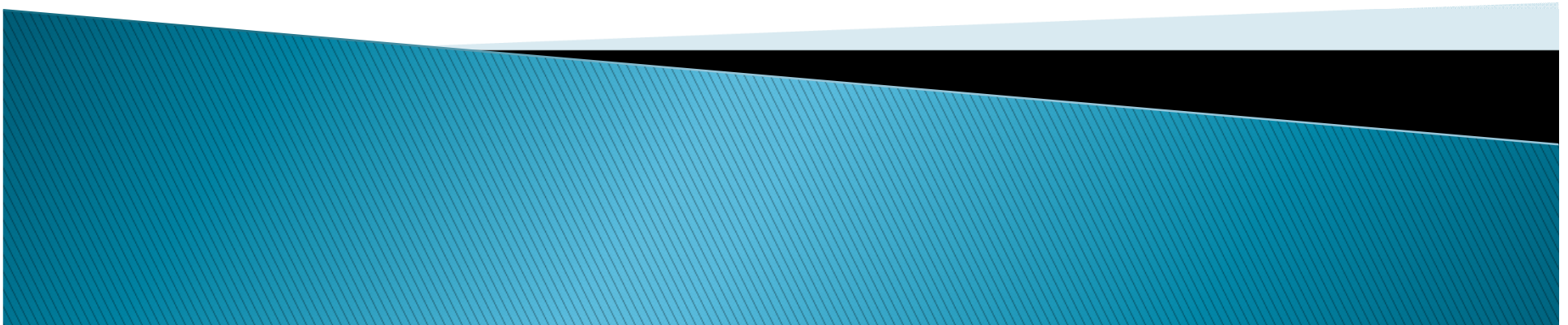


GIS in Emergency Management

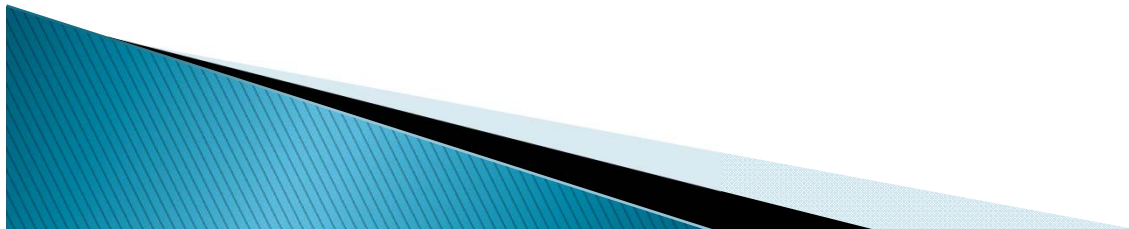
By, Javid A Syed
G200901290

For, Dr. Baqer Al-Ramadan
CRP 514



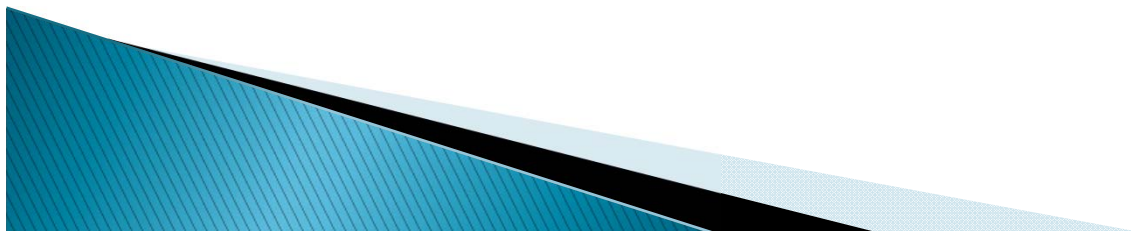
Contents

- ▶ Introduction
- ▶ Emergency
 - Definition
 - Types
- ▶ Emergency Management
 - Phases
 - GIS usage in phases
- ▶ GIS/EM – Case Study (UoR)
- ▶ Recommendations



