Radiation Protection Measures during the Investigation of Po-210 Traces in Hamburg in December 2006.

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Introduction

In late 2006, Alexander Litvinenko died as a result of a poisoning with a highly-radiotoxic alpha-emitter, polonium-210 (Po-210), which allegedly occurred at a meeting in London. Media reports at the time linked Dimitri Kovtun to this meeting and to the German city of Hamburg. An investigation was started by Hamburg Police into Kovtun's movements during a visit to Hamburg in the week directly before the alleged poisoning. As the presence or magnitude of the radiation hazard in Hamburg was unclear, the Hamburg Police called on the unit responsible for the defence against nuclear hazards at the Federal level in Germany, known from the German abbreviation as the ZUB. The ZUB is a collaboration between the Federal Office for Radiation Protection (BfS), the Federal Police (BPol) and the Federal Criminal Police Office (BKA) [1].

FIG 1. Map of Germany showing the 16 Bundesländer. The city of Hamburg (a Bundesland) is marked. North of Hamburg is the Bundesland of Schleswig-Holstein, where sites were also investigated

Radiation protection

The deployment followed a concept with a 1 mSv combined direct and incorporated maximum radiation dose for both the workers and the general public, even though the radiation protection workers at BfS are allowed to receive a yearly routine radiation dose of up to 20 mSv. This is in accordance with the ALARA principle of minimising the radiation exposure.

Measurements

BfS was responsible for the measurement of Po-210 at the sites visited by Kovtun, the radiological evaluation of the measurements and the radiation protection recommendations. Following a measurement for airborne contamination at the sites involved, both field and laboratory techniques were used to monitor the Po-210 contamination.

FIG 2. A BfS measurement expert at work at one of the sites investigated. Note that the clothing is appropriate for preserving traditional forensic evidence at the scene - there was no airborne contamination present

Table 1. Three examples of measurements taken at the scene using a hand-held alpha detector and then confirmed as Po-210 in the laboratory using a grid ionisation chamber and radiochemistry techniques.

Sample	Sample size (cm^2)	Po-210 (grid ionisation chamber, Bq/cm^2)	Po-210 (Radiochemistry, Bq/cm^2)	Hand-held α-detector (cps)
Sofa	180	0.23 ± 0.06	-	0.6
Car head-rest	130	3.1 ± 0.7	4.4 ± 1.1	9
Car neck-rest	200	1.5 ± 0.4	2.1 ± 0.7	0.78

In addition to the type of measurements shown in Table 1, gamma spectroscopy was used in order to rule out a significant presence of Pb-210. This confirmed the Po-210 as coming from a **reactor-produced** source rather than a source separated from uranium-238 daughter products.

Table 2. 59 urine samples were collected from 53 people.

Group tested	24h-activity (mBq/d)	Dose (mSv)
Toddler (urine from nappy)	106.0 / 156.0	0.84 / 1.25
Family of ex-wife	20.0 ± 4.8	0.03 ± 0.02
Special unit forces	4.4 ± 3.8	0.005 ± 0.004

As shown in Table 2, the highest radiation dose was received by the toddler. In all cases the BfS deemed that no further medical measures were necessary and that the people involved could be informed over the local authorities. Stochastic risks were discussed according to the dose.

Conclusion

The deployment of the ZUB in Hamburg from 8th to 22nd December 2006 was successful and at no time were any members of the emergency services or the public at risk from the health effects of radiation [2]. The traces of Po-210 found by BfS were of little radiological consequence and the radiation protection measures taken by BfS reflected this fact. However, neither the radiation protection measures taken by the emergency workers nor the reaction of the general public and press reflected the actual level of danger all of the time.

Summary and Outlook

The high scientific standards of the BfS were necessary in order to characterise and evaluate the low activities of Po-210 found during the deployment in Hamburg. The evaluation of the measurements enabled the BfS to offer effective radiation protection advice and to assist the police investigation. The majority of the Po-210 traces were found in places that had been in skin contact with Kovtun, leading to the conclusion that Kovtun had most probably incorporated Po-210 or become contaminated with Po-210 *before* his visit to Hamburg in October 2006. As yet, no formal charges have been brought by the German authorities against Kovtun and the costs of the operation remain under discussion.

REFERENCES

[1] IAEA International Conference on Illicit Nuclear Trafficking: Collective Experience and the Way Forward, Edinburgh, U.K., November 2007, Conference contribution, Eisheh, J.-T. (Federal Office for Radiation Protection).

[2] Polonium 210: The public health response, HPA, London 27th March 2007, Conference contribution, Hoffmann, M. (Federal Office for Radiation Protection),