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The Chernobyl disaster

SAM NAHMIYAS



RESEARCH
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Student Officer: Sam Nahmiyas - Vice-President

Introduction

On 26 April 1986, the fourth reactor at the Chernobyl Nuclear Power Plant in the Soviet Union exploded during improper testing at low-power, which resulted in the loss of control. The explosion and afterwards fire in the fourth reactor caused immense amounts of radioactive particles to be released from the core of the reactor to the atmosphere. Two workers in the power plant directly passed away from the effect of the explosion and a further 28 workers died in the following week due to radiation poisoning. 350,000 people were evacuated in 30 square kilometers within the explosion in a matter of hours. The town of Pripyat, around 3km away from the reactor zone is now considered to be a ghost town due to the high radiation levels. The spread of high radiation levels through wind and rain would further affect hundreds of thousands of people around Europe.

Definition of Key Terms

Nuclear Reactor: devices that can initiate and control a self-sustaining series of nuclear fissions.

Ghost Town: a deserted town with few or no remaining inhabitants. Due to the Chernobyl Accident, many Ghost towns emerged around the nuclear power plant due to high radiation levels within the region.

Acute radiation syndrome (ARS): an acute and fatal illness caused by the contact of the body with high doses of radiation in a very short period of time.

Chernobyl Exclusion Zone: The exclusion zone refers to the area extending up to 30 km in all directions around the Chernobyl nuclear power plant that was most contaminated by the accident. After the accident, its population was evacuated and all agricultural and industrial activities were suspended.

SSR: An abbreviation for “Soviet Socialist Republic”. For example, Ukraine SSR and Byelorussian SSR means, Ukraine Soviet Socialist Republic and Byelorussian Soviet Socialist Republic, respectively.

General Overview

The Power Plant and Cause of Accident:

The Chernobyl Power Complex, lying about 130 km north of Kyiv, Ukraine, and about 20 km south of the border with Belarus, consisted of four nuclear reactors of the RBMK-1000 design. The first and second reactor was constructed between 1970 to 1977 and the power plant commenced operation in 1972. The construction of the third and fourth reactors was completed in 1983. The four reactors were

capable of producing a total of 4,000 megawatts of energy, which at the time of the explosion counted for 10% of Ukraine SSR's electricity. The Chernobyl Power Plant was one of the most important energy assets of the USSR.

On 25 April 1986, the operators of the fourth reactor at the Chernobyl power plant were getting ready for a test to determine how long turbines would spin and supply power in case of loss of main electrical power supply. This test had been carried out at Chernobyl the previous year, but the power from the turbine ran down too rapidly, so new voltage regulator designs were to be tested. Approximately, at 2 pm of 25 April, reactor No. 4's emergency core cooling system was disabled to keep it from interfering with the test. A series of events carried by plant workers including disabling the automatic shutdown mechanism caused the reactor to come to an unstable level. By the time the operators tried to shut down the reactor in order to decrease its extreme heat and energy, the fourth reactor was out of control. The situation quickly escalated as the unique design of the soviet made RBMK-1000 reactor caused a power surge, accompanied by a large explosion and fire.



The aftermath of the Explosion:

In the early hours of 26 April 1986, the first explosion occurred, quickly followed by a few more. These explosions blew the 1,000-ton roof right off the reactor, and shot a fireball high into the sky. First, firefighters were rapidly directed to the scene, without knowing the radiation presence; they were not wearing protective equipment. At 2:15 a.m, local Soviet Officials gathered regarding the unexpected disaster at Chernobyl. A plan of secrecy and hiding was adopted by the USSR, which decided to block cars from exiting or entering Pripyat, a nearby city that was built to house Chernobyl's workers. Thousands of police and state officials were transported to the region to assist on the road blockage and disaster efforts, all not wearing protective equipment, not aware of the high radiation levels. Only by 27 April, it was decided for Pripyat to be evacuated, leaving its residence in danger for 36 hours. People were told that this evacuation was temporary. In reality, they would never be able to return to their homes after the establishment of the Chernobyl Exclusion Zone on 2 May 1986.

