# **Standard Operating Procedure (SOP) Title: Handling Cyanide Compounds**

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| Assessor: | Joshua Linfoot | | | Location of work: | MSRH 502 |
| Principal Investigator: | | | Prof Alan Spivey | | |
| Date of approval: | | 13/09/2021 | | Date for review: | 13/09/2022 |

## **Justifying the hazards:**

Cyanides, such as potassium cyanide, are fatal by all routes of exposure; including ingestion, inhalation, or skin contact. Cyanides can affect the organs including heart, testes, brain and thyroid. Exposure to as little as 200 mg can be fatal for humans. The oral LD50 in rats for KCN is 7.49 mg/kg and the dermal LD50 in rabbits is 14.29 mg/kg. It should be noted that quantities below this still pose extreme health risks. Due to the high dermal toxicity of cyanide, particular care needs to be taken with cyanide salts dissolved in DMSO, a solvent which can deliver compounds through the skin.

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| Identify hazards with specific risk assessments and a College or a departmental approval process | | | |
| [Ionising radiation sources](https://www.imperial.ac.uk/safety/safety-by-topic/laboratory-safety/) |  | [Biological sources](https://www.imperial.ac.uk/safety/safety-by-topic/laboratory-safety/) (microorganisms, human/animal tissues, plants) |  |
| [Class 3R, 3B or 4 Lasers](https://imperiallondon.sharepoint.com/sites/fons/faculty/safety/lasers/SitePages/laserhome.aspx) |  | [Offsite work](http://www.imperial.ac.uk/safety/safety-by-topic/off-site-working/) |  |
| Confirm if [Lone working](https://www.imperial.ac.uk/safety/safety-by-topic/lone-working/) is permitted with this SOP?  If it is permitted, describe the control measures for lone workers: | | | |

## **Preparing for the SOP:**

* **DO inform yourself of the hazards** – Read the Safety Data Sheet and the [Cyanide Chemistry Safety Presentation](https://imperiallondon.sharepoint.com/sites/fons/faculty/safety/chemistry/Documents/Cyanide%20Chemistry%20Safety%202018.pdf?csf=1&e=qRigK5&cid=7fc383ac-0637-48e4-beb8-d7954452231c), fill in your COSHH form. Every reaction involving cyanide salts has to be countersigned by a **level 1 trainer** (even if the person performing the reaction is also a level 1 trainer).
* **DO let everyone know** – Sign in on a notice board in the lab to let everyone know you are doing a “cyanide reaction”.
* **DON’T** store cyanides in close proximity any acid.
* **DO replace with a less hazardous alternative where possible (e.g. CuCN instead of KCN).**
* **DO prepare a Bleach Bath** (to quench cyanide compounds) – 500 mL of bleach (available from stores) per 2 g of cyanide compound used, diluted with 1 L of water. Label bleach bath as cyanide waste and with creation date. Dispose of as hazardous waste after one reaction.
* If a regular use or large scale reaction is planned please contact H&S Team in advance to organise for emergency plan with the local hospital for the treatment of cyanide poisoning.

## **Procedure:**

ATTENTION: Contact with acid liberates very toxic gas (hydrogen cyanide)!!!

**Handling Potassium Cyanide during the Reaction:**

1. All cyanide salts must be stored in a locked, ventilated cabinet. Only senior group members (**Level 1 trainers**) may access the locked cabinet and each use must be recorded in a log book.
2. All procedures for cyanide reactions must be performed inside a fume hood with the sash as low as possible. This includes the use of a rotavap to remove solvents containing potassium cyanide and the use of a balance to weigh the compound. Wipe the balance thoroughly with bleach after use before returning to the initial location. Alternatively, it is permitted to insert the compound into a tared vial inside a fume hood, close and weigh on a balance outside the fume hood.
3. All glassware and gloves that came into contact with potassium cyanide must be rinsed with acetone (or in water if not soluble in acetone) and immersed in the bleach bath for at least 24 hours to quench the cyanide. Handle everything contacted with cyanides as you would handle the product itself! Bleach baths must be stored in a fume hood at all times.
4. The rotavap solvent trap and must be washed after use (check the procedure in Cyanide Compounds Safety Presentation). The rotavap must be cleaned with acetone (or in water if not soluble in acetone). All cyanide waste must be collected in a cyanide waste bottle.
5. The cyanide wastes must be quenched with bleach and collected in a cyanide waste bottle.
6. After you have finished the cyanide reaction, leave the cyanide waste bottle in the ‘toxic’ fume hood for collection.
7. Wash hands before breaks and immediately after handling cyanide compounds!

## **Disposal:**

All produced waste must be disposed of as hazardous waste and stored in a dedicated ‘toxic’ fume cupboard prior to collection.

**Personal Protective Equipment (PPE):**

Labcoat, two pairs of protective nitrile rubber gloves and safety specs.

## **Risk Analysis of SOP and emergency procedures:**

(In addition to [Safe Lab Practice](https://imperiallondon.sharepoint.com/sites/fons/faculty/safety/SitePages/Basic%20Laboratory%20Rules%20for%20All%20Laboratories%20in%20FoNS.aspx))

### **Always remember to include fire associated risks and control measures where appropriate**

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| Hazard | Raw risks | Current control measures | Residual risk  (Low/Med/High) |
| Cyanide compounds | Spillage, Intoxication,  Environmental release | Always work in the fumehood and wear PPE.  Inform researchers around on your work.  Use minimum possible quantities.  Neutralise with bleach solution.  Ensure the equipment and sample preparation area are cleaned after each use. | Med |

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| **Additional control measures to minimise residual risks** | **Implementation date** |
| Make sure bleach solution remains active by preparing a fresh solution after each quench. | Before and during work |

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| **Who may be harmed** | |
| Staff / students | Cleaners / Engineers |
| Supporting staff | Others (specify): |

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| **Emergency procedures** – describe the response(s) required by the user and lab members |
| If the **fume hood breaks down** - Evacuate the lab. Contact estates facilities on x48000 and report defect immediately. Contact the FoNS safety team.  **Spillage in the fume hood** - sweep up the cyanide compound or soak up with a spill pillow or absorbent material. Place in an appropriate container and quench with bleach. The container should be clearly labelled as Toxic Cyanide Wastes and stored in a dedicated ‘toxic’ fume hood.  **Spillage outside of fumehood** – immediately evacuate the lab and contact FoNS Safety team (07872850018 or 07566950899). Respiratory protection required for clean up. The procedure will be risk assessed in conjunction with the Department and external contractors prior to commencing.  **Fire** – Use sand, dry chemical or alcohol resistant foam extinguisher. Contact with acid liberates toxic hydrogen cyanide gas. As in any fire – activate a fire alarm and evacuate the lab. Inform Fire Safety Officers or Security where the fire is located and what it involves when they arrive at the building.  **Skin/eye contact (cut/wound)** - Wash affected area immediately with plenty of water (also under the eyelids if eye contact occurred) for at least 15 minutes. Immediate medical attention is required!  **Inhalation** - (even if very little is inhaled) remove the person to fresh air and seek medical attention at once. Do not use mouth-to-mouth resuscitation if victim ingested or inhaled the substance; induce artificial respiration with a respiratory medical device. |

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| Recommended trainings and records: |
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| List of individuals competent to demonstrate safe work practice and train others (level 1 trainers): | Names of those that have been trained and can work unsupervised (level 2) and date training completed: |
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