GUIDELINE | HS920 Gas and Regulator Safety Guideline
---|---
Area covered | University-wide

Version 1.0  
Approval date | 23 June 2016  
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Guideline Statement

Purpose
This document provides expectations on the use and maintenance of gas systems and regulators in the workplace. Gas systems must not be operated without detailed training from a competent person. This guideline does not constitute training.

Scope
This guideline applies to workers at UNSW who use or maintain gas systems and regulators in the workplace.

Exclusions
This guideline does not cover the design and set-up of gas systems in the workplace, which must be done in consultation with UNSW Facilities Management and other competent persons.

Guideline Steps and Actions

Gases are chemicals that can, dependent on their composition, present a range of hazards. The way that gases are supplied also presents hazards such as compressed in cylinders at high pressure or reticulated from a larger external storage vessel. Workers must be aware of the relevant hazards and associated control measures.

1. Gas types

<table>
<thead>
<tr>
<th>Gas type</th>
<th>Examples, non-exhaustive list</th>
<th>Hazards</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flammable</td>
<td>Acetylene, Butane, Ethylene, Hydrogen, Methylamine, Propane, Silane, Germane, Carbon monoxide, Vinyl chloride.</td>
<td>The ease at which it can ignite in air depends on the concentration, presence of ignition source and the auto-ignition temperature. Many of these gases can spread far from the cylinder if it leaks.</td>
</tr>
<tr>
<td>Highly reactive</td>
<td>Acetylene, 1,3-Butadiene, Methyl acetylene, Vinyl chloride, Tetrafluoroethylene and vinyl fluoride. Silane, Disilane, Diborane, and Phosphine.</td>
<td>If exposed to slight temperature or pressure increase or mechanical shock they may undergo an uncontrolled chemical reaction.</td>
</tr>
<tr>
<td>Non-flammable non-toxic</td>
<td>Nitrogen, Carbon dioxide, Helium, Argon. Cryogens. Dry Ice (1kg produces 0.45m³ of gas).</td>
<td>Will displace an equivalent volume of air and decrease available oxygen concentration. Safe oxygen level in air is between 19.5% – 23.5%. Some gases are heavier than air and disperse less readily thus posing a greater risk.</td>
</tr>
<tr>
<td>Oxidising</td>
<td>Oxygen, nitrous oxide</td>
<td>In the presence of an ignition course and fuel these can promote and accelerate combustion. They can react violently with organic substances, finely divided metals and easily oxidisable substances. Do not use oil, lubricants and sealants in connections as many are not compatible. Never use oxygen as a substitute for compressed air.</td>
</tr>
<tr>
<td>Toxic</td>
<td>Carbon monoxide, nitric oxide, chlorine, arsenic, germane.</td>
<td>They cause adverse health effects with exposure through inhalation, eye or skin contact. Some toxic gases may have more than one hazard e.g. also corrosive and flammable. Ensure that workplace exposure limits cannot be exceeded.</td>
</tr>
</tbody>
</table>
2. Gas cylinders general do's and don'ts

Gas cylinders can pose multiple hazards all of which must be considered for the workspace in which they are stored/used.

**Do's**
- Ensure that equipment is compatible with cylinder pressure and the nature of the gas.
- Use only approved valves and equipment required for each gas type (refer to gas supplier/manufacturer for details).
- Be sure pressure gauges on regulators are correct for the pressure of the gas cylinder used.
- Label all associated equipment, reticulated gas lines and piping with the gas name to prevent unintentional mixing of incompatible materials.
- Keep piping, regulators and other apparatus gas tight to prevent gas leaks. Release pressure from systems before connections are tightened or loosened and before any repairs.
- Use the recommended inlet and outlet pressure.
- Where possible, reticulate gas rather than having cylinders in the work space. If this is not possible and cylinders are in the room, place the cylinder as close as possible to point of use.
- Only ‘in use’ compressed gas cylinders and the smallest size practicable should be kept in the laboratory.
- Cylinder keys should be left in the cylinder valve when the gas is in use, to facilitate rapid cut-off in an emergency.
- Leave the valve protection cap/guard in place until the cylinder has been secured.

