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GIS Dynamic Population Model Tool for Savannah River Site Emergency Response

by

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2.0 ABSTRACT

The Savannah River Site (SRS) is a 310-square-mile Department of Energy site located near Aiken, South Carolina. With a workforce of over 10,000 employees and subcontractors, SRS emergency personnel must be able to respond to an emergency event in a timely and effective manner, in order to ensure the safety and security of the Site. Geographic Information Systems (GIS) provides the technology needed to give managers and emergency personnel the information they need to make quick and effective decisions. In the event of a site evacuation, knowing the number of on-site personnel to evacuate from a given area is an essential piece of information for emergency staff. SRS has developed a GIS Dynamic Population Model Tool to quickly communicate real-time information that summarizes employee populations by facility area and building and then generates dynamic maps that illustrate output statistics.

3.0 LIST OF ACRONYMS

EGIS	Environmental and Geographic Information Systems
ArcSDE	Arc Spatial Data Engine Software
EOC	Emergency Operations Center
ERO	Emergency Response Organization
ESRI	Environmental System Research Institute, Inc.
GIS	Geographic Information System
GUI	Graphical User Interface
SRS	Savannah River Site
VB	Visual Basic

4.0 INTRODUCTION

Many computer-based population models are used in emergency preparedness and planning, to address issues such as resource allocation, population evacuation, etc. A Geographic Information System (GIS) population model can add a spatial component to a population distribution model, providing key information to decision-makers during a simulated or actual emergency event.

Savannah River Site (SRS), a 310-square-mile Department of Energy site with a population of over 10,000 employees, faces a challenge similar to any large facility during an emergency event. The issue of where employees are located and what actions should be taken to protect their well being, and that of the public, is of the utmost importance. Depending on the type of emergency event, decision-makers may choose to evacuate employees from a particular location that has received a bomb threat, or to have them remain indoors, as in the case of a chemical or radiological release.

5.0 GIS IN THE SRS ERO

The Emergency Response Organization (ERO) is the organization designated to respond to simulated or real emergency events at Savannah River Site. The SRS ERO holds several emergency drills throughout the year, to keep members current in their emergency preparedness training and execution. Currently, four GIS specialists are members of the Savannah River Site ERO, and serve on a monthly rotational basis for 24-hour response to drills or real emergency events. The GIS specialist who is on-call operates the ArcGIS® software, the SRS GIS data and the custom tools in the Emergency Operation Center (EOC) for the event. The Environmental and Geographic Information System (EGIS) section of the Process and Geographic Software Engineering group has designed and built custom GIS tools to provide key information to the ERO team in a timely manner. These tools include the **Keyhole Tool**, used for providing real-time wind direction information for release events, the **Field Worker Tool**, which tracks check-in/check-out times and location information for workers in the field, and the **Personnel and Asset Locator Dynamic Update Tool (PALDU)**, which tracks the deployment of emergency personnel and equipment assets during an event.

6.0 THE GIS DYNAMIC POPULATION MODEL TOOL

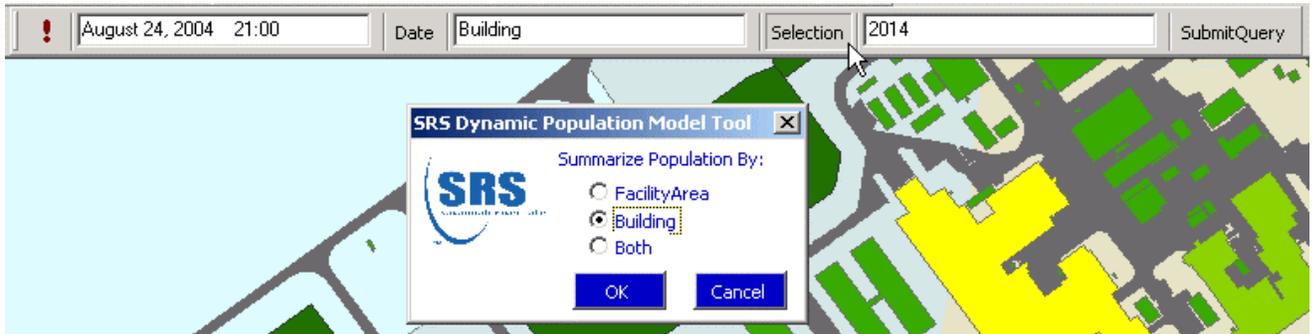
The **GIS Dynamic Population Model Tool** was developed using Visual Basic (VB) 6.0 and ArcObjects™, the programming object model used to customize the ArcGIS® software. It is written as an extension to ArcGIS 9.1, and integrates the SRS employee phone directory and shift code database information with the GIS to create dynamic choropleth maps of the SRS facility area boundary and building layers, color-coded by population totals.

As an enhanced feature to the current GIS system, the GIS specialists have now designed and developed a new tool to display SRS employee population distribution across the site at the time of an emergency drill or event. The **GIS Dynamic Population Model Tool** relates to the SRS employee phone directory database using employee shift code information to calculate the minimum and maximum number of employees on a building, facility area and site-wide basis. A shift schedule table was also developed by a student intern, along with the help of the SRS Human Resource Department, as part of this effort, to provide shift start and stop times for the tool. SRS has numerous shift schedules that allow employees flexibility in the start and stop times for their particular work shift, and the table includes a start-time and an end-time range to account for this variation.



While the tool defaults to using the current time and date, the user has the ability to do “what if” scenarios by selecting a custom time and date as well. The user can then select whether to summarize the population statistics by facility area, building or both.

The tool then provides the total SRS population in the GUI, while adding the selected GIS layers to the map color-coded by population ranges.



The original version of this tool simply created a set of temporary tables, which were then joined to the GIS facility area and building layers and dynamically added them to the user's ArcMap® session. The final version of the tool which will be deployed to the Emergency Operation Center will use ArcSDE and ORACLE to create dynamic spatial views of the data, which dramatically improves the data display and refresh times for the user.

7.0 SHORTCOMINGS OF THE MODEL

As is the case with most models, there are several shortcomings of the **GIS Dynamic Population Model Tool**, which should be identified for the user. First, the shift code start and stop time information is estimated, and therefore, should not be considered concrete when used for calculating the population statistics. This is why minimum and maximum population statistics are provided, to give the user a possible range in population.

Secondly, this population model does not take into account employees who have left their assigned building or facility area to attend to a meeting or training, or who are off-site completely due to vacation, sick leave or other reasons. This may vary the population numbers slightly. However, since the purpose of the tool is to give emergency managers approximate employee population statistics on which to base their decision-making, that level of accuracy is probably not required.

8.0 FUTURE ENHANCEMENTS TO THE MODEL

While the GIS Dynamic Population Model Tool is a useful tool for emergency personnel by itself, when coupled with some of the other custom GIS tools at SRS, it has the potential to provide even greater utility to the user. It could be used in conjunction with the Keyhole Tool to determine how many employees are affected by a “remain indoors” action for a release incident. It could also be used with the Field Worker Tool to use the field worker numbers in its population calculations. The population model results could also be used as an input variable for evacuation model routing scenarios in the Network Analyst extension for ArcGIS®.

9.0 CONCLUSION

While no population model is perfect, the **GIS Dynamic Population Model Tool** gives SRS decision-makers a better understanding of the population distribution at SRS, which is key for managing its employee population during an emergency event. The tool can be integrated with the other custom GIS tools already deployed in the Emergency Operation Center (EOC), which gives it added value to emergency management community. The safety and security of employees is the number-one concern of SRS management, and the **GIS Dynamic Population Model Tool** aids decision-makers in this endeavor.