

**Project 15: Emergency Supply Planning (Dessouky and Ordonez)**

This project is developing a decision tool to guide emergency response planners in determining where to locally store supplies and the best strategy to disburse the supplies.

**Modeling Area:** Risk Management

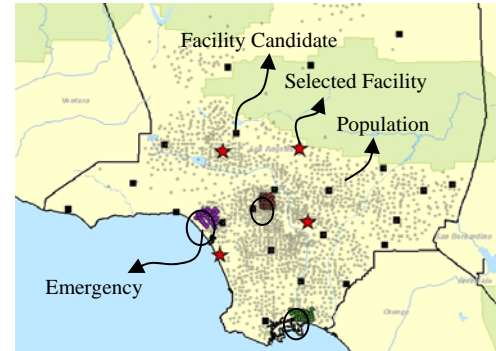
**Case Studies Supported:** Bioterrorism

**Principal Investigator:** Maged Dessouky

**Institution:** University of Southern California

**Other Investigators:** Fernando Ordóñez

**Student Research Assistants:** Hongzhong Jia, Zhihong Shen

**Brief Description:**

A key ingredient in an effective response to an emergency is the prompt availability of the necessary supplies at the emergency sites. For example, to address out-breaks of infectious diseases, the Federal government's Strategic National Stockpile contains 300 million doses of small-pox vaccines and enough antibiotic to treat 20 million people for anthrax. In the event of an emergency, these vaccines would be delivered in push packages of emergency supplies to the Emergency Staging Area (ESA). Timely delivery and disbursement of adequate supplies at ESAs pose major logistical challenges, more so in high-density urban regions like Southern California.

**Objectives:**

The primary objective of this research is to develop a family of planning models that determine the location and distribution of inventoried items in response to a large scale emergency.

**Major Products and Customers:**

The major product is a tool that enables facility location and vehicle routing solver embedded in a GIS environment. This would be useful to planners working in the Departments of Emergency Preparedness at the regional and local levels and the Center for Disease Control.

**Interfaces to other CREATE Projects:**

This project will interface with the CREATE Bioterrorism Case Study, the Emergency Response project led by Richard Larson, and the project "Transportation Plan for Strategic National Stockpile (SNS) – Deployment Within Los Angeles County" led by David Belson.

**Interfaces to non-CREATE Projects:**

This project will interface with a project led by Randolph Hall on a "Collaborative to Improve Patient Flow through Efficient Service Delivery and Resource Utilization for Los Angeles County."

**Technical Approach and Milestones:**

There exists research both on emergency system dynamics (such as the propagation of diseases and performance of vaccination strategies) and on distributions systems in non-emergency scenarios. However to date, this research has not been integrated in the form of distribution systems for emergency situations. We plan to address this gap in the research community by developing

emergency response planning models for the distribution of inventoried items. Our research will specifically focus on addressing the following interrelated questions in the context of an emergency:

- Where do you locally store supplies for emergencies, and what should be the supply levels at each location?
- What is the best strategy for disbursing supplies once an emergency has occurred?

At the heart of these questions there is a transportation network where the distribution of the inventoried supplies takes place. The question of where to set the storage facilities can be translated to a facility location problem within this supply network. The problem of disbursement of supplies can be posed as a vehicle routing problem on this network.

#### Facility Location Problem

- Complete Model Formulation (May 05)
- Complete Genetic Algorithm Solution Procedure (December 06)
- Benchmark Solution Procedure against theoretical bounds and other heuristics on sample problem instances (May 06)
- Integrate into GIS (August 06)
- Develop a strategy to broaden the facility location problem to evaluate the entire supply chain including the SNS, vendor managed inventory, local caches and distribution centers (August 07)

#### Vehicle Routing Problem

- Complete Model Formulation (October 05)
- Complete Heuristic Solution Procedure (November 06)
- Benchmark Solution Procedure against theoretical bounds and other heuristics on sample problem instances (May 07)
- Integrate into GIS (August 07)