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RÉPUBLIQUE FRANÇAISE

Ministère de l'Écologie, du Développement durable, des Transports et du Logement

# ARIA News flash

February 2012

# Mis-identification of chemicals: Beware of mixing incompatible products!

**The accidents presented below involve chemical reactions between incompatible products inadvertently placed into contact with one another. Encountered in all types of activities, such accidents are frequent and occur not only during the delivery of chemical products (wrong destination reservoir, etc.), during handling or cleaning operations (mistaken chemical substance, simultaneous use of 2 incompatible products), but also when emergency interventions deploy inappropriate resources for the type of accident at hand (use of water on a fire fuelled by reactive metals).**

**These accidents sometimes reflect equipment malfunctions and, in all instances, organisational breakdowns (inadequate identification of substances, procedures that are missing, insufficient or ignored, lack of controls, human error, etc.), with such anomalies being regularly reported in the ARIA database.**

**Beyond the economic losses caused, the resulting discharges are potentially hazardous to both human health and the environment. The prevention of this type of accident at the source relies primarily on an accurate identification of substances and their incompatibilities (chemical or material-related).**

## 1st Case : 05/10/2007 - Germany - FRANKFURT (ARIA 35830)

A cloud of chlorine gas was accidentally generated around 10.30 am while transferring hydrochloric acid (HCl) into a tank containing sodium hypochlorite (NaClO or liquid bleach) in a chemical wholesale company.
The accident happened during a period of rebuilding of the unit; the filling station and the delivery station were in the process of being renewed. At the delivery station for tankers there only one connection for all chemicals but $FeCl_3$. A pump transports the fluids via pipe to a connection battery / filling station for drums. At the battery, a worker connects the pipe, by using a hose, to the right tank. The technician chose the wrong tank at this point. Realizing his mistake, he stopped the transfer operation thus limiting the quantity of chlorine released to 200 kg. The employee was severely poisoned and died a month later.
The police stopped traffic in the industrial area and the residents within a perimeter of 200 metres were required to stay indoors for 2 hours. 54 people were treated by around 120 fire-fighters.
Further to this accident, the unit is rearranged:
- The delivery station for roadtankers was equipped with a separate filling pipe for hypochlorite. The adapter was equipped with left hand threads (mistake-proofing?).
- All adapters of the storage unit were locked off and keys will be released after analysis by the laboratory personnel.
- All connections were clearly labelled.
- The hypochlorite pipe will be monitored by a pH-electrode.

In the absence of targeted measures (e.g. keyed connectors), mixing becomes frequent during the delivery of chemical products (see ARIA News flash on tanker deliveries)

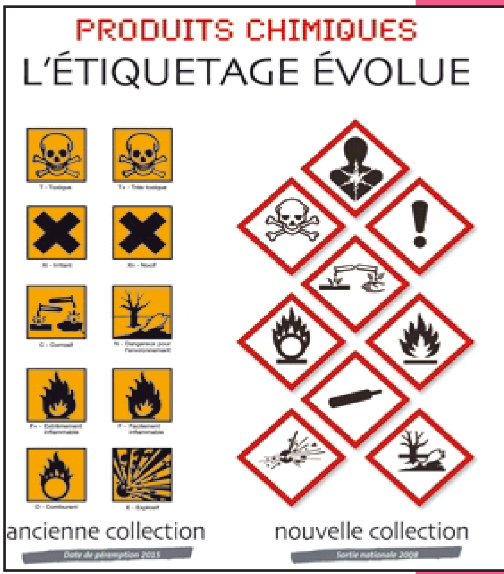
*Photo : Laurent Mignaux - Ministère du Développement durable*

### What are the risks ?

A mix of incompatible products triggers a violent chemical reaction or a reaction that generates hazardous substances capable of leading to:

- an **explosion or fire** subsequent to the creation of an inflammable gaseous and potentially explosive mix;
- **human intoxication** following the release of a toxic product into the air;
- **pollution of the natural environment** as a consequence of the overflow of a hazardous substance;
- **property damage** (deformation or rupture due to a pressure surge, accelerated corrosion, etc.).

