Austria's Collaboration During DSSNET Emergency Exercises

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Abstract. A global strategic topic is the development and the application of a safety- and security – network. In this frame decision support systems for nuclear accidents to protect man and environment and to mitigate the consequences are essential. In the 4th and 5th Framework Programs of the EC the system RODOS (Real-time On-line DecisiOn Support system) was developed. Improvements and exercises were performed in the Thematic Network DSSNET.
In 2000 the Austrian Research Center at Seibersdorf (ARC) acquired and installed the system RODOS which was operated as a stand-alone version. In the frame of DSSNET ARCS participated with RODOS in all DSSNET Emergency Exercises. To generate comparable conditions as much as possible for the participating countries collaboration between several of the neighbour countries was necessary. This collaboration could be either in the preparatory phase or in the exercise phase or in both phases.
The first two exercises concentrated on the near range and the early phase of a nuclear accident. Therefore no exchange between countries was necessary. During the 3rd DSSNET Exercise Austria participated in the zone "South" together with the Slovak Republic, Czech Republic, Hungary, Slovenia, Romania, Bulgaria and Greece. The fourth exercise concentrated on the intermediate and later phases of an accident. Here the Slovak Republic worked together with Austria as "Acciland" and "Neighbourland". An intensive dialogue took place in the preparatory phase and was continued during and after the exercise. The experiences of all these collaborations will be discussed in the paper.

KEYWORDS: Emergency Plans, International Cooperation, Reactor Accidents, Exercises.

1. Introduction

The objective of this paper is a review of Austria's experiences gained during the participation of international emergency exercises using the system RODOS (Real-time On-line DecisiOn Support system) [1].

The development and the application of a safety- and security – network is a global strategic topic. In this frame decision support systems for nuclear accidents to protect man and environment and to mitigate the consequences are essential. In the 4th and 5th Framework Programs of the EC the system RODOS (Real-time On-line DecisiOn Support system) was developed. Improvements and exercises were performed in the Thematic Network DSSNET [2]. This network was established in October 2000 and consisted of thirty-seven institutions from twenty-one countries of Eastern and Western Europe.

The Austrian Research Centre at Seibersdorf (Austrian Research Centers GmbH - ARC) acquired and installed the system RODOS which was operated as a stand-alone version. In the frame of DSSNET ARC participated with RODOS in all DSSNET Emergency Exercises. To generate comparable conditions as much as possible for the participating countries collaboration between several of the neighbour countries was necessary. This collaboration could be either in the preparatory phase or in the exercise phase or in both phases.

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2. The System RODOS

The Chernobyl accident caused a profound effect on emergency preparedness and post-accident management in Europe. Based on detected deficiencies in emergency preparedness a number of requirements for an improvement emerged. Among them were the need for a more coherent and harmonized response in Europe and in the different stages of an accident, the exchange of information and data in an emergency to enable neighbouring countries to take more timely and effective actions, and the necessity to make better use of limited technical resources.

As a consequence the RODOS project was established in 1989 and increased in size through the European Commission's 3rd, 4th and 5th Framework Programmes. Up to 40 institutes from some 20 countries in the European Union, Central and Eastern Europe and the Former Soviet Union were actively involved in this project. As a result of the effort the comprehensive decision support system RODOS has been developed which can be applied within Europe.

The system is able to support decisions about the introduction of a wide range of potentially useful countermeasures as sheltering and evacuation of people, distribution of iodine tablets, food restrictions, agricultural countermeasures, relocation, decontamination, restoration, and mitigating the consequences of an accident with respect to health, environment and the economy. The conceptual RODOS architecture is split into three distinct subsystems, which are denoted by Analysing Subsystem, Countermeasure Subsystem and Evaluating Subsystem. The system is supported by several interfaces to plant safety data, radiological and meteorological networks. Based on the information coming from these interfaces a diagnosis and prognosis of the radiological situation is performed. This calculation can be performed either with the incoming on-line meteorological data and prognosticated meteorological fields, or with historic or user defined meteorological information. Finally exposures from all pathways of potential importance are assessed both during and after the passage of a radioactive cloud. The transfer of radionuclides from the cloud to terrestrial food as well as the resulting radiation exposure are modelled in the Terrestrial Food Chain and Dose Module FDMT. The products considered in this module can be adapted to the specific situation in different parts of Europe. The list of products comprises 21 types of feedstuff and 33 types of foodstuff. In a last step the countermeasure strategies can be evaluated.

