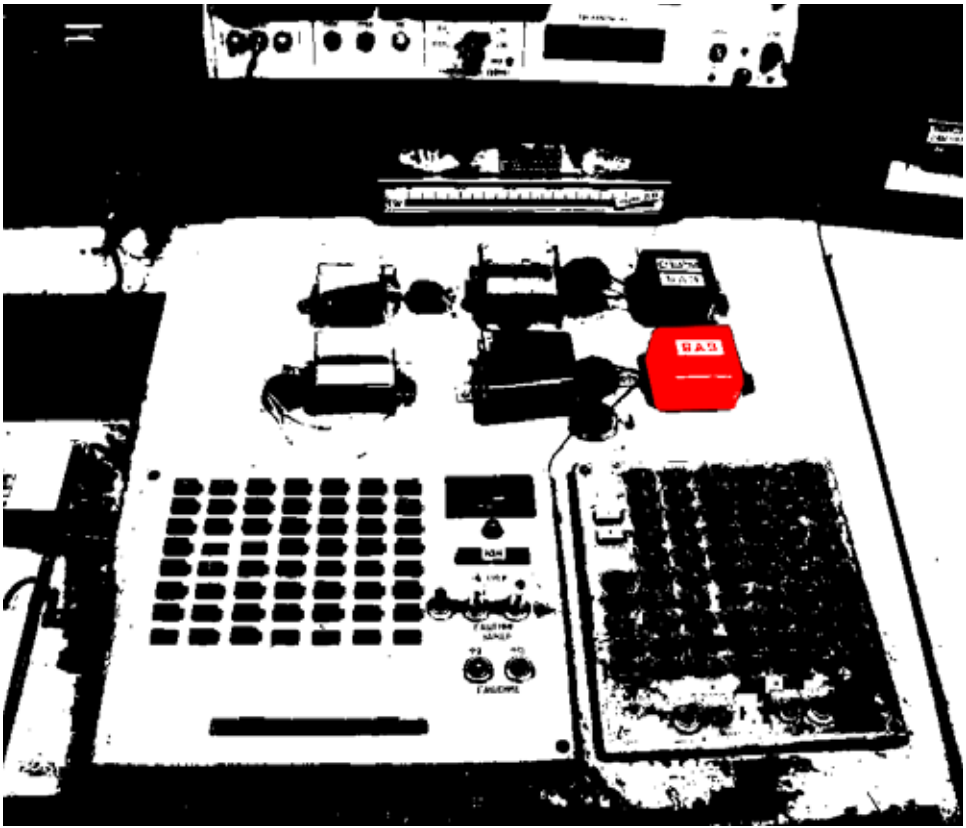
CHERNOBYL

The Worst Nuclear Disaster in History

Jack Finegold



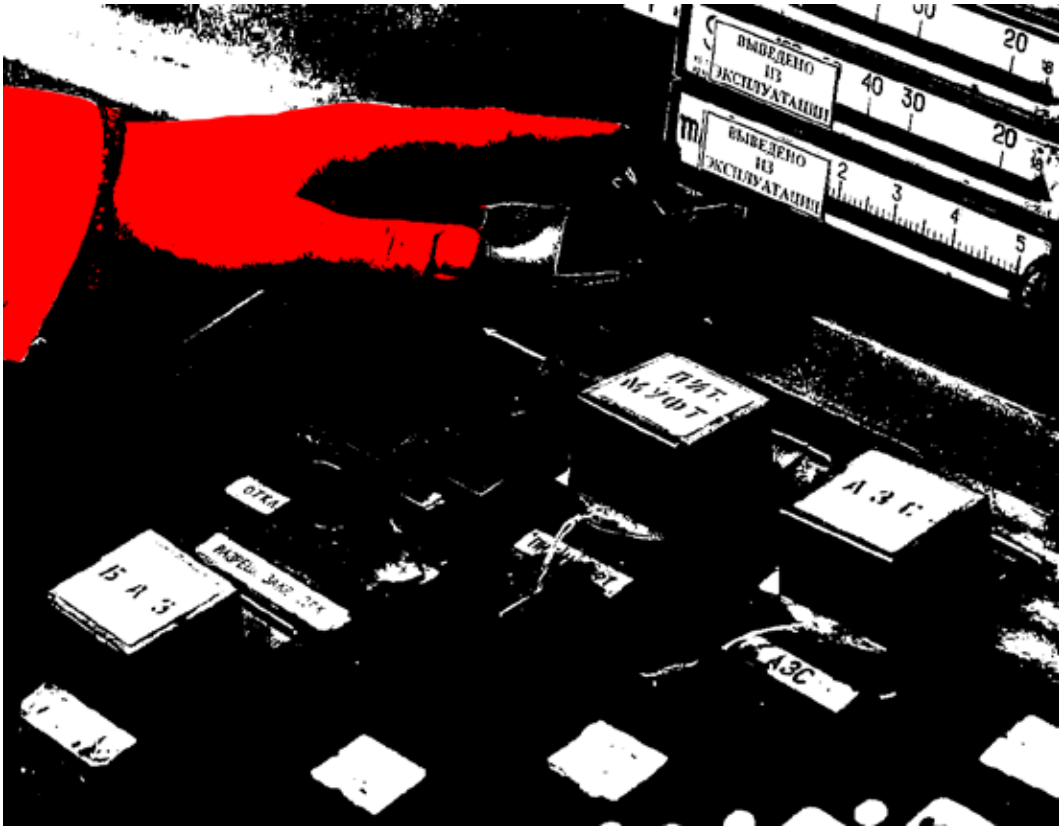
a. Preface

Chernobyl's meltdown occurred for plenty of reasons, though it's impossible to point to one specifically as the 'cause.' Plenty of small things went wrong throughout the 25th and 26th of April, 1986, ultimately resulting in the meltdown and detonation of the Chernobyl nuclear powerplant's primary reactor.

Some things that are important to note or remember about the reactor's failure are that even when the reactor is 'off' it's still generating heat. This heat still needs to be cooled down, despite being a fraction of the heat generated by the actual nuclear reactor's normal operations. In order to cool the reactor, there were roughly 1.6k coolant pumps present. Experts predicted that the heat coming from the actual reactor could have potentially powered the coolant tanks enough to alleviate the disaster that we know today, but for some reason it wasn't used at all.

Chernobyl is largely considered the worst nuclear disaster in history, though death counts are disputed. It's predicted by the WHO that roughly 4,000 long-term deaths have occurred due to radiation surrounding the dead reactor, and the actual reactor's detonation caused 30 almost deaths; 28 reactor technicians, and 2 first responders. Undisputably, though, the area surrounding the reactor has been completely uninhabitable for years after the disaster.

Chernobyl demonstrates that nuclear power, while an incredible example of human ingenuity and engineering prowess, is still an extremely dangerous and potentially catastrophic force. Human beings must demonstrate immense care as the need for nuclear power becomes greater and greater in the age of fossil fuels. Chernobyl is not an isolated incident, and could very well happen again.



