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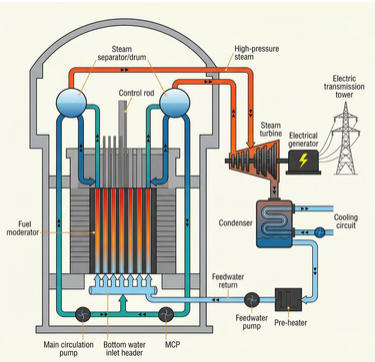
# Chernobyl at 40

## Pressure, drift, and the failure to stop




## Description

On 26 April 1986, Reactor 4 at the Chernobyl nuclear power plant was destroyed during a turbine generator rundown test. The purpose of the test was to determine whether the rotating turbine could briefly supply enough electricity to keep the main circulation pumps running until the diesel generators took over.

The planned shutdown and test sequence had already been delayed for many hours. During the later power reduction, reactor power collapsed to around 30 MW thermal, leaving the reactor in a xenon-poisoned low-power state. Power was then raised again to around 200 MW, and the test continued.

When the turbine generator rundown test began, the four main circulation pumps supplied from the slowing turbine-generator began to lose power, coolant flow started to decrease, slightly warmer feedwater entered the core, and steam voids increased, especially in the lower part of the core. At 01:23:40, the AZ-5 emergency shutdown was initiated. Instead of stopping the reaction immediately, the first stage of rod insertion briefly increased reactivity in the lower part of the core. Within seconds, power surged, fuel channels ruptured, explosions followed, and Unit 4 was destroyed.

## Key findings

Chernobyl resulted from the combination of unsafe reactor characteristics, incomplete communication of known technical concerns, and the decision to continue with the test after the reactor had moved into an unfavourable state.

The RBMK reactor had important design weaknesses. At low power it became difficult to control. Its positive void coefficient meant that increasing steam in the core could increase reactivity rather than reduce it. The core was also very large, making internal conditions harder to interpret during unstable operation. The emergency shutdown system, AZ-5, was not instantaneous and could initially intensify the transient.

Known weaknesses were not fully shared with operators. Earlier incidents and technical concerns did not lead to open learning across the reactor fleet.

The delayed shutdown, the power collapse, the xenon poisoning, the forced recovery, and the low operating margin all showed that the unit was no longer within its safe operating envelope for the test.

The event also showed that a reactor can appear stable enough to proceed while operating conditions and remaining control margin have already deteriorated significantly.

## Why does it concern me?

Chernobyl is not only relevant to nuclear power. It is relevant to any industry that depends on technical barriers, operating procedures, operating limits, and disciplined decision-making under pressure.

In many sectors, work continues successfully under delay, uncertainty, and small deviations. Over time, those deviations can become normal. The result is that people may continue even after the underlying conditions have changed.

The lesson from Chernobyl is not only about flawed design. It is also about the failure to stop. A test, intervention, or recovery action can itself become dangerous if the system is already outside its safe operating envelope

### Ask the following questions:

- Are we still within the approved conditions for the test?
- Has the plant state changed since the test was planned?
- Are known technical issues understood where the work is being carried out?
- Do incident findings and technical concerns lead to action across the organisation?