

Estimation of potential Natech impacts in port areas in Mexico and El Salvador

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Natural hazard-triggered technological accidents (Natechs) have emerged as a significant contemporary threat, posing complex and uncertain challenges to disaster risk management globally. Mexico and El Salvador are no exception to these risks (Figure 1). In particular, the port areas of Manzanillo and Acajutla—critical infrastructure for their national economies—exhibit heightened vulnerability to such events due to their industrial facilities and exposure to natural hazards. Both areas are earthquake and tsunami-prone and have experienced such events in the past.



Figure 1. Study areas within the scope

This presentation outlines the methodology for estimating potential Natech impacts in these key port areas, with a focus on the interplay between natural disasters and industrial activities involving hazardous substances. It also presents results from preliminary analyses (Figure 2).

Initially, a comprehensive characterization of the study areas in Mexico and El Salvador was conducted. This involved identifying facilities engaged in various

processes, with a particular focus on those handling hazardous materials. Facilities were selected based on available public information, then updated using researchers' on-site experience and lessons from past events. The characterization considered key factors such as industrial activities, nearby communities and hazardous materials inventories, access to health services and education, and existing emergency response infrastructure. The goal was to assess the potential for industrial accidents—such as fires, explosions, or supply chain disruptions—triggered by earthquakes or tsunamis, while also accounting for critical infrastructure. This holistic approach allowed for a robust understanding of the multi-hazard environment and the inherent vulnerabilities of the industrial infrastructure.

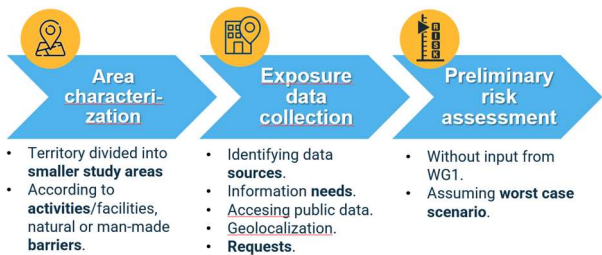


Figure 2. Methodological steps

The second step involves collecting exposure data by systematically gathering detailed information on elements at risk, such as industrial facilities, populations, infrastructure, and environmental assets. To date, we have compiled comprehensive datasets for both Manzanillo and Acajutla—essential for

developing a robust framework to assess compound risks in later stages. These datasets have been geolocalized on municipal maps and will be supplemented with information from local stakeholders during upcoming field trips and online meetings.

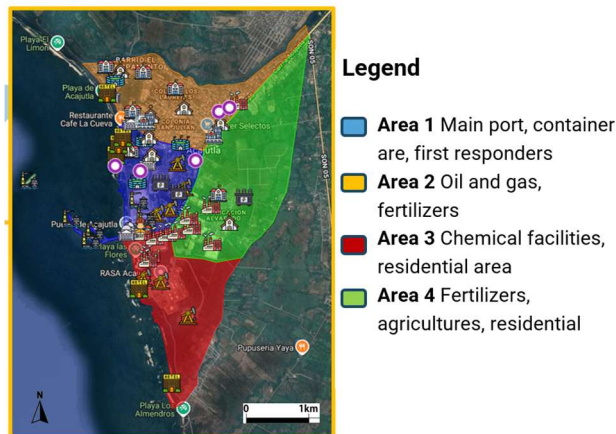


Figure 3. Defined study areas for El Salvador

A preliminary risk assessment has been conducted for some of the identified facilities, retrieving information on their activities and hazardous materials inventories. The results for both municipalities will be presented. This assessment highlights specific vulnerabilities and potential cascading effects that could exacerbate the impact of natural disasters on industrial infrastructure. This assessment represents the third step in the overall methodology, integrating findings from the characterization and exposure data to identify initial hazard scenarios and potential impacts.

This assessment represents the third step in the overall methodology, integrating findings from the characterization and exposure data to identify initial hazard scenarios and potential impacts. some results of this preliminary analysis will be presented (Figure 4), including the developed preliminary compound risk

maps (visually representing areas with elevated risk levels and highlighting regions where multiple hazards converge, thus necessitating targeted risk reduction strategies)

LNG – flammable areas

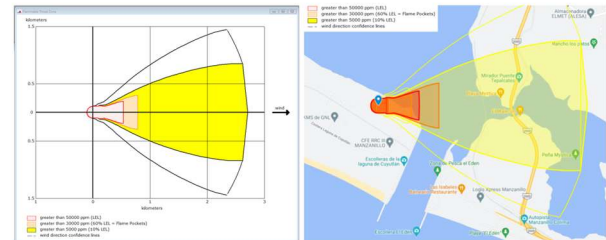


Figure. LNG scenarios, flammable áreas (left), effects on Manzanillo map (right).
* LEL. Lower Explosive Limit (LEL)

Figure 4. Example of preliminary results in Mexico

Finally, this presentation will showcase the key results of the preliminary analysis, including compound risk maps delineating earthquake- and tsunami-triggered Natech scenarios, alongside a robust compound risk assessment framework. These outputs integrate prior characterization, exposure data, and risk evaluations to identify critical vulnerabilities, cascading effects, and actionable mitigation priorities for enhancing resilience in Manzanillo and Acapulco.

The preliminary results have already been shared with local stakeholders in both countries, including representatives from local and national governments, first responders, students and professors from local universities, researchers, and industrial facilities. These engagements have enhanced Natech risk awareness and established communication channels among stakeholders, reflecting their shared commitment to maintaining the risk reductions efforts in these areas.