

The FALCON decision support system: Preparing communities for weapons of opportunity

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Abstract

Since September 11, 2001, awareness of potential terrorist targets has increased greatly. Industrial chemicals, either in storage or transport, are now considered dangerously accessible materials that could be used to cause substantial harm. In response to this new threat, emergency organizations are beginning to plan for such possible chemical releases. Currently there is no tool that allows a community to track, analyze, query, and display data about these chemical “weapons of opportunity” and the readiness of the communities around them.

Decision support systems are computer environments designed to assist decision makers within a particular problem-solving context. A particular type of DSS, environmental decision support systems (EDSS), assists environmental scientists and planners in making environmental management decisions. A hazardous materials decision support system called “FALCON” will assist emergency organizations by integrating information describing chemical inventories, security, health readiness, geography, and population into one information system. Emergency organizations will be able to assess response readiness of a community for chemical releases and prioritize antidote stockpiling, training, and security. Emergency organizations and first responders will use the FALCON DSS to simulate and prepare for real-time events, assess possible casualties, and receive emergency contact information. And with the help of FALCON, law enforcement and security personnel will be able to evaluate and augment protection of the most dangerous facilities.

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1. Introduction

As local communities plan for possible terrorist attacks, industrial chemicals have been recognized as potential “weapons of opportunity.” The need has arisen for a comprehensive and easy-to-use method of determining possible outcomes of hazardous chemical releases. Decision support systems (DSS) can help decision makers plan responses to potential catastrophic events associated with the release of hazardous materials (HAZMAT). Decision support systems are computer environments designed to assist decision makers within a particular problem-solving context. A particular type of DSS,

environmental decision support systems (EDSS), assists environmental scientists and planners in making environmental management decisions. Focusing on specific problems and decision makers, these systems work by integrating data and analytical tools within a single application environment. The information in a DSS must be timely with respect to the dynamics of the decision problem, accurate in relation to the information requirements and easily obtainable, in order to provide relevant information to the user quickly and reliably. The available decision support systems addressing hazardous materials are lacking in three major areas: they lack risk assessment scales that rank the risk posed by a potential release depending on the toxicity of the chemical; they do not make provisions for preparedness of hospitals in the region, which will respond to chemical emergencies; and they do not consider the security systems which

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may or may not be employed to protect industrial chemicals from criminal actions.

The FALCON decision support system has been designed to facilitate hazardous materials vulnerability assessment and will be used at both a local and a regional level throughout the United States. The system will integrate chemical inventory data, toxicity data, health care readiness data, population data, security data, risk assessment models, and air and water dispersion models. Using FALCON, emergency managers will be able to simulate possible scenarios and determine the potential outcomes. More importantly, emergency response planners, health care providers and emergency medical services (EMS) training personnel will also have the ability to evaluate community preparedness in response to catastrophic spills or releases and will therefore be able to prioritize training and resources. Finally, law enforcement and security personnel will be able to identify facilities most in need of additional security system development.

2. The problem

Advance preparation and planning is the best method of dealing with any type of catastrophe, and it is essential for saving lives. The need for the FALCON DSS exists because there is currently no system that will allow an emergency response planner to query, analyze, and display chemical inventory data, health readiness data, geographic data, and population data, while at the same time creating dispersion models and response readiness assessments. Without these capabilities, planners are ill prepared to prioritize training or allocate proper resources for possible chemical emergencies based on vulnerability.

Emergency planners lack a tool that integrates an inventory of hazardous materials in the community with health planning data, response readiness assessment models, and security system assessments. These planners need the ability to make decisions using “what if” scenarios based on comprehensive risk assessment of the chemicals stored in their regions and the toxicity of these chemicals. Then, with this knowledge, emergency managers can begin to assess the response readiness of their regional hospitals regarding a chemical emergency and to address prioritizations for antidote stockpiling and training of hospital staff. During a real chemical event, first responders will need to identify the chemicals in the facility and their toxicity information, as well as with any nearby chemical storage or transport sites that could be impacted by the event. First responders also need to be able to identify the locations and contact information of all health care facilities within a specified distance, and project the number of exposures and potential casualties from the event over a period of time while preparing for the safety of other emergency responders. Law enforcement and security personnel need to be able to identify those facilities which have the weakest security system and which present the greatest health risk in the event of a catastrophic release. These facilities may then be the focus of security improvement efforts, or enhanced patrol/protection during periods of heightened alert.

3. Existing software

There are several software packages currently available which have similar components to the FALCON DSS.

3.1. *Cameo*

Developed by the Environmental Protection Agency’s (EPA) chemical Emergency Preparedness and Prevention Office (CEPPO) and the National Oceanic and Atmospheric Administration Office of Response and Restoration (NOAA), Computer Aided Management of Emergency Operations (CAMEO) is a system which incorporates a few software applications to assist first responders in gaining accurate information quickly during a time of emergency or for use in planning for possible chemical release situations. CAMEO has a chemical database, an air dispersion model, and a simple mapping capability. Widely used to plan for and respond to chemical emergencies, it helps its users meet the chemical inventory reporting requirements of the Emergency Planning and Community Right-to-Know Act (EPCRA or SARA Title III). It was created primarily for firefighters, police and local emergency response personnel who did not have accurate information about chemicals nor the proper safety response actions readily available to assist them. CAMEO is also now being used by industries, schools, environmental organizations, state emergency commissions (SERCs) and the Tribal Emergency Response Commissions (TERCs).

CAMEO is really a suite of three separate software applications – CAMEO, Marplot and Aloha. The original application contains a database of hazardous chemicals, with chemical-specific information on cleanup procedures, health hazards, fire and explosive hazards, firefighting techniques, and protective clothing. The user could enter basic information taken from the EPCRA Tier II forms (or their equivalent) required by the EPA from the chemical inventory of a facility. Included are additional templates to store EPCRA information. Another part of the software is MARPLOT, allowing the user to display maps from the U.S. Bureau of Census TIGER/Line files, displaying data such as roads, facilities, and schools. MARPLOT could be combined with ALOHA, an atmospheric dispersion model, allowing the user to estimate the downwind dispersion of a chemical cloud based on atmospheric conditions and the chemical’s physical characteristics. A “cloud footprint”, plume, can be plotted on maps. A separate software application, LandView can also be used to display demographic/economic information and EPA environmental databases.

Primarily used as a database of over six thousand hazardous chemicals, the database does not include health readiness data, a ranking of chemicals that pose the greatest risk in terms of potential health impact, potential number of casualties over time (how many, how fast), ease of detecting exposure, need for rapid treatment and complexity of medical treatment. The FALCON DSS, on the other hand, would also include medical facility locations, which facilities are prepared for that an event if a chemical event were to occur and types of antidotes, training and equipment that are available and

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