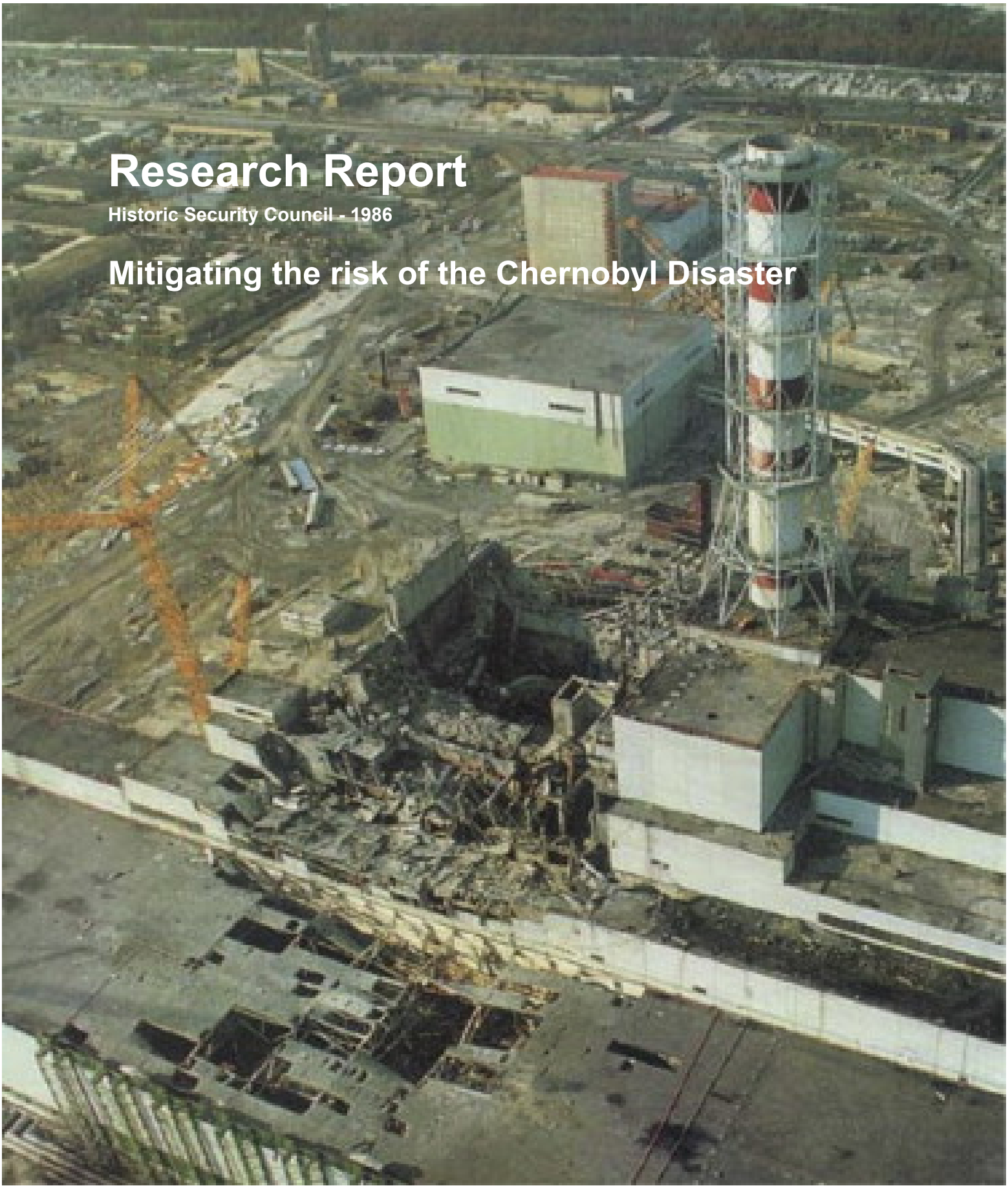

Research Report

Historic Security Council - 1986

Mitigating the risk of the Chernobyl Disaster

Model
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Forum:	Historic Security Council of 1986
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Introduction

The Chernobyl disaster, which occurred on April 26, 1986, remains one of the most catastrophic nuclear accidents in history. A combination of flawed reactor design, human error, and inadequate safety protocols led to a catastrophic explosion at Reactor No. 4 of the Chernobyl Nuclear Power Plant in the Soviet Union. The explosion released massive amounts of radiation into the atmosphere, affecting not only the immediate vicinity but also spreading across Europe. The consequences were far-reaching, including the evacuation of over 100,000 people, long-term health issues due to radiation exposure, and widespread environmental damage.