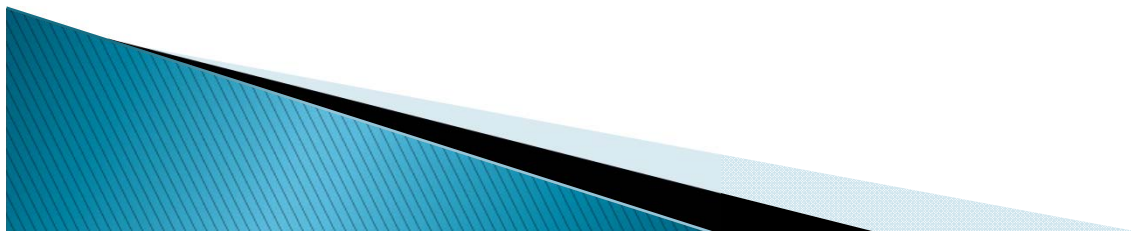
Emergency

- ▶ Emergency defined as “All events that endanger normal functioning of services/companies, endanger lives, or threaten stability of state.”



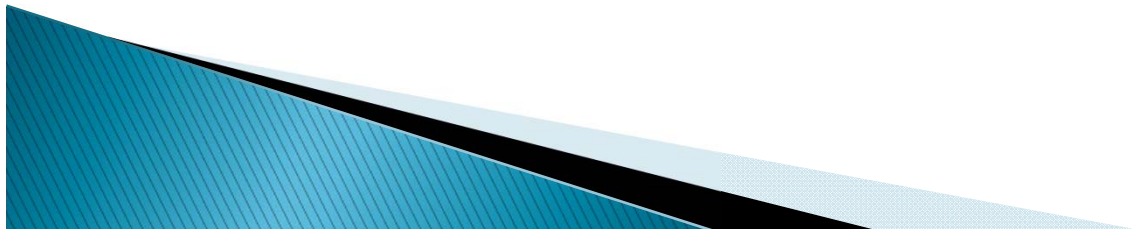
Types of emergencies

- ▶ **Natural Emergencies**
 - Earthquakes, Landslides
 - Volcanoes, Fires
 - Tsunamis, Floods
 - Tornadoes, Hurricanes, Typhoons
- ▶ **Man-made emergencies**
 - Health related emergencies
 - Social Unrest/War
 - Toxic Spills



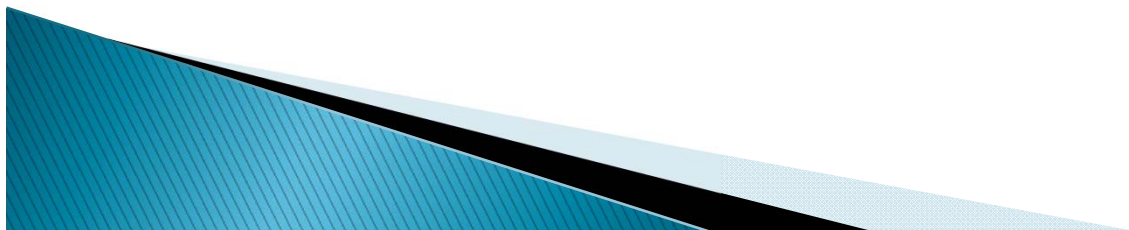
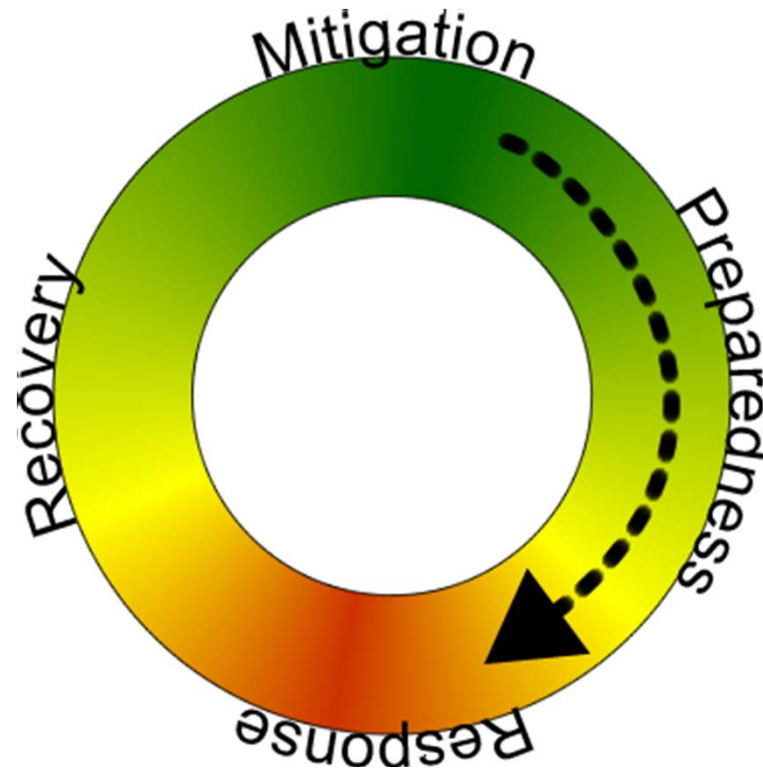
Emergency Management

