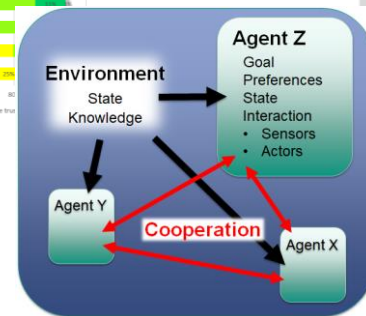
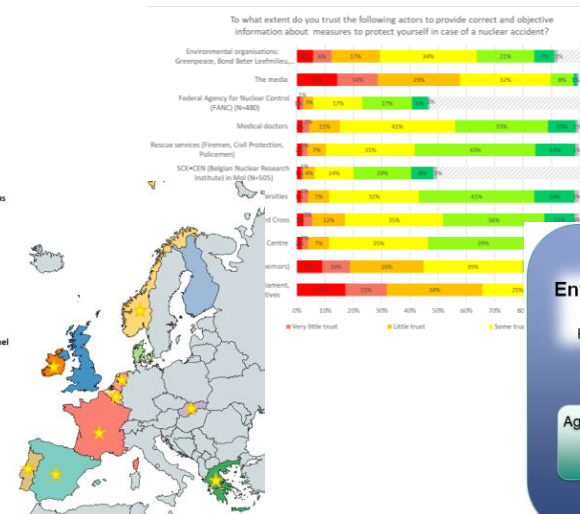
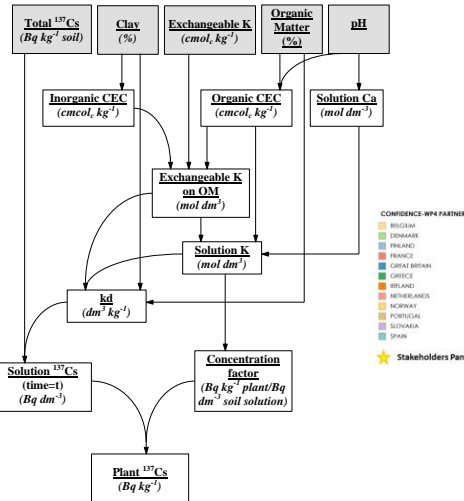
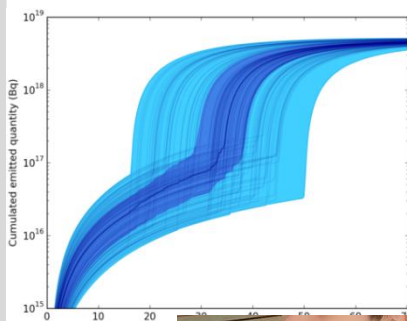


# The CONFIDENCE project, objectives and status

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Karlsruhe Institute of Technology (KIT)



# Background

- In emergency management and long-term rehabilitation uncertainty information on the current situation, or its predicted evolution, is an intrinsic problem of decision making
- To protect the population, conservative assumptions are often taken which may result in more overall harm than good due to secondary casualties as observed following the Chernobyl and Fukushima accidents
- Therefore, the reduction of uncertainty where practicable, and developing approaches to deal with uncertainty information, are crucial to improve decision making for the protection of the affected population

# Uncertainties

- Uncertainty relates to being unable to answer a question precisely
- Many types of uncertainty exist:
  - Stochastic uncertainties
  - Epistemological uncertainties
  - Judgemental uncertainties
  - Computational uncertainties
  - Model uncertainties
  - Ambiguity, Lack of Clarity and Endpoint Uncertainties
  - Social and ethical uncertainties
  - ...

# Introduction

- The CONFIDENCE Project performs research focussed on **uncertainties** in the area of **emergency management** and **long-term rehabilitation**. It concentrates on the **early** and **transition** phases of an emergency, but considers also longer-term decisions made during these phases.
- Duration: 1.1.2017 – 31.12.2019
- 31 partners from 17 countries
- Budget: 6.201.026 €, request to EC: 3.252.487 €
- Part of CONCERT



# Research Questions

- Can atmospheric dispersion simulations and dose estimations be improved in the pre- and release phase with uncertainty analysis and an ensemble approach?
- How to reduce uncertainty in dose assessment for improving situation awareness and risk estimation?
- Are radioecological models fit for the purpose?
- How can stakeholders be involved best in the decision-making processes during the transition phase?
- What are the social, ethical and communicational aspects of uncertainty management?
- How can decision making be improved if it is based on uncertain data?
- How to share lessons learned through training and dissemination?

