

ORGANIC PEROXIDES (Catalyst in UPR Industry)

SAFETY, OUR FIRST PRIORITY!!



Akzo Nobel India Ltd

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Akzo Nobel

- Akzo Nobel: Global Fortune 500 Multinational company
- Leading industrial company in coatings, Paints and Chemicals
- Listed on Euronext Amsterdam stock exchange
- Chemicals Industry leader on the Dow Jones Sustainability Indexes
- Revenues totaled around Euro 15 billion (90,000 Cr)
- Employs around 68,000 people subsidiaries in more than 80 countries

Chemicals Industry Leader



FORTUNE 500



Peroxides (Initiators/Catalyst/Hardner)



Why?

See this formula



Why Safety ?

- Organic peroxides contain relatively weak O - O bond in their molecule.
 - Due to this peroxides are thermally unstable compounds i.e. sensitive to heat and will decompose above certain temperature.
 - Decomposition leads to heat production
 - If this heat cannot be transferred to environment then a runaway reaction occurs and peroxide will explode violently with or without combustion after some time.
 - Hence strict temperature control is required for handling and storing Organic Peroxides to prevent undesired decomposition.
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- Risk of Organic Peroxides
- Hazardous properties Organic Peroxides
- General safety aspects



Application (cure reaction):

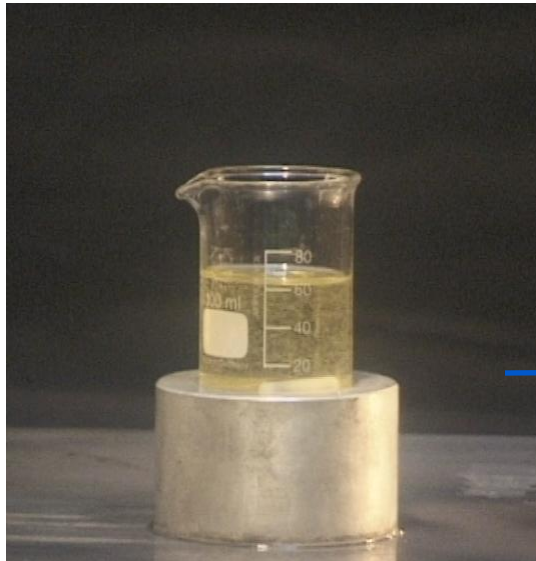
peroxide + resin \longrightarrow cure + heat

Pure formulation (transport, handling, storage,...)

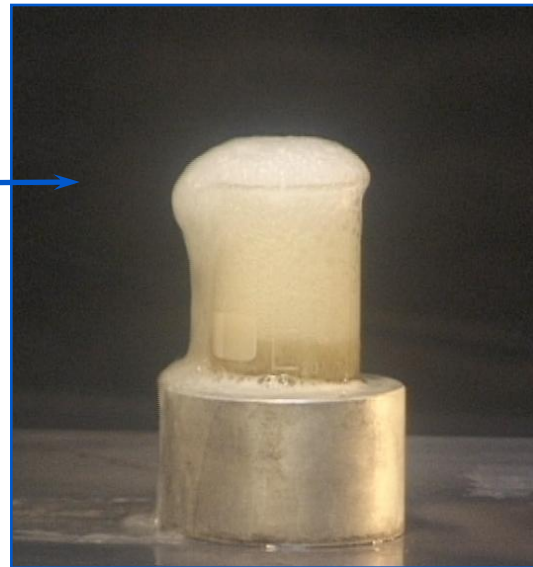
temperature
peroxide \longrightarrow decomposition products + **HEAT**
contamination



