Chernobyl: Grappling with the Effects of the Chernobyl Disaster

Chair: Aishi Gulati

Crisis Director: Marvin Yen

USG: Milad Brown

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I. Letters from the Dais

Chair - Aishi Gulati

Dear Delegates,

My name is Aishi Gulati, and I am thrilled to be your Chair for the Chernobyl Committee. I am a third year here at Berkeley, studying Economics and minoring in Data Science. I applied for UCBMUN largely out of curiosity, but I have been captivated ever since. My time in this club so far has shown me many of the interesting facets of Model UN, from the creativity of crisis backroom arcs to the tense internal politics of a GA bloc. However you choose to navigate this complex activity, those who participate in Model UN leave as more knowledgeable, skilled, and mindful people.

Chernobyl as a committee is interesting because it is one of the most famous disasters in history, and there is a lot of misinformation about the accident. Many political factors led to and exacerbated the damages caused by the explosion, and it is up to you as a committee to decide your own motivations and actions in accordance with these motives. I'm excited to see what sinister plots some of you delegates might cook up and what kind of explosion, literal or not, it might cause in committee.

Sincerely,
Aishi Gulati
Chair, Chernobyl

Crisis Director - Marvin Yen

Dear Delegates,

I am extremely excited to welcome you all to BearMUN 2023's Chernobyl Crisis Committee! My name is Marvin Yen, and it is my pleasure to serve as your CD for this conference. I am currently a sophomore at UC Berkeley majoring in Economics and Data Science, and have been a member of UCBMUN since my freshman spring. MUN originally intimidated me, but after discovering crisis committees, I've fallen in love with the mixture of chaos and creativity during debate. Outside of MUN, I love cooking as well as binge watching cute cat videos on Youtube :).

Chernobyl has long been a topic of high controversy, I am excited to see your passion in resolving whether this incident was due to poor engineering or simple negligence. The complexity of the topic is exactly what you will be debating on, and I can't wait to see what arcs each of you take on, whether explosive or investigative! I recommend thoroughly reading through the background guide and doing personal research on your character outside of the information included here. Every character plays a unique role into the meltdown, so be sure to familiarize yourself with your character as that paves way for the best character arcs!

All the best,
Marvin Yen
Crisis Director, Chernobyl

II. History of Nuclear Power

1931: Ernest O. Lawrence Founds Lawrence Berkeley National Laboratory

In a bold step towards unlocking the secrets of the atom, physicist Ernest O. Lawrence founded the Lawrence Berkeley National Laboratory in 1931. The lab became a hub for groundbreaking nuclear research, with Lawrence's invention of the cyclotron leading the way. This early work laid the foundation for future advancements in nuclear science, contributing to both the understanding of nuclear reactions and the development of nuclear technology.

1938: The Discovery of Nuclear Fission

In 1938, Otto Hahn and Fritz Strassmann were experimenting with uranium and discovered that it broke down into lighter elements like barium. They were puzzled by the results, but Lise Meitner and Otto Frisch figured out that the uranium nucleus was actually splitting in two, releasing a massive amount of energy. They called it "fission," and it set off a flurry of research. Suddenly, people realized that this reaction could be used to create a new energy source, and it even had the potential to develop atomic weapons.

1942: First Controlled Nuclear Reaction

Enrico Fermi, often referred to as the "architect of the nuclear age," led a team that achieved the first controlled, self-sustaining nuclear chain reaction. The experiment took place on December 2, 1942, underneath the University of Chicago's Stagg Field in a makeshift laboratory. Fermi and his team constructed what they called a "nuclear pile" or "atomic pile," known as Chicago Pile-1 (CP-1).

The pile was built from a carefully arranged combination of graphite blocks and uranium fuel. The graphite acted as a moderator, slowing down neutrons to sustain the chain reaction, while the uranium underwent fission, splitting and releasing more neutrons to continue the reaction. By manually adjusting the control rods, the team was able to regulate the reaction, ensuring that it was self-sustaining but under control.

This controlled chain reaction was a critical step in demonstrating that nuclear fission could be harnessed and managed. It opened the door for further research into both military applications, such as the atomic bombs developed during the Manhattan Project, and the civilian uses of nuclear power. Fermi's experiment laid the groundwork for the nuclear reactors that would eventually power homes, businesses, and industries around the world.

