Working Safely with Arsenic Guideline

Section 1 - Purpose and Scope

(1) This Guideline provides advice about The University of Queensland's (UQ) requirements for working safely with arsenic and arsenic containing compounds. The Guideline outlines hazards and safety considerations by providing information on:

a. Risk management for working safely with arsenic and arsenic compounds;
b. Health surveillance requirements; and
c. Emergency procedures and first aid.

(2) The Guideline provides further information to the Chemical Storage Safety Guideline and applies to all UQ workers who carry out work with arsenic and arsenic containing compounds at UQ.

(3) This Guideline should be read in conjunction with other applicable UQ policies, procedures and guidelines 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 ensuring the risk of exposure to arsenic compounds be 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 to preserve life if an acute arsenic exposure occurs.

(5) UQ workers have a duty to comply, so far as they are 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) It is important to consider the following when planning to work with arsenic and arsenic-containing compounds:

a. Conduct a risk assessment to enable effective risk control measures to be indemnified and implemented.
b. Risk assessments must be recorded in UQSafe.
c. Health monitoring requirements.
d. Training and competency requirements.
e. Waste disposal requirements.
f. Emergency procedure requirements including:
    i. spill response,
    ii. health effects and symptoms,
    iii. first aid response.

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

Section 3 - Key Requirements

Part A - Risk Management

(8) Arsenic is a toxic material and a known human carcinogen. It is ubiquitous in the environment in low concentrations, but when handled in concentrated form presents a significant health hazard. Arsenic and arsenic-compounds can be classified as:

a. the metalloid (As);
b. trivalent compounds (As[III]);
c. pentavalent compounds (As[V]); and
d. organoarsenic compounds.

(9) Arsenic compounds in occupational settings occur predominantly as As(III) and As(V) compounds as mists, fumes, vapours, or dusts. Organoarsenic compounds are primarily found in seafood. Arsine is formed when arsenic comes in contact with an acid and is a highly poisonous and flammable gas. Arsenic pentoxide, arsenic trioxide and arsine are also chemicals of security concern, refer to the Chemicals of Security Concern Procedure.

(10) In nature, it is found as a metal in mineral ores, particularly some copper, lead and zinc ores. The most common arsenic mineral is arsenopyrite.

(11) Precautions must be taken to minimise exposure and eliminate the risk of arsenic poisoning. Persons working with arsenic and its compounds, must complete a risk assessment prior to ordering the substance or mineral ores containing arsenic and its compounds, to identify and reduce or eliminate the associated hazards. The risk assessment should also include reviewing if persons working with arsenic are pregnant, as work with arsenic is associated with adverse pregnancy outcomes and infant mortality.

(12) If the arsenic or arsenic-compound are not able to be eliminated or substituted, then engineering controls, e.g. control of airborne arsenic compounds with local exhaust ventilation (fume cupboards), along with training, supervision and appropriate PPE must be used. It may also be appropriate to include an administrative process by which other workers in the area are formally advised when work with arsenic is planned to take place so that they can avoid the area.

(13) Under the Work Health and Safety Regulation 2011, arsenic and its compounds are listed as a restricted hazardous chemical and must not be used for abrasive blasting at concentrations greater than 0.1% as arsenic or for spray painting without authorisation from a relevant WHS regulator. If authorisation is required, work must not commence until the UQ Health, Safety and Wellness Division (HSW Division) Occupational Hygiene Advisor has been contacted.

(14) Schedule 14 of the Work Health and Safety Regulation 2011, specifies that arsenic is a substance that may require health monitoring where there is a significant risk of exposure. Health monitoring under the WHS Regulations is applicable to arsenic and its trivalent and pentavalent compounds, which are the primary species found in the workplace. In the laboratory environment where small quantities of arsenic compounds are used, high order controls are effectively utilised, and there are no spill or release events, health monitoring should rarely be required.

(15) If the risk assessment indicates there is likely to be a reasonable risk of exposure to these compounds after all controls are implemented, work must not commence until the Health, Safety and Wellness Manager or a UQ HSW Division Occupational Hygiene Advisor has been contacted for further advice. Where monitoring is required, it will be arranged through the UQ HSW Division Occupational Health Nurse.

