HARMO22

22nd International Conference on
Harmonisation within Atmospheric Dispersion Modelling for Regulatory Purposes
10-14 June 2024, Pärnu, Estonia

B.PREPARED : EMERGENCY PLANNING AND DECISION SUPPORT SYSTEM IN AUSTRIA FOR MANAGING ACCIDENTS INVOLVING HAZARDOUS SUBSTANCES

Sirma Stenzel, Kathrin Baumann-Stanze, Alexander Hieden

GeoSphere Austria, Vienna

Abstract: Dealing with an accident involving CBRN hazardous substances or toxic materials presents an enormous challenge to the authorities and the emergency services involved due to the high dynamic of the situation and the potentially immense damage. The timely availability of all carefully prepared decision criteria based on current information is a major factor contributing to the successful management of such a situation with the goal of limiting detrimental effects on the health of the population and damage to the environment. The goal of B.PREPARED was to design a prototype for emergency planning and decision-support system for emergency responders and authorities to support them in managing accidents involving hazardous substances. This system will contain threat situation updates, using available data or reference scenarios, information exchange within the first responders, and modelled hazard forecasting in order to provide appropriate decision-making support based on the current information status. The basis for this is, upon other terms, the accurate preparation of the meteorological input data for the models, the definition of suitable procedures to determine the source term and the situation-specific employment of model calculations for the hazard forecast including consideration of the local relevant influence factors. In the frame of the project, the application of three dispersion models for local-scale emergency prediction for airborne hazards in built environments were tested and compared, based on reference scenarios. Great emphasis was placed on the design of the processes to guarantee stakeholder acceptance and usability.

This study was conducted by GeoSphere Austria (former Central Institute for Meteorology and Geodynamics, ZAMG) with project leader JOANNEUM RESEARCH Forschungsgesellschaft mbH (JR) and in cooperation with Chemiepark Linz Betriebsfeuerwehr GmbH (CPLBTF), Oö. Landes-Feuerwehrverband (OÖLFV), the professional fire brigades in Graz (BFGRAZ), Magistratsdirektion der Stadt Graz, Sicherheitsmanagement und Bevölkerungsschutz (MDGRAZ), Disaster Competence Network Austria (DCNA), IRIS - Industrial Risk and Safety Solutions e.U. (IRIS), Intergraph Ges.m.b.H. (HEXAGON), and funded by the KIRAS safety research program at the Austrian Ministry of Finance (www.kiras.at).

Key words: *emergency responce and planing, dispersion modelling for accidental release,local-scale emergrncy prediction*

INTRODUCTION

In case of an accidental release of hazardous gases in the atmosphere, the emergency responders need fast information about: the direction and the dimension of the gas dispersion and the area in which optimal countermeasures should be taken. Huge progress has been made in the past decade concerning the modelling and simulation of the effect of accidents with hazardous substances and their atmospheric dispersion. In order to obtain accurate results, a number of input parameters for the meteorological input and the source term must be considered, not least the buildings structure in urban areas. Aim of the project was to design a prototype for emergency planning and decision-support system for emergency responders and authorities in order to support them in managing accidents involving hazardous substances. On the frame of the workshops during the project, an overview of the available meteorological input data and small-scale dispersion models, according to the state of the art were presented. The requirements for the model results from the perspective of the emergency services as well as challenges in collecting the required model input data were discussed. System requirements were collected in working groups and compared with the current status and questions regarding emergency communication. The concept for the development of the system can be seen in Figure 1.

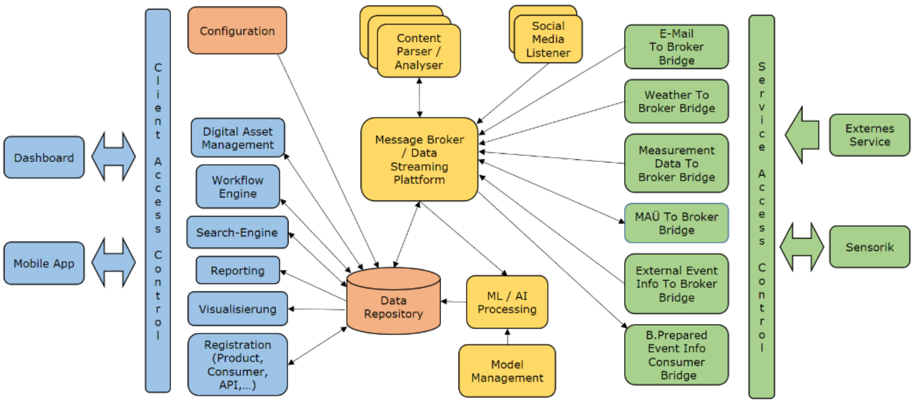

Figure 1. Concept of the modules integrated in the B.Prepared System.