3. The DSSNET Exercises

In the frame of DSSNET five emergency exercises have been performed.

The first exercise took place on April 24, 2001. During this exercise RODOS was not used by the Austrian team. Instead the following codes were used: the dispersion code TAMOS [3], the dose was calculated with the code COSYMA [4] and the source term was estimated with ASTEC (Austrian Source Term Estimation Code) [5]. The main objective of this exercise was to provide feedback on the user's experience with the real-time function and the operability of the used system. This and the next exercise concentrated on the near range and the early phase of a nuclear accident. Therefore no exchange between countries was necessary. The inventory of the assumed plant was typical for a Pressurized Water Reactor (PWR) of German type with a thermal power of 3733 MW. Three release periods have been assumed. The stack height was 150 m.

As a consequence of the evaluation this exercise was repeated on February 27, 2002. At this time ARC used version RODOS PV4.0 as a stand-alone version. The exercise applied historic data for the meteorological data and weather prognoses.

The following 2nd DSSNET emergency exercise took place on May 28, 2002. The source of radioactivity was a fictitious Boiling Water Reactor (BWR) close to the border with a thermal power of 3650 MW. In the scenario of this exercise the radioactivity crossed borders to obtain feedback on existing and improved data exchange procedures between neighbouring countries. Information about

the exercise was provided through different channels as the DSSNET home page, EMERCON forms or weather files. This exercise was performed with the version RODOS PV4.0.

The 3rd DSSNET emergency exercise had following goals: testing the far range dispersion modules and checking the interaction between the decision support system and national weather service predictions. In addition information exchange between "Acciland" and "Neighbourland" especially for cross-border countermeasures was practised. For practical reasons the participants were grouped into regional clusters. Austria participated in the zone "South" together with the Slovak Republic, Czech Republic, Hungary, Slovenia, Romania, Bulgaria and Greece. The accident scenario was based on an accident in the NPP Mohovce and on historic meteorological data. In this exercise on May 27, 2003 the version RODOS PV5.0 was available.

The 4th DSSNET exercise concentrated finally on the intermediate and later phases of an accident. The exercise took place on August 30 and 31, 2004, the version RODOS PV6.0 was used. In total there were 6 clusters each containing two countries. During the exercise the Slovak Republic worked together with Austria as "Acciland" and "Neighbourland". An intensive dialogue took place in the preparatory phase and was continued during and after the exercise to establish the boundary conditions of the exercise. The necessary data were prepared and supplied by the Slovakian team. The focus of the exercise was on data transfer. The scenario was based on an accident at Mohovce NPP with a very specific westwards wind direction.

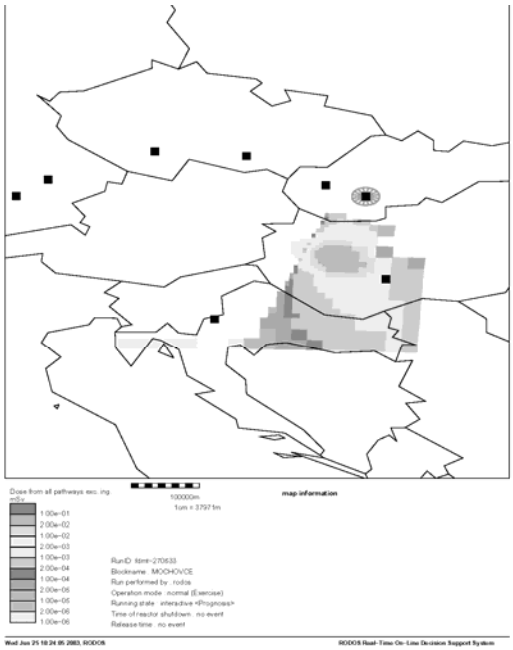

Figure 1: 3rd DSSNET Ecercise: Individual Dose over all pathways except ingestion