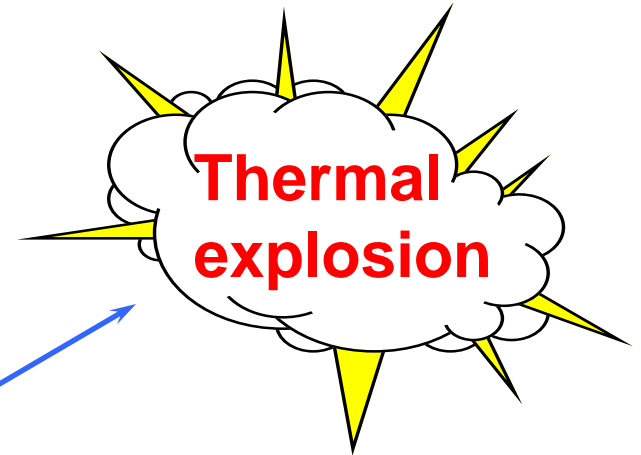
Risk – decomposition events



**Gas evolution
(hours, days)**



**Smoke, boiling,
foaming (minutes)**



- **Thermal stability**
 - ✓ **SADT**
 - ✓ **Contamination**



Thermal stability - SADT

SADT: Self Accelerating Decomposition Temperature

The SADT is the lowest ambient temperature at which self-accelerating decomposition (runaway) occurs with a product in the packaging as used for transport



Thermal stability – Flash Point

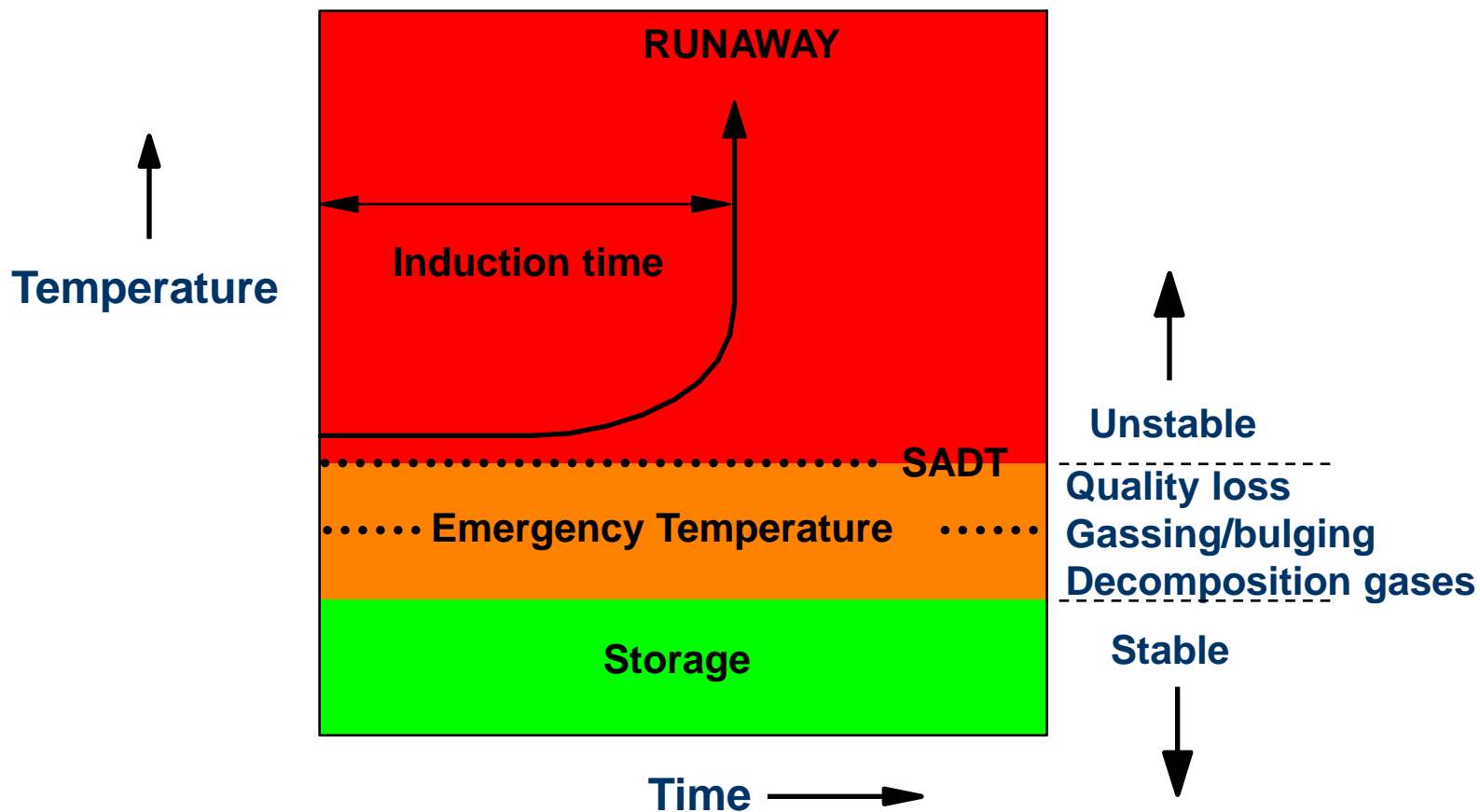
Flash Point is the lowest product temperature at which the product vapor / air mixture can be ignited .

