Nuclear Energy

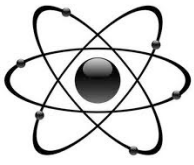
MARCH 32, 2011 MICHELE KWON, EUGENE LEE, MONICA W., DANNY HONG THURSDAY

Learning the new world of nuclear energy...!

Nuclear Chemistry

Radioactive elements are not always harmful.

People remember the horror of the power of nuclear bomb that exploded in Chernobyl. To understand the power of nuclear energy, it is important to understand the chemistry of nuclear elements. Radioactive elements are elements that do not have a stable nucleus. Atoms have three parts within them. The center, nucleus, is made of proton and neutron. The nucleus is surrounded by electrons. Isotope is an element with the same number of proton and electron, but different number of neutron. Their isotopes transform into different nuclides, and this process gives off what we know as radiation. The element's nucleus goes through a process of degeneration that gives off radiation.



Elements with atomic numbers greater than 83 are radioactive; most radioactive elements usually do not occur naturally. There are three types of emission in radiation. Alpha emission is a general process in which an alpha particle is ejected from an atom's nucleus. Alpha emission releases two protons and two neutrons. In result, the alpha particle would have a positive charge. Beta emission releases a high speed electron that leaves the nucleus. It occurs when the element has more neutrons than protons. Gamma emission gives off a ray (high energy photon) in the gamma part of the spectrum from the excited nucleus. This often happens in radioactive elements. The nucleus does not change in the process.

Half-life of any given element is the time that is required for half of the sample to decay. All radioactive elements have a half-life. Half-lives are commonly used to describe amounts undergoing exponential decay.—for instance radioactive decay—the half-life is constant over the life of the decay, and is a characteristic unit (a natural unit of scale) for the exponential decay equation. Still, a half-life can also be defined for non-exponential decay processes, although in these cases the half-life varies throughout the decay process.. The half-life is very helpful in finding out the age of certain fossils. Many archeologists uses half-life to find how old the fossil is.

> Half-life is a radioactive element that allows scientists to find the age of fossils.

BENNETT CHEMISTRY

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Mr. Chemistry leading his way to the world of stoichiometry next week!

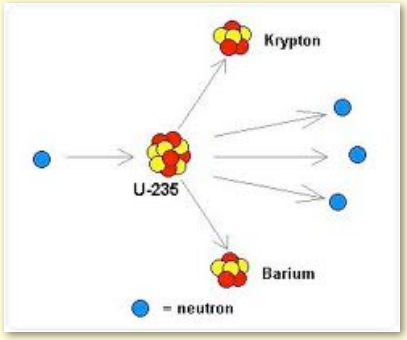
Interview with world best neurologist, John Lindernburg

Fusion & Fission

Fusion

Fusion is a process that gives solar energy to the sun and starts. When two atoms of hydrogen combine and form helium, we call this process fusion.

Fission



Fission is when the nucleus of a heavy atom captures a neutron. It splits a massive element into a smaller unit. This happens through chain reaction, so when the reaction is not stable, fission does not occur.

Fusion and Fission

If we talk simply about the difference between fusion and fission is the process itself. Fusion is a process of joining two light elements and forms an bigger element. However, fission is splitting the bigger element into a smaller portion.

The Wonder of Fusion Power Plant

People usually think atomic power plant as harmful place where it may bring harms to the people living near the plant. However, the fusion power plant seems to change the perspective. Fusion power plant is actually safe. It does not produce any radioactive waster while they require the same cost as the present atomic power plant.

Design of laser-driven fusion power plant

Disaster in Chernobyl

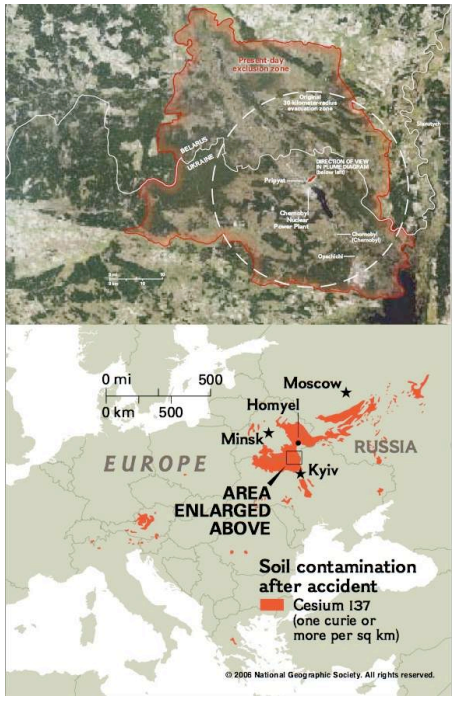
In April 26th, 1986, the Chernobyl Nuclear Power Plant in exploded in accident.

