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Swiss Federal Nuclear Safety Inspectorate ENSI

RODOS
Realtime Online DecisiOn Support system

JRODOS for nuclear emergencies: Implementation and connection to the emergency organisation work flow in Switzerland

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Abstract

ENSI has implemented the software JRODOS as primary prognosis tool for the impact assessment of radiological emergencies in nuclear installations. Calculated activity concentrations and dose prognoses are exported automatically to a visualisation application, where the main products for use by the emergency response partners and decision makers are created with the push of a button. The list of products as well as their visualisation has been reviewed and expanded to increase the strength of ENSI's recommendations, improve the efficiency of the national emergency response network, and ensure that decisions can be based on the best available information and taken in a timely manner.

Overview: JRODOS

- JRODOS is a real-time decision support tool, developed and maintained by the Karlsruhe Institute of Technology KIT on behalf of the German Federal Office for Radiation Protection BfS. It continuously evolves to adapt to the needs of its users, who steer its development through the so-called RODOS User Group. Currently, approx. 17 countries use the software either for operational use in emergency response organisations, for planning purposes or for research.

- The software sports a modern JAVA I/O user interface styled similarly to Microsoft Office products and is thus easily useable in case of an emergency.

- Modelling is performed by a series of modules, each designed for specific tasks, which can be linked into so-called model chains. In case of an emergency, a predefined model chain will be used, requiring minimal user input and interaction, to perform all necessary simulations and provide the relevant information.

- One of JRODOS' main applications is the simulation of the airborne dispersion of radioactive substances and the assessment of its consequences. Currently, three dispersion models are available within the dispersion module: DIPCOT, RIMPUFF and LASAT.

