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THE ETHICS OF NUCLEAR WEAPONS

An Interactive Qualifying Project Report

submitted to the Faculty

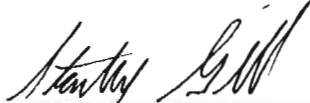
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## **ABSTRACT**

Nuclear weapons could very well be responsible for the end of civilization, as we know it. Developed during World War 2 in a race against Germans and their believed superior technology, we wish today that the Manhattan Project had been abandoned immediately following the discovery that Germany had failed in their attempt. Although nuclear weapons have successfully accomplished their goal of mass destruction, they have failed as a science or technology to positively contribute towards, or benefit, society.

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## **Introduction:**

Nuclear weapons became part of our culture about sixty years ago when scientists first discovered that they could split the atom releasing incredible amounts of energy. The realization that this discovery could lead to weapons of extraordinary power was conceived of rather quickly. Since then over 2000 nuclear weapons have been detonated, detrimentally affecting the entire planet.<sup>1</sup> These weapons of mass destruction have served no good to the peoples of the world and have caused nothing but harm to the Earth and its inhabitants. Fear of nuclear weapons and the damage they can cause is not an empty threat that people should become desensitized to or ignore. Thousands of nuclear weapons still lay dormant, ready to attack at a moment's notice from numerous locations throughout the world.<sup>2</sup> If a nuclear weapon were launched at and detonated on the United States in a hostile fashion, killing hundreds of thousands of friends and family, retaliation would be the first reaction on many citizens' minds. One bomb leads to another, which leads to another, and eventually every country with nuclear capability is depleting its entire arsenal, until the world ceases to exist.

In a society where the subject of nuclear weapons is commonplace, it is hard to imagine what the world would be like today without them. If the United States had never completed the Manhattan Project that created the first nuclear weapon during World War II, would the world be free of such a horrible device today? Adults and children alike all over the world have been exposed to the knowledge of the effects of nuclear warfare. Whether it is the theme of the latest video game currently on the birthday wish list of every child, or a topic on the nightly news, everyone to some extent

has been familiarized with nuclear weapons and the threat they pose.<sup>3</sup> What started with an accidental scientific discovery of the properties of elements, further evolved into a scientific theory in Germany, and later developed into the most destructive man-made creation in a lab in New Mexico potentially threatened every life on this planet.<sup>4</sup> How did a purely scientific discovery eventually progress into such destructive technology?

Most people believe that science and technology exist for the betterment of society. Prime examples of people who have put science or technology to good use are Jonas Salk and Henry Ford. Jonas Salk through science and medicine created the Polio vaccine- a medical treatment and cure that saved or improved the lives of a significant portion of the population at a time when this crippling disease was very common and widespread. Many at that time had either a family member or someone they knew that was inflicted with the disease, and this vaccine was considered a miracle at the time to these people. This is an example of how science can be used to save humanity, and how it possesses the potential to create something extremely beneficial for the people of the world.

Henry Ford, through the use of technology, improved the lives of many people in the wealthier countries. His company's assemble lines mass-produced the first automobiles, making them available to a large number of people for minimum costs. A fifty-mile trip that a century ago would have been considered a mass undertaking lasting a day or more can now easily be made in an hour. Automobiles and hour-long commutes are now considered part of daily life, at worst looked upon as an inconvenience rather than a trip that must be planned for days ahead of time. Society

would not be able to function as it does without this development. By using technology properly, Mr. Ford expanded our accessibility to other places and new things while dramatically reducing the hassles of transportation, as they had been known.

In each case, science or technology was put to a positive use that ultimately benefited humanity. Almost no one would be willing to give up either of these developments because they have drastically affected and improved everyday life. The next question that must be asked is whether or not we are better off today as a result of the creation of nuclear weapons. Those who claim that the world was improved with the invention of nuclear weapons have brought up the point that the United States won the war and maintained its freedom as a result of the development and implementation of nuclear weapons during World War II. This, however, is not the case. Hitler's Germany had already been defeated and surrendered before the completion of creating any nuclear weapons. Fascist Germany posed no threat to the American way of life when the first working bombs were finished. The bombs designed at Los Alamos, New Mexico were solely used on the Japanese, which could not have defeated the allied forces of the United States, Britain and the Soviet Union on its own. The bombs may have quickened the pace in which the war was won. But were they truly necessary? The combined military forces could probably have won with conventional warfare alone. Until August 6, 1945, the only war the world knew how to fight was through conventional warfare. When Japan went on the aggressive and bombed Pearl Harbor, they attacked with the same weapons that all other nations in the war possessed. Conventional warfare had never failed to produce success for one side or another

before. Why did nuclear weapons have to be used to defeat one country at the end of World War II?<sup>5</sup>

The other claimed purpose of nuclear weapons after World War II is that of deterrence against any further conflicts. Many believe that the United States and the Soviet Union never got involved in a physical war because of their possession of nuclear weapons. But, as will be demonstrated later, this may not have been the case at all. The development of each country's nuclear arsenal caused stiff competition between the two, but it was not the reason that no war ever broke out. No other reasons powerful enough to cause an all out war may have ever existed.<sup>6</sup>

The goal of this paper is to demonstrate that nuclear weapons are an example of science and technology going bad. It will be shown that this technology has not done anything to benefit all of humanity. In fact, examples will be given where the testing of nuclear weapons has harmed the environment and those who live in it. A technology could be considered having gone bad when it fails to succeed in its purpose. What is the purpose of designing and constructing nuclear weapons, and have they accomplished what they were meant to? These questions will be answered in later sections of the paper.

## History:

Before an analysis of nuclear technology can be conducted, it is necessary to understand how the technology was created and where it came from. What were the reasons for first creating the weapons? Was it absolutely necessary for the survival of the human species and western culture to build and eventually use nuclear weapons? Also, how did the first discovery of radioactivity eventually lead to the construction of tens of thousands of weapons of mass destruction, capable of ending life on Earth? These are the questions that will be discussed in this section.

In 1896, while investigating the property of fluorescence in uranium salts, the French chemist Antoine Henri Becquerel accidentally discovered radioactivity by noting that the photographic plate upon which his uranium-containing pitchblende had been resting upon was fogged. Although he initially believed this to be a luminescence effect, continued probing found that luminescence was not involved at all. He also discovered that not just a few of the uranium salts did this, but in fact all compounds would produce this same effect.<sup>7</sup> Becquerel laid the groundwork for further investigation, however his discovery was not fully appreciated until accompanied by the work of Marie and Pierre Curie. Pierre discovered uranium, plutonium, and radium in pitchblende in 1898 during his work as a chemist and physicist. Marie, also a chemist, gave the name radioactivity to the emission of radiation from an atom.<sup>8</sup> In 1903, all three scientists shared the Nobel Prize in physics for their advancements and discoveries dealing with nuclear radiation and radioactivity.<sup>9</sup>



These three individuals used science to uncover secrets of nature, and were recognized and rewarded for their work. This hypothesis leads to the theory that it is not the scientific information itself, but the application of the newly discovered knowledge, which can be dangerous. One must remember that knowledge can do nothing on its own when looking to blame someone or something for the results of its application. The knowledge of the possibility to split the atom can be used for beneficial purposes. Nuclear power plants, for example, are widely touted as being the best current method of providing a clean, reliable energy source. They use the same basic scientific and technological principles as nuclear weapons, yet applied differently. Atomic power has been and could be used to a greater extent to provide cheap energy to the entire world. It is true that nuclear power plants do create waste that can be linked to causing cancer in communities near where it is disposed of. It is a problem that those who produce the harmful waste products cannot or do not ensure that its harmful effects on the environment and people are avoided. Better methods of disposing of the nuclear waste are needed that are safer to the environment and do not cause any detrimental effects. If this could be done, nuclear technology used as a power source would definitely benefit society. Due to its potential to be very beneficial to society, the pure science of the discovery does not make nuclear technology harmful and bad technology.

But, this scientific information was also used to develop the atomic bomb. In 1938, two German scientists, Otto Hahn and Fritz Strassman uncovered nuclear fission. They discovered it was possible to split the nucleus of a uranium atom by bombarding it with neutrons, the uncharged components of atoms. As the uranium nucleus split, a portion of its mass converted to energy. This scientific research served

as the basis for the early nuclear weapons. Scientists realized that much new technological advancement could be created if it were possible to harness the extreme amount of energy released from this process, including nuclear weapons and nuclear energy.<sup>10</sup>

This theory quickly began to grow in acceptance and became more widespread among physicists and others in the scientific community. Even in the very beginning, the idea that this scientific breakthrough could be developed into weapons technology was proposed by many top physicists, who speculated amongst themselves the potential power a bomb of this type would theoretically generate. There was not much reason to give this idea a great deal of attention, at least until it was believed that the Germans were actually beginning their own work to develop a nuclear bomb in 1939. The first bombs were created in the United States because those in charge in the government and the scientific community were afraid that if Germany were able to create one first they would be able to defeat the United States in World War II. The program was not started, however, until the President knew that he had the support of the American people to get involved in the war.<sup>11</sup>

Scientists and others aware of the potential of this new discovery realized what would happen if Germany were able to construct a functional bomb of this type before the Allies could. Many scientists felt it was of critical importance to inform the figures of power in the United States government and military about what they believed was happening, and could happen in the future. Commonly regarded as the greatest scientific mind of this time, Albert Einstein signed the letter that first informed President Roosevelt of the idea that the United States might be able to create this

theoretical weapon of extreme power before the Germans could complete their own. Although personally Roosevelt may have wanted to do something with the information, he recognized that he needed to have the support of his country behind him in order to effectively accomplish any goal. If opposing countries were to find out that America was secretly developing a bomb of this sort they might view it as an offensive move, provoking an attack on the United States. Also, the American public may consider that the decision was made against the citizens' wishes. Roosevelt wanted to do his best to satisfy what the public wanted. Since most of the American public did not want to get involved in the war, the option of developing the weapon was not followed through.<sup>12</sup>

World War II pitted the Allies (U.S., England, France and later on Russia) against the fascist ideals of the Germany, Italy and Japan. For the first time in hundreds of years, the independence American had fought so long and hard for against Britain in the late 18<sup>th</sup> century was seriously threatened. Widespread fear existed across the country that Germany, which had looked like the wave of the future might be able to contest the unchallenged freedom American citizens had enjoyed for so long, and walk right over the United States on way their goal of total world domination. For many people, though, this was something that they thought they didn't have to deal with or believe. Up until this point the war had been fought solely on foreign soil, and the American citizens were not that actively involved. As long as the buffer zones of the Pacific to the west and the Atlantic to the east were maintained, a feeling of safety existed in the minds of American citizens.<sup>13</sup>

But everything changed December 7, 1941. On this day the Japanese bombed Pearl Harbor, Hawaii. This act of aggression on the part of the Japanese was a wake up

call to the entire country. Americans' feelings and views on the war now suddenly changed. They became very angry; no country could be allowed to attack the United States directly and get away with it.