## 2nd Case : 23/11/2009 - ANDRÉZIEUX-BOUTHÉON (ARIA 37497)




Despite the implementation of differentiated storage and packaging zones within a plant producing polymers, a technician on duty during the morning shift accidentally poured between 1 and 2 kg of sodium hypophosphite (not classified as hazardous) into a buffer tank containing ammonium persulfate (a combustive fuel). These two white powdery products were difficult to visually distinguish.

The technician informed his team supervisor and lead workshop technician of this handling error, and they both decided to proceed by separating as best they could the products into 2 samples: a 15-kg content of persulfate polluted by the hypophosphite was placed into a new plastic drum, while the 2nd sample containing 2 to 3 kg of hypophosphite polluted by the persulfate was placed into a clear plastic bag.

At 5:45 pm, a technician working the afternoon shift tipped the drum over while emptying it into a dissolution tank containing 1,100 litres of water. A deflagration ensued inside the drum and the blast threw the technician backwards; he sustained a fractured arm and burns due to the spattering of product; a 2nd technician was slightly hurt during the incident as well. [...]

A second deflagration, followed by fire, occurred around 6 pm, injuring another staff technician and a chemical engineer, who had been trying to identify the remaining bag. The flames could be extinguished using a fire blanket. The six individuals present inside the plant workshop were all evacuated. External emergency response units transported the 4 injured employees to receive treatment.

The site operator conducted a study to better understand the mechanism that caused these deflagrations. The 2 chemical products at the origin of this incident were from then on stored in 2 separate rooms.

# Questions to be asked to improve product identification

1. Are all the substances and mixtures produced, stored and/or used onsite well identified? Are the containers (drums, cans, tanks, etc.) all appropriately labelled? Are the labels clearly legible and understandable? Is there any chance they can be confused with one another?
2. Have potential incompatibilities among the various substances and between substances and materials (content/container match) been studied, for example through implementing incompatibility or risk analysis matrices (HAZOP)?
3. Have the risks related to storage been evaluated? More specifically, are the materials and physicochemical conditions (temperature, humidity, light, etc.) of the storage facility well adapted? Are incompatible products likely to be stored together or else held in a shared area? Are the bases separated from the acids, the oxidizers from the reducers, the fuels from the combustibles? Do water pipes run in the vicinity of products incompatible with water? etc.
4. Are reservoirs and their designated connection points accurately identified and secure (indelible and updated indications, locked plugs, blind flanges, keyed connectors, etc.)?
5. If colour codes or keyed connectors are introduced, is their meaning easy to understand and well displayed, especially if subcontractors are brought to use them?
6. Have all specific risks related to transfer operations (deliveries, loadings, etc.) been investigated in depth?
7. Have technicians been adequately trained in coping with chemical risks (tied to the handling of hazardous products, protocol to follow in the event of an accident, first response, etc.)? Are they equipped with the appropriate individual protective gear for handling the designated hazardous substances?
8. Is a double-check process involving 2 different technicians implemented for highly risky operations?

### For further detail...

**- INRS (www.inrs.fr / in French)**
Storage and transfer of hazardous chemical products, INRS brochure, ED 753, 2009
Chemical risk exposed during cleaning operations, safety fact sheet, ED 59, 2005
Learn to decipher new hazard pictograms, INRS, ED 4406, 2011
Chemical product storage in the laboratory, INRS, 2005, ED 6015, 2007
**- BARPI :**
**ARIA news flash**: Deliveries of hazardous substances by tanker lorry (Oct. 2009), detailled accident reports ARIA 4460, 20063, 35830...
- **International Social Security Association** (ISSA / EPSC), Mis-identification of chemicals, brochure n°2047, 2003
- **Consumer Safety Commission,** Prevention fact sheets (http://www.cscnet.org) and in partnership with the SHD organisation: data sheet on handling chlorinated products.