

SPECIAL POPULATION PLANNER 4: AN OPEN SOURCE RELEASE

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ABSTRACT

Emergencies like Hurricane Katrina and the recent California wildfires underscore the critical need to meet the complex challenge of planning for individuals with special needs and for institutionalized special populations. People with special needs and special populations often have difficulty responding to emergencies or taking protective actions, and emergency responders may be unaware of their existence and situations during a crisis. Special Population Planner (SPP) is an ArcGIS-based emergency planning system released as an open source product. SPP provides for easy production of maps, reports, and analyses to develop and revise emergency response plans. It includes tools to manage a voluntary registry of data for people with special needs, integrated links to plans and documents, tools for response planning and analysis, preformatted reports and maps, and data on locations of special populations, facility and resource characteristics, and contacts. The system can be readily adapted for new settings without programming and is broadly applicable. Full documentation and a demonstration database are included in the release.

BACKGROUND AND INTRODUCTION

It has been said that the true measure of a society's greatness is how it protects those least able to care for themselves. Recent emergencies, such as Hurricane Katrina and the recent California wildfires, underscore the critical need to meet the complex challenge of planning for individuals with special needs and for institutionalized special populations. Persons with special needs and special populations often have difficulty responding to emergencies or taking protective actions (such as receiving and understanding public emergency broadcasts) or taking protective action (such as taking shelter or evacuating).

In addition to persons with disabilities, other individuals may have special needs during emergencies. They include:

- People without access to transportation;
- Children who are sometimes home alone;
- Persons who do not speak English;
- Migrant workers, homeless persons, or visitors;
- Individuals who lack financial resources; and
- People who are in confined facilities (e.g., schools, hospitals, nursing homes, prisons).

Persons with special needs deserve the same attention given to our general population. The Americans with Disabilities Act specifically prohibits exclusion of persons from the benefits of government services or programs solely because they are disabled. Also, in 2004, the President issued an Executive Order for Individuals with Disabilities in Emergency Preparedness. The exact definition of "special population" is a policy decision that has not been standardized. Policymakers have included various

combinations of the groups listed above in this category, depending on the context of their work.

Special Population Planner (SPP) is an ESRI ArcGIS-based emergency planning system released as an open source product. SPP provides for easy production of maps, reports, and analyses to develop and revise emergency response plans. It includes tools to manage a voluntary registry of data for people with special needs, integrated links to plans and documents, tools for response planning and analysis, preformatted reports and maps, and data on locations of special populations, facility and resource characteristics, and contacts. The system can be readily adapted for new settings without programming and is broadly applicable. Full documentation and a demonstration database are included in the release.

SPP was developed by Argonne National Laboratory (Argonne) initially for the Alabama Emergency Management Agency as part of its Chemical Stockpile Emergency Preparedness Program (CSEPP). CSEPP aids emergency planning and preparedness in the communities that surround U.S. military installations where chemical weapons are stored pending their ongoing destruction under federal statute and a corresponding international treaty. SPP is the first geographic information system (GIS)-based software tool designed to facilitate emergency planning for special needs populations. It has been used since 2001 to help prepare persons with special needs to become more self-reliant during disasters. As of April 2007, SPP was being implemented in seven of Alabama CSEPP's emergency operation centers to enhance emergency preparedness for approximately 4,500 persons with special needs.

ARCHTECTURE, REQUIREMENTS, AND INCLUDED ITEMS

SPP is programmed as a set of tools within an ESRI ArcMap 9.x project using Microsoft Visual Basic for Applications (VBA), the standard ArcObjects and Crystal Reports object libraries, and standard Microsoft object libraries. The strategy of developing the system in VBA within ArcMap rather than as a separate development package was chosen to reduce observed problems in installing software on a variety of operating systems. Doing this also means it is not necessary to use Visual Studio or another development package to work with SPP code.

ArcMap is a component of both ESRI ArcGIS 9.1 and ESRI ArcView 9.1, and it provides a rich GIS user interface for viewing spatial and tabular data, analyzing the data, and producing output reports and maps. This GIS interface has been augmented with the SPP tools to create a user interface that provides custom functionality for emergency planning. The system as released also includes some hypothetical examples of records for special needs populations, facilities, resources, control points, and sirens that are sufficient for showing how the system would work with real information. A GIS database is included with some publicly available example layers. SPP is designed to use a shared set of files on a networked disk drive and one or more client systems for user access (Figure 1).

