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## THE MANHATTAN PROJECT

# STUDY GUIDE

#LETSBEEUNITED


DOĞUKAN BERKE AŞIK
**UNDER-SECRETARY GENERAL**

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**UNDER-SECRETARY GENERAL**



ITU MUN

## Letter from the Secretariat

Dear Delegates,

It is with great honor and enthusiasm that I welcome you to ITUMUN 2025, where innovation, diplomacy, and collaboration come together to shape a brighter future. As Secretary-General, it is my privilege to witness the incredible passion and dedication each of you brings to this conference.

For this year's ITUMUN, we challenge you to think beyond borders and redefine the possibilities of multilateral cooperation. As a university rooted in engineering and technical excellence, we have embraced our unique identity by curating committees and agendas that emphasize industrial development, technological advancement, and critical technical issues. Whether debating economic policies, grappling with emerging technologies, or navigating historical turning points, you will be tasked with crafting solutions that not only address the challenges at hand but also inspire progress.

Model United Nations is more than just an academic exercise—it is a platform for you to develop critical thinking, refine your communication skills, and foster a spirit of teamwork. This conference is your opportunity to step into the shoes of world leaders, embracing the responsibility and influence that comes with these roles.

On behalf of the entire ITUMUN team, I wish you the best of luck in your preparations and during the conference itself. We are here to support you every step of the way, ensuring that your ITUMUN experience is both impactful and unforgettable. I look forward to seeing the energy and ideas you bring, and the lasting connections you will forge throughout this journey.

Warm regards,

Roya Alhariri
Secretary-General
ITUMUN 2025

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# TABLE OF CONTENT

*“Prometheus stole fire from the gods and gave it to man. For this he was chained to a rock and tortured for eternity."*

## 2. LETTER FROM THE UNDER SECRETARIES GENERAL

Esteemed delegates,

It is our utmost pleasure to welcome you to this year's edition of the annual Istanbul Technical University Model United Nations conference, ITUMUN25, as the Under Secretaries General of the Historical Crisis Committee: the Manhattan Project. We are ecstatic to welcome all of you to the committee that will be recreating one of the most important scientific organizations in history. Before diving into the topic at hand, we would like to take the opportunity to introduce ourselves and explain what to expect in the 4 days of intrigue and conflict that we will be tackling together.

We would like to introduce our two first committee USGs, starting with Ege Kaval. Currently in his 4th and hopefully last year at Bahçeşehir University as a Software Engineering student, he has always had an interest in historical events and how they ended up the way they did. After an 8 year long sabbatical from MUN conferences, coming back to familiar surroundings was a nice pastime and as he reallocated himself, he remembered just how much fulfilment he gets from doing Crisis Committees.

Our second USG is Doğukan Berke Aşık. He's a 3rd year student majoring Political Science and International Relations in Marmara University. Although he's dealing with social sciences and such, Doğukan's eyes have always been up in the sky wondering about the biggest and smallest objects in outer space and quantum physics. Not only that, given the major he's currently enrolled in, he also has interest in historical events and the political landscape of different nations. His interest in diplomatic relations, cooperation and 7 years of MUN experience led to his pursuit of political science.

For this committee, you will be given a specific person that had a major role to play in the United States of America, based on a secret nuclear project done during World War II which is the Manhattan Project. Our interest in the topic stemmed from Christopher Nolan's excellent 2023 movie "Oppenheimer" and how it highlighted the intricacies of espionage with scientific discovery together. We will primarily be focusing on Project Y, the part of the Manhattan Project that took place in Los Alamos Laboratory but will be covering every aspect of the project as a whole. You will be expected to engage in the complicated process of inventing and building the atomic bomb while tackling multiple problems like espionage, time management and such.

We are aware that the topic seems complicated and difficult to grasp but we can assure you that we will be making it as simple yet engaging as possible. Neither you nor we are actual scientists that can create the atomic bomb from scratch but recreating the process is manageable and enjoyable at the same time. Hopefully you are as excited as we are for the days ahead as we progress through the difficulties together.

See you at the conference and remember: *Knowledge cannot be pursued without morality.*

Regards,

Under Secretaries General

Ege Kaval & Doğukan Berke Aşık

## 3. INTRODUCTION TO THE COMMITTEE

The committee is designed to simulate the various aspects of the most important and memorable laboratory ever created, which is the Los Alamos Laboratory and the Manhattan Project. The delegates within the committee will face crises and drawbacks in various fields such as security, politics, physics, technology, ethics and morality. The main target is to create an A-bomb to finalize the international conflict, World War II. The respective committee and its topic will have similarities and connections with the movie *Oppenheimer*.

### 3.1 OVERVIEW OF THE MANHATTAN PROJECT

The United States hurried to create and use the first atomic weapons in history before Nazi Germany did during the Manhattan Project, a historic, top-secret government initiative during World War II. One of the most significant historical occurrences of the 20th century was the United States' use of these weapons against Japan in August 1945. The project created lasting effects that are being felt today and brought about the nuclear age. Three main sites across the nation —Hanford, Washington; Los Alamos, New Mexico; and Oak Ridge, Tennessee — were the sites where the Manhattan Project was developed.

In December 1938, German scientists made the discovery of fission. Leo Szilard, a Hungarian physicist, recognized that new and incredibly potent atomic weapons may be produced by nuclear chain reactions. Szilard warned that an "extremely powerful bomb" might be built in a letter to President Franklin D. Roosevelt in August 1939, which Albert Einstein was to sign and forward. Roosevelt established the Advisory Committee on Uranium, which convened for the first time on October 21, 1939, out of concern for Nazi Germany's continued research and development.

Following the bombing of Pearl Harbor by Imperial Japan on December 7, 1941, the United States formally entered World War II. The Advisory Committee on Uranium came to the conclusion that an atomic weapon could be created, manufactured, and deployed in time to affect the course of the war, as the United States was now at war. The Manhattan Engineer District, led by Brigadier General Leslie Groves, was established in Manhattan, New York, by the Army Corps of Engineers to carry out this mission. This concentrated endeavor brought together industrial, scientific, and military resources. Even while the Manhattan

Project employed hundreds of thousands of people nationwide, it was mainly kept under wraps.

### 3.2 RELEVANCE OF THE MOVIE OPPENHEIMER

The film, directed by the renowned American Christopher Nolan, centers on the life of the well-known physicist J. Robert Oppenheimer. His story about the Manhattan Project, which involved creating the atomic bomb in the United States, has generated a lot of interest from both the scientific community and viewers. A number of people who were significant figures in Oppenheimer's life, including Albert Einstein and Niels Bohr, are also included in the film. According to Martin J. Sherwood and Kai Bird's Oppenheimer biography "American Prometheus," the movie is regarded as Nolan's finest.

In order to defend this crucial decision that altered world history and claimed the lives of over 100,000 people, or just to appease American consciences, films about the atomic bomb that were produced soon after World War II had a propaganda touch. As Nolan concentrates on Oppenheimer's ethical weight as the "father of the atomic bomb," these worries might be resolved by 2023. He does, however, also discuss some of the specifics of the Manhattan Project, which was funded heavily and conducted in extreme secrecy in order to create an atomic weapon before the Germans did.

