

Chapter 23 - Toxic Gas Management Procedures (REDACTED)

23.1 Applicability

This instruction is applicable to all civil servant and contractor employees, and resident agency personnel at Ames Research Center (Ames), Moffett Federal Airfield (MFA), and Crows Landing Flight Facility.

23.2 Purpose

This chapter prescribes the roles and responsibilities and management procedures for toxic gas management. These management procedures must be followed in order to ensure workplace safety for operations with toxic gas, to prevent, control, and mitigate dangerous conditions, and to protect the public from acute exposure due to an accidental release of a toxic gas.

23.3 Policy

It is the policy of the Ames Research Center to comply with all applicable Federal, state, and local regulations.

23.4 Authority

All relevant Federal, state, and local laws and regulations pertaining to the management of toxic gas including, but not limited to:

1. Santa Clara County Toxic Gas Ordinance No. NS-517.44
2. Uniform Fire Code (1994)
3. OSHA Hazard Communication Standard, Code of Federal Regulations Title 29, Section 1910.120
4. OSHA Lab Standard, Code of Federal Regulations Title 29, Section 1910.1450

23.5 Responsibilities

23.5.1 Environmental Services Office, Code QE (Environmental Office)

1. Maintain the official file of any permits and forward copies of any correspondence and permits, as appropriate.
2. Review plans and drawings related to storage and handling of toxic gas for new construction, maintenance, or remodeling to determine compliance with applicable regulations.
3. Recommend facility modifications to achieve compliance with applicable regulations.
4. Prepare and submit updated hazardous materials business plans to local agency.
5. Coordinate inspections of facilities when regulatory agencies require inspections

of facilities.

6. Perform facility surveys annually to determine compliance with applicable regulations. Assist users with maintaining compliant status.
7. Implement, maintain, and monitor the toxic gas program.
8. Report suspected leaks to the applicable agencies.
9. Perform leak testing of cylinders transported to and from Ames.
10. Maintain records of leak test procedures, deliveries, regulatory inspections, and internal audits.
11. Conduct quarterly inventory of toxic gas storage at individual user locations and transmit this information to the Fire Department, Duty Office, DART Team, hazardous materials contractor, Emergency Response Team, hazardous waste contractor, and the Safety, Health, and Medical Services Office (Safety Office).
12. Maintain master key to the lock boxes located outside each laboratory.

23.5.2 Safety Office, Code QH

1. Conduct industrial hygiene review of written standard operating procedures (SOPs), experiment plans, and worksites for operations with regulated gases, and issue project authorizations for regulated and exempt operations.
2. Conduct semiannual ventilation testing to ensure that the hoods and gas cabinets meet the minimum requirements for safe operations.

23.5.3 Pressure Systems Safety Engineer, Code FEF

REDACTED

23.5.4 Line Management

REDACTED

23.5.5 Toxic Gas Users

1. Submit a New Project Information Fact Sheet (Appendix A) and consult with the Environmental Office prior to (minimum two months) any new use of a toxic gas. Note: Any project that is not located in an existing toxic gas area requires a lead time of two years.
2. Submit toxic gas inventory quarterly, or as required by the Environmental Office.
3. Attend toxic gas training and all other training required for hazardous materials use. Refer to Chapter 7, Environmental Training, for more information.
4. Acquire, use, and store toxic gases in accordance with all applicable regulations, policies, and procedures.
5. Understand and use the appropriate personal protective equipment for the specific materials used. Refer to Chapter 6 of the Ames Health and Safety Manual, General Safety, and Chapter 28, Respiratory Protection, for more specific details regarding personal protective equipment.
6. Prepare a written experiment plan for operations with toxic gas. An outline for an experiment plan is provided in Appendix B.
7. Inspect security systems such as access control, locked storage areas, lighting,

fencing, traffic control, and other related requirements, to ensure that spills do not result from vandalism or unauthorized entry. Inform Security Branch of deficiencies.

8. Conduct routine inspections of all hazardous materials, including toxic gases, and maintain records of the inspections.
9. Maintain a secure environment in the work area in order to prevent unauthorized access. Lock the laboratory/work area when not present. All gas cabinets have been supplied with a locking mechanism to secure against unauthorized access.
10. Return unused toxic gases to the vendor or dispose of the toxic gases as hazardous waste when the toxic gases are no longer required.

23.5.6 Dispatch Office, Code J

REDACTED

23.5.7 Facilities Engineering, Code FEF

REDACTED

23.5.8 Facilities Maintenance, Code JFP

REDACTED

23.5.9 Moffett Field Fire Department

REDACTED

23.5.10 Protective Services Office, Code JP

REDACTED

23.6 Definitions

23.6.1 Building Emergency Action Plan (BEAP)

All facilities storing, handling, or dispensing hazardous materials at Ames Research Center have BEAPs that describe the chemicals stored and used, their locations, building hazards, and evacuation and emergency response procedures.

23.6.2 Control Area

A space within a building (typically a room or floor) where the regulated materials may be stored, dispensed, used, or handled. A maximum of four control areas are permitted within a building, except for buildings or portions of buildings used for retail sales, which shall have a maximum of two control areas. A control area is an area formed by one or more of the following:

- An occupancy separation with a minimum of one-hour fire resistive rating.
- The exterior wall, roof, or foundation of the building.

23.6.3 Immediately Dangerous to Life and Health (IDLH)

A maximum concentration from which a person could escape within 30 minutes without a respirator and without experiencing any escape-impairing or irreversible health effects.

23.6.4 Permissible Exposure Limit (PEL)

A time-weighted average concentration that must not be exceeded during any 8-hour work shift of a 40-hour work week. The PEL is intended to protect workers from having any adverse effects from chemical exposures.