1942-1947: The Manhattan Project

In the midst of World War II, the Manhattan Project brought together the brightest scientific minds in a collaborative effort that would alter the course of history. The Lawrence Berkeley National Laboratory, under the guidance of Ernest O. Lawrence, played a vital role in early nuclear research, including the isolation of the Uranium-235 isotope, a key component in atomic bombs. Meanwhile, the project's central laboratory was established in Los Alamos, New Mexico, where scientists and engineers worked tirelessly to design and build the world's first nuclear weapons. Leading the scientific team at Los Alamos was J. Robert Oppenheimer, whose brilliant leadership and deep understanding of nuclear physics guided the project to success. These combined efforts culminated in the creation of atomic bombs that would eventually be used on Hiroshima and Nagasaki, marking the dawn of the atomic age and laying the scientific groundwork for the development of civilian nuclear power like that used at Chernobyl.

Figure 1: Aerial view of the Manhattan Project located in Los Alamos, New Mexico

1951: Experimental Breeder Reactor I (EBR-I)

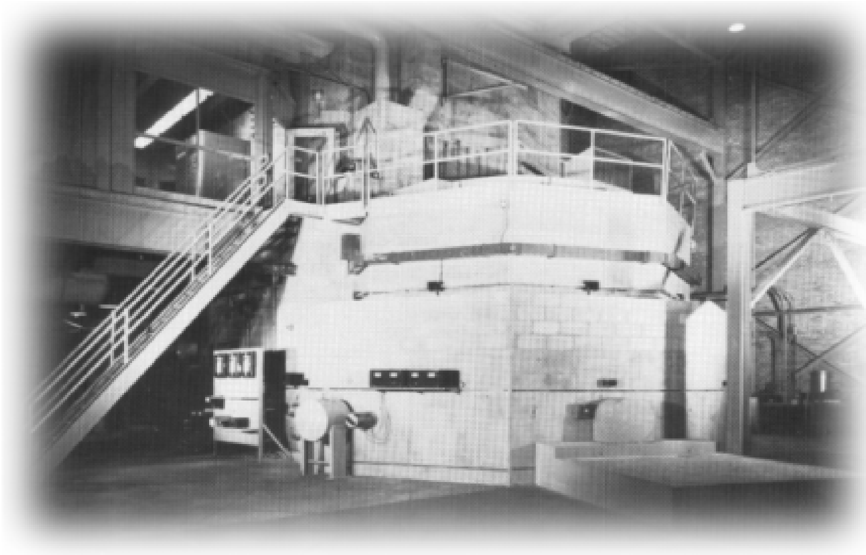

Figure 2: Experimental Breeder Reactor I

In the vast plains of Idaho, the Experimental Breeder Reactor I (EBR-I) made history in 1951 by becoming the first reactor to generate usable amounts of electricity from nuclear energy. This landmark achievement signaled the arrival of nuclear power as a viable energy source, laying the foundation for the widespread deployment of nuclear reactors in the following decades.

1953: Eisenhower's "Atoms for Peace" Speech

President Dwight D. Eisenhower's "Atoms for Peace" speech in 1953 marked a turning point in the global perception of nuclear energy. By advocating for the peaceful use of atomic energy and international cooperation, Eisenhower laid the groundwork for the civilian nuclear industry, transforming a force of destruction into a promise of progress and prosperity.

1954: Soviet Union's First Nuclear Power Plant

Figure 3: Obninsk Power Plant

In 1954, the Soviet Union commissioned the world's first nuclear power plant in Obninsk, pioneering the use of nuclear energy for electricity generation. This milestone demonstrated the practical application of nuclear power on a large scale and set the stage for the global expansion of nuclear energy.

1956: United Kingdom's Calder Hall

The United Kingdom further advanced the cause of civilian nuclear power by opening Calder Hall in 1956, the world's first commercial nuclear power station. Calder Hall symbolized the transition of nuclear energy from experimental technology to a major player in the global energy landscape.

1960s-1970s: Global Expansion of Nuclear Power

Throughout the 1960s and 1970s, nuclear power experienced a period of rapid growth and acceptance. Countries across the globe embraced this new energy source, constructing reactors and integrating nuclear power into their energy infrastructure. This era solidified nuclear energy's role as a key component of the global energy matrix.

1979: Three Mile Island Accident

The Three Mile Island accident in 1979 marked a sobering moment in the history of nuclear power. A partial meltdown at the Pennsylvania plant led to widespread fear and a reevaluation of nuclear safety regulations. The incident served as a wake-up call, emphasizing the need for robust safety protocols and transparency in nuclear operations.