## 4. HISTORICAL CONTEXT

### 4.1. WORLD WAR II: GLOBAL POLITICAL LANDSCAPE

With Nazi Germany's invasion of Poland on the 1st of September 1939 the world was plunged into World War II. This was a long time coming as with the Treaty of Versailles (1919) Germany was forced into an economically devastated state and under Hitler looked to rise back up and free themselves from the political humiliation the world had forced upon them. With the state of the world in general post-World War I, multiple totalitarian regimes such as Mussolini's Italy and Stalin's Soviet Union came to power and aimed to grow. With Europe being stirred in such a way Japan also attempted to expand further into the mainland of Asia, which ended up with the Axis powers being formed with the shared goal of global domination, albeit it being shared in the end.

To confront this force the Allied Powers, consisting of the United Kingdom, France, the Soviet Union and eventually the United States were formed. Their main goal was to stop the expansion efforts as swiftly as possible but were unable to do so, leading to the World War lasting over 6 years and taking the lives of nearly 3% of the entire world's population with it. During this time tensions were high at all ends, even within the so-called alliances the countries had created. Distrust grew among the Allied Powers as the ideological differences between democratic capitalists and the Soviet Union's communist agenda led to the creation of issues lasting even after the war had ended. The main reason these powers stayed together for the long run was the existence of a common enemy in the Axis Powers. In conclusion the entire world was in a state fueled by secrecy, rivalry and competition mainly focusing on areas of military and strategic importance.

## 4.2. ROLE OF SCIENCE AND TECHNOLOGY DURING THE WAR

Scientific advancements shape almost every aspect of our lives. From the invention of the printing press and telephones to the discovery of gravity and evolution, they have had major impacts on the way we live. The early and mid-20th century saw major developments in science occur, especially those that shaped warfare. After the Great War, nations across the globe aimed their research to give them an edge in warfare in case another war were to erupt in the near future. Such advancements that were made included mechanized vehicles such as tanks and aircrafts which allowed increased mobility in fighting, the invention of the radar which basically revolutionized reconnaissance and detection, and communication technologies such as encrypted systems like the Enigma machine. Advances in chemistry included the development and improvement of synthetic materials like rubber which were used in warfare to sustain war efforts to combat resource shortages. Chemical weapons such as napalm were also produced but in fear of increased and extreme retaliation on both sides saw their usage minimized. After the discovery of Penicillin in the late 1920s medical supplies were also mass produced which was used to save countless lives during the war. So almost every scientific innovation made at this time wasn't focused on conventional weaponry but somehow got linked to the war effort even if the invention itself was not aimed for it initially.

## 4.3 EARLY RESEARCH AND RACE FOR NUCLEAR POWER

Within the previous part on the role of science and technology during the war the physics side was left untouched because the major development on that end was the discovery of nuclear fission in 1938 by German physicists Otto Hahn and Fritz Strassmann. Theoretically explained later by Lise Meitner and Otto Frisch this new advancement was revolutionary. The realization that splitting an atom could release enormous amounts of energy sparked global interest in its potential applications, specifically in terms of making it into a weapon.

With WW2 breaking out soon after, it became a race to further develop the applications of this discovery. Scientists all over the world recognized the strategic significance of nuclear technology and what it could imply to warfare. With its discovery being made in Germany, fear of what might happen if the Nazis managed to harness this sort of power set in and led the Allied Nations to make this technology a priority.

Early efforts were marked by a blend of scientific collaboration and intense secrecy. Physicists such as Enrico Fermi, Niels Bohr, and Leo Szilard made significant contributions to understanding the principles of nuclear chain reactions. However, geopolitical rivalries and wartime alliances shaped the trajectory of this research, as nations worked both to advance their own projects and to prevent their adversaries from achieving breakthroughs, leading to espionage both in terms of gathering information to improve their own work and in terms of relaying false information all in order to hinder the other side by any means necessary.

The major downside and difficulty weren't simply the creation of a weapon that used nuclear power, but it also required extensive resources and expertise, including access to rare materials like uranium and plutonium. Mining operations, enrichment facilities, and experimental reactors began popping out all around the globe in an effort to maximize efficiency. With resources being gathered, the top scientists were recruited by nations as to what good the tools would be without their workers. The most significant and world-renowned operation that encompassed all these aspects to their fullest potential was the Manhattan Project. The details of where and how the project was conducted will be dived into later in the guide.

The race for nuclear power was not just a scientific endeavor but a strategic one, reflecting the broader geopolitical competition of the era. It underscored the intersection of science, technology, and military strategy in shaping the modern world.

## 5. KEY FIGURES AND ADMINISTRATION

The scale and goal of the Manhattan Project was one that needed resources and secrecy at a level that was hitherto undreamt of at the time. The US government spared no expense in the creation of it and was hopeful that the research being conducted by the project would define the outcome of the war. Numerous personnel were recruited in bases all across the United States among which the most important one was the Los Alamos Laboratory. Here working on what was named Project Y, were some of the most important people in completing the Manhattan Project.

### 5.1 J. ROBERT OPPENHEIMER

*"Now I am become Death, the destroyer of worlds"* the infamous quote made from a line of Hindu scripture is now associated with this man: J. Robert Oppenheimer. Born in New York 1904, Robert first got a degree in chemistry from Harvard University and later went to the University of Göttingen where he studied under renowned physicist Max Born and finished his doctorate in 1927. After continuing to research in various institutions, he became a professor at the University of California, Berkeley, which later became an important base of operations for the Manhattan Project as the Radiation Lab.

During his time back in the States, like many intellectuals of his time, he was drawn to leftist and socialist ideas. Due to his sympathy for just and progressive causes, he was deeply entangled with the Communist Party of the United States, although he never became a member of it. He attended events hosted by the Party and supported causes such as the Spanish Civil War effort against Franco financially. His brother, Frank Oppenheimer was a member of the Communist Party and many members in his inner circle including his wife Katherine Oppenheimer were affiliated with communist ties. These kinds of details in his life led to many suspecting his loyalty to his country during the war, however despite these ties he was deemed essential for the Manhattan Project and was appointed as the director of Los Alamos Laboratory after being approached by Leslie Groves in the early 1940s.

Robert was known for having extensive connections to scientists and was well renowned among the scientific community. His deep knowledge and interest in theoretical physics along with these connections made him an ideal leader and a pivotal figure in the Manhattan Project. Using his ability to bring together experts of various different fields of research he put together a group that would invent the atomic bomb, and with that be nicknamed as "the father of the atomic bomb". His communist connections that were ignored during the war were later resurfaced as after the war he showed his stance against the development of the hydrogen bomb. This led to the 1954 Atomic Energy Commission hearing where he was accused of being a security risk and was stripped of his security clearance, effectively ending his influence in government nuclear policy.

