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Objectives and achievements in the first four years of the EURANOS project: European approach to nuclear and radiological emergency management and rehabilitation strategies

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Abstract. The 5-year multi-national project EURANOS, funded by the European Commission, started in April 2004. Integrating 17 national emergency management organisations with 33 research institutes, it brings together best practice, knowledge and technology to enhance the preparedness for Europe's response to any radiation emergency and long term contamination. After four years of operation the following achievements can be stated. Two handbooks to assist national and local authorities in the management of contaminated food production systems and inhabited areas in Europe have been developed in conjunction with a wide range of European stakeholders. A governance framework for the sustainable rehabilitation of long term contaminated territories has been developed and tested in France. Its implementation in Norway has started. A consistent methodology for calculating the best estimate possible of current radiological situation in both contaminated agricultural and contaminated inhabited areas has been developed. The migration of RODOS (Real-time On-line Decision Support System) to the operating system LINUX is completed. A mass consistent wind field model was implemented together with a particle model for complex terrain. A complete re-engineering of the system has started aiming to incorporate all the user's recommendations collected within the demonstration projects and the operational use of the system in emergency management organisations.

1. INTRODUCTION

Despite the fact that considerable achievements have been made in the past in developing new methods and information technology (IT) tools under the EC's 4th and 5th Framework Programme, many of these developments are still not fully operational or disseminated all over Europe. As a consequence, the EURANOS (European Approach to Nuclear and Radiological Emergency Management and Rehabilitation Strategies) project aims to increase the coherence and effectiveness of nuclear and radiological emergency management in Europe including the rehabilitation of contaminated areas through the establishment of an effective working platform of emergency management institutions, Research and Technological Development (RTD) institutes, end-users and other stakeholders for initiating application oriented improvements of methods, procedures, guidelines and IT tools, such as the RODOS (Real-time On-line Decisions Support) decision support system [1]. The project started in April 2004 and will last for five years.

2. OBJECTIVES

The overall goal of the project is the enhancement of the technical, methodological and strategic approaches for national and cross-border emergency management and rehabilitation in Europe, which could progressively lead to the establishment of a European Policy for emergency management and rehabilitation strategies.

These objectives can only be realised when those responsible for nuclear or radiological emergency management and rehabilitation strategies within their countries and the research institutes developing methods, IT tools and strategies for a more coherent and efficient emergency response work closely together. In this sense, the EURANOS project, integrating 17 national emergency management organisations with 33 research institutes, brings together best practice, knowledge and technology (see Fig. 1). Countries not involved from the beginning can join the project at any time and the dissemination activities aim to attract more and more organisations/countries to participate in the project.

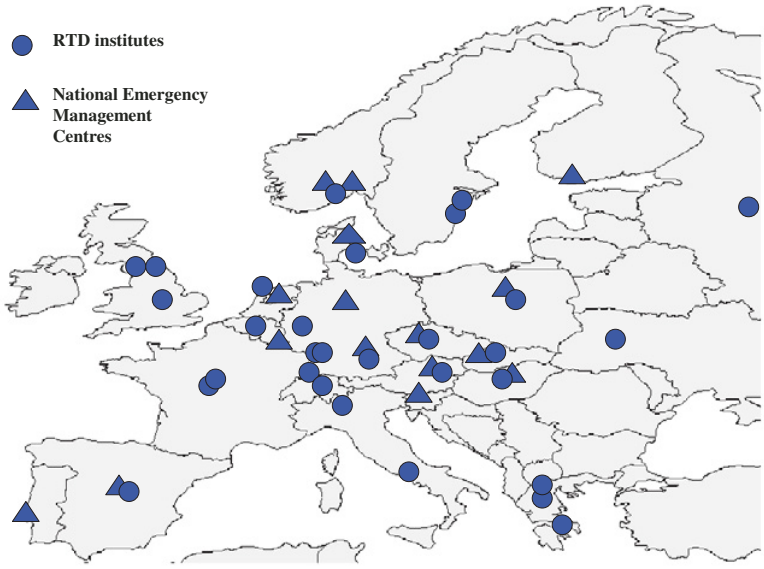

Figure 1. European coverage of the EURANOS project.

3. WORK PROGRAM

The working programme organises in a structured way the interaction between the operational emergency management organisations and the RTD institutes. The continuous performance of demonstration projects creates feedback on the operation and usefulness of new methods, IT tools strategies and guidance.

Demonstration activities are the core element of the project. Demonstration activities started at the beginning of the project with those methods and IT tools developed under RTD projects and thematic networks of FP5, which either ended before the start of EURANOS or which are overlapping with its first phase's work programme. Demonstrations were either carried out as implementation of the tool in nuclear power plants and national emergency centres, respectively, or as exercises performed during a given time frame with a comprehensive guidance how to evaluate the findings of the exercise. As a result of the demonstration activities within the first 24 months, either the operational applicability of the

tested products has been proven or new RTD work has been defined, which was subsequently integrated in the RTD work programme for the remaining years. The results were then investigated in repeated or additional demonstration activities taking place during the final 36 months.

