A different view on Chernobyl

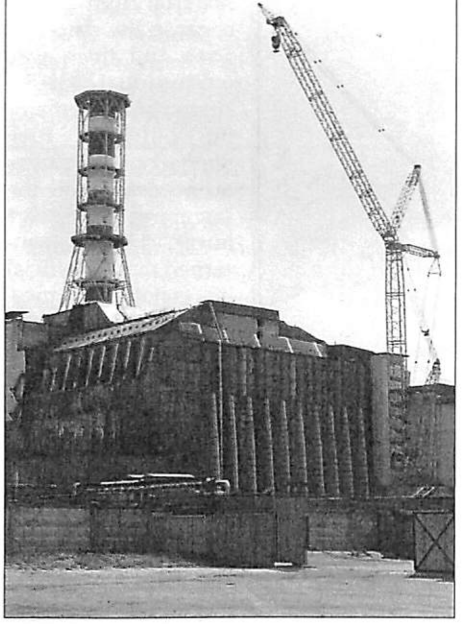
Konstantin Checherov, a physicist from Russia's Kurchatov Institute, has been working inside the crippled fourth reactor at Chernobyl for over 10 years. As a result of his investigations he disputes the official version of what caused the accident and how events progressed subsequently. Judith Perera interviewed him at the Russian Nuclear Society meeting in Electrostal in October.

According to the official version, the Chernobyl disaster resulted from a combination of an ill-considered experiment, inherent design flaws in the reactor and operator error. On 25 April 1986, in the run up to a routine shut-down of Chernobyl's reactor 4, a test was to be carried out to determine how long the turbines would spin and supply power following a loss of main electrical power supply.

Power reduction began just after 01.00 and continued until 03.47, when the reactor was at around half power (1600 MWt). At 14.00 the emergency core cooling system was disconnected so that it would not interfere with the experiment. Power reduction was due to resume at this time, but the grid operator refused to permit it because of demands on the electricity supply. Reduction did not resume until 23.10.

By 00.05 on 26 April, power was down to 720 MWt and still falling, although the test was scheduled to take place at a power level of 700-1000 MWt. It was known that below 700 MWt, RBMK reactors could become unstable and prone to power surges due to a positive void coefficient. This means that increased power or reduced coolant flow would increase steam production in the fuel channels. The neutrons that would have been absorbed by the denser water produce increased fission. At higher power, this is countered by a negative fuel coefficient; the higher temperature of the fuel has the effect of reducing the neutron flux.

Sarcophagus over the stricken reactor



However, by 00.28 power was down to 500 MWt. At that point control was transferred from the local to the automatic regulating system. But either the operator failed to give the "hold power at required level" signal or the regulating system failed to respond to this signal, causing a further unexpectedly rapid fall in power to 30 MWt. To push power back up again, control rods were removed, but it had only reached 200 MWt by 01.23.04 when the test was started by closing the turbine feed valves.

The coolant pumps began to coast down with the turbine but as the water flow diminished, power output increased as a result of a positive void coefficient. The generally accepted explanation is that the accident occurred when the operator pressed the emergency scram button to shut down the reactor because a peculiarity of the design caused the power to surge dramatically, rupturing the fuel elements and leading to a steam explosion which lifted off the cover plate of the reactor, releasing fission products to the atmosphere.

Without cooling, the core then began to melt. There followed a second explosion which threw out fragments of burning fuel and graphite from the core and allowed air to rush in, causing the graphite moderator to burst into flames. Some 5000 tonnes of boron, dolomite, sand, clay and lead were dropped on to the burning core by helicopter in an effort to extinguish the blaze and limit the release of radioactivity.

Konstantin Checherov takes issue with this account and says its widespread acceptance is due to inertia. "Everyone is ready to accept this account, even the reactor designers, just to be left in peace." He felt that the 'tidy' linking of all these factors – the experiment, the design 'problems' and operator error – were artificial. "I decided to conduct my own investigation and spoke to many of those who were on duty that night." He also studied all the written evidence. "The picture I came up with was very different," he says.