In conclusion J. Robert Oppenheimer was a brilliant scientist whose contributions to the Manhattan Project were instrumental in ending World War II. However, his association with leftist politics in his early career led to significant controversy and personal struggles after the war had ended. Even though he was still revered as one of the greatest minds of his generation by his peers at the time, his legacy was left tainted because of his sympathetic ideal. Today, he is remembered as a visionary physicist and a symbol of the moral dilemmas faced by scientists working on powerful and potentially destructive technologies. He will be represented as a board member within the committee.

### 5.2. GENERAL LESLIE GROVES

The Manhattan Project was a government funded military project, and as such needed a high-ranking member of the military. The assigned person was Brigadier General Leslie Groves, a 1896 born army man who also had a knack for engineering. Serving in the U.S. Army Corps of Engineers, he gained experience managing large-scale construction projects. Before being assigned to lead the Manhattan Project, he was a critical figure in overseeing wartime infrastructure such as military bases and airfields. One of his many important contributions to military infrastructure came in the form of leading the construction of the Pentagon, the headquarters of the U.S. Department of Defense.

In 1942 he was assigned to lead the Manhattan Project as the military leader. Under the supervision of Henry Stimson, the Secretary of War at the time and the Military Policy Committee, Groves was responsible for managing the enormous logistical, financial, and security challenges of the project. He had full authority of the project and would make critical decisions about the project's direction, budget allocation and timeline. Despite his lack of knowledge on nuclear physics prior to the project, he made an effort to learn the basics to ensure there were no miscommunication issues between the scientists and the military.

After selecting sites where major facilities involving the project would be built such as Los Alamos, Oak Ridge and Hanford Site, he oversaw the construction so that the sites were built rapidly under strict secrecy. To ensure secrecy he enforced strict security protocols to prevent leaks and espionage. He implemented compartmentalization, meaning workers only knew what was necessary for their specific tasks. Even focusing on resource gathering aspects he ensured a steady supply of rare materials like uranium and plutonium, working with mining operations in the U.S. and Canada.

Even though he was the initial person to approach Oppenheimer and convince him to work on the project, the relationship between the two was a complicated one. While Oppenheimer had a more intellectual and introspective approach to matters, Groves was more pragmatic and goal oriented. Even though the two would disagree on matters such as military control versus scientific freedom, they ultimately managed to work through their differences and finish the project successfully. After the Trinity Test, the first detonation of an atomic bomb, he urged for the creation of the bombs "Little Man" and "Fat Boy" which would later be used in the bombings of Hiroshima and Nagasaki in August 1945. His leadership, to this day, is still remembered as the driving force behind the success of the Manhattan Project, but he was also known for being extremely strict among the scientists in Los Alamos. He will be accompanying Oppenheimer as the second board member of the committee.

## 5.3. KEY SCIENTISTS AND ENGINEERS INVOLVED

As mentioned before with Oppenheimer's connections, many individuals with advanced knowledge in their respective fields were recruited throughout the project. Mainly stationed in Los Alamos or the Radiation Lab in the University of California, some of these individuals were exceptionally important in the project's development.

John von Neumann: While Oppenheimer was known as the main brain on the nuclear physics front, von Neumann was the mathematical brain behind the Manhattan Project.

After developing an interest that grew to be expertise on explosions which were described as “phenomena that are difficult to model mathematically”, von Neumann became a master of shaped charges, explosive charges specifically shaped to focus the energy of the explosion. His calculations led to the understanding that there wouldn’t be enough uranium-235 to make more than one bomb and thus the project switched to the implosion method that could be implemented by the use of plutonium-239. He wasn’t included in Nolan’s “Oppenheimer”, perhaps due to the complications he could bring by potentially stealing the spotlight from the main character.

Ernest Lawrence: A Nobel Prize in Physics winner thanks to his invention of the cyclotron, the particle accelerator that would be used for the electromagnetic separation method used to produce enriched uranium for the bombs. He worked at the University of California, was later responsible for the design and construction of the electromagnetic separation plant at Oak Ridge, and frequented Los Alamos to help with the creation of the bombs there.

Enrico Fermi: While Oppenheimer is regarded as the “father” Fermi is regarded as the “architect” of the atomic bomb. The Italian physicist did groundbreaking work, creating the world’s first artificial nuclear reactor and the first human-made self-sustaining nuclear chain-reaction via an experiment he led. He was responsible for the F-division in Los Alamos, focused mainly on nuclear and theoretical physics specifically created for and named after himself.

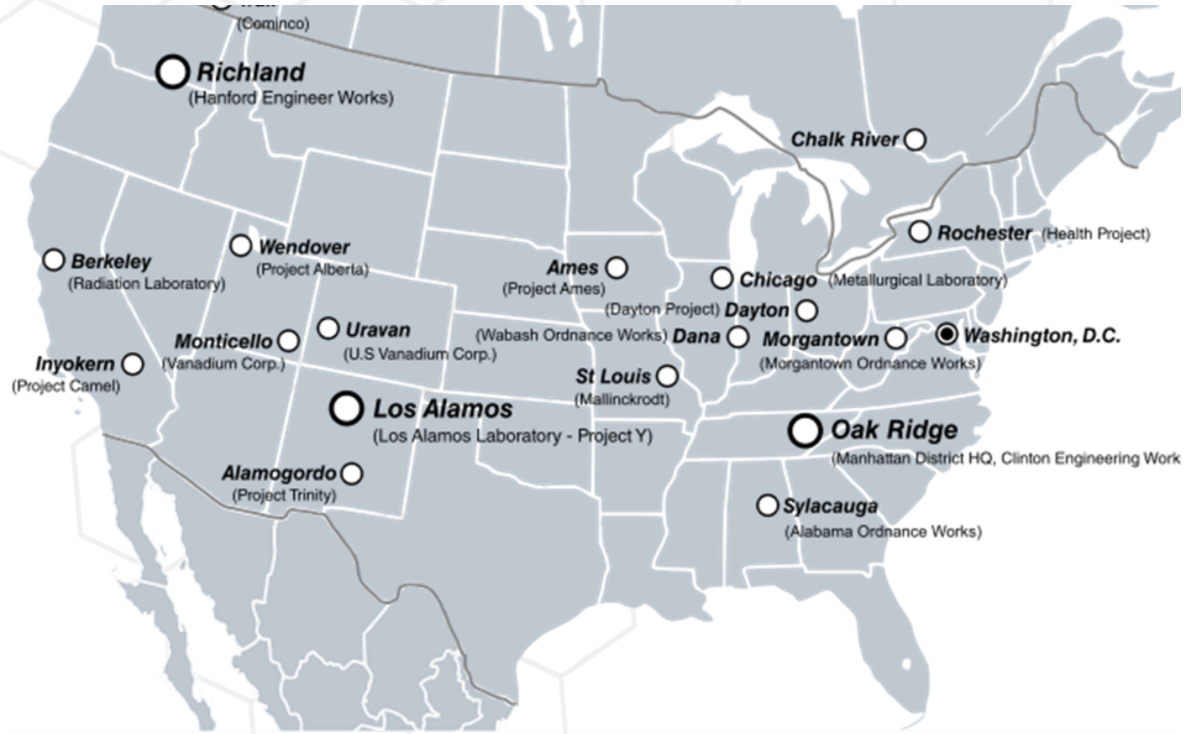
Edward Teller: Having already worked with his colleagues Fermi and Oppenheimer, Teller was one of the first people to be invited to work in Los Alamos, specifically in the Theoretical (T) division. With a deep understanding of nuclear fission he suggested that a weapon based on the concept could lead to a weapon made from nuclear fusion as well. Long before even the Manhattan Project was formed, he was unimpressed with the magnitude of a potential “atomic” bomb and with his sights set on bigger things this early he would eventually invent the weapon he deemed worthy of his expectations and be known as “the father of the hydrogen bomb”.