- ▶ Emergency Management is “The use of science, technology, P&M to deal with events that can lead to loss of life, property, or disrupt community life”.



Phases of Emergency Management

- ▶ Mitigation
- ▶ Preparedness
- ▶ Response
- ▶ Recovery



Phases of Emergency Management

▶ Mitigation:

- Attempts to prevent hazards from developing into disasters,
- Done by risk analysis

▶ GIS

- Can identify zones and classify them as risk
- Sloped flammable vegetation which is near fire zone
- Bridges resting on certain soil types in earthquake zone
- Identify the path of a flood based on topo features



Phases of Emergency Management

- ▶ Preparedness:
 - How we change behavior to limit the impact of disaster events on people
 - Involves developing plans for efficient use of resources in crisis
 - Govt. can
 - Compiling state resources
 - Doing training exercises
 - Installing early warning systems
- ▶ GIS
 - Shows where fire station should be located for 5 min response time
 - Shows where paramedic teams should be
 - Shows wind direction in case of a chemical cloud situation



Phases of Emergency Management

▶ Response

- Activities immediately following a disaster
 - Designed to assist victims – Search and rescue, feeding
 - Or to stabilize the situation & reduce secondary damage – Shutting off reactor
 - Speed up recovery operations – Damage assessment

▶ GIS:

- Quickest emergency response teams can be selected, routed and dispatched
- In a bldg fire, hydrants/fire hose/electrical panel location can be identified ASAP
- Advanced Vehicle Location used in real time to track emergency units



Emergency Management Phases

▶ Recovery

◦ Short Term

- Restore vital life support to minimum standards
- Clean up, temporary housing, food & water
- GIS
 - Damage assessment using GPS
 - Distribution of emergency centers based on GIS
 - Restored services can be highlighted

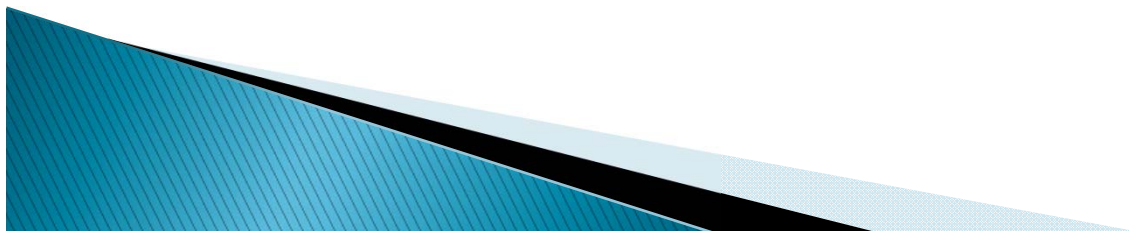
◦ Long Term

- Continues for a number of years after disaster
- Redevelopment loans, legal assistance, community planning
- GIS
 - Prioritization of restoration investment using GIS
 - Long term plans tracked
 - Funds can be allocated to location points on GIS