April 25th's M

b. Safety Test

In the early AM during the morning shift at the Chernobyl powerplant, a shutdown was scheduled for the reactor. The reactor was scheduled for a safety test, in order to make sure everything was running properly, and the reactor could handle the stress it was being put through.

The test was going to involve the reduction of power to the reactor, running the generator at a normal speed, four of the primary power units would be supplied with outside power, and the steam would be turned off in order to trigger an automatic reactor shutdown. The reactor would then be monitored to see how it reacted to the shutdown, and allowed to slowly wind down after the emergency power was fully supplied.

At about 1 AM, the power was slowly reduced as according to the test's plan. This involved the disabling of the the emergency core coolant in order to see how the core would shutdown when it began to overheat without emergency coolant.

The test was scheduled to begin at 2:15 PM, but by 2 PM, the demand for energy from the city of Kiev was too high to be able to power the reactor down fully.

The test was eventually postponed, but the emergency core coolant was not re-enabled, because the process to re-enable it was too strenuous and would take an entire shift alone. Nobody on the PM shift was able to spare time in order to re-enable it, and while that didn't affect the actual disaster that ensued, it is really bizarre that such an important factor in the safety of everyone involved was allowed to be simply pushed off.

The test was resumed as the evening shift was about to end in the hopes that the night shift could then simply maintain the test and not have to worry about anything else.