# Works packages

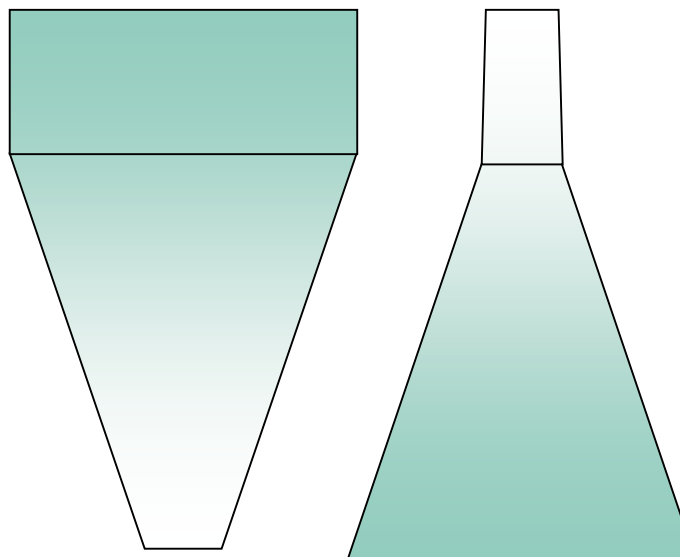
## Importance for the decision making process

**During the release phase**  
**Post release phase**

**WP1:** Pre- and release phases (**NERIS**)

**WP2:** Improve the common operational picture (**EURADOS**)

**WP3:** Improve radioecological models (**ALLIANCE**)



**WP4:** Transition to long term recovery (**NERIS**)

**WP5:** Stakeholder, social and ethical aspects (**SSH**)

**WP6:** Facilitate decision making (**NERIS**)

**WP7:** Education and training

# Methodologies for WP1 to WP3

- Early phase modelling
  - Analysing and ranking sources of uncertainties
  - Performing scenario calculations to propagate the uncertainties through atmospheric dispersion models (ADMs)
- Operational picture
  - Combination of model results and monitoring information
  - Health risk assessments based on WHO methodology
- Foodchain models
  - Improving model data bases including through experimentation
  - Investigate process based models
  - Study the effect of “hot particles”

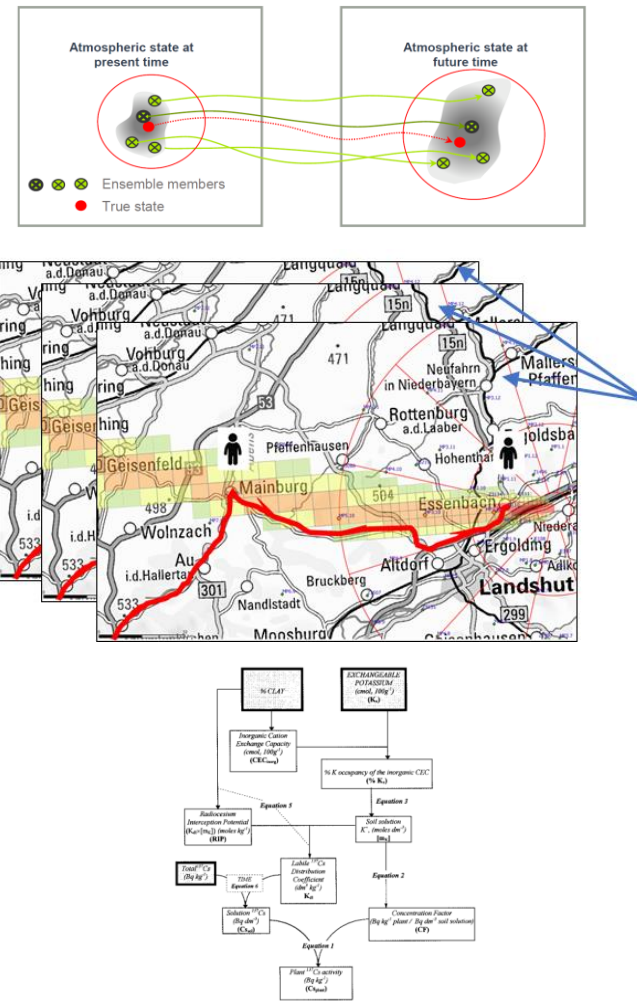
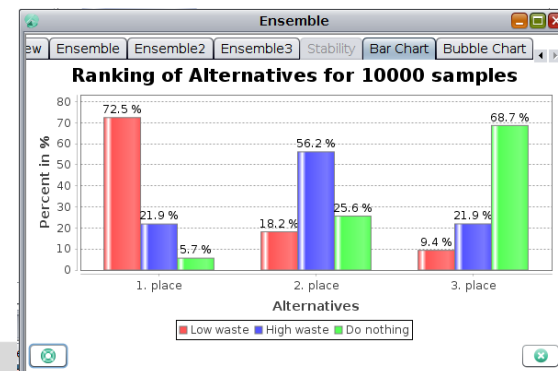
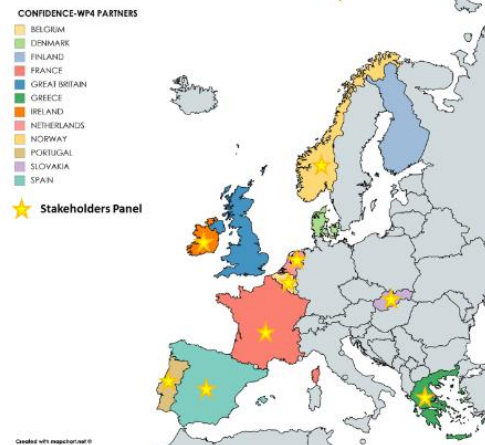


