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**Emergency and post accidental management:  
Lessons learned from the European project  
EURANOS**

4<sup>th</sup> EURADOS Winter School

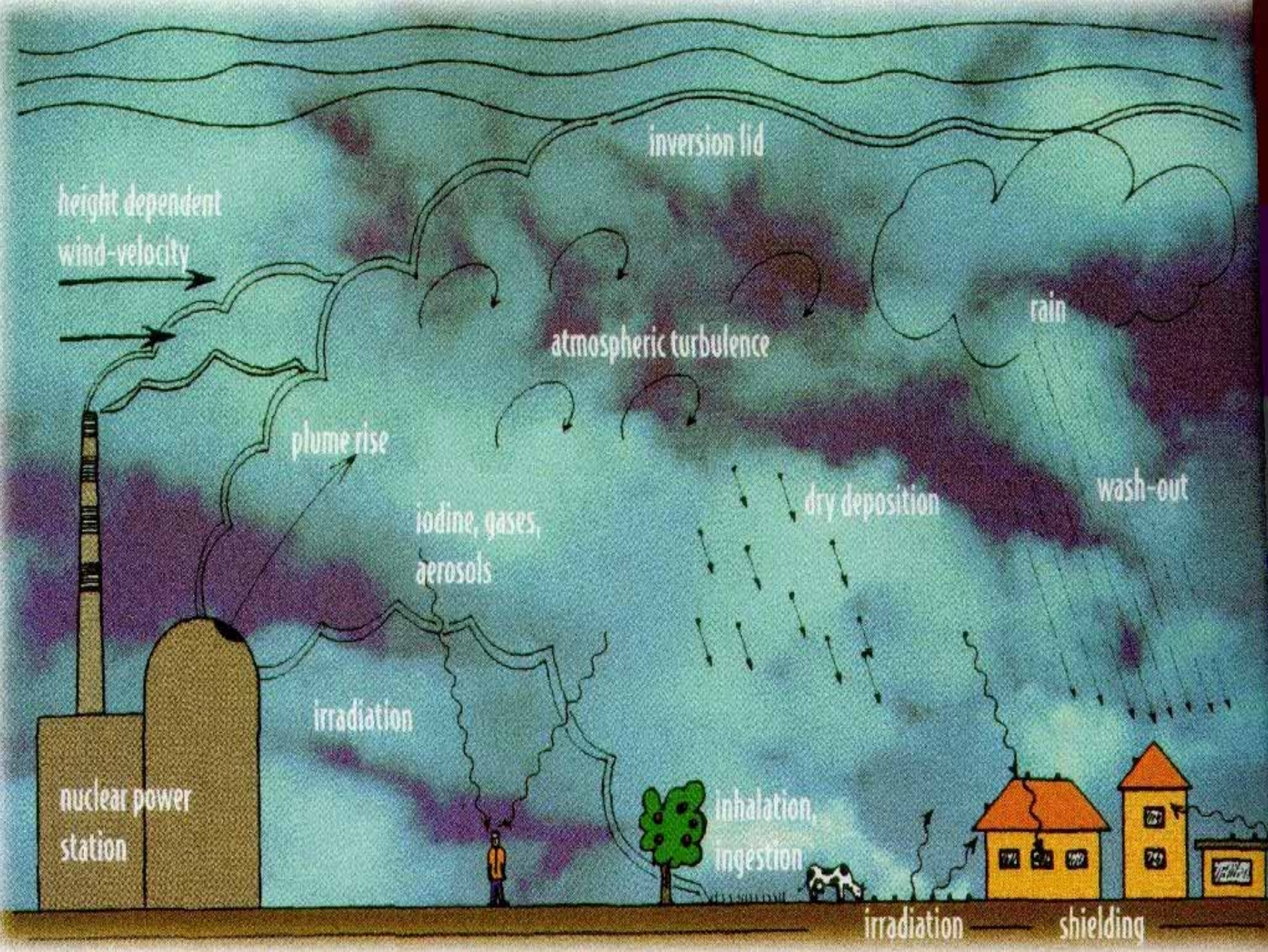
**Radiological emergencies – Internal exposures**

Rome, 3 February 2010

# Outline

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- Introduction
- Main functions of a decision support system such as RODOS (Real-time On-line Decision Support system)
- What can a DSS deliver to the decision making team
- Improvement of emergency management and rehabilitation in the last five years (EURANOS project)
- How to continue