- The most advanced model LASAT (LAgrange Simulation of Aerosol Transport) is developed and maintained by Janicke Consulting and incorporates state-of-the-art methods for the treatment of physical processes. It conforms to the VDI guideline 3945 part 3 and was the basis for the development of the German regulatory model AUSTAL2000.
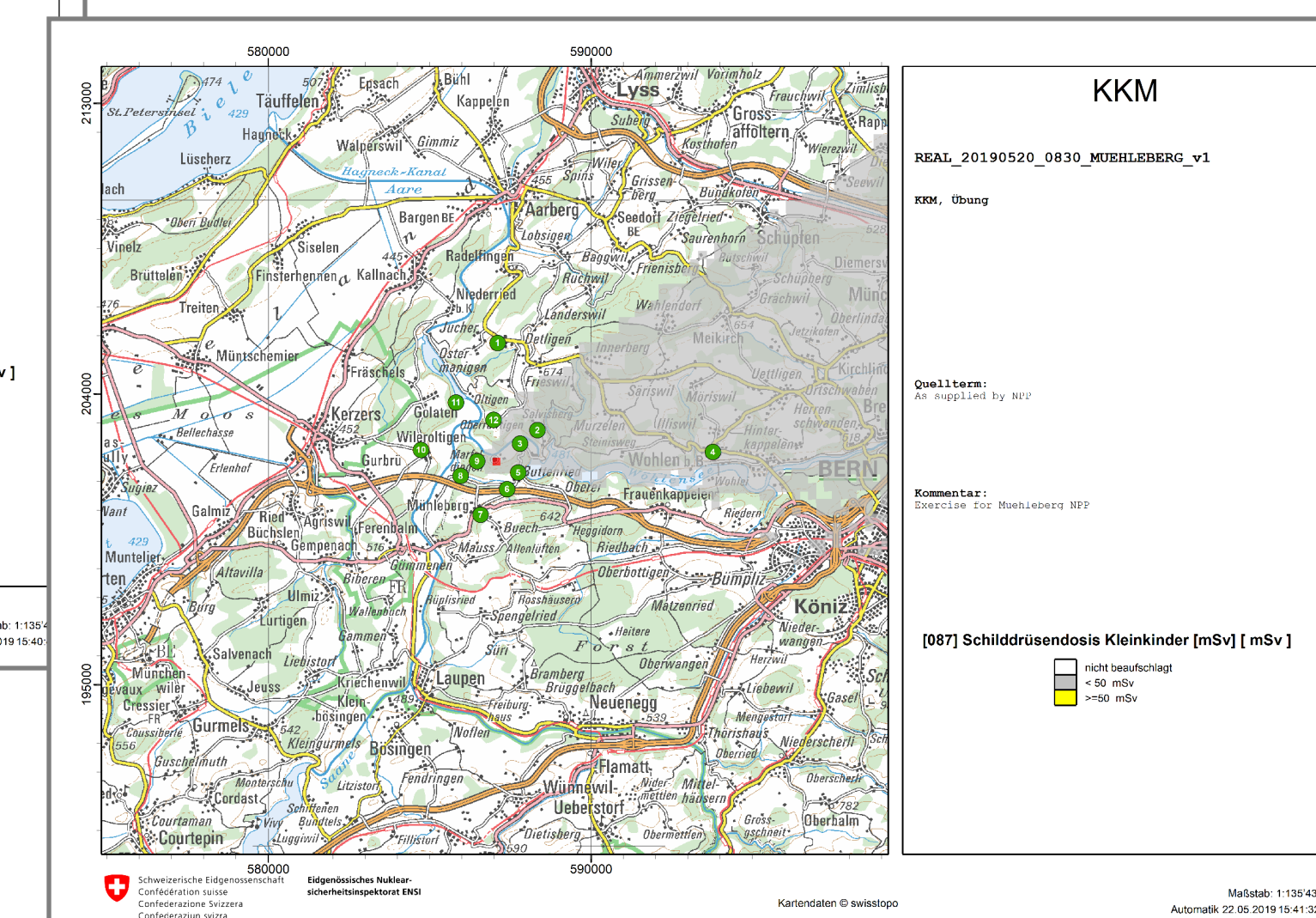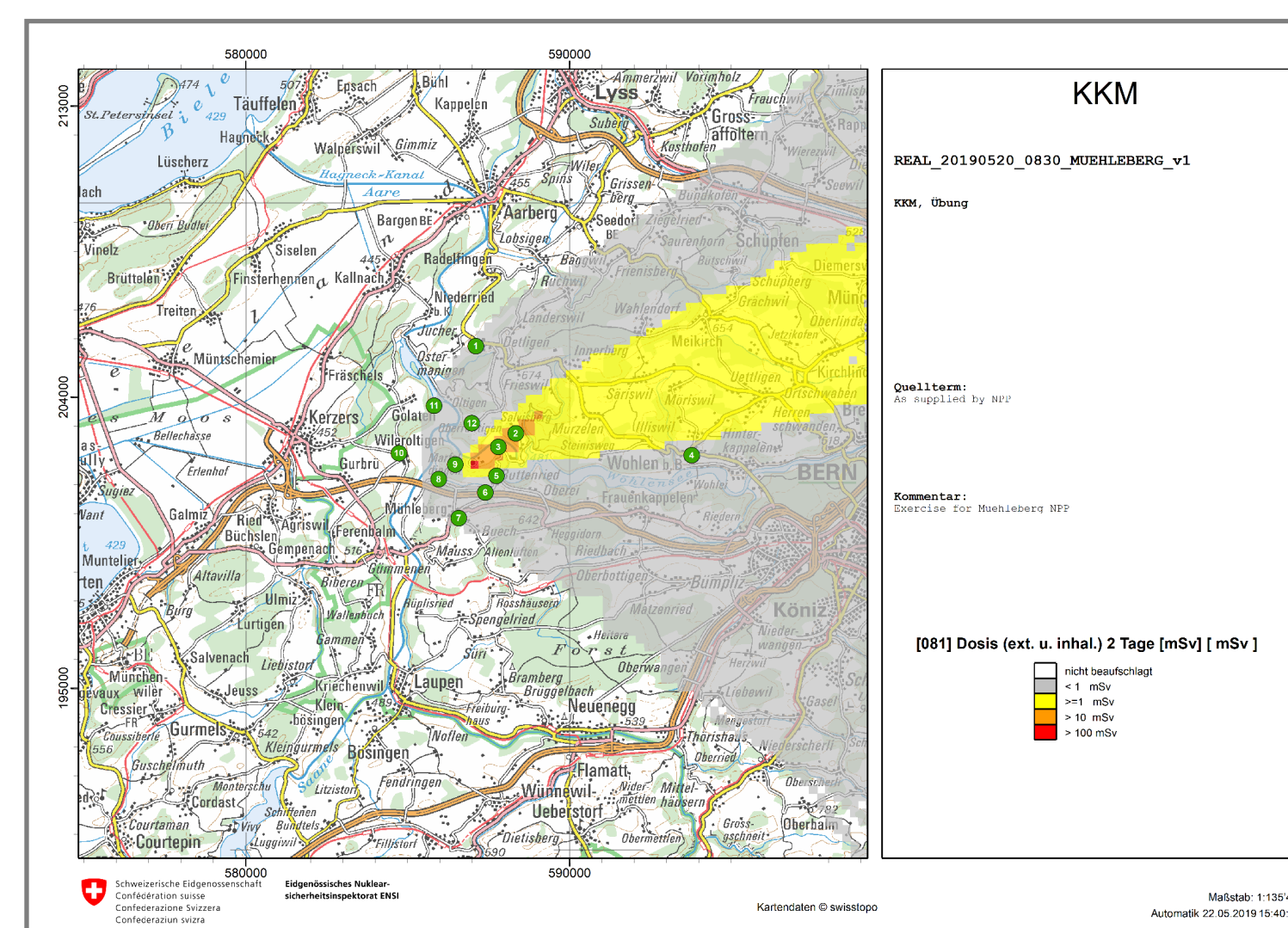
Overview: ENSI

