API 656 Storage Tank NATECH Natech (Natural Hazard Triggered Technological Accidents)

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FINANCIAL TIMES
Last updated: August 30, 2005 1:07 pm
Hurricane drives crude oil prices to record high

API SCAST Endorses New Publication

- First meeting held on 14 Feb 2020
- Taskgroup formed to author this publication
- PEMyers of PEMY Consulting and Earl Crochet of Kinder Morgan to co-chair this TG
- Tank owners/operators have interest in this project
- This project is needed given most of the world is not seriously considering how to deal with Natech, developing methods, guidelines and publications related to Natech
- By API acting now, this will head off other SDOs from issuing potential publications which would replace API publications and best practices

Topic:Natech-Natural Hazard Triggered Technological Accidents

- Natural hazard triggered technological accidents involving the releases of hazardous materials (hazmat) are known as Natechs
- A few:
  - 1994 Milford Haven Storm in UK – flammable vapors release and lighting results in fire that causes 10% loss of UK refining capacity.
  - 2005 Hurricane Katrina and Rita in US result in oil and gas releases including a tank that contaminated over 1800 homes and huge losses for the oil and gas industry
  - 2008 Wenchauan earthquate in China results in release of sulfuric acid and ammonia causing evacuation of 6000
  - 2011 Great East Japan Earthquake and Tsunami cause extensive damage to infrastructure
  - 2017 Hurricane Harvey causes sinking floating roofs and tanks sliding resulting in spills

Natech Initiators

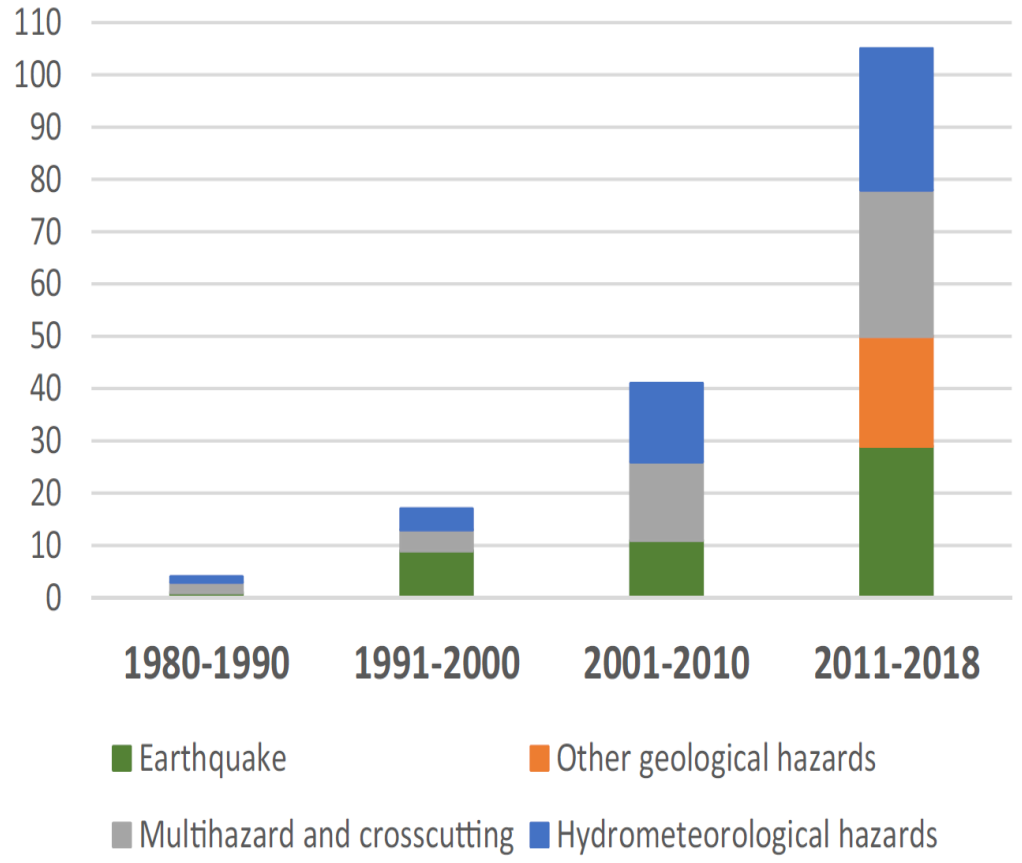
Table 1
Classification criteria for grouping and analyzing Natech research.

Classification		Risk management stages
a) Geological hazards	• Earthquake • Volcanic eruption • Tsunami • Landslide	• Accident analysis and return of experiences. • Risk assessment. • Risk treatment/risk reduction. • Risk communication and risk perception.
b) Hydrometeorological hazards	• Storms • Tropical cyclones (hurricanes/typhoons) • Tornadoes • Floods • Lightning • Extreme temperatures	
c) Multi hazard and cross cutting		

Progress in Disaster Science “Advances in Natech Research – An Overview” Cruz Suarez-Paga

Natech Categorization

1. Three groups
   - Geolocial
   - Hydrometeorological
   - Multihazard
2. Geological
   - Earthquakes
   - Volcanos
   - Tsunamis
   - landslides and related
3. Hydrometeorological
   - Storams
   - tropical cyclones
   - Tornados
   - Wind
   - Flooding
   - Lightning
   - xtreme temperatures
4. Multihazard: Multiple effects and domino effects (e.g. Fukushima Daiichi 2011)



Reliability Engineering & System Safety
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Development of parametric fragility curves for storage tanks: A Natech approach