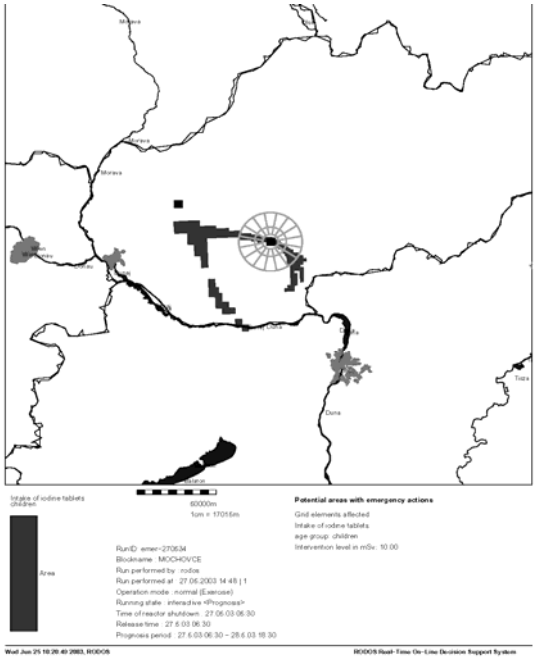

Figure 2: 3rd DSSNET Ecercise: Iod tablets for children

4. Results

The main results of the first exercises was the detection of the deficiencies of the system used and the composition of the team. Most of the participants did not select correctly the source term and in consequence the radiological quantities were not predicted correctly. In addition the unstable system resulted in crashes. After the evaluation of the exercise several improvements were suggested and realized. The performance of the teams and the system was improved considerable during the repetition of the 1st DSSNET exercise. However the corrections of errors done during the exercise were still too time-consuming. Therefore it was not possible to follow the exercise on time.

During the 2nd DSSNET emergency exercise additional problems appeared concerning the communication with the neighbour countries. Each country performed actions according to the national regulations and sent this information to the neighbour country resulting in no response in most cases. Nevertheless the analysis of the situation and the proposed measures were successful. The first time the C-user concept was available. Now it was possible to compare the own results with results generated by a partner. This comparison had no impact on the Austrian actions because there was good agreement between the results.

A lot of preparatory work had to be performed for the 3rd exercise with a European coverage especially the installation of the new version RODOS PV5.0. During this working phase several deficiencies of the new version were detected and a considerable amount of time was spent to become familiar with the system. As a result of this effort all the necessary information could be received and processed without any problem. Unfortunately several of the countries in the same cluster were not so successful which resulted in a very limited information exchange between the countries. Two of the Austrian results of this exercise are shown in Fig.1 and Fig.2.

The goal of the last DSSNET emergency exercise was to test the applicability in the intermediate and later phases of the accident with the focus on data and information transfer. For this emergency exercise an intensive dialogue took place between the Slovakian and Austrian teams to establish the boundary conditions of the exercise. The necessary data were prepared and supplied by the Slovakian team. However some difficulties with the data import and with new modules in the system arose. The interaction between both countries was very satisfactorily. All kinds of information (email, ftp, phone, fax, C-user) worked properly. A comparison of late phase results generated with RODOS with results generated with the code OECOSYS [6] showed good agreement. Fig.3 and Fig.4 represent two of the Austrian results.

Table 1 and Table 2 contain the composition of the Austrian and the Slovakian emergency team. Slovakia as a country with nuclear power plants has a much larger team. In addition the members come from more organisations than in Austria. Consequences of nuclear accidents can be comparable in every country and therefore the difference in size and composition is not explainable with rational arguments.

