Verifying the Comprehensive Nuclear-Test-Ban Treaty by radioxenon monitoring

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The chemical inertness of noble gases allows them to escape from an underground nuclear explosion more easily than isotopes produced in solid form. Most fission gases decay within seconds, but a few (^{133}Xe, ^{135}Xe, ^{133m}Xe and ^{131m}Xe) have half-lives long enough to allow detection at large distances. Radioxenon analysis has therefore been included in the verification regime for the Comprehensive Nuclear Test-Ban Treaty (CTBT). This verification system will provide worldwide monitoring for evidence of nuclear explosions and includes 321 monitoring stations of which 40 will be used for radioxenon monitoring. An overview of the verification system will be presented and the political and scientific challenges in this context will be briefly discussed. The establishment of the verification system for CTBT has prompted the development of a new generation of fully automatic radioxenon sampling and analysis systems in a few countries, and several systems have been installed in the verification system in the framework of the International Noble Gas Experiment (INGE). One of the systems participating is the Swedish Automatic Unit for Noble gas Acquisition (SAUNA). Principles and scientific challenges in using sampling and analysis of radioxenon as a verification tool are discussed using SAUNA as an example.

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