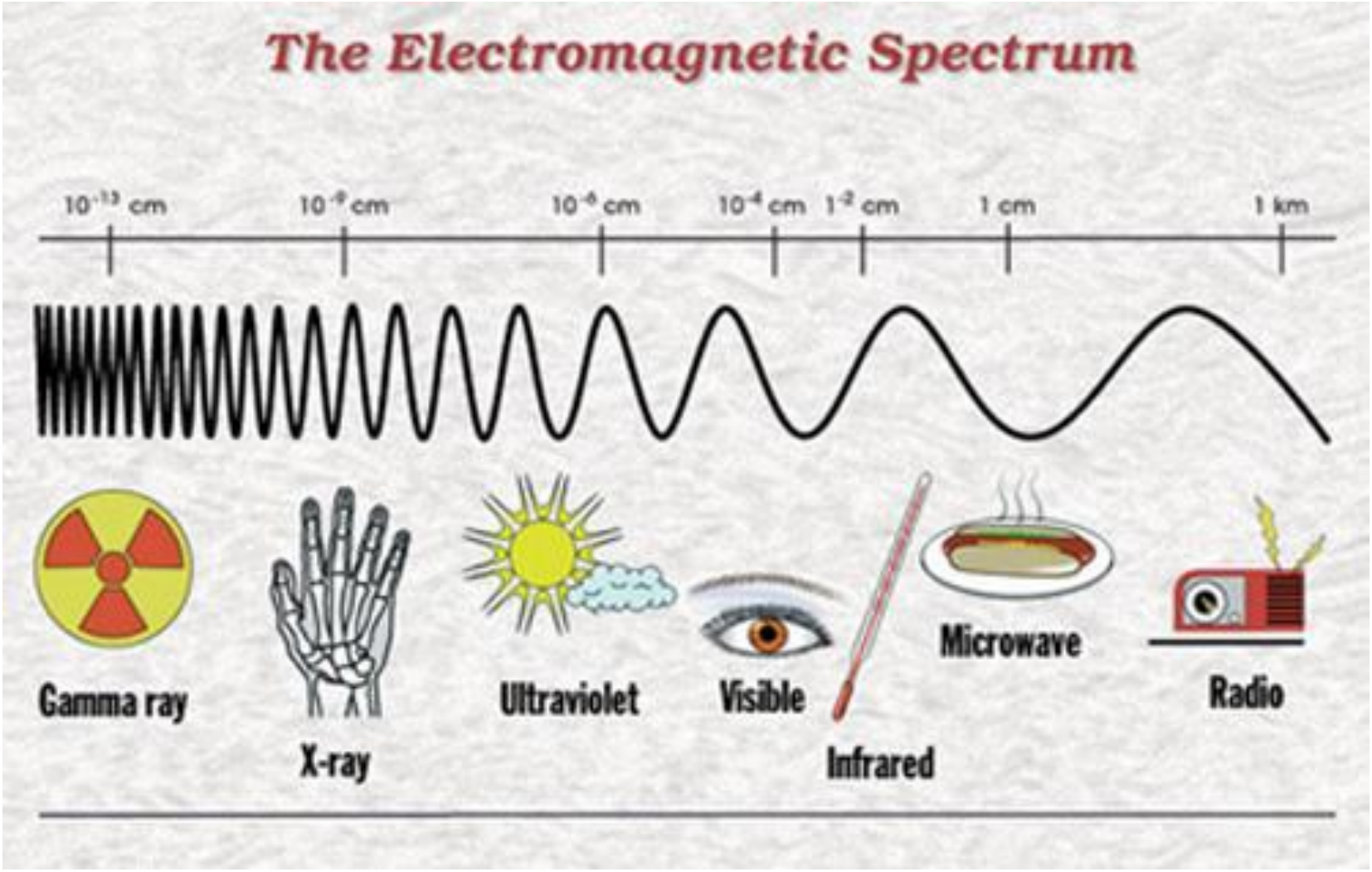
Nuclear Applications

Discover of Radioactivity

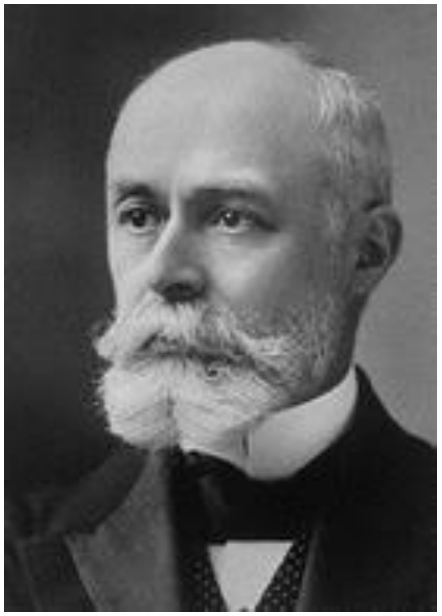
William Roentgen

- **November 1885 discovered x-rays**
  - **X-rays are energetic electromagnetic waves that can travel through matter.**

