UCC
University College Cork, Ireland
Coláiste na hOllscoile Corcaigh

Oifig Sábháilteachta agus Sláinte
Health and Safety Office

No. 5 Carrigside,
College Road, Cork.

T +353 (0)21 4902187
E safety@ucc.ie
www.ucc.ie/en/occupationalhealthandsafety

MEMO

TO: **Heads of Function: College of Science, Engineering & Food Science, College of Medicine & Health, APC, ERI, CCRC, Tyndall Institute Vice President for Research & Innovation, UCC**

C.C. **Ms K. Neville, College Manager, College of Medicine & Health, UCC**
Ms K. O'Brien, College Manager, College of Science, Engineering & Food Science, UCC
Dr P. Bolger, Manager, ERI, UCC
Dr D. Soden, General Manager, CCRC, UCC
Mr D. Hayden, Safety Officer, Tyndall Institute, UCC
Dr S. Cudmore, General Manager, APC, UCC

RE: **CONTROLLING WASTE ANAESTHETIC GASES IN HEALTHCARE SETTINGS**

DATE: **14TH OCTOBER 2014**

We would draw your attention to the attached information sheet on the Controlling of Waste Anaesthetic Gases in Healthcare Settings (WAGs) from the HSA.

Functional Areas (FA) should ensure that all constituent Schools \ Departments \ Centres adhere to this guidance information if anaesthetic gases are utilised in research or operational areas, whether healthcare or not.

Functional Areas are asked to note requirements regarding the avoidance of exposure and the need for atmospheric monitoring, where avoidance is not possible. The onerous monitoring schedule as prescribed by the HSA on page 5 of the information sheet should be followed in the case of the latter.

The HSA will expect to see that the FA have such a monitoring regime in place in all areas where WAGs are used.

Please disseminate the attached to Heads of Schools\Departments\Centres\Units within the Functional Area and advise them of the legal requirement to implement same, under SHWW regulations and UCC Safety Policy.

The cost of such monitoring is extremely expensive and would involve significant analysis costs in accredited labs, costly capture media and monitoring expertise all accruing to many thousands of euro per individual monitoring day. Should the FA be unable to change technologies as referred to in page 4 of the information sheet, then the costs of same and recurrent expenditure involved will have to be borne by FAs\users.

The University Occupational Hygienist (sessional consultant) can offer advice on monitoring systems and avoidance opportunities, as relevant during his next scheduled visit in Dec 14\Jan 15. Schools \ Departments may contact this Office to arrange a meeting on said schedule.

Yours sincerely

John F. Ring

JOHN F. RING
UNIVERSITY SAFETY OFFICER
Encl

John F.Ring BE, DipSHWW, HDipOSH, HDipEnvEng, MIOSH, Euring, CEng, MIEI, A.I FireE
University Safety Officer

Joan M.Lenihan BA, HDip in Ed
Administrative Assistant

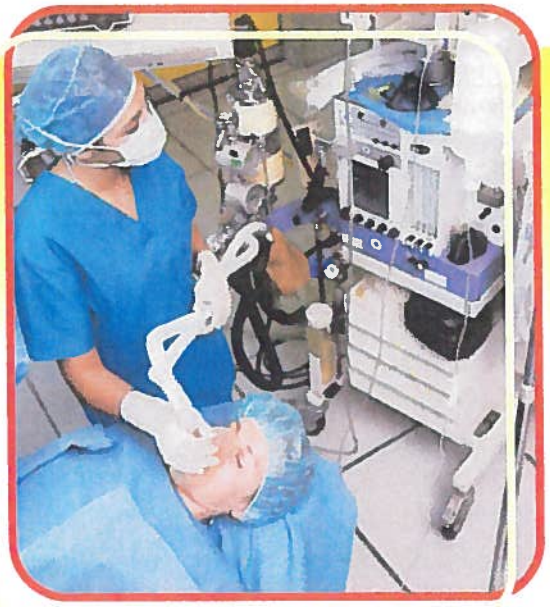
Disc6.44a:\letters\141013-061

Controlling Waste Anaesthetic Gases in Healthcare Settings

Information Sheet

September 2014

The purpose of this guide is to provide general information and guidance about Waste Anaesthetic Gases (WAGs) and healthcare workplace exposures. It highlights the main control measures required to prevent potentially harmful WAGs exposure.