(16) Air quality monitoring of the workplace may also be undertaken when it is not certain on reasonable grounds,

whether the airborne concentration of arsenic or arsine exceeds the relevant exposure standard, and/or periodically, to confirm the effectiveness of control measures against aerosol or dust release. Every attempt should be made to keep exposures well below the workplace exposure standards given in the Safe Work Australia's Workplace Exposure Standards for Airborne Contaminants (2022).

(17) 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.

(18) Working procedures must be monitored and reviewed regularly to ensure their effectiveness and changed if required.

Risk Controls for the Main Routes of Exposure

(19) Where there is a likelihood of worker exposure to arsenic or arsenic-compounds, steps should be taken to minimise that exposure as far as reasonably practicable and a thorough examination of work practices is essential. Procedures should be adopted to ensure that workers are not unnecessarily exposed to the hazard and that they are not working alone.

(20) Control measures for each of the main routes of exposure include, but are not limited to:

Inhalation

(21) Work is performed in a dedicated and functionally certified fume hood whenever possible.

(22) Work is undertaken with a fit for purpose dust extraction system for crushed ores.

(23) Where work with arsenic is carried out outside a fume hood, respirator appropriate to the form of arsenic contaminate being generated (e.g. dust, fume, or gas) should be worn.

(24) Work is carried out in a well-ventilated area.

(25) Creating aerosols and gases when using arsenic and its compounds must be avoided (note: arsine is formed when arsenic comes in contact with an acid).

(26) Good housekeeping should be practiced to avoid dust accumulation on surfaces.

Skin Exposure

(27) Work is undertaken in dedicated and functionally certified fume hood whenever possible and the worker must wear appropriate PPE where the risk assessment determines such as lab coat, apron, chemical protective gloves, safety glasses with side shields or goggles etc.

(28) Regular hand washing and showers on the completion of the workday to ensure dust and solutions are removed from the skin surface before leaving the work area.

(29) Launder all clothing which has been exposed to these substances separately and it is recommended workers change into clean clothes between each work session and showering.

(30) Earphones or earbuds must not be worn while handling these compounds.

(31) Hair must be tied back while handling these compounds.

(32) The integrity of all containers must be checked regularly and ensure containers are sealed and stored appropriately after use.

(33) Good housekeeping practices must be implemented to avoid dust accumulation on surfaces.

Ingestion

(34) Hands must be washed regularly, including before leaving the work area and before eating, drinking, or smoking.

(35) Gloves compatible with the substance being used are worn. PPE should be removed before leaving the work area and hands washed.

(36) Do not eat or drink while handling these compounds.

(37) These compounds must not be stored in food containers or facilities used for food preparation.

(38) Good housekeeping practices must be implemented to avoid dust accumulation on surfaces.

Part B - Health Monitoring

Exposure Standards

(39) Worker exposure to arsenic and arsenic containing compounds should be kept as low as reasonably practicable. Every attempt should be made to keep exposures well below the workplace exposure standards outlined in the Safe Work Australia's Workplace Exposure Standards for Airborne Contaminants (2022).

Health Monitoring Overview

(40) Schedule 14 of the Work Health and Safety Regulation 2011 stipulates that health monitoring is required where there is a significant risk of exposure during use. Health monitoring under the WHS Regulations is applicable to arsenic and its trivalent and pentavalent compounds, which are the primary types found in the workplace. Health monitoring for organoarsenic compounds and arsine is not covered in this document. Where it is identified through a risk assessment and discussion with a UQ Occupational Hygiene Advisor that health monitoring is required, it will be co-ordinated by the UQ Occupational Health Nurse Advisor.

(41) For arsenic exposure, the specific health monitoring procedures used will be determined by a health professional such as an occupational physician but may include the following:

a. Collection of demographic, medical and occupational history.
b. Records of personal exposure.
c. Physical examination with emphasis on the peripheral nervous system and skin.
d. Urinary inorganic arsenic by speciation (inorganic arsenic plus methylated metabolites).
e. Seafood may contribute to a worker's urinary total urinary inorganic arsenic levels. Seafood consumption, particularly over the previous few days prior to sample collection, should be noted.
f. Smokers may also have higher background total urinary inorganic arsenic levels. Smoking status should be noted.
g. Other tests to consider a worker's possible exposure to arsenic may include:
    i. urinary total arsenic (without speciation);
    ii. blood arsenic levels; or
    iii. hair and nail arsenic levels.