Although only speculation at best, it has been suggested that Roosevelt may have been forewarned of the attack on Pearl Harbor and made the decision to let it happen unchallenged. By doing this, the American public would become outraged and demand that something be done to retaliate; he would then be able to take the next step on his agenda, entering the war, while still complying with the public's desires. There is some evidence that can help to back this claim. For a long period of time previous to our actual engagement in the war, British Prime Minister Sir Winston Churchill had tried to convince President Roosevelt to join the war in order to assist the British. Churchill repeatedly asked for help from the United States, and each time Roosevelt would answer rather ambiguously. He would give just enough hope and support to the British to keep them fighting, yet little enough so that the American public could remain secure in their feeling that they were not physically engaging in the war themselves. The Lend Lease Act is a good example of Roosevelt doing the best he could to help the war effort while still keeping the country happy.<sup>14</sup>

The idea of building a nuclear weapon that had been brought to President Roosevelt's attention earlier by Albert Einstein among others was suddenly atop Roosevelt's list of priorities after the official declaration of war on Germany and Japan the day following the attack on Pearl Harbor. The project was formed under the control of the United States Army and General Lesley Groves. General Groves made the

unlikely yet brilliant decision to appoint J. Robert Oppenheimer to the position of head scientific director of the project.<sup>15</sup>

The story of J. Robert Oppenheimer and his involvement in the creation of the first atomic weapons is very interesting. He was considered by many to possess great intelligence. This physicist was involved with many others in the Manhattan Project, in which the first nuclear bomb was developed and tested. When involved in the creation of the weapon he strongly felt that the weapon should be created and knowledge learned about its potential power. Yet, later in his career, after the first weapons were developed and eventually used in a wartime situation on the Japanese mainland, his opinion changed. He would go on to oppose the further creation of such weapons of mass destruction. This extremely intelligent man, who had been so close to the technology and research, after all his experience with nuclear weapons, went on to lobby against further development.<sup>16</sup>

Born in 1904 to a wealthy family, J. Robert Oppenheimer attended the Ethical Cultural School in New York. During the summers, he frequented a family ranch in New Mexico where he lived in a natural mountainous setting. He spoke six different languages and finished his Harvard education in just three years. As a young man, Oppenheimer had never been involved in political matters, and stuck to purely intellectual areas of study. As a Jew with friends and relatives in Germany, he eventually became more interested in the events that were taking place in the world around him. He read all three volumes of Marx's Das Capital in the original German version, as well as finishing the complete works of Lenin.<sup>17</sup>

Hitler's army was growing, and fascist governments were beginning to rise in power. Oppenheimer saw this both as a threat to his own family and also as a threat to the way of life in the United States. He considered Germany the new wave of power that could destroy the Western way of life. As time passed, Oppenheimer began to move more and more towards left wing politics. He married in 1940, and shortly thereafter his wife, brother, and sister-in-law joined the Communist party. Even though he never joined himself, his name was nevertheless put on a list of people to be imprisoned in case of national emergency by the FBI.<sup>18</sup>

During this same time, Oppenheimer was also one of the top physicists involved with researching the splitting of the atom here in the United States. He was teaching physics at University of California at Berkley. As he became more involved in politics and current events, he increasingly wanted to aid the cause of Western civilization somehow. His wish was fulfilled when he was appointed head of the Manhattan Project, with the official title of "Coordinator of Rapid Rupture". This was the perfect opportunity he had been looking for to help his country. He grew from an irresponsible intellectual discovering the secrets of nature without care about their uses in the real world, into a person who realized he could best serve his country and his beliefs by using his knowledge to create working technology that would help the war effort.<sup>19</sup>

As head scientist and director of the project, J. Robert Oppenheimer made the decision to conduct all of the work at a single location. He felt that this would enable him to exercise much more control and supervision over every aspect of the process than he would otherwise be able to had the research been spread across the entire country, as was previously planned. Oppenheimer was given such a broad range of

responsibility and power over the project because he was viewed as intellectually superior to the others involved in the development of the weapon. This belief was not held solely by General Groves, but by Oppenheimer's colleagues and fellow scientists as well who worked side by side with him in the development of the weapon.<sup>20</sup>

In the summer of 1942, low flying aircraft were frequently spotted in the area around the Los Alamos Boys School in New Mexico, just a short distance from the ranch where Oppenheimer had spent his summers as a young man. Soon after the sightings, the school was invaded by swarms of bulldozers and a construction crew. The project, known today as the Manhattan Project, would eventually occur at this very site, high atop a mountain in Los Alamos, New Mexico.<sup>21</sup>

After the initial site selection was made, Oppenheimer's next major task was to personally choose the group of scientists he believed could offer the most towards his efforts of creating this new technology. Once his list was finalized, he had to convince these scientists and their families to join him at an undisclosed location, for an unspecified period of time to work on a project he could not yet tell them about; except for the fact that it was in New Mexico. He originally envisioned a small community of about 30 scientists and their families being sufficient to accomplish his newfound goal. However, when all was said and done, what he ended up with was a city of 6000 people. This was the largest gathering ever of Nobel laureates, physicists, mathematicians, scientists and their brightest students all working towards the same common objective. The task they were given was to create a mechanism that in one millionth of a second would create a chain reaction resulting in the largest explosion the world had ever known. For obvious reasons, the project was deemed top secret, and

even the people who lived right nearby could only speculate at best as to what was going on inside the buildings of the Los Alamos site. Oppenheimer was in charge of it all, and he understood every step that was performed throughout the entire course of the project. Everyone involved felt they were involved in a race against the Germans to develop the technology necessary to save civilization, where failure would result in losing a thousand years of advancements and accomplishments, and a return to the dark ages.<sup>22</sup>

Late in 1944, United States intelligence learned that Germany's attempt to create this weapon of mass destruction had failed. Theoretically, there was no reason to continue development on our nuclear weapon. The original purpose of the creating the nuclear bomb was to ensure that Germany did not possess more powerful weapons than the United States did. However, instead of calling off their efforts, canceling the project and sending everyone home, the scientists at Los Alamos actually began to pick up the pace, working six days a week. Germany surrendered in the spring of 1945, and it became readily apparent that they had never come close to completing a functional nuclear weapon. Even then, with the threat all but gone, the scientists never stopped their work. Not only was the thought of abandoning the project not even considered- it was unheard of. It was almost as if the scientists, military and advisors had no time to stop and think about what they were doing; they didn't notice that there was no one else to worry about. They were no longer competing against anyone, aside from finishing the goal they had started for their own sense of accomplishment. The scientists working at Los Alamos became so caught up in the machinery of their work that it was almost as if stopping now would be a waste of all that they had done.<sup>23</sup>



One scientist at Los Alamos organized a meeting to consider the moral implications that would result should one of these bombs they were working on day and night to complete actually be detonated. Only between thirty and fifty of the scientists attended, and Robert Oppenheimer was one of them. It was at this assembly that Oppenheimer voiced his opinion, as well as others, that the world would be better off to know if the possibility of a bomb really did exist, rather than keeping it secret. Part of the reason he believed this to be the best solution was that it was at this time the United Nations was being formed; and it would be better formed if it was done so with this knowledge. At this point in his career, Oppenheimer was still deeply involved with and in favor of creating a nuclear bomb. As a scientist, he wanted everyone to know the possibilities and potential of their discoveries.<sup>24</sup>

Two hundred miles south of the development site was a desert region near the town of Alamogordo, New Mexico which was home to a handful of cattle ranchers and homesteaders. This site, named the Trinity site by Robert Oppenheimer, was selected as the location for the testing of the first atomic bomb. In 1942 the few families that were living on this land were ordered to move by federal judges and the Army Corp of Engineers. Soon after this, there were several hundred military personnel and civilians working in secret to prepare for the test at this location. A one hundred-foot tower was constructed in the middle of the utterly flat surrounding area, which would be used to raise the bomb off of ground elevation for the purposes of explosion analysis. Suspending the bomb over the ground in such a manner was believed to result in a more forceful explosion, and doing so in the test as well would result in a better representation of the damage that would be caused during actual usage.<sup>25</sup>

There had been a secret agreement reached between Oppenheimer and the governor of New Mexico to evacuate the state should any major problems be caused by the test. There was some concern, along with some side bets among the scientists that the detonation could possibly destroy all of New Mexico or create a chain reaction that would incinerate the entire planet's atmosphere, ending all life on earth. Yet they were willing to make the choice to take this chance for everyone else on the planet. The scientists, who worked on the bomb, like any other employee anywhere wanted the fruit of their labor to work, but they did not want it to be that dangerous. Oppenheimer had hoped that the information regarding the project and any tests would be disclosed to Stalin rather quickly, but President Roosevelt must not have agreed since that ended up not being the case.<sup>26</sup>

The first test occurred at the Trinity site on July 16. It was predicted that the explosion would light up the entire desert and have a 60-mile visibility. And so at midnight, in the midst of a rainstorm, the first nuclear weapon ever was detonated. Spectators recalled the ominous cloud, colored deep purple from the radiation, which rose from the explosion and seemed to hang in the atmosphere for quite some time. There was also some surprise as to the amount of heat that radiated from the explosion, even at the observation posts five miles away. One local farmer, who was woken by what he believed to be an earthquake, looked out the window and commented to his wife that she could come and witness the sun rising in the wrong direction. The radiation from the explosion caused white spots to appear on the sides of cattle exposed to the light. Another account from the Trinity test that helps to envision what it must have been like involved a blind girl commenting on the light she saw from the

explosion as her family drove her back to school late that night in their car. A common reaction immediately after detonation from some of the scientists that had worked on the bomb was a sigh of relief that the bomb had worked, and that the test was a success.<sup>27</sup>

The war in Japan continued. The United States conducted saturation bombings that leveled many of Japan's major cities. Truman, now president, demanded nothing short of unconditional surrender from Japan. Many of its cities were destroyed, and over one million civilian casualties occurred. The use of an atomic weapon in a wartime situation became a viable issue in the United States government.<sup>28</sup>

There were several possible ways that a nuclear bomb could be used in the war. One option was to detonate a bomb on an uncivilized island off the coast of Japan. This would allow the Japanese to see the power and destruction that these new American weapons had. The Japanese public would rightly fear for their lives and attempt to convince the government to surrender, giving victory to the United States with fewer required enemy deaths, which is obviously better for both sides. A second related option was to conduct another test at the United States test site, attended by foreign leaders. Again, this would demonstrate to them the power that both the weapons, and the United States possessed. A major reason that these two options were not considered as heavily as they should have been is due to the fear among some government and scientific leaders that the bomb could be a dud. The chance alone that this could happen, with all of the drama that would have to lead up to it, was not worth the risk. A failed test would make the United States appear weak and look like fools to other

nations. The final option was to drop the bomb a populated area on the Japanese mainland, without any warning or notice to the people there.<sup>29</sup>

Politics also come into play in any major decision. Robert Oppenheimer had a seat on an advisory panel that was to make recommendations as to how a nuclear weapon should be used. Despite suggestions from colleagues at Los Alamos that another test such as the one that occurred at Trinity be conducted, with Japanese and other foreign leaders in attendance to witness the power of the weapon, he still brought up the fear and concern that the test might produce a dud. In the end, the advisory committee did not take a stand against using the bomb on a populated area. In fact, no one in any position in the government had the courage or foresight to protest against using this weapon on the Japanese mainland. The military and bureaucratic systems were already set up, in place, and waiting for the order to drop the bomb. They had been preparing for an attack on the Japanese mainland. At this point, it would have taken more strength on the part of the President to stop its use than it would have to give the order to use it. Had the U.S. decided not to use a nuclear weapon in the war at the earliest possible point, this would surely come out in later political debates. Any U.S. casualties that occurred after the point where use of the weapon would be feasible would be on the hands of the president. Ultimately, it was believed that using a nuclear bomb on Japan would help to end the war more quickly, with fewer deaths throughout the course of the war.<sup>30</sup>

The United States military chose a number of Japanese cities that could be potential targets for use of the nuclear weapon. These places were left untouched in the conventional attacks so that when the bomb was used, the full effects of the blast could

be more clearly seen and better judged. Hiroshima was one of cities on the list of potential targets, which were spared from the destruction of U.S. saturation bombings. The first bomb dropped in a wartime situation occurred on August 6, 1945. In nine seconds, more than 100,000 people were dead. Another 40,000 were injured and 20,000 were missing due to the use of an atomic weapon on the city of Hiroshima. Those who were not killed instantly suffered from burns, blindness and radiation sickness. Years later, people were still suffering and dying from the effects of the nuclear radiation.<sup>31</sup>

A common first reaction of the scientists to the news that the bomb that they had created had been detonated on the city of Hiroshima was a feeling of relief that the weapon did not fail. There was fulfillment in knowing that what the scientists had spent two years of their life designing had completed its assigned task and did what it was supposed to do. Then reality struck, and they were filled almost immediately by a feeling of shock and horror at the number of people of whom they had just contributed in killing. It was commonly believed by many of these same scientists that what was done must never happen again. Regardless, three days later, a second bomb was dropped on the city of Nagasaki, Japan, which killed an additional 80,000 Japanese people. Little known is the fact that the U.S. military planned a third attack, but it was never accomplished because Japan surrendered before it could be coordinated or launched.<sup>32</sup>

Robert Oppenheimer gave a famous speech two years after these bomb drops at MIT. In the middle of his talk he made the comment that, “the physicists have known sin.” Some of those who had worked on the initial bombs became depressed after they

were used on Japan. Some chose to leave the nuclear energy and weapons industries completely as a result. In retrospect, scientists have said that the bomb should never have been used on a populated city. Still others feel that they should have thought to stop after the U.S. achieved victory in Europe, but admit that at the time the thought never crossed their minds. After Japan surrendered the veil of secrecy was lifted off of what the scientists had been working on. Much of the American public felt that the use on the nuclear weapons had played a large role in the victory over Japan, and Robert Oppenheimer instantly became an American hero for his work on the project.

