Working Safely with Isoflurane Guideline

Section 1 - Purpose and Scope

(1) This Guideline provides advice regarding The University of Queensland's (UQ) requirements for working safely with isoflurane by outlining the hazards and safety considerations through:

a. providing information on risk management for working safely with Isoflurane; and
b. providing information on Emergency Procedures and First Aid.

(2) The Guideline provides further information to the Chemical Spill and Response Procedure and applies to all UQ workers and UQ undergraduate students who carry out work with isoflurane at UQ.

(3) This Guideline should be read in conjunction with other applicable UQ Policy and Procedure Library (PPL) documents covering chemical management and chemical waste disposal.

Section 2 - Process and Key Controls

(4) UQ has a duty under the Work Health and Safety Act 2011 to provide a system of work that ensures the risk of exposure to isoflurane is eliminated or minimised as far as practicably possible. This includes avoiding potential exposure that could result in chronic health effects, as well as ensuring the workplace has suitable first aid procedures.

(5) UQ workers and UQ undergraduate students have a duty to comply, so far as reasonably able, with any reasonable instruction, and to cooperate with any and all reasonable policy or procedure relating to health or safety at the workplace.

(6) The following requirements apply to all UQ workers and UQ undergraduate students who use, store, handle, transport and/or dispose of isoflurane:

a. Prior to working with isoflurane, a risk assessment must be documented in UQSafe to enable effective risk control measures to be identified and implemented.
b. Under no circumstances will isoflurane be used without the use of a scavenging/ventilation mechanism that minimises inhalation exposure to the user.
c. Exposure to isoflurane should be avoided by pregnant workers. Pregnant workers should consider speaking with their Supervisor regarding working with isoflurane to avoid exposure. Contact the Health, Safety and Wellness Division Occupational Nurse if there have any concerns.
d. Read the Safety Data Sheet (SDS) and receive training from their Supervisor as per the 'Training and Competency' provisions below.
e. Store in a secure location so that it is not accessible by the general public.
f. Have detailed emergency response and waste disposal procedures in place.

(7) All incidents, hazards and near misses must be reported in UQSafe.

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Section 3 - Key Requirements

Part A - Risk Management

(8) Isoflurane is a highly volatile, fluorinated organic liquid used for the anaesthesia of animals. It is usually delivered by means of a precision vaporiser but may be administered by means of simpler apparatus for short-term anaesthesia.

(9) UQ workers and UQ undergraduate students may be exposed, via inhalation, to anaesthetic gases and waste anaesthetic gases (WAG), including isoflurane if care is not taken to scavenge or prevent release into the laboratory environment. The quantity of isoflurane gas escaping into the workers breathing zone will depend on the type of equipment being used and the size of the animal being anaesthetised. Other factors influencing worker exposure to isoflurane is the suitability of the animal to be intubated (minimising direct leakage), the physiology of the animal and the skill of the worker performing the anaesthetic procedure, e.g. students may be exposed to higher isoflurane levels intubating an animal than an experienced animal anaesthetist.

(10) The variations in the source of contaminate isoflurane, the type of animal being anaesthetised, and the level of worker experience must be considered when assessing the risks from isoflurane.

(11) Other incidental exposures to isoflurane may also occur, e.g. lab workers filling vaporisers and technicians calibrating or trouble shooting issues with precision vaporisers.

(12) Precautions must be taken to minimise exposure and eliminate the risk of exposure to isoflurane. Persons working with isoflurane must complete a risk assessment prior to ordering the substance to identify and reduce or eliminate the associated hazards.

(13) If the isoflurane is not able to be eliminated or substituted, then engineering controls, along with training, supervision and appropriate PPE must be used.

(14) If the risk assessment indicates there is likely to be a reasonable risk of exposure to isoflurane after all controls are implemented, do not commence work until you have contacted the local Health, Safety and Wellness Manager or the UQ HSW Division Occupational Hygiene Advisor and the UQ HSW Division Occupational Health Nurse for further advice.

(15) The risk assessment must be checked and approved by the research group’s Supervisor to ensure all identified and appropriate controls to avoid or minimise exposure have been implemented.

(16) Safe working procedures must be monitored and reviewed regularly to ensure their effectiveness and changed if required.

