Atomic Bomb Radiation

When neutrons strike certain atomic nuclei, notably those of uranium and plutonium, they do not radiate in the usual way. Instead, they split into two roughly equal parts and give off a large burst of energy. It is this energy that provides the explosive power of an atomic bomb, and that can be converted into useful power in an atomic pile.

Thermal Radiation

The thermal radiation consisting of ultraviolet rays, infra-red and light rays follows a nuclear explosion which creates a tremendous amount of heat, comparable to the interior of the sun in a volume of space a few inches in diameter. Because the reaction is completed in microseconds a violent explosion results. Near the epicenter or Ground Zero (the exact point of the detonation) the temperature reaches 10,000 degrees and incinerates the body, blisters tile surfaces and instantly ignites flammable objects. At distances of about three kilometers (1 ½ miles) the skin is charred, but at distances closer to the epicenter, internal tissues are injured as if they are roasted and death occurs immediately. As thermal radiation and the penetrating nuclear radiation of gamma rays and neutrons act upon the body simultaneously, the combined effects were lethal for those out in the open within 1,500 meters (1 mile) of the epicenter, even for those who were not injured by the trauma.

Hiroshima

Thermal radiation from the bomb dropped on Hiroshima left burn imprints that matched the fabric pattern of the woman's dress. Photograph by Kenichi Kimura, September, 1945

One Mile from Ground Zero

The photograph below shows typical flesh burn on exposed skin only. This man was in the open approximately one mile from ground zero in Hiroshima. The photograph was taken seventy-nine days later shows partially healed second-degree burns with keloid formation.

Thermal Radiation and Blast Winds

This boy was exposed to thermal radiation approximately one mile from the Nagasaki hypocenter. Photograph by U.S. Army, November 1945.
The blast waves, areas of pressure that expand supersonically outward from an explosion, caused injury not only because of their tremendous force that buckled concrete walls like the force of an earthquake at close distances from the epicenter, but in addition they created a blast wind of hurricane speed that flung bodies off the ground several meters, that turned loose objects into flying missiles and the shattered glass fragments of varying size into flying blades cutting or penetrating the body. Furthermore, the skin that just seconds before was scorched by the thermal radiation was ripped off leaving strips of skin hanging from the body and exposing bleeding skin surfaces. The blast wind left clothing in tatters while others were completely naked.

At the Medical School hospital, it was often noted that individuals without burns or trauma injury died, some instantly, slumping at their workplace, while others died in the next day or two after the bombing and solely from what was later determined to be radiation poisoning and its effects on the brain, and became known as "brain death."

In common they soon experienced extreme fatigue, extreme thirst, vomiting and diarrhea. With a longer survival period other systems developed such as bleeding from the skin and other parts of the body and painful ulcers in the throat and gums as well as hair loss, often accompanied by sustained high fever prior to death. Large bumps began to appear on their skin known as keloids. Those who developed infections required a long period before healing ensued if at all due to a lack of white blood cells. Otherwise localized infections often spread and became fatal. Victims in whom radiation sickness was delayed for several weeks after the exposure were more likely to survive.

**Lethal Radiation Effects**

The amount of absorbed radiation was sufficient to destroy blood cells and the blood elements that control bleeding. The bleeding into the skin to the degree shown in the photograph represents bleeding within all the internal organs of the body, thereby indicating this was a sign of a terminal event.

**Hiroshima and Nagasaki Death Toll**

The mortality was greater in Hiroshima because the city was located in a flat delta, in contrast to Nagasaki’s Urakami Valley. The Nagasaki-Uarakami is enclosed by mountain ridges that shielded the city. Nevertheless, the instant lethal effect revealed consideration of the use of these annihilative weapons in warfare can be tolerated by man now that nukes of far greater destructive power are now available.

The real mortality of the atomic bombs that were dropped on Japan will never be known. The destruction and overwhelming chaos made orderly counting impossible. It is not unlikely that the estimates of killed and wounded in Hiroshima (150,000) and Nagasaki (75,000) are over conservative.
"Hibakusha": Those who Survived and How They Survived

In 1979, thirty-four years after the atomic blast at Hiroshima, Akihiro Takahashi became director of the Hiroshima Peace Memorial Museum and one of Japan's most conspicuous "hibakusha"—literally, "those who were bombed." Talking this summer in a basement office at the museum, he divided his life story into three fourteen:s: the fourteen years before the bomb fell, the fourteen hundred meters he stood from the bomb's epicenter (distance from the epicenter is a crucial factor in certification as a hibakusha), and the fourteen hospitalizations he has endured because of radiation-related sickness. He has delicate features and a very precise way of speaking as he remembers how on that day (as everyone in Hiroshima refers to the date of the bombing), he was burned all over his body. His charred skin sloughed off and hung in long swathes exposing the muscles underneath. Like so many of the survivors, he made his way to the river to try to extinguish his burning flesh. He had no way of knowing then that the physical suffering had only begun.

By now such stories are dangerously familiar. Though they have not really been assimilated, they have been dismissed as part of our past.

There is a group also called the *Nijyuu Hibakusha, “the twice bombed”,* there were 165 people who survived both atomic blasts. They survived the Hiroshima blast and had been evacuated or moved to Nagasaki and survived the second atomic blast.
Manhattan Project (the research project that developed the first nuclear bombs)

In Hiroshima, at least 66,000 people were incinerated in an instant by the atomic bomb nicknamed “Little Boy”, at least 30,000 three days later when we used a second bomb, codenamed “Fat Man” on Nagasaki. Exact casualty figures are impossible to state, because population records turned to ash along with the record-keepers, and radiation caused many deaths long after the actual explosions. Tadatoshi Akiba, a former math professor at Tufts, published an article in 1983 in which he calculated that 200,000 people had died as result of the bomb in Hiroshima by 1950, and another 140,000 in Nagasaki. Many from the initial explosion but many in the days and weeks after due to the fallout, the radioactive material propelled into the sky that eventually falls back to earth. Nearly all were civilians—only 150 Japanese military were killed.

But the statistic that Americans might be most surprised to learn is that 226,598 officially certified survivors of the atomic bombings are still alive in Japan today. The average age of these witnesses, however, is now seventy-three. Most have been struggling with radiation-related illness for much of their lives, and death will surely have silenced the majority of them by the seventieth anniversary of the bombing in 2015.