

Estimates of Production Rates of Argon-37 by Underground Nuclear Explosions in Various Geologies

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The radioisotope Argon-37 is produced in underground nuclear explosions (UNE) through the neutron activation of Calcium-40 in rock and soil. A sensitivity study was conducted using Monte Carlo N-Particle Code (MCNP) and SCALE to model the predicted production rate of Argon-37 per kiloton explosive equivalent in various rocks following a UNE. The detonation was modelled in MCNP using a simple geometry to estimate the neutron flux further away from the detonation. This neutron flux from MCNP was the input to SCALE to model the yield and decay of Argon-37 in each rock. The reaction cross section of Calcium-40(n, α)Argon-37 is not well known, so both threshold and 1/v cross sections were modelled. The sensitivity study revealed the importance of characterizing the thermal neutron cross section to improve our understanding of the predicted production rate of Argon-37 from UNEs. It also showed the importance of radioargon as a signature from UNEs since it can be detected up to 700 days after a detonation. An experiment was designed to measure the thermal neutron cross section using alpha spectroscopy at the University of Texas at Austin.

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Promotional text

Accurately estimating the production rate of ^{37}Ar from the thermal neutron activation of ^{40}Ca in geologic media is important for radioactive noble gas monitoring for underground nuclear explosions.

Oral preference format

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