April 25th's Night Shift

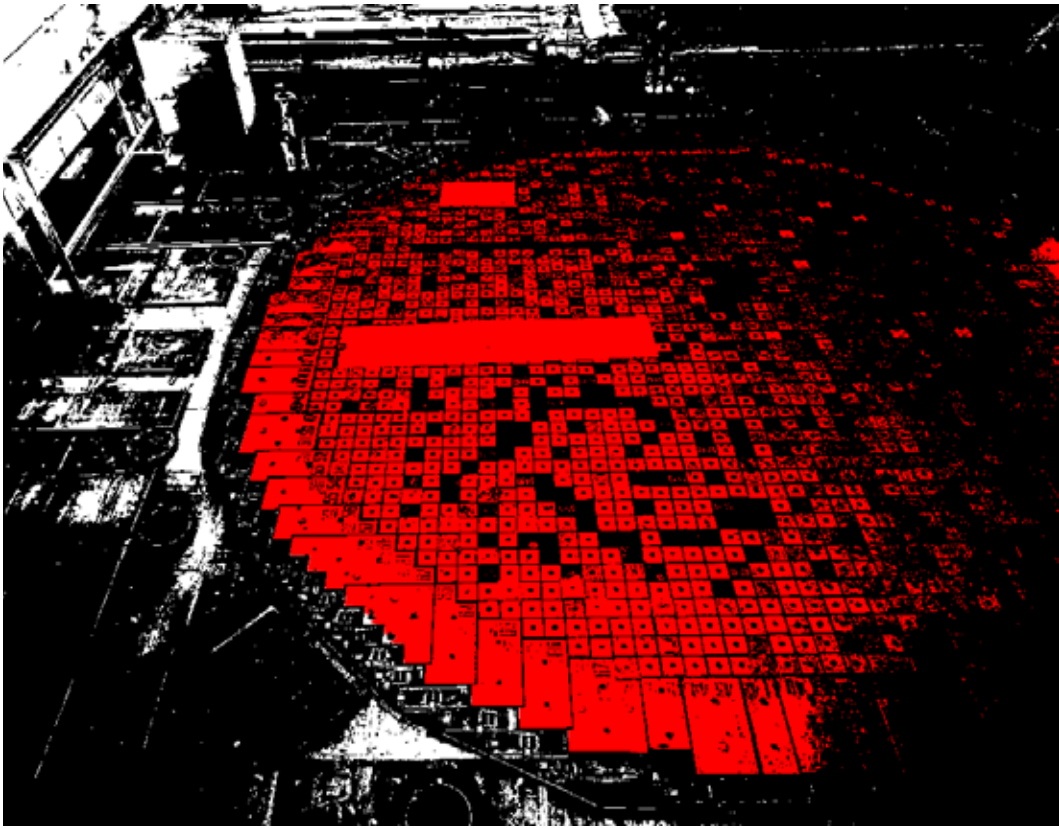
April 26th's M

c. Botched Test

The midnight shift ended up being tasked with carrying out the test from the prior morning shift with very little preparation from the evening shift that just packed up and left before them. The reactor's power began to further decrease as the test required, and produce reactor poisoning, which causes the reactor to become more difficult to control, but is relatively normal for such a test.

Once the reactor had met the lowest power level intended, the reactor then switched from an automatic decreasing into a manual input. The Senior Reactor Control Engineer then further reduced the power, but it shouldn't have been reduced. The control rods failed to activate, making the test, at that point, begin to fail. It's argued whether or not the failure from this point was the Senior Engineer's fault or the reactor's fault, but the official 'blame' was placed on a failure of the power rod system.

As the Senior Engineer lowered the power, the people monitoring the reactor began to notice that the power was much *too low*. They then began to pull more power rods from the core, causing the core to restabilize. The core was then flowed with immense amounts of water to keep it tempered for the test, before the call for the test to resume was made.



Resumption of Test

1:05 AM on

d. Fail Conditions

The test was continued, though the reactor was much too low in terms of energy to successfully pull off the test. The floods of water were cooling off the reactor so well that operators decided it would be safe to remove more rods from the reactor, which resulted in the rods ultimately being lowered much further than should have been operational.

As a result, the reactor became extremely unstable, and unbeknownst to the operators, almost every single power rod had been pulled from the core. The boiling of the coolant water on the core would cause steam, which was unaccounted for in regards to the test.

Because the test involved the use of steam, the reactor was bound to have some sort of a reaction. The reaction would obviously result in some kind of meltdown or failure, but because none of the operators knew that there were no more power cores remaining (as there was no indicator of any kind) the test was continued once more.

Ultimately, the failure conditions were as follows:

1. Low power level during testing
2. Lack of power rods
3. Overflowing of coolant, resulting in steam.
4. A lack of knowledge of the above conditions.

Emergency Shutdown

1:30 AM on

e. Accident

The actual accident was unseen by anyone. Because there was no indicator of a lack of power rods, nobody operating the reactor had any idea that the reactor was going to begin to meltdown as soon as the test continued. At 1:23 AM, the Senior Engineers of the reactor pressed the emergency stop button (the AZ-5). It caused the reactor to begin automatically re-inserting all of the control rods. Everyone in the control room was completely calm, but at this point, it was too late. The reactor was self destructing.

