

Mitigation of Entonox Emissions, A Quality Improvement Project



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INTRODUCTION

The commonly used anaesthetic agent, Nitrous oxide has a global warming potential 300 times higher than carbon dioxide (CO₂). Intermittent inhalation of Entonox which is a mix of 50% Nitrous oxide and oxygen is a safe and commonly used form of analgesia for labour, as well as other medical procedures. When exhaled into the atmosphere after use it persists for 120 years. In 2019/20, Cardiff and Vale emitted 4500 tonnes of CO₂e from Entonox use, comparable to driving 930 times around the world in a petrol car. Our aim is to reduce emissions of Entonox without limiting patient choice or restricting access to pain relief.

METHODS

Three Entonox manifolds were identified on our site. One supplied the Emergency department(ED). The other two supply maternity and the Children’s Hospital.

PDSA cycle 1: Manifold maintenance

Previous work on N₂O has shown that manifolds can leak[1]. The first PDSA cycle was to check for leaks, carry out repairs and upgrade the panel on the maternity manifold.

PDSA cycle 2: Remove unnecessary manifolds

An audit in the ED found that Entonox use has declined with the introduction of penthrox and that there was an oversupply of wall outlets. A pilot using small Entonox cylinders was successful, resulting in the closure of the ED manifold in September 2023.

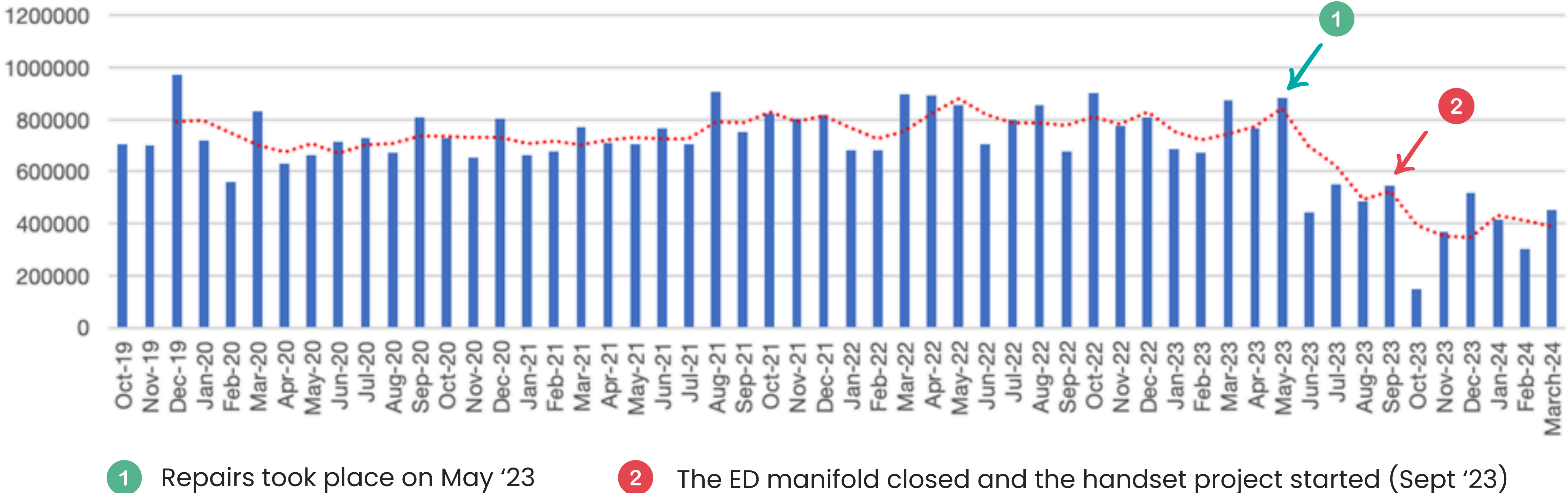
PDSA cycle 3: Unplug handsets when not in use.

Work done in Hull showed wall outlets can cause microleaks and wastage[2]. In September 2023, we changed the practice to unplug the handsets in the maternity unit when not in use. A weekly audit was done to monitor compliance.

RESULTS

The run chart shows each PDSA cycle and its impact. Litres of N₂O in Entonox supplied each month are on the Y-axis. Manifold repairs resulted in a 40% reduction in Entonox consumption. A further reduction was seen after the closure of the ED manifold and the handset project. In total, the volume of Entonox supplied has reduced by nearly 50% from May 2023 to March 2024 that is from 800,000 litres to nearly 400,000 litres.