height dependent  
wind-velocity

inversion lid

atmospheric turbulence

rain

plume rise

iodine, gases,  
aerosols

dry deposition

wash-out

irradiation

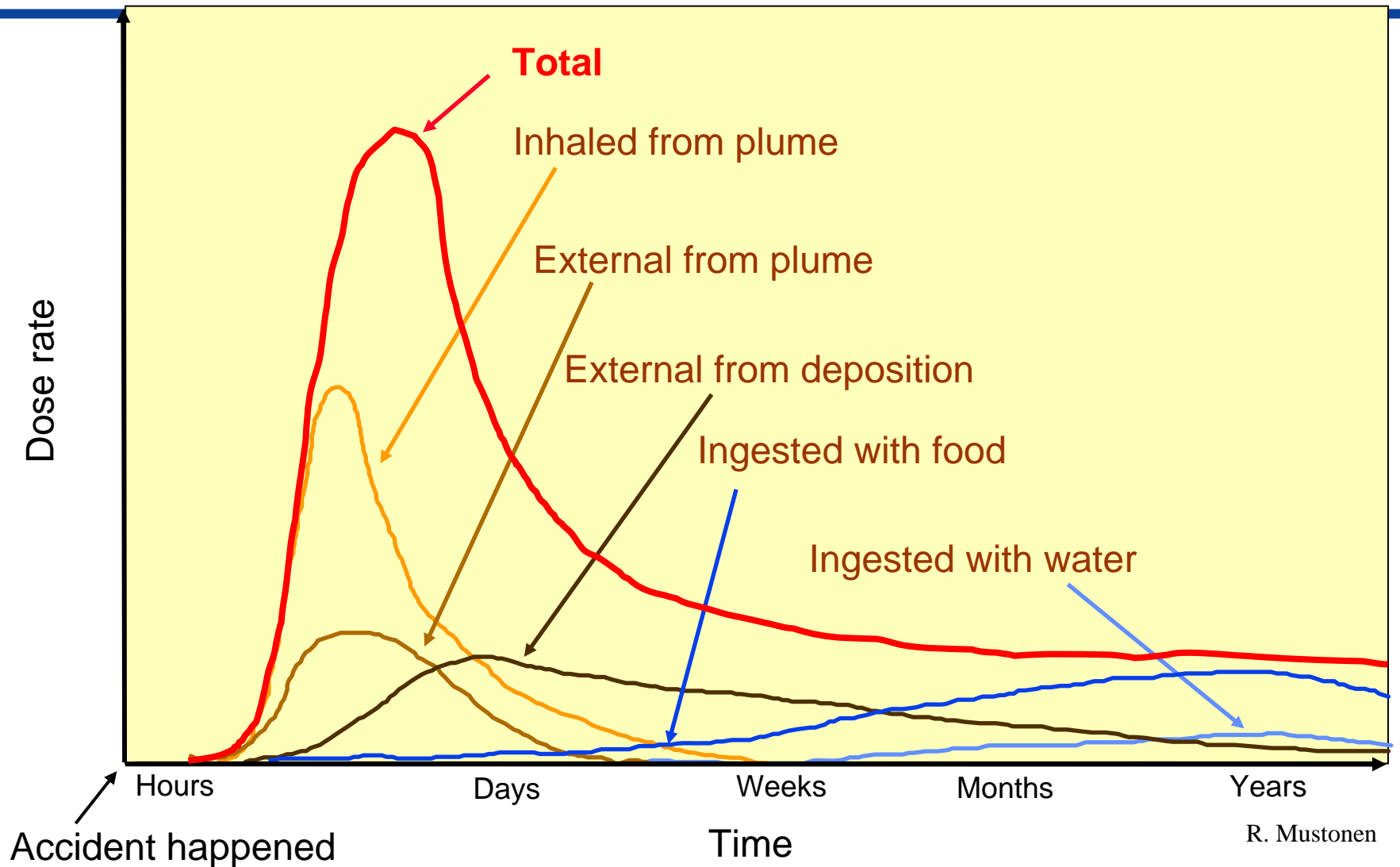
nuclear power  
station

Inhalation,  
ingestion

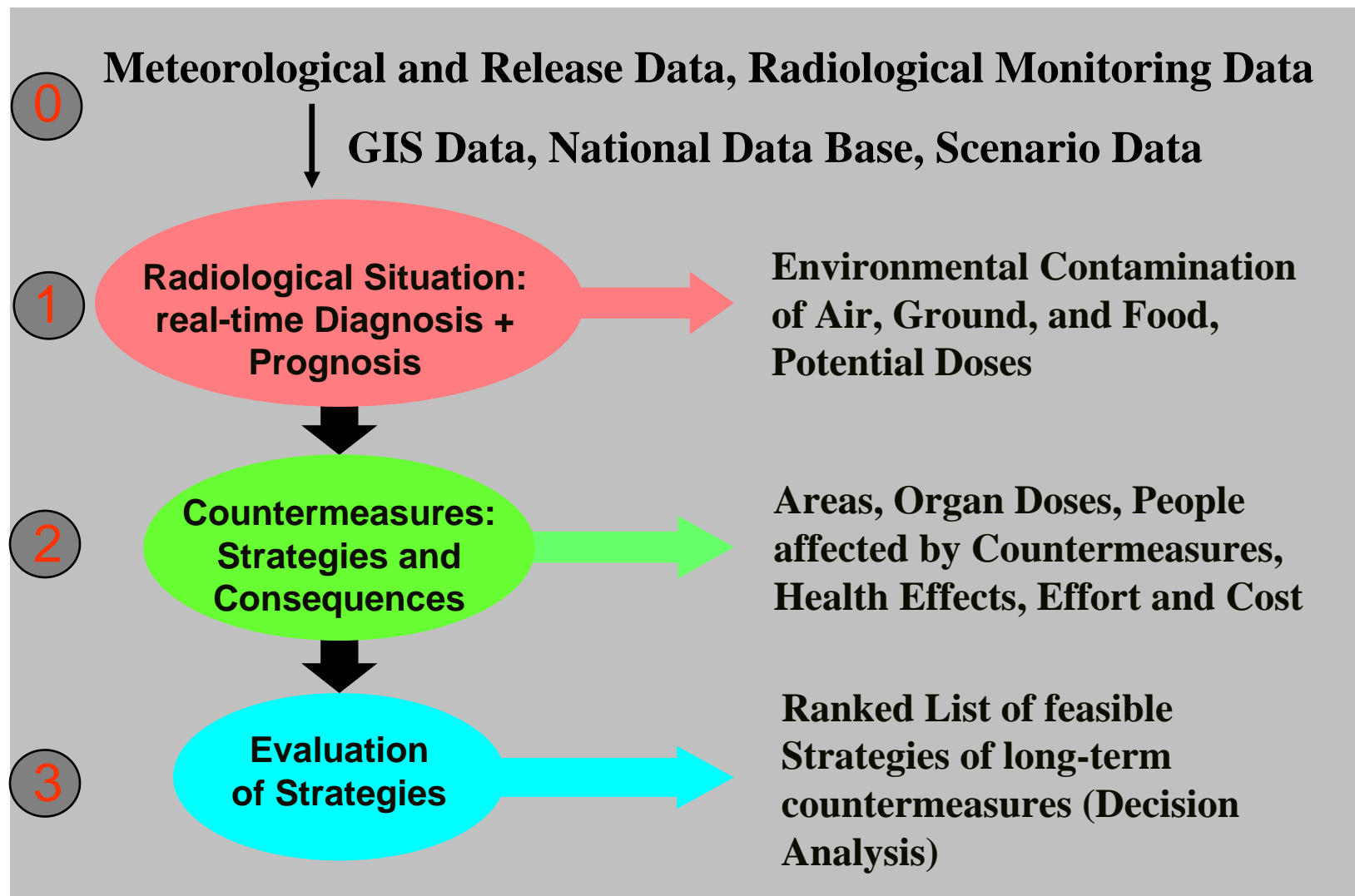
irradiation

shielding

# Exposure during and after a nuclear accident



# Information processing in RODOS



# Information available in the pre-release phase

- Reception of the alert
- Status of the NPP and the potential evolution of the accident (uncertain, partly unknown and not fully understood), including a first estimation of a source term (source term might be uncertain: amount and timing)
- General information
  - On-site meteorological data and radiological data
  - On request prognostic meteorological data
  - Pre-planning
  - Availability of teams
- **Early phase countermeasures are most effective when implemented early before the release**