George Kistiakowsky: Head of Division B, responsible for fuels, gases and chemicals used to make the bombs in the National Defense Research Committee, Kistiakowsky was initially unimpressed by the knowledge Americans had over explosives when he first started working in the U.S. After a need for an expert on the matter rose in Los Alamos, Kistiakowsky was called to join the effort which he was initially reluctant to join due to his belief that the bomb wouldn't be ready in time to impact the war. He mixed the implosion method with shaped charges and ultimately played a key role in the creation of the bomb.

Numerous great minds were called upon to the Manhattan Project and all of them had a part to play in the proceedings. Now looking back years after its completion it is clear to see that without the collective intelligence of everyone involved, the atomic bomb could potentially not have ever existed, or worse: had been discovered by the Nazis before the U.S.

## 5.4. ORGANIZATIONAL STRUCTURE OF THE PROJECT

The Manhattan Project wasn't limited to a singular site where scientists got together and discussed the creation of the atomic bomb, but rather a massive organization. With posts dedicated to different aspects of the project it encompassed throughout the States with some sites having rather higher importance than others.



**Hanford Engineer Works (Richland):** This site was built as the first full-scale plutonium production reactor for the Manhattan Project. Brigadier General Leslie Groves, with the help of Franklin Thomas, a Civil Engineer working for the military, chose the location for the facility to be built on. The area was specifically chosen as it would be located far away from highly populated cities to ensure the safety of the population and to keep the project site a secret. Construction began March 1943 with 45.000 people working on the massive site to have it made as fast as possible. Buildings were built to house the newly working personnel near the site around Richland which saw the peak population of 17.000 people. Franklin Thomas, after overseeing the construction, later made extensive efforts to ensure that the deliveries to Los Alamos Laboratory would be on time. Such deliveries contained processed plutonium that was made in the identical D and F reactors that came online in December 1944 and February 1945 respectively.

**Oak Ridge:** Similar to Hanford Engineer Works, Oak Ridge was built to develop materials that would be sent to Los Alamos. Leslie Groves chose the site again personally this time with even greater content. The low population in the area meant that acquisition would be cheap and the area having a civilian population beforehand meant that infrastructure was already there. The existence of highway and rail access along with utilities like water and electricity made the area very desirable. Many residents were forced out of their homes with nothing more than an eviction notice and no explanation other than it being done for the war effort. Same as Hanford, work began in March 1943 and by the end of the year uranium was being produced in the facilities. As research continued in Los Alamos the need for plutonium made the facility turn to the production of that material.

**Radiation Laboratory (University of California-Berkeley):** Home to Ernest Lawrence's cyclotron, the Rad Lab was already a hot spot for great minds working on nuclear physics. Oppenheimer as professor along with names such as Lawrence, Luis Alvarez and Edwin McMillan made it a hot spot which led to Leslie Groves going to the site to recruit scientists for the Manhattan Project. By that time Berkeley was already regarded as the center of theoretical physics in the U.S. and thus had brought in even more scientists like Hans Bethe, Edward Teller, Robert Serber and Emil Konopinski, all of which would have a role to play in the invention of the atomic bomb.

**Chicago:** Just outside southwest of the windy city, Argonne Forest preserve was chosen as a spot to build a pilot plant for plutonium production. A lease was arranged for the construction to begin but was later seen as too small for the massive scale of the operation. Thus, leading to the area being used as a research and testing station, focusing efforts on Oak Ridge. Delays kept piling up and as a result the construction of the first nuclear reactor was authorized and was built under Stagg Field, the football stadium of the University of Chicago. Although further difficulties arose such as the source of uranium metal being so limited and the ongoing delay issues, on the 2nd of December 1942, Enrico Fermi and his team initiated the first self-sustaining nuclear chain reaction in an experimental reactor known as Chicago Pile-1. Come January 1943 the reactor was eventually moved to the initial preserve area due to safety concerns regarding the reactor being dangerously close to a densely populated area.

**Los Alamos Laboratory:** Oak Ridge was initially planned as the site for Project Y, but it was later decided that the location should be a bit more remote and far away from any prying eyes. On Oppenheimer's recommendation possible locations in Albuquerque, New Mexico were investigated and with the decision being made from Leslie Groves the Los Alamos Laboratory was built. The engineers in charge of construction were concerned that the lack of a proper road and limited access to water and electricity would hinder progress but the area was deemed entirely too valuable to pass on. The existence of the Los Alamos Ranch School in the vicinity was the only issue regarding acquisition but was quickly solved and work began in late December 1942. With the budget constantly being increased all the way up to 7 million$ the site was finally completed on the 30th of November 1943. Los Alamos was more commonly referred to as "Site Y" or "the Hill" at the time and the U.S. government had initially created it under the pretense of it being a military laboratory, meaning that the researchers working there would be commissioned into the Army. Robert Bacher and Isidor Rabi were convinced that the scientists wouldn't be fond of the idea so Oppenheimer offered a compromise where the lab would operate under the jurisdiction of the University of California while being under contract to the War Department. After two years of extensive research, secrecy and maximum effort, the site later became known as the birthplace of the atomic bomb. The secrecy element was key, with Brigadier General Groves emphasizing precautions on every occasion. Extensive background checks were made for every individual coming into the site and were all met by Dorothy McKibbin, who would be known as "the gatekeeper of Los Alamos".

## 6. POLITICAL DIMENSIONS

### 6.1 US GOVERNMENT AND MILITARY INVOLVEMENT

In terms of both methods and goals, the Manhattan Project was a military endeavor. The Army supplied the resources and guidance that enabled the production of an atomic bomb, a practical military weapon. The military was involved from the beginning. The Advisory Committee on Uranium was established in October 1939 with representatives from the Army and Navy, and part of the early research was funded by the military forces. The National Defense Research Committee and the Office of Scientific Research and Development, two civilian organizations and experts, assumed the lead in guiding research for two years starting in the summer of 1940. Military engagement progressively increased as research started to show that an atomic bomb was possible and might be available for use in the ongoing conflict. Vice President Henry Wallace, Secretary of War Henry Stimson, Army Chief of Staff General George C. Marshall, Vannevar Bush, and James Conant were the members of the Top Policy Group that President Franklin D. Roosevelt established the program in late 1941.

