Working with Venoms and Toxins Guideline

Section 1 - Purpose and Objectives

(1) This Guideline outlines the required safe work practices for all staff, students, visitors, volunteers and contractors who are undertaking processes where animal venom, venom extracts, or their toxic components are handled.

Section 2 - Definitions, Terms, Acronyms

Term	Definition
Allergy	An irritating or harmful immune system response to a foreign substance that is harmless to most people.
Anaphylaxis	An acute, severe allergic response involving multiple organs of the body. If untreated anaphylaxis can be fatal.
Biological Material	Includes, but is not limited to blood, blood products, tissues, body fluids and any derivatives produced by chemical or physical means; micro-organisms – wild type or mutant; plants and plant material.
Biosafety	Measures relating to the protection of an environment or population etc. from contamination with or infection by a biological agents (Oxford English Dictionary)
DSGL	Defence and Strategic Goods List.
Envenomation	The injection of a poisonous material by sting, spine, bite, or other similar means.
LD50	LD stands for 'Lethal Dose'. LD50 is the amount of a material, given all at once, which causes the death of 50% (one half) of a group of test animals.
PPE	Personal Protective Equipment.
Risk Assessment	Evaluating the potential risk of an undertaking and identifying control measures that may reduce the negative outcome of the risk. Persons are encouraged to use the UQ Risk Management Database.
Toxin	Poisonous substances produced by living organisms, plants and animals.
Toxoid	A substance that has been treated to destroy its toxic properties to decrease its toxic effect but that retains its antigenic power.
Venom	Poisonous secretion of an animal such as a snake or spider, usually transmitted by bite or sting. Venom is made up of poisonous chemicals called toxins.
w/w	The mass of the substance as a percentage of the total mass of the solution or the mixture.

Section 3 - Guideline Scope/Coverage

(2) This Guideline applies to all persons undertaking research with or on animal toxins and venoms in the laboratory. They are applicable to all processes where crude venom or purified toxins (or synthetic variants) are handled and stored. The animal venom/toxin may be in liquid or solid (lyophilized) form. Animal venom may include but is not restricted to that collected from snakes, molluscs and fish.

(3) This Guideline applies to:

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a. Work with biological toxins and venoms or their synthetic derivatives that present a life-threatening or severe irreversible health effect risk in a single exposure incident scenario.

(4) This Guideline does not apply to:

a. Toxins/venoms collected from cone snails as there are special regulations that apply to cone snail venoms.
b. Use of toxoids.

(5) Additional regulations apply to toxins that may be lethal via absorption (e.g. tetrodotoxin, cone snails - DSGL list 1C351.d.3).

Section 4 - Guideline Statement

(6) This Guideline assists workers with the safe working procedures for possessing and conducting work with biological toxins and venoms and their derivatives in the laboratory.

Section 5 - Considerations when Working with Venoms and Toxins

Work Practices

(7) Caution is to be used at all times when handling animal venoms/toxins. All personnel handling animal venoms/toxins must complete the Biosafety online training module and receive appropriate training in the handling, disposal and first aid of animal venoms/toxins from experienced supervisors.

(8) Possession and research use of biological toxins or venoms requires a potentially hazardous biological material proposal to be approved by the Institutional Biosafety Committee before the commencement of work. Refer to the Working with Hazardous Biological Material Procedure for more information.

(9) When working after hours, the risk of some hazards may increase due to the reduction in immediate assistance in the event of an incident. When working with toxins and venoms it is advisable to have a second person in the vicinity as a support person. If the risk assessment identifies high risk, then working with toxins alone after hours should not be carried out.

(10) All training must be competency based training and signed off by the supervisor/trainer.

(11) A risk assessment must be carried out prior to the commencement of any experiment to ensure safe operating procedures are developed before undertaking laboratory operations with a toxin/venom.

a. Example risk assessment for working with toxins/venoms in the laboratory.
b. UQ Risk Management Database.

Training

(12) Prior to commencing work with venoms and toxins specific training is required covering work practices management and health and safety issues. Please complete a training needs analysis with your supervisor.