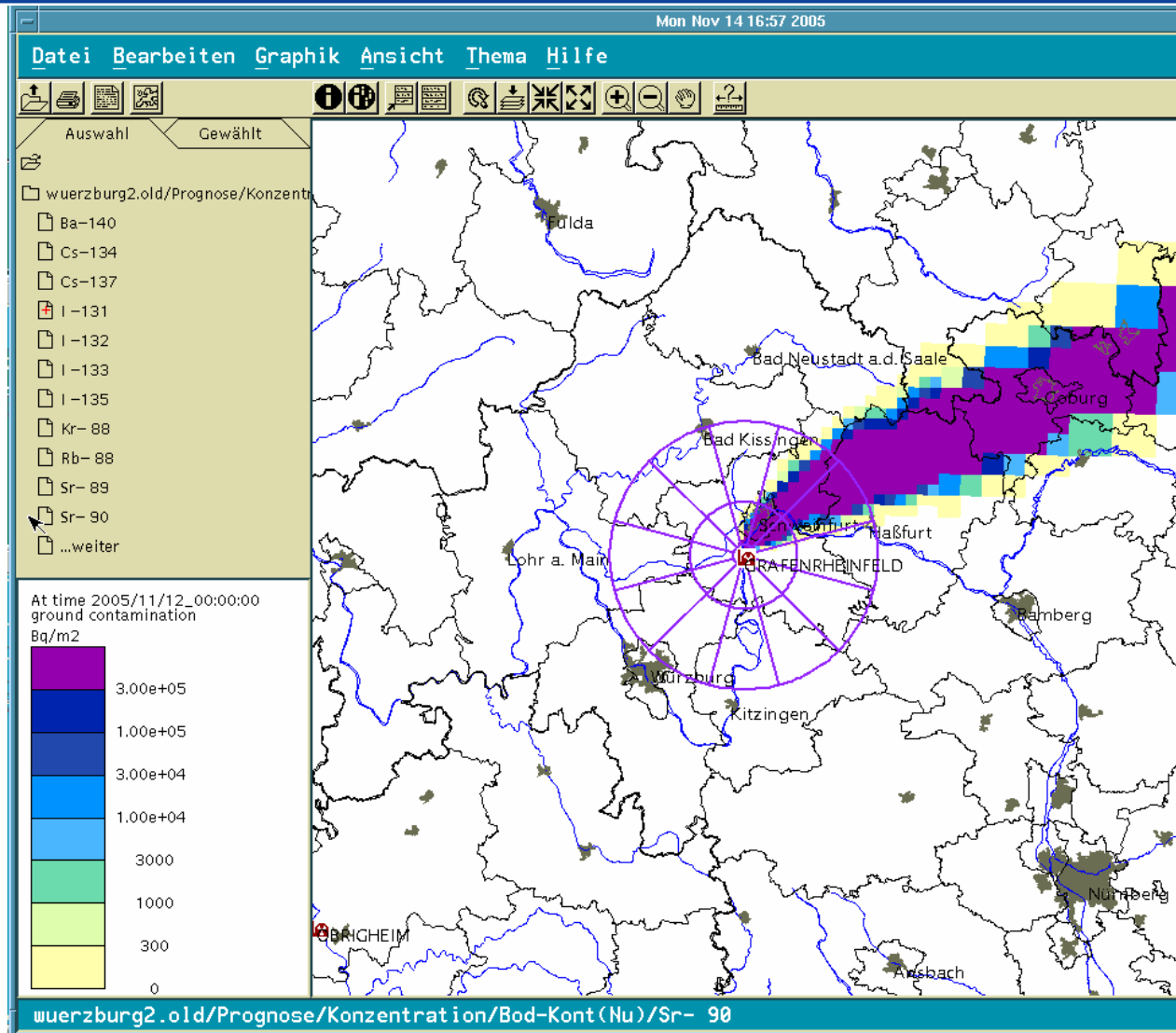
## Information available in the release phase

- Status of NPP and the potential evolution of the accident, including an estimation of the source term (monitored via stack (**best**), monitored by external instruments close to the building (**some help**) no monitors (**very uncertain**), not appropriate or defect monitors (**disaster**))
- Radiological monitoring
- On-site meteorological data and prognostic weather data
- Prognostic information is requested on
  - Activity concentrations, doses and potential areas to initiate early countermeasures in the vicinity (~100 km) of the accident location
- **Early phase and early late phase (e.g. food) countermeasures have to be considered**

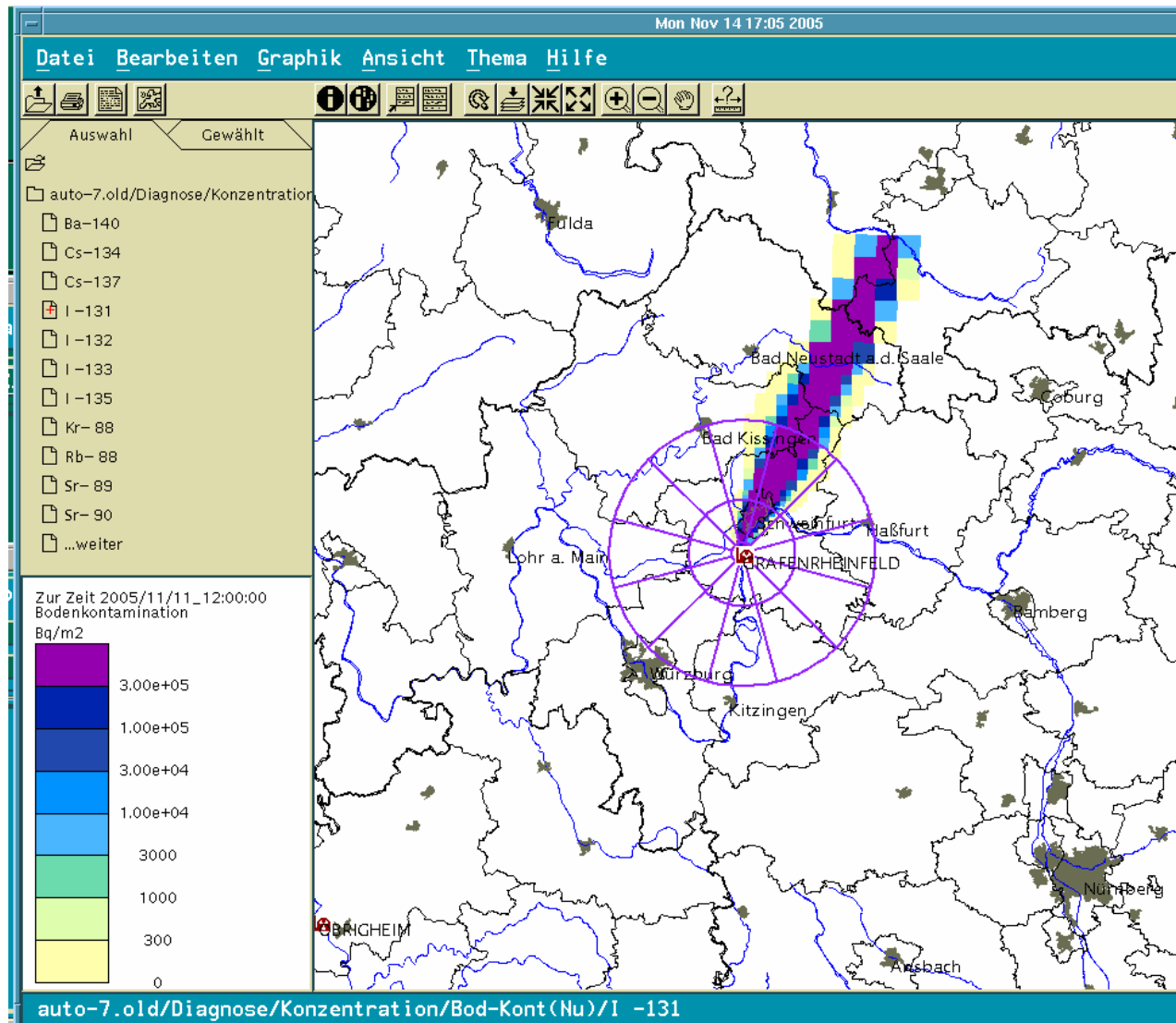
# Support provided by a DSS in the release phase

