

CHAPTER 1

Imagination Regarding the Atomic Bomb

SECTION 1

Explosion of the atom

Atomic theory

In ancient times, there was the belief, both philosophically and physically, that matter was made of continuous elements like seawater and noncontinuous elements like beach sand. Later, modern science divided matter further till there was the smallest element, which could not be divided further, yet keeping space between each other like sand particles. This is atomic theory.

Atoms

Matter is made of 92 elements on the earth. The smallest unit of these elements is called the atom. The size of the atom is really very small. To understand its smallness, think that an atom on the skin of an apple when magnified is proportionally the size of an apple on the surface of the earth. It is very small.

Atomic structure and extranuclear electron

The smallest and simplest element is hydrogen. The largest and most complicated is uranium, whose atomic structure was discovered by Dr.

Nagaoka of our country. According to him, the atom is made of an atomic nucleus surrounded by rotating electrons. The explosive reaction of a gunpowder bomb is by external electrons, but the atomic bomb is by nuclear fission.

The structure of the atom is as follows. A particle called the neutron, which doesn't have positive or negative charge, and another particle called the proton, which has the same weight as the neutron and is positively charged, make a mass by having the utmost bonding together. The number of protons in the nucleus is constant for each element. For example, the simplest, the hydrogen nucleus has a single proton, whereas the most complicated, uranium, has 92 protons. The number of neutrons is almost constant for each element, though it varies a little. The number of extranuclear electrons and internuclear protons is the same, so that each atom does not show electric charge. The repulsive force acts between two electric charges of the same sign.

Nuclear energy

In the nucleus many protons repel each other. There, particles must bear

great power, a potential to hold these protons inside the nucleus. Also, electrons have to rotate with constant speed in constant orbit, so they will not be drawn into the positively charged nucleus. The source of the potential rotating power must be in the nucleus.

If the atomic nucleus is broken, the separated conjugation of the neutron and proton releases its potential power, and there will be tremendous power relative to the size of the atomic nucleus. For example, the ratio of power inherent in atomic matter the size of a matchbox could blow up a battleship. This is the conception of the atomic bomb.

Decay of the atom

It is already known that uranium decays naturally and releases particles and atomic energy as radiation at the same time. Uranium changes to simpler atoms by decay, as it becomes the famous element, radium.

Radium and its series elements perform natural decay violently, releasing radiation. This is the well-known power utilized for medical purposes.

Since the natural decay of uranium and radium already releases tremendous power, the artificial breakdown or fission of a large amount of uranium would mean an even more terrible, powerful force of radiation.

Therefore, every country looks for uranium material to make atomic bombs. However, the destruction of the atomic nucleus requires a collision with a high energy particle.

In the research stage before the war the initial fission reactor apparatus was so unwieldy that atomic bombs were not considered a useful weapon. After the beginning of the war, scientists of many countries worked to discover a simple and light apparatus for the destruction of the atomic nucleus. Of course, our country was progressing in its atomic research, but we had only a few scientists specializing in the field, as well as capable assistants who were drafted, and only a little money left for research. Therefore, with great numbers of scientists and such a large budget of \$1.2 billion US dollars and reliable and serious military support, American scientists were able to complete the development of atomic bombs first.

SECTION 2

Circumstances of the bombing

Surprise bombing

There was a public announcement that a new type of bomb was dropped on Hiroshima, August 6, 1945, which resulted in substantial damage.

Because the announcement did not offer further details, people were not prepared for the atomic bomb. Therefore, when Nagasaki was attacked with the same bomb on August 9, the military, government, and people were caught off guard. Even though I was interested in the atomic bomb,

I did not know of its existence until I saw the enemy's propaganda leaflets scattered that night. The truth of the situation is that the entire Japanese population was caught by the surprise lesson from the enemy.

Bombing method

It was an ideal day for bombing. From the preceding day, a few enemy planes were circling Nagasaki air space constantly. In retrospect, these were reconnaissance flights observing the weather and activities of the people.

However, all enemy planes eventually cleared the Kyushu district and the air-raid alarm ended at about 10 : 00 a.m. The people of Nagasaki came out of their shelters and started to work seriously in each of their work stations. At this time, an enemy plane, carrying the Devil, came through Shimabara from the direction of Nobeoka, and skillfully intruded into Nagasaki. At 11 :02 a.m., the enemy plane slid into Nagasaki, stopped its engines, and dropped a bomb with a parachute at 8,000 meters altitude. The enemy plane ascended at full speed immediately after dropping the bomb and got out of the way. The people who realized it was an enemy raid hurriedly jumped into shelters. However, the sound waves from the descending bomb took a few moments to reach the surface of the ground. The bomb exploded in the next moment following the hearing of the sound. The epicenter of the explosion must have been 500 meters above Matsuyama-machi.