Vapor pressure of peroxides is in general low . Flash point of OP is only meaningful when it's below SADT of peroxide formulation.

Flash point of organic peroxides does not give any indication about it's stability or decomposition effect.



Thermal stability - Traffic light picture



SADT OF Products

PRODUCT	SADT (°C)	Ts Max (°C)	Ts Min (°C)
TBPB (Trigonox C)	60	25	10
MEKP (Butanox M50)	60	25	-
CHP (Trigonox K80)	75	40	-30
AAP (Trigonox 44B)	60	30	-10
BPO (Perkadox BT-50)	50	25	

Ts = recommended max. storage temperature related to quality

Tc = control temperature: max. transport temperature allowed by the regulatory agencies, temperature related to safety

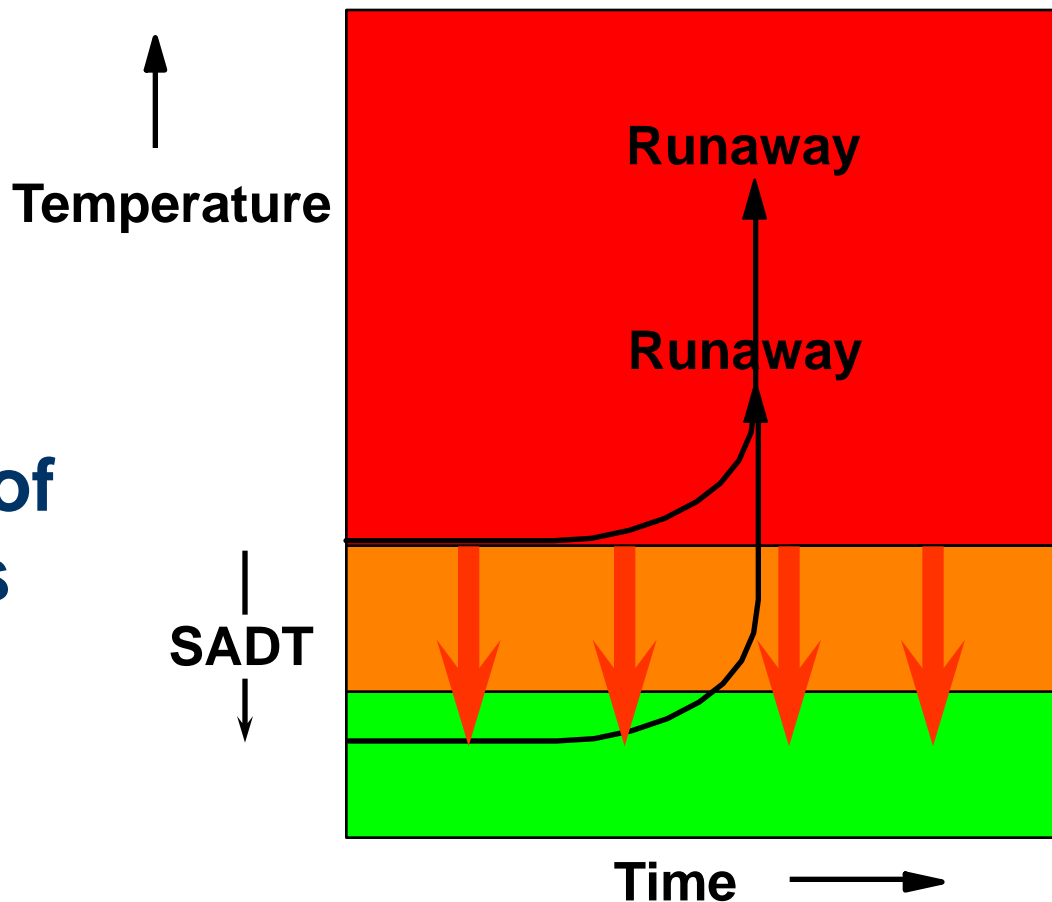


Temperture criteria

SADT	Control Tem (Transport Tem)	Emergency Tem
Over 35 Degree	10 degree below SADT	5 degree below SADT



**Contamination
reduces the SADT of
organic peroxides**



Contamination

Notorious examples are :

- **Accelerators (Co, Vn,)**
- **Metal salts**
- **Amines**
- **Acids and caustics**
- **Construction materials like iron, copper**
- **Organic liquids**
- **Resins/monomers**

Especially ketone peroxides are very sensitive for contamination



Hazardous properties organic peroxides

- **Explosive properties**

- ✓ Thermal explosion

- **Burning behavior**

- ✓ Ignitability

Most peroxides are difficult to ignite

- ✓ Burning rate

Once ignited, they may burn fiercely



Transport classification

Organic peroxide classification	Hazard rating	Max. container size
Type A	Explosive	Banned
Type B	Very high	25 kg
Type C	High	50 kg (max.)
Type D	Medium	50 kg
Type E	Low	400 kg/450 l
Type F	Very low	IBC's/tanks
Type G	No	Unrestricted



Burning rate

Trigonox C(TBPB)	8.1 kg/min.m ²
Trigonox 21	7.2 kg/min.m ²
Butanox M-50(MEKP)	5.3 kg/min.m ²
Perkadox BT-50 (BPO)	1.7 kg/min.m ²
Acetone	0.5 kg/min.m ²
Ethanol	0.7 kg/min.m ²