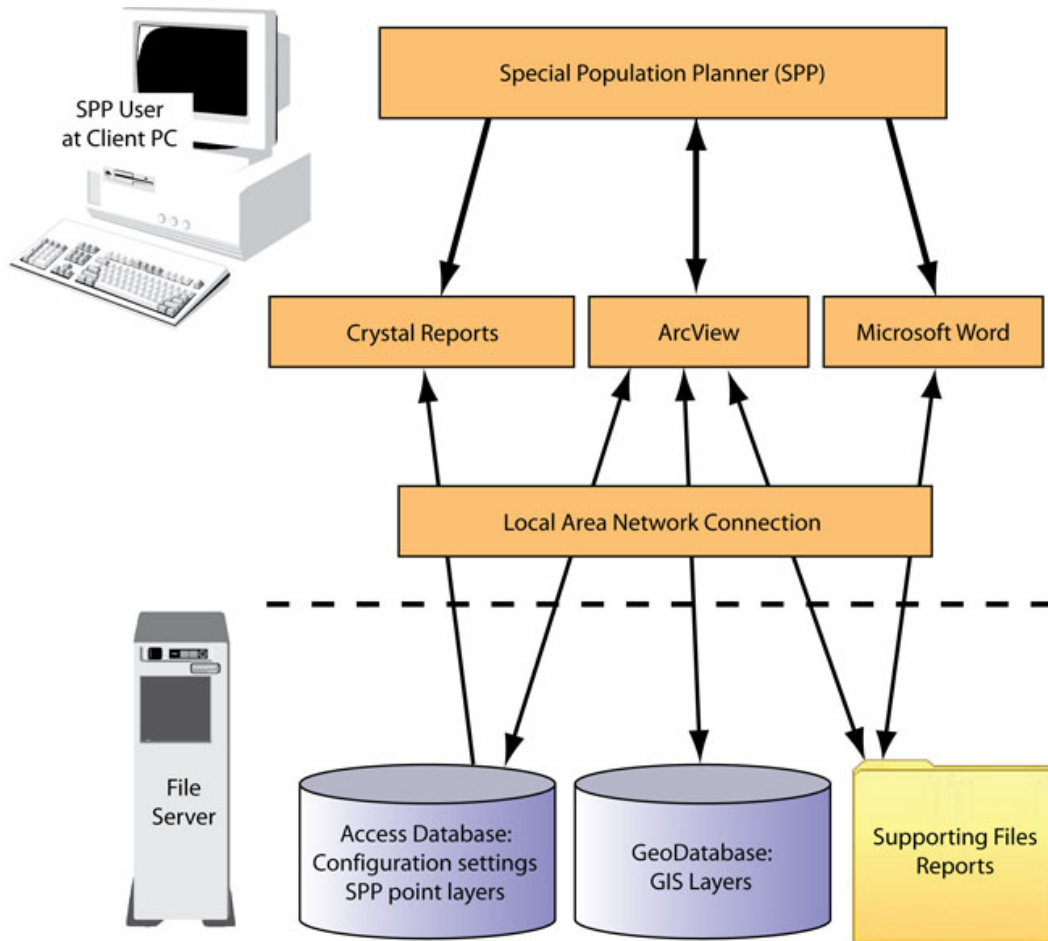


Figure 1. SPP System Architecture

No commercial software is needed for the server components. ArcView 9.1 or higher (or ArcGIS 9.1 or higher) is required for each client system, as is Crystal Reports 11, which is bundled with ArcView and ArcGIS software. Microsoft Access 2002 or higher is required for operations within the SPP database, including changes to the SPP database for use at a new installation. It is not required for typical planning activities. The example database is set up on the basis of the assumption that Microsoft Word or a word processor that supports *.doc files is present, but it can be easily configured to use a different word processor.

FEATURE OVERVIEW

SPP provides a rapid way to build a registry of information for planning areas that can be visualized in a geographic perspective and integrated with other emergency preparedness systems and models. The software is flexible and can easily be adapted for a variety of applications beyond the default configuration. The need for an emergency planning tool that considers persons with special needs is expected to increase. As new organizations implement SPP, the software licensing will allow them to

customize and add elements that fit their needs and share them with the larger emergency planning community.

Five main activities are supported by the SPP tools:

- Creating and updating a voluntary special needs population registry of key personal data;
- Creating and updating regional GIS information, including assigning map locations to registered persons on the basis of their street addresses (address geocoding);
- Automatically generating reports and maps;
- Analyzing data in the context of planning zones and scenarios for preparing response plans; and
- Organizing emergency response plans for quick retrieval and update.

