Hospital Gears Up to Combat the Flood

Full Mitigation Best Practice Story

Harris County, Texas

Harris County, TX – A nightmare, to put it mildly, is how Houstonians refer to the reign of Tropical Storm Allison. In June 2001 she ruled with a vengeance, creating massive flooding.

Among those worst hit by flooding was the Texas Medical Center, which sustained over $2.03 billion in damage. Located in the heart of the low-lying downtown area of Houston, Texas, the medical center is the nation's largest health-care mega-plex consisting of 42 medical institutions, 19 of which are hospitals, including St. Luke's Episcopal Hospital. Most of the buildings are connected by an underground tunnel system.

The rainfall overwhelmed flood protection systems, allowing rushing water to enter through inter-connected basement-level tunnels.

"It was horrible. I saw it all," recalls Gustavo Garcia, Mechanical Supervisor in the Facilities Engineering Department at St. Luke's. "I could see the water rising and could hear the rumbling of objects being pushed by the force of the water. I called my superior and told him that we were losing the building. Everything was shutting down. It was the weirdest feeling."

Following the 2001 flood, an engineering firm was retained to perform a study prior to developing a comprehensive flood mitigation plan. Installation of water-tight sub-basement doors was a part of the plan.

The submarine-type doors have a seal (bladder) surrounding their perimeter, which is inflated once doors are closed. They can withstand water up to 12 feet deep.

The Dry Flood Proofing Project began in December 2002 and was completed in December 2004, at a cost of $5,013,496. St. Luke's received a $3,866,698 grant from the Federal Emergency Management Agency (FEMA) through its Hazard Mitigation Program (HMGP). The hospital paid the other 25 percent. The project called for the installation of 20 submarine doors.

HMGP pays 75 percent on approved projects that will prevent or reduce damage from storms and other natural hazards. These grants are made available for both public and private projects.

St. Luke's Episcopal Hospital, home of the Texas Heart Institute, has been providing primary and tertiary health care to patients in the Houston metropolitan area and around the world for nearly 50 years.

The area that flooded is in the second basement, which houses the majority of the power distribution center. It had been protected by "flood logs" intended to prevent flooding. They were installed in the Texas Medical Center after a 1976 flood.

Manufactured in light weight aluminum, the "logs" provide an economical barrier against water flow through doorways. But it took time and manpower to operate. According to Garcia, it took about one-half hour and two men to bolt and secure the logs in place.

"The water came so fast it was impossible to secure all of the logs," Garcia said. "As soon as we secured the first log, the water began to rise above it. We tried a second, then a third. By the time we got to the fourth log the water was above my thighs. I knew it was time to head for safety."

As Garcia ran for safety, he said he saw water rushing against the giant barriers and spewing through the cracks like a fountain. The logs were no match for what lay ahead.

Now that the submarine doors are in place, there is a definite feeling of security. "My confidence is high with the submarine doors," Garcia said. "There is still a concern, when it rains, among some of the staff. However, when they see that I'm happy, that I'm not bothered, that seems to calm their fears."

Activity/Project Location

Geographical Area:	**Single County in a State**
FEMA Region:	**Region VI**
State:	**Texas**
County:	**Harris County**
City/Community:	**Houston**

Key Activity/Project Information

Sector:	**Public**
Hazard Type:	**Flooding**
Activity/Project Type:	**Flood Control**
Structure Type:	**Masonry, Reinforced**
Activity/Project Start Date:	**12/2002**
Activity/Project End Date:	**12/2004**
Funding Source:	**Hazard Mitigation Grant Program (HMGP)**
Funding Recipient:	**Critical Facility - Medical**
Application/Project Number:	**Project Worksheet 2489**

Activity/Project Economic Analysis

Cost:	**$5,013,496.00 (Actual)**

Activity/Project Disaster Information

Mitigation Resulted From Federal Disaster?	**Yes**
Federal Disaster #:	**1379 , 06/09/2001**
Federal Disaster Year:	**2001**
Value Tested By Disaster?	**Unknown**
Repetitive Loss Property?	**Unknown**

Reference URLs

Reference URL 1:	**http://www.floodsmart.gov**
Reference URL 2:	**http://www.fema.gov/hazard/flood/index.shtm**

Main Points

- When Tropical Storm Allison hit in 2001, the Texas Medical Center sustained over $2.03 billion in damage.
- The Texas Medical Center is the largest mega-plex in the nation consisting of 42 medical institutions.
- Rainfall overwhelmed flood protection system; thus, the tunnels that inter-connect the 42 medical institutions flooded.
- The flood protection system at the time consisted of "flood logs." However, they took a lot of time and man-power to put into place, and did not protect against the 2001 floods.
- Using HMGP funds from FEMA, submarine doors were installed in place of the "flood logs."
- Though the submarine doors have not yet been tested, there is a feeling of security.

Garcia demonstrates operation of submarine door

Garcia demonstrates submarine door closure

Picture of flood logs in front of door