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## of the long-term evolution of Ar-39 produced in an underground nuclear explosion

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Measurements of gas collected from locations surrounding historic underground nuclear tests have identified that Ar-39 produced during a nuclear explosion can remain in the subsurface decades after the event occurred. As an activation product produced by the interaction of neutrons with geologic potassium, Ar-39 is produced in significant quantities in almost any underground nuclear explosion. With a half-life of 269 years, the primary loss mechanism for Ar-39 over time is dilution in the atmosphere or the geology surrounding the event. In order to better understand how the transport of Ar-39 affects its viability as a long-lived underground nuclear explosion signature, a series of simulations were performed of an initially pressure-driven Ar-39 source with varying depth and geology type surrounding the source. The evolution of both Ar-37 and Ar-39 was modeled over 30 years and the loss to the atmosphere or to dilution in the surroundings was tracked.

### Promotional text

This work discusses further evaluation of the viability of Ar-39 as a potential long-term indicator of underground nuclear explosions as it compares to Ar-37, with simulations demonstrating persistently detectable subsurface Ar-39 concentrations even decades after events.

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