HAZUS-MH and Technological Hazards

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Outline

- Introduction
- Overview of HAZUS-MH Methodology
- HAZUS-MH Walkthrough
- HAZUS-MH and Technological Hazards
Introduction
HAZUS-MH is the cutting-edge software model at the Federal Emergency Management Agency (FEMA) for estimating losses that may occur if disasters (floods, earthquakes and hurricanes) happen.

HAZUS-MH allows users to run what-if scenarios.

Results from HAZUS-MH provides decision makers with necessary information to:

- Assess level of readiness and preparedness to deal with a disaster in a given region within the U.S. (before the disaster hits).
Decide on how to allocate resources for most effective and efficient response and recovery when a disaster hits a certain region.

Prioritize the mitigation measures that need to be implemented to reduce future losses.

HAZUS-MH is still evolving to include additional hazards: airborne toxic releases, dam failures, etc...

For more information on HAZUS, please visit: WWW.FEMA.GOV/HAZUS
Overview of HAZUS-MH
HAZUS-MH Components

- Identify Hazard
- Model Inventory
- Quantify Impact

HAZUS provides comprehensive risk assessment by integrating information on hazard with that on inventory.
HAZUS-MH comes with a wealth of information on buildings and infrastructure. You have information on buildings (residential, commercial, industrial, religious, educational, etc...), on infrastructure (roads, bridges, hospitals, ports, airports, etc...), and on demographics (broken down by age, ethnicity, income, and ownership).
HAZUS-MH Impact Assessment

HAZUS quantifies the impact in terms of economic, social, functionality, and system performance.
Merits of HAZUS

- HAZUS has been used since 1997
  - Federal, state, and local government officials use HAZUS for pre-disaster preparedness and mitigation and post-disaster planning & response
  - Financial institutions such as banks and insurance companies use it to assess their exposure to the disasters (Schwabb, Wells Fargo, BofA, ISO, …)
  - Universities (professors and graduate students) use it for advanced applied research (MIT, GT, Univ of IL, Princeton Univ., Stanford, UC Berkeley, …)
  - Transportation and utility agencies use it to assess the reliability of their systems (CalTran, LADWP, PG&E, …)
HAZUS-MH Walkthrough
Step 1: Creating New Region

Welcome to HAZUS-MH.

In order to use HAZUS-MH, you need to define the study region to be used in the analysis.

Please select the desired option below, and a wizard will guide you through the necessary steps.

- Create a new region
- Open a region
- Delete a region
- Duplicate a region
- Export/Backup a region
- Import a region

Create New Region

Hazard Type
The hazard type controls the type and amount of data that will be aggregated. The hazard type selected affects the analysis options that will be available.

Your study region can include one or more of the following hazards. Check below the hazard(s) you are interested in.

- Earthquake
- Flood (selecting this option imposes a limit of 4 counties max. on the region size)
- Hurricane

Note:
Once a study region is built with a given hazard(s), it cannot be modified later on, in other words, you cannot add another hazard to it. Alternatively, you may re-create a similar region with different hazard(s).
Step 1: Creating New Region

**Study Region Name**
Each study region needs to be identified with a unique name.

Enter below a name which identifies uniquely your region. The name can be up to 50 characters long.

**Region description (optional):**

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**Aggregation Level**
The aggregation level defines the procedure by which the study is defined.

You can define your study region differently and at any desired detail. We call that the aggregation level. Please select below the aggregation level you want to use:

- State
- County
- Census tract
- Census block
Step 2: Accessing a Created Region

Welcome to the Open Region Wizard

This wizard will help you select the study region to work on among the regions you have created already.

To continue, click Next.

<table>
<thead>
<tr>
<th>Region</th>
<th>Description</th>
<th>Created</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHARLESTON</td>
<td>CHARLESTON COUNTY</td>
<td>11/1/2002 18:00</td>
</tr>
<tr>
<td>CHAR1STN</td>
<td>CHAR1STN</td>
<td>11/1/2002 18:04</td>
</tr>
</tbody>
</table>

Select Region
The study region selection sets the region that will be opened.

Below is a list of the valid study regions you have created so far. Select the region you want to open.
Step 2: Accessing a Created Region [2]

Open Region

Study region hazards selection
If a region has data for multiple hazards, one only can be worked on at a time, and needs to be selected before the regions is opened.

The region you have selected has data for the hazards listed below. You can only work on one hazard at a time.

You can always switch hazards at any time from the study region menu.

Please select the hazard to be current when your region is opened.

- Earthquakes
- Flood
- Hurricane

Open Region

Completing the Open Region Wizard

You have successfully completed the Open Region Wizard.