Figure 4: An air view shows the Three Mile Island nuclear power plant near Harrisburg, PA

III. The History of Chernobyl[1]

The Chernobyl Nuclear Power Plant, situated near the town of Pripyat in Ukraine, represents a significant chapter in the history of nuclear energy within the Soviet Union. Conceived in the early 1970s as part of an ambitious plan to meet the growing energy demands of the region, the plant was envisioned to become a symbol of technological advancement and industrial progress. Utilizing the innovative RBMK reactor design, only later found to have severe design flaws, Chernobyl's development was marked by both triumph and challenge. The following timeline delves into the key events and milestones that defined the early years of this remarkable facility, exploring the complex interplay of engineering, politics, and human aspiration that shaped its inception and operation.

[1] "Chernobyl | Chernobyl Accident | Chernobyl Disaster." *World Nuclear Association*, https://world-nuclear.org/information-library/safety-and-security/safety-of-plants/chernobyl-accident.aspx.

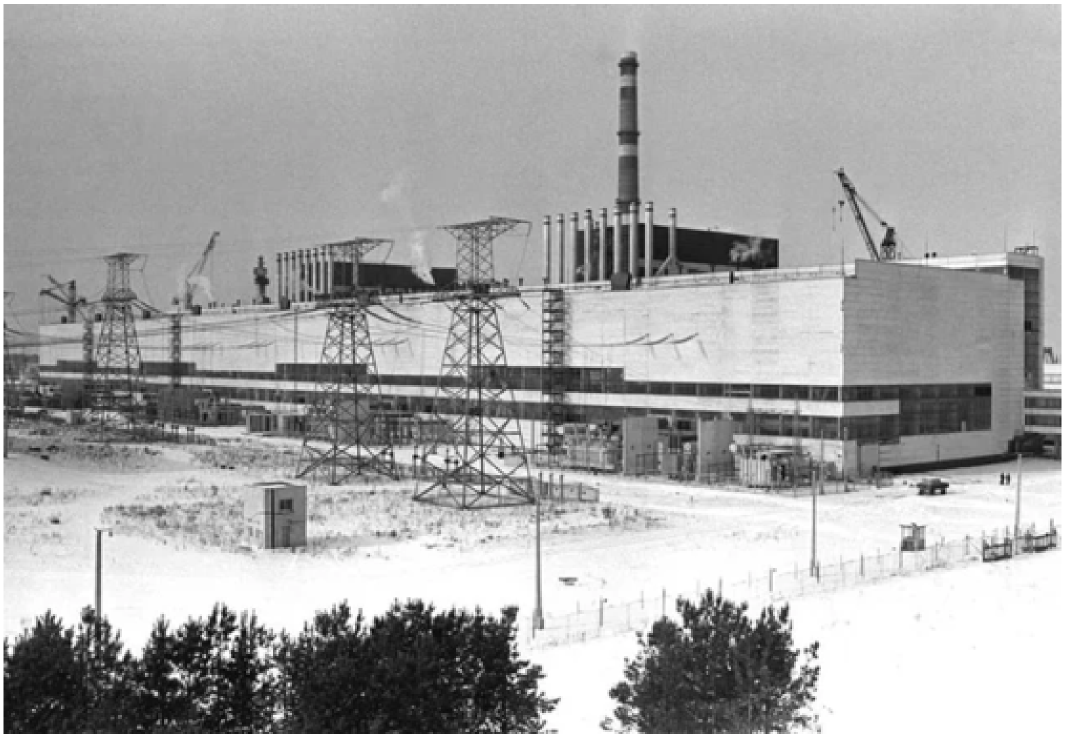

Figure 5: Reactors 1 & 2 begin construction in 1970

1970: Planning and Construction Begins

In the early 1970s, plans were drawn up for the Chernobyl Nuclear Power Plant with Pripyat to be constructed nearby as a home for its workers and their families, known as an *atomgrad*. Construction began, with an ambitious vision to create one of the largest nuclear power facilities in the Soviet Union.

1977: Reactor No. 1 Becomes Operational

On September 26, 1977, Reactor No. 1 was commissioned, marking the beginning of the plant's operation, and shortly after its completion, Reactor No. 2 was built in 1978. Utilizing an RBMK reactor design, thought to be very sturdy and robust, it was hailed as a significant achievement in the Soviet Union's growing nuclear energy program.

