RODOS: Realtime Online Decision Support System for nuclear emergency management

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Under the auspices of its Euratom Research Framework Programmes, the European Commission (EC) has supported the development of the RODOS (Real-time On-line DecisiOn Support) system for off-site emergency management after nuclear accidents for more than two decades. Being limited to the early phase and the near range, the system covers now all phases of an emergency and can be applied worldwide. The current version named JRodos is the result of an engineering process initiated by the user community. The new version (JRODOS) is fully JAVA based and can be operated under Windows and Linux as the JAVA structure allows such independent installations.

The JRODOS system provides coherent and detailed information for supporting decisions at all levels, ranging from descriptive reports, such as maps of contamination patterns and dose distributions predicted by model calculation or measured, if available, to a detailed evaluation of the benefits and disadvantages of various countermeasure strategies and their ranking according to the societal preferences as perceived by the decision makers. It is also able to perform 'what-if' calculations, allowing investigations of how a situation could develop in different scenarios.

The JRODOS system provides suitable interfaces to meteorological and radiological monitoring data and to numerical weather prognoses from national weather services broadly used in Europe. Customisation guidelines help the user in adapting the system to regional and national conditions. JRodos is the only decision support system that contains besides terrestrial also an aquatic model chain.

The core of the system however is devoted to the terrestrial pathways. A meteorological pre-processor provides the necessary meteorological input to the atmospheric dispersion models, comprising information about the status of the boundary layer and a 3-dimnsional wind field that define the flow in the area of interest. In addition information about rain patterns is given, too. Meteorological information needed for that pre-processing is either obtained from national weather services, remote surveillance networks or, in particular for exercises, can be put in by the operator of the system via dedicated interfaces.

There are several models for atmospheric dispersion and deposition available in the distance range up to several 100 km. This includes the Gaussian puff model and RIMPUFF and the particle models DIPCOT and LASAT. For longer range calculations serves the Eulerian model MATCH.

The transfer of radionuclides to terrestrial food stuffs and the resulting radiation exposure are modelled in the Terrestrial Food Chain and Dose Module, FDMT. Activity intake by animals is taken into account using season dependent feeding practices. The products considered in the Food Chain Module can be adapted to the specific situation in different parts of Europe; the default list of products presently comprises 21 types of feedstuff (17 based on plants, 4 based on animal products) and 33 types of foodstuff (17 plant products, 16 animal products). The

estimation of doses is performed via all external and internal exposure pathways of importance during and after the passage of the radioactive cloud.

The JRODOS system, in a coherent and comprehensive approach, simulates and estimates the timing and the extent and duration of all countermeasures which might be implemented to limit the health and environment impact of an accident. Intervention strategies adopted in various European countries can also be considered. All information available about the types of intervention listed below have been integrated and synthesized in the corresponding models and the databases associated with them:

- sheltering,
- distribution of stable iodine tablets,
- evacuation,
- decontamination of inhabited areas,
- temporary and permanent relocation, and
- agricultural countermeasures

Finally, the MAV/UT-based software package, WebHipre, has been linked to JRODOS to enable users to compare and evaluate the benefits and drawbacks of different countermeasure strategies (e.g., risks, costs, feasibility, public acceptance, perceptions, social, psychological and political implications, and preferences or value concepts of decision-makers, etc).

With the models implemented, the JRodos system allows to develop countermeasure strategies for inhabited areas and food production systems and compare their efficiency, among others, in terms of dose received, dose saved, resources needed and time required. Linking these countermeasure strategies to the WebHipre tool, the user can also study the influence of soft factors such as acceptance and preferences of decision makers to select the most suitable countermeasure strategy in that given situation.

In a specific module named ICRP-screening, the system allows to set up early phase strategies which arein compliance with ICRP-103 regulations taking into account for all exposure pathways and the residual dose at the end of the first year.

In the CONFIDENCE project that started in 2017, uncertainties in nuclear emergency management will be studied to improve the decision making process under high uncertainties. Results of this project will be implemented in the JRodos system supporting the selection of countermeasure strategies in the transition phase for both, the authorities and the public.

This presentation describes the current status of the JRODOS system and how it is used to select appropriate countermeasures.