

Fire in a chemical plant (Venezia, Italy)

Lessons Learnt from INDUSTRIAL ACCIDENTS. 15th Seminar. IMPEL

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TOPIC: Environmental monitoring and decomposition of products in smokes

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The site of the industrial establishment



The area within a **two-kilometers** include **industries** and populated **buildings**, **airport**, **port**, **lagoon**



The UT establishment used to **produce** highly reputed **specialties** for personal and **home care**, **paper**, **plastics**, **textiles**, **cosmetics**, and other industries



Involved substances

Tank TK 2.2 was likely to have been holding

WASTEWATER CONTAINING METHYL ALCOHOL, ETHYL ACRYLATE, WHITE SPIRIT, XYLENE (H226 - *Flammable* liquid and vapor; H411 - *Toxic to aquatic life with long-lasting effects*)

The amount directly involved in the event was 130 tonnes



Other substances present at the establishment in the units affected (plants, units and storage on the forecourts)	
2-ethylhexyl-4-aminobenzoate	bis-Aminopropyl ethylenediamine
Xylene	tert-Butyl hydroperoxide
Acetone	tert-Butylamine
Methanol	Ammonia
Ethyl acrylate	Diisopropylamine
White spirit	Xylenic mixture
Morpholine	

Accident dynamic

The accident occurred in the **morning** during **modification** works, by an **external firm**, which was connecting **tank TK 2.2 to the wastewater network**

One hour **before** the event, these **workers had cut the pipe** that was being worked on

The event occurred when **the cut pipe was being sealed**, while an **electric arc welder** was in use

The **trigger** gave rise to the **explosion and catastrophic rupture** of the atmospheric tank

An **internal domino effect** was generated, in a succession of **fires and explosions**



Emergency response

The **External Emergency Plan** (EEP) was activated by the **Prefect's** Office, following first notification from the **fire brigade**

People living in the industrial district **within 1km** radius of the establishment were asked to **stay at home** with the **windows closed** until the emergency was over

Following intervention by the off-site external emergency services, the **fire** was brought **under control** at 14:00, and the **emergency** was declared **over** at 17:00

Approximately **30 fire brigade vehicles** attended with **90 firefighters**, including from **neighbouring** stations



Consequences on equipment and structure



<< Plant Unit #3



Tanker
Truck
>>



Collapsed Fiberglass tank

IBC and
DRUMS
>>>>



<<<<
Plant
Unit
#6

Damage to human health, environment and property

- ❑ 2 employees sustained burns to 30-40% of their bodies, hospitalised for 2 months, but at the end they recovered well
- ❑ 3 employees first degree burns to the face and neck; inhalation of toxic fumes; multiple bruises: they recovered in a couple of weeks
- ✓ EUR 35,000,000 (*material losses*)
- ✓ EUR 14,000,000 (*response, clean-up, restoration costs*)



- No pollutants were found in the waters of the Lagoon, traces were found in the industrial canals



Air sampling activity: event in progress and event closure

Based on the **meteorological and climatic** conditions of pollutant **dispersion**, air quality monitoring was carried by the Regional Environmental Protection **Agency** out using **canisters**

- **4 points inside and adjacent the site**, in the industrial area
 - *High values of solvents such as **Ethylbenzene, Xylenes, Ethanol, Acetone, Acetates, Acetonitrile** generated by the **fire** and characteristic of the **production cycle** of the establishment*
- **16 sensitive points downwind**, towards **urban centers and Venice lagoon (10km of radius)**
 - *Traces of some pollutants, such as **Ethanol, Acetone, Acetonitrile***
 - *The **high-volume sampling (3 bubblers)** for the search for organic micropollutants shows only **traces** of Dioxins and furans (**PCDD/PCDFs**), polychlorinated biphenyls (**PCBs**) and polycyclic aromatic hydrocarbons (**PAHs**), probably **deriving from the industrial area** of Porto Marghera*

Sampling of runoff water and neighboring channels

The huge deployment of **extinguishing water** led to the **saturation** of the **wastewater collection and storage system** of the production site with the activation of the **emergency discharge** into the industrial **channels**

From the **17 samples** taken at the point of **entry of the wastewater into the body** of water, solvents used in the **production cycle** were determined such as **Benzene, Toluene, Ethylbenzene, Acetone, Acetates**

Significant concentrations of **cyanides** have been found both **in the discharge and** in some external points of the **receiving industrial canal (7km)**, which have led to the **huge death of fish**

Monitoring of consumer agricultural products and related bans

1. Precautionary **fishing prohibited** for at least **5 days**
2. **Sampling of fish collected** in order to verify the **causes** with search for **substances** potentially deriving from the **site**
3. **Avoid** consuming **agricultural products** while waiting for **sampling**

The **local health authority** provided n. **8 samples** of **agricultural and horticultural products** in the urban area (**7km**) subject to the **fire fallout**

➤ *The polycyclic aromatic hydrocarbons (PAHs) research parameter **tracer of potential releases** was found to be **below the Limit Of Quantification (LOQ)***

Lessons learned

- ✓ A risk analysis on all **changes** (**preliminary** risks, risks during **implementation** and risks during **operation**), resulting in the identification of **preventive and protective measures** to be implemented, as well as the related **training activities** for the staff
- ✓ Always keep systems subject to **modification works under isolated and inert conditions** to prevent the environmental conditions from changing, which could lead to the **formation of potentially flammable and/or explosive atmospheres**



Lessons learned

- ✓ The **work permit** process must always pay attention to: **checks** prior to and/or during the **performance of the activities**; **supervision** by the persons responsible; **formalization**
- ✓ Follow the **procedures** for the correct **positioning of stores of hazardous substances** and mixtures on the **forecourt** (e.g. tanks, drums, IBCs, etc.), including related fire **protection systems** and equipment, as a result of an appropriate **risk analysis**

Discussion

In **chemical** specialties industry there are many **SMEs with a poorer safety culture**. As **competition** is higher, technical interventions are done under **hurry**, and recognized **practices** are possibly **disregarded**. Experience and knowledge are forgotten, **risks are ignored** or misunderstood at all

The **lack/impoverishment of safety** culture makes internal organization **impervious** to external knowledge

The industrial **associations** should supply the **weakness** of single enterprise, with a capillary action to **disseminate knowledge** through their network



Conclusions



- Regulatory **authorities** have a huge responsibility. In particular, the mandatory **inspections**, required by the Seveso Directive, **should verify actual safety culture**
- In the chemical specialties sector, **inspectors should pay attention to the management of changes**, where recognized good practices may be forgotten, preferring **informal procedures**, which may cause **accidents** with flammable substances
- **Sample interviews** with personnel of all levels can be useful for inspectors to understand the level of **awareness and knowledge of the personnel**
- Inspectors **should prescribe** specific interventions for the **promotion of the safety culture**

Thanks for the attention!

Questions...???

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<https://www.aria.developpement-durable.gouv.fr/synthese/proceedings-of-the-15th-impel-seminar-lessons-learnt-from-industrial-accidents-2023/?lang=en>