This report provides an overview of the events leading to the disaster, the technical factors involved, and the timeline of key moments during and after the accident. It also highlights the critical role of reactor design, emergency systems, and human error in the escalation of the crisis. Through understanding the causes and impact of the Chernobyl disaster, we can better appreciate the importance of nuclear safety and the lessons learned from one of the worst nuclear catastrophes in history.

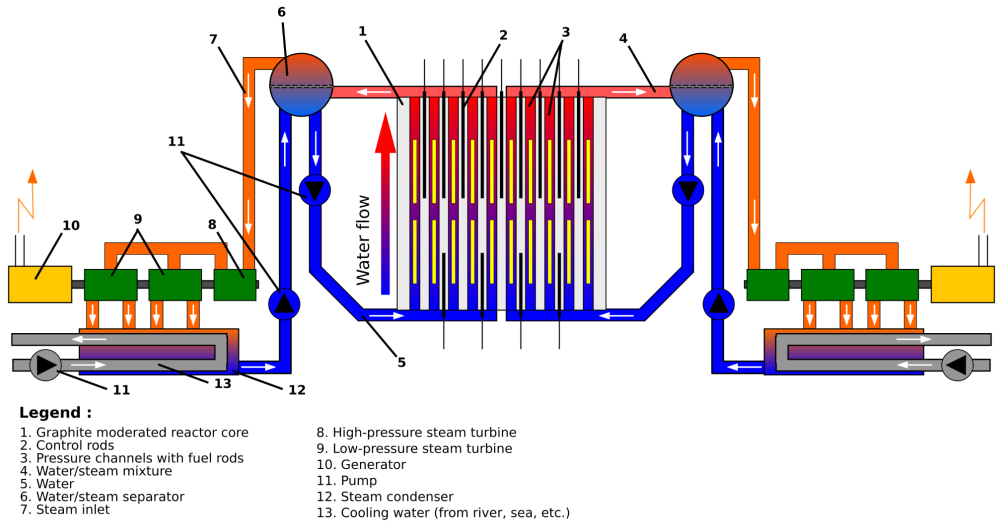
Definition of key terms

Nuclear Meltdown	A severe nuclear reactor accident that results in core damage due to overheating,
Exclusion Zone	A 10km zone set up 36 hours after the disaster which was later expanded to 30km
Acute radiation syndrome (ARS)	Health effects that are caused by exposure to ionising radiation
Nuclear fission	The process of splitting an atom into two or more smaller nuclei in turn releasing large amounts of energy
RBMK Reactors	A class of graphite moderated nuclear reactor that was built by the Soviet Union and used in the Chernobyl power plant
Emergency core cooling system (ECCS)	A system that cools the reactor core by pumping cooling fluid to the core
Nuclear chain reaction	When one nuclear reaction leads to another reaction which then leads to another, creating a self propagating series and continued explosion.

General Overview-

Background to event-

In the years leading up to the disaster, several attempts were made to confirm the turbine run-down energy capability of Reactor No. 4. Starting in 1982, these tests faced setbacks due to insufficient excitation voltage and various equipment malfunctions. Despite modifications to the electrical system, subsequent tests in 1984 and 1985 were also unsuccessful. In 1986, a test was scheduled during a planned power-down of the reactor. The test involved several significant changes, including the decision to disable the emergency core cooling system While this decision received approval from the site chief engineer, it raised alarms about the overall safety culture at the plant, as the reactor would operate for hours without emergency protection.



(Figure 1 - process flow diagram of the reactor)

Initially set for April 25, 1986, the test was delayed due to unexpected demands on the power grid. This delay, combined with a shift change, meant that inexperienced night shift operators would carry out the test.

The Accident-

At 01:23:04, a test started where four main circulating pumps (MCPs) were powered by a coasting turbine, while the other four pumps operated from the grid. Steam to the turbines was cut off to let the turbine generator slow down. Diesel generators began operating and were expected to fully take over by 01:23:43. As the turbine slowed, its power output dropped, reducing water flow and increasing steam bubbles in the coolant. At 01:23:40, an emergency shutdown, or scram, was triggered by pressing the AZ-5 button, which caused all control rods to be fully inserted. The timing of this decision is unclear, as only Akimov and Toptunov made the choice, and witnesses reported a calm atmosphere.

The RBMK reactor design complicated the situation; when control rods were inserted, they initially displaced neutron-absorbing water with graphite, which could increase the reaction rate instead of reducing it. This behaviour had been noted in a previous incident at the Ignalina Nuclear Power Plant in 1983. Moments after the scram began, a power spike occurred, causing overheating and fracturing of fuel rods. This may have blocked the control rods, which were only partially inserted. The reactor output then surged above 530 MW, leading to a rapid rise in steam pressure, fuel cladding failure, and the release of fuel elements into the coolant, damaging the containment channels.

