times background radiation levels.

The Hanford Debate

As the documentary demonstrates, one of the most hotly debated incidents involving radiation in the United States concerns Hanford Nuclear Reservation in Washington State. This facility, which opened in 1943, produced plutonium for nuclear reactors for 44 years, during which time it generated vast amounts of radioactive and chemical waste. According to the Energy Department, between 1944 to 1957 725,000 curies (a measurement of radioactivity) of iodine-131 were allowed into the atmosphere. In addition, it is estimated that from 1944 until the last of the original eight reactors was shut down in 1971 more than 440 billion gallons of nuclear waste that were not considered highly radioactive were dumped into the soil. To this day, radioactive and chemical wastes are stored in 177 underground tanks, and so far 70 of them have leaked about one million gallons of waste into the soil.[3]

In the 1950s, when most citizens trusted their government and believed that atomic power was a progressive force, few were concerned about Hanford's health effects. As the decades passed, however, people began to notice peculiar patterns of illness—seemingly unexplainable cases of leukemia and other cancers. Citizen activists formed the Hanford Education Action League (HEAL) to pressure the government to release relevant documents. Several studies were conducted and the results were mixed. In 1998 the National Institute for Occupational Safety and Health released a study finding no link between certain rare cancers in children in the Hanford area and their fathers' exposure to external ionizing radiation. Six years later, the Centers for Disease Control and the Fred Hutchinson Cancer Research Center released their final report on Hanford, which stated that there is no evidence of a link between the release of iodine-131 and thyroid disease. On the other hand, in May 2003 an article in the *Archives of Environmental Health* stated that "the data and discussion we have presented indicate apparent excesses in all cancers, thyroid cancer, CNS neoplasms, and possibly female reproductive cancers, in Hanford downwinders. These excesses were much larger than we could reasonably expect as a result of selection bias alone. The findings of this community-based study, and their consistency with other published data, suggest that there may be an association between cancers and environmental radioactive contamination."[4]

The so-called downwinders remained convinced that they were poisoned by their own government. One often-reproduced complaint is a bit of poetry by a downwinder called "Betrayal":

It's as safe as mother's milk, they'll say:
When wanting to assure you that it's all O.K.
If mom, a downwinder, eats Columbia River's fish,
Or consumes white snow -- garden salads on the spot
Then mother's milk can become a deadly lot.

So I fed poison to my nursing son
With radioactive iodine-131.
Just because we lived in the wrong place
I maimed my babe for that nuclear race.

[3] http://www.everything2.com/index.pl?node_id=139929
[4] http://www.findarticles.com/p/articles/mi_m0907/is_5_58/ai_112448475/pg_1

Hanford Plutonium Factory - Timeline

1944 -- Hanford begins making plutonium for atomic bombs and radioactive contamination begins to be released into the river, air, and soil. [5]

1946 -- The U.S. Congress passed the Atomic Energy Act, which makes Hanford a civilian operation allowing the Atomic Energy Commission and, later, the Department of Energy, to operate weapons material plants without independent oversight.

1947 – A ten-year expansion at Hanford begins. It includes construction of 5 new plutonium production reactors, 2 chemical reprocessing plants, and 81 underground waste storage tanks.

1949 – Officials at Hanford stage what it known as the “Green Run,” in which approximately 8,000 curies of iodine-131 are secretly released into the atmosphere. It is the largest single release from Hanford.

1951 -- Special iodine filters on Hanford's processing plants begin to fail.

1962 – An accident at the Plutonium Finishing Plant releases some 1,200 curies of radioactive gases over three days.

1964 -- President Lyndon Johnson orders the gradual shutdown of Hanford.

1971 – The last of the original eight reactors at Hanford is shut down.

1986 -- The U.S. Department of Energy releases 19,000 pages of documents relating to the release of radioactive material from Hanford.

1989 -- The USDOE, the Environmental Protection Agency, and the Washington State Department of Ecology sign an agreement about the cleanup of Hanford.

1998 – The National Institute for Occupational Safety and Health releases the results of a study of certain rare cancers in the children of workers at three sites, including Hanford. They find no link between the childhood cancers and the fathers' exposure to external ionizing radiation.

2002 – The Centers for Disease Control and the Fred Hutchinson Cancer Research Center release their Final Report on Hanford, concluding that there is no evidence of a link between the release of iodine-131 and thyroid disease.

2003 – An article in the *Archives of Environmental Health* shows “apparent excesses” in cancers in Hanford downwinders.

[5] http://www.doh.wa.gov/hanford/publications/history/timeline.html#VC1b1

Terms Used in the Documentary

ABCC -- The Atomic Bomb Casualty Commission. An agency established in Hiroshima in 1947 and in Nagasaki in the following year under the auspices of the U.S. National Academy of Sciences. Its mission was to conduct an epidemiological and genetic study of the atomic bomb survivors. It was replaced in 1975 by The Radiation Effects Research Foundation, a nonprofit Japanese entity.

Depleted Uranium -- A by-product of uranium enrichment for nuclear weapons or nuclear reactors. Nearly twice as heavy as lead, it is used to make ammunition that penetrates armor and to make protective armor that wards off standard artillery shells. Iraqi authorities have contended that it is responsible for an increase in cancers, a claim the U.S. military rejects.