**Don'ts**
- Do not apply excessive force when trying to open the cylinder valve. If the cylinder valve is difficult to open, discontinue use and contact supplier. Forced freeing of “frozen” or corroded valves should NOT be attempted.
- Do not partially open a cylinder valve (“crack” the cylinder) to remove dust or debris.
- Do not use adapters, home-made fittings or exchange fittings between cylinders and regulators.
- Do not use Teflon tape on fittings (straight thread) where the seal is made by metal-to-metal contact. Use of Teflon tape causes the threads to spread and weaken, increasing the likelihood of leaks. Small pieces of tape can also become lodged in the valve mechanism resulting in possible valve failure. Note: if Teflon tape is used on an oxygen line it must be suitable for oxidisers.
- Do not keep spare or ‘empty’ cylinders in a laboratory
- Do not remove identification labels provided by the supplier.

3. Hazards associated with gas cylinders

Below are listed some of the typical hazards with some suggested control measures.

3.1. Pressure

Gases are often supplied at high pressure. Gas can be accidentally released from a leaking or broken valve, regulator or tubing.

A cylinder at pressure can become an uncontrolled projectile if it is damaged. For example, if a cylinder falls it can cause the valve to break and release gas at high pressure.

A gas cylinder is never completely empty as a small amount will remain at room pressure and temperature; therefore treat “empty” cylinders with the same precautions as full cylinders.

**Control measures:**
- Having the gas reticulated, rather than storing cylinders inside a laboratory is preferable.
- It is recommended that reticulated systems should have (refer to a Dangerous Goods consultant for detailed advice):
  - Step-down regulators to enable gases to enter the lab at a lower pressure.
  - Fixed tubing compatible with the gas type and incorporate flow restrictors, fail-safe gas
control outlets and automatic control panels.
- Ventilation failure alarm and/or Oxygen depletion alarm.
- Automatic shut off of gas supply in the event of loss of power to ventilation.
- Ability to cap off reticulated gas supply that is not required.
- Flash-back arrestors, check valves, pressure relief valves, spark proof components and<br>intrinsic safety features if the gases are flammable.
- No copper piping if the system is using acetylene or ammonia gas.

- The cylinder valve is the primary safety mechanism in controlling the gas under pressure. The valve opens anti-clockwise and closes clockwise. The valve must not be opened without a regulator attached.
- The cylinder must be kept upright and secured. Do not restrain at the neck or regulator. Use fit-for-purpose chains or straps, one approximately 2/3 the height of the cylinder and preferably a second at 1/3 height.
- Even “empty” cylinders must be restrained. Store these separately to full cylinders and clearly labelled.

3.2. Manual handling

Cylinders can be extremely heavy, for example a G-size CO₂ cylinder can be >80kg (32kg gas+50kg bottle).

Control measures:
- A cylinder trolley must be used to transport gas cylinders. Trolleys must have a sufficiently deep tray, sturdy brackets and restraints positioned at least at the midpoint of the cylinder. Preferably one with pneumatic tyres and 4 wheels or a counterbalance should be used.
- If a lift is needed, ideally use a designated Dangerous Goods lift with an over-ride key which prevents the lift stopping at unwanted floors thus preventing unauthorized access to the lift. If this is not possible, place a notice across the entrance(s) of the lift to prevent others entering while a cylinder is in transit. Do not ride in the lift with a cylinder.
- Moving technique: Never lift, drag or horizontally roll a cylinder. To move it a short distance rotate along its round bottom edge and grip the neck of the bottle below the valve. Wear protective footwear and heavy-duty gloves.
- Never place a gas cylinder in the passenger compartment of a vehicle. Ideally transport in the tray of a utility vehicle after securely attaching it to the tray to prevent movement.
- Note some cylinders can react violently after being excessively shaken, heated, knocked or laid on their side.

3.3. Temperature

Integrity of gas cylinders can be compromised if stored at high temperature, for example temperatures above 65°C can cause increased internal pressure.

Control measures:
- Store cylinders in a temperature controlled environment, where possible.
- A heat sensitive test tag can be hung on the cylinder to detect changes. Normally it sticks out straight. If the tag has ‘drooped’ the cylinder has been exposed to high temperature and should be returned.
- Do not store gas cylinders in heat above 65°C.

3.4. Hazardous properties of the gas

The hazardous properties of gases can result in asphyxiant, health or fire hazards.

