



European
Commission

Introduction to Natech risk:

Concepts, gaps and JRC activities

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Joint
Research
Centre



theguardian

Chemical leaks threaten Prague as floods hit Dresden

ENERGY NEWS

Hurricanes Destroyed 109 Oil Platforms: US Government

China quake hits chemical industry

16 May 2008



Natech Definition

A NATECH accident is a chemical accident caused by a natural hazard, such as floods, earthquakes, landslides etc.

Chemical accidents include oil and chemical spills, gas releases, and fires or explosions involving hazardous substances from fixed establishments (e.g. petrochemical, pharmaceutical, pesticide, storage depot), oil and gas pipelines and offshore industry





Studies show that 5 % of accidents in industrial accident databases were caused by natural hazards

AND

There is a bias towards high-consequence accidents in databases, so the actual number of Natech accidents is probably higher



"Well he certainly does a very thorough risk analysis."

Natech risk-reduction situation:

- Legislation, codes and standards for chemical-accident prevention rarely address Natech risk explicitly (*BUT: Seveso III, regional acts!*).
- There is little knowledge on the dynamics of Natech accidents.
- There are hardly any methodologies and tools for Natech risk assessment and no guidance for industry on how to assess Natech risk.
- Emergency response plans do not consider the characteristics of Natech accidents (loss of utilities).
- There are no Natech risk maps to identify areas in danger.

.... from a JRC survey on the status of Natech risk reduction in EU MS and the OECD

Expected increase in Natech risk:

→ **more hazards**

(climate change, industrialisation)

→ **higher vulnerability**

(urbanisation, interconnectedness)

... in a situation where Natech risk assessment methodologies & tools and guidelines for Natech risk management are missing.

**From a JRC survey on the status of Natech risk reduction in EU MS and OECD*

E. Krausmann, D. Baranzini (2012) Natech risk reduction in the European Union, J Risk Research 15(8): 1027-1047

Priority work areas*:

- Implement and enforce regulations for Natech risk reduction
- Develop methods, tools and guidance for Natech risk management
- Develop dedicated Natech emergency management plans
- Develop Natech risk maps
- Raise awareness and improve risk communication
- Train stakeholders on Natech risk reduction

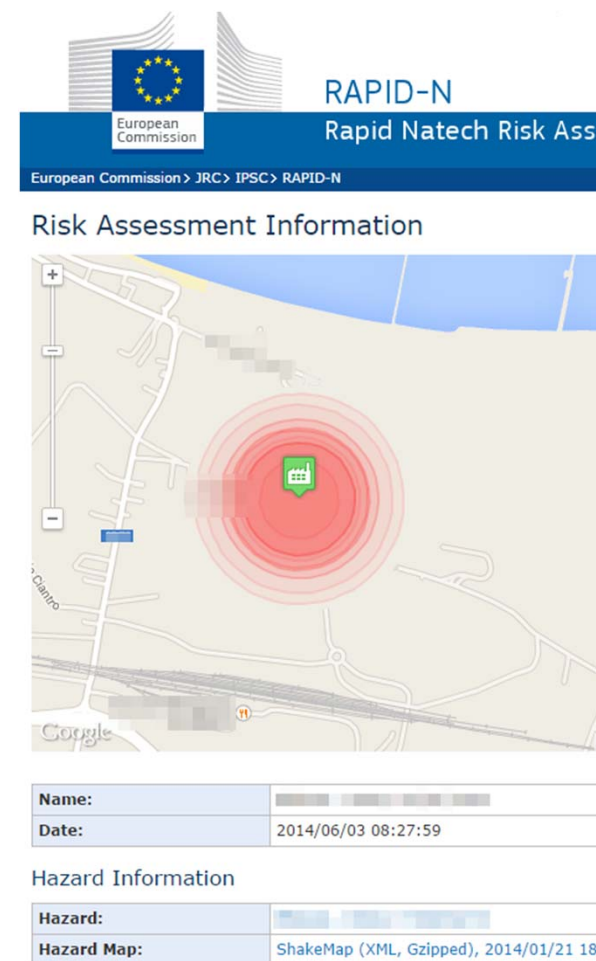
Accident analysis and guidance

- Identification of vulnerable equipment (*fixed, pipelines, offshore*), scenarios and consequences (*earthquakes, floods, lightning, hurricanes*)
- Site surveys for Natech damage assessment (*Japan, China*) & statistical analysis
- Lessons learned & recommendations

- Natech accident database: **eNatech**
<http://enatech.jrc.ec.europa.eu>

Risk analysis tools

- Framework for Natech risk assessment and mapping: **RAPID-N**
<http://rapidn.jrc.ec.europa.eu>





JOINT RESEARCH CENTRE

eNATECH - Natural hazard-triggered technological accidents

European Commission > JRC > IPSC > eNatech

Natechs

Country: Hazard: Natech ID:
 Site: Date: - Status:

50 record(s) found. Page: Rows: Sort by:

No	Date	Country	Natural Hazard	Site	Natech ID	
1.	1923	Japan	Tokyo Earthquake	Yokosuka Naval Base	10	
5.	1989/09/20	United States	Hurricane Hugo	Amerada Hess Oil Co.	55	
6.	1994/01/17	United States	Northridge Earthquake	ARCO-Four Corners Pipeline	44	
7.	1994/02/22	South Africa	Merriespruit rain	Harmony Gold Mine	56	
8.	1994/07/24	United Kingdom	Lightning	Pembroke Refinery	47	
9.	1994/10/19	United States	San Jacinto River Flood	Pipeline	45	
10.	1995/10/24	Indonesia	Lightning	Pertamina Cilacap Refinery (Unit Pengolahan IV)	4	
11.	1998/02/27	Ecuador	Landslide	Trans-Ecuadorian Oil Pipeline	38	
12.	1998/04/25	Spain	Doñana Disaster/The Los Frailes tailings dam failure/Aznalcollar Disaster/Guadiamar Disaster	Los Frailes mine	27	
13.	1998/09/26	United States	Hurricane Georges	Chevron Pascagoula Refinery	3	
14.	1999/08/17	Turkey	Kocaeli Earthquake	TUPRAS İzmit Refinery	2	
15.	1999/08/17	Turkey	Kocaeli Earthquake	AKSA Acrylic Fiber Production Plant	5	
16.	2000/01/30	Romania	Heavy rainfall	Aurul Mine	28	

<http://enatech.jrc.ec.europa.eu>

(Natech) risk assessment

Main questions to address:

WHAT can go wrong?

