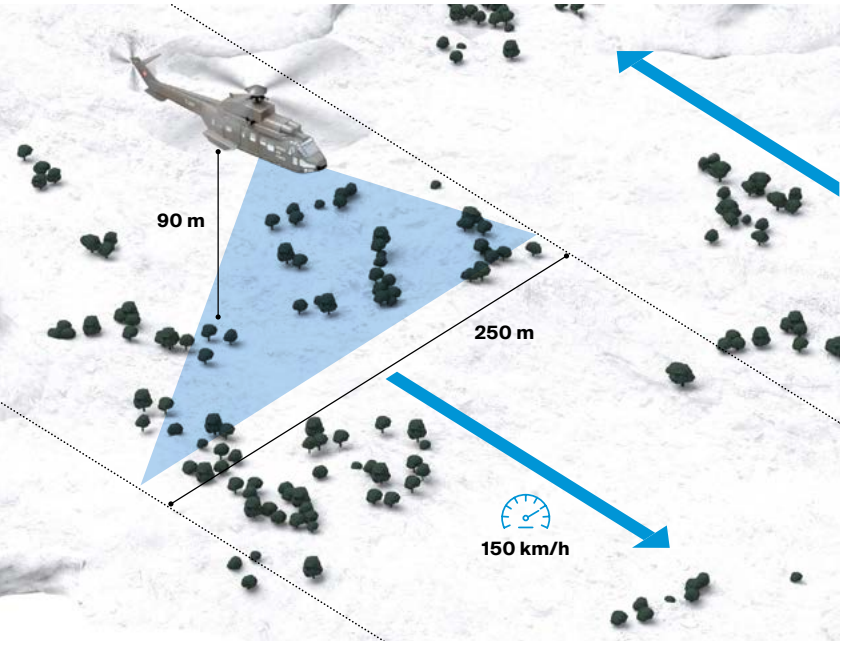
Factsheet
Bern, May 2025

Aeroradiometry

Measurement of radioactivity from the air

Aeroradiometry is a way of detecting radioactivity from the air. The method allows for thorough and seamless ground-level radioactivity readings. Around 100 km² can be measured within three hours.

In readiness for such a deployment, members of the air force can install the highly sensitive equipment used to measure radioactive radiation in an Armed Forces Super Puma helicopter within just a few hours. To create a seamless radioactivity map, the helicopter usually flies at a height of around 90 metres above the ground in parallel paths 250 metres apart. The readings are recorded at one second intervals.



The helicopter 'scans' the area to be surveyed in parallel paths from a height of around 90 metres at a speed of 150 km/h (standard parameters). The data are recorded by a computer in the helicopter and displayed graphically. After the flight, the measurement data is analysed in detail.

The aeroradiometry measurement method is used to map radioactivity that is naturally present on the ground or due to contamination. It also an efficient means of searching for radioactive sources. Cases where such measurements need to be taken are incidents in nuclear power plants, transport and industrial accidents involving radioactive material, satellite crashes and thefts of radioactive material. The sensor technology used not only measures the actual dose rate (intensity), but also enables statements to be made about the type and possible origin of the radioactivity with a nuclide-specific evaluation.

Annual flight week

Every summer, the National Emergency Operations Centre NEOC carries out aeroradiometric measurement flights over a one-week period. These annual measurement campaigns ensure the operational readiness of equipment and personnel, collect radioactivity data in urban areas and in the vicinity of critical infrastructure, practise cooperation with cantonal and international partners and carry out radiological surveys in the vicinity of nuclear facilities. The data obtained is used to verify control measurements taken elsewhere and as reference values that can be used to recognise deviations more easily in the event of a nuclear incident.

Measurement programme in urban areas

In recent years, radiological surveys have been conducted in all major cities in Switzerland, including St. Gallen (2020), Lugano (2021), Zurich (2022) and Rapperswil-Jona (2023). These data serve as reference values in order to identify deviations more quickly in the event of an incident.

Schweizerische Eidgenossenschaft
Confédération suisse
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Federal Department of Defence, Civil Protection and Sport DDPS
Federal Office for Civil Protection FOCP
National Emergency Operations Centre NEOC

Exercises with partners

Operational exercises are used to practise cooperation between the various emergency services, compare measurement results and exchange experiences. On the one hand, the focus is on joint exercises with the soil-based measuring equipment of the sampling and measuring organisation. There is close cooperation with foreign aeroradiometry teams so that the various systems can be used together in the event of an incident.