(13) Training must include:

a. Toxin/venom extraction and handling Standard Operating Procedure (SOP) for delivering a consistent and

reproducible product.

b. Basic understanding of the properties of the venom/toxin they are working with including the LD50.
c. Emergency measures, what to do in the event of eye exposure to liquid venom or needle stick.
d. For commercially available animal venoms/toxins, training should follow the Safety Data Sheet (SDS) (if available) for information on hazards, safe handling and storage.

(14) Refer to the Working with Biosecurity Goods Procedure.

Personal Protective Equipment

(15) Personal protective equipment worn for toxin manipulations should be selected for potential to prevent the venom/toxin contamination from coming into contact with your personal clothing or exposed skin.

(16) Standard chemical PPE must be worn while working with any quantity of venom, this includes but is not limited to fully enclosed shoes, eye protection, laboratory coat, gloves (puncture proof preferable if using sharps or risk of puncture), etc. Wear protective breathing apparatus when handling very highly toxic venoms e.g. jelly fish venoms.

(17) Once any protective device becomes soiled with venom, special attention must be given to cleaning it, as dried venom easily becomes airborne dust and is a significant health and safety risk involving allergy induction.

Defined Work Space

(18) Work with venoms/toxins should be carried out in a defined and signed workspace. Ensure others in the laboratory are aware of the specific areas where work on venoms and toxins are carried out. For example, place a sign above the laboratory bench or door, “toxin use in progress-authorised personnel only” or equivalent. Under routine circumstances, no one should enter the area where this work is being conducted aside from personnel authorised to work with the toxin.

(19) Powdered toxin preparations need to be carried out in a Class 2 biological safety cabinet (BSCII), a chemical fume hood or Cytotoxic Biosafety Cabinet. This is to avoid contaminating the rest of the laboratory with powdered venom or toxin. Engineering controls should be selected according to the risk assessment for each specific toxin procedure.

(20) Note: Remove all items that are not necessary for the procedure at hand from the BSCII before handling the toxin to further reduce spill/contamination potential.

Sharps

(21) The use of sharps should be kept to a minimum to reduce the chance of getting a contaminated cut or puncture. When using scalpel blades, ensure that caution is exercised. Dispose of the blade using a Qlicksmart device to minimise handling of the contaminated blade. Discarded needles/syringes should be placed directly into puncture-resistant sharps containers.

(22) Plastic consumables should be used for ease of disposal and not needing to wash up implements contaminated with venom residue or pathogens.

(23) The other significant exposure risk scenario is an accidental injection or cut while transferring or administering the toxin with a sharp device. The use of sharps in procedures should be minimised as much as possible and those handling these devices need to follow sound safety practices to protect themselves and others who share the lab space from exposure to the toxin.

(24) For toxin applications, the following additional provisions apply:

a. Use only syringes with luer-lock integrated needles or consider safety syringe systems such as vanishpoint.

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b. Use vial adapters whenever possible to eliminate the need to use a needle to add diluents into a septum vial.
c. If introducing a needle through a septum, ensure that the vial is secured with a device that allows the non-dominant hand to be outside of the “strike zone” of the needle. Either secure vial in a rack or use a clamp to hold the vial instead of holding it directly by hand during needle introduction and removal.
d. Use a safety engineered device (i.e. one that has a mechanism to enclose the sharp end/edge after use) if one is available and feasible to use on the procedures.
e. When administering toxins to animals, be well-trained in physical restraint techniques before attempting to administer any hazardous materials with a sharp device.

(25) Extra care must be taken when working with venoms in a syringe for the injection of venom into a laboratory animal.

(26) Note: However, in the case of snake venom, the entire quantity in the syringe used in such experiments is invariably much less than the lethal dose for humans and the amount coating the needle is typically capable of causing only trivial symptoms. For this reason, antivenom is not required to be stored by institutions working only with venom (rather than with venomous animals), as the likelihood of a severe envenomation is extremely unlikely.