26 April 1986

01:23:45

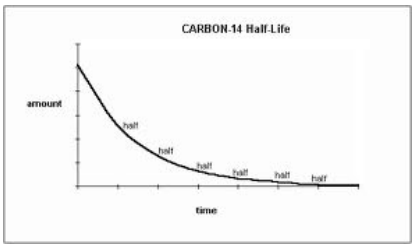
Chernobyl is a city in Ukraine. In 26th of April, 1986, a huge accident that is still known as world's worst nuclear accident occurred. The nuclear power

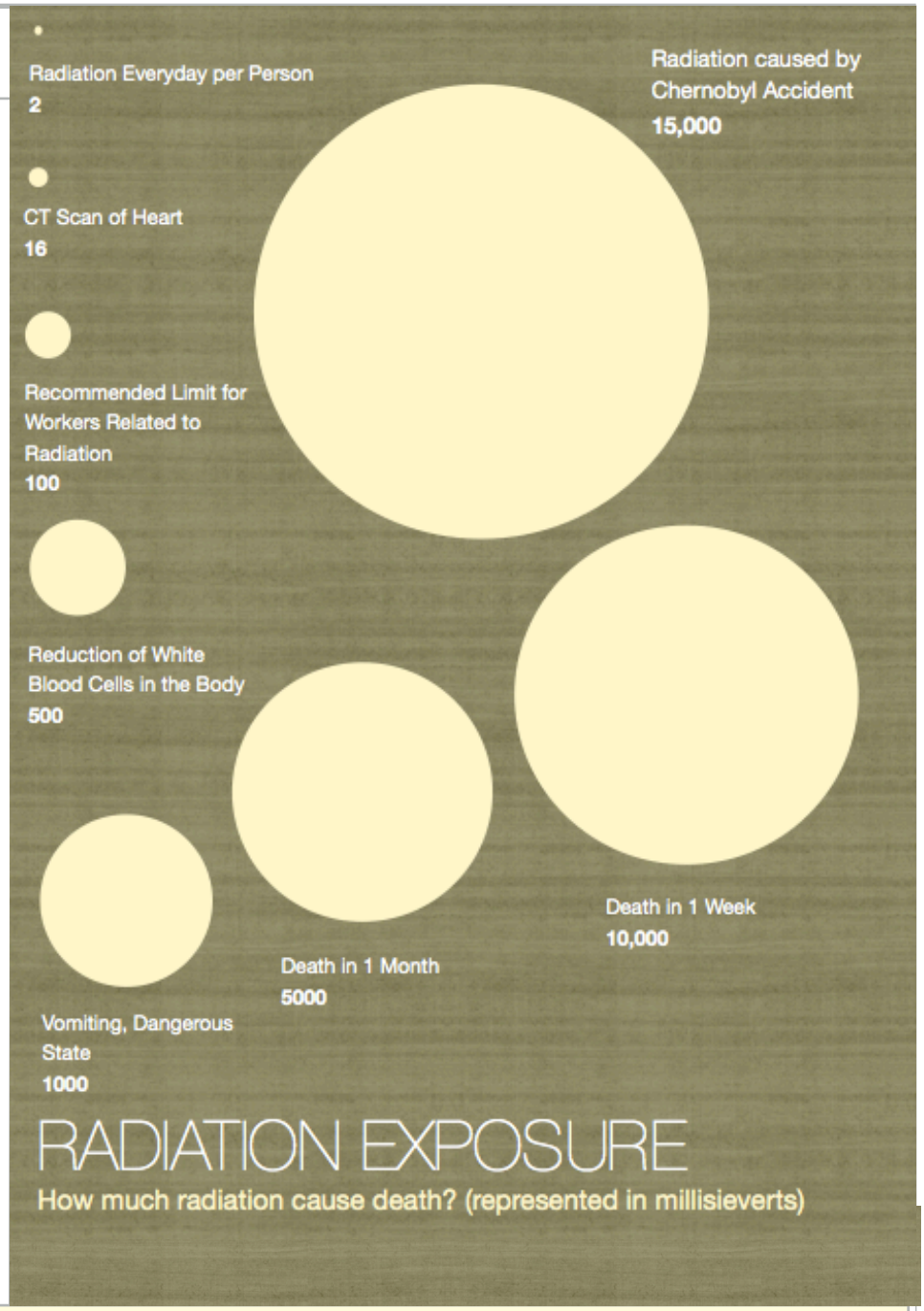
plant had exploded. The radiation still remains and people have been affected by it. There has been many fishes distorted found and especially new-born babies had diseases that are not usually shown. Scientists used mice in order to study the affect of radiation. Mice are useful in a way that scientist can compare them to human since they are both mammals. The scientists tried to get the DNA genetic information of the radioactive mice. This DNA code would allow the scientist to recognize the symptoms of radioactive genetic disorder. They can compare the genetic information with the babies and see if they also have diseases. However, the scientists are still not able to predict the unexpected result that the radiation may bring.



