

Instructions for the handling of chemicals that can form explosive peroxides

Reference 1-24/2023

Valid from 12 January 2023

NOTE: This is a translation of the official version Anvisningar för hantering av kemikalier som kan bilda explosiva peroxider. The Swedish version is the official document. In the event of any discrepancy between the versions, the Swedish version constitutes the official decision and the Swedish wording will prevail.



**Karolinska
Institutet**



Instructions for the handling of chemicals that can form explosive peroxides

Table of Contents

Introduction	4
Purpose	4
Terms and definitions	4
Peroxide forming chemicals	4
Handling	4
Risks when handling peroxide-forming chemicals	5
When handling peroxide-forming chemicals applies	5
Preventative measures when purchasing	6
Preventative measures during delivery	6
Preventative measures during storing and handling	6
Visual inspection	7
Peroxide test	7
Labelling	8
Waste management	9
Information and contact	9

Karolinska Institutet – Instructions for the handling of chemicals that can form explosive peroxides
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Introduction

The following instruction revises and replaces the previous document “Anvisningar för hantering av kemikalier som kan bilda explosiva peroxider (Dnr 2-1977/2013)”.

The basis for this instruction is AML 1977:1160 in its entirety and applicable provisions. Emphasis is placed on the Swedish Work Environment Authority's provisions “Chemical Hazards in the Working Environment AFS 2011:19”.

Purpose

The purpose of these instruction is to clarify that the handling of chemicals that can form explosive peroxides entails risks of accidents and ill health and to prevent the risks that may be associated with the handling.

To limit the risk of injury, for all affected activities it is mandatory to make a risk assessment and issue written handling and protection instructions specifically suited to their circumstances.

Terms and definitions

Peroxide forming chemicals

Chemicals classified with hazard statement EUH019. They can form explosive peroxides when stored under certain conditions.

Handling

Handling is defined as manufacturing, processing, treatment, packaging, storage, transport, use, disposal, destruction, conversion and comparable procedures (AFS 2011:19).

Risks when handling peroxide-forming chemicals

When storing peroxide-forming chemicals, especially in the presence of light and heat, potentially explosive peroxides are formed. The higher the storage temperature, the greater the risk of peroxides forming. As the concentration of peroxide increases, the risk of explosion also increases. In an opened package, which has been stored for a long time, you should assume that there are always peroxides, to a greater or lesser extent. This also applies to peroxide-forming chemicals that are stored in containers that are not the original packaging from the manufacturer.

Examples of peroxide-forming chemicals that are common at KI are:

- Diethyl ether CAS: 60-29-7
- 1,2-Dimethoxyethane CAS: 110-71-4
- 1,4-Dioxane CAS: 123-91-1
- Tetrahydrofuran CAS: 109-99-9

When handling peroxide-forming chemicals applies

in general:

- Work may only be carried out by those who have sufficient knowledge of the risks that may arise during handling and use and how these risks can be avoided.
- The responsible manager must ensure that documented risk assessment is carried out before handling begins, that adequate protective measures have been taken and that local handling and safety instructions have been issued.
- The responsible manager must ensure that the employees concerned fully understand the risks involved in the handling and that they have been informed about the local handling and safety instructions.

Preventative measures when purchasing

- Plan purchases based on estimated consumption.
- Buy as much as you will use within a 3-month period.
- Choose smaller containers (1 litre or smaller) rather than larger containers.

Preventative measures during delivery

- Must always be taken care of directly on arrival.
- Before handling the containers, a visual check must be made (see section Visual inspection).
- Always label new containers with arrival date.

Preventative measures during storing and handling

- Containers must be labelled with the date when the seal is broken for the first time. Be careful not to cover important information on the packaging.
- Opened containers should not be stored for more than 6 months, or up to the manufacturer's expiration date if tested every three months and peroxide-free.

An inhibitor is generally added to prevent peroxide formation.

However, the risk of peroxide formation increases the longer the solvent is exposed to air (the inhibitor is consumed) or if the solvent has been purified (for example through distillation). Old and half-empty flasks should therefore be closely monitored. How long it takes for a dangerous amount of peroxides to be formed depends on how the peroxide-forming chemical is stored.

- Store peroxide-forming chemicals in a dark and cool place in tightly closed containers according to the recommendation in the safety data sheet. Storage in refrigerators intended for private use is not

permitted due to the risk of explosion. Special EX-classified refrigerators are required for storing flammable liquids that must be kept cool.

- Before handling the containers, a visual inspection must be done (see section Visual inspection).
- Make regular tests of the peroxide content (see section Peroxide test).

Visual inspection

This is done in two steps, first on the shelf and then after carefully lifting it out.

- Is the container in good condition? Are there no deformation cracks etc.?
- Is the container and cap free of crystals? Do NOT open to control this!
- Is the container free of stratification, cloudiness and wisp-like structures?

If any answer is 'No', do not touch/move the container. Follow the information in section Waste management.

Peroxide test

NOTE! The test should only be performed by a person who is familiar with the risks that can arise when handling peroxides and how to minimize them!

Peroxide formation is easily detected using a test strips, e.g. Sigma-Aldrich 0.5-100 mg/L H₂O₂, MQuant.

- Peroxide-forming chemicals must be tested regularly and before each use for possible peroxide formation.
 - If the peroxide content is lower than 3 mg/L, the chemical can be used.

- If the peroxide content is 3 mg/L or higher, the chemical must be disposed according to section Waste management.
- If a solution is turbid (cloudy), discoloured, or if crystals form, the container should not be touched.
- Opened containers must be tested regularly.
- Unopened containers of peroxide-forming chemicals (NOTE! clear solutions) that have passed their expiration date must be analysed for peroxides and then disposed according to section Waste management.
- Do not mix peroxide-forming chemicals with other organic solvent waste.

NOTE! If a solution is turbid, discoloured, or when the contents have evaporated and there are precipitation/crystal formation, do not touch/move the container.

Even with strong peroxide formation, there is no danger if the chemical is not moved from its position.

Labelling

When labeling the chemical, the following must be stated:

Warning: May form explosive peroxides!		
Date received:		
Date opened:		
Peroxide test results (mg/L)		
(Peroxide tests should be conducted every six months)		
Date:	Result:	Initial:
Date:	Result:	Initial:
Date:	Result:	Initial:
	...	
	

Waste management

You should not personally handle solutions with a peroxide content $\geq 3\text{mg/l}$.

For lower peroxide concentration ($< 30\text{ mg/L}$):

- Contact Stena for collection directly from the storage location.

For old peroxide-containing chemicals:

- When the contents have evaporated and there is no liquid remaining, except precipitation or crystals.
 - When the liquid is turbid (cloudy) or discoloured and/or there is precipitation or crystals on the bottom of the container.
 - When you cannot see through the container, and you know that it has been stored unsuitably (warm) or for a long period (more than 1 year).
 - When you do not know how old the container is or how it has been stored.
 - When you have detected a high peroxide concentration, $\geq 30\text{ mg/L}$.
- Contact the Safety advisor for consultation and the Safety and security unit (kemikaliesakerhet@ki.se) for information.

NOTE! Peroxide-forming chemicals must not be poured into drains or onto the ground.

Information and contact

For more information, contact the Safety and security unit at kemikaliesakerhet@ki.se.

The contact information for KI's contractor for hazardous laboratory waste and for KI's Safety Advisor can be found on KI's Staff Portal under Laboratory Waste and Contact.