

# The manhattan project



<http://ageer370.wordpress.com/brutus-and-mark-antony-an-analysis-of-their-pervasive-styles-of-persuasion/>The Manhattan Project QUANTA TO QUARKS Gather process and analyse information to assess the significance of the Manhattan Project to society.

The top secret ??? Manhattan Project???, set up in 1942, was the code name used for the United States effort to produce the first atomic bomb during World War II. Its objective was to research nuclear fission and to develop an atomic bomb before Nazi Germany could [5]. The Manhattan Project had, and continues to have a significant effect and presents some difficult questions to be considered by science and society. In 1938, German scientists, many of whom were refugees from Nazi Persecution, discovered nuclear fission and raised the possibility that Nazi Germany might develop an atomic bomb.

In 1939, Physicists Leo Szilard, Edward Teller and Eugene Wigner convinced Albert Einstein to write his famous letter (outlining the danger of nuclear research in Nazi Germany and advocating the immediate development of an atomic bomb) to the then President of the USA, Franklin D. Roosevelt. Einstein had written to inform Roosevelt that research leading into chain reactions utilising uranium made it probable that an ample amount of power could be produced by a chain reaction and that by harnessing this power, the construction of the atomic bomb was possible. Following this ??? letter of concern???, Roosevelt set up an Advisory Committee on Uranium in October that year [2] and L. J. Briggs, director of the National Bureau of Standards headed a committee supported by a mere \$6, 000 to start research on the project [5].

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It was conceived that there were two different pathways to an atomic bomb, using uranium-235 (U-235) or plutonium- 239 (Pu-239) as a fuel. The most complicated issue was to produce ample amounts of each of these to sustain a chain reaction. By March 1940, it was confirmed that the isotope U-235 did undergo fission with slow electrons. However, U-235 only constitutes to a small percentage of Uranium, the majority being U-238 (which does not fission withy slow electrons)[2].

Theoretically, two possible processes used to separate U-235 from U-238 were Gaseous diffusion and Electromagnetic separation. Through gaseous diffusion, enriched uranium was able to be produced by converting the uranium metal to the gas uranium hexafluoride, allowing it to pass through a series of membranes. It was hypothesised that the lighter U-235 would more readily diffuse and so its concentration would be increased after each membrane.

A separation of U-235 and U-238 could also be achieved through electromagnetic separation. By bending a current of uranium ions in a magnetic field, the lighter U-235 ions would bend more easily than the heavier U-238 ions, thereby allowing them to be separated. In mid 1941, plutonium was identified and its ability to undergo fission was proven (and at a higher rate than U-235). Vast amounts of electricity and large complex facilities and plants were constructed to produce U-235 from natural uranium and Pu-239 from the neutron bombardment of U-238 [5]. On 7 December, The Japanese attacked Pearl Harbour which brought America into WW II.

This ultimately accelerated the rate of production for the atomic bomb. In May 1942, the army, under the command of Colonel Leslie Groves, was brought into the construction activities necessary for the Manhattan Project to proceed. Groves purchased a site at Oak Ridge Tennessee for the gaseous diffusion plant and appointed the theoretical physicist Robert Oppenheimer to direct the actual weapon design and manufacture. In 1942, Enrico Fermi and his scientific team designed the first nuclear reactor, which was built in a squash court at the University of Chicago. As part of this process, Fermi was able to develop the required technology incorporating fuel rods, moderator and control rods to produce the first- self sustaining, and controlled chain reaction in December of that year. The theoretical work on the atomic bomb was done at Los Alamos in New Mexico where a secret laboratory was built on the site of a boys ranch school.

This is where the greatest scientists of the world gathered to build ??? the weapon??™ of mass destruction. By 1945, sufficient U-235 had been produced (through gas diffusion and then electromagnetic separation) to be fashioned into a bomb. The uranium bomb, known as the gun-type bomb, consisted of a piece of U-235 in a barrel that could be fired into another piece of U-235 to assemble the super-critical mass. As well, the production of Pu-239, produced by bombarding U-238 in a reactor in Hanford Washington was proceeding. The Pu-239 bomb was made by having a sphere of Pu-239 surrounded by explosives to form the super-critical mass [2]. The first atomic bomb, using Pu-239 was exploded on 16 July 1945 near Alamogordo, New Mexico.