From a tactical viewpoint, the target point slipped to the north. Perhaps the main target was Ohato pier, but it deviated northward by mistake. If the bomb had dropped on the pier, the entire city of Nagasaki, including Urakami, would have been annihilated with only one bomb.

Experiencing the bomb blast

First, people heard the unusual roaring of an engine, followed by the flash of a very bright white light. Some people said that the earth's surface lit up red. The people called this pika, which means a lightning bolt from the blue sky visible to the naked eye. Moreover, anybody facing the epicenter or the opposite direction must have seen the same thing, a flashing light which must have covered the entire sky. The people in the hypocenter felt heat on their skin. Following that came the blast of the atomic bomb.

Hell on earth

Everything on the earth was shattered instantly. The earth became bare ! Within one kilometer, wooden buildings were smashed. Steel concrete buildings collapsed. Factories were flattened. Tombstones were knocked over. The leaves of plants were blown away. Big or small, all trees fell down. Any living creature outside, from insects to cows, horses, humans, died instantly. People were buried by their own houses collapsing on them. In one moment, the Urakami area had changed to a hell on earth. It took only one moment.

Everywhere, brush fires started, yet there were no survivors who could fight the fire. The whole area became a sea of fire. Everybody, including the dead and injured, was burned by this conflagration. Survivors received whole body doses of strong radiation, which became a kind of radiation poisoning, because of which they could not keep up their fighting spirit. Their movements were dull.

This horrific scene has been branded on my mind. I will never forget. It is far beyond my ability to describe. This must have been the Apocalypse or a scene right out of hell. How awful was the sight of groups of people climbing the hills on the far side to avoid the fire. The injured also pulled their dying friends. Children carried their dead parents ; parents held the corpses of their children, as they desperately climbed the hill. Their skin was stripped, stained with fresh blood. Everybody was naked. They kept looking back at the spreading flames, as they sought safety.

Was anyone there to help? Moaning, crying out, some of them faltered and died. Some of them became insane and just kept running around. Here and there voices called for help, screaming out from burning, fallen houses. This scene was profoundly sad. The pass on the hill to the valley was filled with dead and injured people moaning, "Please help me, please give me water." And there was no place to rest.

At first glance, perhaps 20,000 people died instantly, and several tens of thousands of injured would be numbered. The worst things were that the university's emergency medical organization and equipment, expected to perform well, were in the hypocenter. Not only was the building destroyed and burned, the president was injured, the hospital superintendent was dead, and most of the staff members, students and nurses, were dead or injured. Rescue activities were totally lost.

Immediately after the bombing, a giant and thick gas like cloud covered the entire hypocenter. Because of this, people in the hypocenter lost vision for one or two minutes. People in the far distance recognized many lightning like flashes in the gas cloud. The gas cloud gradually ascended, staying above the sky even in the night.

Two hours later, the burning fire reached its maximum intensity. The local winds often changed direction. At 1 : 00 p.m., the weather was still sunny. Big black drops of rain fell from the clouds. The enemy planes kept coming back for reconnaissance. The burning fire gradually subsided, but it continued to burn and spread around even into the night.

Scene in the night

The sun set. A cool new moon lighted low above Mt. Inasa. The gas cloud was still hanging in the air. The apocalyptic flames of the end of the world illuminated the city. The wind gradually calmed down. Choral singing of "Umiyukaba" arose from the valley. The hymn continued from the fields, purifying the minds of the dying people.

Patients on the hill cried for help. The patients lying next to me asked for "water, water." Survivors and the dead stayed overnight in the fields

under constantly low flying enemy planes.

SECTION 3

Function of the atomic bomb

Mechanism of action

With the above conditions described and the investigation after the bombing, the function of the atomic bomb must be hypothesized as follows : the used atom must be of the uranium or radium series. However, it would not be possible to estimate its atomic weight.

Three kinds of power

By the fission of a great amount of atoms at the same time, potent energy was released. What flew out of the explosion? I would hypothesize the energy to be three kinds of matter : particle group, electromagnetic waves, and atomic energy, particularly atomic nuclear energy.