- As for the pre-release phase
  - Data collection, simulation of activity concentrations and countermeasures (early)
- Two different sets of information are available:
  - Measured and predicted data
- Important to bring both together!
  - Measurements only represent situation at one time at one particular location
  - But required are quantities representative for a longer time period and area
- Data assimilation can combine both monitoring and modelling

# Test calculations: Prognosis



# Test calculations: Diagnosis (locally measured meteorology)

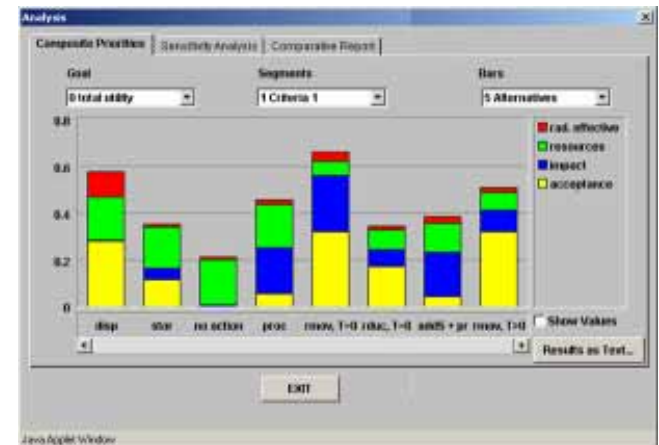
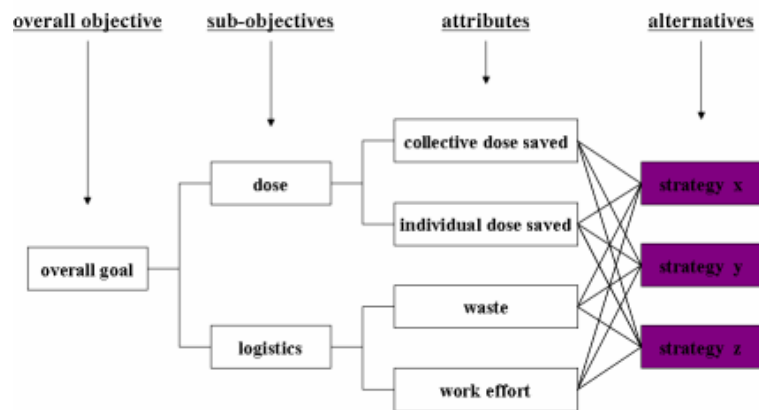


# Information available in the post-release phase

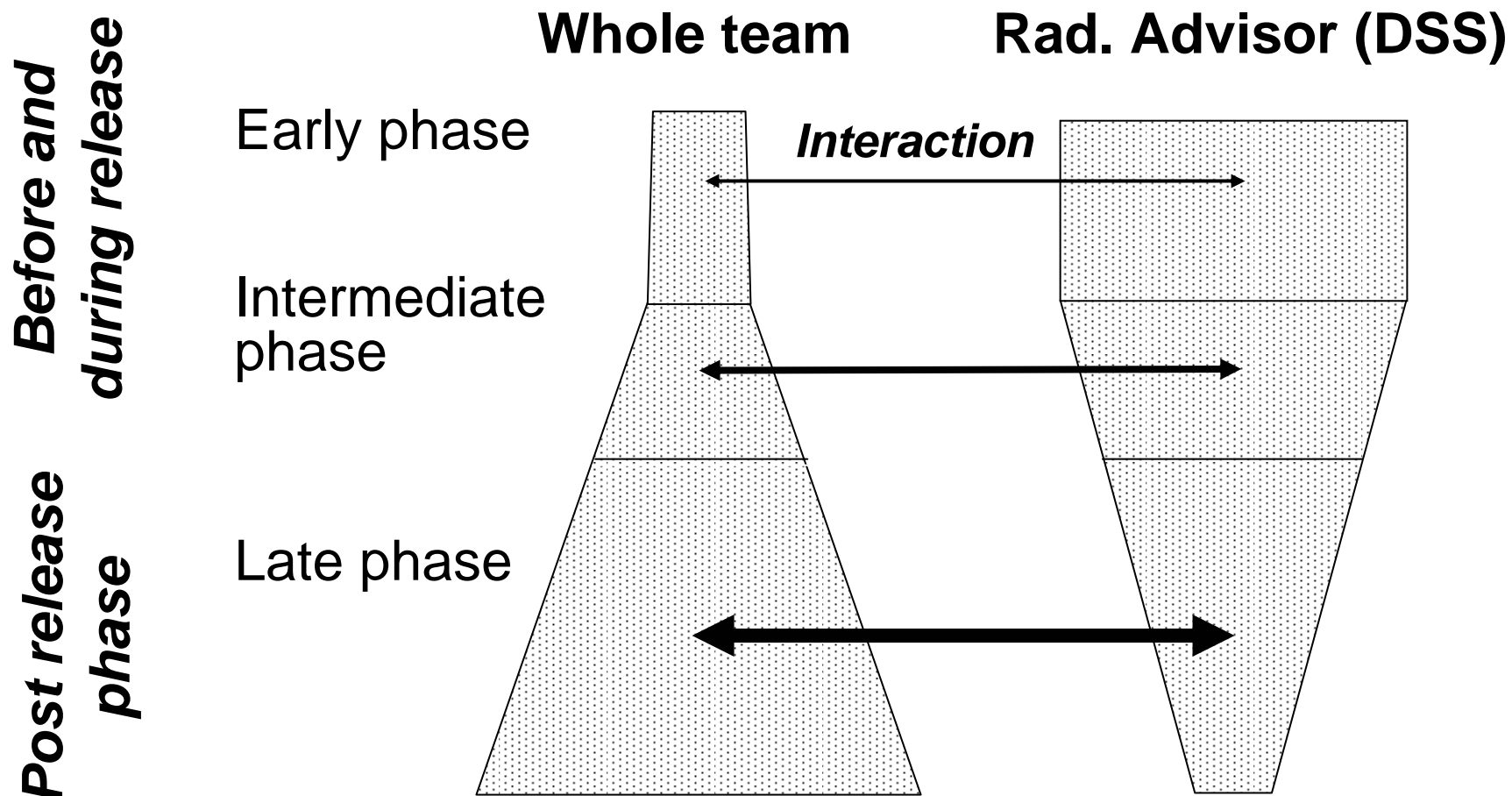
- Status of the NPP (release has stopped)
- Radiological monitoring (radiological situation is stable)
  - Nuclide vector
  - Identify hot spots
  - Footprint of the cloud
  - Doses to the population/rescue teams
- Prognostic information is still needed
  - Time evolution of the activity concentrations, doses and potential areas to initiate late phase countermeasures (relocation, decontamination, food banning) wherever necessary

