



Singapore Healthcare Management 2024



Singapore General Hospital
SingHealth

Clearing the Air: Industrial Hygiene Monitoring of Waste Anaesthetic Gases (WAGs)

Chang Yoke Bee¹, Maureen Cheng Su Lin², Teng Chai Lian³, Katherine Concepcion Tesalona⁴, Tan Hui Li⁵, Cheong Shao Qiang⁶, Ng Hui Fenn⁷, Toh Hui Xian⁸, Chua Xinni¹, Kam Wai Kuen¹

¹Workplace Safety & Health, Division of Organisation Planning & Performance

²Department of Anaesthesiology, Division of Anaesthesiology & Periop Med

³Operating Theatres, Division of Nursing

⁴W52A & Ward 53A, Division of Nursing

⁵Specialty Nursing, Division of Nursing

⁶Facilities Management & Engineering, Division of Estate Management

⁷Bio-medical Engineering, Division of Service Support

⁸Infection Prevention & Epidemiology, Division of Nursing

AIM

Sampling Media: Halogenated Anaesthetic Nitrous Oxide



- To assess the occupational exposure of staff to WAGs in accordance with the local legislation and international standards.
- To optimise work practices and review the adequacy of control measures to minimise the risk of occupational exposure to WAGs and environmental pollution.

METHODOLOGY

Information gathering was performed through observation of work activity, staff interview and internet-based research

Prioritisation of worst-case work activities, locations, and similar exposure groups for industrial hygiene monitoring

Personal air samples were collected and sent to external laboratory for analysis

Comparison of air monitoring data, work practices and existing control measures with the legislative requirements and international standards

RESULT

Anaesthetic Administration



45% sevoflurane samples (Total: 11 samples) collected from Anaesthesiologists exceeded the National Institute for Occupational Safety & Health (NIOSH) Ceiling Limit of 2ppm.

Patient Care at Recovery Area / PACU



11 sevoflurane / desflurane samples and 11 nitrous oxide samples collected from PACU nurses were below the NIOSH Ceiling Limit of 2ppm (halogenated anaesthetics) & MOM permissible exposure level (PEL) of 50ppm (nitrous oxide)

Patient Care at Labour Ward



9% nitrous oxide samples (Total: 11 samples) collected from nurses providing patient care during labour exceeded the MOM PEL of 50ppm

Patient Care During Anaesthetic Sedation at ICU



All sevoflurane / desflurane samples (Total: 2 samples) collected from nurses providing patient care to patients undergoing anaesthetic sedation were below the NIOSH ceiling limit of 2ppm

- Retrospective survey of staff practices or/and work activity revealed that:
 - Anaesthesiologists whose air sample result exceeding the PEL were more likely to have left the air flow and vaporiser on, or only turned off the vaporiser.
 - Labour ward nurse whose air sample result exceeding the PEL was involved in patient care delivery for patient who was on anaesthetic administration for relatively longer duration.
- The air change per hour (ACH) in post anaesthesia care unit (PACU) was lower than the recommended ACH, however none of the PACU samples exceeded the PELs for both sevoflurane and nitrous oxide. Rectification work was done to meet the recommended ACH.

CONCLUSION

- The study revealed that variations in individual practices and anaesthetic usage by patient were potential factors contributing to the elevated occupational exposure levels.
- Additional control measures were explored to minimise the occupational exposure risk to as low as reasonably practicable.
- Re-monitoring of nitrous oxide was planned to ensure ongoing safety and compliance with legislation.

Acknowledgments

The project would not have been possible without the accommodation of leaders, doctors and nurses of Department of Anaesthesiology, Operating Theatres, Medical Intensive Care Unit and Ward 52A