Particle group

First, neutrons, protons, and electrons which resulted by the complete fission of atoms ; Second, atoms of an unstable condition just prior to the fission ; Third, new elements, e.g. radium, radiation atoms created from the atomic fission ; Fourth, uranium atoms of incomplete fission. These are solid particles below the second group, which have the potential to be radioactive after decaying naturally. This is the cause of long term radiation affecting human bodies at the hypocenter after the bombing.

Electromagnetic waves

Fifth, nuclear vibrations at the time of the atomic bomb explosion were ejected as radiation. These electromagnetic waves were a mixture of wavelengths. One of them was long wavelength like a heat wave. This gave heat to skin and caused burns. Also, there was visible light, which was visible as flashes. Ultraviolet rays were probably ejected also.

Furthermore, it has been theoretically known that short wave electromagnetic waves such as X-rays and gamma rays with strong penetration power were produced. In retrospect, human body disorders developed later after exposure to such large amounts of gamma rays.

Also, cosmic like rays could be mixed in the ejection.

This is electromagnetic wave in contrast to previously-mentioned solid particle rays.

Atomic energy

The next is the release of energy, i.e. the main power of the atomic bomb explosion. The tremendous power of matter potentially present since the beginning of the world is released in a single stroke by nuclear fission.

This is similar to condensed air spreading with great speed when a container is broken. This spreading becomes a storm-like explosion that destroys everything. It is believed that the previously mentioned three kinds of power comprise the force of the atomic bomb : destruction is by atomic energy, primary body injury is by electromagnetic wave, and secondary body injuries are caused by the particle group.

Speed

Because the speed of electromagnetic waves is 300,000 kilometers per second, it takes one electromagnetic wave 600,000ths of a second to reach 500 meters, from the air to the ground, which is to say the time is momentary. Therefore, as soon as one sees the flashing light, electromagnetic waves have already passed through the body ; irreversible injuries are already present. So, people who jumped into the shelter after seeing the flashing light, even those not injured by the blast, had already received atomic radiation. These people were not injured initially, but developed many severe symptoms later. The speed of the blast was almost the same as sound waves. But, I do not know if the speed is exactly the same or not. The speed of this particle group is unclear. However, I would imagine that there are different speeds according to the composition of particle.

Reaching distance, distribution density, reflection interference

The flashing light appeared to be the greatest in the reaching distance. Considering the distribution density of particle, there were more groups of particle in some places, less in others. The idea that the density was not even became theoretically and practically sound considering that there was quite a difference in the prevalent rate of secondary radiation injuries in later days.

The electromagnetic wave blasts also probably had inconsistent particle density. The electromagnetic waves were probably even in each direction. Because Urakami's geographical features resemble a ship-conformation with reflecting mountains on each side, the directions of the blast became complicated and stirred up the ground. This made blast results different from Hiroshima, which is on flat ground. The interference of the blast waves by the mountains, seen in the wind's sand lines, was visible from the university playground. Also, the houses on the hillside were seen to move away from the direction of the associated and yet also from the reflected direction of the hill. Some people heard two consequent sounds of the bomb blast. There are many houses whose indoor items were stirred up.

Also, it is considered that the direction of the blast reflected off the ground and moved parallel to the ground surface. Houses a short distance from the hypocenter had their floor joists collapsed and the tatami mats on the first floor were blown up. The stone fences on the road were seen to be pushed horizontally, even towards the direction of the hypocenter. Many Western-style tombstones were also seen to have moved hori-

zontally.

Ionization

There is no question that negative and positive ions were made when short wave electromagnetic waves, like gamma rays, passed through the air. The particle group passed through next. Probably, this particle group ionized molecules in the air. On the other hand, the particle group was electrically neutral, but there were many others negatively or positively charged according to electrified bodies in the air conjugated or repelled each other, which must have started a chemical reaction. This must have been the cause of the thick gas cloud that developed. Also, many small flashing lights in the gas cloud must have been caused by the electric discharge during neutralization. The negative or positive electrified body loitered on their way like that. However, the neutrons went straightaway to exhibit their great power on the earth, without any interference.

Secondary radiation

Farther on, these electromagnetic waves and particle groups developed secondary dispersion rays as they went through the air. This secondary radiation was also electromagnetic waves and particle radiation. The radiation, which reached the ground, was primary radiation ejected from the bomb, adding to the secondary radiation.