HOW likely is it?

WHICH consequences are expected?



Qualitative versus quantitative

Qualitative: requires little effort and no specific RA expertise → understand which hazards need to be prioritized to reach pre-defined risk reduction targets

Quantitative (QRA): powerful technique but application is complex, time-consuming and requires skilled resources → well-accepted Framework for QRA exists, allows identification of system weaknesses and the prioritization of safety measures

Natech RA: regardless of approach chosen, extensions to both qualitative and quantitative RA need to be made to fully consider Natech characteristics

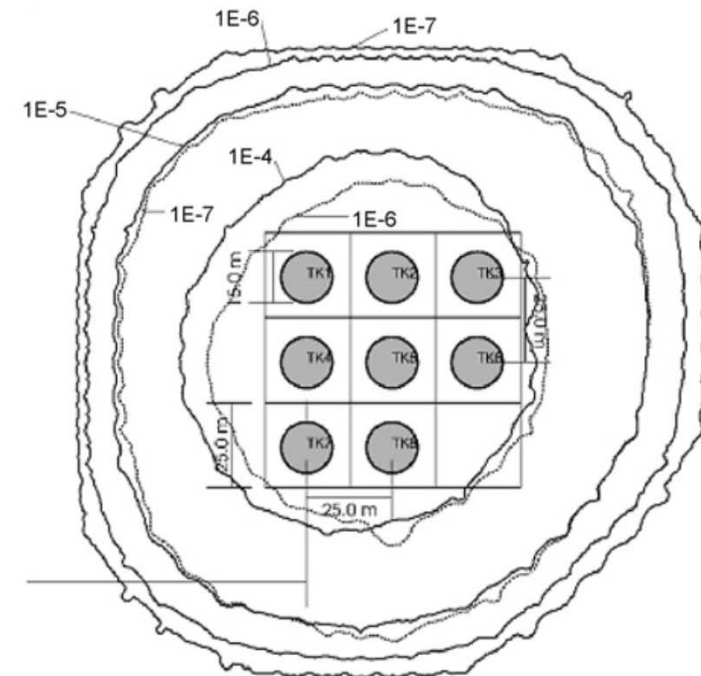
Steps in Natech risk assessment

- 1 Characterization of the natural hazard
- 2 Identification of critical equipment
- 3 Identification of damage severity and accident scenarios
- 4 Estimation of damage likelihood / probability (**Equipment damage models**)
- 5 Consequence evaluation of the accident scenario
- 6 **Identification of credible event combinations**
- 7 **Probability / likelihood calculation for each combination**
- 8 **Consequence calculation for each event combination**
- 9 Risk integration

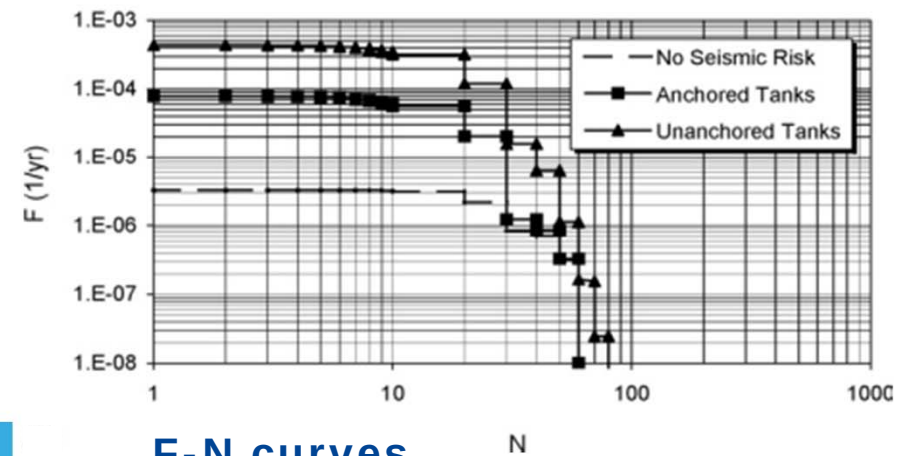
Individual Risk curves

Risk matrix

		Impact				
		Very Low	Low	Medium	High	Very High
Likelihood	Very High					
	High					
	Medium					
	Low					
	Very Low					



Impact zones



Lack of recognition that industry is vulnerable to the impacts of natural hazards.

Lack of guidance on how to identify Natech hazards and assess the associated risk.

Data availability → incomplete knowledge of dynamics of Natech accidents and hence lack of scenarios.

Questions about **adequacy of design basis**:

- Design codes and standards aim at preservation of life safety, not prevention of loss of containment.
- Uncertainty as to which level of damage or failure is to be expected above the design-basis loading.

Natech risk assessment is fundamentally a **multi-disciplinary issue** and cuts across traditional professional boundaries.

Thank you for your attention!



RAPID-N tool for rapid Natech risk assessment and mapping:
rapidn.jrc.ec.europa.eu



eNATECH database for Natech accidents
enatech.jrc.ec.europa.eu

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