Introduction

Anaesthetic gases are used in a variety of treatment fields throughout the healthcare sector (e.g. operating theatres, dentistry etc.) and in veterinarian practice. Where small amounts of volatile anaesthetic gases escape into the work environment having leaked from the patient's anaesthetic breathing circuit, they are referred to as waste anaesthetic gases.

The most commonly used anaesthetic gases are:

- nitrous oxide,
- sevoflurane,
- desflurane,
- halothane,
- enflurane, and
- isoflurane.

During medical procedures, patients are exposed to relatively high concentrations of anaesthetic gases (to make them effective) but this should happen rarely in their lives. Conversely healthcare staff may be exposed to lower concentrations but at a much higher frequency (e.g. daily over their working life).

The Risks

For many years there has been concern about the possible harmful effects of repeated exposure to WAGs.

Some potential effects of exposure to WAGs are nausea, dizziness, headaches and fatigue. There are also concerns about more serious physical impairments such as reduced fertility and problems during pregnancy but without being definitively established.

A responsible approach to worker health and safety, therefore dictates that any exposure to WAGs should be kept to the lowest practical level.

HEALTH AND SAFETY AUTHORITY

The personnel most likely to be affected by WAGs include:

- anaesthetists,
- operating room personnel,
- recovery room personnel,
- dentists,
- veterinary personnel,
- other clinical personnel (working in delivery rooms, X-ray, endoscopy etc.), and
- maintenance and delivery personnel dealing with piped and bottled anaesthetic gases.

Situations of particular concern potentially causing high worker exposure to WAGs :

- Gas anaesthesia in rooms with no/inadequate Active Gas Scavenging System (AGSS) or ventilation,
- mask anaesthesia used for long periods,
- disconnection of the gas circuits without any reduction in gas flow (e.g. end of procedure),
- where the tightness of the machine/patient connection cannot be guaranteed (e.g. throat surgery), and
- where the transfer system is not tight.

The most important influencing factors are:

- frequency of exposure,
- duration of exposure,
- magnitude (i.e. concentration) of exposure.

In the Health & Safety Authority's 2011 Code of Practice for Chemical Agents, Occupational Exposure Limit Value (OELV) is defined as, the limit of the time-weighted average (over 8 hours) concentration of a chemical agent in the air within the breathing zone of a worker. The magnitude of the OELV for a chemical agent, corresponds to the exposure level (even when repeated throughout a working lifetime), which is not expected to result in adverse effects on the health of exposed workers. The Safety, Health and Welfare at Work (Chemical Agents) Regulations 2001 require that occupational exposure limit values must not be exceeded.

Table 1 below illustrates the current Irish OELV for the anaesthetic agents listed.

Table 1: OELVs for anaesthetic agents in Ireland (2011 Code of Practice)

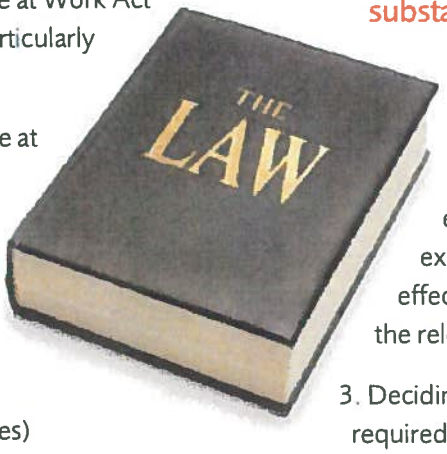
	ppm	mg/m³
Nitrous Oxide	50	90
Halothane	10	80
Enflurane	50	380
Isoflurane	50	380
Sevoflurane	*-	-
Desflurane	*-	-

*Currently there is no OELV in Ireland for Sevoflurane or Desflurane.

