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²³⁵U enrichment determination on UF₆ cylinders with CZT detectors

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		ACCEPTED MANUSCRIPT
1		235 U enrichment determination on UF ₆ cylinders with CZT detectors
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3 4	The	e European Commission, Joint Research Centre, EC JRC Directorate for Nuclear Safety and Security, TP 181, Via Fermi, Ispra, Italy
5		
6	Key	/words:
7 8		mma spectrometry, Nuclear Safeguards, cadmium Zinc Telluride, Semi-conductors ectors, 235 U enrichment, UF ₆ , Non-destructive assay methods
9		Abstract
10		
11 12 13 14 15 16 17 18 19	safe the keV are coo (Na 30E	asurements of uranium enrichment in UF_6 transit cylinders are an important nuclear eguards verification task, which is performed using a non-destructive assay method, traditional enrichment meter, which involves measuring the count rate of the 186 gamma ray. This provides a direct measure of the ²³⁵ U enrichment. Measurements typically performed using either high-resolution detectors (Germanium) with e- ling and battery operation, or portable devices equipped with low resolution detectors I). Despite good results being achieved when measuring Low Enriched Uranium in 8 type cylinders and natural uranium in 48Y type containers using both detector tems, there are situations, which preclude the use of one or both of these systems.
20 21 22 23	cur inst	e focus of this work is to address some of the recognized limitations in relation to the rent use of the above detector systems by considering the feasibility of an inspection trument for 235 U enrichment measurements on UF ₆ cylinders using the compact and it Cadmium Zinc Telluride (CZT) detectors.
24 25 26	full	the present work, test measurements were carried out, under field conditions and on -size objects, with different CZT detectors, in particular for situations where existing tems cannot be used e.g. for stacks of 48Y type containers with depleted uranium.
27 28 29 30	μCZ OR	e main result of this study shows that the CZT detectors, actually a cluster of four CT1500 micro spectrometers provide as good results as the germanium detector in th TEC Micro-trans SPEC HPGe Portable spectrometer, and most importantly in particula natural and depleted uranium in 48Y cylinders.
31		
32	1.1	Introduction
33 34 25	Saf	asurements of uranium enrichment in UF_6 cylinders are a significant Nuclear eguards task. They are routinely carried out by a non-destructive assay method using traditional enrichment meter principle, which is based on the prepartionality between

- the traditional enrichment meter principle, which is based on the proportionality between the net peak area of the 185.7 keV line of ²³⁵U, and the enrichment in case of infinitively
- 37 thick samples [1].
- 38 Both high-resolution and low resolution detectors are currently used routinely by nuclear
- 39 inspectors for this purpose. Inspection instruments include the ORTEC Micro-trans SPEC
- 40 HPGe Portable spectrometer [2] equipped with a germanium detector of 50 mm
- diameter and 40 mm length, and the hand-held monitor system HM-5 equipped with a
 NaI detector of 1 inch diameter * 1 inch thickness [3].

¹ Retired

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