The bomb generated an explosive power equivalent to 20,000 tonnes of TNT. It was not thought necessary to test the U-235 bomb as it used a simple method of assembling the super-critical method, and so, the uranium bomb was dropped without a test. With Germany defeated and surrendering just as the project reached success, many of the scientists strongly opposed the actual use of the atomic bombs on Japan and petitioned for the Japanese to be warned of the awesome power a nuclear weapon can release. The consequences of the development and use of these weapons were to have a significant effect on science and society [6]. On 6 August 1945 the U-235 bomb (nicknamed little boy) was dropped on Hiroshima. Three days later a Pu-239 bomb (nicknamed fat boy) was dropped on Nagasaki. Japan officially surrendered on August 15 1945. The Manhattan Project was the largest and most costly project of the war.

The original \$600 million authorised, grew to \$2 billion in 1945 dollars [5]. The results of the Manhattan Project are a source for endless controversy. One of the most significant impacts of this project occurred when the two bombs were dropped on Hiroshima and Nagasaki.

The use of the bombs brought an end to WW II and an end to what could have been a prolonged conflict. However, it also led to the deaths of millions of Japanese civilians. The rain that follows an atomic bomb is heavily contaminated with radioactive particles and so, many survivors of the initial blast, eventually died from radiation poisoning. Those that didn't die suffered severe burns, nausea, fatigue, hair loss and diarrhoea, and passed on leukaemia and other such cancerous diseases to their offspring [4]. The Manhattan Project drew incredible financial support from the US government.

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Therefore, money used into researching the possibility of an atomic bomb could have contributed towards positive resources such as medical care for wounded soldiers and financial relief of soldiers that were killed during the war. Also, the development of nuclear weapons created great stresses to society on a global basis. The Cold War that followed led to the US and Soviets building up huge arsenals of nuclear weapons and to the development of even more powerful, nuclear weapons.

This threat of nuclear war between the superpowers caused great concern for many and shaped the political atmosphere and social change. However, the immediate result of the Manhattan Project i. e. the bombs in Japan, meant that every country saw the devastating potential of these weapons, which was one of the reasons why no atomic bombs were used during the Cold War. As such, the Manhattan Project led to the abandonment of use of the atom bombs in war since the end of World War II [3].

Technologies arising from the Manhattan Project were significant scientific advances to society and brought into strong focus the role of science and the discoveries it makes. The field of medicine has taken advantage of the atomic bomb as the technology used in the atomic bomb is also used for CAT scans and chemotherapy. Enrico Fermi's development of the first nuclear reactor, (which perfected a controlled fission reaction) made possible the development of nuclear power as a source of energy.

As society becomes increasingly aware of the negative impacts of polluting the environment such as the depletion of the ozone layer ??? global warming??™ and ??? climate change??™, nuclear power has brought about

benefits as it is a much cleaner source of energy, a more efficient means of generating electricity and is potentially less dangerous to the environment when compared to the burning of fossil fuels. Many are beginning to look at nuclear power in a much more favourable light as it can supply large amounts of energy, while producing minimal amounts of the greenhouse gases, responsible for causing climatic problems. This will see them become far more important to science and society as choices for energy consumption and production become even more pressing.

However, nuclear power stations, and the waste they produce, have become targets for protest by some parts of the community. Disasters like Chernobyl (a nuclear accident which occurred in 1986, which resulted in a severe release of radioactivity following a massive power excursion that destroyed the reactor), led many people strongly opposing their use [1]. Ultimately, as can be seen the Manhattan Project had a significant impact on society due to its negative effects in the deaths of Japanese civilians, the passing of cancerous diseases to the generations, The devastating Chernobyl Disaster, the fear and tension that it caused and the ample expenditure used to fund the research.

The project also had a positive influence on society, in increasing public interest for the use of nuclear power as an alternative to the burning of fossil fuels, for its applications in industry and medicine (from the technology arising from the project), the realisation that nuclear weapons can have a devastating impact on society (as seen from the bombings in Japan) and it essentially brought an end to WW II. Hence, in assessing the significance of the Manhattan Project on society, it can be argued that although there are

strong points disfavoured the project, one advantage outweighs all the potential disadvantages—that is, the global realisation of the devastating effects the releasing of an atomic bomb can have. This realisation is why countries have not used atomic bombs after WWII, even though in today's society, the world has developed more powerful weapons of mass destruction with potentially catastrophic effects for humanity. Essentially, the main point is that the atomic bomb would have been developed one day, (if not because of the Manhattan Project), due to the curiosity of mankind to discover, experiment and develop. For this reason, it becomes important to appreciate that because of the Manhattan project, a particular country is unlikely to use an atomic bomb to destroy another country, as global communities are aware of the devastating effects this can have. Bibliography [1] Chernobyl Disaster.

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