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Source and Setting

- Natechs can be triggered by any **kind and size** of natural hazard event, it **doesn't need** to be a major one.
- Natech risk exists **everywhere**, where hazardous-materials installations are **located in** natural hazard zones.
- Natechs risk **expected** to increase in the future due to more frequent natural hazards (e.g. climate change), industrial growth and increasing vulnerability of society (e.g. urbanisation, interconnectedness)

Exposure and Vulnerability

- **Simultaneous** releases from **multiple** sources over wide areas
- **Unavailability of lifelines** needed for accident mitigation
- **Competition** for scarce resources
- Hazardous releases **hampering emergency response**
- **Non-functional** or **inappropriate** civil protection measures

Natech Risk Assessment

- **Powerful** tool for identifying Natech **hazards** and estimating associated **risk**
- **Overlay** of natural hazard risk and industrial installations does **not** indicate **Natech risk**!
- Physical **damage** due to natural hazard impact and related hazardous **consequences should** be analysed
- The analysis should **consider**:
  - Multiple and simultaneous releases
  - Damaged safety barriers/systems
  - Unavailable support systems
  - Unusual environmental conditions
  - Cascading events (e.g. domino effects)

Steps in Natech Risk Assessment

1. Characterization of the natural hazard
2. Identification of critical equipment
3. Identification of damage severity and impact scenarios
4. Estimation of damage likelihood
5. Estimation of loss of containment and accident scenarios
6. Identification of credible combinations of events
7. Calculation of likelihood of each combination
8. Evaluation of consequences of each combination
9. Risk evaluation

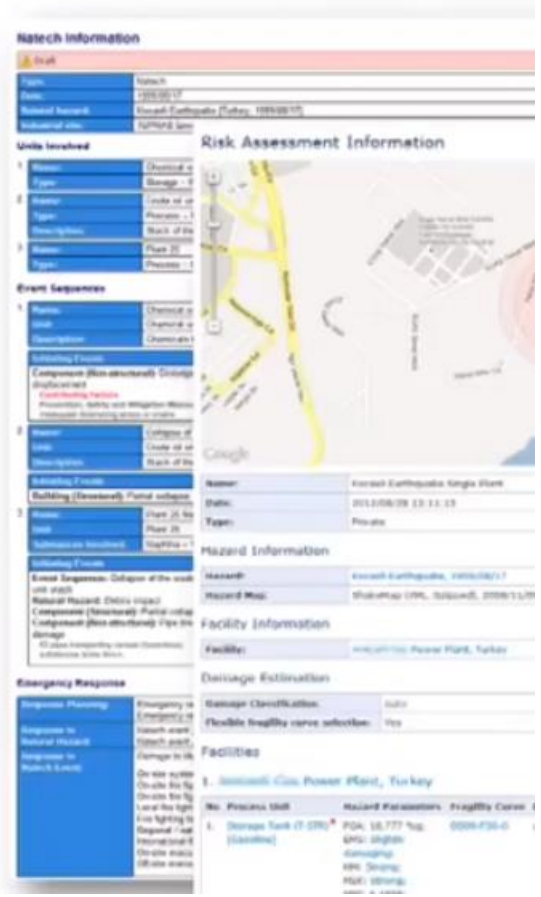
Data need is **minimal** if **natural hazard and industrial risk data** are collected **considering** Natech risk!

Good Practices for Addressing Natech Risk

- European Union: **Seveso III Directive** explicitly addresses Natechs and requires installations to identify and evaluate Natech risks
- OECD: Natech addendum to the **guiding principles** for chemical accident prevention, preparedness and response contains Natech-specific amendments
- U.S.A.: California Accidental Release Prevention (CalARP) program calls for Natech **risk assessment** for earthquakes
- Japan: Laws on industrial safety and industrial disaster prevention requires **additional measures** to reduce Natech risks

Tools for Natech Risk Assessment

- **eNatech**: Natech accident database for systematic collection and analysis of global data (http://enatech.jrc.ec.europa.eu)
- **ARIPAR**: QRA for chemical facilities (module for earthquake impacts on single sites)
- **RAPID-N**: Semi-quantitative general framework for Natech risk assessment and mapping (http://rapidn.jrc.ec.europa.eu)



Event	Standards	Damage Mechanisms	Value Added
Flooding	ASCE7-16, FEMA	Sliding, piping -> spills Wind dependency	Little current guidance Provide ballast requirements to prevent damage Priority: high
Rainfall	API 650, NOAH Precip Server, ASCE7-16	Damage, sunk floating roofs -> spills Flooding dependency	Little current guidance Provide guidelines about floating roof drains, sizing, maintenance: Priority: high
Wind	ASCE7-16, FEMA	Sliding, buckling, overturning Flooding dependency	Little current guidancxe Guidelines about how flooding impacts potential wind damage Priority: high
Seismic	API 650, ASCE7-16	Sliding, buckling, overturning	Guidance well established Priority: low

Event	Standards	Damage Mechanisms	Value Added
Snow	API 650, ASCE7-16	Floating roof sink Fixed roof damage Dome buckling; spills possible	Reasonable current guidance Limited to colder regions Priority: low
Ice	API 650, ASCE7-16	Damage, sunk floating Inoperability Damaged drains and piping; spills possible	Some guidance Limited to colder regions Priority: medium
Tsunami	?	Low probability Vulnerability limited to coastal	Little guidance Limited discussion at this point Priority: low until determined otherwise
Other			Not yet discussed

Next Steps

- Conf call to be scheduled before API Spring 2020 meeting in New Orleans
- 2.5 hr f2f meeting in New Orleans week of April 2020
- API welcomes participation by other members/organizations under the ANSI accredited SDO process
- Let me know if you are interested in participating