



## Development of a Radioxenon Forensics Laboratory

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### Abstract:

A radioxenon forensics laboratory is under development in an effort to detect and measure quantities of radioactive xenon and other noble gases. Noble gases measurements are one method of detecting releases of radiation from nuclear power plants, radiopharmaceutical facilities, and nuclear explosions. Of particular interest are the four major radioxenon isotopes. Investigating the four radioxenon isotopes is best done by having a method of creating the gas on site. The samples are to be made using a Starfire nGen-800 neutron generator capable of producing neutrons of an energy of about 2.5 MeV per neutron. Reaction chambers can be built around the generator head to collimate and moderate neutrons.

The gas samples will be collected and controlled using a gas manifold setup. This setup includes a vacuum pump, multiple ports for both taking in gas samples and purging the system with noble gases, and an isolation cell in which the radioactive sample can be counted. Memory effects in the system are reduced using a pumping and filling system with noble gases to remove remaining radioactive gases between measurements. The detection system will consist of a Mirion Technologies PIPSbox silicon semiconductor for beta counting, as well as two NaI(tl) scintillation detectors and an HPGe semiconductor detector for photons. The counting system allows for differentiation of the four major radioxenon isotopes using beta-gamma spectroscopy.