

**Picric Acid Safety**

**Introduction**

Picric acid (2,4,6-trinitrophenol) is an organic compound that is commonly used in synthetic chemistry and as a fixative and stain in histology. Due to its relatively low solubility it is most commonly found as a saturated solution or slurry in water or alcohol which is easily recognised by its distinctive yellow colour. Picric acid is toxic by skin contact, ingestion or inhalation causing skin discolouration and sensitisation and in high concentrations it can cause kidney and liver damage. In addition to its toxicity, picric acid can present a risk of explosion when encountered as a dry solid (in particular when crystalline). Picric acid crystals are reportedly very sensitive to heat, friction and shock all of which can cause the dry material to detonate. Picric acid crystals are especially sensitive to shearing forces meaning that should any residue crystallise in the threads of a container, simply opening the container could potentially trigger an explosion, this is especially true of containers with ground glass stoppers.

To help mitigate the risk of explosion, picric acid is usually supplied as a saturated solution in either water or alcohol which causes it to become desensitised significantly reducing the risk of explosion so long as it remains moist. Like most explosives picric acid is subject to regulation under the Explosives Regulations 2014. However it is exempt from regulation in solutions with a concentration of 2% or less so long as it is to be used as an analytical reagent, dye, stain or fixative. Other applications (including the use of picric acid as a chemical reagent) are subject to the usual limit of 5g of desensitised material for the purposes of research.

In addition to its inherent toxicity and explosive nature, picric acid can also react with ammonia, concrete and metals such as calcium, copper, iron, lead nickel and zinc to form extremely unstable picrate compounds. Picrate compounds are even more sensitive explosives and every precaution should be taken to prevent their formation.

**Management and Use of Picric Acid**

As with all hazardous substances the use of picric acid should be subject to a suitable and sufficient CoSHH assessment before it is used. Due to the associated hazards it is recommended that where possible the use of picric acid should be eliminated and a safer alternative sought. However, as with most hazardous substances there are circumstances where this isn’t possible and picric acid is still used in some disciplines. To minimise the risk the following safety precautions should be implemented:

* Due to the inhalation toxicity of picric acid its use on the open bench should be avoided where practical. To avoid skin contact users should wear suitable PPE including lab coat (or equivalent) gloves and eye protection taking care to ensure that wrists are protected and that correct glove removal techniques are used.
* Picric acid should be stored in a dry, dark environment away from potential sources of ignition, where stock solutions of picric acid have been prepared, the concentration and solvent used should be clearly marked on the outside of the container.
* Picric acid should not be stored with incompatible chemicals including ammonia and metals to avoid the formation of unstable picrate compounds.
* Strict stock control should be used to avoid stockpiling large quantities of picric acid which can then degrade. Care should be taken to avoid having several partially used containers of picric acid and where it is used by several groups a sharing scheme should be encouraged to keep stocks low.
* Picric acid containers should always be examined after use and any residue on the neck of the bottle should be carefully washed back into the bottle with a pipette and the threads cleaned with a damp cloth to remove any residue.
* Picric acid solutions should be subjected to regular inspection throughout their lifetime. Bottles should be carefully examined on at least a monthly basis to ensure that the material is not drying out and that no crystals or residue are present in threads of the bottle. Where safe to do so water (or other appropriate solvents) should be added as required to keep the solid material wet and samples may need to be gently turned to rehydrate any dry material projecting from solution. This inspection should be clearly recorded to provide evidence the checks have been completed.
* Picric acid containers should be disposed of after no more than 2 years to prevent dehydration and degradation. New bottles and stock solutions should be clearly labelled to indicate the date of receipt.
* If a container of picric acid is found to have dried out or shows a dry crust or crystals around the cap or screw threads of the bottle **do not attempt to open the bottle!** Seek advice from the chemical safety adviser who will provide guidance on how to make the container safe.
* Picric acid **must not** be stored in containers with metal caps under any circumstances. If any historical samples are identified with metal caps then they should not be touched and specialist advice should be sought immediately. This may require evacuation of the immediate area and the attention of an external agency to facilitate safe disposal.

**Safe Disposal of Picric Acid**

When a container of picric acid is no longer required it should be disposed of as quickly as possible to remove the hazard from the laboratory and prevent degradation / dehydration of the contents. The first step in any disposal procedure should be to care3fully carry out an examination of the bottle to confirm its condition. The contents of the bottle should then be documented and if it is in good condition with no evidence of dehydration or crystallisation around the cap disposal should be arranged via the University’s chemical waste disposal contractor.

If the container is found to be dehydrated or any evidence of dry residue is found around the neck or cap of the bottle then it should be left undisturbed and advice sought from the chemical safety adviser. Any containers in this condition **must not be opened**.

Dry picric acid can be successfully rehydrated with little risk if a safe system of work is followed. However any such procedure should be subject to both a general risk assessment and a CoSHH assessment and should be undertaken using a defined safe system of work.

**Note: Rehydration procedures for dry picric acid stocks are usually carried out under the supervision of the chemical safety adviser who should be consulted before any attempt is made to open the bottle or rehydrate the contents.**

**Note: Under no circumstances should excess stocks of picric acid be poured to drain, this could easily lead to an explosion due to the formation of unstable picrate compounds. Picric acid should always be disposed of via the University’s approved chemical waste disposal provider.**

**Note: Although this guidance note deals specifically with picric acid another compound; 2,4,-dinitrophenylhydrazine (DNPH) presents a similar (if not greater) risk of explosion. For guidance in working with or disposing of 2,4-DNPH please contact the chemical safety adviser.**

**Further Guidance and Support**

When managed appropriately picric acid can be stored and used quite safely but it can pose a significant risk when historical samples are identified or stocks are not adequately managed. For advice and support with picric acid or for guidance in safely disposing of dry or crystalline samples please contact the chemical safety adviser for advice.

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**Chemical Safety Adviser:**  0141 330 2799

**E-mail:** [safety@glasgow.ac.uk](mailto:safety@glasgow.ac.uk)



**Picric Acid Inspection Record**

**Bottle ID:**

**Contents / Quantity:**

**Storage Location:**

**Date Received:**

**Date for Disposal:**

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| --- | --- | --- |
| **Date of Inspection** | **Inspected By** | **Condition / Description** |
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