1978-1981: Additional Reactors Commissioned

In 1983, after scientific advancements resulted in the new second generation of RBMK reactors, Reactors No. 3 and 4 were commissioned, further expanding the plant's capacity. The RBMK design, although considered innovative, had underlying safety concerns that were not fully addressed. Similar but smaller accidents resulting from the same flaws which caused the Chernobyl accident had previously occurred in 1975 in Leningrad and in Ignalina in 1983.[2]

1982-1984: Early Signs of Problems

In 1982, a partial core meltdown occurred in Reactor No. 1. And in 1984, soon after their construction, Reactors No. 3 and 4 suffered several serious incidents that resulted in it being known to Moscow as “one of the most dangerous nuclear power plants in the USSR.” Though largely contained and not widely publicized, these incidents were early warning signs of the potential risks associated with the plant's design and operation.[3]

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[2] https://www.e3s-conferences.org/articles/e3sconf/pdf/2023/13/e3sconf_ersme2023_01052.pdf
[3] https://www.reuters.com/world/unsealed-soviet-archives-reveal-cover-ups-chernobyl-plant-before-disaster-2021-04-26/

1983-1985: Continued Expansion and Safety Concerns

The plant continued to expand, with construction beginning on additional reactors 5 and 6, the first of which is about 70% complete at the time of this committee. Meanwhile, concerns about safety procedures and the RBMK design persisted within scientific and engineering circles, but these warnings went largely unheeded due to the Soviet bureaucracy's desire to maintain a false appearance of total success and technological leadership in nuclear power. Even the operators of the reactors were not informed of multiple design flaws and operating quirks. Lines in the safety manual would be crossed out, with operators told to ignore the instructions entirely.

1986: Present Day

ChNPP has failed multiple previous tests to determine whether, in the case of a loss of power to the plant, the remaining power from the reactor would be able to sustain the plant's continued operation for the minute or so it would take for the backup power to kick in. Pressure from Soviet officials is mounting, and another test is set to take place shortly.

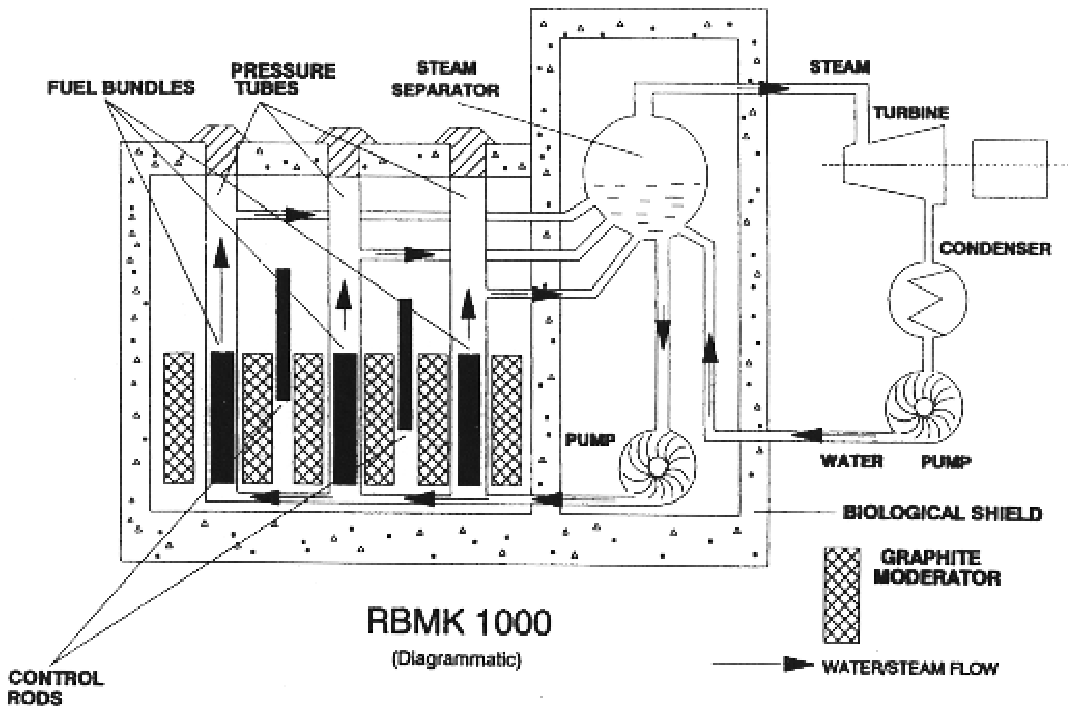
IV. Reactor Design[4]