Volume of Nitrous Oxide as Entonox supplied each month (litre)



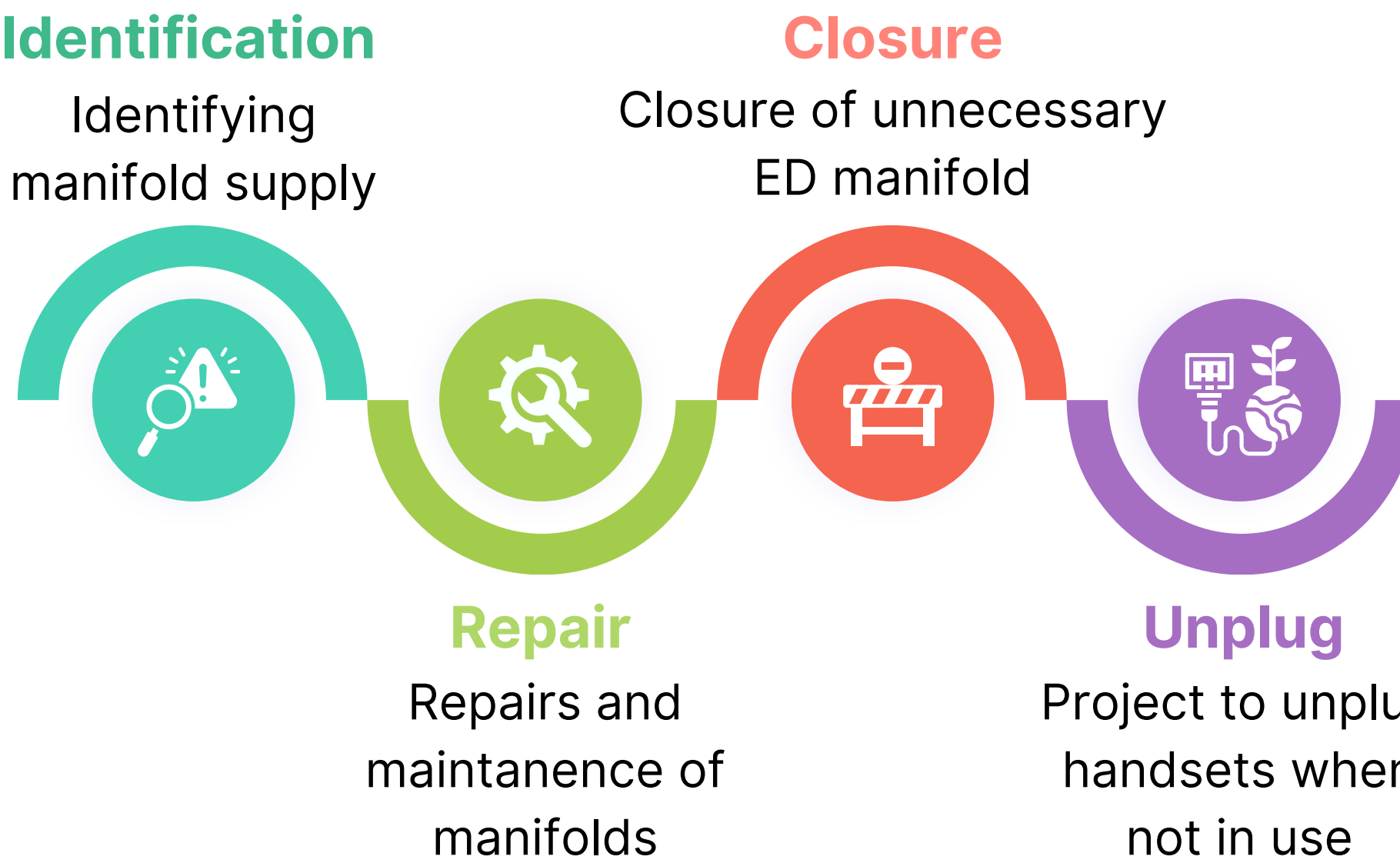
DISCUSSION

Data collection is ongoing. If the current improvements are sustained, the estimated benefits are:

- 1) Reduced Entonox emissions, with a saving of 2250 tonnes of CO₂ each year.
- 2) Cost savings of about £18,000-£24,000 per year.
- 3) Social cost savings of £145,000 annually based on the carbon price in the UK[3].

The quality of care given to labouring women and their analgesic options remains unchanged.

Mitigation of Entonox emissions



REFERENCES

- 1) A. Chakera, S. Harrison, The Nitrous oxide Project: assessment of advocacy and national directives to deliver mitigation of anaesthetic nitrous oxide. January 2024. <https://associationofanaesthetistspublications.onlinelibrary.wiley.com/doi/10.1111/anae.16211>
- 2) Marc Beaumont, Entonox Reduction at Hull University NHS Trust | The Women’s Health: The Sustainability Network Event.The Centre for Sustainable Healthcare Networks Platform. August 2023. https://www.youtube.com/watch?v=Gzjl_IlcSJQ
- 3) <https://www.gov.uk/government/publications/determinations-of-the-uk-ets-carbon-price/uk-ets-carbon-prices-for-use-in-civil-penalties-2024>