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RÉPUBLIQUE FRANÇAISE
Ministère de l'Écologie, du Développement durable et de l'Énergie

ARIA News Flash
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Intense cold weather: beware of freezing… and then thawing!!

Periods of intense or extended cold weather, accompanied by temperatures well below 0°C or varying abruptly with corresponding freezing and thawing phases, are prone to incidents and accidents.
Ice pressure can, above all, cause cracking or even a complete break in pipelines and damage the process-related devices carrying or containing hazardous substances. Yet «ancillary» equipment is also vulnerable and requires vigilant monitoring (sensors, fire extinction networks, etc.).
The electrical network, which is heavily loaded and perhaps overloaded during peak consumption hours, may be subject to voltage variations that weaken the electronic system (including safety functions). Network collapse is another possible and dreaded outcome.
Auxiliary means of heating (torch blowpipes, space heaters, etc.) for thawing or warming equipment create myriad opportunities for «atypical» dangerous hotspots.
Lastly, snow and ice can give rise to physical hazards by overloading building roofs, limiting accessibility to industrial installations, etc.



Industrial installations in France, february 2012 (D.R.)

A sample of sensitive equipment:

- aboveground pipes, with inadequate or no insulation / utility lines: transfer lines, drainage or purge circuits, «dead legs», open cooling circuits and water intake lines…
- mechanical devices (pumps, valves, etc.) and «fragile» accessories (collars, joints, etc.) exposed to physical stresses
- excessively filled and poorly-insulated containers, bowls and basins, etc.
- sensors (including connecting pipes), with an emphasis on level and pressure readings, capable of malfunctioning or displaying erroneous values
- emergency intervention / protection equipment: fire hydrants, water supply networks, ring gears, etc.

1st Case : 17/12/2002 - Chalampé (ARIA 23839) - See also the detailed sheet on the ARIA website

A cyclohexane leak is discovered at a chemical site due to a pressure drop on the supply line of a production facility. The substance is transferred at 20°C and at 2 to 3 bar through lagged overhead or underground piping. […] The leak occurred from the **rupture of a 40 mm pipe due to the dilation of liquid cyclohexane in the overhead part of the pipe between two blockages of crystallized cyclohexane**. **A malfunction of the pipe heating device (T < 6.5°C) led to the formation of blockages, with the cyclohexane then reliquifying primarily in the section the most exposed to the outside heating**. 30 hours were necessary to identify the leak. The operator launched remediation actions; in 6 months, 440 t of cyclohexane were pumped from the water table and the ground. [...]

2nd Case : 02/01/1969 - Repcelak (Hungary) (ARIA 7645)

Inside a liquid CO_2 production plant, one of the 4 vertical storage columns undergoing filling exploded in a BLEVE. Due to the domino effect, a 2nd storage column exploded (BLEVE) and a 3rd column was blasted into the laboratory 30 m away, killing 5 employees on the spot. Projectiles due to the BLEVE were responsible for 4 other deaths; 15 persons were injured. **The likely cause of this explosion was an overfilling condition due to a frozen level detector (freezing of water not completely extracted from the CO_2). Moreover, the component material of the 2 exploded tanks was not adapted to low-temperature applications.**

3rd Case : 27/12/2010 - Woippy (ARIA 39508)


ARIA 39508 - picture: DREAL

An empty but not degassed butadiene railcar tanker was temporarily stopped in a marshalling yard. **Due to the effect of ambient cold temperature (-17°C), the gaseous phase of the butadiene liquefied (boiling point temperature = -4.4°C) and the tanker underwent relative depressurisation before collapsing. [...] The injection of nitrogen into the non-degassed tanker cars, a procedure typically carried out to avoid tank depressurisation during cold weather periods, had been omitted. [...]**

4th Case : 06/02/2012 - Saint-Rambert d'Albon (ARIA 41779)

A valve on the sprinkler network of a warehouse broke as a result of freezing. **The water leak triggered a load loss in the network** and activation of 2 diesel-powered pumps, which stayed on after the sprinkler network's backup water supply tank had emptied. Since the two motors were no longer being cooled (cooling circuit water extracted by tapping on the pump discharge line), **ignition occurred due to overheating of one of the motors**; the fire outbreak was quickly extinguished thanks to the absence of combustibles inside the sprinkler utility room. […]

5th Case : 10/02/2012 - Villeneuve-le-Roi (ARIA 41754)

Fire broke out around 9 am in a 2,000-m² building used to store paper bundles and cardboard that belonged to a recycling firm. The site was located in an environmentally-sensitive zone: proximity of a railroad line, a harbour basin connected to the SEINE River and a 55,000-m³ oil depot. […]
A static electrical discharge had occurred when the metal telescopic arm of a construction vehicle made contact with the paper; this phenomenon became amplified due to the dry and biting cold weather during the morning of the accident (-5°C).

For further information:
- BARPI - selection of 251 accidents related to extreme climatic conditions (intense cold) [in French]
- CSB (US Chemical safety board) safety messages : « Prevent Accidents During Subfreezing Weather », a 4-minute video on the technological risks associated with cold weather.
(downloadable on www.csb.gov)

Questions to ask prior to facing the winter season...

Workplace organisation for dealing with «intense cold»

1. Has an operating procedure been introduced to better resist periods of «intense cold», including a list of controls to be performed on the sensitive parts of the installation?
2. Have operators received risk awareness training and been provided «checklists for coping with intense cold weather»?
3. Have the raw materials capable of freezing (or precipitating out) in contact with the cold been identified? Have procedures specific to their thawing been adopted?
4. Has the heightened risk of electrostatic phenomena (cold and dry air) been taken into account?
5. Are the various departments, primarily works and maintenance, prepared for the thawing period (enhanced monitoring for leak detection, replacement of damaged equipment, etc.)?

Equipment preparation

6. Is the steam or electrical tracing of pipes and devices operational?
7. Is the heat insulation / insulators in good working order?
8. Are the heating systems located inside storage cells operating properly?
9. Has all sensitive equipment undergone preventive draining / de-icing (anti-frost mode) ?

Incorporation of «snow» and «ice» risks

10. Has the building structure been designed to bear the weight of snow / ice?
11. Have all spots where large ice cubes can form or ice accumulate in mass been identified (facilities located near steam vents, cooling towers, etc.)? Would their fall be capable of damaging sensitive equipment?

Fire protection

12. Have all networks and stationary facilities used to fight fires (e.g. motor-driven fire pumps) been protected against frost and freezing?
13. Will a sufficient quantity of water be available should a fire break out?

For all comments / suggestions or to notify an accident or incident : srt.barpi@developpement-durable.gouv.fr
Accident summaries recorded in the ARIA database may be consulted on www.aria.developpement-durable.gouv.fr