Risk Control

(17) A thorough examination of work practices is essential to determine if there is a likelihood of worker exposure to isoflurane and steps should be taken to minimise that exposure as far as reasonably practicable. Precautions should be adopted to ensure that workers are not unnecessarily exposed to the hazard and that they are not working alone. These precautions include adequate general ventilation in the surgical areas, the use of well-designed and well-maintained scavenging systems, work practices to minimise leaks and spills while the anaesthetic agent is in use, routine equipment maintenance to minimise leaks and reducing the number of animal surgeries performed to reduce exposure time.

(18) Since there is limited data, a workplace exposure standard for isoflurane has not been determined. Therefore, until more information is available, it is prudent to attempt to minimise occupational exposure to isoflurane as with all anaesthetic agents.

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Ventilation

(19) Under no circumstances shall isoflurane be used without the use of a scavenging/ventilation mechanism that minimises inhalation exposure to the user. Isoflurane must be used in a well-ventilated room, preferably with no recirculation of exhaust air.

(20) Proper engineering controls including a fume hood, downdraft table or scavenging system are to be used:

a. Fume hood – The procedure is done in a chemical fume hood. This is impractical for large animals or where highly controlled anaesthesia is required, as a precision vaporiser will not fit in a fume cabinet.
b. Downdraft table - The procedure is performed on a down draft table. Downdraft tables provide the most effective Local Exhaust Ventilation extraction, although they are expensive as well as impractical for small animals. Charcoal canisters must be used to adsorb isoflurane or other halogenated anaesthetics if using this method.
c. Scavenging - The collection and disposal of WAG is essential for reducing occupational exposures. An appropriate anaesthetic gas scavenging system is the preferred method of control to protect employees from exposure to anaesthetic gases. Removal of excess anaesthetic gases from the anaesthesia circuit can be accomplished by either active or passive scavenging.
    i. Active scavenging – Procedures done using active scavenging involve an exhaust extraction system. Extracted air can be either removed from the room or cleansed using charcoal filters and returned.
    ii. Passive scavenging – Procedures are done where a combination of exhalation effort of the animal and positive pressure from the delivery of anaesthetic gas drives the air through an activated charcoal canister.

(21) For most laboratory situations, active scavenging should be employed in combination with good general dilution ventilation for a high level of protection from contaminate gas to be provided to workers. It is important that the scavenging system be part of the regular maintenance and calibration of the anaesthetic equipment.

(22) A visual check of hoses for cracks, obstructions or kinks should be performed. Leaks should be identified and corrected, before the system is used. The visual check should also include the flow-monitoring indicator of the scavenging system and this should be done before and throughout use of the equipment.

(23) If scavenging equipment is used, a log of usage should be kept ensuring the charcoal filter is replaced regularly.

Optimising Equipment

(24) Equipment should be optimised to minimise isoflurane leakage into the air. Steps to be taken include:

a. Selecting nose cones to suit various sizes and species encountered. When a nose cone is used for induction or maintenance of anaesthesia, use a nose cone that properly fits the contour of the animal's face to minimise gas leakage.
b. Using a box for induction of anaesthesia in small or uncooperative animals. As with the nose cone technique, the induction box method usually requires high gas-flow rates, with potential for substantial risk of anaesthetic spillage to occur. Methods to minimise this spillage include tight seals on the box and placement of the box near a ventilation port of a well-ventilated room or an exhaust extraction system. Only purpose-built induction boxes should be used.
c. Ensuring that components of anaesthetic circuits are specifically designed for animal anaesthesia, especially connecting tubing and nose cone equipment. Improvised equipment is likely to leak and expose workers to isoflurane, as well as compromise the anaesthesia of the animal.
d. Ensuring keyed fillers with good seals are used when filling anaesthetic vaporisers.

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Personal Protective Equipment

(25) Nitrile gloves, lab coats and eye protection (safety glasses, goggles, or a face-shield) should be worn to prevent contact with liquid anaesthetic gases as determined by the risk assessment.

Part B - Training and Competency

(26) UQ workers working in laboratories with hazardous chemicals are required to complete online training modules for laboratory and chemical safety. Access to these modules can be found on the HSW Division website: Staff and Health and Safety Training and Induction.