(42) Health monitoring records will be kept by the HSW Division subject to the Privacy Act and UQ policies and procedures for personal records and a copy provided to the worker. For further information on health monitoring records refer to the Information Management Policy and Records Management Procedure, and Safe Work Australia's health monitoring resources.

Health Monitoring Frequency and Duration

(43) Health monitoring for arsenic may be required before the worker starts work so that baseline assessment can be taken and any future changes to the worker's health can be detected.

(44) Health monitoring frequency and duration will be determined by an occupational physician or appropriately qualified medical practitioner and should include the following:

a. Before staring work to establish a baseline so that changes to the worker's health can be detected.
b. Post exposure if any recent excessive exposure has occurred (e.g. spills).
c. Urine testing every 90 days unless levels are consistently low and workplace exposure levels are stable, then reduced frequency on the advice of a medical practitioner.
d. At termination of work involving arsenic.

(45) For further details on this process refer to Safe Work Australia Health Monitoring for Arsenic.

(46) UQ workers must contact the Occupational Health Nurse Advisor at (hsw@uq.edu.au) before starting work with arsenic and its compounds to determine requirements for a health surveillance assessment.

Part C - Training and Competency

(47) 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.

(48) In addition to these online modules, UQ workers dealing with hazardous compounds must be given appropriate training in the safe handling of arsenic by their Supervisors, the safe use of any plant involved in the process, safe storage procedures, and in the safe disposal and clean-up of spills or releases of the materials.

(49) Staff Training and Development also conduct regular courses on the safe storage, use, disposal, and spill clean-up of hazardous chemicals – these courses are recommended as a useful practical supplement to the online modules.

(50) Supervisors should verify and document worker competency before allowing work with arsenic and arsenic-compounds to proceed in their areas of responsibility. The local site safety induction conducted by Work Health and Safety Coordinator (WHSC) are an important complement to this process. Local WHSCs should be notified if any work with arsenic or arsenic-compounds planned for the area. All training elements should be documented in the risk assessment as administrative controls.

Part D - Waste Disposal

(51) The Safety Data Sheet (SDS) has information on how to safely dispose of arsenic and arsenic compounds including containers used to store the compounds, the UQ Science Store (chemwaste@uq.edu.au) should also be contacted to ascertain waste requirements.

(52) A request for chemical waste disposal can be submitted through the UQ Science Store under "Chemical Waste Request".

Part E - Emergency Procedures

Spill/Contamination

(53) The category (minor or major) of spill likely to occur should be assessed as part of the risk assessment in

consultation with the Chemical Spill and Response Procedure.

(54) Factors determining the category of spill include the quantity and physical form (solid, gas, solution) of the spill, the location and potential for exposure to workers and others, and other factors such as damage to the environment. A spill kit must be available in the immediate work area where arsenic and its compounds are being used.

(55) The risk assessment, based on information in the SDS, provides information on laboratory spills and appropriate waste disposal. Arsenic and its compounds have serious environmental impacts and must be prevented from escaping into drains. If there has been a spill directly into a sewer or waterway, immediately contact UQ Security on 336 53333 and UQ Sustainability (sustainability@uq.edu.au) on 336 51587. The HSW Division should also be contacted immediately and notified of the spill.

(56) Workers in proximity to the spill or others involved in the clean-up may be exposed to the chemical and should seek advice about surveillance and testing from the UQ Occupational Health Nurse Advisor.

(57) The incident 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.

Major Spill

(58) In the event of an unexpected spill, evacuate the area of all personnel, call UQ Security on 336 53333 or other emergency contact as designated on the campus emergency procedure card for the location. If workers have been contaminated, the contaminant must be removed as fast as safely practicable. If assisting in removing contaminated clothing, appropriate PPE must be worn including gloves, once the contaminated clothing has been removed, the worker is to be moved to a safety shower/eyewash, the contaminants must be washed off thoroughly (at least 15 minutes under shower or eyewash as appropriate). Contact the local First Aid Officer and UQ Health Care for further advice.

Minor Spill

(59) Minor spills must be cleaned up immediately. Use appropriate PPE including gloves, safety glasses and respirator where dust/vapour is present. Collect waste into appropriate waste containers and label accordingly. Contact the UQ Science Store (chemwaste@uq.edu) for correct disposal advice.

Health Effects and Symptoms

(60) The main exposure routes for arsenic are through inhalation of dusts and fumes, ingestion via poor hand hygiene and skin contact.