- ENSI is the regulatory authority for all nuclear installations in Switzerland. As stipulated by law, it maintains its own emergency response organisation incl. an alarming system capable of ensuring that the emergency response task force becomes operational no later than one hour after notification by the utility.

- In case of an accident at a Swiss NPP ENSI is, among other duties, tasked to assess the situation at the plant and in its vicinity, make prognoses on the development of the situation on-site and off-site, and recommend protective actions for the public to the decision maker at national level.

Implementation at ENSI

- Within its emergency response task force, ENSI uses JRODOS with LASAT as primary prognosis tool for the impact assessment of radiological emergencies.

- Depending on the severity of the situation, prognoses for the radiological situation in vicinity of the power plant (up to approx. 50 km) and in Switzerland (up to approx. 300 km) are produced.

- The relevant results are exported automatically to a visualisation application using WPS and visualised on predefined background layers. After visualisation, these products are exported as PDF files and uploaded to the national electronic situation overview. Additionally, the main emergency response partners receive these results as SHP files

- Because they serve as intervention levels for protective actions for the public, only the following results were produced up to now (so-called DMK doses):

  - Effective Dose from external radiation and inhalation for adults; and

  - Thyroid organ dose for children (1 year old).

- These results were visualised by colour-coding the calculation grid to represent stipulated protective actions, as demonstrated by the following examples taken from past exercises:


Review and results

- As part of ENSI's continuous improvement process, we revised the list of products provided to our emergency response partners, including their presentation and visualisation. Regarding the latter, a special emphasis has been placed on 'speaking the language of our partners' to ensure an implicit mutual understanding.

- As a result, we expanded our product list and included new visualisation forms to provide a better, more easily understandable situation assessment and recommendation. The resulting list of products to provide to our emergency response partners reads as follows:

  - Potentially affected area in case of a release during the next 12 hours (based on a unit source term, produced once the emergency response task force becomes operational and recurrently every 6 hours);

  - Graphical representation of recommended protective actions, based on zoning provisions;

  - DMK doses (see above), visualised on the calculation grid using a colour scale representing the stipulated protective actions, overlaid with zone/sector boundaries;

  - DMK doses, visualised based on communal boundaries using a colour scale representing the stipulated protective actions, overlaid with zone/sector boundaries;

  - List of affected villages/towns/cities incl. maximum values for DMK doses;

  - Residual doses for DMK dose definitions, taking into account ENSI's recommendations on protective actions;

  - Ground contamination for Cs-137 and I-131 at the end of the simulation;

  - Dose rates at the end of the simulation;

  - Cloud arrival time; and

  - Visualisation of the meteorological situation (precipitation, wind velocity and direction).

- From the list above, all products are currently operational except for those in grey text colour. While some can be produced via GIS interface, others have to be created manually using Word forms.

Summary and Outlook

Summary

⇒ JRODOS is fully operational and the ENSI emergency response task force's main tool for the impact assessment in case of a radiological emergency at a nuclear installation in Switzerland.

⇒ As overview of the radiological situation for our emergency response partners, we produce a series of plots, containing only the necessary information and designed to be easily understandable.