1. **RMKB:** The RBMK (Reaktor Bolshoy Moshchnosti Kanalnyy) reactors are graphite-moderated, water-cooled reactors. They were the first of their kind to produce both plutonium and electric power and are considered Generation II reactors.
2. **Fuel Rods and Graphite Moderation**: The core of the RBMK reactor contained vertical channels where the fuel rods were placed. These fuel rods were made of enriched uranium oxide. Surrounding the fuel rods was graphite, which served as a neutron moderator. This graphite structure helped to slow down the neutrons, allowing them to sustain the nuclear chain reaction within the fuel rods.

[4] "Chernobyl | Chernobyl Accident | Chernobyl Disaster." *World Nuclear Association*, https://world-nuclear.org/information-library/safety-and-security/safety-of-plants/chernobyl-accident.aspx.

3. **Control Rods**: The RBMK design used control rods made of boron carbide with graphite tips. These control rods could be lowered or raised within the fuel rod channels to control the rate of fission, as boron is a neutron absorber and would completely end all reactions. The graphite tips were intended to prevent coolant water from entering the lower part of the reactor when the rods were withdrawn, but they created a design flaw, momentarily increasing reactivity if the rods were suddenly inserted during an emergency.
4. **Cooling System**: Two separate water coolant loops were used to remove heat from the reactor core. Water served as the coolant and was converted into steam, driving turbines to generate electricity. An auxiliary cooling system was also designed specifically for emergencies.
5. **Positive Void Coefficient**: The RBMK reactors were notable for having a positive void coefficient. This means that if steam bubbles (or voids) were formed in the coolant, the reactivity of the reactor would increase. In many other reactor designs, such as those where water is used as a moderator, the void coefficient is negative, providing a natural dampening effect on reactivity. The positive void coefficient in the RBMK design created a potentially dangerous feedback loop.
6. **Containment Structure**: Unlike many Western reactors, the RBMK reactors at Chernobyl were not encased in a heavy, reinforced containment vessel. Instead, the core was contained within a cavity lined with reinforced concrete and sandwiched between two massive metal plates. This design made the plant more vulnerable to a potential explosion or release of radioactive material.
7. **Steam Drums and Turbines**: The coolant loops were connected to steam drums, where the heat energy generated by the reactors would create steam which was used to power turbines. These turbines would spin, generating an electric current, which was then fed into the power grid.

