

Emergency preparedness for nuclear accidents and radiological incidents: a German perspective

Gerald Kirchner, Michael Hoffmann, Erich Wirth

Federal Office for Radiation Protection, Germany

Topical Day, Brussels, 10 May 2007



This presentation

Presentation of the German

system for nuclear accident emergency preparedness (IMIS)
system for radiological incident preparedness

Emphasis will be on our intention to use synergism in both
fields of emergency preparedness

to use all available know how

to save human and financial resources

Topical Day, Brussels, 10 May 2007



Nuclear accident and radiological incident preparedness have basically similar objectives:

- to estimate the source term,
- to measure the contamination of the environment,
- to estimate the (potential) dose to man,
- to recommend the (radiological) optimum response strategy to involved authorities.

Topical Day, Brussels, 10 May 2007

The German Nuclear Emergency Preparedness System IMIS (Integrated Measurement and Information System)

Designed for the evaluation of accidental releases of radioactivity from nuclear facilities into the environment.

Goal: to support decision makers and the public with all relevant information to evaluate the radiological situation.

About 80 different clients are integrated in IMIS (ministries, authorities, laboratories).

Topical Day, Brussels, 10 May 2007

IMIS consists of several tools:

- Automatic networks to measure external dose rates and radionuclide concentrations in air
- Mobile equipment for nuclide-specific measurements
- About 60 laboratories to perform radionuclide-specific analyses in environmental samples in food und feed

Topical Day, Brussels, 10 May 2007



- Two Decision Support Models (PARK and RODOS) for the estimation of environmental contamination and the dose to man in the near- and far field of an emitter
- A data centre to compile and analyse the data and to prepare documents for decision makers and the public
- An electronic system for rapid and reliable transmission of data and information

Topical Day, Brussels, 10 May 2007



Radionuclide Monitoring Systems available within IMIS for nuclear emergencies

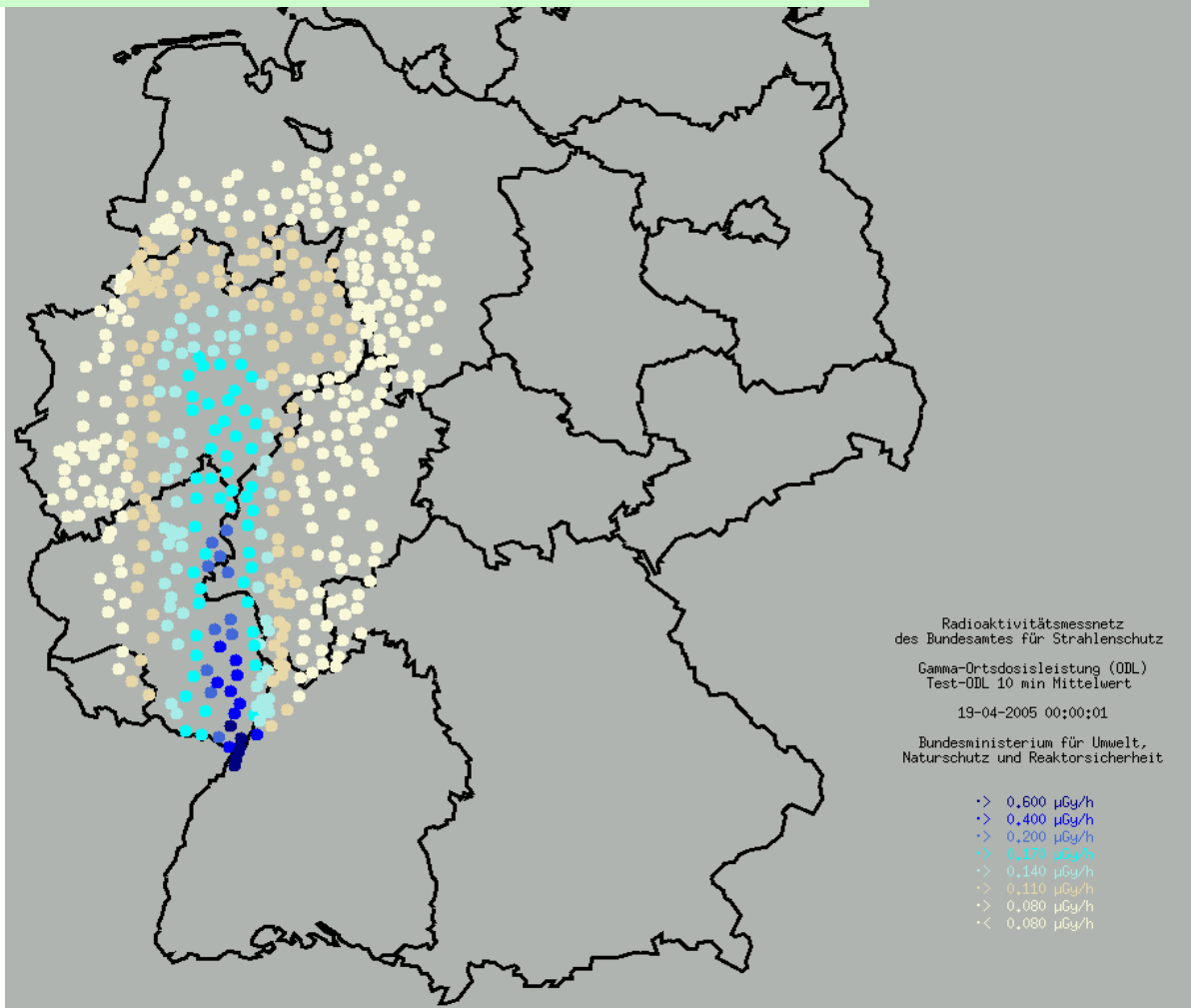
- Dose rate monitoring network
 - ca. 2000 probes, full-time operating
 - data transmission every 10 minutes