Carbon Dating

Carbon dating is a method of measuring the age of an object containing carbon. They use a radioactive carbon, carbon-14, that can be applied in the concept of half-life. This is used in finding the age of certain fossils, giving much help to the modern scientists. Carbon'd half-life is 5700 years and it is reliable up to 40,000 years. To perform carbon dating, scientist can use fossils to find the age of it. It is used in dating things such as bone, cloth, wood and plant fibers that were creative in the relatively recent past by human activities. Cosmic rays enter the earth in large quantity every day. Us, humans, are hit by half a million cosmic rays every hour. So, it is usually for the cosmic rays to hit the atoms wondering around the atmosphere of earth. When they collide, the neutron of each elements collide. This makes the nitrogen-14 (seven protons, seven neutrons) to change into a radioactive element carbon-14 (six protons, eight neutron). Carbon-14 is highly radioactive and using this, scientist combine this with oxygen to make CO_2. The plants absorb this naturally to perform photosynthesis and by sensing the left over carbon, scientist measure the age of certain fossils.





Images of Fukushima before (top) and after (bottom) the nuclear leak.

Radiation Leakage in Japan

In March 11th, 2:26 PM, earthquake stroke Japan. Due to the earthquake the nuclear power plant in Fukushima, Japan, leaked its radiation. When the electricity shut down due to the earthquake (strength 9), the freezer that kept the radioactive elements inside the tank stopped and eventually was not able to keep the radiation in. There was an alternative energy to prevent leakage, but the tsunami that hit Japan made the alternative way impossible, too. Out of 10 nuclear plant in Fukushima, 6 plants had a leakage problem. There has been a critic that the power plant was about 40 years old, making the power plant to be too old to sustain the radiation safe from people. However, what is important is that the radiation has been exposed to people.

Currently, it has been notified that the rest of nuclear power plant is broken. People living in Fukushima are in refuge and have to together in a certain area. They are being checked on how much radiation has affected them.

Usage of Radioactive Materials

Doctor checking x-rays of brain

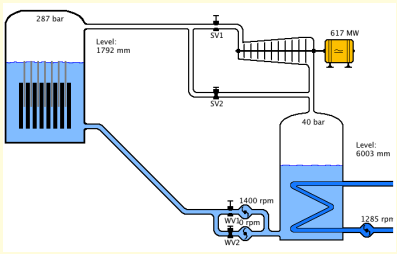
Radiation can actually be used to diagnose people!

Radiation is not always harmful. Sometimes, it benefits people. Radiation is sometimes used in medicine and to diagnose people. Iodine-131 is used as a liquid or capsule to cure thyroid cancer. People can meet easily with radiation when they go to the dentist and have their teeth checked. Doctors use x-rays or

CT scan to diagnose patients. Also some radioactive materials are sometimes used for nuclear medicine imaging. Not only in medicine, but in can also be used in detecting bombs. In everyday industry, radiation can be used to kill germs in foods, medical equipment, etc. without harming the substance itself. In agricultural industry, it uses radiation to make better production, such as exposing the plant seeds to radiation to make it a better plant. Engineers uses radiation-contained gauges in order to find the thickness of paper product, fluid levels in oil and chemical tanks, etc.

This is not the end of the usage of radiation in everyday life. Medical researchers uses radioactive elements to find cure for various kinds of cancer. Farmers uses radiation that make better plants that may survive through floods or droughts, or even have resistance to diseases. Microwaves uses radio waves that gets absorbed by water, fat, and sugar to be converted into heat. Nuclear power is also used as electricity. 31 states in United States, such as California, Arizona, Illinois, Pennsylvania, New York, etc. uses nuclear power for electricity. Let's notice how airports uses radiation. Radiation is used to scan the bags of people. Products such as foods, mail, supplied for hospitals, are sterilized by using radiation.

Nuclear Power Plant



Parts

The nuclear reactor and a nuclear plant is consisted of fuel, moderators, control rods, shielding, cooling, turbines, generator, cooler pipes, shielding, and a water supply.

Main Function

The main part of the nuclear power plant is cooling. Cooling allows the radioactive elements to not be so active. The movement of gas is directly proportional to the temperature. If the temperature is low, the gas does not move much and allows not much collision that would exert force to each other to happen. When the cooling does not happen, the movement of gas gets faster and eventually causes the danger of gas to escape from the nuclear plant.

Relationship with Japan

The earthquake had struck Japan along with tsunami. The earthquake made the alternative cooling to work, but the

disaster happened when the tsunami also made the alternative cooling not possible. This majorly led to the explosion of the radiation to the atmosphere.