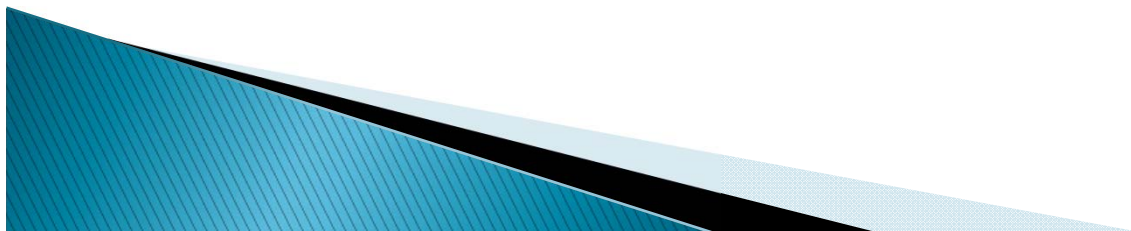
Case Study – Uni of Redlands

- ▶ Threats facing UoR:
 - Human threats
 - Chemical spills
 - Utility failures
 - Plane crash
 - Explosions
 - Riots, demonstrations
 - Terrorist attacks
 - Natural threats
 - Earthquake – San Andres fault
 - Wild fires – Dry region
 - Heavy rain
 - Seven Oaks Dam – flood



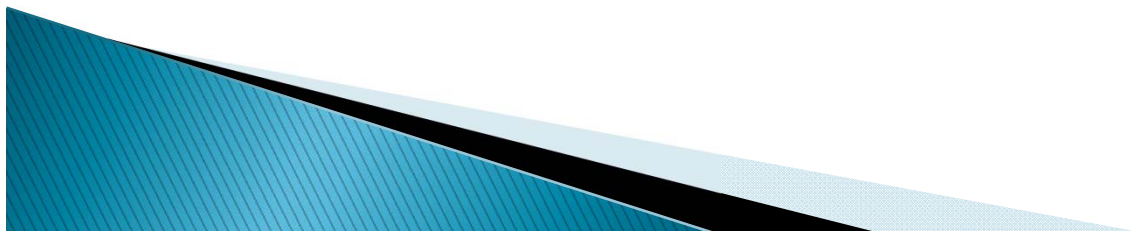
GIS Emergency Management System – GEMS

- ▶ Based on ArcView 8.x
- ▶ Interactive software
- ▶ Goal is to integrate location based data and GIS to support EM at UoR
- ▶ Data stored on ArcGIS personal geodatabase



GIS Emergency Management System – GEMS

- ▶ Mitigation Phase
 - Situational awareness of the University using spatial data layers
 - Analyze people population round the clock
- ▶ Preparedness Phase
 - Simulated disaster occurrence to support planning
 - Provides a better visualization of disaster effects



GIS Emergency Management System – GEMS

▶ Response Phase

- Risk areas can be cordoned off
- Recorded using a circular threat range or modeled plume
- Population under threat can be identified
- Responders can be directed to affected zone