The Law

The most relevant sections of Irish legislation dealing with WAGs include:

- the Safety, Health and Welfare at Work (Chemical Agents) Regulations 2001 (S.I. No. 619 of 2001), particularly Regulations 4 – 6, and 2011 Code of Practice,
- the Safety, Health and Welfare at Work Act 2005 (S.I. No. 10 of 2005), particularly Parts 2 & 3,
- the Safety, Health and Welfare at Work (General Application) Regulations 2007 (S.I. No 299 of 2007), particularly Regulations 6, 28 and Part 6 chapter 2, and
- SI 252 of 1994 European Communities (Medical Devices) Regulations 1994 and subsequent amendment regulations.



What are the legal requirements?

Determine which hazardous substances are present in the workplace

- The hazardous substances potentially present are the anaesthetic agents themselves.

Assess the risks to employees and others from the presence of these hazardous substances, this includes:

1. Evaluating the information on the hazards and uses (potential exposure).
2. Considering the likelihood of being exposed and the severity of such exposures (which may lead to an adverse effect on worker health and safety, taking all the relevant information into account).
3. Deciding on the appropriate control measures required to reduce exposures to as low as reasonably practicable.

Prevent or control exposure to the hazardous substances to as low a level as is reasonably practicable

The hierarchy to control exposures to as low as level as reasonably practicable is:

The first action the employer must take is to avoid exposure to hazardous substances by elimination or substitution with a non-hazardous chemical. Where this is not possible or practicable then the exposure must be controlled.

When attempting to control potential exposures to WAGS, assess available engineering controls:

- Install an active scavenging system with the anaesthesia delivery system to remove waste anaesthetic gases from the operating room, placing the exhaust in an area where waste gases will not be reintroduced into intake air for the building. Installation must be in accordance with appropriate standards (see Appendix 1).
- Install a ventilation system in accordance with desired performance criteria e.g. Appendix 2 of HTM 03-01 (see Appendix 2).

Where Atmospheric Monitoring /Occupational Exposure Assessments (OEAs) is required to be undertaken as a specific protection measure from risk assessment, such monitoring should be undertaken with reference to IS EN 689 (NSAI, 1995) and in particular:

A Measurement Strategy should address:

- internationally validated procedures like OSHA-103 (Enflurane, Haloflurane & Isoflurane) and OSHA-166 (Nitrous Oxide) or others such as MDHS series (HSE (UK), NIOSH etc,
- selection of employees to assess,
- sampling size,
- time Weighted Average (TWA) or Short Term Exposure Limits (STEL) assessments,
- static or personal monitoring,
- representative measurements, taking into account workplace factors and patterns, measurement conditions, timing & duration (time of year, day of week, and time of day), specific operations undertaken etc,
- potential additive / synergistic effects of similar anaesthetic gases (where applicable),
- worst case sampling, taking account of any 'situations of particular concern', and
- measurement procedure (including all calculations).

Conclusion of OEA should be made, such as:

- the exposure is above the OELV, to include the reasons why, the immediate corrective actions to be taken and requirement and timing of repeat assessment,
- the exposure is well below the OELV and is likely to remain so on a long-term basis, and
- the exposure does not fit either of these but periodic measurements may still be required.

Periodic Measurements (PM):

The emphasis of which is on longer term objectives such as checking that control measures remain effective. For the results of a PM programme to be of real use, it is essential to be able to compare consecutive sets of results (this

implies that how, where and when samples are collected needs to be rigorously planned to ensure the overall error can be estimated and that genuine changes in the exposure pattern can be recognised).

The interval between PM-measurements should take account of:

- Normal working conditions
- Consequences of control failure
- % of OELV obtained in OEA
- Effectiveness of process/engineering controls

The following PM-measurement intervals are recommended in IS EN 689 (NSAI, 1995):

- 64 weeks if the OELV concentration is <25%
- 32 weeks if the OELV concentration is >25% but <50%
- 16 weeks if the OELV concentration is >50%
- If OELV concentration >100%, Immediate remedial steps to remedy situation and repeat OEA.