Monitoring areas in the vicinity of Swiss nuclear facilities

On behalf of the Swiss Federal Nuclear Safety Inspectorate, emergency protection zone 1 (radius 5 km) surrounding the Swiss nuclear facilities (Gösgen, Leibstadt, Beznau, Mühleberg, Paul Scherrer Institute, Würenlingen interim storage facility) is surveyed every two years. A medium-term goal is to survey the wider vicinity of the nuclear power plants beyond the emergency protection zones at a lower resolution in order to have reference values available if necessary.

Transversal flights

Transversal flights do not survey areas with preprogrammed flight lines, but follow a connecting line, usually a transport axis. The ARM operators determine the flight route and individual target points on the fly. The pilots carry out the flight manually according to these specifications. Transversal flights that have already been carried out include the following stretches of railway Bern-Zurich (2006), St. Gallen-Herisau-Rapperswil-Glarus-Chur-Maloja (2014), Bern-Kandersteg (2018), Lake Constance-Lake Geneva (2010) and Schaffhausen-Chiasso (2001).

Further measurements

Further measurements are carried out on behalf of partners from the science community and the administration, such as the Federal Office of Public Health or the Paul Scherrer Institute.

Analysing the measurement results

The measurements are processed in the helicopter within a second and displayed as automatically generated maps and graphics. This enables the operators to carry out a quick initial assessment and allows them to react quickly in the event of anomalies. For example, a point can be flown over again or additional measurements can be taken on the ground. After the flight, the measurement data that have been collected are analysed and products such as finalised measurement maps are produced. A detailed scientific evaluation of the measurement data is carried out after the campaign at the Paul Scherrer Institute, which draws up a scientific report within a year.

Background information

Switzerland has several networks that continuously monitor radioactivity, which automatically monitor various measured variables. This includes the NADAM network for automatic dose rate alerting and measurement. This comprises 76 stations throughout Switzerland, where the ambient dose rate is measured and transmitted to the NEOC as 10-minute mean values. In the event of a radiological/nuclear incident, the NEOC can supplement these automatic networks with additional measuring equipment from the sampling and measuring organisation (measuring teams, mobile probes). Aeroradiometry is used to obtain an overall picture of the radiological situation in a short space of time and to identify radiologically hazardous areas and use that information as a basis to plan and prioritise the measurement strategy on the ground.

Aeroradiometry was integrated into the sampling and measurement organisation in 1994. Since then, activities have been carried out under the guidance of the NEOC. The Super Puma was chosen as the platform because it has sufficient power reserves to maintain a constant distance from the ground even in hilly terrain. In addition, it can carry a heavy sensor so that measurements can

also be taken from the minimum altitude permitted in Switzerland of around 90 metres. The ADR system is installed in a Super Puma by the Air Force in Dübendorf or Payerne and takes about 4 hours.

The Super Puma has a range of approx. 800 km and can remain airborn for more than three hours without refuelling. For aeroradiometry, this makes it possible to survey an area of up to 100 km² without landing, regardless of the topography, with a flight line distance of 250m and air speed of 150 km/h. This corresponds to four times the area of Lake Walen.

The ADR flights are carried out by specialists from either the NEOC (civilian) or the NDC EOD Centre of Excellence (military), supported by militia members of the NEOC Federal Council staff or the NBC defence troops. In both cases, Air Force pilots and technicians are also deployed. Each year, these organisations practise running measurement flights and deployment scenarios during a dedicated flight week. They share their experiences in joint workshops and training blocks.

Helicopter type:

- Super Puma AS 322 M1 (Swiss Air Force)
- approx. 4500 kg unladen weight

Measuring device:

- 16 Liter sodium iodine crystal detectors (NaI(Tl) detectors) with additional Geiger-Mueller-counter
- 340 kg total weight
- Field of application: Estimation of the ambient gamma dose rate, nuclide-specific radiological mapping, source search

Crew/Operation:

- 2 pilots
- 2 operators
- 1 flight technician/loadmaster

Optimum measurement altitude and speed:

- 90 m (300 ft.)
- 150 km/h

Mission duration/scanned area without refuelling:

- 3 hrs
- 100 km² (with flight line distance of 250 m)

88.126.e 05.2025