Examples of products from past general emergency exercises:
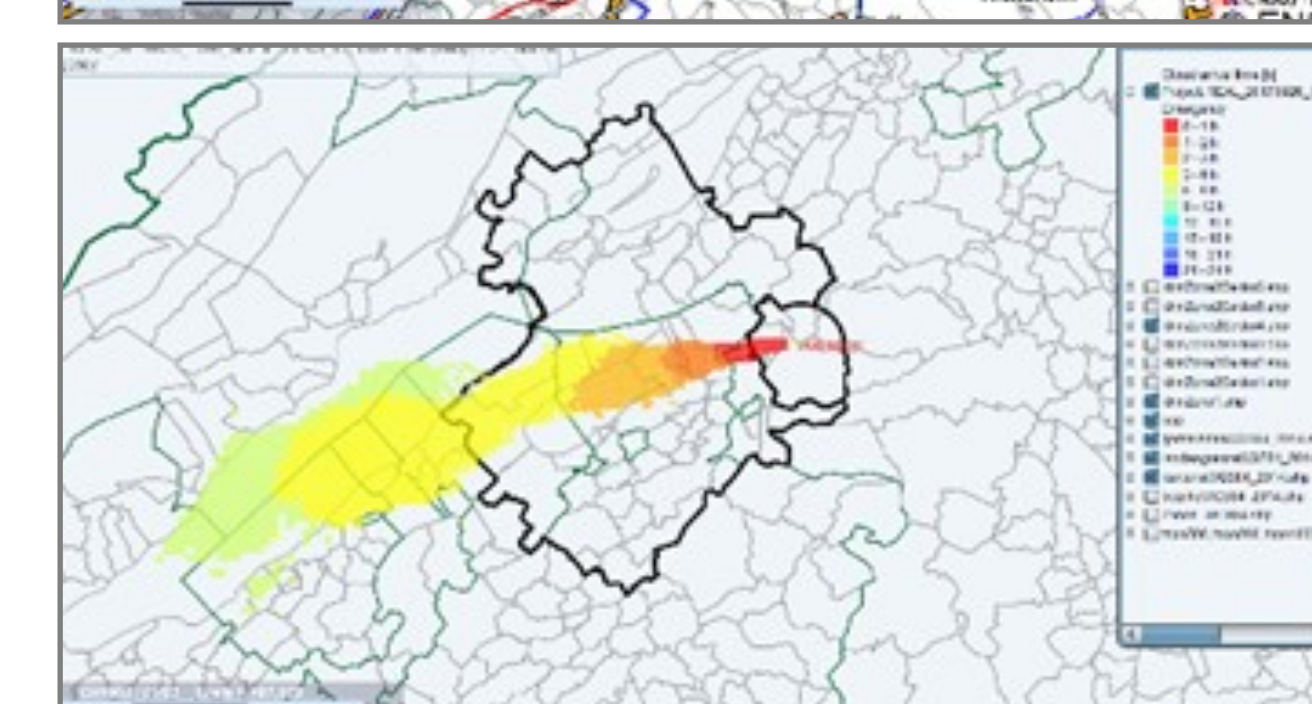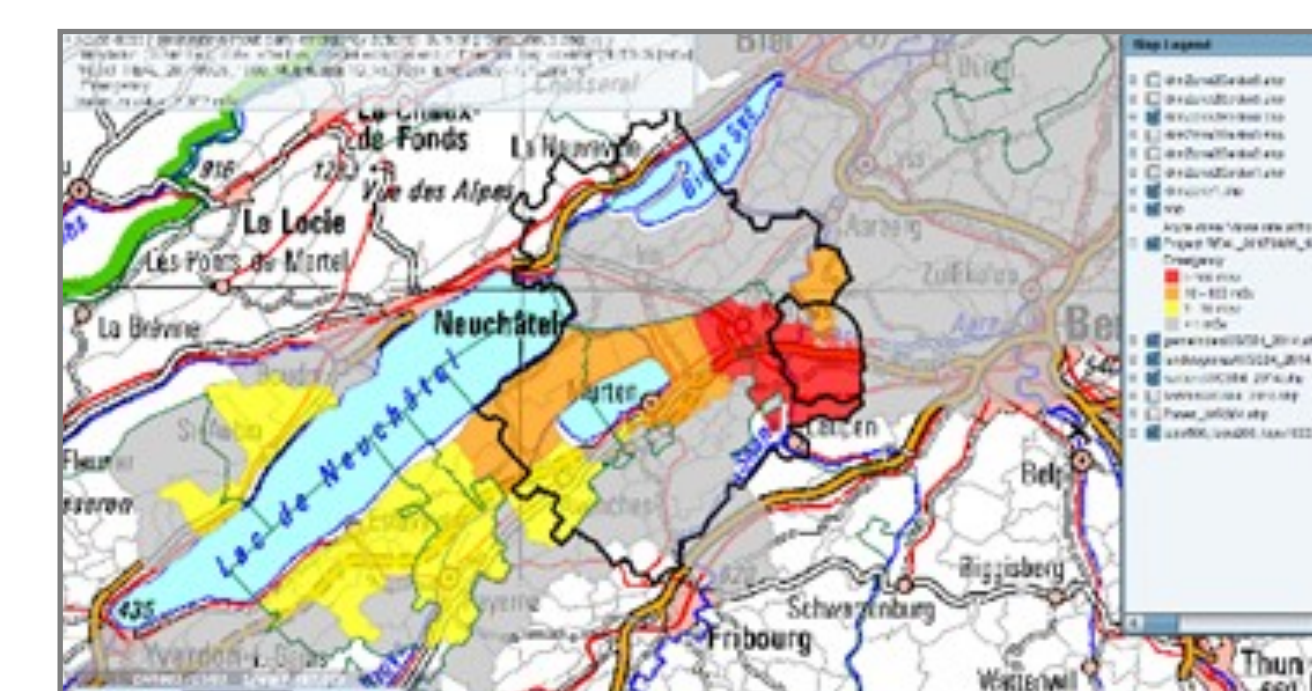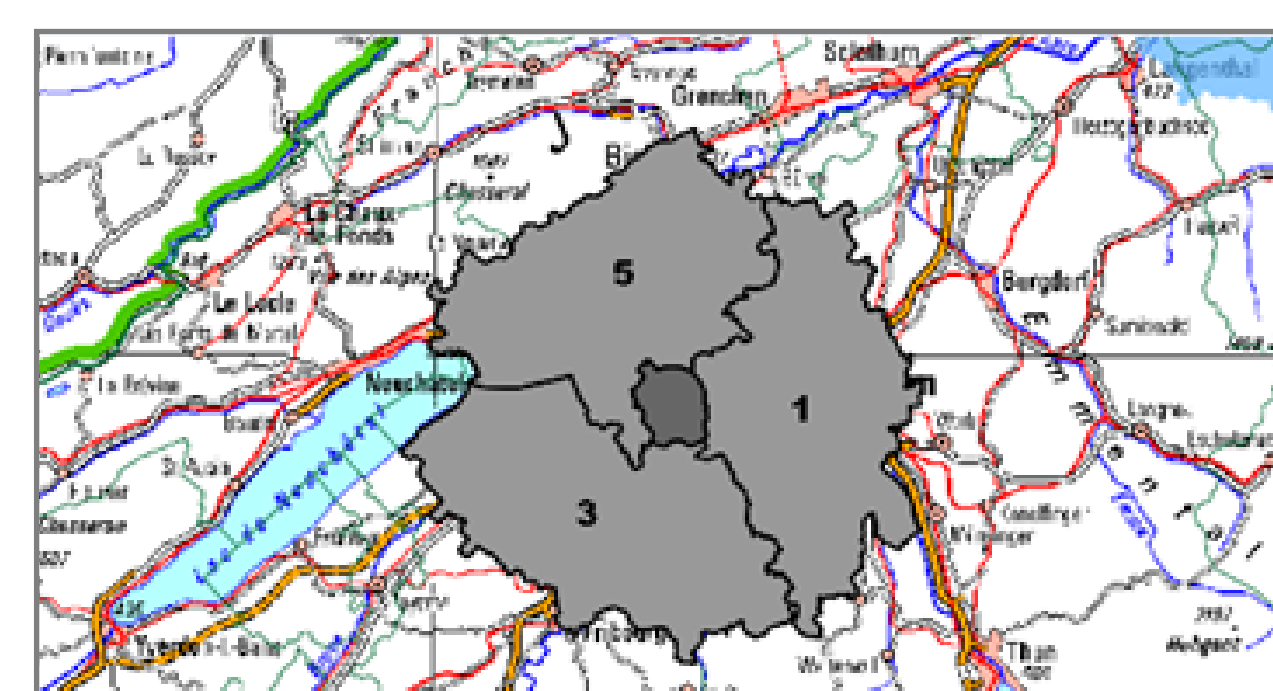
Legend:
Above left: potentially affected area in zones 1 (dark grey) and 2 (light grey) with sectors labelled; above right: effective dose from external radiation and inhalation for adults; below right: cloud arrival time in hourly steps.

Outlook

⇒ We intend to expand the current data flow to produce the remaining products as well.

⇒ In addition to the products themselves, we intend to revise the various checklists used to assess the situation, which are currently filled in by hand, scanned, and uploaded separately to the national electronic situation overview. Ideally, these lists will be filled in digitally and, augmented by the direct inclusion of the products mentioned above, synthesised into a situation report.