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Special Population Planner: An Emergency Planning GIS

By Jim Kuiper and Dan Miller

Argonne National Laboratory developed and implemented an emergency planning GIS focused on special needs populations to support the State of Alabama Emergency Management Agency's Chemical Stockpile Emergency Preparedness Program. The Special Population Planner (SPP) was developed as a county-level emergency planning system with detailed, geographically referenced information about populations, facilities, potential events, emergency response resources, infrastructure, and traffic control points.

The SPP permits easy production of maps, reports, and analyses to develop and revise emergency response plans. It is a broadly applicable GIS designed to support emergency planners as they address emergency management issues.

Emergency Planning for Special Needs Populations

Planning for the needs of the handicapped is now a standard practice in the design and construction of buildings. However, much remains undone in addressing emergency planning issues for the handicapped and others, such as latchkey children, who may have difficulty responding to an emergency without assistance.

The stories of wheelchair-bound individuals in the World Trade Center on September 11, 2001 are a chilling reminder. One woman had a specialized chair that allowed her to be carried to safety from the 68th floor, while a wheelchair-bound man who worked on the 27th floor lacked such a chair. He and a friend who waited for help from emergency responders died in the collapse (HR 2001, Newsday.com 2001, WRAL.com 2001).

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Mapping the Trails of Lake County

By Richard Hilton and Keith Caldwell

Not too long ago the word "trail" would conjure up rustic images of dirt paths in state and national parks. Over the last decade in northeastern Illinois and many other parts of the country, trails have become popular and important components in recreation and transportation plans. Many miles of new trails have been created and much greater expansion is expected.

Trails serve a number of purposes for the public and enjoy wide support. There are now a number of web sites that offer information about the trail system in northeastern Illinois. However, most websites deal only with portions of the overall evolving trail system. Maps, if present, vary widely in their level of detail, accuracy, and currency. It can be difficult to distinguish between what has

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It is speculative to conclude that the efforts of an emergency planner would have changed the outcome for a particular individual, but the example does highlight that effective emergency planning must first identify unique situations where individuals or groups may have difficulty responding to an emergency, and then plan accordingly for the assistance needed.

The Special Population Planner is a GIS tool produced by Argonne National Laboratory for the Alabama Emergency Management Agency. It is used by emergency planners supporting the Chemical Stockpile Emergency Planning Program (CSEPP) to identify and plan for the needs of special populations in emergency situations. Special populations identified in the project include those with physical or mental limitations, persons without transportation, and persons too young to drive.

The SPP GIS database covers a six-county region around the Anniston Army Depot in northeastern Alabama, the location of a large U.S. Army stockpile of aging chemical weapons that are scheduled for destruction. Although the chance of a large release of chemical agents into the air before destruction is complete is considered very low, such an accident would require rapid implementation of protective actions for threatened residents.

Two planning zones are used for emergency planning around the depot. The Immediate Response Zone (IRZ) encompasses an area of 8–10 miles around the site where the response to an accident would be most urgent. The Protective Action Zone (PAZ) is the area 8–30 miles around the site that could be affected by a chemical release, but less quickly than the IRZ.

Identifying and Locating Facilities and Special Needs Persons

The first requirement when planning for special needs populations is finding them. In this case we used an aggressive public safety survey with saturation mailings to invite those with special needs to identify themselves. Telephone interviews were conducted with persons referred by others as possibly having special needs.

SPP presents relevant information to the planner in a graphic interface that includes evacuation routes, resources, and traffic control points.

All mailings were synchronized with newspaper and radio announcements and with letters to community leaders. Our survey identified approximately 2,691 persons with special needs from 31,000 IRZ households and 1,586 persons from among 125,000 less-intensively surveyed PAZ households.

The data collection effort also targeted facilities for which unique planning would be required. These facilities include areas of public congregation (e.g., churches, malls, hotels); facilities hosting controlled populations (e.g., hospitals, schools, nursing homes); facilities with loud noise environments where public warning sirens could be difficult to hear; and facilities with large numbers of employees.

The data on special needs individuals and facilities were compiled into two database tables (Persons and Facilities). Address geocoding was used to spatially locate these database records.