X-Rays – increased frequency, decreased wavelength



Discover of Radioactivity



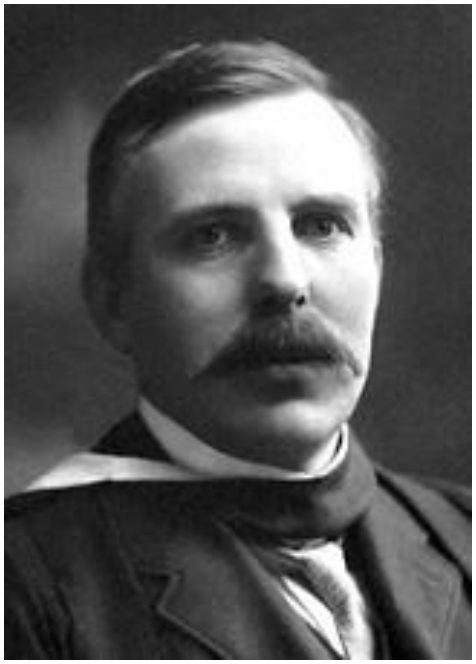
- **Within a few months, Henri Becquerel discovered the presence of naturally occurring radiation in uranium salts.**

Discover of Radioactivity

1898

Marie Curie found that compounds of thorium were also radioactive. She eventually isolated two more radioactive elements, polonium and radium.

Discover of Radioactivity



- Ernest Rutherford

Discovered two forms of radioactivity, alpha and beta particles.

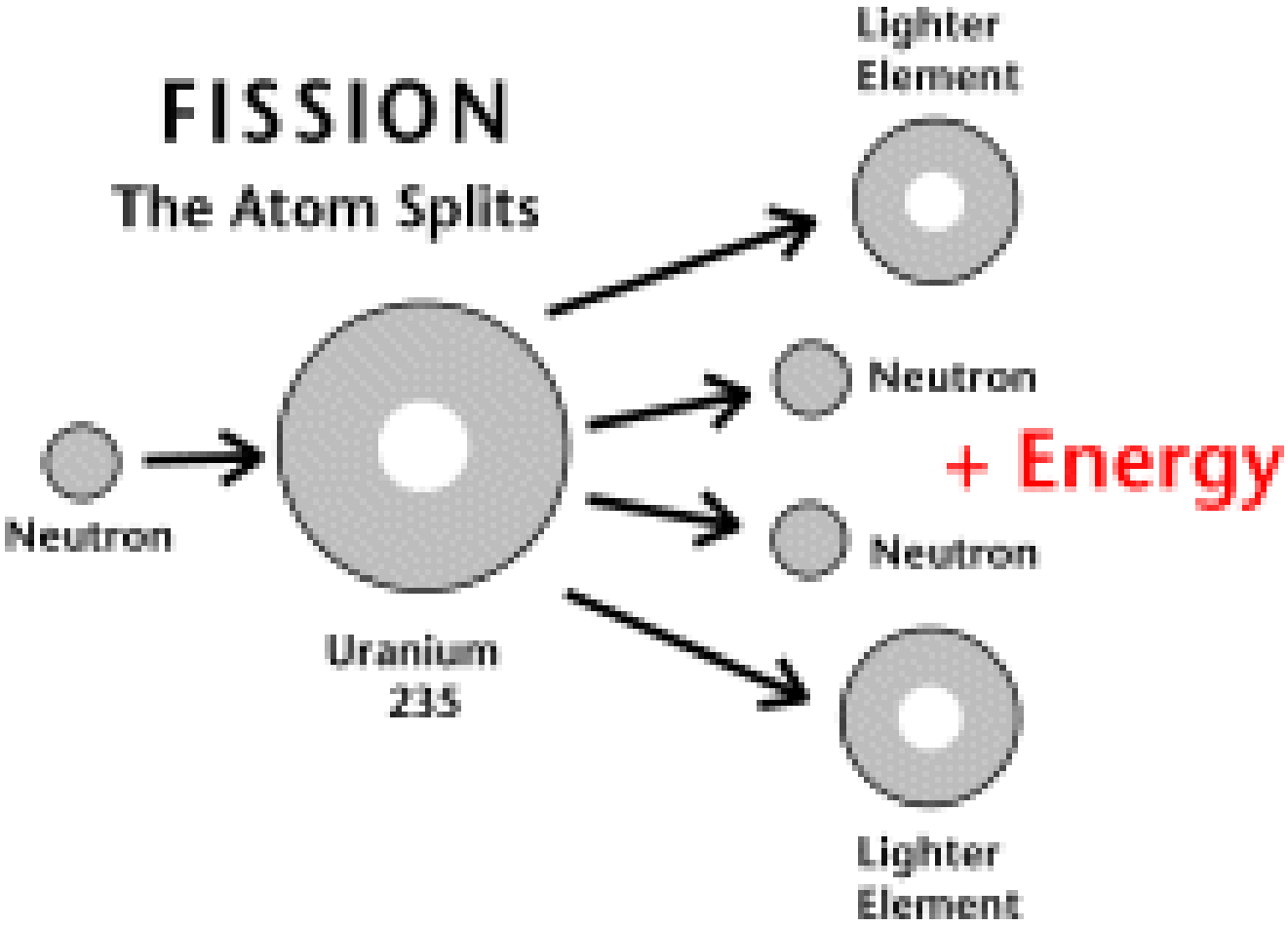
A third form, gamma rays, was discovered shortly thereafter.