Hanford Thyroid Disease Study – A study mandated by Congress in 1988 to investigate whether thyroid disease was increased among persons exposed to atmospheric releases of radioactive materials from the Hanford Nuclear Site in eastern Washington between 1944 and 1957. The final report, issued in 2002, found no association between radiation and thyroid disease. (See “Web Resources”)

Leukemia -- A cancerous disorder of the tissues of the body, especially the bone marrow that forms blood.

Manhattan Project – The $2-billion U.S. effort during World War II to develop nuclear weapons. The commanding officer was Leslie M. Groves, and the head of the scientific team was J. Robert Oppenheimer.

Persian Gulf War – A conflict that began when Iraq invaded Kuwait in December 1990. A coalition of 32 nations led by the United States retaliated and crushed the Iraq army. After the war the United Nations imposed economic sanctions on Iraq to discourage its leader, Saddam Hussein, from developing weapons of mass destruction. In 1995 a UN study team reported that over a half million Iraqi children might have died as a result of declining standards of nutrition, sanitation, and medical care since the sanctions were put in place.

Plutonium – A radioactive chemical element (no. 94) that comes in the form of a silver-gray radioactive metal. It is produced in nuclear reactors from uranium and is used as a nuclear fission fuel.

Radionuclide -- A radioactive type of atom characterized by a nucleus that is made up in such a way that it is unstable, which causes the atom to emit corpuscular or electromagnetic radiation.

Thyroid gland – An endocrine gland located in the neck that secretes hormones that are needed for growth and metabolism.

Books

Anthony Arnove. *Iraq Under Siege, Updated Edition: The Deadly Impact of Sanctions and War*. South End Press, 2002.

Mick Broderick, *Hibakusha Cinema*. Kegan Paul, 1996.

John Catalinotto, ed., *Metal of Dishonor-Depleted Uranium: How the Pentagon Radiates Soldiers & Civilians with DU Weapons*. International Action Center, 2004.

Marie Curie, *Radioactive Substances*. Dover Publications, 2002.

Carolyn Fulco, et al., *Gulf War and Health, Volume 1: Depleted Uranium, Pyridostigmine Bromide, Sarin, Vaccines*. National Academy Press, 2000.

R. E. Gephart, Hanford: *A Conversation About Nuclear Waste and Cleanup*. Battelle Press, 2003

Michele Stenehjem Gerber, *On the Home Front: The Cold War Legacy of the Hanford Nuclear Site*. University of Nebraska Press, 2002.

Michihiko Hachiya, *Hiroshima Diary: The Journal of a Japanese Physician, August 6-September 30, 1945: Fifty Years Later*. University of North Carolina Press, 1955.

T.E. Marceau, *Hanford Site Historic District: History of the Plutonium Production Facilities, 1943-1990.* Battelle Press, 2003

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Kyoko Selden, *The Atomic Bomb: Voices from Hiroshima and Nagasaki*. M.E. Sharpe, 1997.

J. Samuel Walker, *Permissible Dose: A History of Radiation Protection in the Twentieth Century*. University of California Press, 2000.

Alan E. Waltar, *Radiation and Modern Life: Fulfilling Marie Curie's Dream*. Prometheus Books, 2004.

Web Resources

http://rex.nci.nih.gov/NCI_Pub_Interface/raterisk/risks90.html — An informative essay from the National Cancer Institute on “Ionizing Radiation.”

http://news.bbc.co.uk/2/hi/health/medical_notes/461921.stm – From the BBC, a succinct and clearly written survey entitled “Radiation Sickness.”

http://www.radford.edu/~fac-man/Safety/Radiation/chp7.htm – An excellent survey from Radford University of the evidence and theories on how radiation causes cancer.

http://nuclearhistory.tripod.com/index.html – The “Nuclear History Site,” the purpose of which is “to discuss the history of nuclear energy in the United States, both for military and civilian purposes.”

http://www.nrc.gov/ -- Home page of the U.S. Nuclear Regulatory Commission.

http://www.icrc.org/Web/Eng/siteeng0.nsf/iwpList74/4BBFCEC7FF4B7A3CC1256B66005E0FB6 — From the International Committee of the Red Cross, a thorough survey entitled “Iraq: 1989-1999, a decade of sanctions.”

http://seattlepi.nwsource.com/national/95178_du12.shtml – A thorough article from the Seattle Post-Intelligencer on the controversy on the use of depleted uranium in Iraq.

http://www.iacenter.org/depleted/du.htm – The website of the “Depleted Uranium Education Project.”

http://www.mediamonitors.net/north1.html – An essay entitled “Leukemia in Iraq.”

http://www.inicom.com/hibakusha/ -- A site called “Voice of Hibakusha” that contains eyewitness accounts of the bombing of Hiroshima.

http://www.hiroshima-is.ac.jp/Hiroshima/radiation.htm – From the Hiroshima International School, a survey of the effects of the atomic bomb.

http://www.afsc.org/pwork/1298/declead5.htm – From the American Friends Service Committee, an essay entitled “The Globalization of Hibakusha,” which describes possible victims of radiation poisoning outside Japan.

http://www.cdc.gov/nceh/radiation/hanford/htdsweb/index.htm -- The report on the results of the Hanford Thyroid Disease Study from the U.S. Centers for Disease Control.

http://www.hanford.gov/ -- The U.S. Department of Energy’s website on Hanford.

http://www.hanfordwatch.org/ -- A useful site called “Hanford Watch.”

http://www.downwinders.com/hanford_hist.html – The website of the Hanford Downwinders.