Limiting project responsibilities to one of the military services was crucial as the research effort moved toward large-scale design and production due to the requirement for strict security. The Army was presented with the possibility of construction projects of previously unheard-of magnitude. The obvious choice to oversee the project was the Army Corps of Engineers, which had just been given command of all Army construction operations. The Manhattan Engineer District (MED) was established by the Corps of Engineers to supervise the work. Nevertheless, the MED lacked the necessary components, tangible assets, and technological and scientific know-how to create and construct an atomic weapon. Due to the project's urgency, size, and complexity, the MED had to hire some of the biggest industrial and construction firms in the country, along with a number of esteemed colleges, as contractors to plan, construct, and run the facilities. The MED managed the work, kept security, and controlled contracts.

A number of distinctive internal organizations were created by the MED. In order to maintain the confidentiality of the atomic bomb project, the MED established the Counterintelligence Corps (CIC). In a highly unique setup, the CIC reported directly to General Leslie Groves, the commander of the MED, but continued to function under the larger Army Intelligence

("G-2") framework. In the beginning, the Special Engineering Detachment (SED) was established to provide a means for crucial technical staff to continue working on the project in spite of being drafted into the military. However, Groves quickly recognized that the project required a sizable number of junior scientific staff members in addition to scientific personnel. He greatly increased the size and responsibilities of the SED and started looking for Army troops with technological skills or education. The Women's Army Corps (WAC), which served in a wide range of technical and daily roles, and the Military Police, who were the main law enforcement officials and worked guard duty, were among the military organizations that served at the Manhattan Project sites and numerous other Army posts. Due to the atomic bomb project's highly interdisciplinary requirements, military people brought a unique variety of experience to the table.

For those who worked and resided at Manhattan Project locations, the complex social dynamics at work included tensions between civilians and military personnel, some of which were amicable and some of which were not. The disparity in the standard of their food, housing, and income were some frequent points of contention between the two groups. Despite being volunteers, the majority of military troops had far less control over their everyday life and no choice over their station once they joined the army. If civilian personnel were to be retained, their salary and living conditions simply had to reflect the fact that civilians, regardless of their patriotic motivations or the depth of their sacrifices, were always free to depart Los Alamos. All of the original enlisted soldiers who served at Los Alamos had volunteered for overseas service, and some of them were bitter at being assigned to the United States, especially after seeing so many young men without uniforms. Furthermore, none of the initial detachment's enlisted men or officers were allowed to understand the significance and particulars of their task.

### 6.2 THE ROLE OF ALLIED NATIONS

During World War II, the Manhattan Project was mostly a U.S.-led endeavor to create atomic bombs, but it also featured close cooperation with Allied countries, especially the United Kingdom and Canada. Here is a quick summary of these nations' roles:

**United Kingdom:** The UK joined the atomic research endeavor early on. The MAUD Committee, which carried out first research on nuclear fission, was the first to collaborate. As part of the Tizard Mission, the British provided the United States with important information and documents related to their atomic bomb research. Notably, the development of the project was aided by British scientists such as James Chadwick, who discovered the neutron.

**Canada:** By providing uranium and founding the Montreal Laboratory, Canada contributed. Harold Agnew was one of the Canadian scientists who worked with American scientists. Canada's Chalk River site became essential for heavy water supplies and nuclear research, both of which were required for certain types of nuclear reactors.

Other nations in comparison had rather a small impact. Scientists who originated in countries that Nazi's invaded such as Czeckoslovakia often fled to the UK or US and contributed with scientific assistance.

### 6.3 ESPIONAGE AND THE SOVIET CONNECTION

For the Manhattan Project, security was a way of life. The whole atomic bomb effort was to be kept a secret from Japan and Germany. Security authorities from the Manhattan Project were successful in this. However, they also aimed to prevent the Soviet Union from learning about the atomic weapon. The Soviet Union remained a repressive dictatorship and a possible future adversary despite being an ally of the United States and Britain in the war against Germany. Security personnel had less luck here. Critical knowledge that accelerated the creation of the Soviet bomb was sent back to Russia by Soviet spies who broke into the Manhattan Project at Los Alamos and multiple other sites.

There was no mystery about the potential for creating an atomic weapon. The world rapidly learned of the discovery of fission, which had taken place in Berlin. Any competent research physicist could now clearly see the scientific basis for a prolonged, or even explosive, chain reaction. Even though the majority of physicists initially believed that an explosive chain reaction was implausible, the idea could not be completely ruled out. Germany tried to establish a vast spy network within the United States with its own atomic bomb development. However, the majority of German spies were apprehended promptly, and none managed to break through the Manhattan Project's secrecy. That was it. German physicists had heard reports and suspected that the United States, Britain, or both were working on an atomic weapon project. Japan conducted a little program of atomic research as well. Though, similar to Germany, no Japanese spies were able to infiltrate the Manhattan Project, rumors of it also made their way to Japan.

Because it was able to capitalize on the ideological inclinations of a sizable portion of Americans, British, and other émigrés, the Soviet Union demonstrated greater skill at espionage. Soviet intelligence services spent a great deal of money spying on Britain and the United States. The Soviet Union received secret information from hundreds of Americans in the United States alone, and the quality of Soviet sources in Britain was considerably higher.Many of the thousands of members of the Communist Party of the United States of America (CPUSA) were highly educated and probably employed in delicate wartime industries. Prior to the war, a large number of physicists belonged to the CPUSA.

Soviet intelligence initially learnt of Anglo-American discussions about an atomic bomb program in September 1941, nearly a year before the Manhattan Engineer District (MED) was established. The information most certainly came from John Cairncross, one of Britain's famed "Cambridge Five" spies. (Cairncross worked as a private secretary for Lord Hankey, a British government figure who had access to some British discussions on the MAUD Report.) Donald Maclean, another member of the "Cambridge Five," informed his Soviet handlers of the possibility of an atomic bomb around the same time. (Maclean was an important Soviet operative. In 1947 and 1948, he served as a British liaison with the Atomic Energy Commission, which succeeded the MED. The subject's significance was quickly acknowledged by Soviet intelligence, which assigned it the fitting codename, ENORMOZ ("enormous"). The various American residencies were under pressure from the Soviet intelligence headquarters in Moscow to create sources within the Manhattan Project. Counterintelligence officials from the Manhattan Project and the Federal Bureau of Investigation (FBI) identified and stopped many of these early spies' recruitment efforts. They were made aware of Soviet efforts to get in touch with physicists working on related projects at the University of California, Berkeley's "Rad Lab" in February 1943. To be assigned away from sensitive subjects, the scientists in question were placed under observation and, if feasible, conscripted into the military. In 1944, another scientist who was detected giving secrets to the Soviet Union at the Rad Lab was fired right away. Early in 1944, the FBI also became aware of a number of "Met Lab" workers who were allegedly giving their Soviet handlers access to classified material. The staff members were fired right away. Although these Soviet espionage efforts were identified and stopped, other Soviet operatives remained undiscovered.

