Nitrogen oxides

including **nitrogen monoxide, nitrogen dioxide, dinitrogen tetroxide** *and* **dinitrogen oxide**

Substance	Hazard	Comment
Nitrogen monoxide (Nitric oxide; NO) *Gas*	 **OXIDISING** **CORROSIVE** **TOXIC**	DANGER: May cause or intensify fire. Causes severe skin burns and eye damage; fatal if inhaled; may cause respiratory irritation; corrosive to the respiratory tract. Effects of exposure by inhalation may or may not be immediately apparent and can develop or increase over time. Inhalation by those with known breathing difficulties (eg asthma) may exacerbate such pre-existing conditions. In the past, HSE has said for 15-minute exposure, the concentration in the atmosphere should not exceed 2.5 mg m^{-3}. It reacts with oxygen in the atmosphere to form nitrogen dioxide (see below). It may be formed by the reaction between oxygen and nitrogen in the air, especially in car engines. This is a major contributor to acid rain and photochemical smog. The mixture of NO and NO_2 formed in this way is often referred to as NO_X.
Nitrogen dioxide (NO_2) **Dinitrogen tetroxide** (N_2O_4) *Gases*	 **OXIDISING** **CORROSIVE** **TOXIC**	DANGER: May cause or intensify fire. Causes severe skin burns and eye damage; fatal if inhaled; may cause respiratory irritation. Effects of exposure by inhalation may or may not be immediately apparent and can develop or increase over time. Inhalation by those with known breathing difficulties (eg asthma) may exacerbate such pre-existing conditions. For 15-minute exposure, the concentration in the atmosphere should not exceed 1.91 mg m^{-3}. They are formed as air pollutants from nitrogen monoxide (see above). They are formed in the laboratory by the action of heat on many nitrates and by the reaction of nitric acid on some metals. They are very soluble in water; there is a risk of suck back.
Dinitrogen oxide (Nitrous oxide; N_2O; Laughing gas) *Gas*	 **OXIDISING**	DANGER: May cause or intensify fire. For 15-minute exposure, the concentration in the atmosphere should not exceed 549 mg m^{-3}. This is an anaesthetic in large amounts. It has been used as a general anaesthetic in controlled environments, eg by dentists. An approved food additive, E942, where it is used as a propellant and foaming agent, eg for cream.

Typical control measures to reduce risk

- If preparing the gas in test-tube reactions, use the smallest amounts possible and take steps to avoid suck-back (eg a Bunsen valve).
- Wear eye protection.
- Use a fume cupboard for anything larger than test-tube amounts of gas; ensure good laboratory ventilation.
- Do not expose asthmatics to the gas.
- Use catalytic converters in car exhausts to reduce the amount of nitrogen oxides released into the air.

Assessing the risks

- What are the details of the activity to be undertaken? What are the hazards?
- What is the chance of something going wrong?
  eg a leak of a gas from apparatus into the laboratory atmosphere.
- How serious would it be if something did go wrong?
- How can the risk(s) be controlled for this activity?
  eg can it be done safely? Does the procedure need to be altered? Should goggles or safety spectacles be worn?

Emergency action

In all emergency situations, alert the responsible adult immediately. Be aware that actions may include the following:

- In the eye — Irrigate the eye with gently-running tap water for at least 20 minutes. Call 999/111.
- Vapour breathed in — Remove the casualty to fresh air. Call 999/111 if breathing is difficult.
- Gas escape in a laboratory — Open all windows. If over 1 litre of gas is released, evacuate the laboratory.

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