What is RADIOACTIVITY?

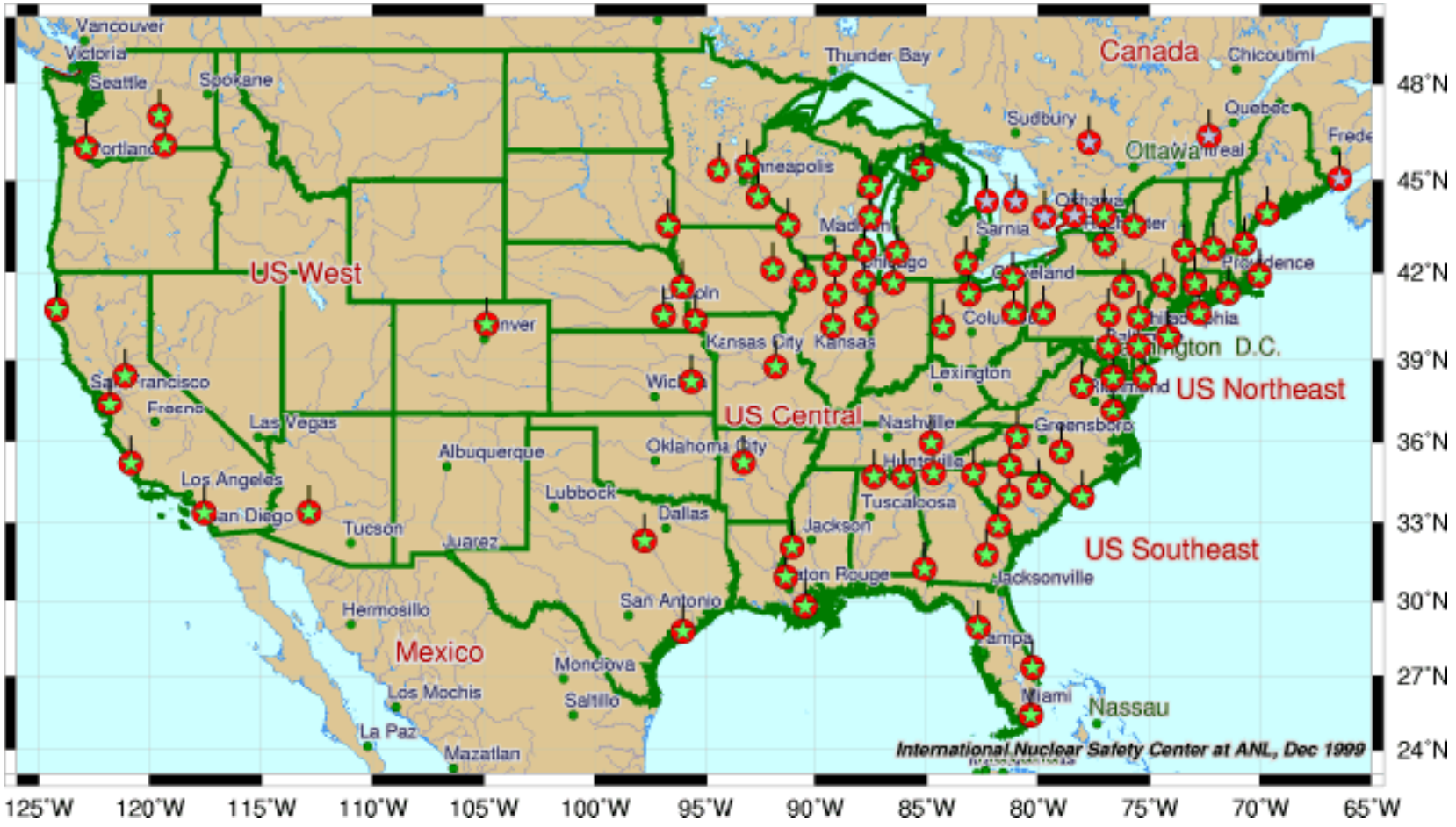
- It is the process of nuclear decay.
- Nuclei of large atoms (83 protons or more) are radioactive.
- The nucleus is unstable and can begin to decay, when the nucleus decays it emits these waves of radiation.
- Elements with nuclei that have a different number of neutrons, more or less, to protons are radioactive.

