Chernobyl Nuclear Accident

Submitted By:-
Amisha Gupta 16ucs031
Komal Kungwani 16ucs093
Parul Shandilya 16ucs126

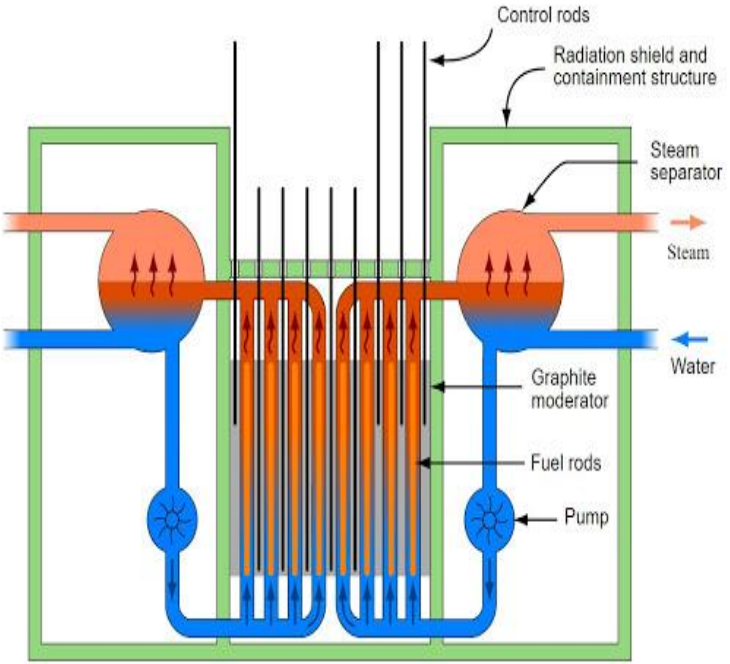
INTRODUCTION

- Nuclear energy constitutes to 11% energy production across the world today.
- **Chernobyl** is a city situated in Ukraine then part of Ukrainian Soviet Union.
- Chernobyl Nuclear Powerplant consisted of 4 RBMK nuclear reactors.
- It happened due to a steam explosion which led to a roof hole from which the radiation got exposed.
- Chernobyl Nuclear Accident is considered the most fatal nuclear accident in history due to the amount of nuclear radiation exposed.
- 100 times more active than Heroshima.
- This nuclear accident led to significant change in RBMK reactor design.
- It is one of the 2 energy accidents rated at level 7 in terms of severity.
- It is a classic example of human error in designing nuclear core reactors and how it impacted countries for decades due to radioactive exposure.
- It was the result of a "safety trial" gone terribly amiss.

How AN RBMK Nuclear Reactor Works

- The RBMK nuclear reactor is a soviet-designed reactor dating back a few decades in design.

DESIGN



- In RBMK reactor graphite is used to slow down the fast neutron in reactor core.
- RBMK reactor use water as a coolant.
- RBMK reactor differs from other reactor In terms of void coefficient. It measures the change in reactivity when void coefficient Is introduced inside reactor.
- RBMK reactor had high positive void coefficient which means more steam and less water in reactor which can rapidly become unsafe

Initial Incident Which Led To The Accident

- The accident happened on 26 April 1986 when technicians planned to test the backup cooling system of reator no. 4.
- The test was a simulation of an electrical power outage to aid the development of a safety procedure for maintaining reactor cooling water circulation until the back-up electrical generators could provide power.
- In case of a power cut, the RBMK reactor would stop pumping water through the core.
- The power backup diesel fuelled generator caused a delay of 60 seconds which led to putting the reactor in danger.
- The test got delayed by 10 hours by power grid officials.
- This led to the night shift team conducting the test who were not qualified to perform the test.

- To perform the test, the reactor had to be put into a dangerous low-power state.
- During the 10 hour delay, the core's low-power state caused a build-up of xenon, another type of atom that in essence blocks the nuclear fission process. The core temperature also dropped so much it stopped boiling water away and producing steam.
- The experiment involved shutting down the coolant pumps, which caused the coolant to rapidly heat up and boil.
- Pockets of steam formed in cooling lines. When the coolant expanded in this particular design, the power level went up.
- All control rods were inserted again. When the rods were inserted they became deformed and stuck so the reaction would not be stopped.
- The rods melted and the steam pressure caused an explosion, which blew a hole in the roof which also resulted in a graphite fire.
- The reactor was constructed with only partial containment, which allowed the radiation to escape which led to the extreme leakage of radioactive substance in the environment.

Reasons for the accident

- Worker’s lack of Knowledge of reactor physics and engineering as well as Lack of training and Experience.
- Insufficient communication between the Safety Officers and the operators in charge of the experiment
- Disabled all safety systems
- Operator error and structural flaws
- Poor Quality (typical soviet craftsmanship)

Immediate Impact

- 231 people were hospitalised immediately due to acute radiation sickness
- 31 of them eventually died. Most of these people were workers in the plant or local firefighters

Long Term Impact

Radioactivity was spread Internationally-

- Radioactive cloud floated almost all over Europe

Radioactive Release-

- Highly radioactive elements accumulated in food chains such as isotopes of idodine and strontium
- During Explosion , Noble gases like xenon and Krypton were released in the atmosphere
- About 55% of the radioactive iodine was released

Long Term Impact

Environment contaminated with residual radioactivity

- Levels of radioiodine,radiocaesium and radiostrontium raised in rivers , lakes and reservoirs.Fished were also contaminated due to this.
- Pine forest near the reactor turned ginger brown and died
- In the area closest to the power plant, known as the Exclusion Zone, wildlife appears to be diseased and there are lower rates of beneficial bacteria, according to National Geographic.

Long Term Impact

Socio Economical Impact

- Agricultural sector was worst hit economically
- Crippled market for foodstuff and other products due to restrictions on agriculture
- Consumers were rejecting products from affected areas

Health Effects

- Increased Thyroid cancers due to release of radioactive iodine
- Ionizing radiation was causing leukaemia among the people of affected areas
- Cataract cases increased due to eye exposure with radioactive material
- Cardiovascular diseases increased

What was the solution for the Chernobyl disaster?

- Chernobyl, the scene of the worst nuclear accident in history, has been enclosed by a vast steel shelter designed to prevent radiation leaks from the site.
- It was designed to last for 30 years to protect Kiev, Ukraine and the whole world from nuclear contamination.
- People were relocated from that are.

What could have been done to avoid chernobyl disaster?

- The accident could have been prevented completely, and its consequences could have been mitigated, with effective training, management and regulatory oversight.
- Strict government laws to check and ensure safety of the machineries used.

Summary

- Chernobyl Nuclear reaction was one of the deadliest nuclear accidents.
- It could have been prevented if the engineers were trained well.
- Machinery used was well checked before use and details were not hidden from the people about the machine.
- If there was not any internal politics.
- After the accident people died and many who lived had suffered due to radiations they inhaled.
- Years after the accident nuclear reactive particles are still in plants, animals and humans.
- It has been been enclosed by a vast steel shelter designed to prevent radiation leaks from the site.
- Wildlife in the nearby affected area suffers some diseases.

Thank You