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Excessive radiation exposure can cause radiation sickness. Caution signs, like this one, warn people about the dangers of radiation exposure.

Nuclear energy has risks. One of the most significant occurs when living things are exposed to high doses of radiation. (Early pioneers in x-ray technology - many of whom were injured or died - discovered that fact.)

Radiation is emitted when the unstable nuclei of atoms decay and release particles. When those particles touch organic material (like human tissue), damage can result. Whether there *actually* is damage depends on how much radiation has reached living tissue.

When human beings are exposed to radiation, the dosage measurement is called "rem" which stands for "**R**oentgen **E**quivalent in **M**an." It represents the amount of radiation needed to damage living tissue.

Total body exposure above 100 rems causes radiation sickness, although smaller doses may produce detectable levels in human blood. As the rems increase, so do the symptoms and the illness severity.

An exposure of 450 roentgens has caused radiation sickness and death in half the individuals measured. Someone exposed to 100,000 rems could be dead in an hour.

What are the symptoms of radiation sickness? Smaller doses produce nausea and vomiting initially, then headaches and some loss of white blood cells. (White blood cells, or leukocytes, help the body's immune system fight infection.) Three hundred rems, or more, cause temporary hair loss and internal injuries to nerve cells and digestive-lining cells.

Besides the leukocyte problem, radiation exposure can also reduce the body's ability to produce platelets, which help the blood to clot. Victims of radiation sickness are therefore prone to hemorrhaging. Doses of 800 rems, or more, are always fatal.

When Einstein sent his first letter to President Roosevelt, neither he nor his colleagues fully appreciated the danger people could face from atomic power. Similarly, when Henri Becquerel discovered radioactivity and Marie Curie (together with her husband, Pierre) isolated the radioactive element radium, they did not realize the personal risks they were taking from working with such substances.

As the "Manhattan Project" produced more and more evidence of the potential downside of nuclear energy, however, some of the projects' scientists - like Leo Szilard (who first encouraged Einstein to write FDR in 1939) - became increasingly concerned.

At Szilard's urging, in March of 1945, Einstein sent another letter to President Roosevelt. He wrote, in pertinent part:

*The terms of secrecy under which Dr. Szilard is working at present do not permit him to give me information about his work; however, I understand that he now is greatly concerned about the lack of adequate contact between scientists who are doing this work and those members of your Cabinet who are responsible for formulating policy.*

Before he could read it, Roosevelt died (on April 12, 1945).

How would his successor, Harry Truman, react when two weeks later he learned the country, with the approval of FDR, was secretly developing a nuclear bomb?

See Learning Tasks for this story online at:

<http://www.awesomestories.com/asset/AcademicActivities/RADIATION-SICKNESS-Einstein-s-Letter>

## Media Stream

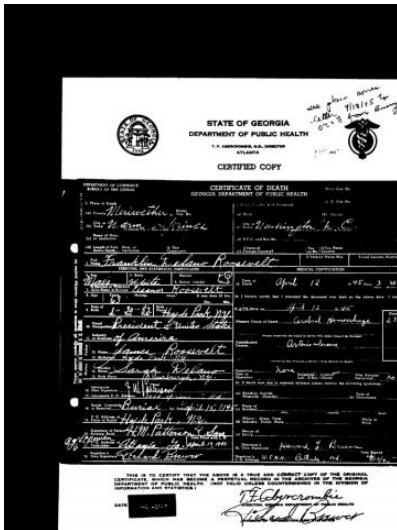


### Radiation Sickness

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### FDR - Death Certificate

Image online, courtesy U.S. National Archives.

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### Henri Becquerel - Discovers Radioactivity

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