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# of underground nuclear explosion cavity evolution for radioxenon isotopic composition

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Isotopic ratios of radioxenon captured in the atmosphere can be indicators of the occurrence of an underground nuclear explosion. However, atmospheric background from civilian sources of xenon isotopes can interfere with detection of nuclear testing signals according to a standard model of the evolution of radioxenon isotopic abundances in a nuclear explosion cavity. We find that this standard model is idealized by not including the effects of physical processes resulting in the partitioning of the radionuclide inventory between a gas phase and rock melt and by ignoring seepage of gases from the cavity or collapse zone. More realistic assumptions about the state of the detonation cavity produce isotopic activity ratios that differ from the civilian background more than the idealized standard model indicates, while also reducing the quantity of radioxenon available for atmospheric release and subsequent detection. Collapse of the cavity potentially has the greatest effect on partitioning of the refractory fission products that are precursors to radioxenon. The model allows for the possibility that post-detonation seismicity can be used to predict isotopic evolution.

## Promotional text

An often-used model for predicting the radioxenon composition of released gases actually yields a bound on isotopic compositions because it is based on an idealized cavity model. Improved predictions of suspect UNE signals may be realized using detailed cavity evolution models.

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