

## Evaluation of Argon-37 as a means for identifying clandestine subsurface nuclear tests

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The verification of the CTBT (Comprehensive Nuclear-Test-Ban Treaty) relies on analytical tools for the identification and localisation of clandestine nuclear test explosions. Subsurface tests produce radioactive noble gas isotopes that may migrate in soil gases away from the detonation site and to the surface [1]. Measurement of these isotopes in quantities occurring above background levels are therefore strong indicators of a nuclear test.

For on-site inspections (OSIs) under the CTBTO, measurement of the noble gas Argon-37 was considered an important technique, as Ar-37 is a definitive and unambiguous indicator of a nuclear underground explosion. The probability to detect this isotope in air or soil gas samples collected during an OSI depends on many parameters. These include the calcium content of the medium surrounding the device, the characteristics of the neutron flux generated (it is noted that earthquakes do not produce neutrons, hence a natural triggering event produces no Argon-37), the existence of sufficient transport pathways for Argon to the surface and even the occurrence of low barometric pressure events which can enhance soil gas transport [1]. A reliable and definite identification of an UNE depends on a sound understanding of natural production and transport mechanisms of Argon-37 in the subsurface. From theoretical calculations it is known that the natural production rate strongly depends on

the depth below surface [2]. However, only few Argon-37 measurements are available from subsurface soil air. New data at different locations and lithologies are presented. Measured depth profiles of Argon-37 concentrations allow conclusions about the main production channels and transport mechanisms in shallow soils. This preliminary results indicate that natural Argon-37 levels in soil exceed background concentrations found in the atmosphere [3, 4] by several orders of magnitude. The depth stratification of Argon-37 in soils has important implication for the interpretation in terms of the identification of clandestine nuclear explosions. The potential of Argon-37 for remote sensing [3] will also be addressed.

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### References

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