# Support provided by a DSS

- As for the other phase
  - Data collection, simulation of activity concentrations and countermeasures (early and late)
- Support monitoring (e.g. in inhabited areas)
- Data assimilation (e.g. inhabited areas and food)
- Evaluation of late-phase countermeasures to point out the most effective ones

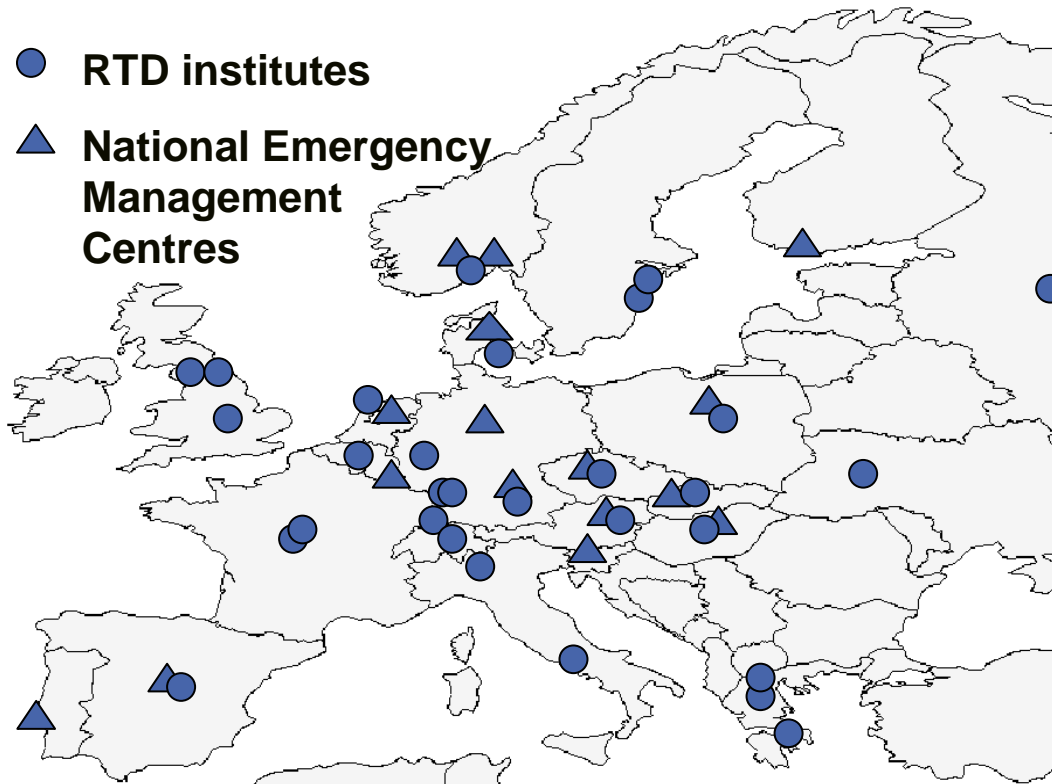


# Changing role of the radiological advisor and thus the DSS in the ongoing emergency situation



# FP6: Integrated project EURANOS

## „European approach to nuclear and radiological emergency management and rehabilitation strategies“



**partners:** 33 RTD institutes and 17 national emergency management centres from 23 European countries

**budget:**  
total costs: 14 Mio €

**start:** April 2004

**end:** June 2009

**co-ordination:** FZK

# Topics in EURANOS

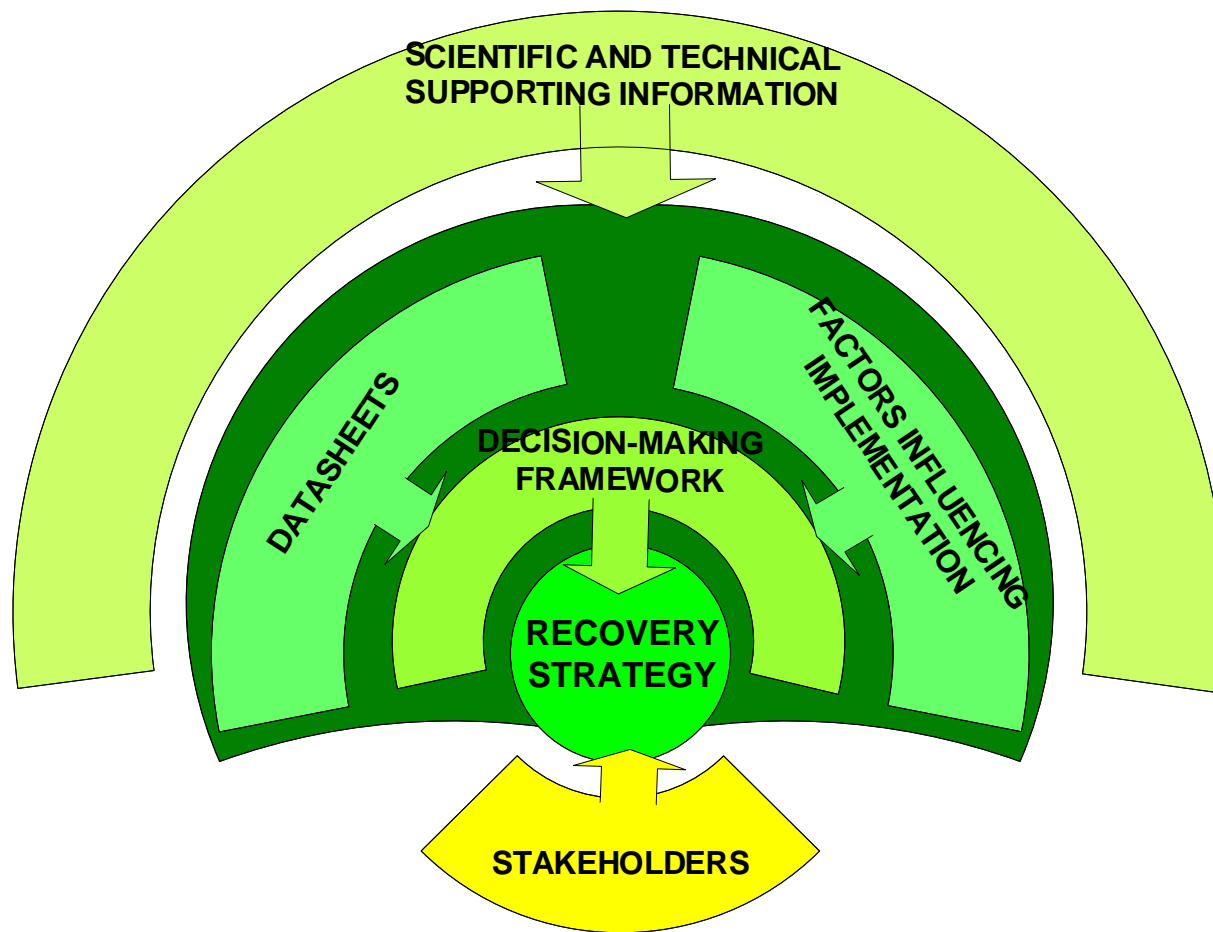
- **RTD work programme (22 individual activities) subdivided into three main categories**
  - **CAT1: Strategies and guidance on emergency actions, countermeasures and monitoring strategies**
  - **CAT2: Enhancement of decision support systems for operational application**
  - **CAT3: Strategies and guidance for the sustainable rehabilitation and development of long term contaminated areas**
- Demonstration projects (15)
- Training courses (8)
- Management activities (9 topics)

# Main topics of work package CAT1

## Strategies and guidance on emergency actions and countermeasures

- Objectives and achievements
  - Expand and complete existing information on countermeasures (**compendia**)
  - Produce handbooks for managing contaminated **inhabited areas** and **food production systems** in close collaboration with stakeholders
  - To develop guidance on the **lifting** of emergency countermeasures
  - To establish a Handbooks' **Users Group**

