The Three Mile Island Meltdown

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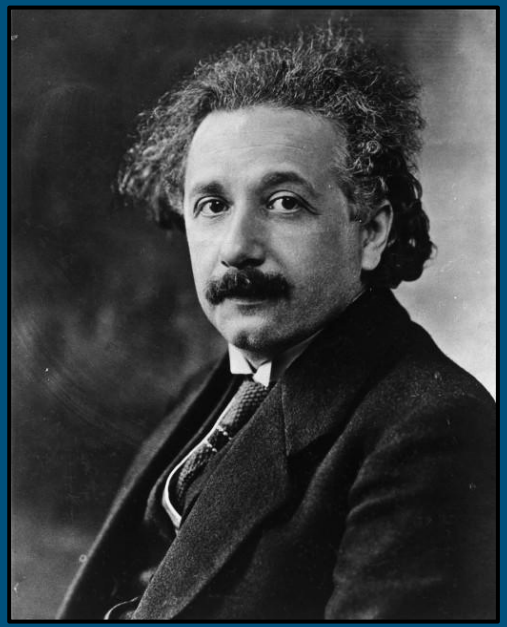
“Nuclear Power Is One Hell Of A Way To Heat Water.”



~ Albert Einstein

First, Let's Get Some Quick Facts Out Of The Way.

- Three Mile Island wasn't the "Chernobyl" of the U.S., and it wasn't even a full meltdown.
- Not to spoil anything that I will cover later, but the whole facility didn't go "CODE RED", it was just a massive and extremely unfortunate turn of events caused by a mix of improper training, faulty machinery, and a few other things that I will cover in a bit.

Now, In The Beginning...

- It all started at about 4 A.M., on the wednesday morning of March 28th, when the main reactor of TMI-2 started to overheat.
- Due to inaccurate information and equipment, the workers were unable to notice this happening until it was too late, and the reactor started to overheat drastically, leading to it expelling radiation into the air around it.

Looks Like Things Are Really “Heating Up”..

- And they were, at around 6:50 A.M, the technicians and officials of the plant begin to realize that this is turning into a much more serious problem, and declare a site emergency.
- At 7 A.M., Clarence Deller of the State Emergency Management Office is notified of the ongoing situation and begins to launch an evacuation order for York, Lancaster, and Dauphin counties.

Hopefully Things Are Finally “Cooling Down” Though...

- And fortunately, they were, as around 8:10 A.M. the evacuation order is cancelled, but Cumberland County emergency officials are notified of what has happened, accompanied by many news stations and reporters appearing at the site.
- At both 11 A.M. and 4 P.M., engineers vent radioactive steam into the air, thus bringing a somewhat quick “resolution” to this event.

But How Could It Have Happened?

- Well, the events that led to the extreme overheating of the reactor were a mix of poor worker training, inaccurate electronics, and neglect of upkeep in one certain situation.
- It started when the plant experienced a failure of some kind in the secondary, non-nuclear section of the plant.

What Happened Next?