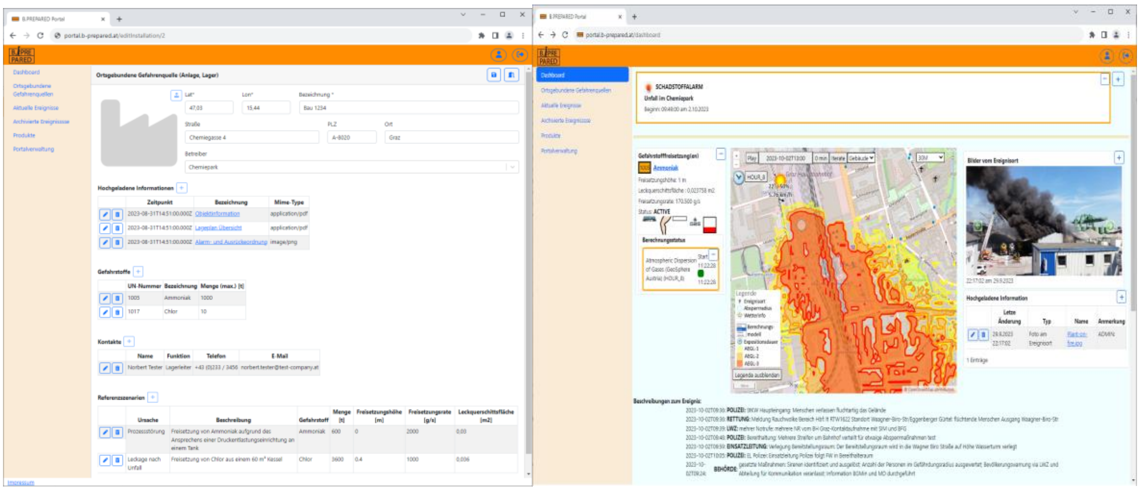

Figure 2. Example of the input interface (left) and the Dashboard (right) in the B.Prepared System.

Model calculations for two scenarios, an industrial accident at a SEVESO site (Chemiepark Linz) and a transport accident (Graz train station), were conducted with the modells ALOHA (https://www.epa.gov/cameo/aloha-software) and LASAT (Janicke, 2019) and implemented in the B.Prepared System. As a working basis, scenarios and data based on emergency plans and accident data as well as existing data sets from authorities were collected, and an analysis of possible use cases was carried out through literature and case studies. Reference scenarios were developed in collaboration with stakeholders and project partners. Three levels of complexity were calculated concerning the topogryphy: flat terrain, terrain and terrain and buildings. For the test scenarios in Linz and Graz, wind field libraries were created in advance for selected areas using the MISKAM CFD model (J. Eichhorn und A. Kniffka, 2010). A process for situation assessment and impact assessment of accidents involving the release of hazardous substances has been defined, which describes the required data and the communication channels. The need to integrate existing processes and structures as well as the abilities of those involved to collect data for model calculations were taken into account.

The results of the ALOHA and LASAT models for the test scenarios at the Graz Central Station are shown below. The two dispersion models differ greatly in terms of the complexity of the simulation and also slightly in terms of the input parameters required to describe the meteorological conditions and the release. The calculated danger zones are correspondingly different. The various LASAT runs show that considering the terrain or/and the buildings in the area can significantly influences the local wind field. On the one hand, this leads to a deflection of the cloud of hazardous substances and faster dilution due to higher turbulence. The resulting danger zones is correspondingly smaller. The influence of the terrain is not so dominant in the two selected areas, but can be the main influencing factor elsewhere, in more structured terrain.