Additional emergency planning activities can be supported in conjunction with SPP tools. These include:

- Scenario modeling,
- Integration with 911 data,
- Addition of new database tables and map layers,
- Linking of dynamic Internet data sources, and
- Implementation of real-time data sources and responses.

The interface is implemented as an additional custom menu and toolbar (Figure 2) in the ESRI ArcMap program (Figure 3). The standard tools in the toolbar, from left to right, are Open Event, Zoom to Cluster Extent, Open Plan, Open Report/Export Data, Add SPP Map Layers, Select by Attributes, Select by Location, Clear Selected Features, Define Wedge, D2-Puff Plume, User-Defined Event, Location Editor, Add Evacuation Route, Delete Evacuation Route, Add Alert Route, Delete Alert Route, Show Coordinates, and Hyperlink. Once it is populated with location-specific data, the table of contents shown on the left side controls the map content, including which themes are drawn, symbolization, labeling, and many other properties. All the standard GIS tools are available and enabled, or they can be hidden if desired to simplify the interface for new users.

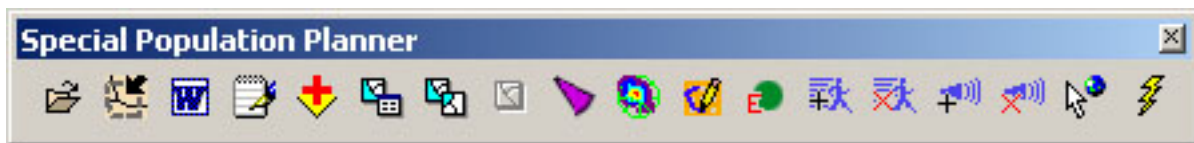


Figure 2. SPP Toolbar

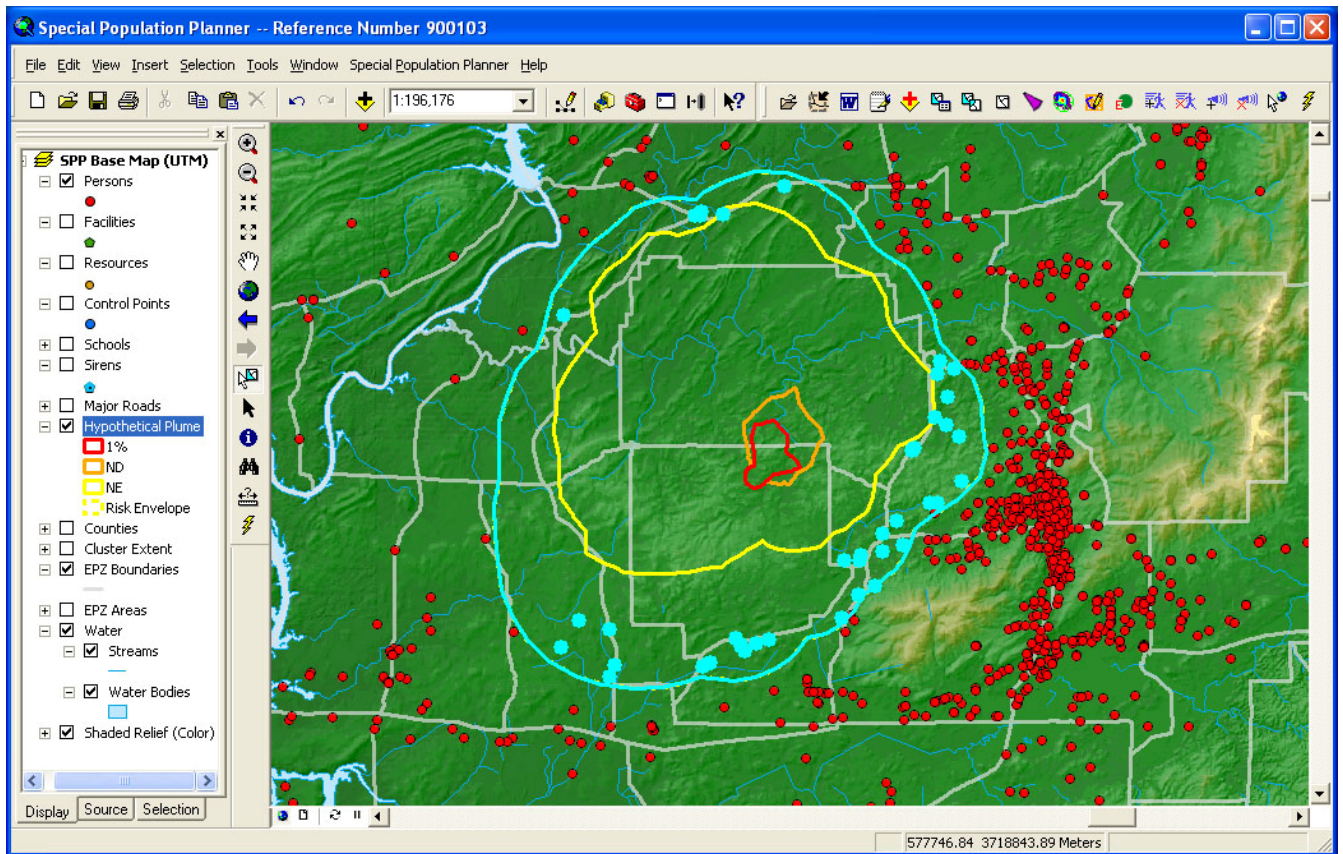


Figure 3. SPP Interface with Map Showing Hypothetical Extent of an Airborne Plume with a Conceptual Distribution of Special Needs Households

