

Selected Software Tools Used for CBRN Situation Assessment within CZECH Armed Forces Chemical Corps

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In relatively recent time the Czech Republic (CR) has become a steady part of North Atlantic Treaty Organization (NATO). By this it has taken over an obligation to accept NATO methodic, procedures and standards which create a framework of forces' operational activities. Obligations that CR has introduced are very important not only for development of military rules of all doctrine levels but also for development of special software products which have to respect those obligations and rules set in military publications.

The current time is, more than in history, characterized by rapid development of software products for the evaluation of radiological, chemical and biological situation. In recent time a process of implementing of a new tactical alliance publication, which is known in short as ATP-45 D has been completed. The version "D" enhances properties of version "C" and it is incorporated in a new software tool CBRN Anlysis™. Likewise, it has recently launched a new product of HPAC in version 5.0 which has enhanced the version of 4.0.4. The main question is: Why do we need new uniform software tools for supporting of military commanders' decision-making process in the whole spectrum of military operations?

A term of CBRN situation evaluation is defined as a result of a detailed analysis of a character and a scope of air, terrain, troops and inhabitants contamination caused by Radioactive (Radiological) Agents, Biological Warfare Agents, Chemical Warfare Agents and Toxic Industrial Materials (TIM). It also involves their effects of units' combat capability, industrial objects work, inhabitants and environment. Evaluation creates a base for protective measurements setting [1].

Providing of high quality information concerning both potential Weapons of Mass Destruction (WMD) employment and activities in places where some contamination can be caused by TICs leakage is fundamental for each commander. As well it is significant to provide information concerning the scope of radiological, chemical and biological contamination to operational commanders as quick and exact as possible. This quickness and exactness is assured by very sophisticated software between them NBC-Analysis, resp. CBRN-Analysis™ a HPAC ve verzi 5.0 belong to.

In accordance with the Czech Armed forces Battle Rule measurements of both force protection and support of troops operations belong to so called passive activities [2]. They are performed to reduce the enemy's efficiency of command weapon systems and to ensure protection against their effects. In an area of Chemical, Biological, Radiological and Nuclear (CBRN) protection and chemical support we speak about measurements which belong to the group of CBRN situation monitoring as a part of chemical support and, moreover the warning and reporting as a part of special measurement of force protection in a category of CBRN protection.

CBRN-Analysis™ is a final software solution for support of CBRN risk management. This solution is suggested to quickly provide exact information to military commanders. It increases their survey about CBRN situation on a field. It supports effectively and improves incident

management in all phases of operation, thus from the phase of force deployment to after conflict restoration.

CBRN-Analysis™ is a commercial application package used for CBRN Defense for warning and reporting against CBRN threats and results of nuclear, biological and chemical incidents. It is intended for military defense forces and institutions responsible for emergency plans. It is suitable not only for organizations working on protection of the environment, but also for other institutions working in emergency situations for the benefit of the civilian population.

Benefits from using this product can be seen:

- In imminent prediction of danger and in a graphical summary of threat of affected units and vulnerable areas
- In the ability to notify subordinate units about radiation, chemical and biological threats
- In the exact basis for quick and exact decisions
- In the immediate presentation of the strategic, operational and tactical CBRN situation
- In a presentation for the press conference organized by command (control) authorities responsible for evaluation of CBRN situation
- In a quick overview of the effects of the secondary damage due to the TIC release.
- In a quick and reliable estimation of losses

In the text introduced above it is clear that in "combined operations" is very important to speak with "one language". This is valid not only in an oral communication but also in communication through in the digital world.

Principle changes between version "C" and "D" can be mainly seen in [3,4]:

CBRN message format changes, new formats and styles of messages will be designed strictly in accordance with the ATP-45 D. Used versions are reviewed in accordance with APP-11 (C) Proposed amendments presented in the 457 and 500.

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Received August 02, 2012; Accepted August 02, 2012; Published August 03, 2012

Citation: Otrisal P (2012) Selected Software Tools Used for CBRN Situation Assessment within CZECH Armed Forces Chemical Corps. J Def Manag 2:e115. doi:10.4172/2167-0374.1000e115

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Changes of the calculations concerning of the prediction and evaluation of the effects of chemical and biological weapons. The changes relate to work with the results of calculations and predictions evaluation of the consequences of chemical and biological weapons usage;

Addition of Toxic industrial Materials (TIM) in the calculation of CHEM, respectively BIO different categories of WMD, TIM are newly included in the reports identified either CHEM or BIO. It follows that there is even a merger the calculations concerning.

