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Guidelines for
Safe Handling of Toxins

M. Szilagyi

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ABSTRACT

Toxins are highly toxic chemicals which cause illness through all routes of entry into the body. This technical note has been prepared to ensure that preparation, handling, and disposal of toxins does not constitute a greater occupational hazard than is necessary. It includes hazards that may be encountered and the precautions that should be taken against such hazards.

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Guidelines for Safe Handling of Toxins

Executive Summary

The report outlines guidelines for the safe handling and use of toxins in defence research. It details the precautions to be taken on receipt, storage, handling, and disposal.

As research in biological defence began at AMRL, it became obvious that while toxic materials had been handled in the laboratory, the procedures for the handling of toxic materials of biological origin needed to be defined. There are three reasons for this:

- i) to ensure the protection of laboratory staff working with toxins
- ii) to ensure the protection of laboratory staff and transient employees occupying the same building
- iii) to satisfy the various committees overseeing the research, that all the necessary precautions were being taken.

The result is a set of procedures that the laboratory worker must follow that will minimise exposure to toxins.

The outcome is the safety of laboratory personnel, and the prevention of laboratory contamination.

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Maria Szilagy graduated BSc from Monash University in 1981 and MAppSci (Tox.) from Royal Melbourne Institute of Technology in 1992. Maria joined MRL in 1986 and worked on the interaction of nerve agents and potential prophylatic drugs at adenosine and muscarinic receptors. This led to research on the effect of nerve agents on the release of the neurotransmitters gamma-aminobutyric acid and glutamate. Presently, Maria is involved with research in biological defence.

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1. Introduction

Toxins are poisonous substances produced and derived from living plants (eg. ricin), animals (eg. tetrodotoxin), or microorganisms (eg. Staphylococcal enterotoxin B). These guidelines have been prepared to ensure that preparation, handling, and disposal of toxins does not constitute a greater occupational hazard than is necessary. The guidelines include basic safety procedures to promote awareness of the potential hazards involved and to ensure safe practice. The document should be read in its entirety.

2. Hazard

Toxins manifest toxicity on exposure to very small amounts. However, since most toxins are solids bought in and used as solutions, vapour inhalation is not considered a hazard. Percutaneous absorption of the solids is slow. The main hazard associated with toxin use is aerosol formation and skin penetration of toxin solutions. Toxin solutions and suspensions can result in the formation of aerosols during handling, which can be inhaled. There is also the possibility of direct entry via the skin either through skin puncture from sharps or absorption through cuts and wounds.

3. Receipt and Storage

Toxin importation and use is regulated by the Australian Quarantine Inspection Service (AQIS), whose reporting requirements must be met.

1. A record should be kept of the date of acquisition, quantity in stock, storage location and principal user. Each withdrawal, user, and the balance of stock remaining is also to be recorded and signed by the user.
2. Toxins must be stored under lock and key. They should be stored in a sealed container with adsorbent material (eg. vermiculite) to prevent contamination in case of accidental breakage and spillage.
3. Receipt/despatch should notify receipt immediately upon arrival of toxin so that it can be stored safely immediately.

4. Precautions

1. Universal biohazard or cytotoxic chemical sign is to be posted on the laboratory access door when toxin is present in the laboratory. When toxins are in use, the sign "Toxins in use - Authorised Personnel Only" is to be displayed outside the laboratory door. The laboratory door is to be kept closed, but not locked, while experiments are in progress.
2. Material Safety Data Sheets are to be available in the area at all times - displayed as per other safety material.
3. An emergency shower and eyewash is to be available for immediate use.
4. **Sharps** should **not** be used unless necessary as in the case of septums. Use blunt needles for dispensing.
5. **Inhalation** of toxins is to be avoided by taking precautions to avoid aerosolization of toxins.
6. **Open wound contamination** can be avoided by wearing protective clothing.
7. No smoking, eating or drinking is allowed in the laboratory.
8. No mouth-pipetting is allowed in the laboratory.
9. Wash hands after removing protective clothing prior to leaving the laboratory.

5. Handling

It is recommended that pregnant women, women intending to become pregnant, and those who are breast feeding do not handle toxins known or suspected of having effects on germ plasm. Male staff planning to father progeny should also be made aware of the risk of chromosomal damage during spermatogenesis.

For the purpose of this document, 'waste bin' signifies bins specifically to be used for cytotoxic waste unless otherwise specified.