Control measures:
- Use a less hazardous gas.
- Minimise storage inside the laboratory. Only cylinders in-use should be kept in the laboratory, otherwise store outside. Do not store gases inside a lab when not in use.
• Have the supplier take back empty or partially full cylinders.
• Ensure labelling is fully identifiable. Contact the supplier if labelling is insufficient.
• Make sure there are emergency stop buttons to manually shut-off gas supply.
• Lock rooms containing toxic gas when not occupied.
• Do not work with toxic gases alone.
• Where necessary, wear personal protective equipment to prevent eye and skin contact.
• Ventilation:
  o Mechanical or natural ventilation should be at a sufficient rate to keep oxygen levels above 19.5% in the event of a major leak, for example if the largest cylinder catastrophically discharges its full contents into the room.
  o Maintenance on the ventilation system should include an annual calibration of the airflow, or airflow sensors.
  o A ventilation failure alarm is recommended in some situations.
  o Gas cabinets can be used as a safety control for toxic, flammable and corrosive gases. The gas cabinet is a ventilated enclosure with an automatic shut off when leaks are detected or gas flow exceeds pre-set levels. Gas cabinets must be labeled with contents and hazard information.
  o Pyrophoric and highly reactive gases should be stored in a flammable gas cabinet with water sprinklers or other appropriate fire suppression.
  o Cabinets for highly reactive and toxic gases must be installed with purge facilities.
  o Toxic gases emitted from exhaust systems can cause exposure to roof workers. Where necessary, an emission control device may be needed e.g. scrubber, flare device, adsorbent) before purged gas can be vented to exhaust duct. Contact Facilities Management if it is believed there may be a release that is above exposure standards.
• Gas monitoring:
  o Gas monitoring can be used to detect asphyxiant, flammable or toxic gases.
  o The requirement for monitoring is decided on a case-by-case basis; this may depend on the size of the room, concentration/quantity of gas, if there are poor physiological warning properties (e.g. smell).
  o Gas monitoring can be fixed (i.e. sensor hard wired or wireless to a central reporting system), portable (i.e. worn by a person, used for confined space entry) or transportable (for short-term work).
  o Ideally the gas monitor is connected to the building management system and interlocked with ventilation, gas supply and electrical supply so that a process shuts down automatically, ventilation is boosted and an alarm is raised when gas is detected.
  o The monitoring panel or mimic panel should be located outside the room.
  o Alarms should be audible and visible both inside and outside the room.
• Sensors:
  o Sensors should be installed close to where a leak would most likely occur and dependent on the density of the gas.
    ▪ Asphyxiant: If density > air (e.g. CO₂, liquid nitrogen) then sensor is placed at a lower level.
    ▪ Asphyxiant: If density = air (e.g. helium) then sensor is placed at breathing zone.
    ▪ Flammable: If density < air (e.g. hydrogen, methane) then sensor placed near ceiling.
    ▪ Flammable: If density > air (e.g. propane, butane) then sensor is placed low to the ground.
    ▪ Room ventilation exhaust sensor is placed at lower level.
  o The manufacturer will advise on sensor levels, calibrations and replacement.

<table>
<thead>
<tr>
<th>Sensor</th>
<th>Hazard</th>
<th>Function</th>
<th>Sensor location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oxygen</td>
<td>Oxygen deficient atmosphere. Asphyxiant hazard. Oxygen enrichment with increased risk of explosion</td>
<td>Oxygen measured and alarms if there is too little or too much. Normally first alarm at 19.5% to investigate and 18% for immediate evacuation</td>
<td>Breathing zone</td>
</tr>
<tr>
<td>Carbon dioxide</td>
<td>Asphyxiant and adverse health effects</td>
<td>CO₂ sensor used to measure CO₂ concentrations. Measures TWA and STEL; alarms at these levels to assist in indicating slow or catastrophic release</td>
<td>Below breathing zone</td>
</tr>
<tr>
<td>Combustible/</td>
<td>Explosive hazard.</td>
<td>Sensor measuring LEL.</td>
<td>Dependent on</td>
</tr>
</tbody>
</table>
3.5. Fire/Explosion

Flammable gas leaks can spread far from the cylinder and if it reaches an ignition source can cause a fire.