The EURANOS RTD activities have been subdivided into the following concurrent and closely co-ordinated categories:

- CAT1: All activities related to emergency actions and countermeasures;
- CAT2: All activities related to the further enhancement of decision support systems for operational application;
- CAT3: All activities related to rehabilitation strategies and guidance.

RTD activities, in particular the development of new tools are backed by integrated training programmes providing a sound basis for their operational use.

4. RESULTS

4.1 CAT1

The accident at the Chernobyl Nuclear Power Plant prompted a number of initiatives to document and evaluate options for managing the effects of this type of radiological emergency. Since 2000, information on these management options (countermeasures) has been recorded in a systematic way using a datasheet format. The EURANOS project has produced compendia of datasheets for the management of contaminated food production systems and inhabited areas that cover all phases of response not only of nuclear but also radiological incidents (e.g. terrorist attack). More than 100 datasheets have been produced providing information on effectiveness, feasibility, legal constraints, incremental dose, environmental impact, as well as social and ethical implications of the management options.

Only subsets of these options are likely to be applicable according to the timing, scale and types of radionuclides released. Consequently, a need was identified within the EURANOS project to develop handbooks to aid decision making, not just from scientific or technical points of view but also taking into account stakeholder opinion. A first version of two generic handbooks for food production systems and inhabited areas were published in 2007 and are available from the EURANOS website. Demonstrations of the handbooks in emergency centres confirmed their value for both contingency planning and incident management.

A handbook users group (HUG) was established to serve as a focal point in collecting and assimilating the feedback from the demonstrations and to be a dissemination mechanism related to all aspects of the handbooks. Furthermore, it might build in future the platform to maintain the handbooks after the end of the EURANOS project.

4.2 CAT2

4.2.1 Modelling in food production and inhabited areas

Two new models were developed to calculate, with a consistent methodology, the best estimate possible of the current radiological situation in both contaminated agricultural and contaminated inhabited areas. This methodology includes modelling and data assimilation, with input on countermeasures from the compendia and handbooks developed under CAT1. As a result, a single consistent European model framework – the European model for inhabited areas ERMIN has been completed.

Similar to the inhabited area model, a model for agricultural areas (AgriCP) is under development aiming to provide a much higher flexibility in defining countermeasure strategies than any model has realised so far. This has been achieved by integrating the countermeasure simulation engine into the physical modelling complex of the foodchain module.

Integration of both models into the RODOS and ARGOS [2] decisions support systems is ongoing.

4.2.2 Data assimilation

In case of an emergency, the estimation of the current radiological situation and the forecast of the development of the activity levels with time are of highest importance. To this purpose, simulation models and also measurements are available, however, both may contradict each other. As this may strongly affect the quality of the decisions, methods had to be established to harmonise predictions and measurements. In this respect, data assimilation tools were developed in the recent years and prototype version of two modules to update the deposited activity and feed and food contamination were implemented into RODOS. Both data assimilation models will be further developed and their methods will be made more robust against erroneous input as only this robustness can assure that the user will apply these methods in case of a real emergency.

4.2.3 Decision aiding components

The evaluation tool Web-HIPRE [3], aiming to structure the decision making process and setting priorities, was integrated into RODOS which provides support in this area by integrating hard facts derived from the RODOS system with soft factors such as socio-economical factors, constraints, feasibility aspects and preferences of the decision making team.

Besides general improvements of the implemented model, two areas were identified where further work was necessary. Post accident management requires decision making in the longer term (up to several years) and the outcome of sequential decisions depends on decisions made at each of several stages. Since such decisions are not taken independently, but are nested in a series of related decisions, appropriate decision support is necessary, but not implemented at the moment, as all decisions are treated as independent from each other. Additionally, uncertainties which are considered in RODOS in the various simulation modules have to be communicated to the decision making team allowing some estimation of the possible range of decisions to be taken.

4.2.4 Operability of the RODOS system

An important goal of the EURANOS project is the improvement of RODOS to an extent that it could be used by national emergency management organisations in a fully operational emergency mode. As a consequence, the RODOS system was migrated from the HP-UX operating system to Linux which will build a sustainable platform for the forthcoming years. Furthermore, the RODOS Users Group (RUG) has been established as a discussion and interaction forum for co-ordinating and managing activities related to the demonstration and enhancement of the RODOS system and for providing essential feedback to the developers. The interaction with the RUG in the last years has led to significant modifications of the work programme of the EURANOS project. New RTD activities initiated by the RUG have been:

- In a first step a newly structured user interface was developed using state of the art IT technologies with its implementation in JAVA (object oriented programming language). This new interface facilitates direct error management of the user's input and guides him through a series of easy to understand input frames.
- In a second step the existing system was carefully examined and user requirements for further developments were collected. Based on these results a complete re-design of the RODOS system has been initiated, focusing on modern IT-technology and enhancing the system to be used as an information platform for tools related to emergency management and rehabilitation.

