

# Case Study

## CUH Nitrous Oxide Reduction Project

Saving 600 tonnes of carbon per year by decommissioning the nitrous oxide piped system for anaesthesia in CUH theatres and providing canisters for N<sub>2</sub>O supply

HSE Capital & Estates  
Sustainable Infrastructure Office



**We're taking climate action**

### Why the project was undertaken

Nitrous oxide is an anaesthetic gas and is also a potent greenhouse gas which contributes significantly to the HSE's carbon footprint. Nitrous oxide has 265 times the global warming potential of carbon dioxide. This means that every kilogramme of nitrous oxide that is used has the same global warming effect as 265 kgs of carbon dioxide.



A study undertaken by members of the College of Anaesthesiologists of Ireland's Sustainability Committee, and published in the British Journal of Anaesthesia, showed that in 2019, total emissions from inhaled anaesthetic agents used across all Irish public hospitals and the majority of private hospitals amounted to 17,865 tonnes carbon dioxide equivalent for the entire country. Nitrous oxide was the main contributor to emissions of inhaled gases, at 84% of emissions. Since the sharing of the results of this study, hospitals have been taking action to reduce these emissions.

CUH staff found that a significant portion of nitrous oxide use and emissions at the campus were due to gas leaking from the manifold and piping infrastructure distributing the gas throughout the hospital. During 2024, CUH has successfully decommissioned this piped supply of nitrous oxide gas. The gas is now supplied locally in theatre via a small canister on the anaesthetic machine, as needed. In most theatres N<sub>2</sub>O is rarely used, with an increasing use of total intravenous anaesthesia (TIVA), which is the greenest form of general anaesthesia.

For the HSE to achieve net-zero emissions by 2050, the climate impact of nitrous oxide and related anaesthetic products needs to be tackled in all facilities nationally where piped N<sub>2</sub>O is used.

### Who was involved

The nitrous oxide project in CUH was led by Dr Cathy Burke (Consultant Gynaecologist / Obstetrician, CUMH) and Dr John Chandler (Consultant Anaesthetist, CUH) and was supported by key members of staff including Nelius O'Sullivan (Chief Biomedical Engineer, CUH), Denise O'Brien (Biomedical Engineer, CUH), Cathal Flannery (Principal Biomedical Engineer, CUH), PJ Murphy (Maintenance Dept, CUH), Aisling Lehane (CMN3 Theatre Dept, CUH), and Lavinia McCarthy (Anaesthetic CNM2, CUH).

### Aims of the project

The overall aims of the project were to:

1. Reduce the significant portion of nitrous oxide emissions which are due to leakage from the piping system through decommissioning the entire pipeline infrastructure.
2. Replace with portable nitrous oxide canisters locally within theatres, where needed.
3. Contribute to reducing the HSE's overall carbon footprint.



Courtesy of Irish Examiner Archive

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### How it was done

- A meeting was organised with the clinical lead for Anaesthetics and Head of Biomedical Engineering where removal of the nitrous oxide pipeline facility for anaesthetic machines was discussed. Locations that would continue to occasionally use nitrous oxide were identified, and provision for a local nitrous oxide cylinder facility was outlined for those users.
- Biomedical Engineering met with the anaesthetic machine vendor to establish how nitrous oxide cylinders could be retrofitted to the CUH anaesthetic machines:

### The following solution was identified:

- 1: An additional cylinder receptacle
- 2: A shorter nitrous oxide hose
- 3: A pin index nitrous oxide regulator with Schraeder valve to fit atop the cylinder

Biomedical Engineering organised the provision of adequate cylinder stock and storage with theatre and purchasing staff.

Anaesthetics and Biomedical Engineering clarified and outlined the procedures regarding the additional nitrous oxide cylinder with regard to it being maintained open or closed. As per normal practice, it was decided that all cylinders remain closed until its use is required by anaesthetics.

Theatre management and the Anaesthetics lead co-ordinated the removal/changeover date to facilitate effective correspondence to all parties.

### To preserve theatre starting times, prior to 8:30am on the removal/changeover day:

- Regulators were installed
- Cylinders of nitrous oxide were fitted
- Pipeline hoses were removed

Maintenance were contacted to inform them that the changeover had been carried out, therefore piped gas could be turned off.



### The key steps

1. **Ensure** canisters are in place with a localised supply for each theatre - Biomedical Engineering Team
2. **Install** the new gear without disrupting the availability of the surgical equipment – Biomedical Engineering Team
3. **Notify** the supplier and de activate the supply – Maintenance
4. **Decommission** the pipes - Maintenance

### What the project has saved...



The project is estimated to save 600 tonnes of carbon dioxide equivalent emissions and €20,000 per year at the hospital.

While nitrous oxide gas will continue to be used, this is anticipated to be at only a fraction of previous use. CUH is tracking this usage for comparison, and will refine the savings made.

The project team is available to provide support and advice to clinicians looking to implement this change – helping to reduce the emissions and use of nitrous oxide across healthcare facilities in Ireland.

For further information contact: [climate.action@hse.ie](mailto:climate.action@hse.ie)