Section 6 - Storage Requirements

(27) Venom and toxin samples to be stored should be in clearly labelled, sealed containers. The samples should be labelled in a manner capable of notifying any other handler of the description of the material and the person responsible for the item in storage. All venoms/toxins must be stored in locked freezers if kept outside a secure laboratory.

(28) It is also mandatory that the primary container be one that is non-breakable i.e. plastic or plastic coated glass. Vials should be maintained in a closed secondary container that will not allow escape of the product in the event that it is dropped. To further stabilise vials, place them in a rack or Styrofoam tray inside the secondary container. An inventory of stored toxins and venoms should be kept and available in the laboratory.

Section 7 - Toxin Waste Disposal and Inactivation

(29) Due to each toxin/venom being biochemically different, there is no universal method of inactivation. It is critical that researchers who are using toxins/venoms in their studies become knowledgeable in the methods of inactivation for their particular toxin/venom.

(30) Generally, 70% w/w ethanol should be used to wipe down the work area before and after handling the venom/toxin. All sharps should be placed in a sharps container for disposal and toxin/venom waste denatured using 70% w/w ethanol.

(31) Sharps contaminated with toxin/venom may be disposed of in a bio hazardous sharps container, sealed and placed in a clinical waste bin for incineration.

(32) Surfaces of non-disposable implements should be sprayed with 70% w/w ethanol to denature proteins before final treatment e.g. wash and then autoclave.

(33) Solid waste items (i.e. gloves, waste vials, bench paper, etc.) should not be soaked in a liquid decontamination solution.

a. In the event that the toxin/venom can be inactivated by autoclave treatment, solid waste should be collected in an autoclaveable bag and sterilised via autoclave before it leaves the lab in a clinical waste bin.

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b. If the toxin/venom cannot be inactivated by autoclave, the waste should be disposed of as solid toxic waste (i.e. gloves, waste vials, bench paper, etc.). Double bag and place in the clinical waste stream for incineration.

(34) Liquid waste containing a toxin/venom that can be inactivated with bleach may be disposed of via the lab sink, similar to other bleach-treated biological liquids. If the toxin/venom liquid waste is not inactivated by bleach, then the method of inactivation will need to be validated and outlined in a risk assessment before disposal. The need for collection as liquid hazardous waste may apply.

Section 8 - Spills and Exposure

(35) Preparation for spills and exposure is necessary before any toxin/venom handling takes place. Because there is no universal decontaminant, spill procedures must be tailored for the individual toxin/venom being used and outlined in the risk assessment.

(36) Basic steps for responding to a spill of liquids containing toxins/venoms are outlined below.

a. Isolate the area. (This should have already been done in the case of toxin/venom use. Only those who are authorised for toxin/venom work should be permitted into lab areas where toxin/venom use is underway.)
b. Remove the breached container. If breached container is glass, remove glass pieces using tongs or disposable broom/dust pan. Place glass in sharps container for disposal. If container is not glass, place it in a plastic bag for treatment and disposal or an appropriate secondary container.
c. Treat, absorb and remove the spill contamination. Cover spill with decontaminate-saturated paper towel and allow contact with spill for several minutes. Absorb and remove spill contamination. (Use tongs or other tools to minimise direct handling of spill materials if feasible.) Place absorbed spill materials and associated wastes in plastic bag.
d. Decontaminate all impacted surfaces. Apply decontaminant to all surfaces impacted by the spill, wait the prescribed contact time before removing decontaminated residues.

(37) NOTE: Use care to limit contact with contaminated surfaces when removing PPE. Place all used spill response materials in a plastic bag for final treatment and disposal.

Section 9 - First Aid

(38) The SOP should include first aid treatment, emergency contacts, location of first aid kit, safety shower and eye wash and contact details for advanced first aid responders/medical assistance. Emergency contact details should also be displayed in the dedicated workspace and with the first aid kit.

(39) If available, include the Safety Data Sheet (SDS) information for the venoms/toxins being handled.