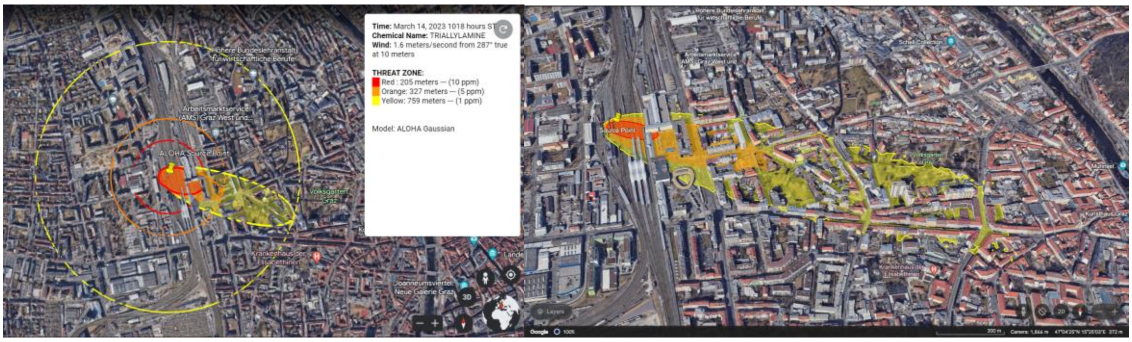

Figure 3: Threat zone, based on the thresholdvalues, calculated with ALOHA (left) with LASAT (1st run - flat, without buildings, right) for the accident release scenario at Graz train station. ((Map data ©2022 Google)

Figure 4. Threat zone, based on the thresholdvalues, calculated with LASAT (2.nd run – with terrrain) for the accident release scenario at Graz train station (Map data ©2022 Google)

Figure 5. Threat zone, based on the thresholdvalues, calculated with LASAT (3.nd run – with terrrain and buildings) for the accident release scenario at Graz train station. (Map data ©2022 Google).

An Example of some further visaulisation features in the B.Prepared System are shown in the Figure 6.

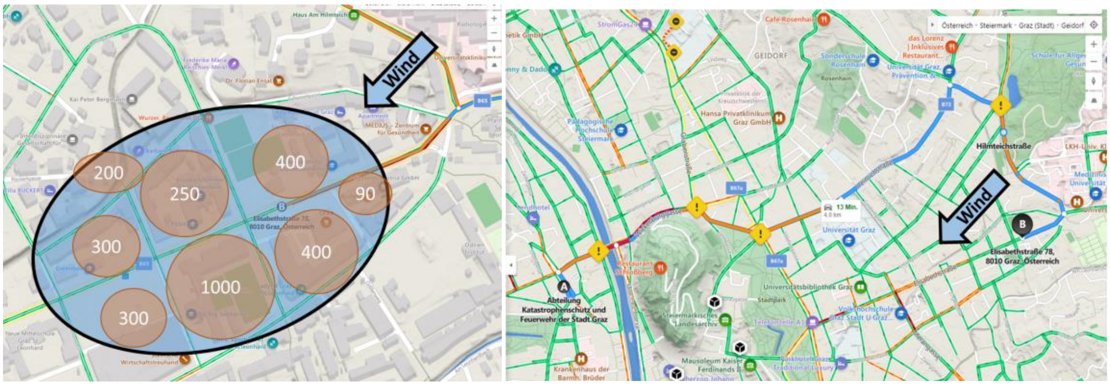

Figure 6. Example of the number of people affected in the threas zone (left) and a proposed transport way for the first responders (right).

CONCLUSIONS

The applicability and usability of the B.Prepared System tool, developed in the project, were evaluated using representative scenarios together with the target audience in the form of two tabletop exercises, partly with the support of Virtual Reality Training (XVR). The authority and first responder organizations confirmed the need for such a solution and expressed the hope that it could be further developed into a product that can be used in practice as quickly as possible. The implementation of dispesrion modells for local-scale emergency prediction for airborne hazards in built environments, into the system was tested. Although enough products are available that employs more complex dispersion models to assess the consequences of an accident, in Austria, there is still a demand of a further development and implementation of a complete and harmonised system, which can include and connect all the currently available data, model simulations and information. This kind of a system can provide support to both, emergency responders and decision – makers in coping with the situation in case of an accidental release of toxic substances as well for the emergency planing and managment.

REFERENCES

Janicke Consulting, 2019: Dispersion Model LASAT Version 3.4 Reference book.

J. Eichhorn und A. Kniffka, 2010: „The numerical flow model MISKAM: State of development and evaluation of the basic version,“ Meteorologische Zeitschrift, Vol. 19, No. 1, pp. 81-90,.