Mahatten Project Essay, Research Paper

Manhattan Project and the A-Bomb

Just before the beginning of World War II, Albert Einstein

wrote a letter to President Franklin D. Roosevelt. Urged by

Hungarian-born physicists Leo Szilard, Eugene Wingner, and Edward

Teller, Einstein told Roosevelt about Nazi German efforts to purify

Uranium-235 which might be used to build an atomic bomb. Shortly after

that the United States Government began work on the Manhattan Project.

The Manhattan Project was the code name for the United States effort

to develop the atomic bomb before the Germans did. “The first

successful experiments in splitting a uranium atom had been carried

out in the autumn of 1938 at the Kaiser Wilhelm Institute in

Berlin”(Groueff 9) just after Einstein wrote his letter. So the race

was on. Major General Wilhelm D. Styer called the Manhattan Project

“the most important job in the war . . . an all-out effort to build an

atomic bomb.”(Groueff 5) It turned out to be the biggest development

in warfare and science’s biggest development this century. The most

complicated issue to be addressed by the scientists working on the

Manhattan Project was “the production of ample amounts of ‘enriched’

uranium to sustain a chain reaction.”(Outlaw 2) At the time,

Uranium-235 was hard to extract. Of the Uranium ore mined, only about

1/500 th of it ended up as Uranium metal. Of the Uranium metal, “the

fissionable isotope of Uranium (Uranium- 235) is relatively rare,

occurring in Uranium at a ratio of 1 to 139.”(Szasz 15) Separating the

one part Uranium-235 from the 139 parts Uranium-238 proved to be a

challenge. “No ordinary chemical extraction could separate the two

isotopes. Only mechanical methods could effectively separate U-235

from U-238.”(2) Scientists at Columbia University solved this

difficult problem. A “massive enrichment laboratory/plant”(Outlaw 2)

was built at Oak Ridge, Tennessee. H. C. Urey, his associates, and

colleagues at Columbia University designed a system that “worked on

the principle of gaseous diffusion.”(2) After this process was

completed, “Ernest O. Lawrence (inventor of the Cyclotron) at the

University of California in Berkeley implemented a process involving

magnetic separation of the two isotopes.”(2) Finally, a gas centrifuge

was used to further separate the Uranium-235 from the Uranium-238. The

Uranium-238 is forced to the bottom because it had more mass than the

Uranium-235. “In this manner uranium-235 was enriched from its normal

0.7% to weapons grade of more than 90%.”(Grolier 5) This Uranium was

then transported to “the Los Alamos, N. Mex., laboratory headed by J.

Robert Oppenheimer.”(Grolier 5) “Oppenheimer was the major force

behind the Manhattan Project. He literally ran the show and saw to it

that all of the great minds working on this project made their

brainstorms work. He oversaw the entire project from its conception to

its completion.”(Outlaw 3) Once the purified Uranium reached New

Mexico, it was made into the components of a gun-type atomic weapon.

“Two pieces of U-235, individually not large enough to sustain a chain

reaction, were brought together rapidly in a gun barrel to form a

supercritical mass that exploded instantaneously.”(Grolier 5) “It was

originally nicknamed ‘Thin Man’(after Roosevelt, but later renamed

‘Little Boy’ (for nobody) when technical changes shortened the

proposed gun barrel.”(Szasz 25) The scientists were so confident that

the gun-type atomic bomb would work “no test was conducted, and it was

first employed in military action over Hiroshima, Japan, on Aug. 6,

1945.”(Grolier 5) Before the Uranium-235 “Little Boy” bomb had been

developed to the “point of seeming assured of success,”(Grolier 5)

another bomb was proposed. The Uranium-238 that had been earlier ruled

out as an option was being looked at. It could capture a free neutron

without fissioning and become Uranium-239. “But the Uranium-239 thus

produced is unstable (radioactive) and decays first to neptunium-239

and then to plutonium-239.”(Grolier 5) This proved to be useful

because the newly created plutonium-239 is fissionable and it can “be

separated from uranium by chemical techniques,”(6) which would be far

simpler than the physical processes to separate the Uranium-235 from

the Uranium-238. Once again the University of Chicago, under Enrico

Fermi’s direction built the first reactor. “This led to the

construction of five large reactors at Hanford, Wash., where U-238 was

irradiated with neutrons and transmuted into plutonium.”(6) The

plutonium was sent to Los Alamos. The problem to overcome in the

development of the plutonium bomb was an isotope of plutonium. The

scientists feared this isotope would cause premature detonation and

most of the plutonium would blow apart before it could all fission.