In the meantime the re-engineering of RODOS has already led to the delivery of many prototypes. The delivered prototypes were immediately evaluated by the RUG. Following this evaluation, the RUG provided guidance in defining the objectives of the next prototype. This interaction is the only guarantee,

that the re-engineering will achieve what the operational community expects and will continue with the next prototypes in the same way.

Besides the improvements in the operational applicability also new simulation models were developed and integrated into RODOS. This comprises an atmospheric dispersion model for complex terrain, an improved wind field modelling and extensions of the data base and models to cover radiological events and transport accidents.

4.3 CAT3

The governance framework for the sustainable rehabilitation of long term contaminated territories has been tested in a Pilot Study implemented in the French context where authorities and experts are questioning and reconsidering their strategies and operational tools for post-accidental management. The objective of the Pilot Study is to take advantage of this situation to initiate and accompany a process of change involving local and national concerned parties with the objective to give the ability to potentially affected French territories to contribute actively to the development of strategies and guidance for the sustainable rehabilitation of living conditions in case of long term radioactive contamination. Having completed this first step in France, the implementation in Norway is ongoing. As a result, a guidance document will be developed allowing further European Member States to implement this framework in their context.

The second step of the framework consists of the development of a national platform integrating national authorities and local communities with their respective stakeholders. This work has been started in France. As part of the development of the French platform on rehabilitation, the work with the Community of Municipalities of Montbéliard in the East part of France has started with the objective to explore how it could be possible to adapt the EURANOS tools (Handbooks, RODOS, rehabilitation Framework...) to the needs of local communities.

Finally, a users group for the long term rehabilitation (LTRUG) has been established with the objectives to provide information to interested parties, facilitate dialogue between members of the users group, diffuse the EURANOS Framework for long term rehabilitation preparedness and act as a focus for exchange of experience on this issue.

4.4 Demonstrations

Demonstrations carried out so far focused on CAT1 and CAT2 methodologies and tools. In the frame of CAT1, the two handbooks were demonstrated and in the CAT2, the demonstrations focused on either tools developed in FP5 such as source term estimation from in plant data, visualisation of real-time data, data exchange between neighbouring countries of user requirements and user interfaces. As the demonstrations were conducted by the end users, partly also active in the RUG, the modification of the work program mentioned above was the result of both the RUG and the demonstration projects. The demonstrations also assured that the end user's perspective was always well represented in the regularly updated working program.

4.5 Training

The promotion and the dissemination of the project achievements is supported by training courses for the end-users of methods, procedures, guidelines strategies, and – in particular – for operators of systems and tools of the IT based methodology. Feedback obtained from the participants is not only used to improve the courses but – if applicable – are considered in the definition of RTD activities. On the other side, the training courses are continuously adapted to the results of the RTD activities and thus, they contribute to an early dissemination of any new developments made under EURANOS. Training courses were conducted on the administration, operation and usage of the RODOS system,

on the evaluation tools and methods for supporting the off-site emergency management team and on strategies and guidance for the rehabilitation of living conditions in long term contaminated territories. In addition training on preparedness and response for nuclear or radiological emergencies is provided and should build the basis for any professional working in the area of emergency response.

5. CONCLUSIONS

Work carried out so far has demonstrated the successful implementation of the demonstrations and the users groups as focal point for application oriented RTD activities inside the EURANOS project. The demonstrations and the intensive interaction with the end-users organised in the RUG and later on the HUG and the LTRUG has led to significant modifications of the working programme from the beginning of the project. They initiated in particular the complete re-design of the RODOS system focusing on modern IT-technology and enhancing the system to be used as an information platform for tools related to emergency management and rehabilitation. Major achievements of the project have been/will be:

- A set of European handbooks developed in co-operation with stakeholders integrating the existing knowledge and know-how on all the instruments (methods, tools, procedures and guidelines) necessary for emergency and rehabilitation preparedness and management. These handbooks would cover food production systems and inhabited areas for all phases: early, late and long term.
- A robust and effective RODOS DSS for emergency and rehabilitation management structured in a way that it addresses the needs of the end-user with different interests and capabilities.
- An inclusive governance framework for both emergency and rehabilitation preparedness and management favouring the engagement of end-users and stakeholders i.e. RODOS and non RODOS based emergency centres, authorities (national, regional and local), expert bodies, administrations (national, regional and local), professional bodies, NGOs.
- A coherent and effective training and information infrastructure to ensure the transmission of the know-how to experts, professionals and authorities, and the diffusion of the relevant radiological protection culture within all segments of the society.
- A Web platform named NERIS to stimulate the exchange in the various users groups and beyond them building a kernel for the sustainability of the EURANOS products beyond the end of the project.

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