

Occupational Safety & Health Circular  
**Safe Use, Handling and Storage of Nitrocellulose**



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## Safe Use, Handling and Storage of Nitrocellulose

Fires often occur at paint and ink manufacturing factories, where nitrocellulose damped with isopropanol (or isopropyl alcohol) is used in the blending process. As nitrocellulose is a highly flammable chemical, it is likely that the fires are caused by ignition of residual nitrocellulose in the blending machine or by nitrocellulose stored on the factory premises.

This circular seeks to educate users on the hazards of nitrocellulose, and offer appropriate measures to adopt to prevent a similar incident from occurring at your workplace.

## Industrial uses of nitrocellulose

Nitrocellulose (also called cellulose nitrate) is commonly used in paints, lacquers, wood, paper and metal varnishes, inks for printing on packaging and in making celluloid. At room temperature, pure nitrocellulose is a white-yellow solid with an ether-like odour. However, industrial nitrocellulose is usually not sold in pure form but damped with water and organic solvents such as isopropyl alcohol, esters, ketones or glycol ethers. Damped nitrocellulose can be solid or liquid, depending on the amount of damping agent used.

## Hazardous Properties of Nitrocellulose

### Flammability

- Dry nitrocellulose is a highly flammable solid that ignites easily and burns explosively. At 13°C, the vapour from the nitrocellulose together with the oxygen in the air will catch fire if a heat source is applied to it. When the temperature is increased to 160-170°C and above, it will spontaneously ignite without an external spark or flame.
- Organic solvents commonly used to damp nitrocellulose are also highly flammable. The organic solvent used also plays a part in determining when nitrocellulose will burn, whether on its own or with a heat source supplied.



### Stability & Reactivity

- Nitrocellulose is stable under normal temperature and pressure. However, it is shock-sensitive and will break down upon heating to produce toxic gases such as oxides of nitrogen and carbon monoxide.
- Both dry and damped nitrocellulose react easily with strong oxidising agents, including strong acids and bases, to produce oxides of nitrogen.

### Health Hazards

- Inhaling nitrocellulose can irritate your nose and throat.
- Contact with nitrocellulose can irritate your skin and eyes. It can also cause dryness of skin and dermatitis.
- The common damping agent isopropyl alcohol can irritate the eyes and skin. Due to its higher vapour pressure, isopropyl alcohol is more volatile than nitrocellulose and thus its vapours are easily inhaled.
- Exposure to high concentrations of the solvents used as damping agents can cause dizziness, difficulties in breathing, and even result in unconsciousness.
- Long-term exposure to damped nitrocellulose can lead to chronic health effects such as kidney and liver damage, depression of the central nervous system and permanent eye damage.
- Toxic gases, such as oxides of nitrogen, hydrogen cyanide and carbon monoxide, which may be produced during decomposition or combustion of nitrocellulose also pose health hazards.

## Safety Measures to Observe

Take all necessary precautionary measures when handling nitrocellulose. Users should refer to the Safety Data Sheets (SDSs) of nitrocellulose-containing chemicals for details on what safety measures to take. We have included some critical safety measures here.

### How to handle nitrocellulose

- As dry nitrocellulose is sensitive to heat and impact, damped nitrocellulose must not be allowed to dry out. The container should be tightly sealed when not in use to prevent evaporation of the damping agent and only opened when the contents are ready to be used. All the container contents should be used each time.
- The quantity of nitrocellulose kept at the processing area should not exceed the amount immediately required for one work-shift.
- Do not subject nitrocellulose to heat through direct sunlight, impact or friction. Do not allow it to come into contact with acids, alkalis, amines or oxidising agents. This could cause it to break down by itself or even ignite.
- Always use non-ferrous tools and materials when opening and closing containers of nitrocellulose. These tools can be made of copper, brass, bronze or wood. Tools made of plastic materials should not be used because they tend to produce static electricity. The tools and equipment should also be explosion-proof.
- Protect all nitrocellulose mixing and processing equipment from static electricity by grounding all metal parts. Ground all containers before transferring nitrocellulose.



- When handling drums containing nitrocellulose, do not allow them to fall or bump into each other. If possible, use a fork-lift for loading or unloading drums. To prevent sparking, do not roll or drag drums on concrete, steel floors or hard surfaces.



- Prohibit all sources of ignition at areas where nitrocellulose is handled. Avoid all work activities which might generate sparks through friction or impact.
- If nitrocellulose is to be used in a confined area, provide a closed system with suitable and effective local exhaust ventilation to prevent the release of vapours.
- Check and clean all ventilation systems regularly to prevent any build-up of dry nitrocellulose in the ventilation systems.

### How to store nitrocellulose

- Store damped nitrocellulose in a cool, dry and well-ventilated area away from all possible sources of heat or ignition, preferably in a fire-proof area. Allow only authorised persons to enter the storage area.
- Do not store nitrocellulose with incompatible substances, such as explosive substances, gases under pressure, flammable substances, oxidising agents, acids, alkalis and amines.
- Store all unopened drums of nitrocellulose in a sealed and upright position.
- A first in, first out policy should be adopted. The nitrocellulose stock with the earliest production date should be used first.

- Do not open or empty nitrocellulose into other containers within the storage area. The nitrocellulose should be kept only in the original containers.
- Keep the quantity of nitrocellulose stored and the period of storage to the minimum. If possible, schedule for the nitrocellulose to be delivered by your supplier directly to the processing area on the day of use itself.
- Affix all drums of nitrocellulose properly with labels indicating the hazards of nitrocellulose, for example flammable solid and toxic, and the necessary first-aid and other safety measures.
- If you have to store nitrocellulose for a longer period, invert the container at regular intervals. This is to prevent the damping medium from separating from the nitrocellulose and the nitrocellulose from drying out.
- Obtain a copy of the SDS of nitrocellulose from your supplier. Place a copy of the SDS in the storage and processing areas.

## How to dispose of nitrocellulose

- Damp any spilled nitrocellulose with water or alcohol immediately. Collect it while in a wetted condition in a tightly sealed container made of suitable materials (e.g. a polyethylene bag) before giving it to a licensed toxic industrial waste collector to dispose of it.
- Nitrocellulose sometimes comes in drums or cartons lined with polyethylene bags. The used bags usually still contain residual nitrocellulose, so they should be double-bagged using another polyethylene bag and kept in a properly closed drum so the residual nitrocellulose cannot dry out and ignite. Keep the used bags away from all possible sources of ignition, and give them to a licensed toxic industrial waste collector to be disposed of as hazardous industrial waste.



- When the drums are empty, wash or wipe them with a damp rag. Clean the inside of the lid and the closure ring as well. Dispose of the used rag in the same manner as spilled nitrocellulose.

## Useful References & Contact

The Workplace Safety and Health Risk Management: Risk Assessment guidelines are available for download from [www.mom.gov.sg](http://www.mom.gov.sg)

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