Put management and administrative controls in place, to reduce or eliminate exposure

Properly maintain anaesthesia machines, breathing circuits and waste-gas scavenging systems to minimise leaks of anaesthetic gases into the operating rooms (as per manufacturer's recommendations).

Properly maintain the ventilation system to demonstrate it is performing to design (it is recommended this is done at least every 14 months or more frequently if recommended by manufacturer).

Where possible minimise the number of exposed employees by job rotation and excluding those not involved in the task.

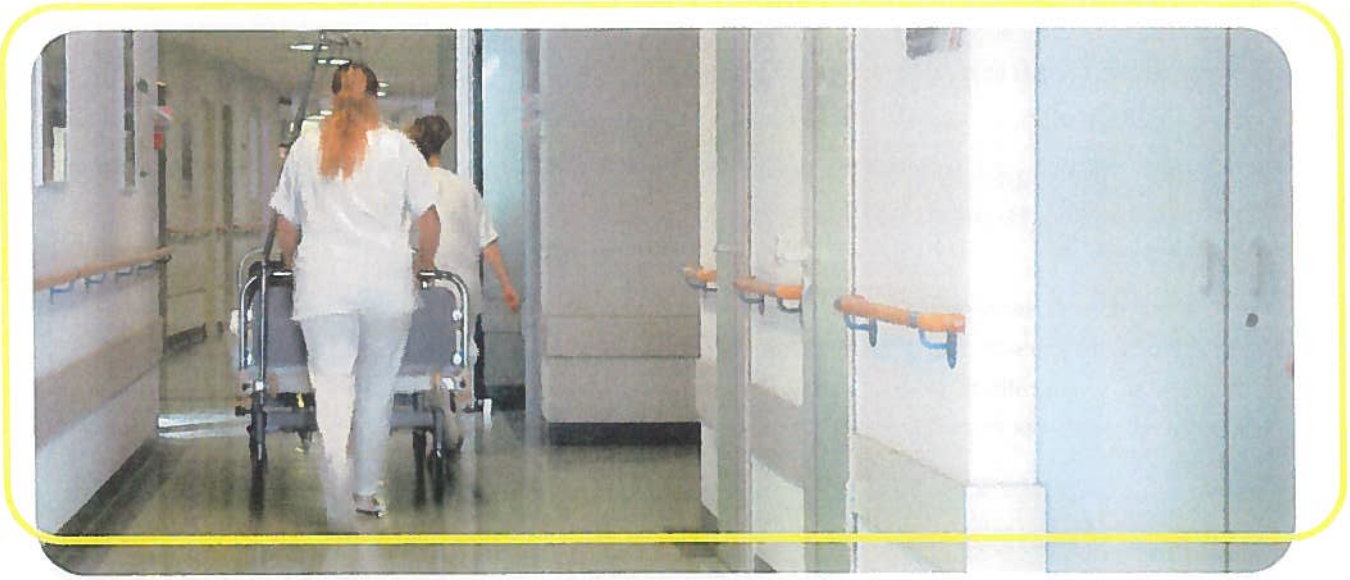
Provide staff training with respect to:

- the anaesthetic agents present,
- the potential risks to their health,
- the actual control measures in place, to protect their health and safety,
- how to handle, move and store anaesthetic agents in a safe manner,
- how to safely clean up spills,
- how to report a problem and who to report it to, and
- emergency procedures (e.g. in the event of a spill or uncontrolled release etc.).