- Monitoring of atmospheric concentrations
 - α , β , radioiodine
 - 12 stations

Topical Day, Brussels, 10 May 2007



Exercise - Test



Topical Day, Brussels, 10 May 2007

• Vehicles

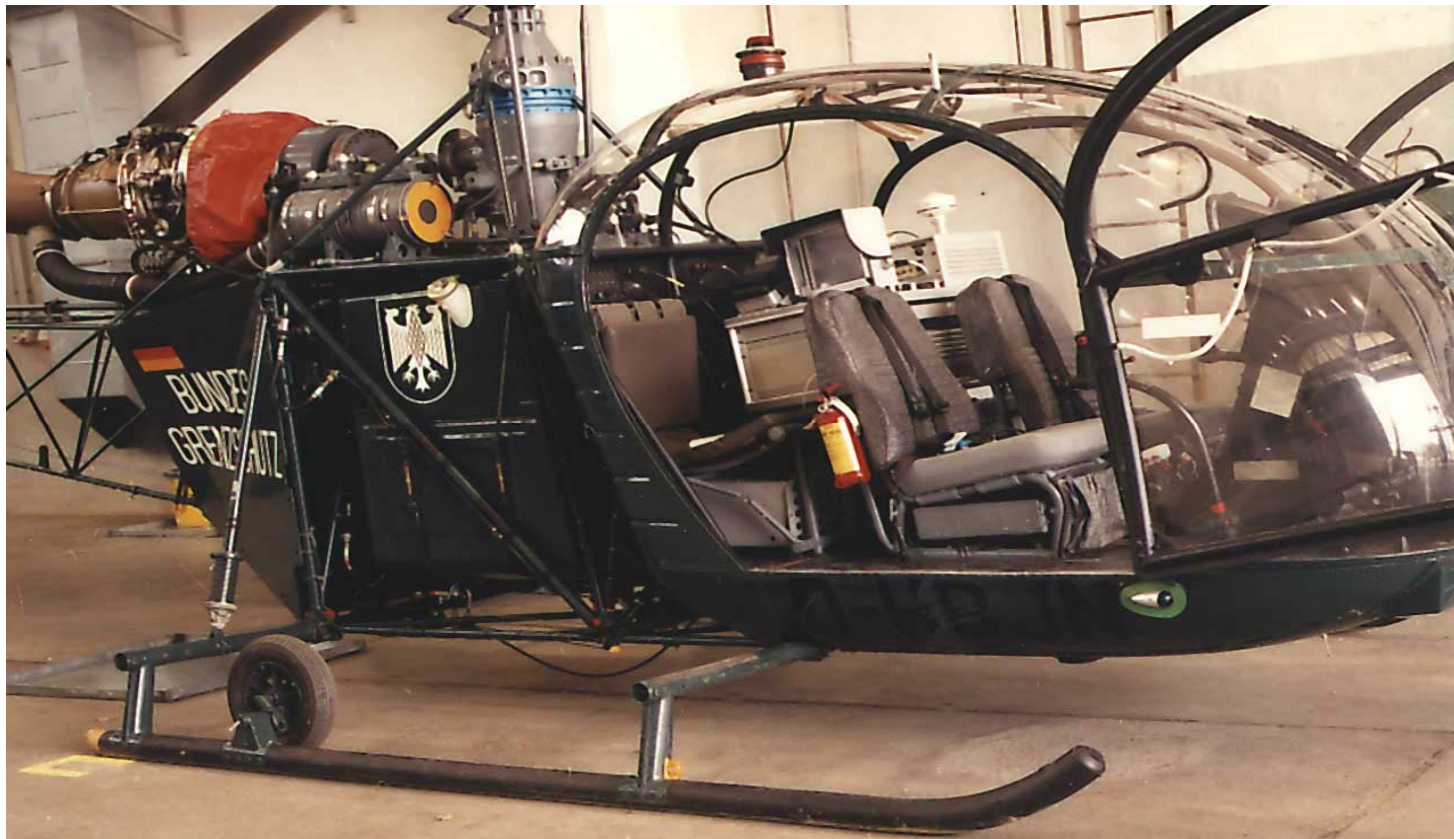
- external dose rate meters
- in-situ γ spectroscopy
- data transmission to data centre.