One of the fundamental concepts in SPP is the use of emergency planning zones to characterize and organize responses. It supports multiple, independent zone configurations, such as both a hazard direction and distance grid and fire districts. Zones are used in the system in many ways, including for map display, as a basis for organizing emergency response plans, and in system reports. Zone identifiers are automatically populated in special needs and other database tables when records are added or edited. Figure 4 shows three sets of example zones provided with the demonstration SPP database. A directional grid is shown in transparent tan colors over a second zone map based on U.S. Census Bureau block groups that are categorized by population density, with a simple square grid shown as red outlines. This approach provides automated direct links among the ways emergencies are tracked, the jurisdictions of responding organizations, and locations of special needs populations.

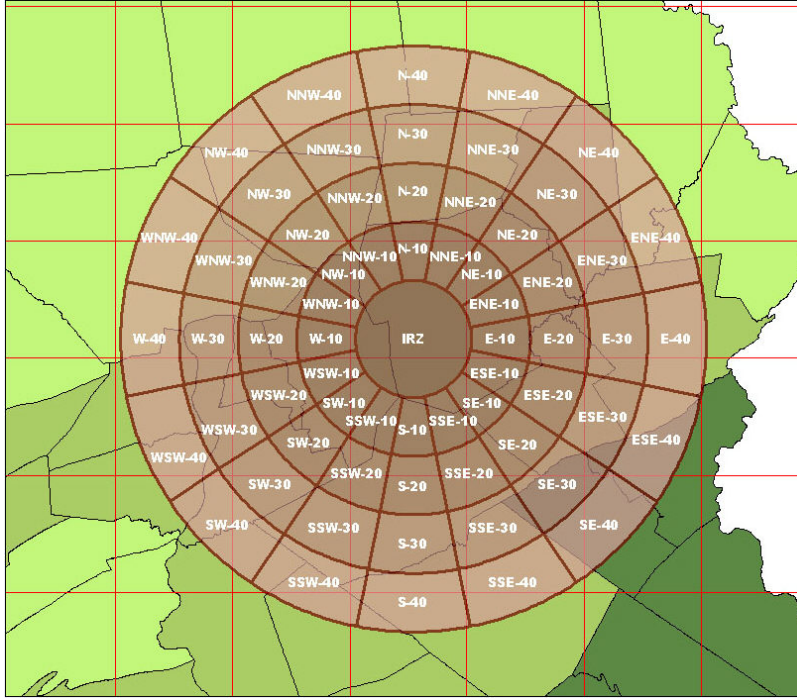


Figure 4. Example Emergency Planning Zones

In SPP, the combinations of the choices of zones, the tools for defining events in many ways, and the open access to standard GIS tools allow it to be effectively used for all-hazards planning. Examples are shown in Figure 5 for analyzing a flood event and Figure 6 for analyzing a forest fire. Locations of emergency events can be brought into the system by any means supported by GIS including, but not limited to:

- Global positioning system (GPS) data,
- Aerial observations,
- Model results,
- Processing of elevation or other geospatial data, and
- Screen digitizing of boundaries on the basis of user knowledge.