Geocoding involves locating a point in a GIS layer based on a specific street address. The process requires a street layer in the GIS coded with street names, address ranges, and zip codes. For the six-county project area, U.S. Census Bureau TIGER street data were examined to assess the capability of the information to support geocoding.

In the initial street layer, only 27% of the streets had both name and address attributes: 2,981 street miles had name and address ranges while 4,046 street miles had names but no address range, and 4,059 street miles had no name or address range.

To improve the geocoding process, the TIGER street layer was extensively edited. This process involved close cooperation and data sharing with local E-911 centers, developing editing tools, and extensive editing of the TIGER data to provide more complete information. In the end, nearly all of the Persons and Facilities records were successfully geocoded using the revised street layer.

Special Population Planner

SPP is an extension of a commercial GIS system that provides the GIS interface to the database. It was designed to simplify map visualization, analysis, reporting, and database maintenance related to emergency plans and to create and retrieve text-based emergency response plans.

SPP presents relevant information to the planner in a graphic inter-

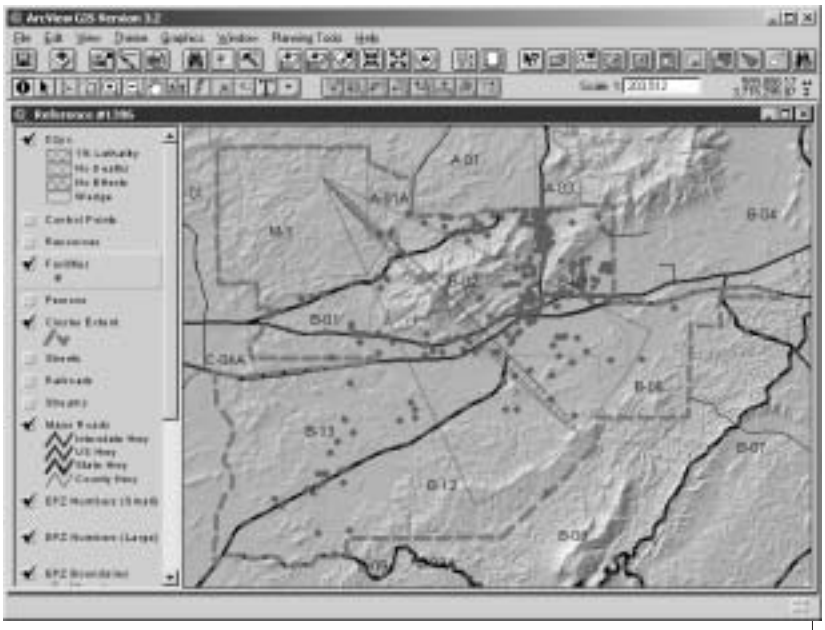

Figure 1. Example SPP Map Display

face that includes evacuation routes, resources, and traffic control points. For analysis of CSEPP-related chemical release emergencies, it displays an air dispersion model result and shows the locations of special-needs individuals and facilities in the affected area.

The SPP planning tools use the IRZ and PAZ planning zones and predetermined emergency events familiar to the planners from their other CSEPP activities and software.

In SPP users can define their own emergency events, specify the planning zones they cover, and formulate plans for those zones. When a user selects an emergency event for planning or response, SPP generates a map of the planning zones and supporting GIS layers associated with the event and enables tools for planning (Figure 1).

Point locations of special-needs persons, facilities, and other layers are dynamically generated from the database. Many custom reports are available to summarize the results for the event being analyzed. The planning tools are sufficiently generic to adapt to a wide range of emergency planning and response needs.

The system also includes tools for database maintenance. These capabilities include individual record editing, batch-table update tools, a location editor for point locations, and street-editing tools to update the street layer. The location editor tool (Figure 2) is used to input or edit locations using a street address, map coordinate, or by clicking within the map view.

An attribute table editor tool (Figure 2) is used in editing many of the supporting database tables by communicating with the database with SQL statements. This tool is an example of the flexibility designed into the SPP. Because the attribute editor window dynamically adapts to the structure of the table being edited, no additional programming is needed to edit records of new tables added to the SPP. As the database is updated, changes to the underlying database are immediately available to planners.