In general, radiation penetrated substances. Ultimately it was absorbed and showed its effects. It is considered that the radiation was very powerful and destroyed the atoms of any substances it penetrated, causing a secondary atomic explosion. It is questioned if this secondary atomic explosion was powerful at the time the bombing observation. For example, the surface of the roof tiles of unburned houses became roughened. And, most interestingly, the shadows of grass were implanted negatively on electric poles. If this was from primary rays coming from above, the grass blades shadows should have been cast down onto the ground. To implant a silhouette from above on to an electric pole, from a ground source, there must have been reflection from below to above. In conclusion, the shadows on the poles must have been the result of secondary radiation.

Absorption by water

There was an interesting case regarding water absorption. Three children were swimming in the river. Two of the children were diving about half a meter deep into the water. One just floated, exposing his back to the surface. The first two had no burns, only the third child received burnt skin injuries on his back. Also, goldfish in the water tank survived. The water easily absorbed the neutrons.

In this case, neutrons were the main cause of destruction. But, heat rays will also be absorbed by 50 centimeters depth of water.

CHAPTER 2

Main Features of Radiation Disorder

Latent period

Radiation may cause destructive and regressive changes of the tissue cells. These changes take awhile to show symptoms. There is a so-called latent period.

This time, some people developed severe symptoms later, even days after they had received no apparent injuries that day (of the bombing).

Tissue sensitivity

The sensitivity of tissues exposed to atomic radiation is different for each tissue. However, the most sensitive tissues with the most severe damage appeared to be the bone marrow and the lymphatic system. At this time, blood disorder of the bone marrow was remarkable, followed next by the thymus, then reproductive gland. These symptoms were also recognized at this time.

Next the mucosa is frail (and vulnerable to atomic radiation).

This time, symptoms of disorder to the digestive systems' mucosa developed in early stages. Almost all victims developed diarrhea. Lots of people became critically ill and died. The exocrine organs and hair papilla were damaged. Depilation (hair loss) was seen quite often at this time.

The skin was quite resistant. Instant skin pseudo-burns were due to long wave heat rays. Radiation injury by short wavelength rays could develop later. Medium damage occurred to the lungs, kidneys, adrenal, liver, and pancreas.

Muscle, connective tissue, blood vessels, cartilage and bone were resistant (to atomic radiation). The most resistant (to damage) was believed to be nerve cells. However, if there were large doses of nerve irradiation at the time, the resistant tissue was also changed.

There was a correlation between the ages of the victims and their tissue sensitivity to atomic radiation. Infants and small children had more injury to their cell tissue. Cells are more sensitive when developing, becoming more resistant when matured. Also, an individual's physical constitution is related to how much cellular damage his tissue sustains.

Tissue injuries

The lymphatic cells were destroyed most severely. But, their power to reproduce was also strong. The spleen, lymph nodes, tonsils are examples of this reproductive power. In bone marrow, first the lymphatic cells were destroyed. Next, the cells of the hematopoietic system were destroyed, followed by red blood cells. If the damage was severe, the bone marrow would become fibrosed.

The reproductive organs were quite often destroyed. Irregularity of menstruation and infertility occurred. It might be temporary with a small dose of radiation, but permanently sterilizing in larger doses. There were cases of malformed infants at birth, which could have miscarried during pregnancy.

In the liver, spotty necrotic foci developed. The pancreas, which decreased its secretion, also developed fibrous scars. The kidneys also showed signs of atrophy. Their function was disturbed and water (urine) output decreased. It could have been due to nephritis. The lungs developed the pathology of pneumonia. Each secretory organ decreased its secretion. The growth of bone cartilage in small young infants was disturbed in their growth. The gastro-intestinal mucosa developed inflammation, which could form ulcers.

Symptoms of diarrhea were certain; they may be associated with bloody stool, tenesmus and frequent colic. The eyes developed cataracts. The changes to blood are remarkable. Coagulation time was prolonged. Platelets decreased. Hemolysis of the red blood cells became visible, which caused hemorrhagic diatheses. The amount of white blood cells increased slightly immediately after irradiation. Later, they remarkably decreased. And then again the white blood cells increased and could become leukemia.

Whole body injuries

The whole body injury symptoms are obvious. Subjectively, one complains of fatigue, apathy, headache, loss of appetite, and nausea. This so-called radiation sickness could happen immediately or on the following day. The duration (of illness) varies and could be prolonged up to two weeks.