Appendix 1

Relevant Standards and guidance include the following;

- I.S. EN ISO 80601-2-13:2012; *Medical electrical equipment - Particular requirements for basic safety and essential performance of an anaesthetic workstation.*
- I .S. EN ISO 7396-2:2007; *Medical gas pipeline systems - Anaesthetic gas scavenging disposal systems.*
- I.S. EN ISO 9170-2:2008; *Terminal units for medical gas pipeline systems - Terminal units for anaesthetic gas scavenging systems.*
- IS EN 689:1995 Workplace Atmospheres – Guidance for the assessment of exposure by inhalation to Chemical Agents for comparison with OELVs and measurement strategy.
- https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/144029/HTM_03-01_Part_A.pdf: Health Technical Memorandum 03-01: Specialised ventilation for healthcare premises, Part A - Design and installation (Department of Health (UK)- Estates and Facilities Division), particularly Appendix 2.
- http://www.bcga.co.uk/assets/HTM_02-01_Part_B.pdf; Health Technical Memorandum 02-01 : Medical Gas Pipeline Systems - Part A Design, Installation, Validation and Verification (Department of Health (UK)- Estates and Facilities Division), particularly Chapter 10.
- https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/148490/HBN_26.pdf; Health building Note HBN 26; Facilities for surgical procedures Volume 1, (NHS estates (UK)), particularly Chapter 3.
- DIN 1946-4:2008; Ventilation in buildings and rooms of health care.



Appendix 2 Recommended air-change rates

Application	Ventilation	AC/hr	Pressure (Pascals)	Supply filter	Noise (NR)	Temp (C)	Comments
General ward	S/N	6	–	G4	30	18–28	
Communal ward toilet	E	6	–ve	–	40	–	
Single room	S/E/N	6	0 or –ve	G4	30	18–28	
Single room WC	E	3	–ve	–	40	–	
Clean utility	S	6	+ve	G4	40	18–28	
Dirty utility	E	6	–ve	–	40	–	
Ward isolation room	–	–	–	–	–	–	See Health Building Note 04-01 (Supplement 1)
Infectious diseases isolation room	E	10	–5	G4	30	18–28	Extract filtration may be required
Neutropeanic patient ward	S	10	+10	H12	30	18–28	
Critical care areas	S	10	+10	F7	30	*18–25*	Isolation room may be –ve pressure
Birthing room	S & E	15	–ve	G4	40	*18–25*	Provide clean air-flow path
SCBU	S	6	+ve	F7	30	*18–25*	Isolation room may be –ve pressure
Preparation room (lay-up)	S	>25	35	F7	40	*18–25*	
Preparation room/bay (sterile pack store)	S	10	25	F7	40*	*18–25*	*50 NR if a bay in a UCV theatre
Operating theatre	S	25	25	F7	40	*18–25*	
UCV operating theatre	S	25*	25	H10 or greater	50	*18–25*	*Fresh-air rate; excludes recirculation
Anaesthetic room	S & E	15	>10	F7	40	*18–25*	Provide clean air-flow path
Theatre sluice/dirty utility	E	>20	–5	–	40	–	
Recovery room	S & E	15	0	F7	35	*18–25*	Provide clean air-flow path
Catheterisation room	S	15	+ve	F7	40	*18–22*	
Endoscopy room	S	15	+ve	F7	40	*18–25*	
Endoscopy cleaning	E	>10	–ve	–	40	–	
Day-case theatre	S	15	+ve	F7	40	*18–25*	
Treatment room	S	10	+ve	F7	35	*18–25*	
Pharmacy aseptic suite	S	20	#	H14	–	*18–22*	# See EGGMP (Orange guide)[a]
Category 3 or 4 containment room	#	>20	#	H14*	–	*18–22*	# SeeACDP guide; *Filter in extract
Post-mortem room	S & E	S = 10 E = 12	–ve	G4	35	18–22	Provide clean air-flow path
Specimen store	E	–	–ve	–	–	–	Fan accessible from outside of store

Notes: 18–22°C indicates the range over which the temperature may float.
18–22°C indicates the range over which the temperature should be capable of being controlled.
S = suppy
E = extract
N = natural ventilation
a – European guidelines on good manufacturing practice published by the Medicines and Healthcare products Regulatory Agency (MHRA)

HEALTH AND SAFETY AUTHORITY

For further information please visit www.hsa.ie or phone 1890 289 389.