Event-related changes of calculations with the prediction and evaluation of the effects of the use of nuclear weapons employment and industrial releases of radioactive substances. These changes are not essential.

Change the existing system of so far forecasting and evaluating events ROTA (Release Other Than Attack) as it relates to radiological and nuclear materials into the new evaluation system RAD.

Changes in the handbook of ERG2008, until such time as the specifics of the use of ATP-45 (D) will be clear to change of the distances listed in ERG 2008 will not be done.

The change (introduction) "Exercise Planning-Hypothetical CBRN 5 both NUC and CHEM. Removing XRAYB will require updates to the creation and use of CBRN 5 messages. This update is not crucial for the system.

Software Product HPAC in the Version of 5.0 is based on the original version, it means in version 4.04 SP4. Automated software, the system HPAC (Hazard Prediction and Assessment Capability) is produced by an organization called DTRA (Defense Threat Reduction Agency). It serves for accurate forecasting and evaluating the effects of hazardous substances by the use of WMD or the outburst of TICs. It provides users the means to predict the influence of outflow of dangerous substances into the atmosphere and the potential impact of such events on the civilian population and combat troops in the field. The system uses highly accurate weather forecasts and analyzes the movement of air masses for dispersion modeling for hazardous areas generated by the military or terrorist incidents or industrial accidents.

The operation of Desert Storm illustrated the need automated tools for prediction threats. During this mission prediction of possible effects of WMD were done in an inadequate and premature way. The predictions were secured by sending requests on the analysis from the scene of operations to the Defense Nuclear Agency (predecessor of the Defense Threat Reduction Agency) in USA. The results of the analysis prediction were then sent back to the theater of operation. This experience caused efforts to risk prediction tool is available in theater.

Product HPAC models effects of nuclear, biological, chemical and radiological incidents, which occurred during a conventional attack on the enemy's WMD, critical manufacturing plants, warehouses, etc. The software system of HPAC also enables to predict the areas which become dangerous when the wind attacked with nuclear weapons, nuclear reactor accidents, etc.

The relevant forecasts of real danger zones require the provision of timely and accurate meteorological data related to interested space. The system allows to the user to relatively easy access to both the predictor data and also data about weather conditions in the real time (the results of observation) if they are user-accessible supporting meteorological data servers DTRA. The system also incorporates the historical

climatological and meteorological data for use in cases when working with a planned incident in the normal time frame unlinked to credible data about weather forecasting using data on the ground in zone one kilometer and support models of air currents (wind) has to calculate the local wind field in the pet space. Data from other various sources can also be obtained from DTRA.

HPAC supports many other various methods of integration of meteorological data and model can be operated even in real-time mode. The model is normally running on ordinary personal computer. There are versions for UNIX platforms.

It is important that system HPAC helps with the use of probability the calculations concerning answering the question "How good is the prediction?" For the dangerous areas to we have to ensure the valuation impact of the degree of uncertainty of weather and turbulence can track the movement of flaps (feet) contamination in the air and calculate its influence in hazardous areas, indicating the degree of reliability

In version 5.0 there have been made some significant improvements that are possible in the component architecture improvements seen in [5]:

- Allowing access to individual abilities through Java
- Interface, which interactively describes how to access all five applications
- Control projects over the so-called dispersion manager
- That control the dispersion is strongly associated with process, which facilitates integration with other calculators of variance
- Allow direct invocation interface "Incident Model"
- That there is no need for conversion of data incident (model) to / from the chemical (biological) response crises, thereby significantly simplifying the process and reduce overhead costs
- The fact that a "logic" and "scope" is located in model "parts" and not "in a client code"

Application modules have been improved in the following:

- All characteristics of radiological and nuclear weapons employment are based on the same data sets, regardless the type of resources
- Events related to nuclear weapons newly using sophisticated new formula for calculation. In the previous version of the model was used to break t-1.3
- Calculated with the fact that the inhalation of radioactive particles depends on their size and it is made on the basis of recent findings by modeling individual responses
- There may be a combination of concentration in the air and soil resulting from the deposition of different isotopes of certain groups or isotopes
- In the HPAC can now run multiple radiological or nuclear incidents, which can be combined into a single output
- Can combine multiple plots of benefits for all cases
- Users can set parameters for smoke generator and events associated with the use of smoke munitions