Effect thermal explosion



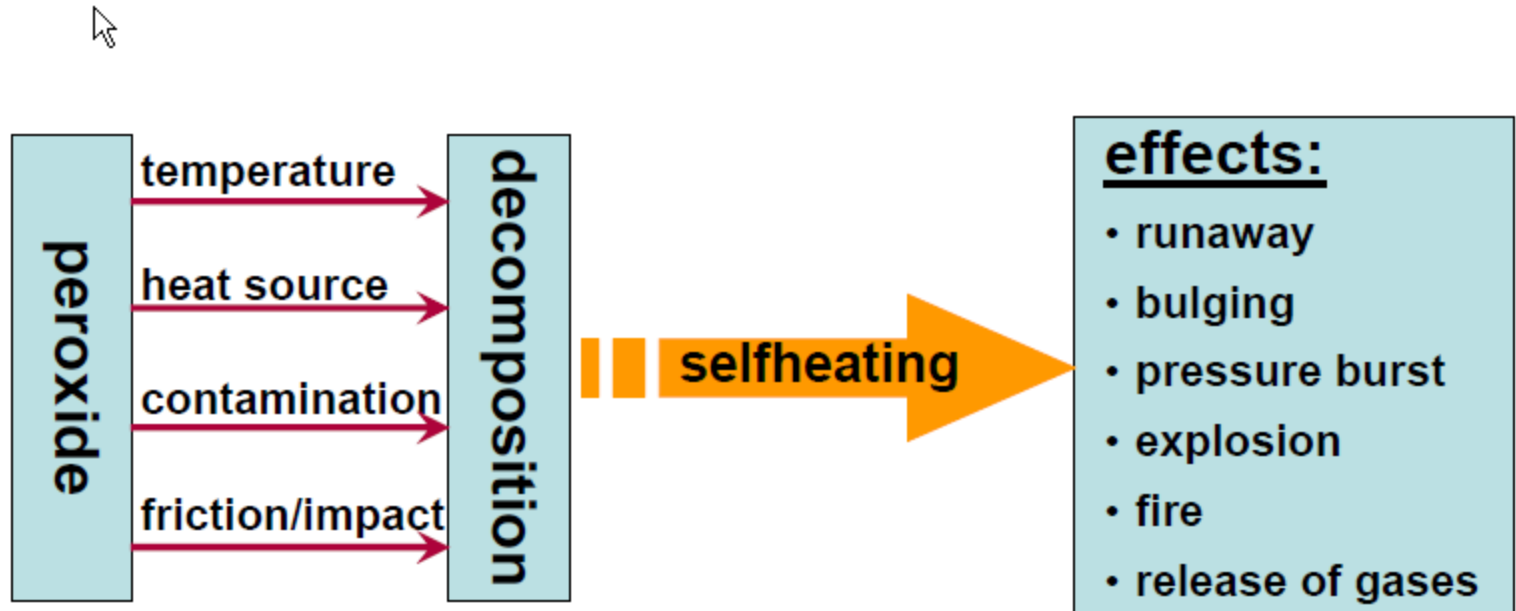
Runaway reaction in plant



**Organic peroxide contained
in pipe**



RISK



Transport incident with organic peroxide



The smoke and flames shot as high as 1,300 feet and could be seen fore miles.



General safety aspects

- **General rules**
- **Personal protection**
- **Spillage**
- **Fire fighting**
- **Storage**



General rules

- **Work clean**
 - **Do not smoke**
 - **Avoid: open fire, sunlight, heaters**
 - **Never mix peroxides with accelerators or other substances**
 - **Packaging material is non-pigmented PE**
 - **Use for weighing and handling only materials which are compatible with peroxides (SS 316, PE, PP, PTFE)**
- (Non-pigmented)**
- **Leave peroxides in their original containers and close the packaging after use**
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SAFE HANDLING OF PEROXIDES

- FIFO
- Empty containers completely. Wash with water. Do not reuse again.
- Minimize amount of peroxides in work area.
- Avoid pack tightly closed glass bottles or metal cans.
- Keep away from heat sources
- Work in well ventilated area & Seek assistance from supplier



Personal protection

- **Protective clothing**