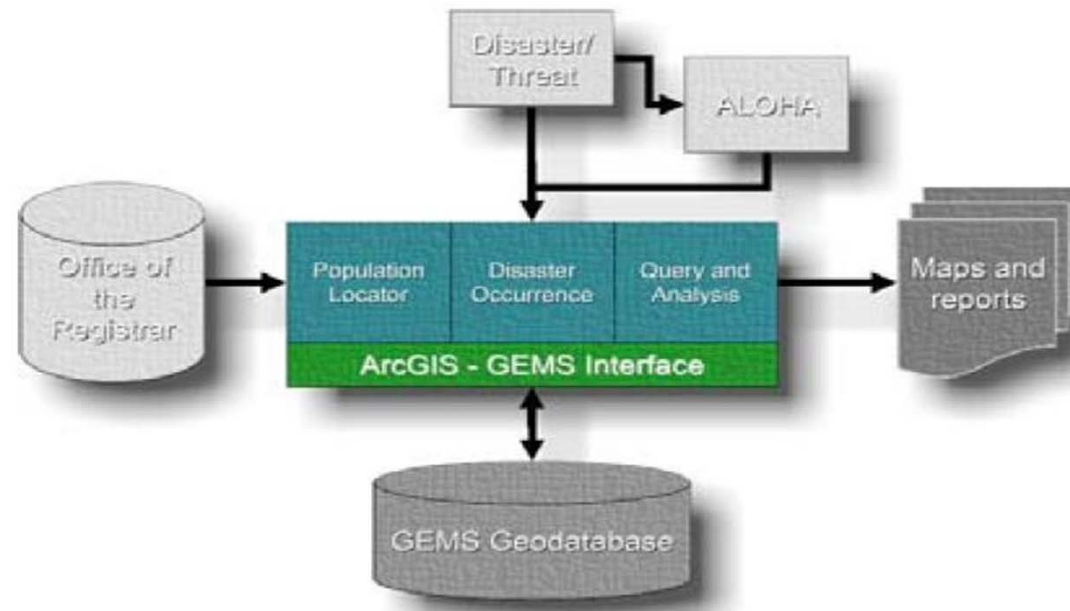
▶ Recovery Phase

- Tracking of recovery status after disaster
- Further analysis by ad-hoc spatial queries
- Reports/maps can be updated & generated



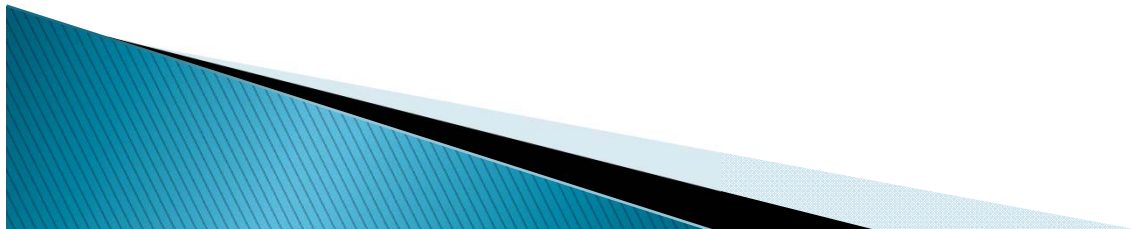
GEMS Components

- ▶ Key components
 - Population locator component
 - Disaster occurrence component
 - Query and Analysis component



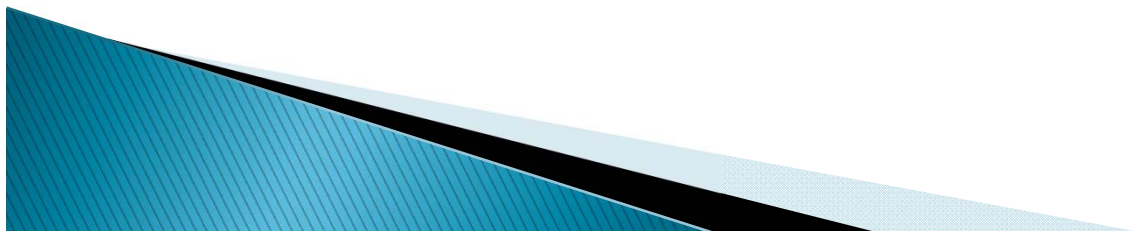
GEMS overview

- Population locator component
 - Spatially locates people on campus throughout the day
 - From the registrar's office and classroom schedule
 - No. of students in classes are identified
 - Also identifies people in dining halls/grounds based on surveys



GEMS overview

- Disaster occurrence quotient
 - Circular threat
 - Threat radius to calculate area
 - Ex. Bomb threat
 - Complex Plume
 - Areal hazards using EPA's Areal Locations of Hazardous Atmospheres (ALOHA) model
 - This model estimates dispersion scenarios for dangerous gases



- ▶ Accident in GL 12/A
- ▶ Building colors identify population inside
- ▶ Gas leak is indicated using wind direction
- ▶ Safe evacuation routes can be planned using roads