Oppenheimer sat on a government advisory commission that dealt with future use of atomic weapons. In his government role he chose to deal much less with work on the actual physics of nuclear weapons and much more with the politics of the whole thing and trying to put regulations on atomic use and testing. In the mid to late forties, after the United States detonated the first two atomic weapons on major cities in Japan, some physicists and scientists, including Oppenheimer, who had worked so hard to create the weapons changed their early views and began lobbying to stop further development of the weapons. Those who had been the closest to the work and had known what had been going on for years felt that further creation of nuclear weapons must end. Others could not feel the guilt that many of these scientists had on their minds. After giving years of their life to create this technology, they were willing to end all future progress on the issue. Only these scientists and engineers who had worked on the bombs in the 1940's have ever experienced these emotions. No scientists working on the bombs today have had to deal with any type of similar occurrence.<sup>33</sup>

In 1947, an international treaty was proposed, known as the Baruch Plan, to put nuclear weapons under international control. The reason for this is that shortly after victory in World War II, a new threat emerged. There was increasing concern in American government and amongst the people about the growing Communist powers in the Russian and Chinese governments. The Soviet Union refused to sign the proposed international agreement, and in 1949, successfully detonated its own atomic weapon. This event virtually eliminated any chance of the United States government abandoning its own nuclear weapons program. Weapons control was no longer considered a realistic solution, and was abandoned by the American government rather quickly. This is the start to what was known as the arms race. With a threat still lingering, engineers and scientists continued their work at the Los Alamos labs.<sup>34</sup>

Edward Teller, a Hungarian physicist who had moved to the United States, was very much against communist movements and played a large role over the course of the Cold War. A colleague of Oppenheimer's at the Los Alamos Labs, he had originally proposed the creation of a hydrogen bomb at the beginning of the Manhattan Project. Despite Oppenheimer's strong opposition to such a weapon following the war, Teller supported continued development of nuclear weapons, because he believed the H-bomb would be much more powerful and destructive than the atomic bombs that had been used in the previous war. After the Soviets entered the nuclear age, President Truman agreed to this, and initiated a program to develop the H-bomb. Scientists at Los Alamos began work on this project without any input or participation from Robert Oppenheimer.<sup>35</sup>

Robert Oppenheimer's views and intentions began to get attacked. Some even went as far as to charge that he was working as a Communist spy. In 1953, his former level of security clearance was suspended pending further investigation into the matter, as he was considered a security risk to the United States. The Atomic Energy Commission (AEC) conducted the proceedings that would determine Oppenheimer's future. His past affiliation with people in the Communist party, including his brother and wife, would come back to haunt him. Oppenheimer was accused of opposing the creation of the Hydrogen bomb for political, technical and moral reasons. Edward Teller testified that he did not believe Oppenheimer should be allowed to know secret information regarding future discoveries or should be allowed to work on any of the governments related projects. Despite support from many of his other past colleagues, Oppenheimer's security clearance was in fact revoked. He would never again advise the U.S. government in any way or work in the nuclear energy field for the remainder of his life. In an interview conducted twenty years after the first test, Oppenheimer said that the halt of nuclear weapons development should have occurred the day after the Trinity explosion. Oppenheimer died in 1967.<sup>36</sup>

In 1951 Edward Teller believed that the Los Alamos labs were not working hard enough on the development of the H-bomb and lobbied the government to create a second nuclear weapons facility. Many debates occurred within the government over whether or not another lab should be built. In 1952, Ernest O. Lawrence, a scientist who had worked on the Manhattan Project and was now teaching at Berkley offered the opportunity to create a second lab as an addition to the university's existing radiation labs. It was agreed that the new weapons lab would be located at the former U.S. naval



air base where the university had already built an accelerator, in Livermore, California. The lab was named the Lawrence Livermore National Laboratory, after Ernest O. Lawrence.<sup>37</sup>

A sense of rivalry existed between Livermore labs and the Los Alamos labs. The creation of the first successful H-bomb was given credit to Livermore, although it was actually developed at Los Alamos. National security prevented this mistake from being corrected, however. This issue did not help to alleviate the existing competition between the two labs.<sup>38</sup>

The first two tests conducted by Livermore labs were duds. Their first bomb, which should have vaporized the tower it was placed on, instead merely bent it. This failure delighted the scientists at Los Alamos. Livermore conducted its second test in the Pacific. The predicted 1.5-megaton explosion (1500 kilotons) actually was closer to about only 110 kilotons; again, considered a failure.<sup>39</sup>

The lab's first successful tests were completed in 1955. In the late 50's, the Lawrence Livermore National Laboratory successfully developed a warhead that would fit on a submarine based missile. With this success came encouragement and more government support. In 1953 the lab had a staff of 633 and a 3.5 million-dollar budget. In 1958 these numbers jumped up to 3,000 people and a budget of 55 million dollars, and in 1963 it was up to a staff of 5,000 with a 127 million-dollar budget; slightly more than the Los Alamos site. Still, in 1987, 8,000 people were employed at the lab, and it had a budget of one billion dollars.<sup>40</sup>

## **Testing of Nuclear Weapons:**

One of the main ways that nuclear weapons have hurt the environment and populations of the world is through the extensive testing that has been performed since 1945. The radiation that is released from an explosion is harmful to human and animal life on this planet. The United States government has admitted to causing physical harm to both its own citizens and those of other countries through its nuclear weapons testing program. Much of the harm has been unintentional, but some has been intentionally done so scientists could get more information on the effects of radiation exposure. This section will describe some of the testing that has been done by the United States and other countries, and show the effects that it has caused on the various environments and people.

The United States has conducted more tests than any other country, a total of 1,054 nuclear explosions through 1998. The last test was performed on September 23, 1992. A total of 109 tests were conducted in either the Pacific or Atlantic Oceans, 928 were tested in Nevada, and the remaining 17 were conducted at other locations.<sup>41</sup> Tests have been conducted at 11 sites in the continental United States, mostly at the Nevada test site. The U.S. has also conducted tests on 4 different Pacific islands as well as in the open Atlantic and Pacific Oceans.<sup>42</sup>

In 1948, the United States made the decision to designate a single test site within the country's borders. It was reasonable to assume that there would be objections from most people living in the area surrounding such a site. The best site would minimize the amount of fallout over the continent. Since the primary wind pattern in the country

is from west to east, the best place to locate a site would be on the East Coast. The prevailing winds would then carry the fallout out to the ocean. However the national government did not own any land suitable for a nuclear test site in this area. They made the decision to select a site only from federally owned lands, because the government did not want to have to go through the trouble of acquiring new lands for the site. This policy limited their possible selections to five locations: two in Nevada, one in New Mexico, one in Utah, and another in North Carolina. They ended up choosing one of the Nevada sites for the future ground tests. The deciding factors that narrowed the choices to Nevada were that the government already owned this plot of land, and its close proximity to the Los Alamos labs. These factors apparently turned out to be more important than other issues such as the health risks that could result if the winds carried fallout over the rest of the country to the East. It does not appear that the government investigated these effects too thoroughly. Consequently, there have been a number of lawsuits against the government by people who claim to have gotten sick from the radioactive fallout. The government has admitted some responsibility for citizens in the downwind communities of Nevada, Utah and Arizona that have been affected by the radiation, but compensation has been given to only a partial amount of the victims.<sup>43</sup>

Radioactive fallout from Nevada tests has been shown to affect places as far away as Albany, New York, and possibly even further. In the early 1950's a series of tests was conducted known as the Upshot-Knothole tests. On one occasion fallout that was being carried by upper level winds was brought back down to the surface and population by a severe thunderstorm that occurred at an elevation of 40,000 feet in the atmosphere. The combination of the storm and the radiation resulted in the city of

Albany being bombarded with much higher levels of radiation than were many of the test sites surrounding communities. This phenomenon is termed a “hot spot” due to the unusually high levels of fallout and radiation that occur.<sup>44</sup>

Between the years of 1946 and 1958, the United States conducted a series of tests on the remote Marshall Island chain in the middle of the Pacific Ocean. In 1954, a 15-megaton H-bomb, nicknamed "Bravo", was exploded on one of these islands. The power of that detonation was one thousand times stronger than the one that occurred at Hiroshima. The radioactive fallout contaminated a Japanese fishing boat that was in the area, and also five hours after detonation, heavy fallout resembling snow fell on the Rongelap Atoll. Children unwittingly played in the snow-like powder without any warning from the military about its nature.<sup>45</sup>

Following these tests, many of the Marshall Islands had to be evacuated, and the United States government made an effort to clean up the area because of what had happened. Some of the island residents were not allowed to return to their homes until cleanup efforts were completed. However, the United States government allowed the native people of Rongelap to return to their island just three years later in 1957. The Atomic Energy Commission wanted to study how people absorbed radiation and were affected when exposed to a contaminated environment, and considered this a valid research opportunity. Many of the people there were later found to have developed thyroid nodules, and fear was common this could metastasize over time into some form of thyroid cancer. One case of leukemia was recorded there as well. In 1972, the people of Bikini Island were finally allowed to return home believing that the clean up was complete. However, they then had to be re-evacuated when it was found that the

vegetation was still contaminated and consumption was causing unhealthily high internal doses of radiation.<sup>46</sup>

The United States government has had to pay a great deal in legal fees and compensation to residents near testing areas over during the nuclear age. The total amount of legal fees that the Department of Energy had to spend in order to defend against lawsuits from both workers and private citizens concerning nuclear weapons production and testing, from October 1990 through March 1995, was \$97,000,000. Under the Radiation Exposure and Compensation Act of 1990, the United States was forced to compensate its citizens that were exposed to radiation from the development and testing of nuclear weapons over the years. Up to the start of 1998, \$225,000,000 had been awarded to the American public. Of the nearly 10,000 claims made, 6,336 were approved and 3,156 were denied.<sup>47</sup>