The success of the system is due in part to a series of workshops held between system developers and emergency planners to refine the system requirements and design and demonstrate initial versions of the software. This allowed SPP development to be focused on the most useful features and to steer away from potential limitations and problems. One example of this was moving the database to PC-based Microsoft Access from Oracle on a Unix server, which was too complex for some of the smaller county offices to administer successfully.

SPP was designed to complement its host commercial GIS software package rather than to operate as a proprietary system. The SPP extension is self-contained and can be added or dropped from the GIS interface during any session. No changes were made to the standard GIS software interface.

Installation, Documentation, and Training

In the fall of 2001, version 2.0 of SPP was installed at six county Emergency Management Agency (EMA) offices in Alabama, and at the state EMA office. Workshops were held with the full group of users, and individual training was provided at each installation.

Emergency planning groups in rural counties often have very limited resources and relatively high personnel turnover. To address these factors, the SPP help system needed to be usable, relevant, and sufficiently informative to allow future users to easily and quickly train themselves.

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SPP documentation was designed to satisfy two broad objectives: (1) to provide relevant, concise, and easily accessible information to allow users to quickly become familiar with each aspect of the system, and (2) to provide enough information to be used for training purposes. Documentation was provided in the form of context-sensitive help files on the system and hardcopy manuals.

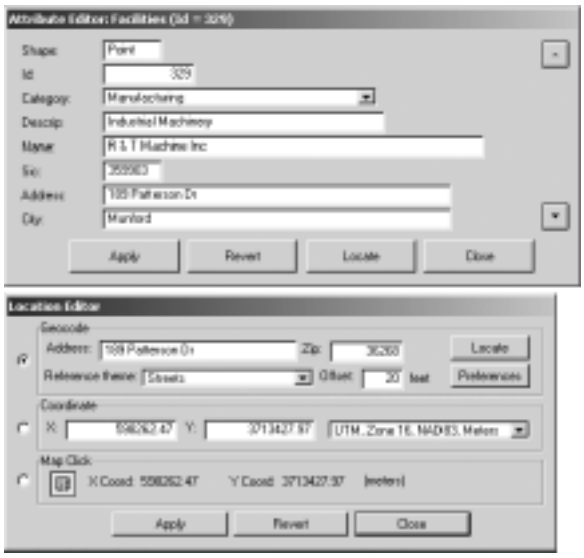

Figure 2: Location Editor and Attribute Editor Tools

The next phase of SPP development is underway, beginning with a workshop to gather feedback on data updates and new functionality from emergency planners who use the system. Special needs individuals and facilities change significantly over time, so it is essential to keep the database up to date.

Also, a new air dispersion model is now available that takes into account variations in wind direction and surface topography. Support for the new model will be added to SPP.

Conclusions

Although SPP was explicitly designed to prepare response plans for conceivable emergency events at a specific facility in Alabama, it is a general-purpose tool suitable for planning for other emergency events as well. This enhanced utility allows it to be used for more frequent incidents. Thus, if and when an accidental chemical weapons agent release ever occurs, users will have maintained a familiarity with the system, data, and its maintenance.

The need for a county-level emergency planning system with detailed, geographically referenced information about special needs populations, facilities, events, and resources is not specific to this hazard or this location. The use of GIS to support emergency management—both in planning and response—is increasing. As this project demonstrates, developing such a system for a localized area is both uniquely valuable and challenging.

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References

HR 2001. Emergency Evacuation. HR Magazine, Society for Human Resource Management, Reprint available at **http://bc.workink.com/articles-single.asp?ID=9354**. Accessed June 3, 2002.

Newsday.com 2001. Focusing on the Day's Work. Available at **http://www.newsday.com/ny-bzfeel182370706sep18.story**. Accessed May 27, 2002.

WRAL.com, 2001. Cary Man Becomes Hero in World Trade Center Attack. Available at **http://www.wral.com/News/962120/**. Accessed May 27, 2002.

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