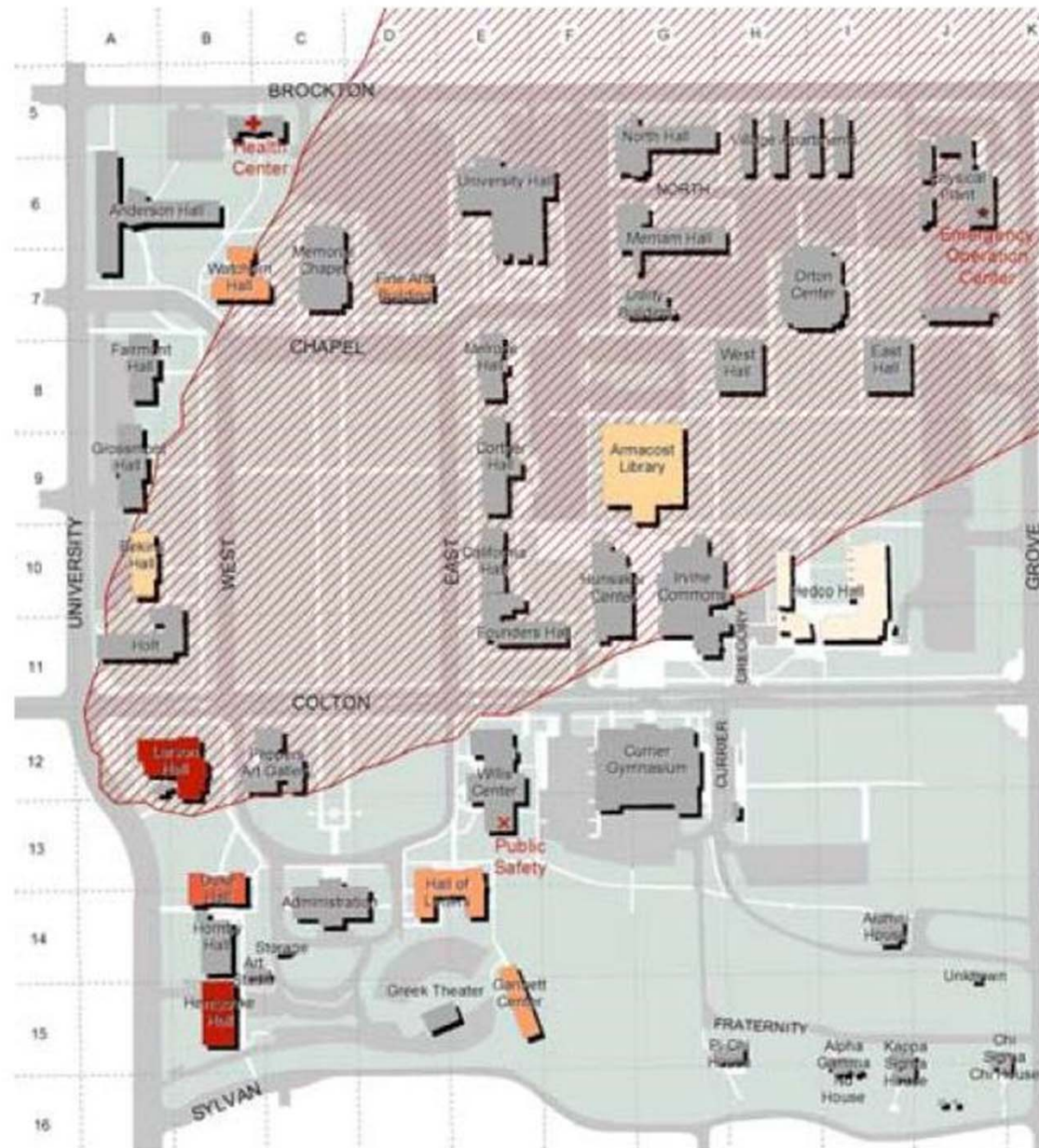
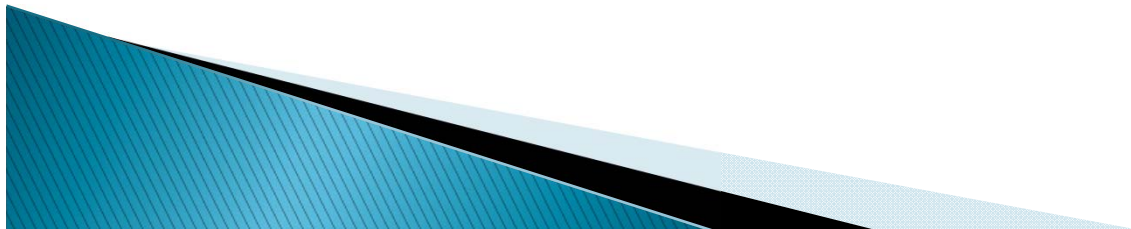