Nuclear Fission

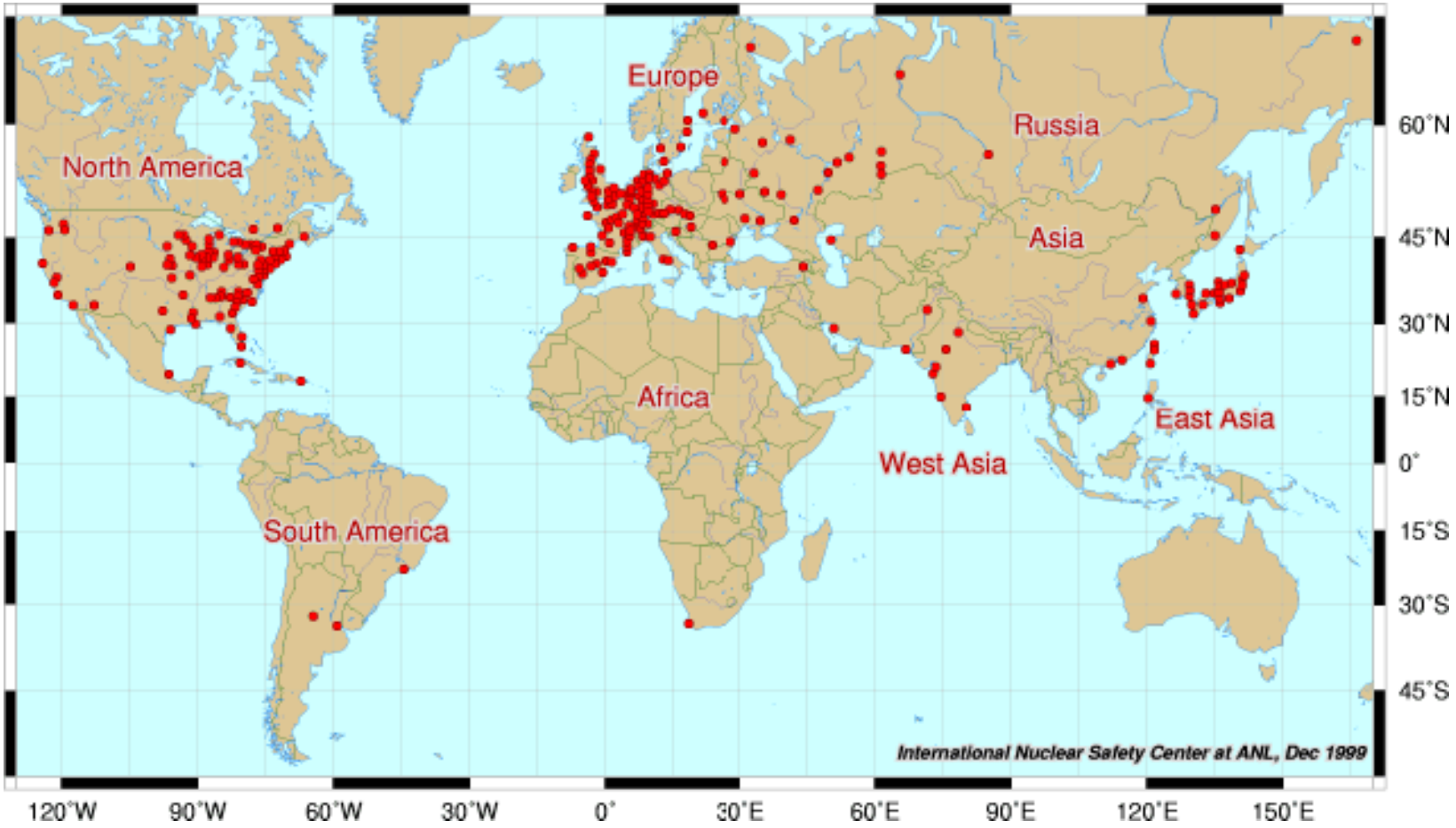
Nuclear Fission