Figure 6[5]: Diagram of the RBMK 1000 Reactor design



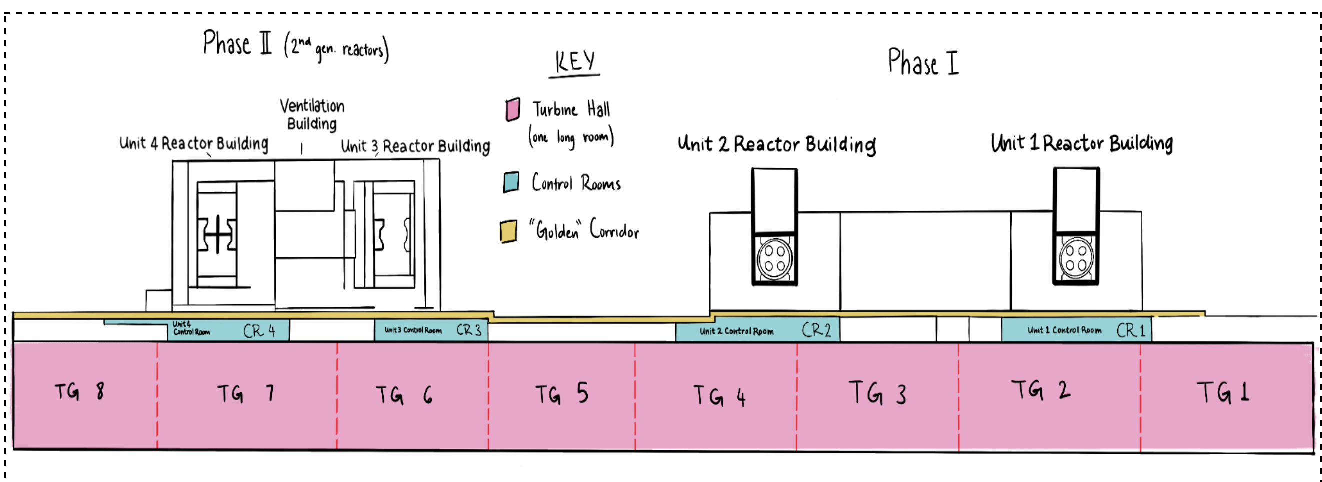


Figure 7: Diagram of the full Chernobyl Nuclear Power Plant (ChNPP). The "Golden" Corridor is the hallway connecting the entire plant, with various operational rooms and worker facilities encompassing the unlabelled rooms. "TG" stands for turbine generator.

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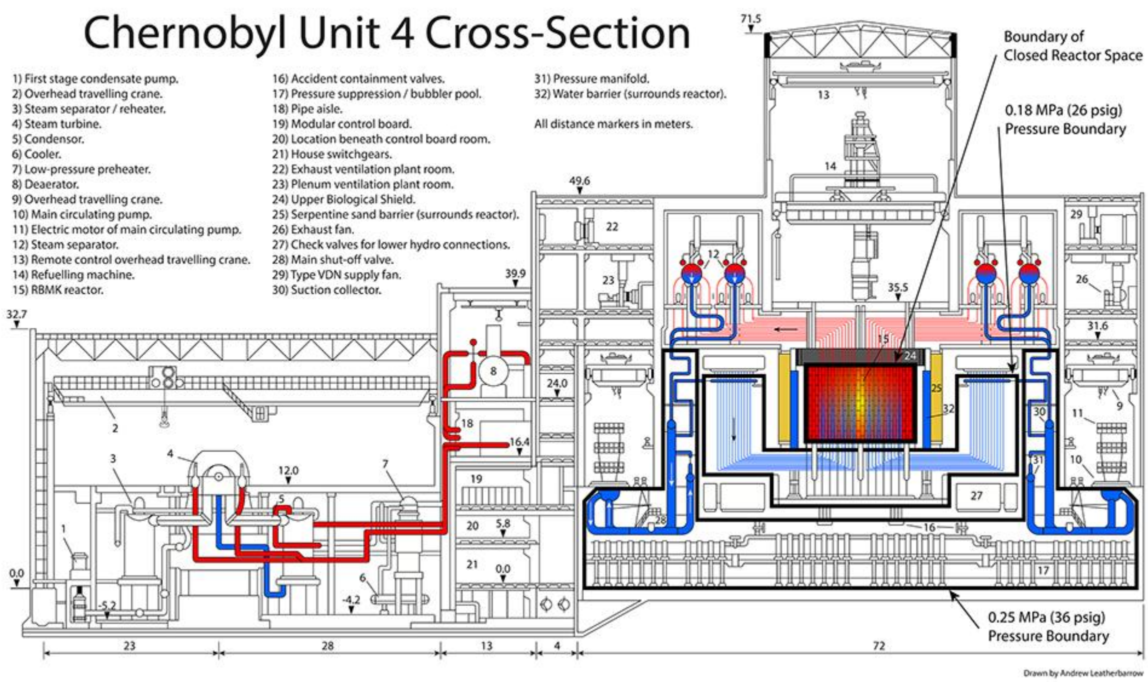
[5] "Chernobyl | Chernobyl Accident | Chernobyl Disaster." *World Nuclear Association*, https://world-nuclear.org/information-library/safety-and-security/safety-of-plants/chernobyl-accident.aspx.

Figure 8: Cross-section with labeled rooms and parts of the Chernobyl No. 4 Reactor which exploded; drawn by Andrew Leatherbarrow



V. Character List

Scientists/Doctors

Valery Legasov- The deputy director of the Kurchatov Institute, the leading authority in Russian nuclear energy. He is called in to direct cleanup efforts, and searches for the truth amidst layers of Soviet bureaucracy and the lives of his people.

Jughashvili- A robotics operator who is managing the cleanup robots for Chernobyl. His efforts to control the robots cleaning up Chernobyl are stymied by the faulty equipment and non-shielded robots he is given.

Nadezhda Vasilyeva: A nurse who treated Vasily Ignatenko and other firefighters in the hospital. She witnessed the severe radiation burns and illnesses caused by the Chernobyl disaster.