In summary the experience gained from the participation of all the emergency exercises was very helpful to assess and finally to improve the quality of a complex decision support system, the efficiency of the emergency teams and the communication with the neighbour countries.

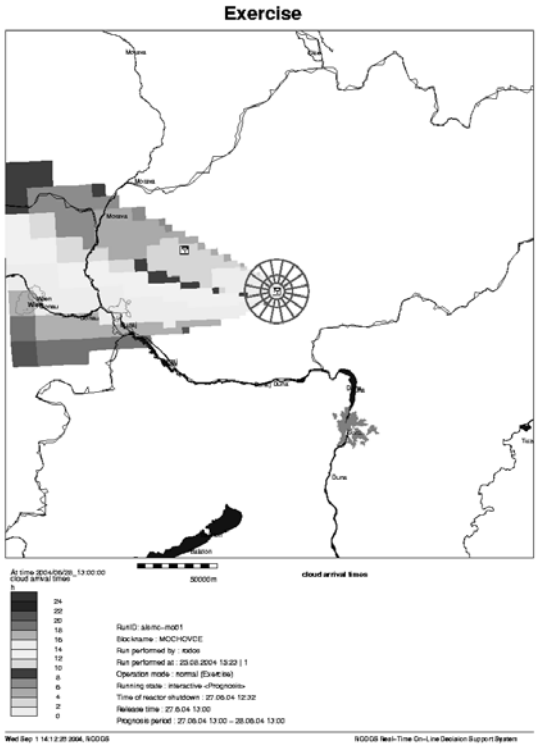

Figure 3: 4th DSSNET Ecercise: Plume arrival time, 24 h prediction

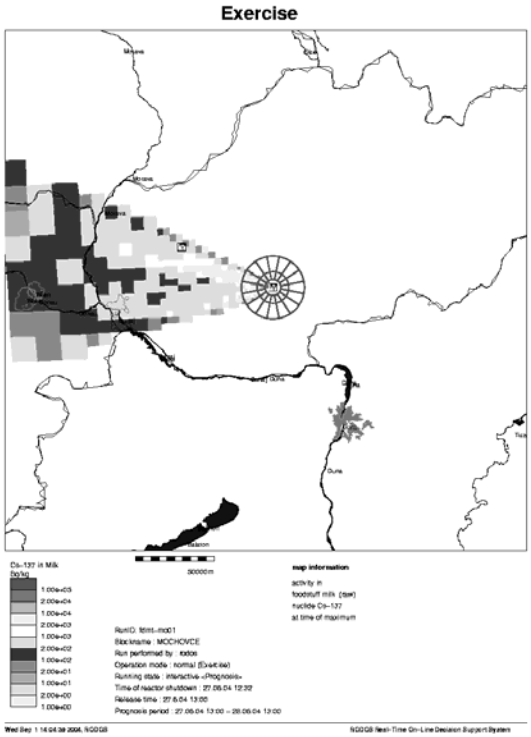

Figure 4: 4th DSSNET Ecercise: Cs-137 concentration in milk, 24 h prediction

Table 1. Austrian Emergency Team During 4th DSSNET Exercise

Federal Ministry of Agriculture, Environment and Water Management	2
Federal Ministry of Health and Women	1
Regional Government of Lower Austria	2
Environmental Agency	2
ARC Seibersdorf (Consulting)	1
ARC Seibersdorf (Operating)	1
Total	**9**

Table 2. Slovakian Emergency Team During 4th DSSNET Exercise

Ministry of Health, Slovak Radiation Monitoring Network	2
Ministry of Interior, Civil Protection Office	1
Ministry of Soil Management, Offices of Crisis Management Trnava and Levice	2
Ministry of Environment, Office of Crisis Management, Slovak Hydrometeorological Institute	2
Ministry of Defense	2
Nuclear Regulatory Authority (EMT Member, operators, administrators)	4
VUJE Inc. (evaluator/facilitator, operators, administrators)	5
SUJB-SURO, Czech Republic (observers)	2
UJV Rez, Czech Republic (observer)	1
Total	**21**

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