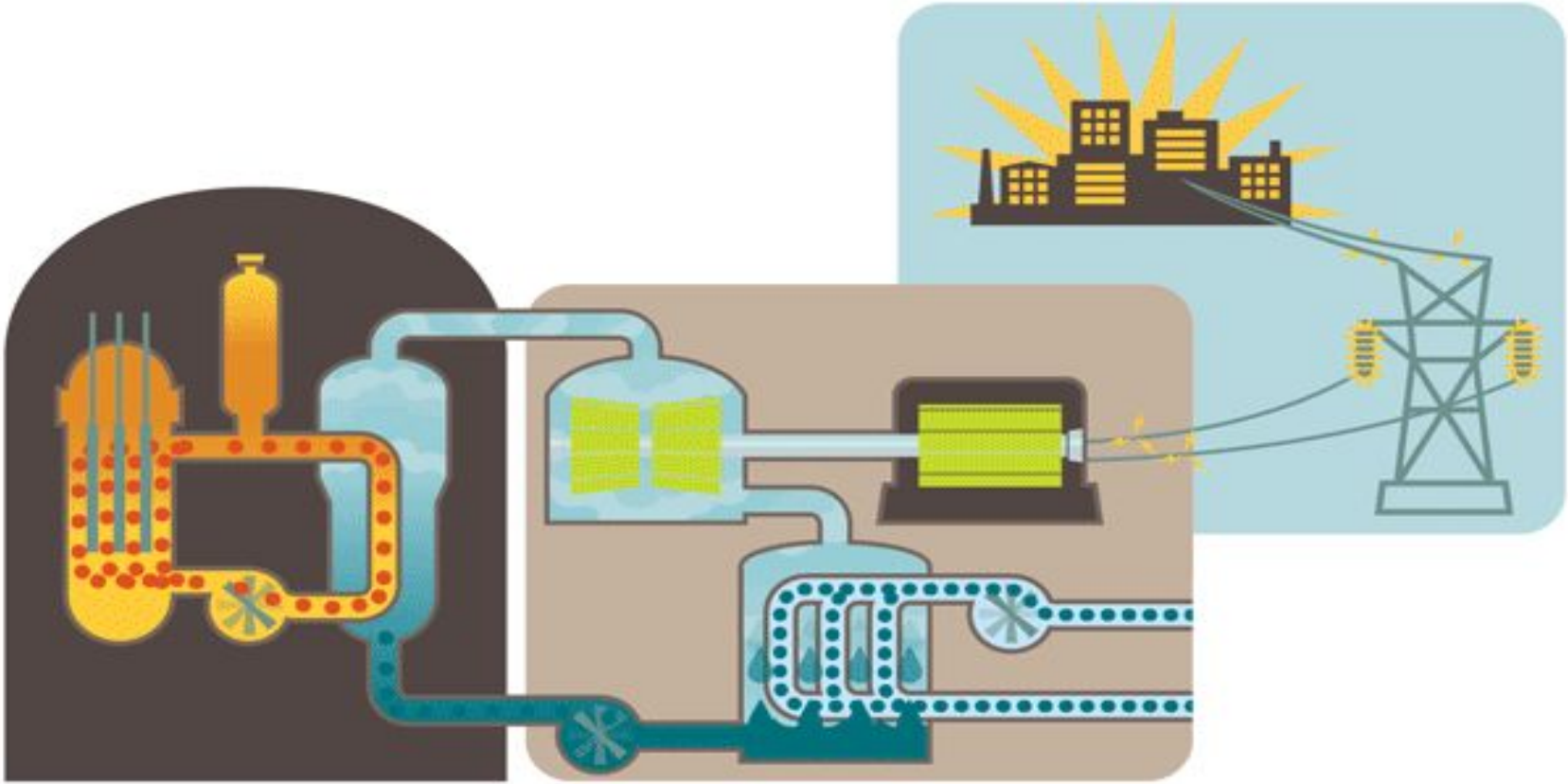
- Then, due to said malfunction, this caused a mechanical or electrical failure to occur with one of the main feedwater pumps, making it so water could not be sent to the steam generators that remove heat from the reactor core.
- This made it so the plant's turbine-core, and eventually the whole reactor to automatically shut down.

This Doesn't Sound Too Good...

- And it wasn't, because as soon as this happened, pressure began to build up in the reactor, so a pressure release valve was automatically open, and should have closed when the levels of pressure inside dropped back to normal.
- What actually happened was that the valve became stuck and the pressure levels began to drop too far. However, on the control rooms, the electrical equipment said that the valve was in fact closed, so the engineers had no clue that coolant water in the form of steam was pouring through the open valve until it was too late and the alarms started going off.

And Then What?