FIGURE 1. Relationship between conceptual pools of radiocesium. Shaded boxes indicate model input data. Equations describing the relationship between pools are referenced to those given in the text.



# Methodologies for WP4 to WP6

- Stakeholder preferences
  - Identify, evaluate and optimise countermeasure strategies by decision-oriented scenario-analysis involving stakeholders
  - Perform Delphi studies for preference elicitation
- Social, ethical and communicational aspects
  - Analyse social uncertainties from past events, study expected behaviour and information needs, and observe emergency exercises
  - Develop mental models to understand how uncertainties are processed by human beings
  - Investigate communication of uncertainties
- Decision making process
  - Use formal decision aiding tools such as MCDA
  - Develop agent based models to simulate and investigate the decision making process in detail

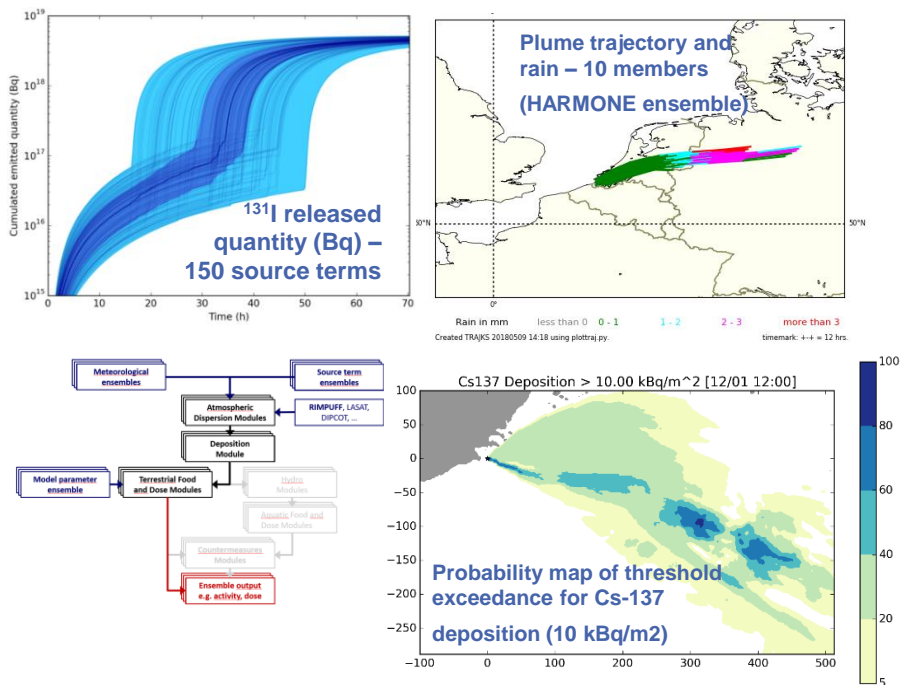




# Summary of Results

- The ensemble approach seems to be appropriate to represent uncertainties in the early phase
- Operational picture can be improved with data assimilation
- Progress was made in developing process based radioecological models
- Stakeholder engagement improves selection of strategies and planning for the recovery
- Social, ethical and communicational aspects are important and have to be part of the decision making
- Formal decision aiding tools improve uncertainty handling
- Visualisation and communication of uncertainties to decision makers is challenging