According to those who were there that night, just 35-36 seconds after the experiment was initiated by disconnecting the turbines, there was a terrible noise. Plaster began falling from the roof and the lights went out. The operators began shouting and asking what was happening. The auxiliary lighting came on after a few seconds and it was only then that the order was issued to stop the reactor. Checherov recalls one operator telling him that he saw the sky and stars through the hole in the roof before he was asked to press the button. "From this it is clear that the accident happened before the reactor was scrammed, and this is supported by much of the written evidence as well as by later investigations. It contradicts the official view that stopping the reactor precipitated the accident."

Checherov was not satisfied and sought a better explanation. He studied analyses made by Mikhail Mikhlayev, Professor of Electrotechnics at the Moscow Institute of Energy, who looked at the electrical parameters recorded by various detectors at the time of the accident. He also discovered that the engines which powered the coolant pumps were protected against both voltage and frequency changes. The engines switched off automatically if the voltage fell below 75% and if the frequency fell from 50 to 45 Hz, the power would be cut.

The detectors showed that just 36 seconds after the experiment began, four out of eight of the coolant pumps stopped within 0.8 seconds due to a voltage drop. This in effect reduced the coolant by half, triggering a rapid increase in core reactivity. This was the cause of the accident, not the emergency scram which came later.

This in turn followed from the experiment which was being conducted and the fact that proper procedures had not been followed in terms of the power level. Checherov says that when the power was reduced to virtually zero, the experiment should have been postponed rather than removing control rods to power it back up. Removal of the rods was crucial; it led to overheating of the coolant and the production of excess steam in the core which led to a catastrophic increase in power when the coolant level fell due to the drop in voltage.

"The reactor itself was not to blame for the accident" says Checherov. "Nor was the control and protection system. It was a loss of coolant accident due to failure of the pumps. However good a reactor is, it will fail if it is deprived of coolant."

He also takes issue with the official version of the accident. He says that from his investigations inside the shelter it is clear that the explosion occurred 60 metres above ground, although still within the building. The overheating of the fuel elements due to coolant loss caused changes in pressure within the reactor which effectively ejected the core into the air where it exploded.

He disputes the description of the explosion as 'thermal'. He insists that it was a nuclear explosion but says it is misleading to draw analogies with a nuclear bomb. Technically it is possible to explode a single nucleus, but no-one produces a bomb with power less than the equivalent of 1000 tons of TNT.

"At Chernobyl many nuclei exploded, but not as many as in a bomb. It was equivalent to only 30-40 tons of TNT but its physical nature was still nuclear." He explains that the characteristics of a nuclear explosion include very high temperatures and pressures, which is precisely what happened at Chernobyl.

"Judging by the debris," he explains, "local pressure was around 2000 to 3000 atmospheres and temperatures reached 6000 to 10 000°C, sending the exploding fuel dust and vapour over vast distances."

This leads to another bone of contention. Checherov, who has personally examined all the rooms inside Unit 4, disputes the official line that most of the fuel is still inside the reactor hall. "We have found less than 10%, perhaps 4-6%," he says. "Inside there was nothing, none of the core, just lots of concrete."

He points out that none of the officials who insist that most of the fuel is still inside have every been to see for themselves.

Checherov believes most of the actions taken after the accident were unnecessary.


The underlying causes of the Chernobyl disaster remains disputed

"Everything was done wrong because neither the cause nor the course of the accident was understood. It would have been better to do nothing, but politically no government could do that." Checherov says there was no need to drop vast amounts of material from the air because the core had gone and there was only residual heat discharge of the remaining 4-10% of fuel. Similarly, there was no need to build the sarcophagus in such a hurry. He is concerned that the official line is not being questioned. "It is very important to understand what really happened so that if something similar occurs in future we would not react in the same way. But unfortunately, the government still does not want to learn from experience."