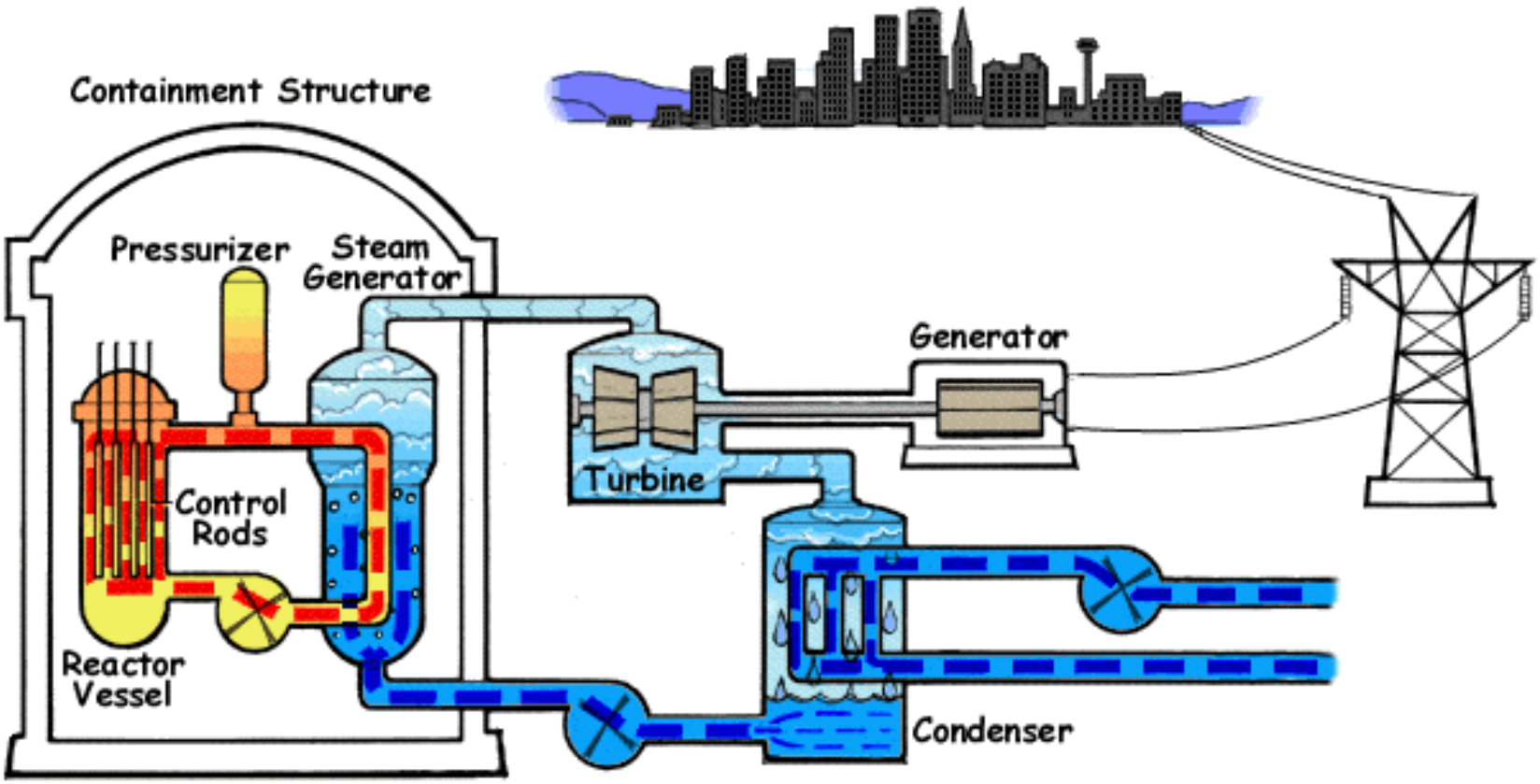
The United States has 66 fission nuclear power plants.