On 28 April 1986, high radiation levels were traced in Norway and Sweden. Swedish air monitors detected a large amount of radiation, tracing back to the USSR. Soviet officials admitted that there's been an accident, but they falsely stated the situation was under control. On April 29, US Officials provided the world with the first photos of Chernobyl via spy satellites. The world now knew the severity of this disaster and the USSR could no longer hide it. Soviet officials refused to cancel the 1st of May Day festivals in Kyiv, even as radiation levels continued to be released. By May 9, tons of radioactive topsoil had been removed, the fire at the reactor core had been extinguished by helicopters, and workers had begun to pour concrete under the reactor.

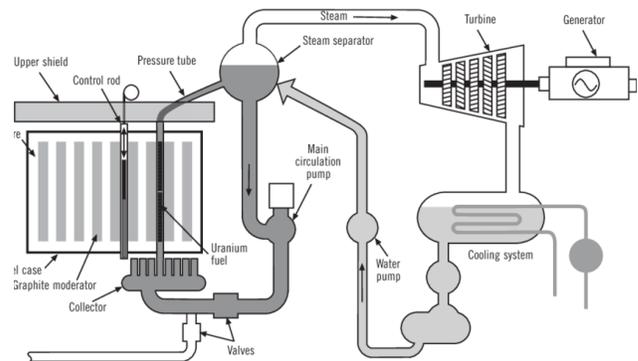
Health and Environmental Implications:

The release of high doses of radiation during and after the Chernobyl Disaster has caused severe health effects. From the 600 workers during the day of the explosion, 134 workers painfully died from acute radiation syndrome 3 days after the event. Among the 600 workers onsite, increased incidences of leukemia and cataracts were recorded for those exposed to higher doses of radiation. The poisonous isotopes of iodine and cesium released to the environment spread to the majority of Europe, affecting millions, especially Ukrain SSR, Byelorussian SSR, and Russian SSR due to their close proximity. Out of the public evacuated from Pripyat, almost 20,000 cases of thyroid cancer were reported in children and adolescents who were exposed at the time of the accident. Also, the exposure to high radiation levels in Chernobyl has been reported to cause high anxiety and other psychological illnesses in the people who have been exposed.

The accident has also severely affected the environment surrounding the area. It was reported that harsh woodland terrain around the Ukrain-Belorussian border has shown anomalies in trees due to radiation exposures. After the accident, the deposition of radioactive iodine contaminated agricultural plants, negatively affecting the health of livestock, and thus the milk produced in parts of Belarus, Russia, and Ukraine. The radioactive materials released from the plant have also been mixed to Pripyat River, close to the plant. This river connects with the Dnieper river, Ukraine's most important river. The radioactive particles, now in the Pripyat River have been passed to the Dnieper river killing thousands of fish. The plants and people who also use the water of both rivers have become contaminated.

Effects of the RBMK-1000 reactor on the Accident:

After the explosion, an emergency report was created by Soviet officials, which was analyzed by professionals in the headquarters of the International Atomic Agency, in Vienna. It's apparent that Soviet Authorities have recognized the factor of human error in regards to the explosion, in addition to the technical flaws in the reactor's design also contributing to the accident. According to the report, "operator errors at the Chernobyl plant on the night of April 25-26 were not the sole cause of the accident, but also the operating function and design of the RBMK-1000 reactor caused further difficulty in management. The distinctive feature of the Chernobyl design, which sets it apart from conventional nuclear power plants, is its tendency to generate a sudden and uncontrollable burst of power in the reactor core. The RBMK-1000 is the only nuclear reactor in the world to use graphite as a moderator together with light water (H₂O) as a coolant. The design of graphite moderators was assumed to slow the neutrons of uranium and stabilize the reaction, however, oppositely caused an uncontrollable increase in the speed of neutrons, triggering an explosion. Since the accident, the RBMK-1000 has gone through major design and safety changes.