You have selected to open the region:

CHARLESTON

The hazard you selected was:

Earthquake

To close this wizard, click Finish.
Step 3: HAZUS-MH Interface
HAZUS-MH and Technological Hazards
Chemical, Biological, Radiological (Dirty Bomb), Nuclear and Explosive Threats (CBRNE)

- ALOHA (Areal Locations of Hazardous Atmospheres) predicts rates of chemical releases and displays a “footprint” plot of the area downwind of a release where concentrations may exceed certain threshold levels.

- ALOHA plume can be combined with HAZUS-MH exposure profiles and demographic data to estimate # people & buildings/facilities affected by release.
HAZUS-MH with 3rd Party TH Models

- 3rd Party Weapons of Mass Destruction Models
- ALOHA / Dispersion
- FLDWAV / Dam Breach

HAZUS-MH Application Database

- DTI Customized Automated Data Integration Tool
- Map and Tabular Generation

- Study Region Aggregation
- Study Region Spatial and Tabular Operation

HAZUS-MH

- Spatial Definition Tools
- Existing Natural Hazard Models
- Customized Man-Caused Hazard Models

Hazard Analytical Tools

Hazard Reporting Tools

- HAZUS Results
- HAZUS Results Viewer

HAZUS Results Viewer

Hazard Description Database

- Vector GIS Data
- Critical & Lifeline Inventory Database
- HAZUS Scenario Results

FLDWAV is a real-time flood forecasting model for dam-break floods and dam-breach flood analyses (NOAA)
### Modeling Technological Hazards: [1] Profiling

<table>
<thead>
<tr>
<th>Hazard</th>
<th>Application Mode</th>
<th>Hazard Duration</th>
<th>Extent of Effects</th>
<th>Mitigation Issues or Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional Bomb</td>
<td>Detonation</td>
<td>Instantaneous; secondary devices may extend duration</td>
<td>Determined by type, location, and quantity of explosive</td>
<td>Ease of access to targets; use of structures/vegetation for shielding</td>
</tr>
<tr>
<td>Chemical Agent</td>
<td>Liquid/Aerosol</td>
<td>May extend for days or weeks</td>
<td>Contamination may be carried by persons, vehicles, wind or water</td>
<td>Weather conditions; shape of buildings and terrain; shielding and other mitigation techniques</td>
</tr>
<tr>
<td>Biological Agent</td>
<td>Liquid or solid contaminants can be dispersed using aerosol or munitions</td>
<td>Hours to years, depending on the agent</td>
<td>Widespread, depending on the agent used.</td>
<td>Altitude above ground of release; weather conditions; other factors</td>
</tr>
</tbody>
</table>
Inherent Vulnerability (components)
- Visibility
- Utility
- Assess ability
- WMD Hazard
- Potential For Collateral Damage
- Occupancy

Tactical Vulnerability (components)
- Site Perimeter
- Building Envelope
- Facility Interior
# Inherent Vulnerability

<table>
<thead>
<tr>
<th><strong>Visibility</strong></th>
<th>How aware is the public of the existence of the facility, site, system or location?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Utility</strong></td>
<td>How valuable might the place be in meeting the objectives of a potential terrorist or saboteur?</td>
</tr>
<tr>
<td><strong>Accessibility</strong></td>
<td>How accessible is the place to the public?</td>
</tr>
<tr>
<td><strong>WMD hazard</strong></td>
<td>Are hazardous flammable, explosive, biological, chemical, and/or radiological materials present on site?</td>
</tr>
<tr>
<td><strong>Potential for collateral damage</strong></td>
<td>What are the potential consequences for the surrounding area if the asset is attacked or damaged?</td>
</tr>
<tr>
<td><strong>Occupancy</strong></td>
<td>What is the potential for mass casualties based on the maximum number of individuals on site at a given time?</td>
</tr>
</tbody>
</table>
# Tactical Vulnerability

## Site Perimeter
- **Site Planning and Landscape Design** – is the facility designed with security features?
- **Proximity** – is the facility in proximity to another landmark that may be chosen as a target?
- **Parking Security** – is vehicle access managed in a way that separates vehicles and structures?

## Building Envelope
- **Structural Engineering** – is the facility designed to be blast-resistant?

## Facility Interior
- **Mechanical Engineering** – are utilities and HVAC systems protected and/or backed up with redundant systems?
- **Fire Protection Engineering** – are the building’s water supply and suppression systems in place?
- **Electronic and Organized Security** – are systems and personnel in place to protect the facility?
- **Architectural and Interior Space Planning** – does security screening cover all public and private areas?
Concluding Thoughts

HAZUS-MH architecture easily enables:

- Linkage to 3rd party Technological Hazards (TH) models, or
- Seamless integration of newly developed TH models

TH results will be provided in the same standardized format to existing HAZUS-MH hazards:

- Structural damage
- Social impact (injuries, deaths, and shelter needs)
- Functionality (disruption of services)
- Financial impact (facilities, contents, and BI)