As the scram continued, the reactor output surged to about 30,000 MW thermal, ten times its normal level, with some estimates suggesting it peaked even higher. While the exact sequence of events is unclear, a steam explosion likely occurred next, caused by steam pressure escaping from damaged fuel channels into the cooling structure. This explosion destroyed the reactor casing and blasted the upper biological shield through the roof. It ruptured more fuel channels and cut off coolant lines, leading to a rapid loss of coolant and a further increase in thermal power.

A second, more powerful explosion happened two to three seconds later, which stopped the nuclear chain reaction and ejected hot graphite moderator into the air. This explosion was equivalent to about 225 tons of TNT and ignited fires from the hot materials. Witnesses reported burning debris and sparks shooting into the sky, some of which started fires on the machine hall roof. Around 25% of the overheated material was expelled from the reactor, leading to intense airflow that fueled the fires. Afterward, some workers, including survivor Alexander Yuvchenko, stepped outside and saw a bright blue light from the ionised air above

the reactor.

(Figure 2 -image of remains of reactor 4 after the explosion from the roof of reactor 3)

Timeline of events -

- April 25, 1986, 1 a.m. - Chernobyl operators begin reducing power at reactor No. 4 for a safety test timed with a routine shutdown.
- April 25, 1986, 2 p.m. - Emergency core cooling system disabled; test and shutdown delayed due to regional power needs.
- April 25, 1986, 11:10 p.m. - Operators receive permission to continue with the test and shutdown; night shift is on duty without proper instructions.
- April 26, 1986, 12:28 a.m. - Reactor power drops below stable levels; operators violate safety guidelines by removing control rods to stabilise power.
- April 26, 1986, 1 a.m. - Power stabilises at a lower level; test proceeds with automatic shutdown systems turned off.
- April 26, 1986, 1:23:04 a.m. - The test officially begins; an unexpected power surge occurs.
- April 26, 1986, 1:23:40 a.m. - Emergency shutdown button pressed, but control rods jam as they enter the core.

- April 26, 1986, 1:23:58 a.m. - First explosion occurs, blowing off the reactor roof and releasing radiation; chaos ensues at the plant.

- April 26, 1986, 1:28 a.m. - First firefighters arrive with no protective clothing, unaware of radiation.

- April 26, 1986, 2:15 a.m. - Local officials meet to block access to Pripyat; police also lack knowledge of radiation dangers.

- April 26, 1986, 5 a.m. - Reactor No. 3 shut down, followed by reactors Nos. 1 and 2 the next morning.

- April 26, 1986, 6:35 a.m. - All fires extinguished except for a blaze in the reactor core.

- April 27, 1986, 10 a.m. - Helicopters begin dropping materials into the core to slow radioactive emissions.

- April 27, 1986, 2 p.m. - Soviet officials begin evacuating about 115,000 residents from Pripyat, misleading them about the situation.

- April 28, 1986 - Swedish air monitors detect radiation traced to the USSR; Soviet officials admit to the accident but claim it's under control.

- April 29, 1986 - U.S. spy satellite photos reveal the extent of the devastation.

- May 1, 1986 - Soviet officials continue with May Day celebrations in Kiev despite ongoing radiation release.

- May 4, 1986 - Liquid nitrogen is pumped under the reactor to cool it; extensive cleanup efforts begin.

- May 6, 1986 - Radioactive emissions drop; schools in Kiev close and residents are advised to stay indoors and avoid leafy vegetables.

- May 8, 1986 - Workers drain 20,000 tons of radioactive water from the reactor basement.

- May 9, 1986 - Concrete is poured under the reactor, later encased in a concrete sarcophagus.

- May 14, 1986 - Soviet leader Mikhail Gorbachev speaks publicly about the incident, stating "the worst is behind us."

Bibliography

- Cover Image - https://en.wikipedia.org/wiki/Chernobyl_disaster
- Page 2 Image - https://www.sciencedirect.com/topics/engineering/chernobyl-accident
- Figure 1 process flow diagram of the reactor. Retrieved from: (https://en.wikipedia.org/wiki/Chernobyl_disaster#/media/File:RBMK_en.svg)
- Figure 2 Photograph of the aftermath of the explosion of reactor 4 from the roof of reactor 3 taken by Igor Kostin/Corbis. Retrieved from: (https://www.theguardian.com/environment/gallery/2011/apr/26/chernobyl-nuclear-disaster-in-pictures)
- The Chernobyl accident 1986 by the World Nuclear Association. Retrieved from: (https://world-nuclear.org/information-library/safety-and-security/safety-of-plants/chernobyl-accident)
- Wikipedia- Chernobyl disaster. Retrieved from: (https://en.wikipedia.org/wiki/Chernobyl_disaster)