- Concentration of the continuous release of the ammunition can be plotted using customizable seats for observers
 - Properties of materials were divided into individual files. Similarly, evaluation of the properties file it is divided
 - Introduced 30 new materials
 - The introduction of a definition of “new material” to be saved to a file server, and possibility of its editing;
 - HPAC 5.0 has new functionality using Internet mapping service with the use of the Web servers of Google and Yahoo
 - Users can upload their own HPAC “pen” that can be superimposed either over the map, or via a satellite high-resolution images, the advantage of these images it is that they are using data stored in large libraries
 - New services use AJAX technology, which is used for quickly enter data into maps and satellite images of most of the world
 - Users can customize the map by clicking and dragging the image and using “zoom” by clicking the cursor picture to adjust the display size
 - User can map (on the selected site) show significant features that might be important to determine the effect of toxic substances
 - XML format is used for flexible and future-compatible recall data
 - Zip file is generated for output of results (this technology is used instead of the directory system: server\ users\username\ Project Name)
 - In urban areas is processed incident after the releases of liquid substances and secondary evaporation
 - Dual display is enabled
 - Database expanded to 10 cities
 - They used data from the census of 2005. It is based on their residence. The newer approach was used to calculate the estimated amount of day and night time. This allows to the determine how people move from residential neighborhoods to commercial areas in the morning and return in the evening
 - In more rural areas were administered highly distinctive images of construction sites. Previously used locating of people in such a way that they are now located in places where they are building. This substantial improvement was made on the grounds that the calculation of the danger area was accurate
 - Allows for the evaporation of secondary toxic substances
 - Are built into the initial events of development resources and integrated sensor technology with the ability to “back-track”, called the joint effect model
 - Introduces the application of error correction
 - There is the ability to receive additional data from files MEDOC
 - Fixed a problem with global domains necessary for application of dual events CBWpn
 - Integrated new a quasi-steady model that is flexible and works with a plastic model of the connection. It allows creating detailed and advanced models. This model is applicable in all doors, walls and windows. They are considered the criteria of specific disorders depend on the type of connection and her power
 - A new integrated model of the explosive thermo baric advanced model. This option is classified capabilities to work for qualified users
 - A new integrated model for the first layer of dry bio-agent or dry biological agent or toxin origin. Using the internal surfaces is applied to a more advanced model
 - A new integrated model of encoding that represents the relative humidity effects in detailed and advanced models. This model, which affects the hydration of the dispute, was originally applied to interior surfaces. It also affects the evaporation rate of wet bio-agent aerosols, especially cold
 - Reaction database has been updated to the current threat missiles
 - Increased ability to capture the high elevations of the original 120 km in 700 km of new
 - Introduced an improved algorithm for the release of very large container storage. Model improvements are subject in leakage caused by debris and generally allows to the calculation of large quantities of spillage of loose container
 - Added option-type surface and improve the calculation of the surface effect, which increases the extent of the spreading area of the pool
 - Was implemented a simple model of “liquid evaporation pool” for “high vapor” pressure (for example chlorine, ammonia), which is responsible for rapid self-cooling pool in very low temperatures
 - Introduced the release of a better algorithm for very large container vessels. Model improvements are subject in leakage caused by a variant of “air blast” impact or overturning. Generally allows a better opportunity to determine the quantity of toxic substances released from the container
 - Has expanded the number of uncovered weapons newly in six on the basis of data in accordance with the DTRA Handbook for WMD
 - Added a new parameter for operational incident. It added the system to allow in input parameters such as operational performance and initial operating performance
 - NFAC application is now connected with the possibility of increasing the number of isotopes. There is possibility of calculating the release rate of isotopes and possibility to enter their concentrations
 - Innovation is the ability to view data files of SEE 2007 CADRG type data sets
- Qualitative and quantitative new approaches in evaluation of the CBRN situation will affect not only training specialists of the Chemical Corps of the Czech Armed Forces, but also to decision-making process support commanders and staff task forces will be processed. Well

prepared commanders and soldiers can very simply communicate in the whole spectrum of operations. Nowadays, there are some problems and challenges we have to solve. The most important ones concern a lot of older versions which are introduced in armies. These are not well able to communicate each other.

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