(40) First aid kits close to work areas where toxins/venoms are being used should be stocked with pressure immobilisation bandages. The risk assessment should also consider whether an EpiPen adrenaline auto-injector and Ventolin inhaler may be required for the event of anaphylactic shock or restricted breathing.

(41) Where EpiPens and Ventolin inhalers are maintained in a workplace first aid kit, they may only be obtained, controlled and administered by a UQ First Aid Officer with formal training in the use of these devices. In workplaces where there is a high risk of an anaphylaxis event occurring, the endorsed First Aid Officer in possession can ensure that key personnel in the workplace undergo certified training in recognition of anaphylaxis and administration of an EpiPen, so that appropriate treatment for anaphylaxis can be delivered in the event the First Aid Officer in possession of the workplace first aid kit EpiPen was not available.

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(42) Training for First Aid Officers at UQ is coordinated by the Staff Training and Development program. Management of anaphylaxis course can be undertaken annually Anaphylaxis (22099VIC) / Asthma (22024VIC).

(43) First Aid Officers at UQ who possess and administer adrenaline auto-injector devices (EpiPens) must comply with the conditions as specified in the approval from the Chief Executive Officer, Queensland Health and in accordance with the UQ First Aid Management of Anaphylaxis Guideline.

(44) Generally speaking, in the event that an exposure incident occurs, the exposed person should take the following actions immediately:

a. Proceed to the closest sink/eyewash. Remove impacted PPE and flush the exposure site.
b. If the agent being used causes significant injury, contact security immediately. Notify laboratory persons for immediate assistance and first aid.
c. If the exposure involves broken or compromised skin, use soap and water to thoroughly cleanse the wound. (Do not use bleach or other harsh chemicals that can degrade tissues).
d. Be careful not to damage the skin with heavy scrubbing.
e. Flush/cleanse the exposure site for 15 minutes.
f. Cover the wound with a bandage (if applicable).
g. Seek medical attention - take any information about the source material that you have readily available along with you.

(45) Notify the Lab Supervisor as soon as possible once medical follow-up actions have been initiated.

(46) Report incident in UQSafe.

(47) Refer to the First Aid Guideline and First Aid Management of Anaphylaxis Guideline for further information on first aid kits and procedures.

Section 10 - Exposure Hazards – Allergies

(48) Inhalation of toxin during handling of dried toxin products is a significant exposure risk. Whenever possible, avoid using a dry toxin product. If one must be used, use a premeasured product that will allow for adding of the diluent without the need to open the container and manipulate the dry toxin.

(49) Sensitisation to venom or a toxin can occur through nasal or ocular exposure, which may lead to anaphylactic shock upon envenomation.

(50) A mild allergic reaction can cause sneezing and other ‘hay fever’-like symptoms to lab workers and thus be nothing more than an inconvenience. However if staff are interacting with venomous snakes in the field or captivity, such an allergy could result in catastrophic anaphylactic shock. As such chronic exposure to dried venom must be avoided either through the use of a P1 half face particulate filter or opening of containers in the fume hood or cytotoxic biosafety cabinet when working with quantities >20mg of powdered venom.

(51) Avoid inhalation of toxin dust, use only in well-ventilated areas, keep container in well-ventilated place and take off immediately all contaminated clothing. Avoid creating aerosols and fine dust with the animal venoms/toxins.

(52) Venoms are otherwise inert by inhalation, ingestion or touch and thus do not count as dangerous goods from the perspective of IATA in regards to transport or storage.

(53) Refer to the Health Surveillance for Laboratory Animal Allergy (LAA) Guideline for more information.

Section 11 - Further Information

(54) Resources include:

a. Clinical Toxinology Resources, The University of Adelaide.
b. Australian Museum - Spider Bites and Venoms.
c. AVRU – Australian Venom Research Unit.
d. Venomous Reptiles: Evolution, Pathophysiology and Biodiscovery [Chapters 2, 5 and 6]. Oxford University Press (2015).

Section 12 - Contact for Additional Information

Biosafety Advisor
UQ Occupational Health and Safety Unit
Phone 336 52365, Email: biosafety@uq.edu.au.

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