Topical Day, Brussels, 10 May 2007

- Helicopters

5 helicopters from the German Federal Police
Type Alouette II or EC135

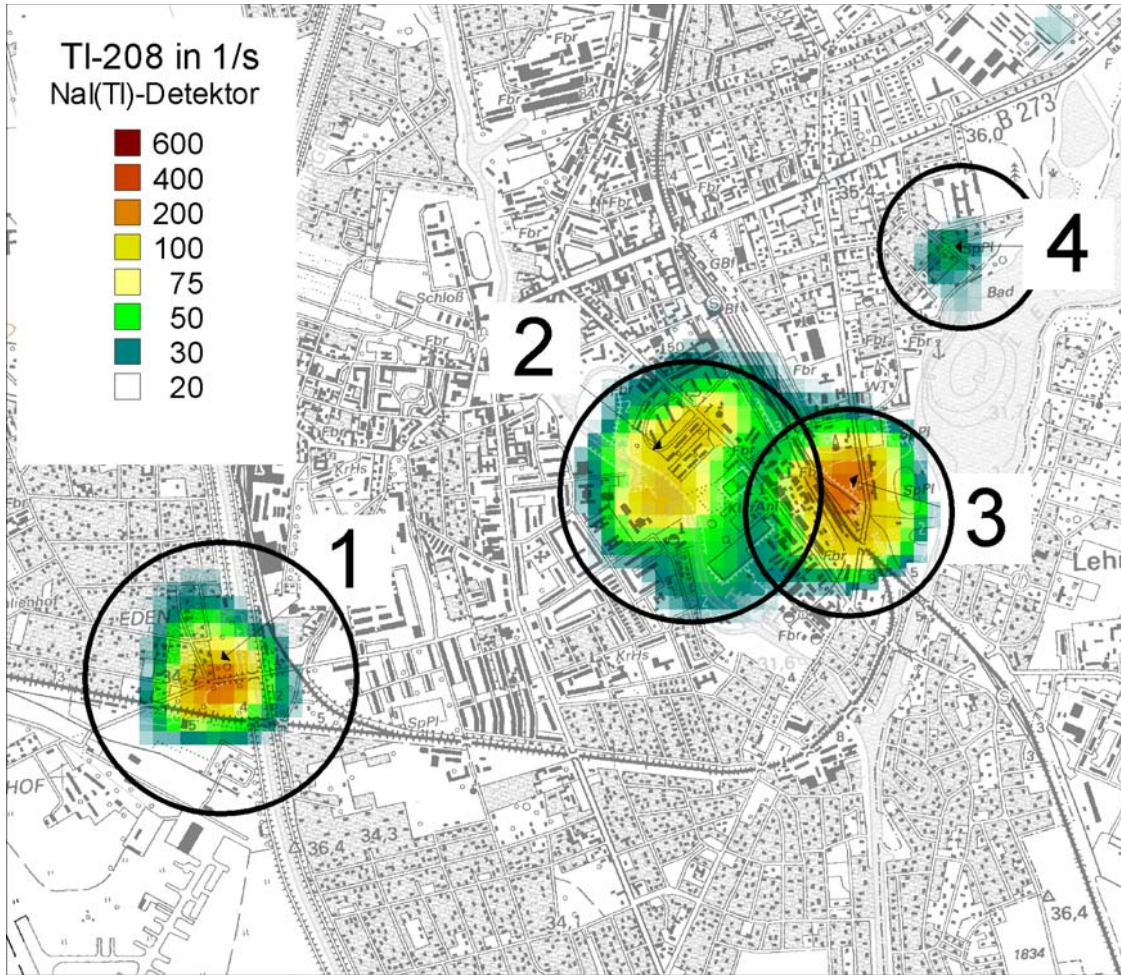


Topical Day, Brussels, 10 May 2007

Basic equipment of the helicopter

- NaI-spectrometer for high spatial resolution of the radionuclide distribution on ground
- high purity Ge-detector (relative efficiency of 50 %) to identify individual radionuclides
- Direct data transfer to a data centre
- Installation of the complete system by two persons within 30 minutes

Topical Day, Brussels, 10 May 2007



Helicopter measurement results:
 Contamination by Tl-208 in Oranienburg, Germany, originating from chemical extraction of thorium

Detection limit:
 4000 Bq/m² for Cs-137
 Flight altitude: 100 m
 40 km² covered in 1 hour

Topical Day, Brussels, 10 May 2007

Current Status of IMIS

- operating since > 10 years
- major software re-design finished 2006
- training by exercises – national and international
- data exchange with many other European countries

Topical Day, Brussels, 10 May 2007



Radiological incidents: Role of the BfS

BfS (Office for Radiation protection) is involved on the demand of the affected Federal State or if a severe misuse of radionuclides might be expected.

BfS has four major tasks:

- to support police task force members in radiation protection issues,
- to detect hidden sources,
- to estimate the radionuclide composition and the total activity of a source,
- to estimate the affected area and the dose to man in the case of a RDD threat.