# Structure of the Food Handbook



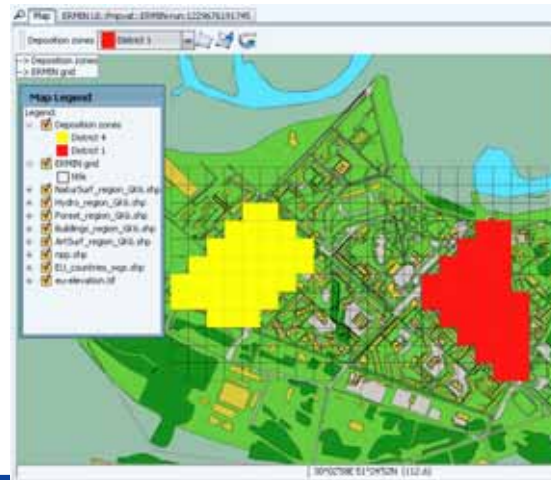
## Enhancement of decision support systems for operational application

### ■ Objectives

- **Models and data** bases for estimating and managing the radiological situation and countermeasures in **inhabited areas**
- **Models and data** bases for estimating and managing the radiological situation and countermeasures in **agricultural areas**
- Enhancement of decision support systems, in particular the **RODOS** system

# Inhabited and agricultural area modelling

- Development of an **inhabited area model** (ERMIN) which integrates state of the art modelling and data bases
- **Improved agricultural model** (AgriCP) which allows to define countermeasure strategies directly in the modelling kernel
- Both models have interfaces to **data assimilation functions**



# Extension of the portability and operability of the RODOS (Real-time On-line Decision Support) system

- Migration of RODOS from UNIX to **Linux** operating system
- Improvement of the **atmospheric dispersion** module by introducing a **mass consistent wind field** model and adopting an advanced **particle model** for **complex terrain**
- **Re-engineering** of the **RODOS** system based on the recommendation of independent IT-experts and the end-users

# New graphical user interface

File Options Tools Help

Site FZK Start of release  
Unit FZK  
Country GERMANY End of release  
Run

Site \ Sourceterm \ Weather \ Countermeasure \ Results \ Run \ Summary \ Training \

Site selection

**Nuclear power plant accident**

Country  
Germany

Close to border  
 Unspecified NPP


**Other accident**

Explosion of rad. dispersal device  
 Radiological accident with fire

Site / Unit  
FZK / FZK

Latitude Longitude  
Geo 49.092 [°] 8.426 [°]

