



# Accidents linked to fireworks shows

Several recent accidents in France (along with others dating further back) have recalled that the handling of fireworks in small warehouses, depots, during the preparation or execution of fireworks shows, carry risks that must be prevented at least through regulatory compliance.

The items contained in this fact sheet are intended to draw the attention of all actors involved in organising and producing fireworks shows; these contents are not to take precedence over compliance with the regulatory requirements relative to explosives applicable to these various activities.

A more complete summary on accident research dedicated to fireworks is available on the Website <http://www.aria.developpement-durable.gouv.fr>.

## **1<sup>st</sup> Case : 21/05/2011 Coullons (ARIA 40398)**

In the garage of his home at around 11:15 am, a pyrotechnician caused the explosion of a 3-kg stockpile of type K3 fireworks while performing welding work nearby. The victim, who had sustained serious burns on 30% of his body, was airlifted by helicopter to the Tours Hospital. Emergency responders, one of whom held a K4 certification, defused the previously bundled fireworks and submerged them in water-filled tanks. A specialised subcontractor was requisitioned to dispose of the ensuing pyrotechnic waste. The 50 year-old victim was an authorised pyrotechnics dealer.



### **Hazardous substances**

Fireworks are pyrotechnic objects and, as such, constitute explosive products. Accordingly, their manufacturing (including bundling), storage (even temporary), possession, sale (including import-export), transport, use (firing) and eventual destruction are all regulated by a series of legislative texts published by the Ministries of the Environment, Transport, Interior, Labour, Defence and Industry.

## **2<sup>nd</sup> Case : 13/07/2011 Cébazat (ARIA 40621)**

Around 11 pm, a fireworks show started in the city park in the presence of some 1,000 spectators. Shortly after the first rockets were fired, between 5 and 10 projectiles were propelled horizontally and exploded adjacent to where the public had congregated behind barricades just tens of metres away, creating crowd panic and jostling. Nine spectators, including four children, were slightly injured; they were transferred to 2 hospital facilities in the Clermont area and released during the night to return home, only sustaining slight superficial burns and hearing discomfort.

The origin of these defective firings remains unknown. The high humidity following rainfall over the previous days might offer one explanation; the humidity would have softened the cardboard mortars used to propel fireworks. According to other sources, the mortars had been fastened to a barrier that swung after the first firework was shot since a second barrier, which served to secure the entire batch, would have been shifted after its installation by the team of pyrotechnicians. A police investigation was ordered.

## **3<sup>rd</sup> Case : 14/12/2011 Saint-Satur (ARIA 41467)**

An explosion followed by fire occurred around 2 pm inside an 800-m<sup>2</sup> stone building housing a number of municipal workshops; 1 employee was killed on the spot and 4 others injured, 3 of whom seriously. Fire-fighters set up a 100-m safety perimeter and extinguished the blaze using 2 nozzles.

The building, intended for storing and maintaining tools, sustained considerable damage: walls collapsed and a portion of the roof was blown off.

In the rubble, emergency response

crews discovered bottles of acetylene, LPG and individual fireworks (bombs). The next day, the land mine removal squad recorded their observations and assumed responsibility for fireworks disposal.

The press suggested the hypothesis of a fireworks explosion triggered by sparks from a grinder.

The presence of fireworks at this spot of the building and at this particular time went unexplained; the gendarmerie carried out an investigation for manslaughter.



#### 4<sup>th</sup> Case : 09/09/2011 Aillas (ARIA 40909)

In a firework-producing firm subject to administrative approval, a series of explosions followed by fire occurred around 11:15 am within a fireworks facility dedicated to preparing and storing assembled fireworks. The 160-m<sup>2</sup> building used for this purpose housed 25 kg of fireworks, cardboard boxes and tables. [...] No neighbouring structures had been compromised and no injuries reported.

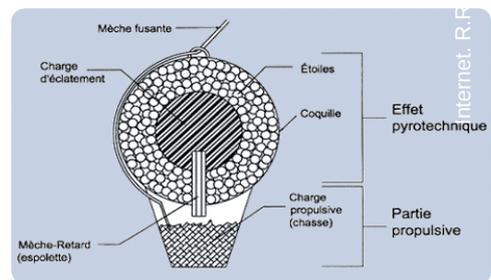
«Misfired» fireworks, which were waste awaiting disposal, are thought to be the source of the explosion. Due to delays experienced in disposing of fireworks waste, the items had been stored in a building that was not designated for this purpose. The inspectorate also pointed out that the waste destruction zone did not provide for secure operations [...]. Site operations (outside of the depot) were suspended until refurbishment of both the damaged building and waste incineration zone. The operator was required to allocate a dedicated spot within the pyrotechnic zone for storing «misfired fireworks» safely (i.e. away from the other buildings, in accordance with storage rules).



#### «Misfired fireworks»

«Misfired» or «duds» are fireworks that have been fired, yet did not function as designed during a pyrotechnic show; they have to be treated like waste bound for disposal. Their apparent state might display the same quality as that of a new still unfired firework («dry» firework with a seemingly non-degraded casing), with just the darkened fuse indicating it performed as a dud.

These fireworks may display heightened sensitivity, and their handling without respecting proper precautions may prove to be hazardous; traces of active material can appear on their casing, thus increasing ignition risks. Therefore, respecting the procedures regarding the handling of duds after a show are important : waiting before dismantling, immersion in water, adequate packaging before transport...



### Questions to be raised to ensure the safety of people and goods

- Has the full set of risks related to the intended operations (storage, handling, etc.) been identified, along with the appropriate prevention and protection measures (fire protection in particular)?
- Does the designated storage allow for a rapid evacuation of individuals? Is it laid out entirely on the ground floor?
- Is the storage facility clean, well organised, cleared of all combustibles and free of any hazardous substance other than the explosives it has been designed to contain?
- Has a rule been adopted that imposes at the very least turning off mobile phones, banning smoking or carrying any smoking paraphernalia, as well as prohibiting (except with special approval) the handling of open flames, incandescent objects, matches or any other means of ignition? If so, has this rule been posted?
- Are bundling operations performed outside the depot and under sufficiently safe conditions, in compliance with the requirements established by current regulations (workstation configuration, an adapted toolbox, individual protective gear, etc.)?
- Are public access restrictions clearly displayed?
- How are unsold objects or duds managed (returned to the manufacturer, disposal, etc.)?
- For a fireworks show, has the show's organiser completed all of the pertinent filing procedures? Has the organiser appointed a storage supervisor (in the case of temporary storage just prior to the show), as well as someone to manage the fireworks launches?
- Are the rules relative to the choice of launch site, place of storage prior to firing and products used all well respected?
- Are the individuals in charge of launching the fireworks certified accordingly ?
- Are the pyrotechnic products all well packaged (sealed cardboard boxes transported into the depots / wrapped for sale in stores, etc.)? Have they been correctly labelled (certification batch number, EC marking, designation, classification group, safety distance to respect, etc.)?