The British physicist Klaus Fuchs was one of the most valuable Soviet spies who escaped capture during the war. In late 1941, Fuchs made his first offer to work for Soviet intelligence. He soon started disseminating information on British atomic research. After losing touch with him in early 1944, Soviet intelligence soon learned that Fuchs had been moved to Los Alamos' bomb research and development facility as one of the recently arrived British scientists. Fuchs was employed at Los Alamos in the Theoretical Division, where he provided his Soviet handlers with comprehensive information about the design of atomic weapons.After returning home to start working on the British atomic program in 1946, he kept giving the Soviet Union classified information on and off until he was apprehended , at which point he confessed everything in January 1950.
Klaus Fuchs was believed to be the only spy who worked as a physicist at Los Alamos for more than 40 years. Theodore Hall was identified as a second suspected scientist-spy in the mid-1990s after the VENONA intercepts were made public. In November 1944, while at Los Alamos, Hall, like Fuchs, a longtime communist who volunteered his services, contacted Soviet intelligence. Although it was not as thorough or extensive as Fuchs's, Hall's data on implosion and other atomic weapons design elements was a valuable addition to and validation of Fuchs's work. Early in the 1950s, the FBI became aware of Hall's espionage activities. However, Hall made no admissions when questioned, unlike Fuchs. The VENONA secret would not be revealed in public by the US administration.  Hall's espionage activities had apparently ended by then, so the matter was quietly dropped.

Julius and Ethel Rosenberg, the most well-known "atomic spies," were never employed by the Manhattan Project. By the conclusion of the war, American engineer Julius Rosenberg had been deeply active in industrial espionage for years, serving as both a source and the "ringleader" of a nationwide network of engineers with similar interests. Both her brother David and Julius's wife, the former Ethel Greenglass, were passionate communists. In the summer of 1944, Army machinist David Greenglass was temporarily stationed at Oak Ridge. A few weeks later, he was moved to Los Alamos and assigned to the Special Engineering Detachment, where he worked on implosion.  Greenglass quickly started passing knowledge on the atomic bomb to his brother-in-law, Julius Rosenberg, who subsequently forwarded it to Soviet intelligence through his wife Ruth. In the words of Greenglass, "I was young, stupid, and immature, but I was a good Communist." Greenglass left the Army in March 1946. He was contacted by Soviet intelligence, which encouraged him to return to atomic research by enrolling at the University of Chicago. Greenglass's application to Chicago was denied, despite the NKGB (the People's Commissary for State Security, the forerunner of the KGB) offering to cover his tuition. Following Klaus Fuchs's confession in 1950, the FBI tracked down his supervisor, Harry Gold, who in turn tracked down David Greenglass. Greenglass confessed when pressed, blaming his brother-in-law Julius Rosenberg and his wife Ruth.

Several of the Manhattan Project's spies have never been proven to exist. According to the VENONA decrypts, the majority are only known by their codenames. One source, a scientist or engineer who was assigned the codename FOGEL (later renamed PERSEUS), reportedly spent years working on the outskirts of the Manhattan Project and shared what knowledge he could. According to Soviet records, he was given a job at Los Alamos but declined it for family reasons, much to the dismay of his managers. In 1943, a physicist known only as MAR started providing information to the Soviet Union. He was moved to the Hanford Engineer Works in October of that year. In another instance, one day in the summer of 1944, a stranger unexpectedly appeared at the Soviet Consulate in New York, departed with a parcel, and hurried away. Later, it was discovered that the package had a large number of classified documents about the Manhattan Project. In order to recruit the package's deliverer, Soviet intelligence made an effort to identify him. But they were never able to identify him. Both an American source codenamed QUANTUM and an Englishman designated ERIC provided confidential information about gaseous diffusion in the summer of 1943 and specifics of atomic development in 1943, respectively. It's still unclear who QUANTUM was and what happened to him after the summer of 1943.

Soviet espionage against the Manhattan Project most likely accelerated the Soviets' acquisition of an atomic bomb by at least 12 to 18 months. The weapon that the Soviet Union used for its first nuclear test on August 29, 1949, was essentially the same design as the one that had been used at Trinity four years earlier.

### 6.4 DECISION MAKING AND SECRECY

The Manhattan Engineers District chose Los Alamos, NM, Oak Ridge, TN, and Hanford, WA as project sites primarily because of their geographic isolation, but District officials went above and beyond to ensure that no one without the proper clearance was allowed access to site buildings or facilities. Each site had multiple security checkpoints that were manned by military police around-the-clock, and tall barbed-wire fencing surrounded the perimeter of each site, preventing any intruders from gaining unwanted access to key buildings and discouraging any employee from secretly sneaking out (possibly with classified documents).

When it came to overseeing the Manhattan Project, General Leslie R. Groves' top priority was confidentiality. Every visitor to the Los Alamos laboratory or any of the other "secret cities" needed a pass and a reason for being there. Workers were warned to keep the project's secrets safe via posters and billboards at each location: "What you see here, what you do here, what you hear here, when you leave here, let it stay here!"

General Groves was the mastermind of an intelligence revolution that raised the bar for security. Leaders in Congress consented to covert budget procedures without legislative supervision. Groves established distinct agencies to conduct surveillance, intelligence, and counterintelligence activities both at home and abroad. These reported directly to him, maintained independent records, and functioned outside of the established military channels. Groves held the highest authority because he was the only one with knowledge of the entire project. Through his choices, he managed the project's priorities, pace, and course. Without the general's approval, no one was allowed to move between locations. Knowledge was divided into different categories. Employees were only given the information they required, and they were not allowed to talk about their duties with anybody but their assigned supervisors.

Scientists objected to the compartmentalization since they were accustomed to the free flow of ideas. Oppenheimer maintained that in order to address complex problems at Los Alamos, weekly scientific colloquia and other interactions were necessary. However, this transparency among Los Alamos's elite scientists was an anomaly and was kept "inside the fence." "Stick to your knitting!" was the motto for everyone else.

## 7. TECHNOLOGICAL DEVELOPMENTS

### 7.1. SCIENTIFIC BREAKTHROUGHS IN NUCLEAR PHYSICS

The road leading to the atomic bomb was a long and winding one, with decades worth of scientific discoveries in the field of nuclear physics building up to it. The most significant breakthrough came in 1938 Germany when physicists Otto Hahn and Fritz Strassmann discovered nuclear fission. They found that bombarding uranium with neutrons would cause them to break apart into lighter elements which then would cause a release of energy. Meitner and Frisch suspected that by implementing Einstein's famous formula of $E=mc^2$, that even tiny amounts of mass could release enormous energy and with that fission had incredible energy potential.