Once the emergency is characterized in one of these ways, the SPP tools automate many of the steps needed to plan and execute emergency response, including:

- Identifying and mapping special needs households within the emergency area and the associated planning zones,
- Visualizing and publishing maps,
- Generating reports,
- Accessing existing emergency plans,
- Linking to Internet information based on map locations (such as a school's web site), and
- Designating evacuation or alert routes.

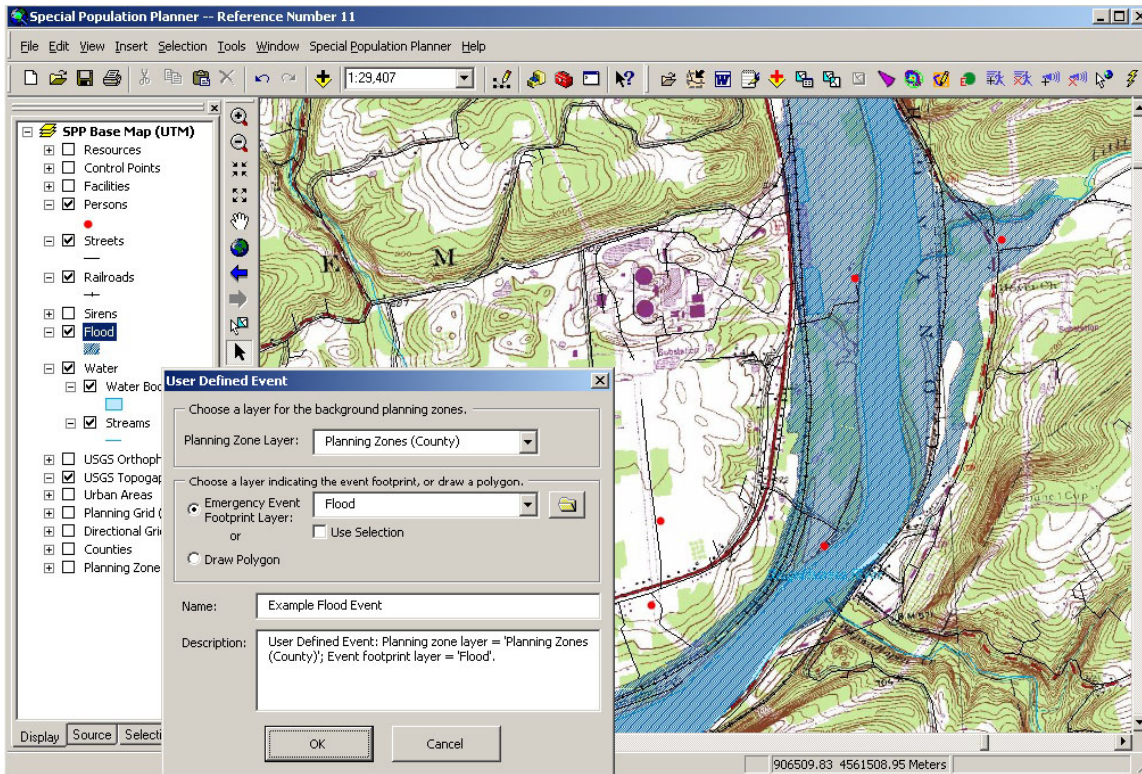


Figure 5. Map Display in SPP Depicting a Hypothetical Flood Event

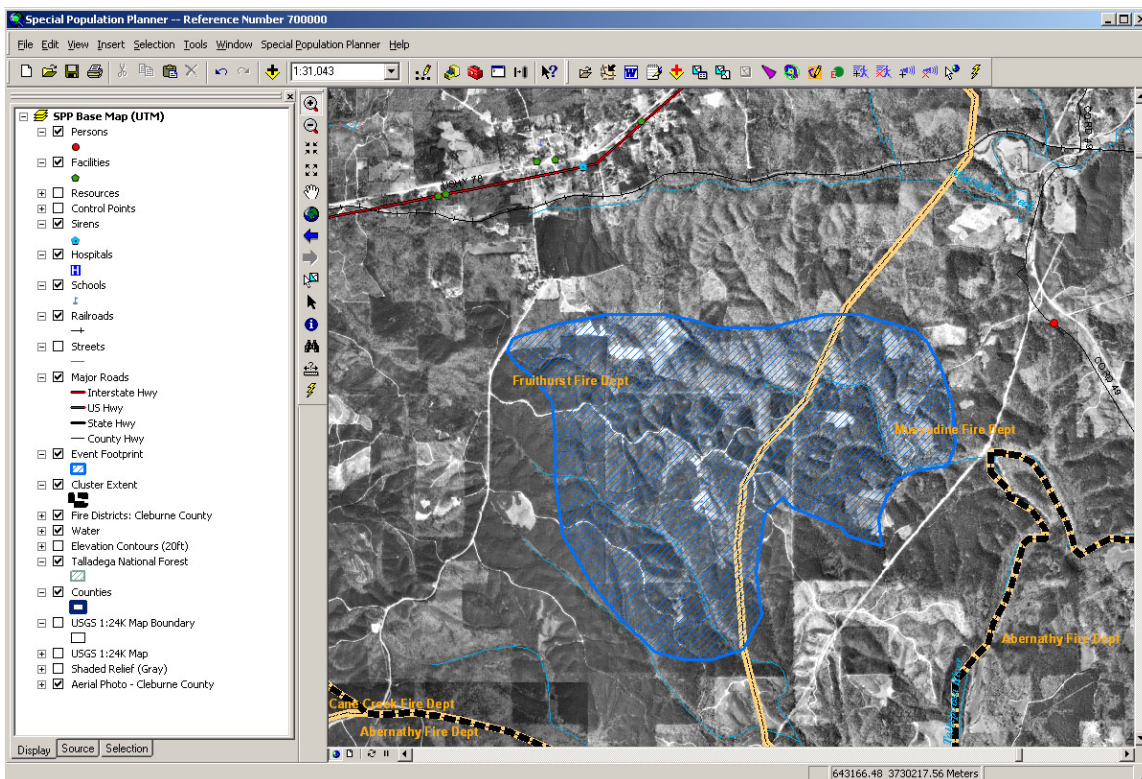


Figure 6. Map Display in SPP Depicting a Hypothetical Forest Fire Event

A key system component is the Open Report/Export Data tool. The system has been provided with some example reports that tie to various items in the database, particularly the special needs persons table. Figure 7 shows an example report as viewed in the software. Reports can be printed or exported to a variety of formats, including Adobe portable document format (PDF). The same SPP tool allows any tabular database information stored in SPP to be exported for use in other systems if needed. Contents of reports and exported data files can be limited to subsets pertaining to a particular emergency event, a user-defined subset, or all the data. Reports are designed with Crystal Reports software, and new reports can be easily designed and added to the system.