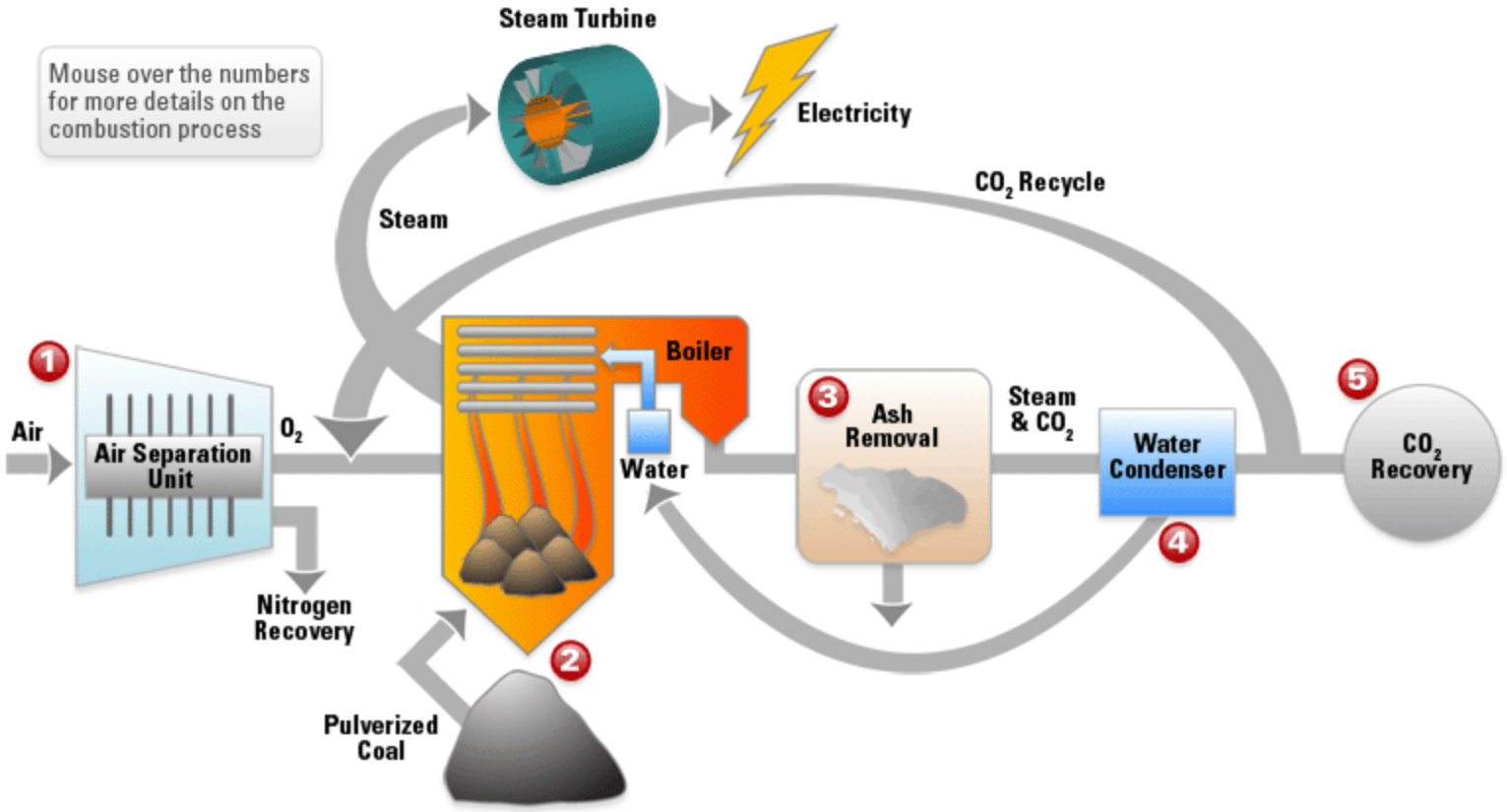
There are 434 fission plants worldwide.