- **Safety shoes**
- **Gloves (neoprene or synthetic rubber)**
- **Glasses**



Personal protection

Avoid:

Contact with the eyes

First aid:

Rinse immediately with water, at least 15 minutes. Keep eye lids open. – Doctor

MEKP is Aggressive



Eye wash fountain



Personal protection

Avoid:

Contact with the skin

First aid:

Rinse immediately
with water and wash
with soap.

Clothing contamination
must be removed and
place in water.



Personal protection

Avoid: Ingestion

First aid: Do not induce vomiting, drink large amounts of water.

Avoid: Inhalation

First aid: Bring to fresh air.

Seek Medical attention



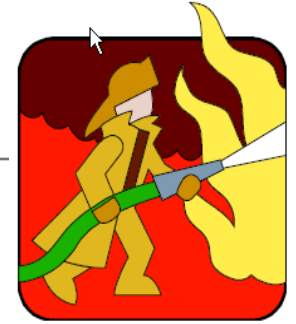
Spillage



- **Liquids**: absorb in absorbent, e.g. vermiculite and add water
 - **Solids**: wet down with water, mop up mechanically and add water
 - **Pastes**: mop up mechanically and add water
- Do not use incompatible materials such as rags, sawdust or paper
 - Remove as organic peroxide waste to a safe location



Fire fighting



- Call the fire brigade
- Extinguish a small fire with Dry Chemical powder or carbondioxide and apply water to prevent re-ignition
- Extinguish a big fire with large amounts of water from a safe distance (fire brigade) 25 mtr.