**Information about the Site**

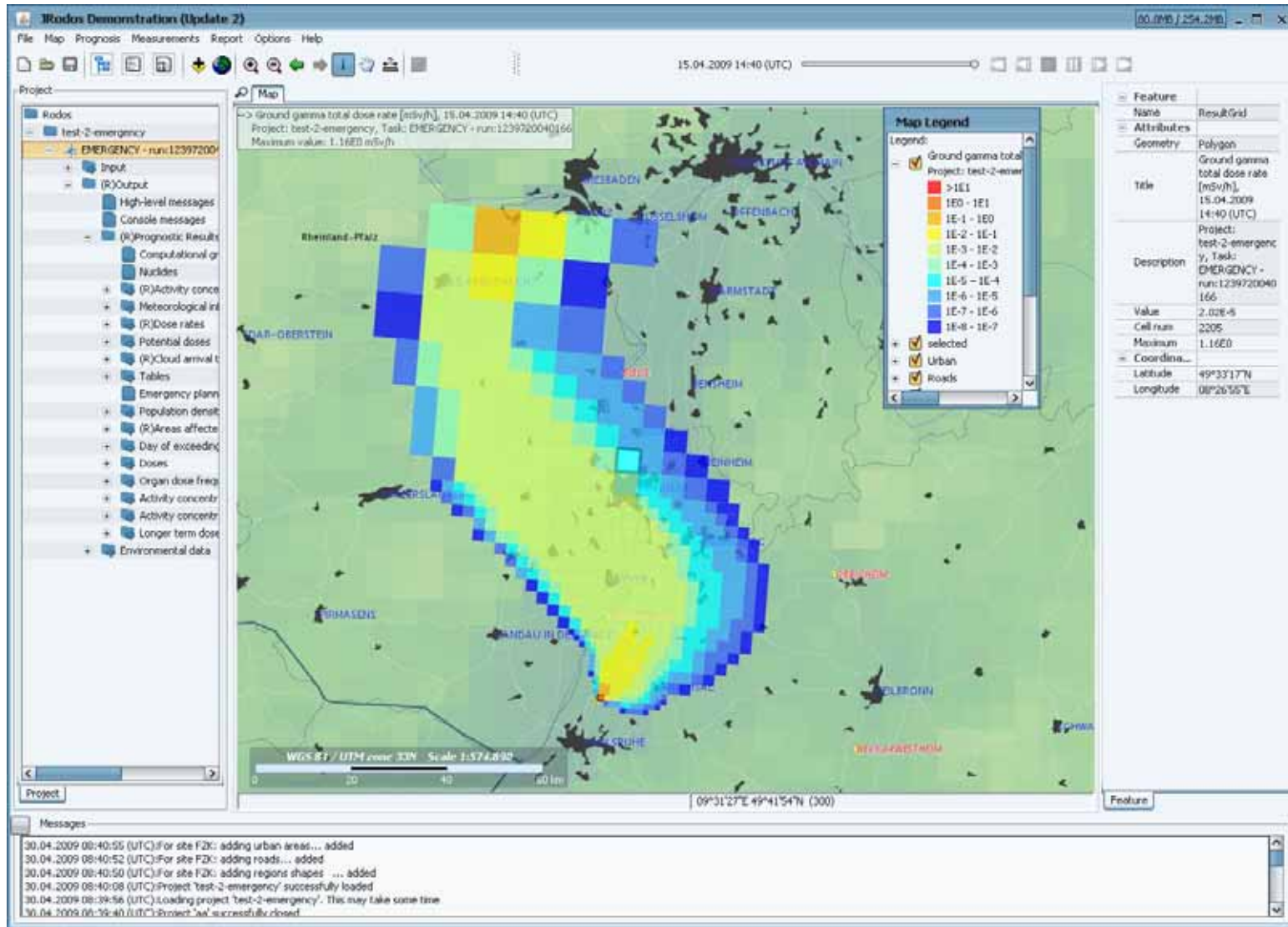


Detail

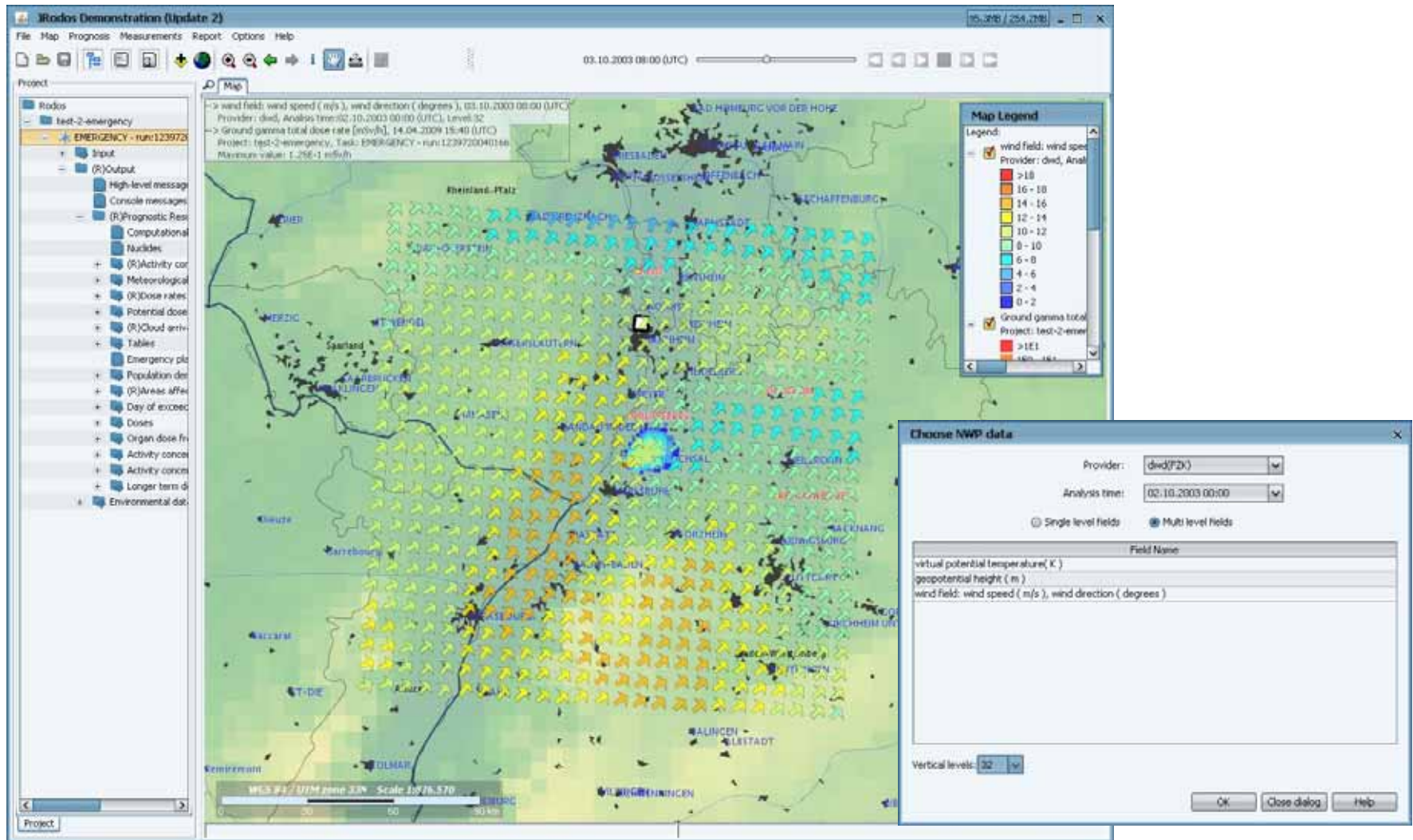
Block type	DEMO
Operation time [day]	999
Thermal power [MW]	3733
Stack height [m]	150

