Decision Support System for Nuclear Emergencies

Introduction

The ARGOS decision support system is used for consequence assessment and emergency support following accident or deliberate release of nuclear, radiological or chemical substances to the environment. The system has been disseminated in more than 10 European countries, as well as in Canada, Brazil and Australia. Since the initial version was released in 1993, the system has developed into a flexible platform which integrates various decision-making tools and decision support systems for the calculation of doses in the food chain and the urban environment.

Atmospheric Dispersion

Atmospheric dispersion in ARGOS is divided into three parts, an urban dispersion model (HSL), taking buildings into account; the short to medium scale model RIMPUP and external long-range transport model (HSL-IMPACT, MDM-ECBC (Canadian), SNAP (Norwegian) and MATCH (Swedish)).

Uncertainties in Atmospheric Dispersion

Current development work within ARGOS DSS is on accumulating and understanding the uncertainties in the dispersion models calculations. A study has been conducted to estimate the uncertainty sources and how to quantify uncertainties in the atmospheric dispersion model calculations, and to present each data in a comprehensible manner. In the DSS, meeting the needs of both experts operating the system and those of the decision-makers, relying on practical decision support. The results of this study will be incorporated in upcoming versions of the ARGOS DSS.

Food Dose Modelling

FDTR is originally based on the radio ecological model ECDYS. The model also includes doses from deposition activity and its suspension and hence can be considered as a general dose-forecasting model. ApriAFC (Agricultural Countermeasure Program) is based on the food and dose model FDTR and is designed to estimate the effects of all kinds of agricultural countermeasures. The model elaborates for the level of agricultural activities through the projection. This model can also be used to test the sensitivity of the set of parameter used in these functions according to the simulation countermeasures. The approach also supported modeling of all reasonable agricultural countermeasures and even combinations of countermeasures.

Cooperation in the ARGOS Consortium

For more than ten years the users of the ARGOS Decision Support System (DSS) has been organized in a consortium of users. The development of the system being driven by a group representing the need for development in the development and introduction of new functionalities into the ARGOS DSS. It is even more important than that it is to facilitate a close cooperation between the user organisations and the scientific lead body, to ensure use of the ARGOS DSS and to facilitate new research related to emergency management.

Dose Calculation in Urban areas ERMIN (European Model for Inhabited areas)

After an accident, emergency management must continually evaluate which immediate actions are needed in specific areas, which countermeasures should be kept in place and which should be lifted. For this purpose protected doses must be calculated. Consequences of implementing different countermeasures then evaluated based on residual doses, waste and worked doses as well as practical issues and costs. The doses cannot be derived from the impact assessment tool alone (dispersion and its interaction with material surfaces etc.) must be monitored represented with a dedicated model for inhabited areas. Input to the model comes from atmospheric dispersion or measurements.

Monitoring

ARGOS is highly integrated with monitoring data. Especially data from the Arizona Gamma Monitoring (AGM) system are well integrated in ARGOS. The advanced software IGMP-FP (Field sampling and analyzing spectrum data is part of the ARGOS consortium) agreement. Supported monitoring types include:

- Y-dose rates and spectra from on-line monitoring stations
- Y-dose rates from European countries’ monitoring systems (EASMP-net)
- Y-dose rates from mobile units
- Accumulations from mobile units
- Isotopes in environmental samples

Figure 1  Calculation of potential food doses after simulated nuclear event (FDTR)

Figure 3  Quantile plate of the total deposition

Figure 4  Probability for exceeding specified value

Figure 5  FDTR mapping of cesium deposition from Fukushima (2011) - Japan. Source information generated by DTU and INP provided by Aarhus.

Figure 6  ERMIN calculation of y-dose after 31 year in the...