Fission Power Plant



Coal Burning Power Plant



Nuclear Power vs. Fossil Fuels

Pros

- More Efficient
- More energy production
- Cleaner, No emissions

Cons

- Mining/ enriching
- Transportation
- Improper function plants
- Storing of spent fuel
- Potential release of radiation

Pros

- Cheap source
- Used for centuries
- Widely used
- CO_2 emission and other gases

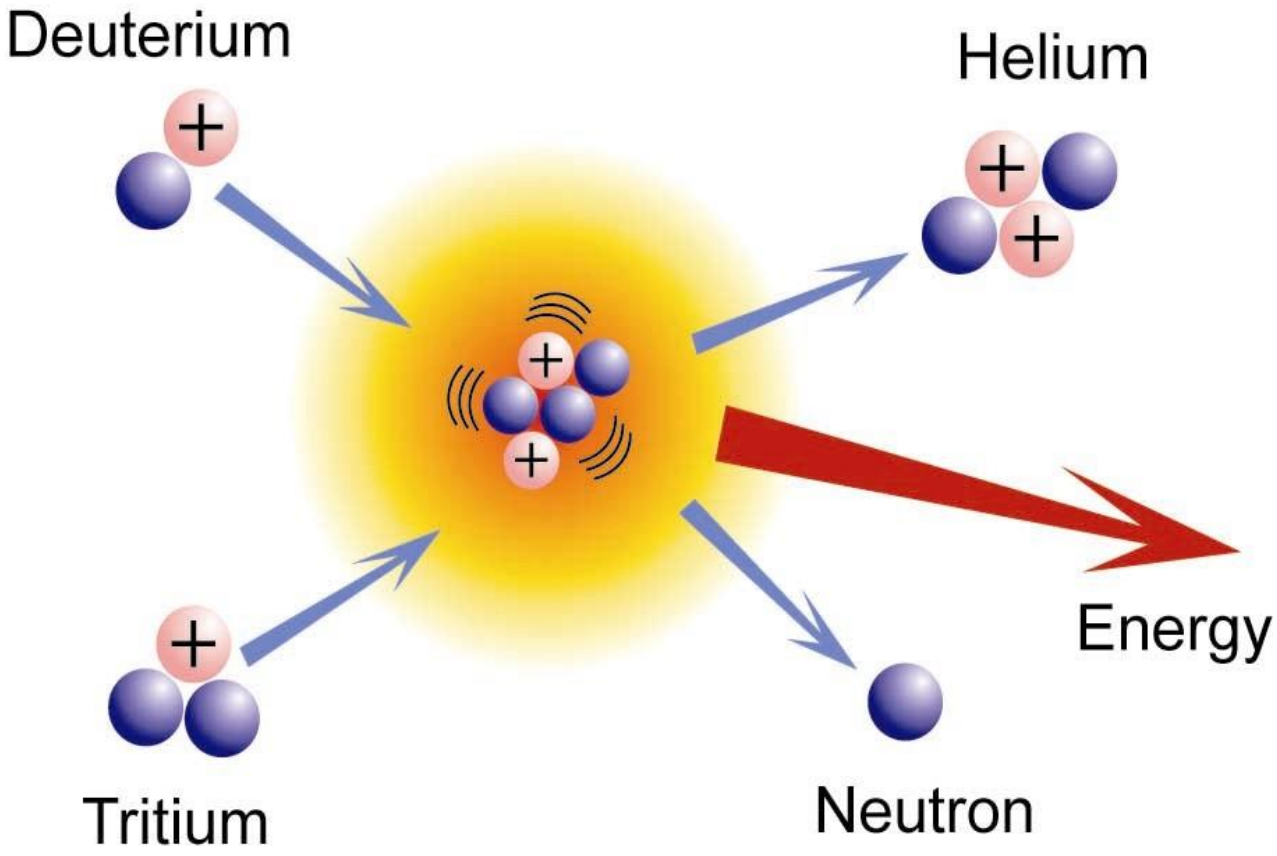
Cons

- Can be expensive
- Dangerous to mine
- Non renewable

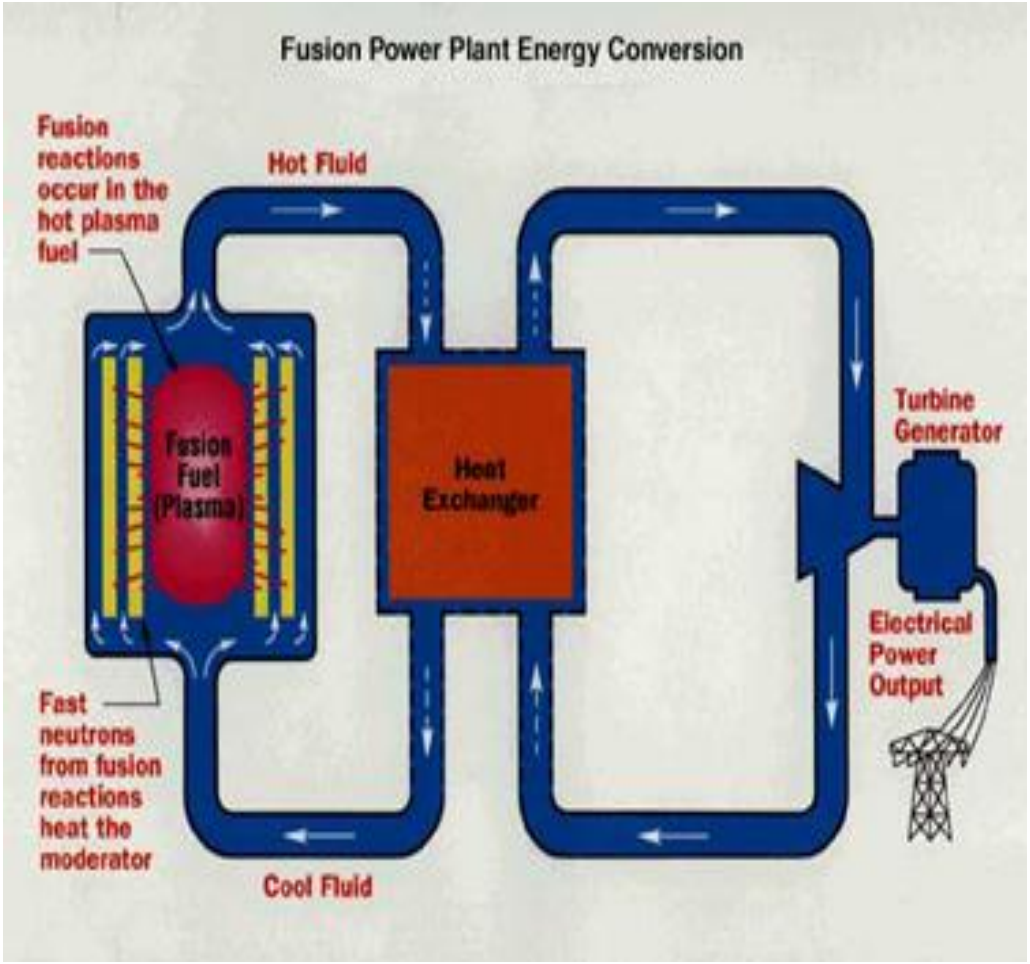
Fusion

- **Fusion is a combination of atoms resulting in a loss of mass and production of energy**
- **When the nuclei of 2 atoms of deuterium [an isotope of hydrogen called "heavy hydrogen"] combine, helium is formed and energy is released. This is an example of fusion**
- **Edward Teller is known as the father of the hydrogen bomb because he discovered how to use fusion to cause explosions.**

Nuclear Fusion



Nuclear Fusion



- France 2005
- Year 2080
- 1kg of Fusion Fuel = 10,000,000 of coal fuel

Nuclear Applications in Medicine

- Molecules in your body can carry radioactive isotopes. Doctors detect this radiation to determine or cure illnesses.

- Cancer cells grow quickly and are more susceptible to radiation therapy.

Which nuclear reaction can occur here on earth?

A. Fission

B. Fusion

Why does fusion only occur in the sun?

A. The sun has a large mass of hydrogen and temperatures hot enough to achieve the combining of hydrogen nuclei.

B. The earth has no source of hydrogen.

C. Hydrogen only exists in forms found in the sun.

D. The isotopes of hydrogen, deuterium and tritium only exist in the sun.

The process that produces the energy of the sun and stars is called_____.

A. Nuclear Fission

B. Combustion

C. Nuclear Fusion

D. Radioactivity