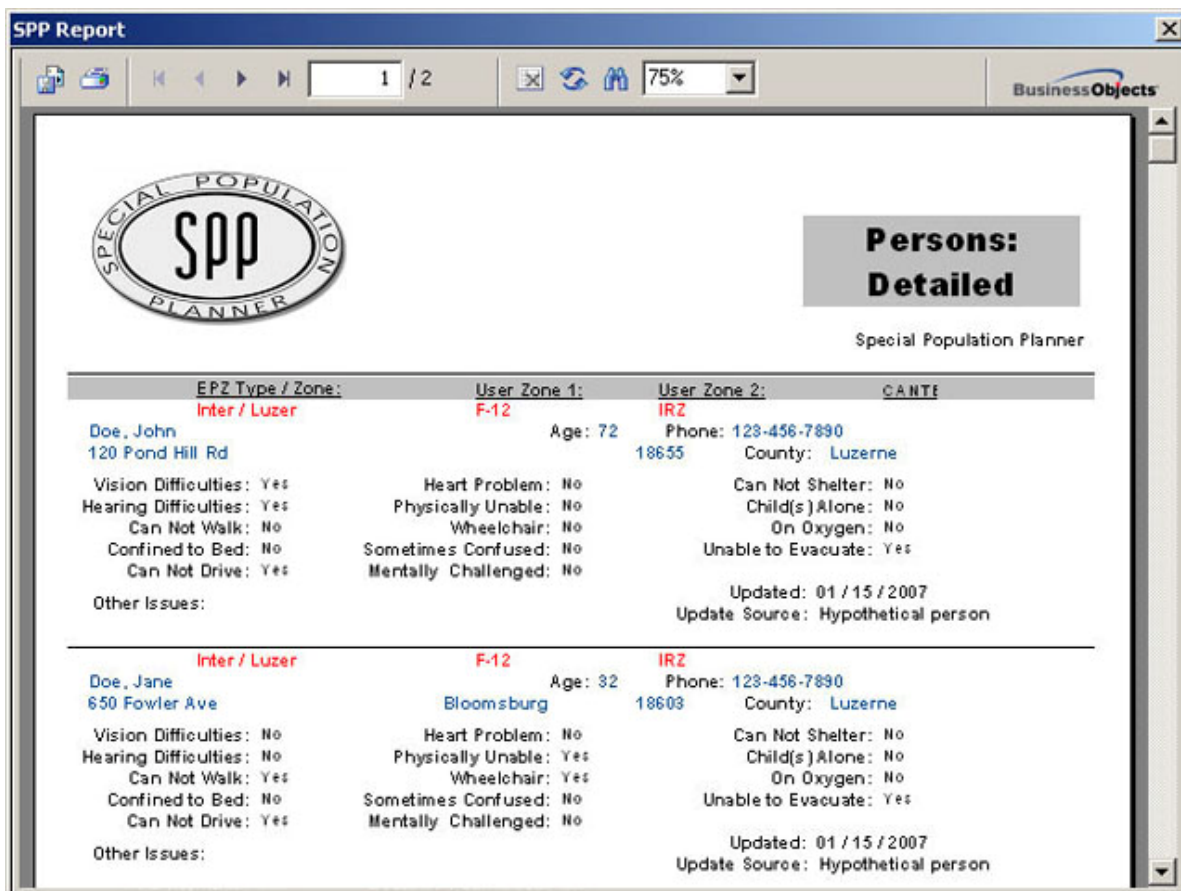


Figure 7. Example of Detailed Persons Report, Showing Hypothetical Data, Including Zones, Contact Information, and Details on Special Needs

The system includes an easy-to-use capability for maintaining special needs registry data and other data layers (e.g., facilities, resources, traffic control points) in the system. These core tables can be customized by system administrators; the necessary instructions are provided in the manual. The editor is designed to automatically configure itself on the basis of the database table structure, and drop-down lists and other customizations can also be added through configuration tables in the database.

Figure 8 shows the Location and Attribute tabs in the Location Editor, which is used to make edits to individual records. The location tab at the left allows the location to be specified or revised by clicking on the map, entering coordinates in the coordinate system of choice, or address geocoding. The address geocoding capability uses (and requires) a GIS layer of streets that is populated with street name, address, and zip code information. The tool uses the specified address and the street layer to locate the address on the map.

The second tab shown at the right is an example of the interface for editing the tabular attributes linked to a record. This tab is automatically populated with editing fields based on the table structure, plus optional configuration settings controlled by a database table.

Depending on the user's choice when opening the Location Editor, records can be added, changed, or deleted from the specified table.

