ID: Type: **Oral**

detection of Ar-39 above UNEs decades later as a signature

Tuesday, 25 June 2019 17:30 (15 minutes)

During the conduct of the Underground Nuclear Explosion Signatures Experiment (UNESE), which involved the injection of Ar-37 into UNE chimneys at the Nevada National Security Site, we detected the unanticipated presence of Ar-39 in gas samples taken from the shallow (0 – few m deep) subsurface. This long-lived UNE observable was present in all of our measurements in the vicinity of UNE sites, spanning different geologies, vertical- and horizontal-emplacement scenarios, and yields less than 20 kt. This implies that the detectability of UNEs by radionuclides at the surface is likely much longer than previously thought. The detections of Ar-39 and Ar-37 rely on low-background, internal-source proportional counters built at Pacific Northwest National Laboratory. We discuss the measurements, natural backgrounds, and implications.

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Session Classification: T2.4 Atmospheric and Subsurface Radionuclide Background and Dispersion

Track Classification: Theme 2. Events and Nuclear Test Sites