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## All-Optical Atom Trap Trace Analysis –Potential Use of $^{85}\text{Kr}$ in Safeguards Activities

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Sensitive measurement techniques for the detection of anthropogenic tracers demand measurement resolutions down to single atoms, as it has been demonstrated by the first atom trap trace analysis experiments. However, technical limitations had lowered the sample throughput to about 200 per year per machine. We have developed an all-optical apparatus which allows higher sample throughput and small sample sizes at the same time.

Krypton-85 as anthropogenic isotope is an ideal tracer for nuclear activities since the only relevant source term is fission. An increased  $^{85}\text{Kr}$  concentration in an air sample indicates, that a plume was passing by during sampling. In practice, however, its applicability may be limited by the global and regional background concentrations caused by the emissions of nuclear fuel reprocessing plants.

The potential of  $^{85}\text{Kr}$  monitoring for safeguards applications has been discussed extensively. Among these is the short range detection of elevated concentrations of  $^{85}\text{Kr}$  in the vicinity of reprocessing plants. Our ATTA technique needs sample sizes of about 1 L of air only and thus for the first time will allow simple environmental sampling of  $^{85}\text{Kr}$  with high spatial and temporal resolution. The design of such a study including local sampling and tracer transport modeling in proximity to a reprocessing plants is outlined. In addition, such a study could be used also for validating near-field atmospheric dispersion models if the  $^{85}\text{Kr}$  source term is known. The potential of environmental analyses of  $^{85}\text{Kr}$  during an IAEA short-notice access is discussed. It is shown that it crucially depends on the emission dynamics after shut-down of fuel dissolution which needs further study.

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