An oxidising gas can react rapidly and violently (causing fire and explosion) with combustible materials such as organic substances, finely divided metals (iron, aluminum), oxidizing substances.

An oxygen gas leak can result in a concentration greater than 23.5%; this oxygen enrichment can cause combustible materials to ignite more easily and fire to spread quickly.

A pyrophoric gas leak can ignite spontaneously on contact with air; refer to the Safety Data Sheet for auto-ignition temperature.

Control measures:
- Never use oxygen as a substitute for compressed air.
- Ensure all equipment is suitable for the gas and all maintenance is carried out.
- Do not use oil, lubricants and sealants in connections.
- Flash back arresters must be fitted to flammable gas cylinders.
- Pyrophoric and highly reactive gases should be stored within a flammable gas cabinet equipped with water sprinklers or other appropriate fire suppression systems.
- Keep all cylinders away from artificial sources of heat e.g. radiators, boilers, steam pipes.
- Keep cylinders clear of combustible matter for 3m.
- Sensors to measure LEL.

4. Gas stores

Gas cylinders stores should be located outside the building, secured from unauthorised access, ventilated, protected from sunlight and heat and have appropriate hazard warning signs. Cylinder locations should be separated into full, empty and spare. Outdoor minor gas stores must be separated from other dangerous goods stores by a minimum distance of 3m and must be greater than 1m from any door, window, air vent or duct.

Indoor storage of cylinders must only be when the building has been designed purposely with fire rated walls, mechanical ventilation and monitoring systems.

The store must segregate different classes of dangerous goods. Gas cylinders must be stored at least 3m from incompatible gases and combustible material.

For more details refer to [HS404 Dangerous Goods Storage Guideline](#).

5. Gas regulators

Gas regulators must be fitted to a cylinder before use, as it will allow the high pressure contents to be brought down to a safe usable working pressure. Pressure regulators control gas pressure, not flow. A flow valve or flowmeter, in combination with a regulator, will be needed to control gas flow.

Regulators are mainly brass or stainless steel and designed to fit directly to the cylinder valve. Stainless steel regulators are required for corrosive or harsh external environments. Regulators for flammable gases have a left-hand thread. All others have a right-hand thread.

Threads, configurations and valve outlets are different for each dangerous goods class to prevent mixing of incompatible gases.

Know the regulator maintenance history before use. Do not assemble gas regulators from existing old regulator parts since gas cylinder fill pressures have increased over the years. Do not change a regulator from one gas service to another without advice from a competent person.

A new design standard for regulators was released in 1995 (Australian Standard 4267); therefore regulators manufactured prior to 1995 must not be used.
Precautions when attaching a regulator to a cylinder:

- Be sure the regulator pressure control valve is closed before attaching it to a cylinder.
- Do not stand in-line with the regulator and valve outlet when attaching the regulator to the cylinder. Stand to one side in case gas is accidentally released under high pressure.
- After the regulator is attached, ensure that the regulator is completely closed, connect the delivery line and then carefully and slowly open the cylinder valve. Pressurize the regulator slowly and ensure that valve outlet and regulator is pointed away from all people when the cylinder valves are opened.
- Use fit-for-purpose tools if required. If a cylinder wrench is needed, leave the wrench in place on the cylinder valve so it is present and readily accessible to open or close the main cylinder valve (especially important in an emergency).
- Most regulators have two gauges; one of which indicates inlet or cylinder pressure and the other outlet or regulated pressure. The gauge that shows bottle pressure should have a maximum deflection reading of at least 150% of the filled pressure which is marked on the bottle. For example, if a G2 bottle of Helium is filled to 20,000 kPa, a gauge marked to 30,000 kPa should be used; an older gauge marked to 20,000 kPa may fail if connected to one of these bottles.

6. Inspection and maintenance

It is important that gas systems and their components are inspected regularly for early identification of faults. Regulators can fail and should undergo periodic maintenance as per the manufacturer’s recommendations. Add regulators and sensors to the local inspection, testing and monitoring plan.

Flash back Arresters fitted to flammable gas cylinders must be checked annually.

In most cases the supplier is the owner of a gas cylinder and is responsible for maintenance and testing of the cylinder. Check the test date and retest date on the cylinder and return to the supplier if there are any concerns.

6.1. Visual checks

Local areas must carry out visual checks of the systems; you can include this as part of the regular workplace inspections.