23.6.5 Regulated Material

Toxic gas with an established Level of Concern (LOC). (See Appendix C). In addition to the LOC, regulated materials are those that are shipped in compressed gas cylinders, or are materials that become or act as a gas upon release at normal temperature and pressure or materials that are used or handled as a gas, whether or not the material meets the definition of a compressed gas, as defined in Article 9 of the Uniform Fire Code.

23.6.6 Restrictive Flow Orifice (RFO)

Used to limit the flow rate of gas that can escape from the cylinder's regulator.

23.6.7 Toxic Gas Cabinet

An approved cabinet designed to provide secondary containment for the storage of a specific gas at a specific quantity. The gas cabinets are ventilated and enclosures may contain sensors to detect leaks of a specific gas.

23.6.8 Toxic Gas Ordinance (TGO)

Santa Clara County Toxic Gas Ordinance, Number NS-517.44.

23.7 Acquisition Procedures

REDACTED

23.8 Systems and Equipment

REDACTED

23.9 Toxic Gas User Requirements

REDACTED

23.10 Contacts

1. Ames Duty Office (EMERGENCY) (9-1-1)
2. Ames Duty Office (nonemergency) (REDACTED)
3. The Environmental Office (Code QE, REDACTED)

23.11 Appendices

23.11.1 Appendix A: New Project Information Fact Sheet

Building and room location:	
Gas/chemical name:	
Quantity of gas per cylinder:	
Number of cylinders:	

Gas cabinet present:	
Hood type:	
Start date of project:	
Length of project:	

Length of project: _____

23.11.2 Appendix B: Outline for Experiment Plan for Toxic Gases

Experiment Plans must include the following elements:

1. Project title, names and organization codes of lead, lead alternate, and support personnel (indicate employer for contractor employees).
2. Location, including definition and labeling of designated areas and access controls.
3. Engineering controls, including toxic gas cabinets, etc.
4. Hazardous materials list (with Material Safety Data Safety (MSDS) available).
5. Any other hazards of the operations (toxic, flammable, reactive, incompatible materials, electrical, etc.).
6. Personal Protective Equipment to be used (list specific items).
7. Description of operations, including amounts of particularly hazardous materials stored and in use during operations, shutdown/cleanup/decontamination following experiment operations, and containment and storage of specimens and byproducts. (Either a summary or detailed operating procedures is acceptable.)
8. Installation/assembly and shutdown/disassembly procedures, including installation, maintenance, and leak testing of regulators and hardware.
9. Safety equipment maintenance and/or function check procedures.
10. Waste accumulation and disposal plan (if any).
11. Code QE is responsible for the toxic gas cylinder leak test and maintains records of receipt and removal of cylinders.
12. Emergency procedures, with instructions for any equipment shutdown to be performed in the event of high alarm, low alarm, ventilation failure, or general building evacuation during toxic gas use. Include information about sensitivity of chemical sensors to other materials in the workplace, materials that are known to inactivate the sensors, and other possible causes of "false alarm."

Provide the following attachments where appropriate and useful:

1. Cabinet and gas sensor list with identification numbers (from BEAP).
2. Alarm signal chart (from BEAP).
3. Applicable MSDSs.
4. TGO project area inspection checklist.
5. Safety equipment maintenance/function check records.
6. Experiment readiness checklist.
7. Gas regulator specifications (including specifications for RFO if required, inspection, and maintenance records).

8. Parts list approved by Pressure Systems engineer (if applicable).
9. Task-specific training records (including supervisor training for specific toxic gases, other hazardous materials, and PPE).
10. Special procurement instructions (for example, toxic gas delivery).
11. Documentation of Risk Assessment for Hazardous Chemicals.
12. Documentation of Hazard Assessment for Personal Protective Equipment.
13. Copy of instructions for receipt of gases in the absence of project staff (instructions to be provided to Branch Chief as backup alternate).
14. Toxic Gas Cabinet access (Lock Box location and access).

23.11.3 Appendix C: Levels of Concern for Regulated Toxic Gases

Toxic gas name	Level of concern (ppm)
Ammonia	30
Arsine	0.3
Boron tribromide	5
Boron trichloride	2.5
Boron trifluoride	2.5
Bromine	0.3
Carbon monoxide	120
Chlorine	1
Chlorine dioxide	0.5
Chlorine trifluoride	2
Diborane	1.5
Dichlorosilane	5
Ethylene oxide	80
Toxic gas name	Level of concern (ppm)
Fluorine	2.5
Germane	0.6
Hydrogen bromide	3
Hydrogen chloride	5
Hydrogen cyanide	5
Hydrogen fluoride	3
Hydrogen selenide	0.1
Hydrogen sulfide	10
Methyl bromide	25
Methyl isocyanate	0.3
Methyl mercaptan	15
Methylamine	10
Nickel carbonyl	0.02
Nitric oxide	10
Nitrogen dioxide	2
Nitrogen trifluoride	100
Phosgene	0.2

Phosphine	5
Phosphorus oxychloride	0.096
Phosphorus pentafluoride	0.26
Phosphorus trichloride	2.5
Selenium hexafluoride	0.2
Silicon tetrachloride	5
Silicon tetrafluoride	3
Stibine (SbH ₃)	0.5
Sulfur dioxide	10
Sulfur pentafluoride	0.1
Sulfuryl fluoride	20
Tellurium hexafluoride	0.1
Titanium tetrachloride	0.13
Tungsten hexafluoride	3
Tungsten hexafluoride	3

23.11.4 Appendix D: Leak Test Tag

REDACTED

END OF DOCUMENT