“To overcome this so-called ‘defect of nature, ‘ the plutonium had to

be brought into a supercritical mass far faster than conventional

ballistics could achieve.”(Grolier 6) Physicist Seth Neddermeyer and

mathematician John von Neumann devised the theory of “implosion.” A

subcritical sphere of plutonium was surrounded by chemical

high-explosives. The 5,300 pounds of explosives were all “carefully

shaped as ‘lenses.’ When these were detonated, they focused the blast

wave so as to compress the plutonium instantly into a supercritical

mass.”(Szasz 25) This was much more complex, and many people doubted

that it would work. There was a debate at Los Alamos about whether to

test the new plutonium ‘implosion’ bomb before it was actually

dropped. “Harvard explosives expert George B. Kistiakowsky and

Oppenheimer both argued for such a test, but initially Groves was

opposed. He was afraid that if the test failed, the precious plutonium

would be scattered all across the countryside.”(Szasz 26) Brigadier

General Leslie R. Groves, the man the army placed in charge, was

eventually persuaded. Hanford’s plutonium production was increasing

fast enough so that a test would cause little delay in time. They

feared that if they dropped the untested plutonium bomb and it failed

to work, “the enemy would find themselves owners of a ‘gift’ atomic

weapon.”(Szasz 26) The final agreement for the test was that the bomb

would be placed in “a gigantic, 214-ton, cylinder-shaped tank (called

‘Jumbo’).”(Szasz 26) If the plutonium correctly fissioned, the tank

would be vaporized. If it did not work correctly, the conventional

explosives would be contained in the tank and the plutonium would stay

in the tank. After further development of the implosion design and

fears that “Jumbo” would dramatically distort all “their complicated

instrumentation-the raison d’?tre for the test,”(Szasz 36) the

world’s largest pressure tank was not used. On Monday, July 16, 1945,

at 5:29:45 A.M., Mountain War Time, the plutonium bomb ignited at the

Trinity site, a remote site in the New Mexico desert. “The explosion

created s brilliant flash that was seen in three states.”(Szasz 83)

There were many reports from civilians from all over that described

the experience. People who saw it said it looked like the sun had

risen for a few minutes and then went back down. Others thought they

had seen a large plane or meteor crash. A sheep herder who was laying

sleeping on a cot fifteen miles away was blown off. “The Smithsonian

Observatory on Burro Mountain confirmed a shock but noted that the

vibrations were unlike any earthquake ever recorded.”(Szasz 84) An

eight year-old boy was awakened and ran for his Methodist parents, and

they considered if this might be the end of the world. The most

powerful statement that has been cited in practically every coverage

of the atomic bomb is Georgia Green’s experience. She was being driven

to Albuquerque. “What was that?” she asked her brother-in-law, who was

driving. This was very unusual because Georgia Green was blind.

Brigadier General Farrell wrote a letter for the Secretary of War.

“‘No man-made phenomenon of such tremendous power had ever occurred

before . . . Thirty seconds after the explosion came, first, the air

blast pressing hard against people and things, to be followed almost

immediately by the strong, sustained, awesome roar which warned of

doomsday and made us feel that we puny things were blasphemous to dare

tamper with forces heretofore reserved to the Almighty. Words are

inadequate tools for the job of acquainting those not present with the

physical, mental and psychological effects.”(Groueff 355) Upon

witnessing the explosion, reactions among the bomb’s creators were

mixed. Their mission had been successfully accomplished, however, they

questioned whether “the equilibrium in nature had been upset — as if

humankind had become a threat to the world it inhabited.”(Outlaw 3)

Oppenheimer was ecstatic about the success of the bomb, but quoted a

fragment from Bhagavad Gita. “I am become Death, the destroyer of

worlds.” Many people who were involved in the creation of the atomic

bomb signed petitions against dropping the bomb. The atomic bomb has

been used twice in warfare. The Uranium bomb nicknamed “Little Boy,”

which weighed over 4.5 tons, was dropped over Hiroshima on August 6,

1945. At 0815 hours the bomb was dropped from the Enola Gay. It missed

Ground Zero at 1,980 feet by only 600 feet. “At 0816 hours, in the

flash of an instant, 66,000 people were killed and 69,000 people were

injured by a 10 kiloton atomic explosion.”(Outlaw 4) [See blast ranges

diagram] Nagasaki fell to the same treatment as Hiroshima on August 9,

1945. The plutonium bomb, “Fat Man,” was dropped on the city. It

missed its intended target by over one and a half miles. “Nagasaki’s

population dropped in one split-second from 422,000 to 383,000. 39,000

were killed, over 25,000 were injured. That blast was less than 10

kilotons as well. Physicists who have studied the atomic explosions

conclude that the bombs utilized “only 0.1% of their respective

explosive capabilities.”(Outlaw 4) Controversy still exists about

dropping the two atomic bombs on Japan. Arguments defending the

Japanese claim “the atomic bomb did not win the war in the Pacific; at

best, it hastened Japanese acceptance of a defeat that was viewed as

inevitable.”(Grolier 8) Other arguments state that the United States

should have warned the Japanese, or that we should have invited them

to a public demonstration. “In retrospect that U.S. use of the atomic

bomb may have been the first act of the cold war.”(Grolier 8) On the

other side, advocates claimed that the invasion of the Japanese

islands could and would result in over one million military casualties

plus the civilian losses based on previous invasions of Japanese

occupied islands.