Timeline of Events

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| 25 April 1986 | <i>Chernobyl's operators begin reducing power at reactor No. 4 in preparation for a safety test. The test is meant to measure how long the reactor can operate without sufficient energy supply.</i> |
| 26 April 1986 - 1 am | <i>A series of events carried out by plant workers including disabling the automatic shutdown mechanism caused the reactor to come to an unstable level. A surge of power occurs which an explosion causes the 1000 ton row to blow, releasing large amounts of radiation to the atmosphere.</i> |
| 26 April 1986 - 2 am | <i>The first team of firefighters arrived at the scene. Soviet officials conduct an emergency meeting, deciding to block all access to the powerplant and Pripyat.</i> |
| 27 April 1986 | <i>The town of Pripyat and the surrounding area is evacuated. Roughly 115,000 rapidly leave the area.</i> |
| 28 – 29 April 1986 (Committee Starting Date) | <i>Swedish air monitors detect a large amount of radiation in the atmosphere, which is traced back to the USSR. US spy cameras see the disaster for the first time. The whole world now knows the accident.</i> |
| 1 April 1986 | <i>In the midst of international controversy and high radiation levels, Soviet officials still did not cancel the May Day events in Kyiv, even though they were only 93km from the accident site.</i> |
| 4 – 9 May 1986 | <i>Liquid nitrogen is pumped to the reactor core to stop the fire. Soviet officials finally close schools in Kyiv and advise residents to stay inside. Workers finish draining about 20,000 tons of radioactive water from the basement and start pouring concrete into the reactor.</i> |
| August 25 – 29, 1986 | <i>An international conference is hosted by the IAEA (International Atomic Energy Association), which scientists blame that the Soviet-made RBMK-1000 reactor had significant design flaws, affecting the accident.</i> |
| Vienna, 8 – 12 April 1996 | <i>An International Conference in Vienna has summed up major social, health, and environmental consequences of the Chernobyl Accident. A comprehensive report is released named “One Decade after Chernobyl”.</i> |

Treaties and Events

After the Chernobyl disaster, the international committee adopted two new conventions regarding nuclear safety on 26 September 1986, 5 months after the accident. The first Convention was “The Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency”, which aims for member states to cooperate with each other and with the IAEA in case of a future nuclear accident. The convention

dictates that parties should invite international experts to analyze the situation and create legal frameworks for nations to properly aid each other in case of a future accident.

The second convention was, “The Convention on Early Notification of a Nuclear Accident”, which aims to create an early notification system for nuclear accidents. It requires States to report the accident's time, location, nature, and other data essential for assessing the situation. The convention also states that nations should share new information they discovered regarding nuclear safety and procedure, in order to inform the world.

Evaluation of Previous Attempts to Resolve the Issue

Both conventions stated have been significant attempts to solve the issue, however, they haven't been enough binding. The conventions aim to take action in order for the mistakes in the Chernobyl disaster to not happen again. The conventions state for mandatory reporting of nuclear accidents because of the disastrous effects caused by the USSR hiding the Chernobyl disaster, or aims for further conducting and sharing of international nuclear information in order to discover and share flaws in future reactors, such as the design flaws later discovered in the RBMK-1000 reactor.

In the end, nuclear disasters are internal matters and thus international intervention is limited. Even though the two conventions, adopted on 26 September 1986 dictate certain mandatory steps, it's still the duty of the nation to inform its people regarding nuclear disasters or train its emergency force about nuclear accidents.

Possible Solutions

The 2011 Fukushima Disaster in Japan showed the world that international measures taken after the Chernobyl disaster weren't enough. Even though the Fukushima disaster emerged after a natural disaster, Japan is a well-trained nation regarding natural disasters and showed the world that further steps should be taken to protect nuclear reactors from future natural disasters.

Delegates should remember that every nation generally uses its own nuclear technology when building a nuclear power plant, specifically its own reactors. Thus, the nation itself only knows the flaws of its own reactor. Nations should fully investigate their own nuclear technology to prevent future disasters. As nuclear technologies of nations are generally government secrets, delegates should find ways for limited and transparent safety information sharing, where the sovereignty of nations is respected. Again, cooperation methods that respect territorial sovereignty should be discussed, as no country can suddenly send a team of inspectors to another country, unannounced, in case of a nuclear accident.

The committee's starting date is April 28, 1986, the day Swedish air monitors record abnormal amounts of radiation within the area, discovering the existence of the Chernobyl disaster. All delegations should cooperate with the USSR as the spread of radiation or a second explosion would negatively affect every nation. The effects of the current radiation level is known but what if a second explosion occurs? The fire hasn't been yet extinguished at the core of the reactor. The USSR should first urgently extinguish the fire, and then cover the whole reactor with a material that would trap the radioactive air inside. Urgent

scientific works should be conducted by the USSR in the area in order to understand the severity of the event, together with long term side-effects.

Finally, international transparency is essential in order for countries to not hide accidents in the future, such as when the USSR hid Chernobyl for 2 days. The IAEA is a powerful UN organization and delegates should find solutions that are in respect of IAEA international guidelines and safety standards in order to prevent future nuclear accidents

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