(61) Health effects typical of exposure to arsenic include:

a. Respiratory tract – irritation of nose, throat and lungs, cough, shortness of breath perforation of nasal septum, lung cancer.
b. Skin and mucous membranes – dermatitis, skin ulcers, hyperpigmentation, keratoses, skin cancer.
c. Gastrointestinal – irritation, abdominal pain, nausea, vomiting, diarrhoea.

Short-Term (Acute) Arsenic Poisoning

(62) Exposure to inorganic arsenic can cause irritation to the noise, throat and lungs, nausea, vomiting, diarrhoea, weakness, loss of appetite, cough, chest pain, giddiness, headache and breathing difficulty.

(63) Exposure to arsine gas may cause sudden death. Acute poisoning by arsenic compounds other than arsine gas rarely occurs in the work environment.

Long-Term (Chronic) Effects

(64) Exposure to inorganic arsenic over time may cause weakness, nausea, vomiting, diarrhea, skin and eye irritation, hyperpigmentation, thickening of the palms and soles (hyperkeratosis), contact dermatitis, skin sensitisation, ulceration and perforation of the nasal septum, and numbness and weakness in the legs and feet. Higher incidents of some types of skin, bladder and lung cancers can also result from chronic arsenic exposure.

(65) Arsenic is also associated with adverse pregnancy outcomes and infant mortality, with impacts on child health.

First Aid

(66) In the event of an emergency, remove the casualty from further exposure, if safe to do so, call the area First Aid Officer, Security on 336 53333 and the area emergency services coordinator (on the campus emergency procedure card).

(67) In all circumstances, first aid is to be provided prior to seeking medical attention and transport to hospital or doctor with copy of the SDS.

(68) All incidents and near misses should be reported in UQSafe to ensure corrective actions and worker follow up can occur.

Skin Exposure

(69) Immediately remove all contaminated clothing, including footwear, flush skin, and hair with running water (and soap if available) for a minimum of 15 minutes.

Inhalation

(70) Remove from contaminated area into well ventilated area and lay patient down. Keep warm and rested.

Eye Exposure

(71) Immediately flush with large amounts of water for at least 20 minutes, lifting the upper and lower lids occasionally. Note: Contact lenses should not be worn when working with this chemical.

Ingestion

(72) Vomiting should not be induced, seek medical attention immediately.

Section 4 - Roles, Responsibilities and Accountabilities

(73) Roles, responsibilities, and accountabilities for work involving hazardous chemicals, including arsenic and its compounds, are outlined in the Chemical Spill and Response Procedure.

Section 5 - Monitoring, Review and Assurance

(74) Organisational heads and Supervisors should regularly review the effectiveness of local procedures and guidance material against this Guideline and the Chemical Spill and Response Procedure, particularly following an incident or near misses.

(75) The HSW Division will review this Guideline regularly for relevance, currency with legislation and evidence-based

recommendations.

Section 6 - Recording and Reporting

(76) Organisational Units are responsible for accurate recording of local procedures involving laboratory work with arsenic and arsenic-containing compounds, and to maintain training records of all relevant workers.

(77) Risk assessments for laboratory work with arsenic and arsenic-containing compounds at UQ must be recorded in UQSafe.

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

Section 7 - Appendix

Definitions

Term	Definition
Time Weighted Average (TWA)	The maximum average airborne concentration of a substance when calculated over an eight-hour working day, for a five-day working week.
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 title-holders, Industry Fellows and conjoint appointments; and 5. Higher Degree by Research students.
UQSafe	UQ's system for the recording of incidents, hazard, near misses and risk assessments.

Contacts and Additional Information

(79) Occupational Hygiene Advisors: hsw@uq.edu.au;

(80) Occupational Health Nurse Advisor: hsw@uq.edu.au;

(81) UQ Science Store website or uqsciencestore@uq.edu.au;

(82) Chemwatch Database: print summary SDS, first aid summary, advice to doctor summary and other relevant information on arsenic.

Status and Details

Status	Current
Effective Date	2nd June 2021
Review Date	2nd June 2026
Approval Authority	Director, Health Safety and Wellness
Approval Date	2nd June 2021
Expiry Date	Not Applicable
Policy Owner	Lucy Beikoff Director, Health, Safety and Wellness
Enquiries Contact	Health, Safety and Wellness Division