Help Confirm

# Re-engineered RODOS

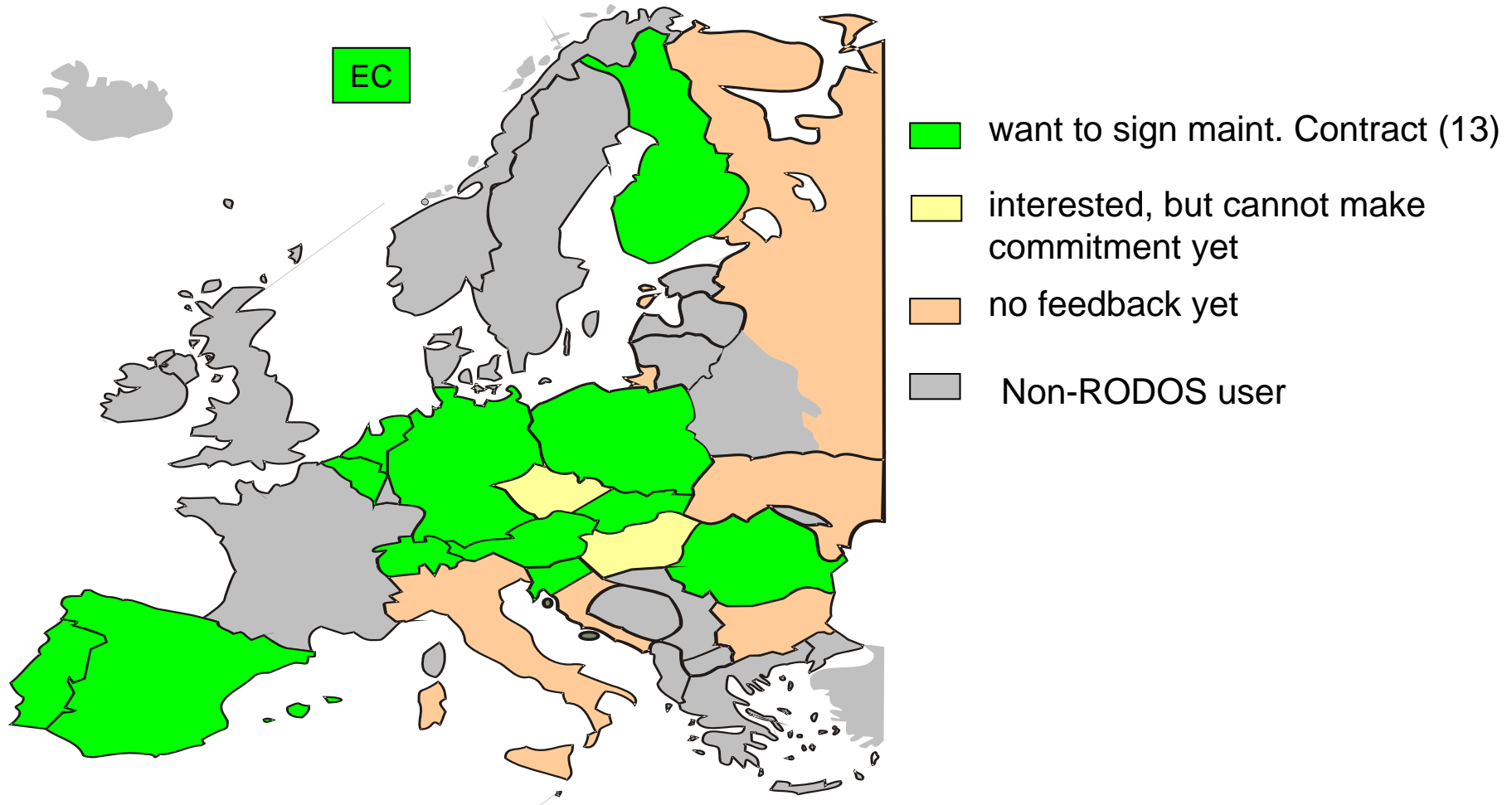


# Example: wind field visualisation





# RODOS maintenance contract – status on 30.Oct. 2009



# Main topics of work package CAT3

## **Strategies and guidance for the sustainable rehabilitation and development of long term contaminated areas**

### Objectives

- **To develop a framework, including guidance on its application that can inform or assist national authorities for engaging a process of rehabilitation preparedness**
- **To demonstrate, disseminate and promote the framework widely in Europe**

# IMPLEMENTATION OF THE FRAMEWORK

- **Step 1: pluralistic co-expertise on the conditions and means to engage in rehabilitation preparedness**
  - Implemented through a pilot study in France
  - Tested in Norway
- **Step 2: local-national cooperation platform on rehabilitation preparedness**
  - Implemented in France
  - Test of the EURANOS tools (Handbooks, RODOS DSS...) at the territory level Montbéliard, Golfech
- **Toward the European Network on Rehabilitation**
  - Creation of a European Long Term Rehabilitation Users Group

# What have we achieved

- **Products such as European handbooks for food production systems and inhabited areas, an improved RODOS DSS for emergency and rehabilitation management and a Framework for engaging authorities and other stakeholders in long term rehabilitation preparedness**
- **There exist users groups for all the three products aiming for sustainability beyond EURANOS**
- **Demonstrated – to a certain extend - that the tools and governance processes developed within the RTD activities of EURANOS fulfil the users' requirements**

# Future

- The three users groups will continue to operate after the end of the EURANOS project
- Information platform established with NERIS web page  
<http://www.eu-neris.net>
- Include preparedness locally
- Expand our activities to radiological
- Include ICRP-103 recommendations
- We will establish a platform on nuclear and radiological emergency management preparedness
- First meeting in the frame of the European IRPA conference in Helsinki, June 2010



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**Thank you very much for  
your attention**

**Questions?**

**<http://www.euranos.fzk.de>**

**<http://www.eu-neris.net>**