Figure 1 – Simulated GEMS disaster occurrence with buildings symbolized by population

GEMS overview

- Query and Analysis Component
 - Concentration of population at specific time can be queried
 - Threats at a specific time can be queried
 - Therefore, at a specific time because of a specific threat, the population at risk can be identified
 - Output can be on map, as well as table



- Query capability up to room level
- Contact info, allergy, medications for students can be identified

The screenshot shows a GIS application interface with a floor plan of a building. A red line highlights a path through several rooms, including 200, 204, 201, 203, 207, 207A, and 211. A 'Reports Info' window is open in the foreground, displaying a table of student data. The table has columns for State, Zip, Father Name, Mother Name, Allergies, Medications, and Notes. The data is as follows:

State	Zip	Father Name	Mother Name	Allergies	Medications	Notes
	153215	DIBENEDETTI...	BROWN VIRGINIA G			
	146462	SCOTTO JO...	BLACKMAN LESLIE A			
	238862	SATROM KI...	MALDONADO GAUDIOSA			
	639669	BAILLEY DAL...	WOODS COENNIE F			
	661381	SMITH DAVI...	HARRELL ELIZABETH			
	774022	OSWALT BR...	WESTFALL LORNA A			
	649121	WOHLMAN J...	LOMAX AUDREY J			
	820901	YEU MOON Y...	ROGERS DONNA H			
	557228	DONATUCCI...	GUZMAN YVETTE	Dairy	Diabetic	Requires blo...
	435215	MAJOR THO...	TUCKER KATHERINE K		Allegra	Required do...
	486106	TOUGAS GA...	JONES KAREN E	See Stings	Allegra	
	079264	CIRINCIO...	BLEVINS KATHI C			

Figure 2 – Drill down to Student Contact information

- HTML output for GEMS
- Red highlighted buildings are critical
- Student count is also mentioned below



Note: Critical buildings containing populations within a threat zone are labeled

The following buildings have populations and are located within the threat zone

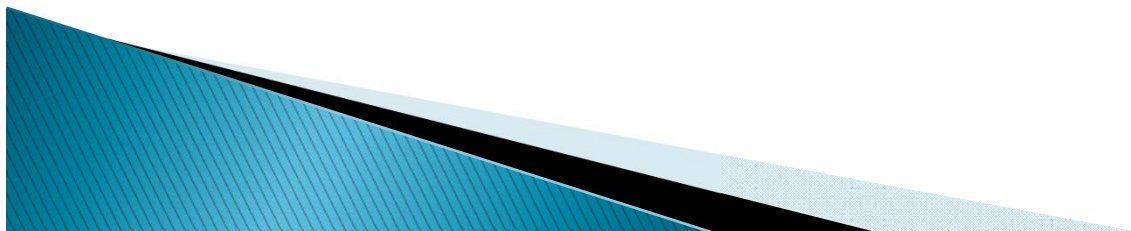
Building (Student Count)

Armacost Library (13)
Currier Gymnasium (26)
Duke Hall (78)
Gannett Center (42)
Hall of Letters (186)
Hedco Hall (45)
Hornby Hall (38)
Peppers Art Gallery (17)

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Recommendations for GEMS

- ▶ Limited disaster event functionality
- ▶ Data must be up-to-date
 - Registrar information
 - Student/teacher data
- ▶ The ITC must provide Registrar data in required format
- ▶ Commitment to learn
 - GIS basics
 - GEMS functionality



Thank you