Complete a visual check of gas line components regularly (e.g. valves, seals, pipes and hoses) to detect any damage, cracks or corrosion. Replace as needed to prevent failure resulting in a gas leak. This process should be completed often if the gas is highly reactive, toxic or corrosive or used continuously. Valves that pass visual inspection may still fail. It is critical that toxic gases are used in ventilated enclosures and have local exhaust ventilation in place for downstream pressure relief valves.

Fluorescent light can be used to check for grease or oil in regulators and Oxygen cylinder valves.

Check all cylinder-to-equipment connections, before use and periodically during use. Be sure they are tight, clean, in good condition and not leaking. Beware of using leak detection fluid that is incompatible with oxygen; ensure you are using the correct one.

Keep regulators and valves free of moisture. Systems should be purged with dry inert gas (for example helium, nitrogen, argon, etc.) before the gas is introduced and capped when out of service.

There should be a commissioning check for any new equipment installations which use gas. If the gas to be used is flammable, oxidizing or highly toxic, check the delivery system first for leaks with an inert gas (nitrogen or helium) before introducing the hazardous gas.

6.2. Regulator inspection and testing

UNSW Facilities Management carry out maintenance of fixed regulators i.e. those attached to a fixed manifold. Local areas must ensure their portable regulators are inspected and maintained.

Valves and regulators should only be serviced and repaired by qualified individuals e.g. regulator
Manufacturers, gas supply companies, regulator specialty shops. Records of maintenance can be kept in the SafeSys Equipment Register.

All regulators should be removed from service periodically and inspected, with an overhaul if necessary. If the life expectancy of the regulator has been exceeded, it should be replaced to prevent failure. Regulator failure will vary considerably based on conditions of use. All regulators manufactured prior to 1995 should be replaced.

Regulator maintenance or replacement can vary with the types of gases used, the length of use, and conditions of use. Refer to the manufacturer’s guidelines regarding the life expectancy of the regulator and recommended valve and regulator maintenance schedules; this is particularly important for toxic and corrosives applications. The table below has some suggested frequencies based on typical manufacturer’s guidelines:

**Guide for portable regulator inspection and testing:**

<table>
<thead>
<tr>
<th>Service</th>
<th>Leak check</th>
<th>Creep test</th>
<th>Inert Purge</th>
<th>Overhaul</th>
<th>Replace</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-corrosive</td>
<td>Monthly</td>
<td>Annual</td>
<td>N/A</td>
<td>5 years</td>
<td>10 years</td>
</tr>
<tr>
<td>Mildly corrosive</td>
<td>2 x month</td>
<td>6 months</td>
<td>At Shutdown</td>
<td>2 years</td>
<td>4 years</td>
</tr>
<tr>
<td>Corrosive</td>
<td>2 x month</td>
<td>3 months</td>
<td>At Shutdown</td>
<td>1-2 years</td>
<td>3-4 years</td>
</tr>
</tbody>
</table>

**Note:**

- In corrosive atmospheres or outdoor use more frequent overhaul or replacement may be required.
- Neoprene diaphragms may dry out and require more frequent replacement.
- If regulators are not properly installed or used, a poor grade of gas is used or purging is not properly done, overhaul and replacement may be required more frequently.
- For oxy-fuel gas systems for welding, cutting, heating and allied processes reference Australian Standard 4839-2001 for maintenance requirements.

**Leak check**

Check for gas leaks within the system. Put the regulator under pressure (both high and low) and check all connections using a gas leak detector or solution. Only use those compatible with the gas. Beware of using leak detection fluid that is incompatible with oxygen; ensure you are using the correct one. If there is any bubbling or foaming of the leak detection fluid during the test, this indicates a leak. If a leak is detected, shut down the gas source, reduce pressure to atmospheric and tighten or redo connection. Then retest. In a closed system the regulator should not lose pressure if the cylinder is closed at the valve.

**Creep test**

Regulator ‘Creep’ is when there is an increase in outlet pressure above a set point. Creep can occur in two ways:

1. Changes in the springs within the regulator when gas flow is stopped.
2. Foreign material lodged in the seat of the regulator (most common). To prevent foreign material causing creep, ensure that the regulator connections, when not in use, are capped to prevent dirt entering the regulator. Tubing should also be flushed to remove foreign material.

