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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 37Ar from the thermal neutron activation of 40Ca in geologic media is important for radioactive noble gas monitoring for underground nuclear explosions.

Oral preference format

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