(27) In addition to these online modules, UQ workers and UQ undergraduate students who handle or use isoflurane must read the Safety Data Sheet (SDS), and receive training from their Supervisor on the hazards of isoflurane including:

a. proper handling, use, storage, and disposal of isoflurane;
b. the anaesthesia procedures, including the use of the anaesthetic machine and the waste anaesthetic gas scavenging system;
c. proper use of chemical fume hoods or other applicable local exhaust ventilation; and
d. spill clean-up and emergency response procedures.

(28) Supervisors should verify and document worker and student competency before allowing work with isoflurane to proceed in their areas of responsibility. The local site safety inductions conducted by local Work Health and Safety Coordinator (WHSC) are an important complement to this process and local WHSC's should be notified if any work involving isoflurane is planned for the local area.

(29) It is also recommended that UQ workers and UQ undergraduate students who handle or use isoflurane enrol in and attend an Anaesthesia Workshop facilitated by Biological Resources Veterinarians.

(30) All these training elements should also be documented in the risk assessment as administrative controls.

Part C - Storage Requirements

(31) Isoflurane is classified Schedule 4 (S4) under the Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP), but it is not included in either regulated restricted drug (RRD) or restricted drugs of dependency (RDD) S4 subcategories where additional acquisition, storage and usage requirements apply.

(32) To comply with S4 requirements, isoflurane must not be accessible to the general public. Facilities and laboratory areas with swipe card access or are secured by locking, are compliant. For open labs without controlled access, a locked cupboard/drawer/fridge must be used. Further details of UQ requirements for scheduled drugs and poisons usage can be found at the UQ Medicines and Poisons intranet site.

(33) Isoflurane should be stored in a cool well-ventilated area.

(34) Isoflurane is non-flammable and is not classified as dangerous goods.

Part D - Waste Disposal

(35) The holder of the substance authority must ensure that waste from a S4 substance is destroyed under the supervision of a person stated in that authority as authorised to destroy the waste.

(36) Disposal of absorbent canisters that contain activated carbon to prevent release of the anaesthetic gas to the

environment must be managed as hazardous chemical waste.

(37) A request for waste disposal of activated carbon canisters can be submitted through the UQ Science Store under "Chemical Waste Request".

Part E - Health Effects

(38) Health effects from short-term, elevated exposure of isoflurane vapour include narcosis with symptoms of drowsiness, dizziness, nausea, vomiting and unconscious. Light to moderate exposures to airborne vapour may result in headache and irritation of respiratory tract in some workers. Isoflurane will cause severe eye irritation if splashed directly into the eyes.

(39) The health effects of long-term isoflurane exposure include hypotension (low blood pressure), tachycardia (increased heart rate), respiratory depression and elevated blood glucose. Exposure to the isoflurane may cause concerns for human fertility based on results from animal studies.

(40) Pregnant workers should consider talking to their Supervisor regarding work with isoflurane to avoid exposure during pregnancy. They should be given information about the measures that have been taken to ensure safety, and those contemplating pregnancy can continue working in areas using anaesthetics, where proper precautions are in place.

(41) Anyone who has concerns relating to pregnancy should contact the HSW Division Occupational Health Nurse Advisor.

Part F - Emergency Procedures

Spills

(42) The primary acute hazard of a spill of isoflurane is narcosis and unconsciousness. The quantities for minor and major spills are for guidance only. The spills category must be assessed during the risk assessment process and an action plan for managing spills must be detailed in the risk assessment prior to commencing work with isoflurane. Refer to the UQ Chemical Spill and Response Procedure for further information. A spill kit must be available in the immediate work area where isoflurane is being used.

Minor Spill (less than 500 ml)

(43) Increase ventilation within the room and consider temporary evacuation of the immediate area while vapours disperse.

(44) Wear nitrile gloves, lab coats, eye protection (safety glasses or goggles) and activated carbon respirator and clean up any remaining liquid using an absorptive material.

(45) Dispose of absorptive material as waste through UQ Science Store – Chemical Waste Request.

