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Federal Department of Defence,
Civil Protection and Sport DDPS

Swiss Armed Forces
Training Command - Engineer/Rescue/NBC Training Unit

Factsheet, 01.07.2021

RLL radiometry system

Radiometry is a reconnaissance technique that remotely detects radioactivity and estimates its concentrations. Radiometry is thus used to map potentially contaminated areas or to search for possible radioactive sources. The sensitivity of the equipment also allows for the mapping of natural radioactivity in the environment. Such detection capabilities can be deployed in case of accidents in a nuclear power plant, of transport, industrial accidents or malicious acts involving radioactive materials, or of crash of a satellite with nuclear propulsion.

1. Introduction

The NBC OED Centre of competence operates various radiometry systems (RLL) on different complementary and interconnected platforms for the protection of the armed forces and their infrastructure. While the primary purpose of these systems is to protect the troops, subsidiary operations for competent authorities and partner organizations are possible and planned. For this purpose, the NBC OED Centre of competence's resources are part of the national measurement and sampling organization (MO).
If necessary, the professional personnel of the NBC OED Centre of competence will deploy for the initial intervention. However, since their number and endurance are limited, the mobilization of specialists of the NBC defence troops may necessary to assist or relieve the professional specialists.

2. Detection equipment

The detection system allows not only a quantitative analysis of the radioactivity present (intensity) but also, as a rule, an identification of the source (nuclides). Specialists can thus classify radiation sources according to their probable origin: for example natural or industrial sources, or medical products. The sensitivity of the detectors depends on their size: the heaviest detectors (around 100 kg) are installed in helicopters and the lightest ones (less than 2 kg) are reserved for use on foot.

The range of platforms and detectors available allows specialists to adapt to the situation by choosing the best compromise between measurement sensitivity, detection efficiency, mobility and responder protection.

2.1. Radiometry helicopter

Aerial radiometry uses a helicopter and allows wide-ranging measurements of ground radioactivity over large areas. Three hours are usually enough to cover about 100 km².

Within a few hours, highly sensitive radiometry equipment is installed on board a Super Puma of the Swiss Air Force. In order to map the region as thoroughly as possible, the helicopter flies over the target area at an altitude of about 90 metres along parallel lines, usually 250 metres apart.

Figure 1 Super Puma of the Swiss Air Force

2.2 Radiometry vehicle

In urban areas or on traffic routes, radiometry vehicles allow efficient detection of radioactivity as close as possible to critical infrastructures as well as to living and working areas. These vehicles remain efficient even at normal traffic speeds.

The radiometry vehicles are especially equipped for this mission and are permanently ready to be deployed. In order to map an agglomeration as thoroughly as possible, the crew covers as many roads as possible and, if necessary, repeats the measurement in the opposite direction for the widest traffic routes.

The omnidirectional orientation of the detectors allows for the precise location of radioactive sources. The pressurization of the cabin and the filtration of the air ensure the protection of the crew when within a contaminated area.

Figure 2 Operator's workplace

Figure 3 Radiometry vehicle

2.3 Pedestrian or robotic radiometry

When the use of helicopters or vehicles is no longer possible, or for more detailed measurements, the reconnaissance can be carried out on foot or with the help of a robot. Even though the areas and distances covered are smaller, this allows for a more precise localization. The use of a robot also reduces the exposure of specialists and the risks involved.
For this purpose, specialists can carry portable devices in a backpack, by hand or can mount them on the robot.

Figure 4 Reconnaissance robot equipped with a portable radiometry device

3. Results analysis

For all platforms, the measurements last up to one second and are repeated continuously. The specialists have access to the values in real time as maps and graphs. An initial automatic evaluation enables them to react in the event of an alarm or doubt. They can for example decide to make a new pass or perform additional measurements to confirm a possible identification or to clarify a location. Under certain conditions, the measurement results are transmitted in real time to the operation center at the NBC EOD Centre of competence in Spiez. When several systems are used in parallel, the centralization and merging of all data allows for a rapid representation and evaluation of the situation and creates favorable conditions for the management of a radiological incident and the exchange of information between the various civilian and military partners.
The recording of the measurements also allows for a thorough analysis of the results afterwards. The data are made available to the competent authorities and civilian partners. The results of the measurement campaigns are thus integrated into the environment monitoring program and published regularly.

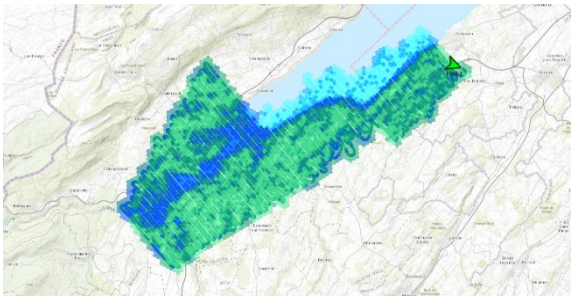

Figure 5 Example of maps produced during an aerial radiometry campaign

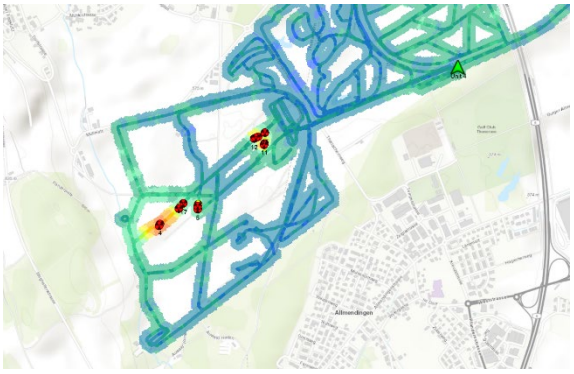

Figure 6 Radioactive source localization exercise with a radiometry vehicle

4. Measurement campaigns

In order to maintain the operational readiness of the equipment and crews, measurement campaigns and exercises are organized and performed regularly.
The two teams operating the aerial radiometry systems consist of specialists of the NBC OED Centre of competence of the Swiss Armed Forces and of the National Emergency Operations Centre (NEOC), as well as their respective militia-based military units. The members of both teams train separately once a year for a two-week measurement campaign and for different intervention scenarios and then share their experiences in joint workshops and training modules. The flight plans are coordinated annually in order to obtain a complete overview of the radiological situation throughout the country.
In parallel, the NBC OED Centre of competence also conducts terrestrial radiometric measurement campaigns.

5. Abbreviations

NBC	Relating to risks and dangers of nuclear, biological or chemical origin
EOD	Explosive Ordnance Disposal
RLL	Radiometry Air Ground (from German *Radiometrie Luft Land*)
NEOC	National Emergency Operations Centre
MO	Measurement and sampling organization (from German *Messorganisation*)

6. For further information:

NBC OED Centre of competence
https://www.vtg.admin.ch/fr/organisation/kdo-ausb/genie-sauvetage/komp-zen-abc-kamir.html

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