Next came the process of turning fission into a chain reaction which would allow it to be self-sustaining, ergo way more efficient. Leo Szilard and Enrico Fermi realized that this could be achieved if fission were to release more neutrons, however if left uncontrolled could produce an explosion. Fermi proved the feasibility of using fission for energy or weapons at the aforementioned Chicago Pile-1 reactor. Now that it was proven that such energy, if harnessed properly, could be incredibly useful, the focus went on what materials could be used. It was discovered that certain isotopes of uranium, specifically U-235, could undergo fission effectively, however this meant that the natural form of uranium, the non-fissile U-238, needed to be enriched. Another potential element to be used was plutonium-239, which had the same issues uranium had in its lack of natural availability. This was not a major issue as it was easier to produce in nuclear reactors. These elements and a further understanding of neutron moderation and critical mass led to the creation of the atomic bomb.

### 7.2. THE SCIENCE BEHIND THE BOMB

The following explanation on the creation of the bomb is the fundamental knowledge that we as the Crisis Team will possess on the matter and is what is expected of you to know during the committee. This is just a friendly reminder that we, like most of you delegates, are not actual nuclear physicists, but will be working hard to ensure that your experience in the reenactment of the Manhattan Project is one to remember. Also, that the process will be made by yourselves primarily, our duty being understanding and making it as smooth for you as possible.

The bomb's operation is based on nuclear fission, the process in which the nucleus of a heavy atom, in this case uranium-235 or plutonium-239, splits into smaller nuclei when struck by a neutron. Based on Einstein's famous $E=mc^2$ , energy equals mass times the speed of light squared, from the small amount of mass, a massive amount of energy is released. Along with the energy neutrons are released which can strike other nearby nuclei, triggering a chain reaction, which then leads to an exponential amount of energy release. For this process to work, the bomb must reach **critical mass,** the minimum amount of fissile material required to sustain an uncontrolled chain reaction, or it would fizzle out.

The bomb would be composed of multiple parts. The fuel used, which as we already mentioned numerous times, consists of the fissile materials of uranium-235 or plutonium-239. Next, a neutron source is required, which would be in the form of a neutron initiator placed at the center of the fissile core. This device releases neutrons at precisely the right moment to trigger fission when critical mass is reached. Surrounding the core with conventional explosives like TNT or RDX would compress the core. A layer of dense material, usually made of beryllium or uranium, would also surround the core as a reflector, so that the escaping neutrons would be bounced back into the fissile material, thus enhancing the efficiency of the chain reaction.

The two main design concepts in developing the two bombs Little Boy and Fat Man were Gun-Type Design and Implosion-Type Design respectively. The Gun-Type Design would work on the basic principle of two sub-critical masses of U-235 being rapidly brought together by conventional explosives to form a supercritical mass. The two pieces would be kept separate in the bomb to avoid a premature detonation and one of the pieces would be shot down a barrel, like in a gun, to collide with the other piece. When the masses combine, they reach critical mass, and the chain reaction is initiated. With the following burst of neutrons, the fission process would start, and the explosive energy would be released. U-235 was especially used for this bomb because it has a lower probability of spontaneous fission compared to plutonium-239, making it the more feasible option. For the Implosion-Type Design however, a spherical core of plutonium-239 was surrounded by explosives that would compress it into a supercritical state. The explosives would be detonated simultaneously from all sides and the implosion would compress the plutonium core to increase its density, allowing it to reach critical mass. The neutron initiator in the center would release the neutrons and trigger the chain reaction resulting in the bomb detonating and releasing a massive amount of energy. The project sites in Oak Ridge and Hanford would provide the materials necessary to build the bombs. Assembly would be done in Los Alamos with great care and precision to ensure nothing wrong would happen during transit.

### 7.3. CHALLENGES IN BUILDING THE BOMB

Such a complicated process brought along complicated problems with it. The main issue was acquiring the fissile materials necessary. Plutonium production was slow and required large reactors, making it difficult to gather enough material for multiple bombs. Uranium was troublesome to obtain in a useful state. Natural uranium contains only 0.7% U-235, so it must be enriched to over 90% purity to be weapons-grade. The processes to obtain both materials were carefully researched and the Oak Ridge along with Harford sites had to be created to make sure they were being made as fast and as efficiently as possible. Testing the bomb was also a concerning issue. Before using the bomb in combat, scientists had to ensure that the bomb would work as expected. The success of the Trinity Test was crucial, but it did not guarantee success for future bombs.

Design complexities created problems as well. The implosion method for the plutonium bomb required extremely precise shaping and timing of conventional explosives to compress the plutonium core evenly. Ensuring a symmetrical implosion was the biggest engineering problem that was faced. Even the slightest miscalculation would result in failure. Worker safety was always a concern as well. Scientists had to develop ways to handle intense radiation produced during the fission process without harming workers or damaging materials. In order to protect personnel from deadly radiation exposure, specialized containment methods were used, and appropriate personnel were recruited. On August 1st, 1944, chemist Donald Mastick ended up ingesting some plutonium. Specializing in radiology, Louis Hempelmann gave Mastick a mouthwash of trisodium citrate, which made the plutonium within the body to turn into a soluble liquid. Mixing that with sodium bicarbonate (baking soda) would then turn the element solid and easier to remove from the body. This proved that experts from all branches were needed to overcome the challenges of the project.

## 8. ETHICAL CONSIDERATIONS

### 8.1 DEBATE OVER THE USE OF NUCLEAR WEAPONS

The debate over the use of nuclear weapons is a complex and multifaceted one, rooted in the very nature of these weapons and their potential for catastrophic consequences. At the heart of the debate lies a fundamental disagreement: do nuclear weapons provide security, or do they represent a threat to global peace? This question is further complicated by the lack of consistent progress towards nuclear disarmament, despite the existence of treaties like the Nuclear Non-Proliferation Treaty (NPT).

A significant challenge in the debate arises from the differing perspectives on nuclear weapons held by various nations. Some nations, particularly those possessing nuclear arsenals, argue that these weapons enhance their security and act as a deterrent against potential adversaries. This view is often framed in the context of national security, prioritizing the defence of borders and the preservation of national power structures. However, this perspective is challenged by those who view nuclear weapons as an inherent threat to global security. They argue that the very existence of these weapons poses an unacceptable risk, regardless of who possesses them. This perspective is often rooted in the concept of human security, which emphasizes the well-being and safety of individuals and communities, transcending national borders and political agendas.

The debate over nuclear weapons is not merely theoretical; it has tangible implications for international relations and global security. The lack of progress in nuclear disarmament, even with mechanisms like the NPT in place, underscores the deep divisions and complexities surrounding this issue. This lack of progress is particularly concerning when compared to the relative success of regimes controlling other weapons of mass destruction, such as chemical and biological weapons. The Chemical Weapons Convention (CWC) and the Biological and Toxin Weapons Convention (BTWC), despite their own challenges, have achieved significant progress in criminalizing not just the use but also the production, development, and stockpiling of these weapons. This success can be attributed, in part, to a broader consensus on the inherent danger of these weapons and the need for their complete prohibition.

A key factor in shaping the debate over nuclear weapons is the concept of security itself. The traditional national security framework, which focuses on military strength and territorial defence, often justifies the possession and development of nuclear weapons as a deterrent. However, proponents of human security argue that this approach is flawed, as it fails to account for the interconnectedness of global threats and the potential for catastrophic consequences that transcend national borders. The devastating humanitarian impact of nuclear weapons, as seen in the aftermath of Hiroshima and Nagasaki, serves as a stark reminder of the dangers inherent in these weapons and the need for a more comprehensive approach to security.