1. All studies involving toxins are to be recorded in a logbook. Entries will include date, toxin in use, amount used, and signed by the user.
2. Preparation or handling of concentrated toxin must be performed in the cytotoxic chemical cabinet. Transportation should be kept to a minimum and should be undertaken with the toxin in a suitable, sealed, unbreakable container.
3. All bottles or vials containing toxin will be clearly labelled with the identity and quantity of the toxin and /or the concentration of the solution.
4. The working surface in the cabinets is to be covered with disposable absorbent paper with an impermeable backing during toxin use. This is then to be discarded to waste bin for incineration at the end of toxin use/the day.

5. Only the required amount should be removed from the cabinet. Exceptional care is to be taken when working with toxin solutions in syringes. Procedures involving the use of needles and syringes will be minimised. Only syringes equipped with locking-type fittings will be used. Two people must be present for all manipulations with syringes containing more than one human LD₅₀.¹ A cotton gauze pledget will be placed around the needle as it is withdrawn from the bottle to reduce the likelihood of aerosol formation.
6. All glassware is to be washed in decontamination solution and soaked overnight before washing. All work surfaces will be wiped down with decon solution at the end of each toxin operation/day.

6. Protective Clothing

Staff handling toxins must wear:

1. Clean-long sleeved, closed-front gown or fully buttoned lab coats.
2. Safety goggles/safety glasses
3. Gloves (surgical)
4. Respirators (with HEPA (high efficiency particulate air) cartridge) should be at hand in the room when dry toxin is being used.
5. All protective clothing used for toxin work must remain in the toxin laboratory.

Laundry

1. Disposable gloves are to be incinerated.
2. Lab coats and gowns are to be autoclaved prior to laundering.

7. Waste Disposal

1. Non-sharps waste is to be collected and disposed of into the waste collection bin for incineration.
2. Sharps waste is to be collected into the specified hard-walled sharps container, sealed, and disposed of into the cytotoxic waste collection bin.

¹ For example, one human LD₅₀ of ricin corresponds to approximately 200µg ricin. For a lethal human exposure from inadvertent injection of 0.1 ml toxin solution, a concentration of 2 mg/ml is required.

3. All liquid waste is to be discarded into the decontamination solution. This solution is then to be mixed with absorbent, sealed and discarded into the waste bin for incineration. Manipulation of waste is to be performed in the fume cupboard wearing safety glasses, labcoat and rubber gloves.
4. Contaminated clothing is to be placed into the waste bin.
5. When the waste collection bins are full, they are to be transported by an EPA licensed carrier to an EPA licensed incinerator.

8. Accidents and Spills

8.1 Inside the Cabinet

A spill decontamination kit must be present in the cytotoxic chemical cabinet at all times. The decontamination solution to be used is either commercial bleach (5% sodium hypochlorite) or a mixture of 2.5% sodium hypochlorite with 0.25N sodium hydroxide.

1. Attend to personal decontamination: Flush contaminated skin with copious amounts of water for at least 15 min. Change contaminated protective clothing.
2. Flood all spills of toxin with decontamination solution and allow to stand for a minimum of 1 hour.
3. Use adsorbent to contain spill and place into plastic bags. Seal and discard into waste bins for incineration.
4. Discard contaminated combustible items into waste bin for incineration.
5. Wash non-combustible contaminated items (eg broken glass) with decontamination solution. Allow to stand overnight in decontamination solution, wash and discard in normal non-combustible waste bin.
6. Wipe out cabinet with decontamination solution.

8.2 Outside the Cabinet

1. Attend to personal decontamination: Flush contaminated skin with copious quantities of water for at least 15 minutes. Change contaminated protective clothing. For gross contamination, remove all contaminated clothing. Shower, if required. Seek assistance for spill clean up if required.

2. Alert co-workers that an accidental spill has occurred and seek assistance, if required.
3. Don additional protective clothing if required.
4. Flood all spills of toxin with decontamination solution and allow to stand for a minimum of an hour.
5. Collect all non-combustible waste (eg. broken glass) and wash with decontamination solution. Let stand in decontamination solution overnight, wash and discard in normal non-combustible waste bin.
6. Use adsorbent to contain the spill and place into bags. Seal and discard into waste bins for incineration.

9. Decontamination

1. Commercial bleach (5% sodium hypochlorite) or a mixture of 2.5% sodium hypochlorite with 0.25N sodium hydroxide is to be used for decontamination. This solution is not to be disposed of 'down the sink'.
2. All decontaminant solution is to be mixed with adsorbent, bagged, sealed and discarded into the waste bin for incineration.
3. All contaminated glassware is to be left in decontamination solution overnight. It is then to be washed normally. The decontamination solution is to be treated as described in 2 above.

10. First Aid

1. Remove member from contaminated area to fresh air.
2. Wash any contamination from skin or eyes
3. For ricin, induce vomiting with warm salted water or mist ipecac if ingested.
4. Seek urgent medical advice

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