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Dispersion modeling of accidental releases of toxic gases – utility for the fire brigades.

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Several air dispersion models are available for prediction and simulation of the hazard areas associated with accidental releases of toxic gases. The most model packages (commercial or free of charge) include a chemical database, an intuitive graphical user interface (GUI) and automated graphical output for effective presentation of results. The models are designed especially for analyzing different accidental toxic release scenarios ("worst-case scenarios"), preparing emergency response plans and optimal countermeasures as well as for real-time risk assessment and management.
The research project RETOMOD (reference scenarios calculations for toxic gas releases – model systems and their utility for the fire brigade) was conducted by the Central Institute for Meteorology and Geodynamics (ZAMG) in cooperation with the Viennese fire brigade, OMV Refining & Marketing GmbH and Synex Ries & Greßlehner GmbH. RETOMOD was funded by the KIRAS safety research program of the Austrian Ministry of Transport, Innovation and Technology (www.kiras.at). The main tasks of this project were
1. Sensitivity study and optimization of the meteorological input for modeling of the hazard areas (human exposure) during the accidental toxic releases.
2. Comparison of several model packages (based on reference scenarios) in order to estimate the utility for the fire brigades.
For the purpose of our study the following models were tested and compared: ALOHA (Areal Location of Hazardous atmosphere, EPA), MEMPLEX (Keudel av-Technik GmbH), Trace (Safer System), Breeze (Trinity Consulting), SAM (Engineering office Lohmeyer). A set of reference scenarios for Chlorine, Ammoniac, Butane and Petrol were proceed, with the models above, in order to predict and estimate the human exposure during the event.
Furthermore, the application of the observation-based analysis and forecasting system INCA, developed in the Central Institute for Meteorology and Geodynamics (ZAMG) in case of toxic release was investigated. INCA (Integrated Nowcasting through Comprehensive Analysis) data are calculated operationally with 1 km horizontal resolution and based on the weather forecast model ALADIN. The meteorological field's analysis with INCA include: Temperature, Humidity, Wind, Precipitation, Cloudiness and Global Radiation. In the frame of the project INCA data were compared with measurements from the meteorological observational network, conducted at traffic-near sites in Vienna. INCA analysis and very short term forecast fields (up to 6 hours) are found to be an advanced possibility to provide on-line meteorological input for the model package used by the fire brigade.
Since the input requirements differ from model to model, and the outputs are based on unequal criteria for toxic area and exposure, a high degree of caution in the interpretation of the model results is required - especially in the case of slow wind speeds, stable atmospheric condition, and flow deflection by buildings in the urban area or by complex topography.