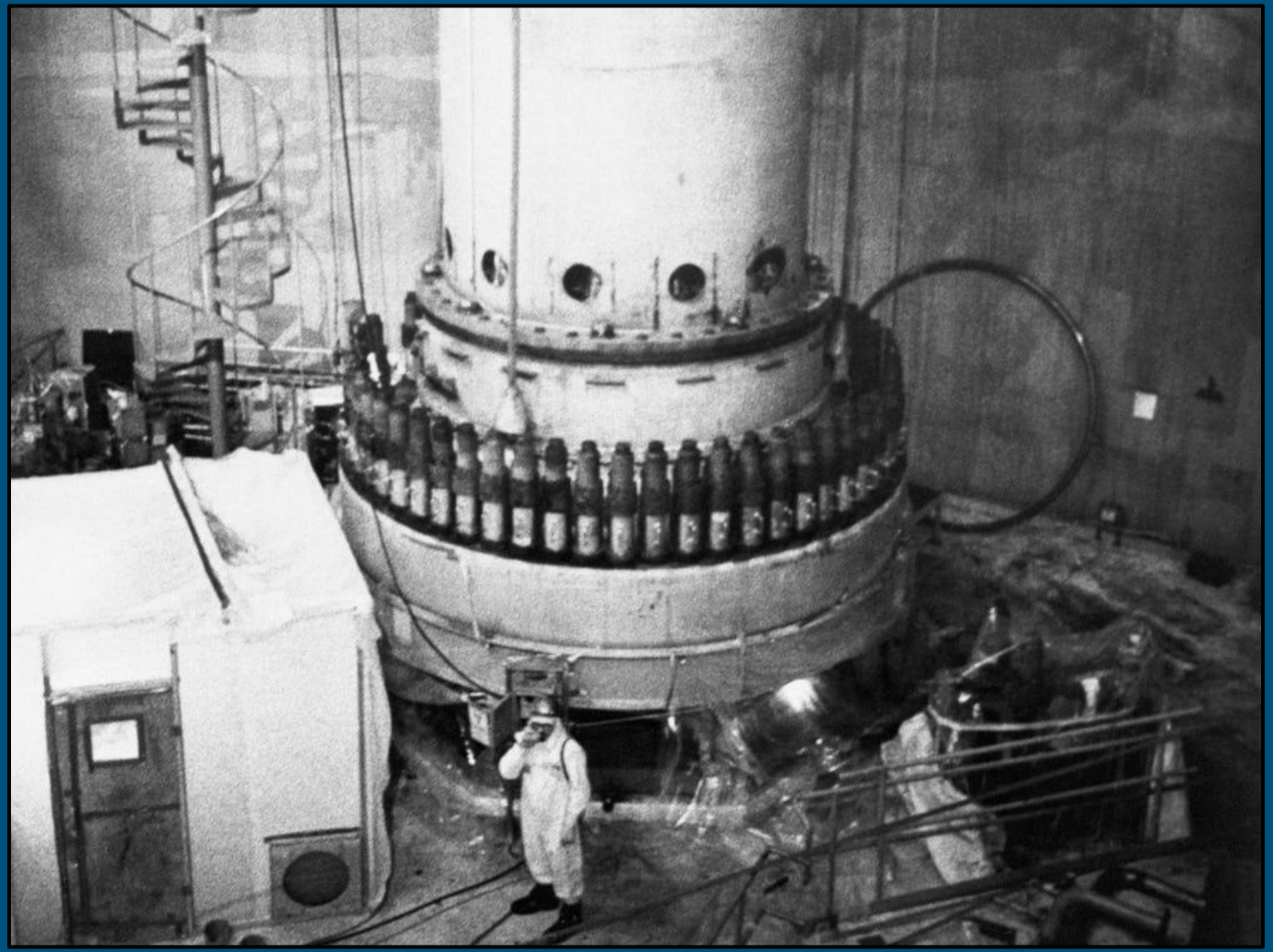
- And then the main event occurred.
- As the engineers panicked due to not knowing what was happening exactly, the immediate thought was to drain the excess water from the reactor core.
- What they didn't know was that due to the stuck open pressure valve, the reactor coolant pumps began to vibrate and turned off, and with the emergency coolant water threatening to completely cover the reactor (something that you do NOT want to happen), they cut back on the water.
- But without the coolant pumps circulating water, and the emergency system being starved of it, the water level in the core dropped and the reactor began to overheat.



But What Happened To The Workers And Environment?