A pressure relief valve installed downstream of the regulator will also protect against creep.

To undertake a creep test:

1. Close the regulator outlet valve or instrument valve to isolate the downstream side of the regulator.
2. Close the regulator by turning the pressure adjustment knob counterclockwise until it reaches ‘stop’ or rotates freely.
3. Slowly turn on the gas supply. When the regulator inlet gauge registers the full cylinder delivery pressure, shut off the gas supply.
4. Turn the regulator adjusting knob clockwise until delivery pressure gauge reads approximately half scale.
5. Close the regulator.
6. Note the reading on delivery pressure gauge.
7. Wait 15 minutes and recheck the setting on delivery pressure gauge. If there is any rise in delivery pressure during this time then the regulator is defective. Remove and replace regulator.
When using pyrophoric, toxic, corrosive, flammable and oxidising gases, regulators and gas distribution lines must be purged. It can also be important for non-reactive gases, particularly in analytical processes, if there is a new gas supply or new piece of gas distribution equipment introduced into the system.

The best way to purge is to alternately pressurise and depressurise the regulator with an inert gas such as nitrogen. This is a more effective way to purge a system that may contain ‘dead pockets’ than by simply flowing gas through the system.

6.2.1. Gas sensors

If gas sensors are installed, maintenance includes:

- Challenge test at installation and after replacement – Exposure the sensor to a concentration of calibration gas which will cause the monitor’s alarms to function.
- Bump test regularly – Exposure the sensor to a known concentration of the gas to ensure that it is functioning correctly. This does not take the place of routine calibration.
- Calibration annually or 6 monthly depending on the gas.
- Replace as per the manufacturer’s guide.
Revision History

<table>
<thead>
<tr>
<th>Version</th>
<th>Approved by</th>
<th>Approval date</th>
<th>Effective date</th>
<th>Sections modified</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>Director, UNSW Safety and Sustainability</td>
<td>23 June 2016</td>
<td>23 June 2016</td>
<td>New document</td>
</tr>
</tbody>
</table>

Supporting Information

Parent Document (Policy, Procedure)
Health and Safety Policy
HS332 Hazardous Chemicals Procedure

Supporting Documents
HS625 Generic Controls for the Storage of Dangerous Goods
HS649 Oxygen Calculator - Asphyxiant Gas
HS669 Ready Reckoner - Toxic Gas Release
HS670 Ready Reckoner - Exhaust Fan
HS671 Ready Reckoner - Flammable Gas

Related Documents
HS404 Dangerous Goods Storage Guideline
BOC Guidelines for gas Cylinder Safety, BOC Australia
Coregas Safety Resources URL: http://www.coregas.com/index.php?option=com_content&task=view&id=83&Itemid=165
AS 2243.2 Safety in Laboratories – Chemical aspect
AS 2243.6 Safety in Laboratories – Plant and equipment aspects
AS 2243.10 Safety in Laboratories – Storage of chemicals
AS 4332-2004 The storage and handling of gases in cylinders
AS 4267-1995 Pressure regulators for use with industrial compressed gas cylinders (Outlines design requirements)
AS 4840-2001 Low pressure regulators for use in industrial compressed gas reticulation systems (for industrial gas pipelines up to 2100kPa).
AS 4618-2004 Gas appliance regulators (for natural gas and liquefied petroleum gas)

Superseded Documents
Nil

UNSW Statute and / or Regulation
Any variation to Policy or Procedure must remain consistent with the parent statute or regulation
Nil

Relevant State / Federal Legislation
Work Health and Safety Act 2011
Work Health and Safety Regulation 2011

Accountabilities

Responsible Officer
Director, UNSW Safety and Sustainability

Contact Officer
Manager, UNSW Health & Safety

Further Information

Keywords for search engine
Gas, gas safety, gas systems, regulators, regulator safety

Definitions and Acronyms

Cylinder in-use
Has a regulator attached and is connected to a gas delivery system, such as an instrument, and is where the gas is used at least monthly.

TWA
Time Weighted Average
<table>
<thead>
<tr>
<th><strong>STEL</strong></th>
<th>Short Time Exposure limit</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>LEL</strong></td>
<td>Lower Explosive limit</td>
</tr>
</tbody>
</table>