The successful campaigns to ban landmines and nuclear testing provide valuable insights into how a human security approach can drive progress in disarmament. These campaigns effectively highlighted the devastating humanitarian consequences of these weapons, mobilizing public opinion and influencing government policy. Similarly, reframing the nuclear weapons debate within a human security framework could help to shift the focus from nationalistic concerns to the shared responsibility for global well-being and the need for collective action to eliminate these threats.

The debate over the use of nuclear weapons is ultimately a choice between two futures: one marked by the continued threat of nuclear annihilation, and another characterized by collective disarmament and peaceful coexistence. The path forward requires a commitment to dialogue, a willingness to re-evaluate traditional notions of security, and a recognition that true security lies not in the threat of destruction but in the pursuit of a world free from nuclear weapons.

### 8.2 CIVILIAN IMPACT: HIROSHIMA AND NAGASAKI

On the morning of August 6, 1945, Hiroshima was bombarded. From the standpoint of its designers, the city, which was flat and encircled by hills, was in many respects a perfect target for the atomic bomb. Devastation and spectacle were their objectives in order to demonstrate to the Japanese, the Soviets, and the rest of the world the capabilities of this new weapon. Because of Hiroshima's topography, a bomb with the explosive output of "Little Boy"- roughly 15,000 tons of TNT - could destroy almost the whole city if it exploded at the right height.

In the immediate aftermath, the smoke, fires, and slaughter were too severe for both those on the ground experiencing the attack and those in the airplanes witnessing it to obtain more than a qualitative impression of the devastation. Later in the day, observation planes unsuccessfully attempted to take pictures of the destruction, but the smoke covered the city too much to determine its exact extent. Eyewitnesses on the ground were mostly ignorant that it had been a single strike, and their surprise at learning that a single jet had simultaneously impacted the entire city is a common theme in all of the testimonies.

News broadcasts from Japan and an American-prepared damage report started to depict the devastation on August 8. Perhaps "as many as 200,000 of Hiroshima's 340,000 residents perished or were injured," according to one United Press account, after aerial scans showed that at least 60% of the city's "built-up areas" were devastated. According to "unofficial American sources" cited in the same publication, there may be more than 100,000 "dead and wounded."

The only pre-Hiroshima estimate known to exist is Arthur Compton's recall that J. Robert Oppenheimer had proposed at a May 31, 1945, Interim Committee meeting that an atomic bomb detonated over a city would kill "some 20,000 people." This estimate does not appear to have carried any particular weight for the participants because it is not mentioned in the meeting minutes or in any other report or correspondence. (Compton clarified that this estimate was based on the assumption that people would take shelter; this did not happen because there was no warning of the attacks.)
During the 1954 hearing on his security clearance, Oppenheimer would make the following indirect remarks regarding the difference between before-and-after estimates:

Q You knew, did you not, that the dropping of that atomic bomb on the target you had selected will kill or injure thousands of civilians, is that correct?

A Not as many as turned out.

Q How many were killed or injured?

A 70,000.

Q Did you have moral scruples about that?

A Terrible ones.

The Manhattan Project's scientific agents, entrusted with comprehending the impact of the atomic bombs, were among the first American teams to land in Japan on August 30, 1945. These officials traveled to Hiroshima and Nagasaki to evaluate all facets of the assaults in order to quantify any residual radioactivity, comprehend what had transpired, and determine what could be broadly referred to as "the effects of atomic bombs" for use in future planning. They were tasked with estimating the overall number of casualties. This endeavor was spearheaded by Col. Stafford Warren, the Manhattan Project's Chief Medical Officer and a nuclear medicine pioneer.
Due to "the extensive destruction of civilian installations (hospitals, fire and police department, and government agencies), the state of utter confusion immediately following the explosion, [and] the uncertainty regarding the actual population before the bombing," the Manhattan Project report, published in 1946, critiqued the "great difficulty" of accomplishing this. The writers of the paper did not go into detail about their methods. They calculated that 66,000 people had been killed and 69,000 had been injured in Hiroshima, out of a pre-raid population of 255,000. Of the 195,000 people living in Nagasaki prior to the raid, 39,000 had perished and 25,000 had been injured. It is noteworthy that Warren, the investigation's lead investigator, appears to have thought the Nagasaki figure was low.

The topography and varying population sizes at Hiroshima and Nagasaki were blamed for the discrepancies in the outcomes. From the standpoint of a bomber, Nagasaki was a less desirable target because its city was not as densely populated as Hiroshima and was separated from it by a ridge of hills that provided some shelter. Furthermore, the bomb went off in the Urakami Valley, northwest of Nagasaki, rather than in the city core.

## 9. CONCLUSION

The Manhattan Project stands as a pivotal moment in human history, marking the advent of the nuclear age and reshaping global dynamics in unprecedented ways. This study guide has explored the intricate and multifaceted aspects of the project, from its scientific and technological breakthroughs to its political, ethical, and social implications. The project not only ended World War II but also set the stage for the Cold War, igniting an arms race that would define international relations for decades to come.

Throughout the guide, we have examined the historical context that necessitated the creation of the atomic bomb, the key figures who played instrumental roles, and the organizational structure that enabled its success. The contributions of scientists such as J. Robert Oppenheimer, Ernest Lawrence and John von Neumann, key military members like General Leslie Groves, and many others demonstrate the collaborative effort that combined scientific ingenuity with military precision to achieve a groundbreaking yet controversial goal.

The technological developments achieved through the Manhattan Project, required the construction of large-scale facilities like Los Alamos, Oak Ridge, and Hanford, and also the brilliant minds that were recruited, who revolutionized the field of nuclear physics. However, these achievements came at a significant ethical cost. The bombings of Hiroshima and Nagasaki resulted in unprecedented destruction and loss of life, leading to ongoing debates about the morality and necessity of using nuclear weapons.

Furthermore, the political dimensions of the project highlight the complexity of wartime decision-making, the influence of espionage and secrecy, and the intricate relationships between allied nations. The involvement of the U.S. government and military ensured the project's success, but also raised questions about transparency, oversight, and the long-term consequences of nuclear proliferation.

From an ethical standpoint, the Manhattan Project serves as a stark reminder of the dual-edged nature of scientific progress. While it showcased humanity's ability to push the boundaries of knowledge and capability, it also underscored the profound responsibility that comes with such power. The debates surrounding nuclear disarmament and non-proliferation continue to this day, reflecting the lasting impact of decisions made during World War II.

In conclusion, the Manhattan Project represents a remarkable intersection of science, politics, and ethics. It serves as a case study in the complexities of innovation under pressure, the responsibilities of scientific communities, and the consequences of wielding unprecedented power. As we reflect on the legacy of this project, it is crucial to continue examining the lessons learned and applying them to contemporary challenges in science, security, and international relations.

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