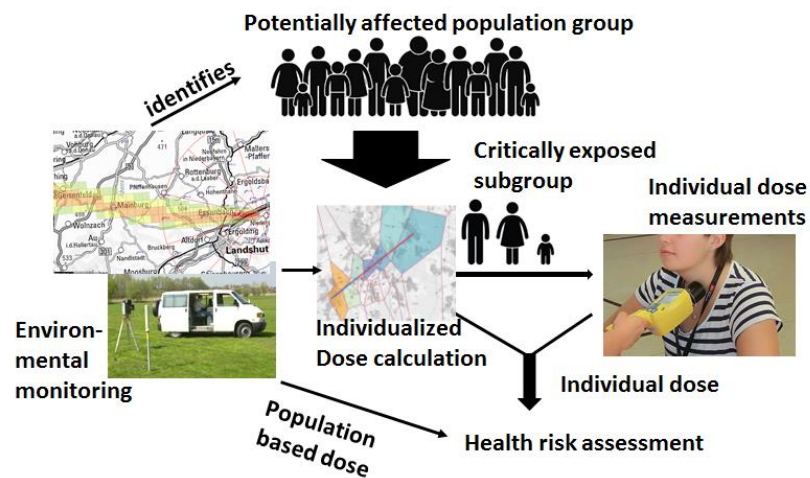
# Detailed Results of WP1 and WP2



Key driver for uncertainties: wind direction, atmospheric stability, source term, start of release (D9.1)

Ensemble approach was used to describe uncertainties from meteorology and source term and propagate them through ADMs to dose and food chain models

Enhanced handling of monitoring and risk estimation improves the operational picture (D9.8, D9.9, D9.11)



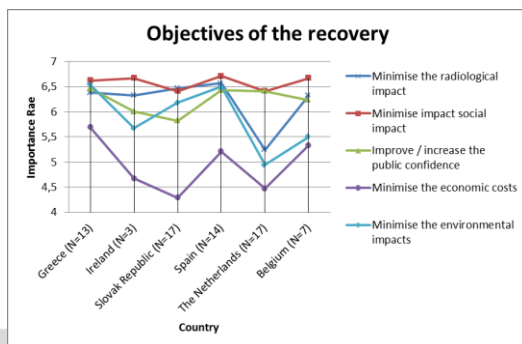
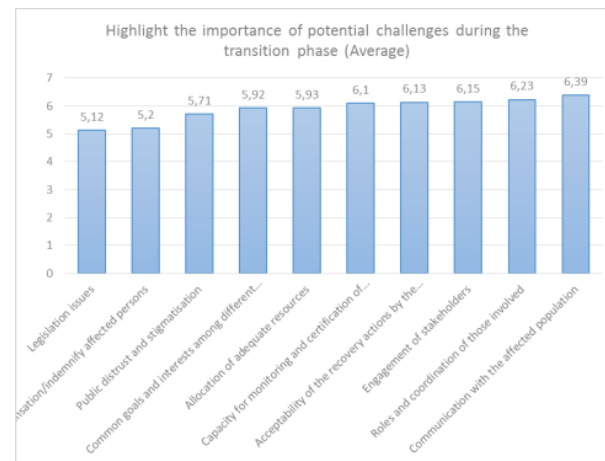
# Detailed Results of WP3 and WP4

Key parameters of operational radioecological models have been identified, process based models developed and in-effect of no root uptake of  $^{131}\text{I}$  after deposition was demonstrated (D9.13)



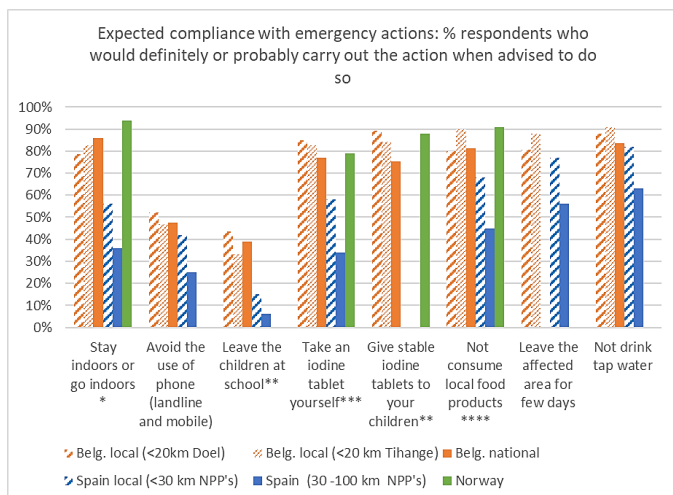
Improving the underlying database with data gained by experiments