The United States government has also paid money to other nations for damage that they caused to the people and the land. The inhabitants of the Marshall Islands have received money and non-monetary compensation worth at least \$759,000,000 since the tests were conducted in the 1950's. The U.S. State Department has also given Japan \$15,300,000 to compensate for the exposure they received from the fallout of the "Bravo" test on the Marshall Islands in 1954.<sup>48</sup>

The estimated amount that the U.S. spent on all nuclear weapons and weapons-related programs in 1998 were \$35,100,000,000. It was also estimated that the government spent \$1,200,000,000 between October 1, 1992 and October 1, 1995 on nuclear testing activities, yet during this period no tests were conducted.<sup>49</sup>

A total of 2,073 tests have been conducted by different countries through 1998, with a total charge of over 550 megatons of high explosives, equivalent to 550,000,000 tons of high explosives such as TNT. The United States has detonated more nuclear devices than any other country, from 1945 through 1992. The former Soviet Union follows with 715 separate tests. All of these occurred between 1949 and 1990. The United Kingdom has also tested a total of 45 nuclear explosive devices. Just over half of these tests were conducted at the Nevada Test Site on the U.S. mainland. This country's last test occurred on November 21, 1991. It has been over six years since the U.S., U.K., or former Soviet Union has performed any nuclear weapons tests.<sup>50</sup>

Other countries have continued to explode nuclear weapons, however. China and France both detonated nuclear devices in 1996. China has detonated 43 explosives since 1964, while France has conducted 210 tests beginning in 1960. India has performed six nuclear explosions since 1974. South Africa announced in 1993 that it had created six nuclear devices, but that it had dismantled them and ended its nuclear program. Israel, Pakistan and Iraq are all widely believed to possess some sort of nuclear weapons capabilities.<sup>51</sup>

## **Treaties:**

One approach that can be used to combat the continuous threat proliferation of weapons of mass destruction carry with them is international law, and more specifically the creation and ratification of treaties. The first major international nuclear treaty of any significance was the Limited Test Ban Treaty. A trilateral agreement between the US, USSR, and UK allowed future tests to only be performed underground, as long as the radioactive debris was not allowed “outside the territorial limits”. This therefore prohibited further nuclear detonations in the atmosphere, or on water. Since its inception in 1963, one hundred thirteen additional countries including future potential nuclear states such as Brazil, India, Israel, and Pakistan have signed the treaty. Two of the other nuclear superpowers, France and the People’s Republic of China, have not signed the treaty. With the exception of one violation by China, they are both abiding by its provision though.<sup>52</sup>

According to the Limited Test Ban Treaty the agencies which conducted the allowed tests were responsible for collecting data on the resulting fallout that occurred. There are a few problems that have come up about the collection of this data. First of all, extensive radiation monitoring is typically only done within close proximity to the explosion. Hot spots are likely to occur at locations far away from the test site, and, unless that particular area has some sort of radiation monitoring system in place, the increase in radiation will go unnoticed and unrecorded. Another problem with this system is that there were initial assumptions made by those recording data, which may not be wholly accurate. One such invalidated assumption is that radiation on the ground

is equal to that in the air, and that different types of radiation occur in the same amounts. It is very likely that radiation will not spread evenly or predictably, but no other way to measure such data is available.<sup>53</sup>

This treaty still allows for tests to continue underground, although the radiation from these tests can still affect the environment and people's health. One way it does this is through unintentional venting of radioactive gases. There have been a number of tests in which large amounts of radiation have escaped through tunnels or holes in the Earth. The idea behind underground testing is that since much of the radioactive materials have short half-lives, up to a few days, they should disappear before causing any or little harm to the local environment. However, radioactive material such as Carbon-14, stays in the ground for thousands of years. Any ground water that passes through this area over the next few thousand years will be contaminated by the radioactive material, and may no longer be a viable water source. The subject of radiation and its effects on those exposed will be dealt with in the following section.<sup>54</sup>

Another in the series of important treaties is the Nuclear Non-Proliferation Treaty of 1968; an agreement made between the US, USSR, UK, and 133 other non-nuclear-weapon states that tried to reduce the number of weapons already in existence and stop new countries from forming them. The non-nuclear weapon states specifically dictated they would not develop, manufacture, or acquire nuclear weapons, and in May of 1995, the treaty was made permanent. Even more recent was the Comprehensive Test Ban Treaty (1996). This agreement, signed by the United States, CIS, UK and 90 other non-nuclear-weapons states would ban any and all nuclear tests, regardless of size, above or below the Earth's surface. It also created a worldwide monitoring system with



170 seismic stations to check possible signals present in the air, water, and soil that a nuclear explosion had been set off. Of all the nuclear weapons states, India was the only one that refused to sign the treaty. For this reason and many others, we should question their intentions for their forces, doctrines and policies regarding their use of power. Will nuclear weapons act as a buffer or a volatile agent for India and Pakistan with their newfound nuclear capabilities? “Wait and see” is a bad policy, with disastrous consequences if left alone for too long. They may believe that there is no price to pay for technology, although this is an illusion. Possessing a nuclear weapon, or the technology to build one alone elevates a country on the responsibility ladder, regardless of whether or not they are ready to handle it. All decisions having to do with international concerns or conflicts must now reflect a heightened sense of maturity. Showing immaturity in the face of such matters could necessitate an unwanted reaction from other superpowers to calm the situation.<sup>55</sup>

Despite the trend for disarmament some countries have continued to test nuclear weapons. In 1995 the United Nations reprimanded both France and China because they have persisted with nuclear testing actions. Both nations ignored the enormous international opposition to such tests. The message from the United Nations was in the form of a resolution that strongly deplored all nuclear testing and which urged an immediate halt to all testing. The resolution remarked on the risk that these continued tests have on interfering with global non-proliferation and disarmament.<sup>56</sup>

## **Radiation from a bomb:**

Two different materials can be used in the fission reactions of nuclear weapons, Uranium-235 and Plutonium-239, which is man-made. Both are extremely scarce, and the government must spend a good deal of money to create them. Hydrogen bombs work differently, using a fusion reaction, creating a thermonuclear explosion. The fallout from the explosion of either of these bombs contains radioactive particles that spread through the atmosphere. The products from the explosion of the materials in the bomb are not the only radioactive particles that are created. A process known as induced radioactivity involves the bombardment of non-radioactive materials by the nuclear explosions. For example, when a molecule of Carbon-14 takes on a proton due to a nuclear reaction, it becomes radioactive.<sup>57</sup>

There are four different types of radiation: gamma, beta, alpha and neutrons. Gamma radiation is electromagnetic energy with high frequency. It will easily pass through paper or wood or clothing. Lead or thick concrete is necessary to prevent the penetration of this type of radiation. Beta radiation consists of energetic electrons. It does not usually penetrate materials, and mostly affects the skin in humans. Alpha radiation in nuclear bombs is made up of helium ions that are produced by the disintegration of Plutonium-239. This radiation also does not penetrate very well. Neutrons are produced in a nuclear explosion. These different types of radiation are what make nuclear weapons testing so harmful to the population. The effects of different doses of radiation will be explained in the next section.<sup>58</sup>

All of the testing previously discussed that has been conducted by various countries has released cancerous radiation into the atmosphere. Most of the radiation people will receive over time will be due to radioactive Carbon-14, which has a half-life of over 5700 years. Half-life is an expression that describes a material's radioactive decay properties. In the case of Carbon-14, half of its radiation will still be around 5,700 years from now. It has also been estimated that the majority of a person's exposure to radioactive material will be through ingestion. Experts predict that 430,000 cancer fatalities will have occurred by the year 2000 due to nuclear radiation alone. The majority of these cases will occur in the Northern Hemisphere of the Earth, where most of the tests have been conducted, and due to the different weather conditions of each separate hemisphere. Of course, if one or more nuclear bombs were to be detonated on a populated area the number of human casualties will greatly increase. That is the topic of the next section of the paper.<sup>59</sup>

## **Detonation on a Populated Area:**

The logical consequence of the preparation for nuclear war is nuclear war. If nuclear war were ever to occur, a great deal of the environment and population will be obliterated in a very short period of time. There would only be a thirty-minute delay between the time the first missile was launched and the time they started hitting the United States mainland. The U.S. warning system would take fifteen minutes to detect the attack and then relay a warning to television and radio broadcasts. Those who happen to be listening at the time would then have the remaining fifteen minutes to say good-bye to their loved ones.<sup>60</sup>

Dr. Helen Caldicott described what would happen if a large nuclear weapon were to detonate over a major populated area in her book Missile Envy, which was written in 1984. Although the book is 15 years old, the information about the destructiveness is still accurate. The description is based on the effects of a 20-megaton bomb falling on a major city, such as New York City. When her book was written, the Soviet Union possessed between one hundred and two hundred weapons of this magnitude in their arsenal. The power of this bomb is equivalent to twenty million tons of TNT. The missile carrying the nuclear warhead would approach the U.S. at twenty times the speed of sound. When it detonated, heat equal to that of the sun, twenty million of degrees Celsius, would be released in a thousandth of a second. The explosion would create a crater three-quarters of a mile wide and 800 feet deep. All of the people, buildings, earth and anything else in that area would instantly be vaporized and become radioactive fallout that would rise in a huge mushroom cloud.<sup>61</sup>

Up to four miles from the epicenter, the blast would produce pressures of 25 pounds per square inch and winds exceeding 650 miles per hour. The force of this pressure would destroy everything, including reinforced concrete and steel structures. Even bomb shelters deep under ground would collapse. All people would be dead. Glass would melt as far as six miles from the center of the explosion. The sheet metal on cars would melt out to a distance of ten miles. Pressures of 7 to 10 pounds per square inch and winds of 200 miles per hour would result from the blast. Reinforced concrete buildings would sustain heavy damaged, and all other masonry and wooden buildings would be leveled. People's eyes will melt and their skin will be fatally burned.<sup>63</sup>

The intense pressures and winds will turn bricks, glass, people or any other objects into missiles travelling up to 100 miles per hour. The pressures will also rupture human lungs and eardrums. At thirty miles, any exposed skin not covered by clothing will receive third degree burns. As far away as forty miles, any one who is looking in the direction of the destruction will go blind due to burns on the retinas at the back of their eyes. The heat from the blast will ignite all easily flammable materials, such as houses, paper, cloth, leaves and gasoline at a distance of sixteen miles from the explosion. These materials combined with heating fuel would start hundreds of thousands of fires. The intense winds, still in excess of 100 miles per hour, would cause these fires to merge into a giant firestorm covering 800 square miles. Flames would consume everything within this area, and temperatures would rise to 1400 degrees Fahrenheit. The death rate would at this distance would still be near one hundred percent.<sup>64</sup>

Smaller firestorms like those described above were created in Hamburg, Dresden and parts of Tokyo after conventional bombing attacks during World War II. It was found from these experiences that only those who left their bomb shelters had any chance of surviving. The people who stayed in their underground shelters were killed as their bunkers were turned into ovens and the fire consumed all of the oxygen in the air.<sup>65</sup>

Many more will be killed later from the effects of the blast. The most prevalent type of injury to survivors after a nuclear explosion will be second and third degree burns received from either the heat of the blast or the thousands of fires that are created afterward. These hundreds of thousands of people will each need immediate and intensive care to treat their injuries, but it will not be available. In the entire United States, there are only 2,000 beds designated specifically for burn victims, with about 100 in each major city. Of course, most of these would have been destroyed in the blast. Only an incredibly small percentage of these people will receive the care needed for them to survive. The rest will die. Many others will also have other injuries. Flying debris will have pierced the skin or broken bones. Others will be blind from the flash, or have collapsed eardrums and lungs from the extreme pressures.<sup>66</sup>