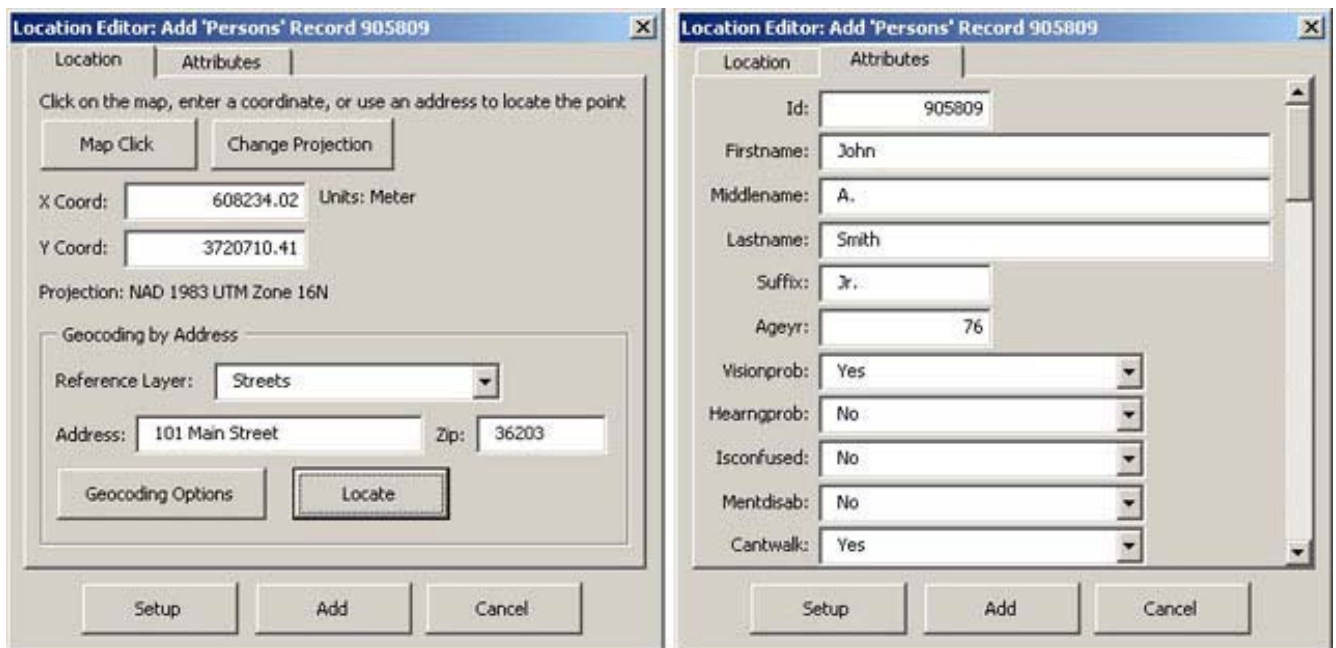


Figure 8. Location and Attribute Tabs in the Location Editor

This paper provides only a cursory description of some SPP tools and capabilities. Considerably more information is available in the user documentation provided with the software.

CONCLUSIONS

Whether it is installed as a turnkey system (without modification or highly customized) or simply being reviewed, SPP provides many building blocks to help implement emergency planning for special populations and persons with special needs. The

architecture is flexible and can be easily tailored by a knowledgeable GIS professional to these people's specific needs, by combining it with other tools, customizing the database and reports, or populating the system with the data on them.

As a word of caution, a key aspect of the SPP system is that it uses a registry to identify persons with special needs. Registry-based emergency planning is one way to enable emergency planners to address the special needs of individuals or groups. However, registries can also raise significant privacy, confidentiality, ethical, legal, and liability concerns. SPP users should consider these issues carefully before initiating a special needs population registry or database. The authors can provide more information about experiences in this area and contacts for other organizations that have implemented similar registries.

SOFTWARE AVAILABILITY AND ADDITIONAL RESOURCES

SPP 4.0 software, including the source code, full documentation, and an example database, is distributed through SourceForge.net: <https://sourceforge.net/projects/spc-pop-planner/>. Copying, distribution, and development of derivative works, with some minor constraints, can be performed under the General Public License-style license. The ESRI ArcScripts web site also has an entry for SPP that links to the main distribution site.

Implementing SPP in its initial Alabama CSEPP context and conducting other emergency preparedness projects have given us a significant amount of experience beyond development of the software itself. Selected additional sources of information on emergency planning for special needs populations, including Argonne resources and resources in the broader community, are listed here:

- Argonne Center for Integrated Emergency Preparedness: <http://www.dis.anl.gov/groups/ciep.html>
- Alabama Special Needs Population Program: <http://www.alabamaspp.com/>
- Federal Emergency Management Agency:
 - Guidelines for those who serve disabled individuals by providing emergency preparedness and disaster relief: <http://www.fema.gov/oer/reference/index.shtm>
 - General information: <http://www.fema.gov/plan/prepare/specialplans.shtm>
- Ready America: Resources for individual preparedness for special needs individuals: <http://www.ready.gov/america/getakit/disabled.html>
- ESRI Special Populations User Group: http://www.spargis.org/esri_specpop Ug.html
- Temple University Center for Preparedness Research, Education, and Practice: <http://www.temple.edu/cprep/index.htm>
- West Virginia University: Guidance and information related to special needs: <http://vmc.wvu.edu/hrsa/specialPopulations.htm>

- Pennsylvania Department of Health: Emergency preparedness fact sheets for special populations:
<http://www.dsf.health.state.pa.us/health/cwp/view.asp?a=333&q=233957>
- Western Pennsylvania Search and Rescue Development Center:
<http://www.wpsardc.org/PLS.htm>
- Metz, W.C., E. Tanzman, L Nieves, and V Holt, "Preparing People with Special Needs for Emergencies: The Alabama Chemical Stockpile Emergency Preparedness Program (CSEPP) Model," *Journal of Emergency Management* 3(4):36–48, ISSN 1543-5865, July/August 2005.
- Metz, W.C., P. Hewett, J. Muzzarelli, and E. Tanzman, "Feedback from the Field: Identifying Special-Needs Households That Need Assistance for Emergency Planning," *International Journal of Mass Emergencies and Disasters* 20(2):255–281, August 2002.

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