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Understanding a Key Nuclear Explosion Signature through the Noble Gas Migration Experiment BRIAN MILBRATH, Pacific Northwest National Laboratory — Radionuclide detections are often considered to be the key "proof" that a nuclear explosion has occurred. Chemically inert noble gases are the radionuclides most likely to escape from an underground nuclear explosion. As part of a multidisciplinary study noble gases, and stable tracer gases were injected into a historical nuclear explosion test chimney in July of 2016. The radioactive gases were Ar-37 and Xe-127, and the stables gases were SF6, C8F8. Subsequent sampling from the cavity/chimney complex, several deep (˜160 meter) segmented bore holes and near surface sampling points have given quantitative results with respect to subsurface plume migration and evolving concentrations over a period of one year due to atmospheric barometric changes. It took several months before the radioactive gases were detected at the surface. Analysis of the datasets obtained thus far have revealed that the stable and radioactive gases migrate through the subsurface at different rates and the radioactive gases appear to migrate at the same speed. Sampling measurements also showed significant quantities of Ar-39 still remained from the initial nuclear explosion and that it was a strong interference for Ar-37 measurements.

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