Always follow local rules



Our Storage rooms



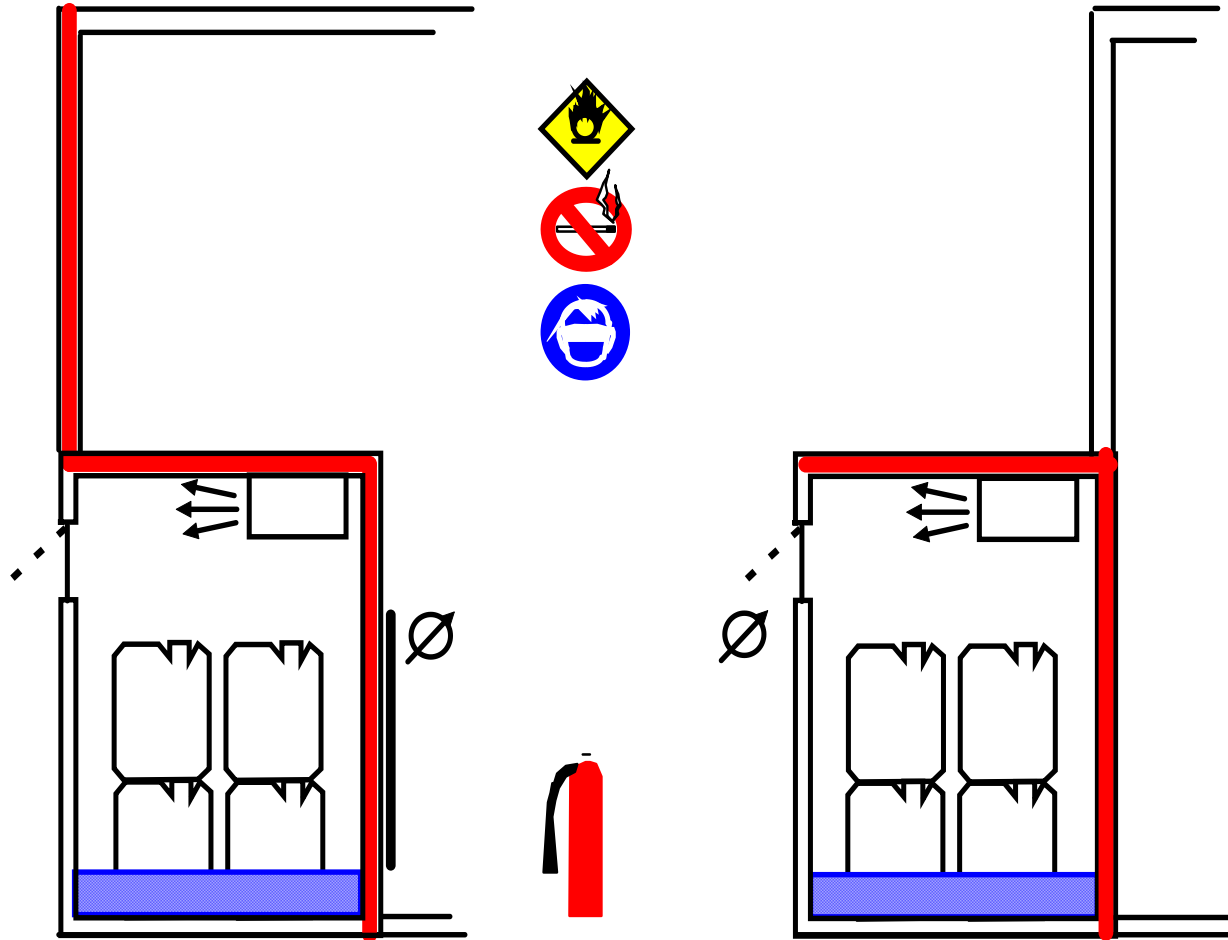
Mobile Storage rooms



Transportation for Quality & Safety



Storage: quantities < 150 kg

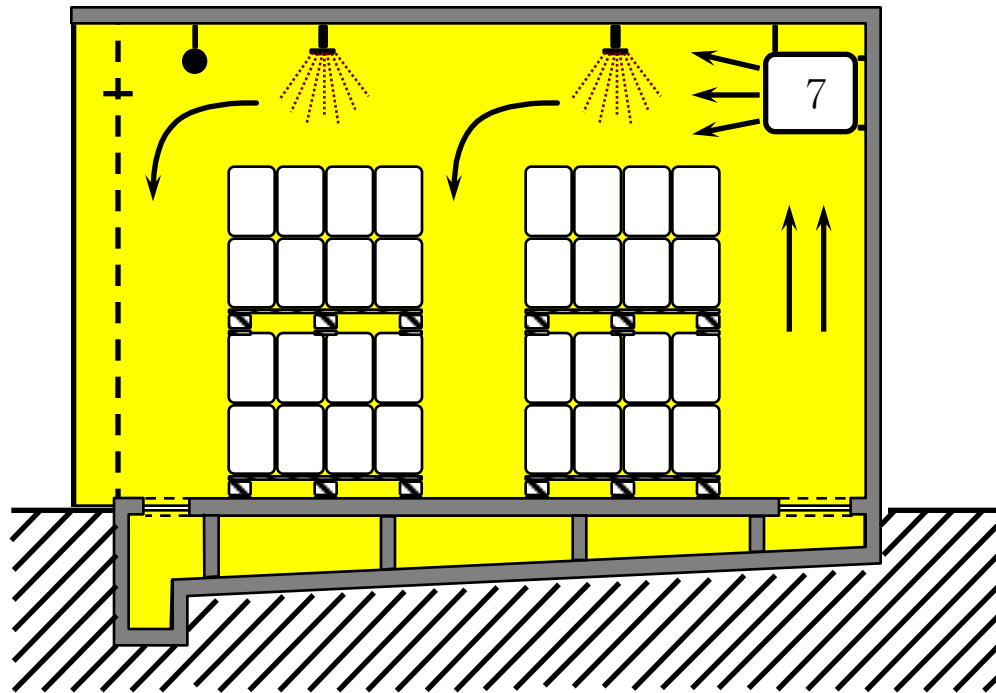


SAFE STORAGE

- Ensure proper air circulation
 - Distance between two pallets > 10 cms
 - Distance between pallet and wall > 15 cms
 - Store in original carton/package only.
 - Monitor correct storage temperature regularly.
 - Log every hour
 - Mark the store with organic peroxide label.
 - Adequate standby power and refrigeration facilities
 - Avoid direct sunlight and all heat sources.
 - Do not store peroxides together with other chemicals
 - Keep MSDS hard copy in storage room
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Storage: large quantities



- Temperature sensor
- Sprinkler
- Fire resistant wall and roof
- Grating
- Catch basin
- Door acting as venting panels
- Evaporator



Indications of Emergency

- **Bulged / Warm Package.**
 - **Smoke from Packages.**
 - **Smell.**
 - **Fire.**
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EMERGENCY PROCEDURE FOR BULGED/WARM PACKAGES

- **Check temperature of cold storage If possible, check product temperature**
 - **Take the bulged/warm package(s) to safe, open place**
 - **Open the packages - slowly and carefully**
 - **Keep upwind**
 - Depute trained personnel only
 - Consider evacuation
 - Apply fine water spray
 - **Wear S.C.B.A., PVC gloves apron. Wear safety shoes.**
 - **Allow the product to decompose under controlled conditions**
 - **Inspect other packages in cold storage for rise of temperature**
 - **Continue Vigilance**
-



Typical handling/safety aspects

TBPB (Trigonox C)

- **solidifies below 10°C**

MEKP –

- **Do not add MEKP to Resin solutions at temperature above 45 degree**
 - **Never mix with acetone , accelerators**
 - **Prolonged storage above 38 DC to avoid**
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“BE SAFE AT ALL TIMES”

Any