Major Spill (more than 500ml)

(46) In the event of a major spill, evacuate all persons from the area, contact UQ Security on 336 53333 (or the contact displayed on the Emergency Procedure Card) and the local Work Health and Safety Coordinator or Safety Mgr. for advice. UQ HSW Division should also be contacted and notified of the spill.

(47) Prevent others entering the area.

(48) Do not attempt to clean up any major spills of this material.

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(49) All incidents must be recorded in UQSafe. The incident must be reviewed, and the risk assessment/SOP updated and modified with any changes identified during subsequent investigation that will attenuate the risk of a repeat incident.

Part G - First Aid

(50) In the event of an emergency, remove the casualty from further exposure if safe to do so, call UQ Security on 336 53333 and First Aid Officer.

(51) Note: internal emergency contact numbers may vary with each campus, refer to campus emergency procedure card for your location.

Skin Exposure

(52) Small quantities of isoflurane on skin or clothing will evaporate rapidly but remove excessive isoflurane from the affected area by flushing with water for at least 15 minutes.

Inhalation

(53) Remove the person affected by isoflurane vapour to an area with fresh, uncontaminated air.

Eye Exposure

(54) Immediately flush with large amounts of water for at least 15 minutes.

(55) Contact the local First Aid Officer and the UQ Health Service for further advice and treatment, if required.

(56) All incidents, hazards and near misses must be reported in UQSafe. Refer to the Health and Safety Incident and Hazard Reporting Procedure.

Section 4 - Roles, Responsibilities and Accountabilities

(57) Roles, responsibilities and accountabilities for work involving hazardous chemicals, including isoflurane, are outlined in the Chemical Spill and Response Procedure.

Section 5 - Monitoring, Review and Assurance

(58) Organisational Heads and Supervisors should regularly review the effectiveness of local procedures, and guidance material, particularly following incidents and near misses.

(59) The Health, Safety and Wellness Division will review this Guideline regularly for relevance, currency with legislation and evidence-based recommendations.

Section 6 - Recording and Reporting

(60) Organisational units are responsible for accurate recording of local procedures involving laboratory work with isoflurane, and to maintain training records of all relevant training of personnel.

(61) Risk assessments for laboratory work with isoflurane must be recorded in UQSafe.

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(62) Supervisors and/or Health, Safety and Wellness Managers and Coordinators must report in UQSafe any incidents, hazards or near misses.

Section 7 - Appendix

Definitions

Terms	Definitions
Regulated Restricted Drug (RRD)	One of the additional 2 sub-categories of S4 regulated drugs.
Restricted Drugs of Dependency (RDD)	One of the additional 2 sub-categories of S4 regulated drugs.
Safety Data Sheet (SDS)	A document containing information on the health, safety and environmental aspects of a material or chemical for the purposes of storing, using and disposing of the substance in a safe way.
Safe Operating Procedure (SOP)	Step-by-step instructions on how to safely perform a task or activity which involves some risk to health and safety.
Scavenging	The prevention of a contaminate gas entering the breathing zone of workers through selective capture at the feed gas interface with the animal. The captured contaminate can then be exhausted from the room or cleaned and return to the work area.
UQSafe	UQ's system for the recording of incidents, hazard, near misses and risk assessments.
UQ Workers	For the purposes of this Guideline includes: 1. staff - continuing, fixed-term, research (contingent funded) and casual staff; 2. contractors, subcontractors and consultants; 3. visiting academics and researchers; 4. affiliates - academic title holders, visiting academics, Emeritus Professors, adjunct and honorary titleholders, Industry Fellows and conjoint appointments; and 5. higher degree by research students.
Waste Anaesthetic (WAG)	Can include both nitrous oxide and halogenated anaesthetics such as halothane, enflurane, isoflurane, desflurane, sevoflurane, and methoxyflurane.
Workplace Exposure Standard (WES)	Represents the airborne concentration of a particular substance or mixture that must not be exceeded.

Contacts and Additional Information

a. Occupational Hygiene Advisors: hsw@uq.edu.au;
b. Occupational Health Nurse Advisor: hsw@uq.edu.au;
c. UQ Chemicals Store: via UQ Science Store website or uqsciencestore@uq.edu.au;
d. Chemwatch database: print summary SDS, first aid summary, advice to doctor summary and other relevant information on isoflurane.

Status and Details

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