

New theory rewrites opening moments of Chernobyl disaster

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A picture of the HDR technology of the Sarcophagus in the Chernobyl Zone. Credit: Piotr Andryszczak

A brand-new theory of the opening moments during the Chernobyl disaster, the most severe nuclear accident in history, based on additional analysis is presented for the first time in the journal *Nuclear Technology*, an official journal of the American Nuclear Society.

The new theory suggests the first of the two explosions reported by eyewitnesses was a nuclear and not a steam [explosion](#), as is currently widely thought and is presented by researchers from the Swedish Defence Research Agency, Swedish Meteorological and Hydrological Institute, and Stockholm University.

They hypothesize that the first explosive event was a jet of debris ejected to very high altitudes by a series of [nuclear explosions](#) within the [reactor](#). This was followed, within three seconds, by a steam explosion which ruptured the reactor and sent further debris into the atmosphere at lower altitudes.

The theory is based on new analysis of xenon

isotopes detected by scientists from the V.G. Khlopin Radium Institute in the Leningrad, four days after the accident, at Cherepovets, a city north of Moscow far from the major track of Chernobyl debris. These isotopes were the product of recent nuclear fission, suggesting they could be the result of a recent nuclear explosion. In contrast, the main Chernobyl debris which tracked northwest to Scandinavia contained equilibrium xenon isotopes from the reactor's core.

By assessing the [weather conditions](#) across the region at the time, the authors also established that the fresh xenon isotopes at Cherepovets were the result of debris injected into far higher altitudes than the debris from the reactor rupture which drifted towards Scandinavia.

Observations of the destroyed reactor tank indicated that the first explosion caused temperatures high enough to melt a two-meter thick bottom plate in part of the core. Such damage is consistent with a nuclear explosion. In the rest of the core, the bottom plate was relatively intact, though it had dropped by nearly four meters. This suggests a steam explosion which did not create temperatures high enough to melt the plate but generated sufficient pressure to push it down.

Lead author and retired nuclear physicist from the Swedish Defence Research Agency, Lars-Erik De Geer commented, "We believe that thermal neutron mediated nuclear explosions at the bottom of a number of fuel channels in the reactor caused a jet of [debris](#) to shoot upwards through the refuelling tubes. This jet then rammed the tubes' 350kg plugs, continued through the roof and travelled into the atmosphere to altitudes of 2.5-3km where the weather conditions provided a route to Cherepovets. The steam explosion which ruptured the reactor vessel occurred some 2.7 seconds later."

Seismic measurements and an eye-witness report

of a blue flash above the reactor a few seconds after the first explosion also support the new hypothesis of a nuclear explosion followed by a steam explosion. This new analysis brings insight into the disaster, and may potentially prove useful in preventing future similar incidents from occurring.

More information: Lars-Erik De Geer et al, A Nuclear Jet at Chernobyl Around 21:23:45 UTC on April 25, 1986, *Nuclear Technology* (2017). [DOI: 10.1080/00295450.2017.1384269](https://doi.org/10.1080/00295450.2017.1384269)

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