Disaster Evacuation Planning in Areas Subject to Natech Risk

Introduction

The purpose of this study was to assess the risk of conjoint natural and technological (Natech) disasters and evaluate the adequacy of emergency evacuation planning for these types of events in Higashnada Ward, Kobe. Meetings with local community associations, government officials and fire fighters were carried out to collect data and information, and served to raise awareness concerning vulnerability to Natech risk and possible risk reduction strategies.

Methodology

This study performed a Natech risk assessment using a qualitative and a semi-quantitative methodology. A Natech risk index (NRI) for each hazmat containing storage tank, in a territory for a given natural disaster scenario, can be defined according to the following expression: [NRI] = [HRL] * [D + Area_sc + C] (Eq. 1)

Where HRL is a score that indicates the likelihood of a release given the natural hazard event; D is a score that accounts for the effects of potential domino chemical accidents; Area-sc is a score that measures the potential consequences on the population; and C is a score that measures the potential consequences on essential facilities that are critical for the safety and well being of the community. Three scenarios were studied: a. Nankai trough EQ; b. Kobe EQ in 1995; c. Tohoku EQ in 2011. The estimated scores and the actual reported consequences for b. and c. (reference scenarios) are shown in Table 1 below. Figure 1 shows the evacuation advisory area and the estimated impact area for the Kobe earthquake.

Conclusions

Natech risk following a Nankai earthquake in the study area is not negligible, pointing to the urgent need to better prepare residents and local officials. Residents should be well informed about the Natech dangers in their area, as well as the disaster prevention and preparedness measures they should take. In particular they should be informed of they types of chemicals handled, the potential accidents, and what they should do in the event of an accident concurrent with a natural disaster.

	A	B		C	
	Score	Score	Reported	Score	Reported
HRL	3	2	LPG released from a flange connection of due to the main shock of the EQ. [1]	3	LPG tank filled with water is damaged by main shock, and collapse due to aftershock causes release and fire. [3]
D	3	3	No consequences	3	17 adjacent storage tanks destroyed by fire/ explosion.
Area_sc	3	3	Evacuation advisory to 72,000 people. Evacuation shelters full. Many people use cars as shelter. [2]	2	Evacuation advisory to 1,000 people. Glass of 118 houses was damaged. [3]
C	4	3	No direct impacts reported. Loss of electricity, damage to water systems, loss of communication, damaged to roads, bridges, etc.	2	No direct impacts reported. Power outages, disruption of public transportation, over-whelmed communications.
NRI	30	18	No deaths, no injuries	21	No deaths, 6 injuries.

Table 1. Estimated NRI scores and reported consequences for reference scenarios

Outreach and outputs

The project has allowed the research team to work with local community associations in Higashinada Ward. A workshop was organized with the Mikage Community Association in July 2014, and since October 2015, members of the research team have participated in the monthly meetings of the Goden Community Association (GCA). In particular, the GCA has been very keen in improving their disaster preparedness and evacuation planning for Natech disasters. The research team has participated at local festivals and fairs, and a disaster evacuation drill. The results of the this project will be presented to the GCA members in July 2015. The "Chemical Emergency Response Guidelines", developed in this project will also be presented to the community.

The results of this project have been/ will be presented at national and international conferences by several members of the research team.

(Source: Google Maps)

Figure 1. Kobe earthquake (EQ) Natech evacuation advisory area (red line), estimated impact area (concentric circles), and shelters.