The national workshops demonstrated that uncertainties were so far mostly ignored but require consideration (D9.22)

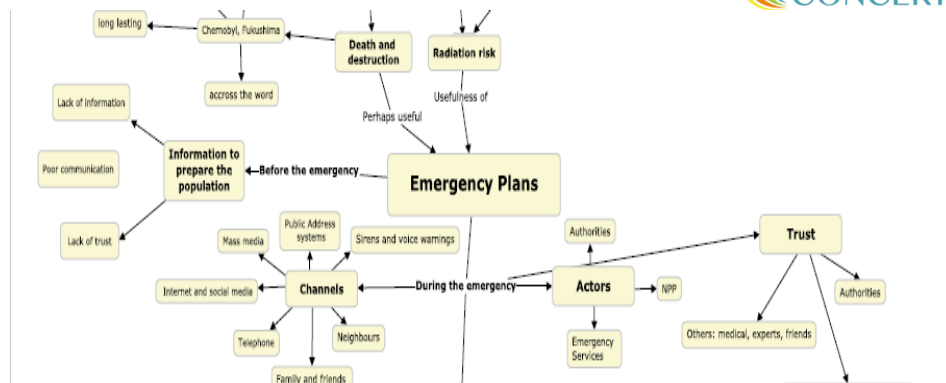


The workshops and the Delphi study resulted in a set of preference values that can be used by the MCDA and ABM (D9.20, D9.21)

# Detailed Results of WP5 and WP6

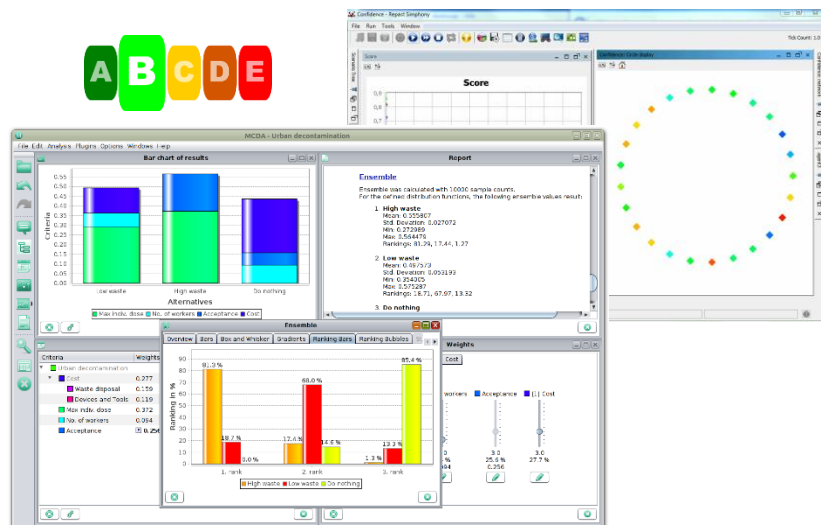


## Surveys in Spain and Belgium



Mental models demonstrated gaps in reasoning about emergency planning between lay people and experts (D9.27)

Preferences and strategies, generated in other work packages were applied to the MCDA and Agent Based Simulation model (ABM) to better understand the importance of the negotiation process (D9.33, D9.34, D9.35,)



# Conclusion

- The CONFIDENCE project was a first attempt to deal with uncertainty handling in nuclear and radiological emergency management
- It brought together participants from ALLIANCE, NERIS, EURADOS, MELODI and SSH, thus fostering the integration of radiation protection research
- Key areas in the decision making process were addressed and methods identified that can improve that process
- Some of the methods were successfully implemented in simulation models and will become operational
- Identifying uncertainties was clearly achieved, yet reducing of uncertainties was not and will require additional efforts

## Further Steps

- The ensemble approach on source term and meteorology will be implemented in national operational simulation models as well as into the European DSS JRodos with more than 20 users in Europe and worldwide
- Findings will be disseminated via the various Platforms and reflected in the research needs identified there as well as fed into the CONCERT SRA and common roadmap
- As uncertainty handling has been largely neglected before CONFIDENCE, we see a need to continue working in this area, included in a CONCERT-2 – if funded



# CONFIDENCE Dissemination workshop

*Coping with uncertainties for improved modelling  
and decision making in nuclear emergencies*

**2-5 December 2019, Lindner Hotel Gallery Central  
Metodova 4, Bratislava, Slovak Republic**

<https://www.eu-neris.net/home/newsletters/190-confidence-dissemination-workshop-first-announcement-2.html>



**Thank you and any questions?**