The city that was destroyed will have become radioactive dust that then spreads over the surrounding area. Shortly after the explosion, many others will be suffering from radiation sickness, the intensity depending on the amount of exposure. The level of background radiation that each person receives each year in the United States is 170 millirads. The rad is the unit that is used to measure levels of radiation, one rad being equal to 1,000 millirads. Someone who is exposed to 5,000 rads will be dead in twenty-

four hours due to what is known as the central nervous system syndrome. The brain tissue swells due to the radiation, causing the body to deteriorate eventually falling into a coma and dying. Once someone had been exposed to doses in this range, there is no effective treatment. A dose of between 1,000 and 5,000 rads will result in death due to fluid and electrolyte loss, infection, hemorrhage and starvation. Lower doses, down to 400 rads, will cause the victim to experience nausea and diarrhea, which will last a few days. The person will then appear to get better. But, the symptoms will return even worse than before as the linings of their stomach and intestines deteriorate due to the radiation exposure. Even with the best and most intensive medical care, the majority of people exposed to this level of radiation will die. Doses in the 100 to 300 rads range will result in similar symptoms originally, but they will eventually subside. However, a few weeks after exposure, their bone marrow will stop producing the normal amount of blood cells. The decrease in white blood cells will prevent any wounds from healing. Hemorrhaging and internal bleeding will occur. These people do have a good chance for recovery if they receive the proper medical care. Of course, doctors will be killed in higher percentages than others in a nuclear attack will because they tend to work in the areas that are most likely to be targeted. Those that did survive would each have thousands of injured patients that needed care. With radiation exposure, it is difficult for a doctor to determine in the first few days which patients will be able to recover except for those who are exposed to extremely high radiation doses. This is because the initial symptoms of different levels of doses are all similar.<sup>67</sup>

Most likely, a great deal of medical equipment and antibiotics would be destroyed in the explosion. That which remained would be used up very quickly. Also,

there would probably not be any electricity in order to use the equipment. Water would also be very scarce. Each doctor would only have about ten minutes to see each patient, if they were able to make it to a hospital at all. Disease too will become more rampant after a nuclear attack. The intense heat from the explosion will ignite human and animal bodies. The burning will release bacteria into the atmosphere, which will probably be mutated by the radiation. Insects are very resistant to the effects of radiation, however birds, their natural predators, are extremely sensitive to radiation. This will allow the insects to thrive and spread disease among the survivors of the blast. The increase in radiation that the people would be exposed to would deteriorate the human immune system, making them more susceptible to disease. This will be aided by the lack of sanitary conditions and a decrease in the number of doctors.<sup>68</sup>

Those who happen to hear a warning of an oncoming attack, and are not close to any targeted area have at most fifteen minutes to make it to the nearest fallout shelter. These people will have to remain in such a facility for three weeks to three months or more depending on the proximity to any explosions. These areas will most likely be very crowded. Certainly some people will enter the shelter after having been exposed to the radiation. Depending on the amount of radiation they were exposed to they will either get real sick or die while in the enclosed area. The ventilation of the shelter would have to be able to filter the different types of radiation, assuming the system itself was not damaged by the radiation. Sanitation cannot be very good over such a period of time under these conditions. Also there will probably not be any electricity or heat, since the power plants are very likely targets for the nuclear weapons.<sup>69</sup>



These are the immediate effects of just one bomb falling on a city. At that time the U.S. possessed almost 11,500 nuclear warheads, 7,800 of which could be used in the first thirty minutes of a nuclear war. The Soviet Union had 8,800 nuclear weapons. 8,100 of these could be used in the first half-hour of an attack. Sixty percent of the American public could be killed with just 300 1-megaton bombs. There were enough weapons to target every city in the U.S. that had a population greater than 10,000.<sup>70</sup>

After an all-out nuclear war, millions of decaying bodies will fill the land. Ninety percent of urban areas and housing will be destroyed. The food supply will be severely diminished, and anything remaining will probably have been contaminated. At any one time, there is only a thirty-day supply of food on the entire planet. The fuel supply will also be destroyed making automobiles and farming equipment useless. The road system will have been destroyed too, making long distance travel almost impossible. Most of the population is inexperienced in making their own food, and are dependent on distribution, fuel and all other processes necessary to get the food to them- which would be unavailable.<sup>71</sup>

The explosion of large bombs also has an effect on the ozone layer; the protective layer of molecules that filter damaging Ultra Violet light from the sun's rays. Bombs that are greater than one megaton in yield penetrate into the Earth's stratosphere, where the ozone layer lies. The particles from the explosion oxidize large amounts of nitrogen in the air into nitrous oxide, which chemically combine with the ozone molecules and destroy them. Depending on the size and altitude of the explosion, each one could oxidize 5,000 tons of nitrogen. After a nuclear war, it is possible that UV levels could increase by up to ten times in the Northern Hemisphere, and double in the

Southern Hemisphere. This would cause an increase in the cases of skin cancer in the war survivors over time.<sup>72</sup>

Although the increase in UV light may increase the amount of heat reaching the planet's surface, the lack of ozone would allow more of this heat to escape from the planet; the opposite of the greenhouse effect. This would result in a global cooling, which would have a huge effect on the environment. There would also be a great deal of fires following a nuclear war. The smoke and fumes from the forest fires, burning cities and oil wells will blanket the sky of the Northern Hemisphere for months, not allowing the sun's light to penetrate the cover. A cooling of the average temperature would result that would freeze fresh water supplies and kill plant life. Only one-fifth of the normal sunlight would be able to penetrate during this time. The effects of nuclear war on the environment and survivors would be detrimental to the chances for life ever continuing on this planet.<sup>73</sup>

This is what would happen if a nuclear exchange or war ever occurred. The technology that scientists have developed from the first discovery of radiation and the possibility of splitting the atom would destroy much of the planet and make the chances for survival for everyone else very unrealistic. This type of engineering cannot be considered advantageous to society. The next section of the paper deals with the scientists that created this technology to end the world.

## **Scientists:**

After hearing a description of what would happen if a nuclear exchange were ever to occur, or even if one nuclear warhead were ever to explode, intentionally or accidentally, on a major metropolitan area, one must question how a scientist or engineer could create such a weapon of mass destruction. That is the question that will attempt to be answered in this section.

When asked to visualize the word scientist, the picture one usually imagines is a middle aged, middle class, white male, which although not correct, is understandable. Over the course of the past few centuries since the first existence of the scientific method, the majority of scientists did in fact fit this description. In the past it would be rare for an average person to associate the term scientist with a minority instead of white man, a child instead of an adult, or especially a female instead of a male.

Only in the past century have women and minorities received anywhere near what could be considered equality. Experiments have shown that men and women tend to receive and interpret information differently. It is unclear still if this has natural causes or if it is due to the way boys and girls are brought up and taught differently at young ages. The fact that experiences are encountered and mentally recorded differently depending on one's gender could directly correlate into new advancements in both science and technology. Whatever the reason, if men and women do interpret information differently, this means that until recently half of all the possible explanations for what happens scientifically is missing from the records. A more diverse point of view is necessary so that possible explanations for what is happening

are not overlooked. Every possible option must be examined. The current methodologies and practices of science and technological development, although not perfect, are too entrenched and successful to simply and quickly change from one system to another. Change must occur gradually with many small steps. A slow transition such as this will cause much less trauma and will not shock the system as greatly. Science is continually evolving with every action and step that is made.

Nuclear weapons can be looked at as trying to serve one of two purposes. First, their goal is to deter to war by making opposing governments fear the mass destruction that will happen if the weapons are launched. The other possible reason that they are designed, developed, and produced is to cause mass destruction of their target.

Although these two purposes are direct opposites of each other, there are arguments for both to be true. Most people, especially those in the government that propose continued development, would say that the purpose of nuclear weapons is to make sure that wars do not happen. But scientists create the bombs so that they will be as destructive to their targets as possible. If this is what they are designed for, it must be considered an ultimate purpose for the nuclear weapons. The scientists that create these weapons have many different reasons and feelings about why they do it. For some it is simply a job just like any other; with a weekly paycheck that pays their bills. However, further probing reveals a deeper insight into what they think of their work and how many rationalize what they do.<sup>74</sup>

Some scientists feel that it is not their responsibility to decide what to do with the bombs. Once the design for the weapon is completed, it is out of their hands and control becomes the responsibility of the government. It is ultimately the decision of

the political leaders what their final purpose shall be. Another way of thinking is that since nuclear weapons already exist, it is their responsibility, as the best engineers and scientists around, to ensure that they work properly and do not cause any more damage than is necessary.<sup>75</sup>

In his book Nuclear Rites, Hugh Gusterson details the inner workings of what goes on at Livermore Labs, based upon what national security would allow him to know. He spent years conducting a series of interviews with scientists and other employees, their families, as well as other non-related residents of the surrounding Livermore community. His findings reveal many similarities among the people who worked there, even though many had very different points of view and beliefs, which became more apparent as his time there progressed.

Since 1952, the Livermore labs have designed 18 different warheads for the country's stockpile, compared to the 44 created by Los Alamos, but were responsible for half of the weapons designed during the 1980's. Officially, about one third of the lab's one billion dollar budget is dedicated to nuclear weapons. However, when interviewed by Gusterson, most of the lab employees there estimated that this percentage is actually probably closer to about two thirds of the total budget. The lab also works on the development of other nuclear technologies, but many of the non-weapons projects also have uses in the nuclear weapons areas.<sup>76</sup>

One thing that many of the scientists have in common is that they are white males. In fact, eighty-six percent of the lab employees during the late 80's, when the author conducted his research, were white, five percent Asian American or Hispanic-American, and only three percent were African-American. Women constituted only

twenty-six percent of the workforce. Of those, many worked in the clerical departments or in the biomedical or environmental sciences, which are not given the same priority as the fields involved with creating weapons. Also, the percentage of women workers in fields such as mechanical engineering, electrical engineering or physics was relatively low, between five to seven percent each. These percentages represent the lack of diversity among scientists that was discussed earlier. Would the work that is conducted be handled differently if more women were employed directly on nuclear weapons projects?<sup>77</sup>

A caste type of system exists within the facility. Scientists and engineers form the top group of workers, while the clerical and technician workers are at the bottom. The physicists are the elite group among the scientists, and as one would imagine, an engineer or scientist with a Ph.D. is given more authority and respect than is one without a degree of the same level. Administrative positions are hard to obtain without possessing a Ph.D. The only town with a higher number of Ph.D.'s per capita in the United States than Livermore, CA is Los Alamos, NM, the location of the other nuclear weapons lab.