The rods began inserting under conditions that professionals claim they never should have. It was claimed 'impossible' to be in such a situation that every rod would need to be removed from a reactor, and as a result, the reactor spiked intensely, fracturing rods that were being inserted, and beginning the process of the core's meltdown.

Steam began to erupt from the core, rods began to fracture, and the reactor started to fall apart irreparably. The fuel for the reactor began to melt into the water that was intended to cool the core down, further worsening the situation, and ultimately spelling demise for everyone in the control room. The mood at this point was still relatively silent and calm, as the only people who had a semblance of an idea of what was going wrong were the two Senior Engineers who would end up dying alongside the reactor.

At this point, 1:30 AM on April 26th, if not earlier, it was impossible to save anyone within the control room of the Chernobyl powerplant, and the reactor was beyond saving, and it hadn't even detonated yet. Steam explosions began as the rods began to crack and reject from the core. The steam explosions then began to rupture the fuel containers, where the explosions caused physical destruction to the reactor's shell.

The Morning

g. Radiation

Despite the explosions and detonation of the core, and breaking of the reactor shell, it's rumored that the Senior Engineers still didn't know that the core had melted down and was emitting lethal amounts of radiation that would mark remaining employees dead in seconds. It's rumored that the Senior Engineers were still frantically demanding more coolant be placed into the core in order to attempt to save it, though it was much beyond saving at that point.

There are few survivors from the Chernobyl accident, most of which being from the nearby power plant and not the actual reactor's control room. The radiation would eventually leach into the surrounding land and cause human beings to deem it completely unliveable. Soviet officials attempted to downplay the magnitude of the reactor's accident, and keep talk about it down.

The Swedish Forsmark Nuclear Power Plant had a radiation alarm go off, which was strange, because their reactor was completely tame in production. The Swedish government then contacted the Soviet Union, who denied any kind of nuclear disaster. The Soviet Union was completely unwilling to acknowledge the fact that there was an accident at the Chernobyl powerplant until they absolutely had to.

Pet dogs infamously survived in the fallout of the reactor by genetically mutating to develop resistances to the effects of the radiation. Houses were abandoned, entire communities had been eviscerated by such a failure, and the ripples are still felt to this day.

h. Aftermath

Chernobyl's effects aren't somewhere in the long past, as the accident happened less than 50 years ago, in 1986. Though nuclear power plants today have much greater regulations and safety operations, Chernobyl stands as a reminder that we need to remain serious and dedicated to the safety of people in areas surrounding technological advancement, and how powerplants or similar may impact their lives.

Chernobyl's meltdown also wasn't completely self-contained, and countries like Sweden, Austria, Bulgaria, and Switzerland have large amounts of ^{137}Cs radiation present as a result of the radioactive meltdown of Chernobyl. Most animals present around Chernobyl almost instantly died, and those that didn't face extremely short lifespans, or rough lives at all, being abandoned completely by the human beings that put them there.

Presently, extremely small tours are held in exclusion zones around the area where the reactor melted down, but Chernobyl as a Ukrainian city is still irradiated, and that won't change for years at a minimum. The Earth is more likely to explode or be completely wiped of life before Chernobyl as a city is deemed 'habitable' once more, as the radiation is predicted to dissipate in 20,000 years or so. Tours of Chernobyl are often brief and require full facial protection.

Radiation is something that needs to be monitored extremely carefully, as the effects of radiation poisoning are not always immediately evident. Radiation strips away at your DNA which is what fundamentally forms you as a person, causing bizarre and invisible effects initially, before slowly dismantling your body (effectively from the inside out.) Many employees of Chernobyl who survived died painfully, and excruciatingly over the span of weeks after the exposure to 6 to 10k Sv.

day

Sources

- "What was the death toll from Chernobyl and Fukushima?" by **Hannah Ritchie**
- A translation of "Who exploded the Chernobyl NPP, Chronology of events before the accident" by **N. V. Karpan**
- "Chernobyl: Timeline of a nuclear nightmare" by **Kim Hjelmgaard** *(from USA Today)*
- "What Happened at Chernobyl?" from ***Nuclear Fissionary***
- *The Legacy of Chernobyl* by **Zhores Medvedev**

Further Reading

- The Bulletin of the Atomic Scientists
- The Therac-25 disasters
- Russia's Demon Core Incident
- The Radium Girls
- The World Nuclear Association's Chernobyl Accident Appendix 1
- That Chernobyl Guy's video titled "The Chernobyl Disaster in Real Time", as well as his video titled "Top Twenty-One Myths About Chernobyl"

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