ITRAP – INTERNATIONAL LABORATORY AND FIELD TEST SITE EXERCISE FOR RADIATION DETECTION INSTRUMENTS AND MONITORING SYSTEMS AT BORDER CROSSINGS

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Introduction

Illicit trafficking in nuclear materials has become more and more a problem, due to the circulation of a high number of radioactive sources and the big amount of nuclear material. The IAEA database counts at present more than 300 verified cases. The endangering cased thereby ranges from possible health defect for the publication to terrorists activities and production of nuclear weapons. In addition to the primary criminal reasons the illegal deposal of radioactive sources as salvage, scrap and others show a further problem, which has lead to severe accidents and lethal effects in the past (e.g. Goiana, Mexico). Some countries have already under taken countermeasures (e.g. Monitoring at the Finnish-Russian and German-Polish border, border monitoring in Italy).

The International Atomic Energy Agency (IAEA) has reacted on this actual problem by setting up a new program to fight against nuclear criminality and has suggested a pilot study for the practical test of border monitoring systems. Co-ordinated by the Federal Ministry of Economy and Labour the Austrian Government financed the pilot study ITRAP (Illicit Trafficking Radiation Detection Assessment Program) carried out by the Austrian Research Centers Seibersdorf (ARCS). Aim of the study was to work out the technical requirements and the practicability of an useful monitoring system at border crossings. The results of the study will be offered by the IAEA to the member states as international recommendations for border monitoring systems.

Radiation Monitoring

Radiation monitoring systems for contaminated scrap metals have been successfully applied in steel plants and scrap yards since several years. Using sophisticated software and dynamic scanning techniques such systems allow to detect a 10% increase in radiation level, even if the natural background is substantially suppressed by the vehicle entering the monitor.
However, measurement conditions at borders are essentially different from that in plants. Large traffic limits the time for detection to a few seconds and multiple checks are impractical. Shielded radioactive sources - even of high activity – which are deeply buried in scrap, can not be detected without unloading the vehicle, which is generally ruled out at borders. Highly sensitive monitoring systems cause frequent false alarms or nuisance alarms due to innocent radioactive materials such as NORM or medical radioisotopes administered to

patients. In support of the IAEA program to combat illicit trafficking and to derive practical performance requirements for border monitoring instrumentation a large pilot study (ITRAP) have been conducted in co-operation between the Austrian Government, the IAEA and the Austrian Research Centre Seibersdorf (ARCS), with participation of 23 manufacturers from 9 countries.

The ITRAP Study

The ITRAP study was carried out from September 1997 to September 2000. After a pre-selection of equipment and comprehensive lab tests at the Austrian Research Centers Seibersdorf the selected systems were installed at the border site Nickelsdorf and at the Vienna Airport for a duration of one year. First results of the study were given at the IAEA Conference On the Safety of Radiation Sources and the Security of Radioactive Materials, Dijon France, in September 1998 [1].

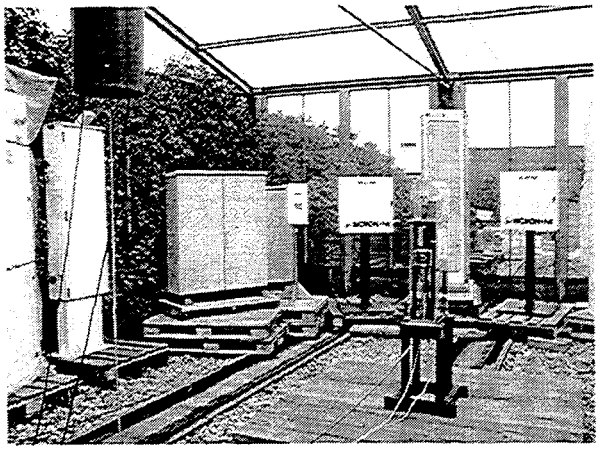

Fig. 1: *View of several monitoring systems at the ITRAP lab test facility and the gamma test source*

A major task of the ITRAP laboratory tests has been to determine sensitivity (false negatives) and false alarm rate (false positives) of commercially available equipment. See the number of tests in Tab.1. As agreed with the manufacturers the minimum test requirements for gamma sensitivity were defined as a radiation signal (dose rate) at the reference position of the detectors of 0.1 μSv/h for a duration of 1 second. For neutron detection the required sensitivity is a flux density of 20,000 n/s of weapon Pu. These radiation levels have to be detected with a failure rate (false negatives) of less than 10^{-3} (1 in 1,000 exposures) and a false alarm rate of less than 10^{-4} (1 in 10,000 passages). About 50 % of the participating instruments passed the ITRAP lab tests after a six month improvement phase concerning neutron detection [2].

Tab. 1: Number of ITRAP lab tests:

	Tests	Number of Tests
Fix-installed monitoring systems	gamma sources: ^{241}Am, ^{137}Cs, ^{60}Co	50.000
	modified neutron source Cf-252	51.000
	false alarm tests	86.000
SUMME		***187.000***
Pocket sized and hand held instruments	gamma sources: ^{241}Am, ^{137}Cs, ^{60}Co	10.000
	modified neutron source Cf-252	10.000
	false alarm tests	20.000
SUMME		***40.000***

The tests at the field test sites showed, that the border monitoring of nuclear and other radioactive material, is possible with acceptable expense, according the worked out minimum requirements for such systems [2]. Each system was online remote linked with the Austrian Research Centers Seibersdorf and could therefore be permanently checked. Border guards have been acquaint with the instruments by recurrent, appropriate training. The permanent call-stand-by of the Austrian Research Centers Seibersdorf assured that even in unforeseen cases sufficient expert support was available. In addition to the practical tests of the instruments by the users the workout of a standardised course of the inspection procedure was an important result.

Acknowledgements

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References

P. Beck, K.E. Duftschmidt, *ITRAP – The illicit trafficking radiation assessment program,* Proc. IAEA Conf. On the Safety of Radiation Sources and the Security of Radioactive Materials, Dijon France, Sept. 1998, IAEA TECDOC-1045, 265 (1998).

P. Beck, ITRAP, Illicit Trafficking Radiation Detection Assessment Program, Final Report, OEFZS-G -- 0005, Oktober 2000.