A mix of beliefs exists among the many different workers at the Livermore labs. There are Liberals as well as Conservatives working together at Livermore, although it has been noted that at the Los Alamos facility, the number of Liberals is much smaller, and that they are looked down upon for their beliefs. A large variety of religious beliefs are represented at the Livermore labs. Some workers in the lab also consider themselves environmentalists, even though the labs are known to have caused pollution in the surrounding area. Some scientists actively protested the Vietnam conflict when

they were younger. Despite their different values and beliefs on other subjects, the one thing that most do have in common is the idea that it is perfectly appropriate to develop nuclear weapons for the purpose of nuclear deterrence. Many have confidence that this purpose will not falter.<sup>78</sup>

The strength that their morals and ethics had at one time carried deteriorates as larger quantities of money are earned. They rationalize the creation of nuclear weapons by separating themselves from the pain they can cause others. They feel that scientists cannot be held responsible for what political leaders do with their designs. It is similar to the auto manufacturer not being responsible for the people killed and families devastated by the actions of a drunk driver. Others feel that nuclear weapons would keep the peace by raising the price of war too high, having unquestioning faith in the weapon's protective powers. Scientists that worked on various projects involved in the completion of the nuclear weapon were asked if they would order a nuclear retaliation against a first strike nuclear attack on the United States. Most said no, claiming that the weapons were only created to deter an attack. If it ever got to the point where they were actually being used, they have already failed their purpose, and there is no further use for them. The question of how and if nuclear weapons deter war will be dealt with later.<sup>79</sup>

No matter how exciting, attractive or lucrative working at one of these nuclear facilities can be, there are always moral dilemmas that go hand in hand with performing the work. Scientists have to make the decision early on whether or not they want to confront the issue, or to simply try to ignore it. Many claim that the weapons are deterrents to war and believe this so fully that they do not have to look at the possibility

that they will be used to kill millions. The bombs are designed to destroy their targets, which will most likely be occupied by human life. It must be hard to ignore the fact that the weapons are being designed to work and cause incredible destruction. The problem is that nuclear weapons scientists work on devices whose use would risk the destruction of millions of lives, including their own, so ignoring it won't make it go away. This means that for someone to create a nuclear weapon, they must have strong convictions. They believe strongly that the bombs will never be used for any purpose aside from deterrence although they engineer them to cause mass destruction. Or, they must be able to separate themselves totally from the destruction and carnage that the weapons would cause, just as doctors try not to emotionally attach themselves to the injured bodies that they operate on.

After the two bombs were dropped on Japan, a few of the Los Alamos scientists traveled to the areas that had been destroyed in Hiroshima and Nagasaki. The bodies that had been turned into shadows of carbon were not viewed as dead humans as much as items of data and research. The wounded victims who did not die in the initial explosions were also seen as continued research opportunities that enabled the scientists to find out how the human body reacted to radiation through follow up studies. The military has used other people to test what happens when exposed to a nuclear explosion. In early atmospheric tests, soldiers were positioned close to ground zero and forced to walk through the cloud of dust, so that the scientists could study what problems they developed due to the exposure to radiation. The government has also purposely conducted radiation tests on the terminally ill and the mentally retarded, viewing them as expendable subjects. Those exposed to radiation in nuclear accidents



have also been studied in great detail. Most people would not be able to deal with causing harm to these people without separating themselves from the individuals tested on. The scientists detach themselves from viewing these bodies as fellow human beings.<sup>80</sup>

Most of the pictures that are taken of the burn victims are taken so close that the race, age and sex of the victim becomes unclear. The human beings become simply body parts, which are objectified so that it becomes hard for the observer to identify with the person who is being studied. The scientists focus more on the details than they do on their own morals, which seem non-existent at times. When people only pay close attention to the details and not the subject as a whole, the human body, pain, the subject and the actual person begin to disappear. They objectify the signs of pain without the pain of the actual person getting in the way of the scientific work. The information that is communicated has more of a generic quality.<sup>81</sup>

Scientists have also used animals to test the effects of radiation exposure. Pigs were used at the Nevada test site due to their fair skin tone, which resembles that of human beings. They were strategically placed in different areas around the explosion. Some were given protective garments to determine how well it prevented exposure amounts. Uncovered skin burnt by the blast was photographed in detail. In 1957, the government also began to use monkeys in their tests. Those not killed instantly by the nuclear blasts were put in cages so that the long-term effects could be better understood. Scientists that use these animals in their studies cannot feel any emotion about what they are doing. They view their work as objective research.<sup>82</sup>

For a scientist to be able to work on nuclear weapons of mass destruction, he or she must be able to look around the fact that they are being created for their awesome destructive force and believe fully that the weapons' only purpose is as a deterrent to war. If they cannot avoid the fact that the weapons could be used on populations, they must be able to objectify to targets and see the destruction only for its research potential. Scientists today can believe that the weapons will never be used because many were not born early enough to remember World War II. Many of the scientists that were around during the early days of the Los Alamos labs were building the bomb to keep Germany from attacking. After the weapons were used on Japan, however, they realized that their purpose could also be as weapons of mass destruction. After the attacks on Hiroshima and Nagasaki, some scientists that had worked on the bombs became depressed or upset and left the profession completely. Robert Oppenheimer never worked on nuclear bombs after World War II and strongly opposed their further creation.

## **Pure Science vs. the Military Industrial Complex**

The development of nuclear technology is based on scientific information that was first realized near the beginning of the century and has been expanded upon since then. The question is whether or not this scientific research can be purely objective with no interests or motives. There are reasons that this general scientific information has been used to create the nuclear weapons used by the governments and militaries of different countries. There are interests involved in the creation of these weapons of mass destruction. The scientists that were discussed in the previous section spend their time designing nuclear weapons because that is where the work is. The government and military have made sure that these areas of scientific research and development are funded kept going. The point of this section is to show that nuclear weapons are created not out of pure scientific inquiry, but rather because they serve the purpose of certain groups who are in control.

Many people seem to feel that increasing the quality and power of technology will solve all of the world's problems, and that science will be the solution to all problems. Supposedly, science can be pure and can exist for its own sake. Pure science is completely objective, and individual preferences will not be a factor in the scientific method. The results will be viewed the same by each person that observes them. Unfortunately, it is not possible for science to work in this ideal and objective way. Certain problems are always given attention and consequently funded sooner than others deemed less important. This simple fact alone proves that pure science is a myth,

and in reality scientific investigation is determined by the interests of a certain few individuals.<sup>83</sup>

This hypothesis holds true as far as the government is concerned as well. Most scientific research is supported at least partially with government money. Politicians determine which projects are funded, putting money and government in control of what science is conducted. The U.S. military also involves itself in a great deal of the scientific research that goes on in this country. The government funds research that develops technology the military can use, as can be seen in the “military industrial complex”. This rather ambiguous term is used to describe the special relationship between the military and industry. It is a very large intertwining network, and many individuals are employed by it in one way or another when they graduate from college. A statistic that puts this in perspective is that during the 1980’s, two-thirds of all U.S. federal research and development funding was directed towards military projects. Los Alamos and Livermore labs together employ six percent of the country’s physicists, the largest percentage working in any one place in the country.<sup>84</sup>

The military-industrial complex has been growing ever since the beginning of the century, when steel companies were given government contracts to produce ships for the navy. Industries and businesses are given government contracts for doing work. They are forced to do what the government wants in order to keep lucrative government contracts and make a profit.<sup>85</sup>

Certain groups and individuals support science and determine what work will be conducted. According to Kuhn, who wrote about the philosophy of science during the middle of the twentieth century, science is an activity, and the sociology of the scientific

community plays a major role in determining that activity. One must be part of the scientific community in order to be considered a scientist. The Native American medicine man is not a scientist, but the pharmacist is. Only the scientific community can determine what is the proper scientific way to determine what counts as a solution to a scientific problem. There are no standards of evidence outside of the community that one could appeal to. There is no higher standard than the agreement of the rest of the community. All the rules to determine what is science exist within the scientific method itself. Science is not answerable to the larger community or the rest of society. Someone who is not considered a scientist by those who are cannot judge scientific findings.<sup>86</sup>

It is also the case that the rest of society allows scientists to do whatever they want, without taking any interest. They do not consider themselves informed enough to make a decision about what is happening or know how to evaluate the information that is presented to them. As far as nuclear weapons go, the public has no input into what projects are worked on. Almost all of the new technology that is developed is classified work. Only the scientists and engineers working on the project know what is going on. The public has no input on what goes on or what decisions are made. The problem with science and technology is that only a very limited number of people have any say regarding what is researched.

The notion of pure science is a myth. It is impossible for science to be done without a driving force behind it telling it what to do. Research can't be performed by itself; there are many other factors involved. Money is required to fund research, to pay for the laboratories, and give the scientists a salary. This nullifies the idea of pure

science. Those who control the money can dictate what they want researched. Most of the time this is either a large corporation supplying the necessary capital, or the government funding the research. In either case, there are definite interests behind what is done.

The motivation for a corporation is usually only to minimize costs or maximize profits, with little concern for other things such as the effects their greed has on the environment. A perfect example of this is Dupont. It was found that the Freon they were producing was mainly to blame for the hole in the ozone layer, which was responsible for the global warming trend, also known as the greenhouse effect. Scientist after scientist lobbied the government testifying that Dupont had to stop Freon production immediately, or else the whole world would suffer the effects it caused. Dupont said that if it was found that the Freon they were producing was in fact responsible for what was claimed, it would stop; however, it must be done so concretely and without any doubt. Eventually, with a coalition between scientists and the government, they were able to convince Dupont they were in the wrong and stop Freon production. However, Dupont was a step ahead the whole time. They used science to their advantage to discover a better way to make even more money than before. They stopped their Freon production only after they had created a substitute that they could sell for even greater profits.<sup>87</sup>

Science and the government and military go hand in hand. The interests of the government dictate what research will be conducted. This contradicts the idea that scientific research can be pure and objective, and that science can exist for its own sake. Even if monetary or political interests were not involved in deciding what topic is

researched, there must be other interests. With no other deciding factors, the scientist would pursue a topic in which he or she was personally interested.

The reason that nuclear weapon technology has been created is that it serves the purposes of the government and military. It is not a topic of research that all of society has decided is important to the benefit and development of the human race. In fact, much of the American population favors the government ending its nuclear weapons programs. The topic of public opinion will be dealt with in more detail later. The public actually has almost no voice in determining what research is conducted. The goals of science are created by a select few who may not have the interests of the nearly six billion rest of us in mind. And, most of the general public does not question the right of the scientific community and the interests behind it to make decisions for everyone else, despite the fact that these decisions effect the lives, health and survival of everyone else.

## **Nuclear Weapons as a Bad Technology:**

Why are nuclear weapons to be considered bad technology? What does it mean for technology to go bad? One way in which technology is considered bad is if it does not complete its purpose. For example, if an automobile company designed an air bag for a car that did not always work on impact, it would be considered bad technology. What then is the purpose of nuclear weapons? According to the governments that create them, nuclear weapons are designed to prevent war. The threat of total annihilation due to the extreme power of these weapons is used to persuade countries not to go to war. These incredible weapons have made an all-out war too disastrous to fight according to those who create them. But, do nuclear weapons actually deter war from occurring? That is the first question that will be addressed in this section.