Government Officials

Boris Shcerbina- The Council of Ministers' Deputy Chairman, assigned to survey the disaster. Although initially skeptical he soon finds himself fighting for the lives of the people affected by Chernobyl, in spite of the bureaucratic restrictions placed on him.

Charkov- The first Deputy Chairman of the KGB and responsible for the spread of information. His goal is to control leaks, plug them, and deal with any dissenters within the Chernobyl cleanup operation, as part of a "circle of accountability".

Mikhail Shchadov- The Soviet Minister of Coal, who is called to send men to assist the disaster. Although Chernobyl does not directly affect his industry, he knows that it is his field that will bear the brunt of energy production even more after Chernobyl.

Andrei Stepashin- A state prosecutor, working to determine who is at fault at Chernobyl. He seeks to bring to justice who he sees as perpetrators of an atrocity, treating what others would see as negligence instead as malicious intent.

Chernobyl Officials

Viktor Bryukhanov- The manager of Chernobyl, who is awoken to disaster and responds with incompetence. Although not present at the time of the incident, he fears that he will be held responsible for the failures of his subordinates, and must act accordingly to save his plant and his people.

Anatoly Dyatlov- The assistant chief engineer at Chernobyl, who is in charge during the disaster. He refuses to acknowledge the disaster, and as a result hinders cleanup efforts in an attempt to save his own skin.

Nikolai Fomin- The chief engineer of Chernobyl, who is awoken to disaster and responds with incompetence. Like Bryukhanov, he fears that he will be held responsible for his subordinates, and acts accordingly to dodge the blame.

Nikolai Tarakanov- A Soviet general and the chief supervisor of the Chernobyl cleanup effort. He is responsible for logistics, and using Soviet military might to aid cleanup efforts.

Aleksandr Akimov- The night shift supervisor at Chernobyl, present at the time of the accident and exposed to lethal doses of radiation. Like Toptunov, he has agreed to reveal what really happened during the night of the accident.

Anatoly Sitnikov- The deputy chief engineer charged with operating the first and second reactors at Chernobyl. He tries to convince his comrades that the accident is much more severe than anticipated, and receives a lethal dose of radiation in the process, making him a vital source of information for the few weeks he has to live.

Boris Stolyarchuk- The senior control engineer for Reactor #4 at Chernobyl, who is present at the time of the disaster. Although not directly complicit, he has reservations about sending his comrades to die in the chaos of the disaster.

Chernobyl Cleanup

Andrei Glukhov- The chief of the mining crew and responsible for the group of miners sent to Chernobyl. He is forced to lead his men in hellish conditions, where protective gear cannot save them from the soaring temperatures under the plant.

Vasily Ignatenko- A Pripyat firefighter married to Lyudmilla Ignatenko, who is sent to fight the fire that fateful night. He represents all of the firefighters who would eventually die of radiation sickness by fighting the irradiated flames.

Pavel Gremov- A civilian liquidator, drafted to help cleanup Chernobyl. He represents the hundreds of thousands of liquidators who were used to clean up the area around Chernobyl at the expense of their own health.

Fighting the explosion

Nikolai Gorbachenko: The pilot of the helicopter that dropped materials into the reactor to prevent a more catastrophic explosion. Helicopter pilots played a crucial role in the early efforts to contain the disaster.

Lyudmilla Ignatenko: The wife of firefighter Vasily Ignatenko. She played a crucial role in the aftermath of the disaster, caring for her husband and witnessing the devastating effects of radiation on those who fought the fires.

Leonid Toptunov: An operator at the Chernobyl power plant who was on duty during the night of the disaster. He, along with Aleksandr Akimov, was involved in the immediate response to the explosion.

Viktor Proskuryakov: The chief of the fire brigade in Pripyat, responsible for coordinating the initial response to the fire at the Chernobyl power plant. Firefighters under his command were among the first responders to the scene.

Journalists

Sergei Preminin: A journalist who reported on the Chernobyl disaster. Journalists played a vital role in bringing international attention to the extent of the disaster and its consequences.

Igor Kostin: A Ukrainian photographer and journalist who documented the Chernobyl disaster. His photographs provided powerful and haunting images of the aftermath, contributing to the global understanding of the tragedy.

Svetlana Alexievich: While not directly involved in the events at Chernobyl, Alexievich is a Belarusian author and journalist who extensively interviewed survivors and witnesses of the disaster. She later compiled these testimonies into the book "Voices from Chernobyl," providing a unique perspective on the human impact of the tragedy.

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