- Several independent and state sponsored departments had all conducted their own research on the radiological effects that the accident happened, and all came to somewhat common grounds:

- The approximately 2 million people around TMI-2 during the accident are estimated to have received an average radiation dose of only about 1 millirem above the usual background dose.
- Simply put, exposure from a chest X-ray is about 6 millirem and the area's natural radioactive background dose is about 100-125 millirem per year for the area.
- The accident's maximum dose to a person at the site boundary would have been less than 100 millirem above background, so while still wasn’t healthy, it certainly wasn’t good either.
- In the months following the accident, questions were raised about possible adverse effects from radiation on human, animal, and plant life in the TMI area, but none could be directly correlated to the accident.
- Thousands of environmental samples of air, water, milk, vegetation, soil, and foodstuffs were collected by various government agencies monitoring the area.
- Very low levels of radionuclides could be attributed to releases from the accident, however, comprehensive investigations and assessments by several well respected organizations have concluded that in spite of serious damage to the reactor, the actual release had negligible effects on the physical health of individuals or the environment.



But Everything Was Fixed And We Got A Happy Ending, Right...?

- Well after the accident, it was positively guaranteed that there would be new regulations and officials stepping up to address the disaster.
- While no one was exactly harmed by the disastrous event, new regulations by the NRC were put in place, and public opinion of nuclear energy slowly turned sideways as people became more and more distrusting of it.


PALMER

What About Those Regulations Though?

- Well, to keep it short and simple, there was basically a VERY long list of changes and corrections introduced to nuclear plants around the country, and even some other countries copied these regulations, but we're not talking about them are we?
- Anyways here's a list of the more major changes:

- Upgrading and strengthening of plant design and equipment requirements. This includes fire protection, piping systems, auxiliary feedwater systems, containment building isolation, reliability of individual components (pressure relief valves and electrical circuit breakers), and the ability of plants to shut down automatically;
- Identifying the critical role of human performance in plant safety led to revamping operator training and staffing requirements, followed by improved instrumentation and controls for operating the plant, and establishment of fitness-for-duty programs for plant workers to guard against alcohol or drug abuse;
- Enhancing emergency preparedness, including requirements for plants to immediately notify NRC of significant events and an NRC Operations Center staffed 24 hours a day. Drills and response plans are now tested by licensees several times a year, and state and local agencies participate in drills with the Federal Emergency Management Agency and the NRC;
- Integrating NRC observations, findings, and conclusions about licensee performance and management effectiveness into a periodic, public report;
- Having senior NRC managers regularly analyze plant performance for those plants needing significant additional regulatory attention;

- Expanding NRC's resident inspector program–first authorized in 1977–to have at least two inspectors live nearby and work exclusively at each plant in the U.S. to provide daily surveillance of licensee adherence to NRC regulations;
- Expanding performance-oriented as well as safety-oriented inspections, and the use of risk assessment to identify vulnerabilities of any plant to severe accidents;
- Strengthening and reorganizing enforcement staff in a separate office within the NRC;
- Establishing the Institute of Nuclear Power Operations, the industry's own "policing" group, and formation of what is now the Nuclear Energy Institute to provide a unified industry approach to generic nuclear regulatory issues, and interaction with NRC and other government agencies;
- Installing additional equipment by licensees to mitigate accident conditions, and monitor radiation levels and plant status;
- Enacting programs by licensees for early identification of important safety-related problems, and for collecting and assessing relevant data so operating experience can be shared and quickly acted upon; and
- Expanding NRC's international activities to share enhanced knowledge of nuclear safety with other countries in a number of important technical area

But How Is The Reactor Doing Now?

- Well ,not too long ago, Reactor Unit 1 produced its last Kilowatt of electricity
- On September 20th, 2019, the plant was shut down, despite having the licensing to operate until 2034.
- The decision to shut it down was made as a result of pure economics, as the state of Pennsylvania refused to give the plant a lifeline financial packaging that could have kept it open for longer.

Citations

https://www.nrc.gov/reading-rm/doc-collections/fact-sheets/3mile-isle.html

https://www.world-nuclear.org/information-library/safety-and-security/safety-of-plants/three-mile-island-accident.aspx

https://www.thebalance.com/three-mile-island-nuclear-accident-facts-impact-today-3306337

https://www.history.com/this-day-in-history/nuclear-accident-at-three-mile-island

https://www.usatoday.com/story/news/politics/2019/09/20/three-mile-island-closes-meltdown-changed-nuclear-energy-america/2352254001/