The development of nuclear weapons can be seen as an incentive for other states to develop their own arsenals. Each country does not want to allow the other to get ahead in weapons technology, so it continues to design new and more accurate weapons. If nuclear weapons are used as deterrence, they could also be viewed as a factor in continuing nuclear proliferation. This is certainly the case in the way in which the U.S. and Soviet Union had practiced deterrence, resulting in an incredible proliferation of their own nuclear power. Each country had to continue designing new weapons equal to the power of its enemy's weapons in order to possess the strength needed to deter the other from aggressive acts.<sup>88</sup>

Despite the claims made by the nuclear superpowers, it is unclear if nuclear weapons have succeeded in their purpose of deterring war. No weapons have been used



in a wartime situation on an enemy state since the two bombs that were used on Japan in World War II. But, has the existence of such weapons stopped any other large-scale confrontations from occurring? Would the United States and the Soviet Union have gone to war at any point during the Cold War, or was the competition between the two over who was ahead in the arms race the only issue that they had to fight over. The United States government claimed to be completely against the Communist movements, yet continued to maintain China as a trading partner during the Cold War. Communism itself must not have been the problem. Maybe the only thing the U.S. had against the Soviet Union was that they continued to create nuclear weapons. The claimed purpose of nuclear weapons is to stop conflict. Has any conflict been avoided because of a country's possession of nuclear weapons?<sup>89</sup>

Deterrence with respect to nuclear weapons is the credible threat of powerful retaliation. Some have argued that nuclear deterrence is the main reason that the U.S. and the Soviet Union did not actively fight during the Cold War. Each was afraid of the lethal consequences that retaliation on the part of the other would result in. Because of this, each country refrained from initiating a nuclear attack on the other. However, the reason that a nuclear war between the two nations did not occur might be that neither government wanted to annihilate the other. A massive nuclear attack on the other would have been an unthinkable atrocity.<sup>90</sup>

It has been argued that possession of nuclear weapons by the United States stopped the Soviet Union from invading Western Europe. However, this is all circumspect because there is no definite evidence to support the notion that they ever planned on invading those countries. As it can now be seen, the former Soviet Union

was having internal problems, which gave it enough trouble just trying to keep its own empire together, until it began to fall completely apart in the 1980's. It may not have been the United States' possession of nuclear weapons that halted the spread of Communism; it may have just been that the Communist powers were not as strong as they appeared, or that they broke themselves in pursuit of nuclear superiority over the United States. No one can be completely sure if deterrence worked during the Cold War. No nuclear war ever occurred, but this is not to say that the reason was fear of retaliation, or if it were some other reason.<sup>91</sup>

Despite the fact that the U.S. owned a large arsenal of nuclear weapons, and the North Vietnamese possessed none, the United States and its South Vietnamese ally were ultimately defeated in Vietnam. The conflict in Vietnam could not be deterred with nuclear weapons. There was also a situation when the Afghans eventually defeated the Soviet Union. Again, the fighting was not stopped by the threat of nuclear war. These two examples show that when fighting against an enemy with a determined purpose, nuclear weapons do not stop conflict. Deterrence will only work if the side that is to be stopped believes that those who threaten with nuclear weapons are willing to use them. It depends on what the aggressor thinks will happen. Deterrence is a theory that predicts that a potential enemy will not commit violence due to the fear of retaliation. If the enemy does not fear retaliation, deterrence does not work. It is reasonable to say that deterrence would not prevent an attack from someone who did not fear retaliation. A terrorist or irrational political leader may want to start a conflict or cause violence, without being concerned for the consequences.<sup>92</sup>

Using nuclear weapons as a form of deterrence requires that certain governments maintain large arsenals of the weapons. These governments claim that the weapons provide security for their citizens. The argument can then be made that if it is reasonable for one state to rely on nuclear weapons for security, then other countries should be allowed to do the same. If the U.S. can secure its interests with the power of its nuclear arsenal, Russia should have the same privilege, as well as China, India, Pakistan, France and anyone else that can develop or buy the technology. Yet, the current nuclear powers of the world do not advocate that every country should have this right. Ironically, the states that have nuclear weapons and the resulting technology are the ones leading the efforts to prevent others states from creating or owning them, as stated in the nuclear Non-Proliferation Treaty of 1968.

If it were actually believed that nuclear deterrence worked, it would only be fair to allow every country to use them to protect their own interests. No one would advocate giving these weapons to everyone. Only those that already have them or those that intend to develop them justify the continued possession of nuclear weapons. This is because the weapons create power and an advantage for these countries. They may believe that eliminating their nuclear arsenals will diminish their security. Yet, they do not want other countries to have equal power.<sup>93</sup>

Saying a nuclear weapon is a deterrent implies that it keeps the peace by raising the consequences of fighting a war too high. Is this an acceptable foreign policy to maintain, though? One argument says no, because it is not ethical to use evil as a means of doing good. The thought that war or violence is itself deterred by the threat of nuclear war is ironic. The possibility that a threat, meant as a deterrent, could itself

cause war lends some credibility to this view. There are many different ways that a nuclear attack could begin, all of which would use a war deterrent to start the conflict. A different view in the argument is that actions should be judged by their results, and it is therefore all right to create nuclear weapons if their purpose is to prevent others from starting a war, conventional or nuclear. Many scientists, for example, feel that by designing weapons that are more powerful than an enemy's, they are helping to diffuse or prevent potential conflicts. The underlying requirement for this to work though is that once a nuclear weapon is actually used, it has failed to successfully complete its purpose.

If the purpose of nuclear weapons is to prevent conflict, has it succeeded? It has been stated that there is no evidence that the Cold War prevented any aggression between the United States and Soviet Union. The Vietnam conflict was also not deterred because of one government's possession of nuclear weapons. The United States and Soviet Union have each spent enormous amounts of money on their development of nuclear weapons; money that could have been used for other programs designed to aid their citizens. What has spending all this money accomplished? The possession of all the weapons created has done nothing to prevent war. Huge sums of money were spent on programs that never accomplished a thing. Nuclear weapons never succeeded in their goal of preventing conflict. And, if a nuclear weapon were ever to be used in an attack, it would also fail in its claimed goal, which is to prevent this from happening.

Another reason to label a technology as bad science is if the purpose of the technology is harmful to the welfare of human beings and the environment. The

development of medicines would be an example of a science whose ultimate goal is the benefit of society. There may be monetary interests involved in deciding what medical applications are studied and researched, but any research can only lead to the healing of many people. One cannot claim that the world would be a better place if certain medication did not exist to prevent fatal diseases. The goal of medicine is to deter disease, and there are millions of cases in which it has succeeded, unlike nuclear weapons whose goal of deterring war may never have been accomplished.

Also, unlike the beneficial purposes of medicines, the driving force behind the development of nuclear weapons is to make them increasingly destructive and lethal. Weapons are designed so that they can achieve a maximum yield of explosive power and be as accurate as possible in reaching their targets. They are made to strike the enemy as quickly as possible so that there is little warning or chance of retaliation. If a weapon were ever used on a populated area, the results would be disastrous, as has been discussed earlier. Millions of people would be dead in a very short time in each major city that is attacked. There would also be negative and possibly fatal health effects on the surviving population for the decades and centuries to come. It is possible for the majority of the United States population to be killed over a relatively short period of time. And, this could happen at any moment, either intentionally or by accident.

Also, the creation and testing of nuclear weapons has had a detrimental effect on the environments and surrounding populations near the testing. Atmospheric tests created radioactive fallout that caused negative health effects on the population. It has been documented that the United States infected the native peoples of the Marshall Islands with doses of radiation, which lead to future health problems for the inhabitants.

Underground tests have left the areas radioactive, which may result in cancer deaths occurring thousands of years from now. Nuclear technology development facilities, such as the Livermore Labs, have polluted the surrounding areas with radioactive particles.<sup>94</sup>

Technology that requires that these negative effects occur on both the environment and the population cannot be considered safe or beneficial. The development of nuclear technology has done nothing to aid the development of human society. The vast majority of society has received no favorable results from this technology. The creation of nuclear weapons has not improved anyone's everyday life. It has however, used up a great deal of money that could have been used in programs which could help the citizens of the United States and the former Soviet Union. Many of the people of Russia are living in poverty because their government spent all of its monetary resources in the arms race.

Testing of these weapons has also damaged the environment and health of human beings. It was already pointed out that the U.S. government and military harmed its citizens, the native people of the Marshall Islands, soldiers in its military, animals, the environment and people who will be born on this planet for next few thousand years. This is all due just to the testing of atomic weapons. The fatality numbers would increase by incredible amounts if a nuclear war ever broke out. This technology has the potential to end all life on this planet. It cannot be considered a good result of scientific research.

## **Public Opinion:**

It was stated earlier in this discussion that only a select few have control, input or knowledge in what is happening with nuclear weapons development. Only those in high ranks of the government and military as well as the scientists and engineers that have been given special security clearance can decide what will be done. The rest of us have no say in what happens. National security and classified information prevent the public from knowing what is going on. Although the public does not know the specifics, many do have an opinion about what their government should be doing. It is the responsibility of the government to listen to the will of its citizens. Those in power should not be allowed to make decisions that affect the future welfare of everyone else if the majority of the population disagrees with these choices.

According to polls taken recently the majority of the American population supports and would feel safer nuclear disarmament occurred. The Cold War has become a distant memory so a substantial majority of those polled no longer feel that there is any reason for maintaining a stockpile of nuclear weapons. By a nine-to-one margin, the Americans surveyed support an international treaty to eliminate nuclear arms, according to Abolition 2000, a global network that consists of 700 different groups that seek elimination of all nuclear weapons.<sup>95</sup>

A nation survey of over 1,000 citizens determined that the public feels unsafe with the current nuclear arsenal. Eighty-four percent said that they would feel safer in a world in which no country, including the United States, possessed nuclear weapons. The survey also found that seventy-seven percent of the public strongly disagrees with

the country's current federal budget that spends more on nuclear weapons than on fighting illiteracy, providing college scholarships and the Head Start program combined. Those polled opposed the maintenance of a nuclear weapons stockpile, and eighty-seven percent supported an international treaty to eliminate nuclear weapons. According to those who created the survey, these feelings are shared by both men and women, Democrats and Republicans, and throughout every region of the country. The creator of the survey remarked that it is quite rare to see such a broad agreement on this type of public policy issue. With such strong public support for eliminating all nuclear weapons, how can the government not do so?<sup>96</sup>



## **Forbidden Knowledge:**

When getting involved in a discussion of what should have, could have, or would have been done differently to better a given situation, the idea of “forbidden knowledge” is another topic that continually arises. The basic principle of this theory is that certain information exists that society as a whole should not know, or is too immature to handle correctly at the current point in time. The best solution many times in such a case may be to suspend knowledge of such information until a future time presents itself when society would be better suited to properly deal with it and its consequences. If the scientists in Germany responsible for the theory of fission had the foresight to not reveal their newly found discovery to anyone else because of the possible applications it could be used for, would it be possible that nuclear weapons would not exist?<sup>97</sup>

Part of this reason is that it may be possible for scientist and others to know too much for their own good. Or, it may be that they know only part of what they need in order to be able to handle certain technology. For example, they know how to create weapons that are capable of destroying all life on this planet, but may not know how to ensure that that never happens. Or, engineers can create nuclear power plants that could supply everyone with unlimited energy, but they cannot ensure that they never contaminate the surrounding environments. Not all knowledge is good knowledge, and nowhere has it been said that knowledge will solve all problems. Earlier cultures recognized that certain limits on knowledge existed for their own good, with words such as taboo, sacred, and unspeakable used to describe such information. But recently, in

this age of scientific discovery, inquisitiveness has led humanity to learn information that maybe it should not know. This idea can be seen in the Bible as well, the most widely read and popular book in the world. In one passage, God says to Noah, “For the imagination of man’s heart is evil from his youth.” (8:21). People feel that they have to see and experience things for themselves. They need proof and will not believe someone on merit alone. Why is this? Curiosity seems like a valid possibility, but is unclear still if this is an inherited quality or if it is created during childhood. The debate of nature versus nurture appears once again. Human beings are either born with some thirst for knowledge, a yearning to understand everything that surrounds or intrigues them, or they are taught this at a young age within an environment that encourages meddling and prying as the basis for acquisition of knowledge. This is a question that has not yet been answered properly or completely.

Nuclear weapons technology may be a form of knowledge that humanity is not ready to know. It may not be the best time to introduce such destructive technology to the world when conflicts still continue to arise. Major conflicts have always occurred throughout history with no end or sign of world peace in sight. Maybe it is not such a good idea to give the knowledge of such destructive weapons to the world when it is in this power hungry state. Is the world capable of knowing this information without ever using its power?<sup>98</sup>

## **Conclusion:**

A number of different points have been made to explain why nuclear weapons are a technology that has failed, or at least never succeeded in its purpose. The main claim made by the governments that possess them is that they are used to prevent war from occurring. This is not the case however; conflict continues throughout the world every day. It is assumed by many that the United States' and Soviet Union's possession of these weapons of mass destruction stopped an all out war from ever occurring. But this is probably not the case, as the two nations had little against each other aside from their arms race. Both countries have gotten involved in conflicts since they have owned nuclear weapons technology with countries that do not possess the same power, and both were defeated in their efforts. Their weapons did not prevent these conflicts or assure them victory.