Topical Day, Brussels, 10 May 2007

Challenges

Characteristics of potential attacks involving a RDD

- early warning time: unknown
- location: may be unknown
needs verification at least
- source: unknown
- release: close to the surface
by explosion
in urban environment

Topical Day, Brussels, 10 May 2007

Characteristics of a radiological incident in comparison to an event in a nuclear facility

- the contaminated area is relatively small
- the gradient of radionuclide concentration within the affected area will be pronounced.

Consequence:

- detailed contamination maps are needed for emergency management.

Requirements:

- mobile measuring systems: measuring vehicles and helicopters – available for emergency and terrorist events

Topical Day, Brussels, 10 May 2007

In case of radiological incidents

- Dose rate monitoring network
- Atmospheric monitoring stations
- Vehicles
- Helicopters

- Other specific measurement equipment

Topical Day, Brussels, 10 May 2007



Choice of the detection system depends on

- the actual situation
- the available time
- the information to be achieved
- the experience of the staff

Topical Day, Brussels, 10 May 2007



Decision Support System in case of RDD threats:

LASAIR (Lagrangian Simulation of Dispersion and Inhalation of Radionuclides) provides results on

- atmospheric dispersion
- ground contamination levels
- inhalation dose to man

Topical Day, Brussels, 10 May 2007



Simulation technique of an instantaneous release of radioactive material by LASAIR:

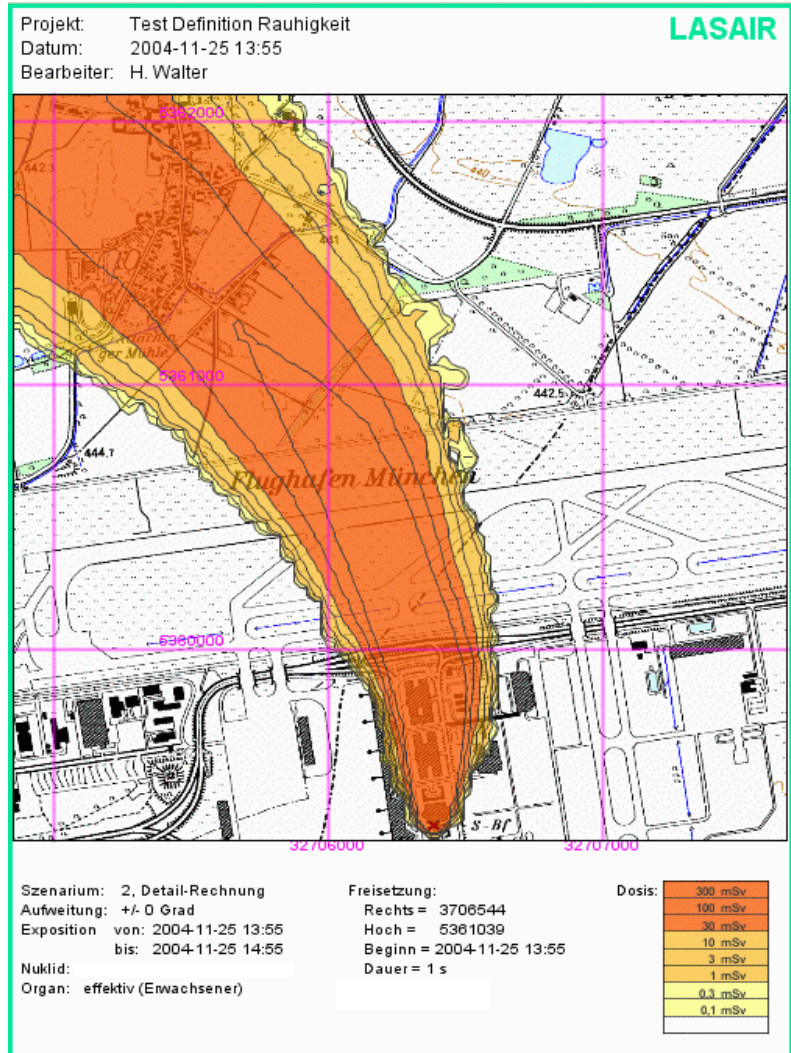
- Initial cloud dispersion simulated by a statistical method, based on statistical evaluation of explosion experiments using video equipment.
- After this initial dispersion phase, LASAIR operates with a Lagrangian Simulation Model which uses basic meteorological dispersion parameters such as wind speed, wind direction and stability class.

Topical Day, Brussels, 10 May 2007

LASAIR Results:

Simulation of an explosion of a dirty bomb at Munich Airport

Topical Day, Brussels, 10 May 2007



Use of IMIS tools for data management after a radiological incident:

- to use IMIS for data transmission
- to use standard presentation in easy understandable form
- to prepare maps and tables

Use of IMIS decision support systems after a radiological incident (PARK and RODOS):

- to predict the evolution of the environmental contamination with time
- to estimate the actual and future doses to man
- to simulate different decontamination strategies

Topical Day, Brussels, 10 May 2007

Countermeasures

- A compilation of countermeasure is available in IMIS with focus on agricultural ecosystems
- EU research is underway to compile experience for urban countermeasures

Topical Day, Brussels, 10 May 2007



Lessons learned from the Hamburg polonium incident

- high number of motivated and trained staff needed
 - 24 h per day
 - several weeks
- measurement strategy has to be flexible
 - large areas
 - high time pressure

Topical Day, Brussels, 10 May 2007

- of prime importance is information given to
 - security forces involved
 - media / the public
- low radiological, but high forensic importance
- limited capacity for analyses of incorporated Po-210

Topical Day, Brussels, 10 May 2007



International Co-operation

- well established for nuclear accident emergency preparedness
- highly appreciated for radiological incidents
 - exchange on experience and strategies
 - analytical procedures for incorporation analyses
 - rapid exchange of information in case of incidents
 - international exercises

Topical Day, Brussels, 10 May 2007