The design, creation and testing of nuclear weapons have also had a negative effect on the people of this planet, past, present and future. The radiation from these tests spread to the surrounding communities and in some cases far beyond that range. The radiation negatively affects the health of these individuals through the development of cancer and other radiation poisonings. The weapons have also destroyed the homes of some in the testing areas. The United States government's tests forced the natives of the Marshall Islands to leave their homes. They also caused the people to be exposed to residual radiation when they were allowed to return, resulting in some cases of cancer. These are only the harmful effects due to the testing of these devices.

The destructive results if a weapon were to ever be used in an attack would be much more disastrous. Millions of people could be killed as the result of just one bomb being exploded in a metropolitan area. Some would be killed instantly, others would suffer in agony for a month before dying, and still others would develop their fatal cancers from radiation exposure ten or fifteen years later. If an all out war were to occur between nuclear superpowers, the results would be disastrous- the extinction of all life on this planet.

Nuclear weapons have not served their purpose, and maintaining stockpiles, especially in countries that are having enough other problems as it is, is not a wise idea. Disarmament and dismantling of nuclear reserves must continue until the planet is free of their terror. The money that governments use to create and maintain these weapons could have much more beneficial values. The duty of the democratic government is to serve the best interests of its citizens, not the best interests of those who are put in charge by them. Polls have shown that an overwhelming amount of the U.S. population favors erasing all nuclear weapons from existence on this planet. Yet, people must realize and remember the harm that they have caused to this world so that the threat of nuclear war never returns.

## References:

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- <sup>1</sup> David Krieger, "Ending the Nuclear Weapons Era," 1998, < <http://www.wagingpeace.org/endnuke/chap15.html>> (Feb 9, 1999)
- <sup>2</sup> Stephen I. Schwartz, "50 Facts about U.S. Nuclear Weapons," 1996, < <http://www.brook.edu/FP/PROJECTS/NUCW/COST/50.HTM>> (Feb 9, 1999)
- <sup>3</sup> Helen Caldicott, *Missile Envy*, (New York: Bantam Books, 1986) 111
- <sup>4</sup> Lawrence Badash, *Scientists and the Development of Nuclear Weapons: From Fission to the Limited Test Ban Treaty 1939-1963*, (New Jersey: Humanities Press, 1995), 12-26
- <sup>5</sup> *The Day after Trinity*, prod. Jon Else, 90 min., Pyramid Film and Video, 1980 videocassette
- <sup>6</sup> Kreiger, ch.15
- <sup>7</sup> Badish, 12-13
- <sup>8</sup> Ibid., 13-14
- <sup>9</sup> "Atomic Archive," 1998, <http://www.atomicarchive.com/> (Feb 9, 1999)
- <sup>10</sup> Badish, 23-26
- <sup>11</sup> *The Day after Trinity*
- <sup>12</sup> Ibid.
- <sup>13</sup> Ibid.
- <sup>14</sup> John Charmley, *Churchill's Grand Alliance*, (New York: Harcourt Brace & Company, 1995)
- <sup>15</sup> *The Day After Trinity*
- <sup>16</sup> Ibid.
- <sup>17</sup> Ibid.
- <sup>18</sup> Ibid.
- <sup>19</sup> Ibid.
- <sup>20</sup> Ibid.
- <sup>21</sup> Ibid.
- <sup>22</sup> Ibid.
- <sup>23</sup> Ibid.
- <sup>24</sup> Ibid.
- <sup>25</sup> Ibid.
- <sup>26</sup> Ibid.
- <sup>27</sup> Ibid.
- <sup>28</sup> Ibid.
- <sup>29</sup> Ibid.
- <sup>30</sup> Ibid.
- <sup>31</sup> Ibid.
- <sup>32</sup> Ibid.
- <sup>33</sup> Ibid.
- <sup>34</sup> Hugh Gusterson, *Nuclear Rites: A weapons laboratory at the end of the cold war*, (Los Angeles: University of California Press, 1996), 20-21
- <sup>35</sup> Ibid.
- <sup>36</sup> *The Day after Trinity*
- <sup>37</sup> Gusterson, 21-22
- <sup>38</sup> Ibid., 24
- <sup>39</sup> Ibid., 24
- <sup>40</sup> Ibid., 24-25
- <sup>41</sup> Las Vegas Review-Journal "Worldwide Nuclear Testing Milestones 1945-1998," 1998, <[http://www.lvrj.com/lvrj\\_home/1998/May-18-Mon-1998/news/7500989.htm](http://www.lvrj.com/lvrj_home/1998/May-18-Mon-1998/news/7500989.htm)> (Feb 9, 1999)
- <sup>42</sup> IPPNW, *Radioactive Heaven and Earth: The health and environmental effects of nuclear weapons testing in, on, and above the earth*, (London: Zed Books, 1991), 50
- <sup>43</sup> Ibid., 50-60
- <sup>44</sup> Ibid., 60-63
- <sup>45</sup> Ibid., 69-88
- <sup>46</sup> Ibid., 69-88

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- <sup>47</sup> Schwartz
- <sup>48</sup> Ibid.
- <sup>49</sup> Ibid.
- <sup>50</sup> Las Vegas Review-Journal
- <sup>51</sup> Ibid.
- <sup>52</sup> "Atomic Archive"
- <sup>53</sup> Ibid.
- <sup>54</sup> Ibid.
- <sup>55</sup> Ibid.
- <sup>56</sup> "United Nations Calls for an Immediate End to Nuclear Testing," 1995 < [http://host.dfat.gov.au/pmb/releases\\_old/minfor/m136.html?NS-search-set=/335ce/aaa281995ce63e&NS-doc-offset=26&](http://host.dfat.gov.au/pmb/releases_old/minfor/m136.html?NS-search-set=/335ce/aaa281995ce63e&NS-doc-offset=26&)> (Feb 10, 1999)
- <sup>57</sup> IPPNW, 4-8
- <sup>58</sup> Ibid., 7-8
- <sup>59</sup> Ibid., 33-48
- <sup>60</sup> Caldicott, 7
- <sup>61</sup> Ibid., 8-14
- <sup>63</sup> Ibid., 7-30
- <sup>64</sup> Ibid., 7-30
- <sup>65</sup> Ibid., 7-30
- <sup>66</sup> Ibid., 7-30
- <sup>67</sup> Ibid., 7-30
- <sup>68</sup> Caldicott, 17-18
- <sup>69</sup> Ibid., 20-22
- <sup>70</sup> Ibid., 8-14
- <sup>71</sup> Ibid., 22-25
- <sup>72</sup> Ibid., 25-30
- <sup>73</sup> Ibid., 25-30
- <sup>74</sup> Gusterson, 38-67
- <sup>75</sup> Ibid., 38-67
- <sup>76</sup> Ibid., 15-37
- <sup>77</sup> Ibid., 38-67
- <sup>78</sup> Ibid., 38-67
- <sup>79</sup> Ibid., 38-67
- <sup>80</sup> Ibid., 101-130
- <sup>81</sup> Ibid., 101-130
- <sup>82</sup> Ibid., 101-130
- <sup>83</sup> Caldicott, 111
- <sup>84</sup> Gusterson, 43-44
- <sup>85</sup> Caldicott, 172
- <sup>86</sup> Lynn Nelson, *Who Knows: From Quine to a Feminist Empiricism*, (Philadelphia: Temple University Press, 1990) 60-78
- <sup>87</sup> John Nance, *What Goes Up*, (New York: W.Morrow, 1991) 179-201
- <sup>88</sup> Krieger, ch.15
- <sup>89</sup> Ibid., ch.15
- <sup>90</sup> Ibid., ch.15
- <sup>91</sup> Ibid., ch.15
- <sup>92</sup> Ibid., ch.15
- <sup>93</sup> Ibid., ch.15
- <sup>94</sup> IPPNW
- <sup>95</sup> Lake Sosin Snell & Associates, "Public Poll on Nuclear Weapons," 1997 <http://www.psrus.org/abolitionpoll.htm> (Feb 10, 1999)
- <sup>96</sup> Ibid.
- <sup>97</sup> Roger Shattuck, *Forbidden Knowledge: From Prometheus to Pornography* (New York: St. Martin's Press, 1996)

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<sup>98</sup> Ibid.

## Bibliography

“Atomic Archive.” 1998. <<http://www.atomicarchive.com/>> (Feb 9,1999)

Badash, Lawrence. *Scientists and the Development of Nuclear Weapons: From Fission to the Limited Test Ban Treaty 1939-1963*. New Jersey: Humanities Press, 1995.

Caldicott, Helen. *Missile Envy*. New York: Bantam Books, 1986.

Charmley, John. *Churchill's Grand Alliance*. New York: Harcourt Brace & Company, 1995.

*The Day after Trinity*. Produced by Jon Else. 90 min. Pyramid Film and Video. 1980. Videocassette.

Fausto-Sterling, Anne. *Myths of Gender: Biological theories about women and men*. New York: Basic Books; 1985.

Gusterson, Hugh. *Nuclear Rites: A weapons laboratory at the end of the cold war*. Los Angeles: University of California Press, 1996.

IPPNW. *Radioactive Heaven and Earth: The health and environmental effects of nuclear weapons testing in, on, and above the earth*. London: Zed Books, 1991.

Krieger, David. “Ending the Nuclear Weapons Era.” 1998. < <http://www.wagingpeace.org/endnuke/chap15.html>> (Feb 9,1999)

Lake Sosin Snell & Associates. “Public Poll on Nuclear Weapons.” 1997. <<http://www.psrus.org/abolitionpoll.htm>> (Feb 10,1999)

Las Vegas Review-Journal. “Worldwide Nuclear Testing Milestones 1945-1998.” 1998. <[http://www.lvrj.com/lvrj\\_home/1998/May-18-Mon-1998/news/7500989.html](http://www.lvrj.com/lvrj_home/1998/May-18-Mon-1998/news/7500989.html)> (Feb 9, 1999)



MacIntyre, Alasdair C. *After Virtue : A study in moral theory*.  
Notre Dame, IN: University of Notre Dame Press, 1981.

Nance, John. *What Goes Up*. New York: W.Morrow, 1991.

Nelson, Lynn. *Who Knows: From Quine to a Feminist Empiricism*. Philadelphia: Temple University Press, 1990.

Schwartz, Stephen. "50 Facts about U.S. Nuclear Weapons." 1996. < <http://www.brook.edu/FP/PROJECTS/NUCW/COST/50.HTM>> (Feb 9, 1999)

Shattuck, Roger. *Forbidden Knowledge: From Prometheus to Pornography*. New York: St. Martin's Press, 1996.

Steingraber, Sandra. *Living Downstream: An ecologist looks at cancer and the environment*. Reading, MA: Addison-Wesley Publishing; 1997.

"United Nations Calls for an Immediate End to Nuclear Testing." 1995. < [http://host.dfat.gov.au/pmb/releases\\_old/minfor/m136.html?NS-search-set=/335ce/aaaa281995ce63e&NS-doc-offset=26&](http://host.dfat.gov.au/pmb/releases_old/minfor/m136.html?NS-search-set=/335ce/aaaa281995ce63e&NS-doc-offset=26&)> (Feb 10, 1999)