Reducing Nitrous Oxide and Gas and Air waste in NHS trusts: Questions & Answers

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General information

Q: Why should work be done to reduce nitrous oxide waste in the NHS?

Reducing nitrous oxide waste in the NHS is vital as it is a potent greenhouse gas, 265 times more harmful than CO_2 and depletes the ozone layer. The NHS uses nitrous oxide for various medical purposes in different clinical areas, but inefficiencies lead to unnecessary emissions. Cutting waste helps tackle climate change, supports environmental sustainability and can save costs. A toolkit has been

developed to support trusts to reduce this waste, that you can access here. This contains guidance for every clinical area that either uses nitrous oxide or nitrous oxide/oxygen mixture (known as Entonox or gas and air).

Q: How was the issue of nitrous oxide waste identified?

A: Much of the work across the NHS to reduce nitrous oxide waste has been inspired by pharmacist Alifia Chakera. Her work has supported many trusts to take action and has contributed to the development of this toolkit.

Q: Does nitrous oxide waste reduction result in financial savings for trusts, and are there any case studies where this has been achieved?

A: Significant financial savings have been realised because of the various approaches to reduce waste of nitrous oxide across trusts. Efforts to optimise the use of nitrous oxide can reduce gas procurement costs, reduce maintenance and investment costs, and support operational efficiencies such as freeing up staff time.

See Greener NHS » Nitrous oxide: cutting waste to reduce emissions and save money for further details on the considerable financial savings realised in Hull Women and Children's Hospital, King's College Hospital in London and Royal United Hospital in Bath. The nitrous oxide waste reduction toolkit also displays cost savings alongside emissions savings for some case studies, where these were calculated by trusts.

Q: What resources exist to help me understand how to reduce nitrous oxide waste?

A: You can find NHS England's nitrous oxide waste reduction toolkit here. This contains guidance and recommended actions to take to reduce nitrous oxide waste. Below the toolkit, on the same webpage, there are 10 supporting resources that add more detail and information. Some of these resources are designed for you to take away and edit, to save you time and avoid duplication in your project documentation. To complement the toolkit, NHS England, NHS Elect and UCLPartners delivered a series of live webinars that you can access recordings of.

Q: Where can I find out more about how nitrous oxide and nitrous oxide/oxygen mixture are used in the NHS?

A: You can find this information here: Nitrous oxide and nitrous oxide oxygen mixture use and supply in the NHS

Q: Where can I find out more about how nitrous oxide/oxygen mixture can be supplied, instead of using a medical gas pipeline?

A: You can find this information here: Portable cylinder system options and equipment

Getting started on reducing waste

Q: What support is available to help me manage this work?

A: There are several resources you can use to help manage your work. The first are the project management templates, these contain a range of common templates used in project management. This includes templates to understand and communicate to stakeholders, track your work and map any risks or issues.

The second resource is the key action checklist. This contains a long list of all the common actions taken in this work, segmented by who usually does these and at what stage. All the actions can be filtered, and the document can be copied or edited for you to add notes or assign progress to each action.

The project communications templates also contain a one-page project overview that you can copy and edit to suit your needs. This one-pager can be helpful when explaining the aims and strategy of the project to stakeholders in a quick, digestible way.

Q: Where can we access the posters developed to communicate changes to clinicians?

A: Posters are available from slide 11 onward.

Q: A clinical area I am working with is about to transition their nitrous oxide supply away from a medical gas pipeline system. What resources are available to help communicate this change?

A: The project communications template contains sample emails that can be copied and edited to communicate the changes across a clinical area. The project communication templates also contain an array of posters that you can put up to help communicate the changes.

Q: I need to put together a business case to progress with this work, what support is available to me?

A: You can find information to help build a business case here. This contains guidance on developing information for each one of the five cases (for a five-case business model typically used by NHS trusts). It contains information for you to copy and edit, saving you time in developing content. It also contains suggestions for assembling an options appraisal and calculating costs and returns based on what other trusts have done.

Ensuring alignment of gas supply to clinical use

Q: I need to understand how much nitrous oxide different clinical areas use in order to categorise them as no, low or high use, what is the best way to do this?

A: Our advice is that you should not need to measure actual clinical usage in detail.

For nitrous oxide or nitrous oxide/oxygen in any setting:

- Email and/or survey clinicians to determine how often they use the gas and compare that to procurement data - we have some templates in the project communication templates resource.

Specifically for nitrous oxide in the theatre setting:

- You can complete a one- or two-week data collection period, using an audit sheet in anaesthetic rooms, where you ask anaesthetists to note if/when they use nitrous oxide. This can be extrapolated to yearly frequency of use and compared to procurement data.
- You can pull usage data from anaesthetic machines, depending on your machines and which EHR you have, these could work, or the guidance on page 19-25 here.
- You could measure use (and waste) using methods published here: Detecting and reducing leaks from nitrous oxide in healthcare facilities – A practical guide | Australian Government Department of Health and Aged Care.

Another option we've heard is to cap off the terminal units temporarily and ask clinicians to try a 'portable supply system' (i.e. an E-cylinder) on a trolley for a month. This will show how frequently nitrous is requested and used in theatres and help you to measure clinical use. This may also be a method suitable for other areas where gas use is hard to quantify, such as nitrous oxide/oxygen mixture in maternity.

Q: How can I keep track of all the clinical areas that use nitrous oxide or nitrous oxide/oxygen mixture and the actions they need to take to reduce waste in their supply?

A: You can use the supply system map and decision template to help. This editable spreadsheet enables you to list all the clinical areas that are supplied the gases and categorise them as areas of no, low or high use. It automatically populates the recommended actions to take in each area.

Q: Do I need to calculate levels of waste before I start this work? What support is there to help me with this?

A: You do not need to start this work by calculating the waste occurring in your supply systems. We recommend concentrating on understanding how much gas is used clinically and then ensuring your supply system matches this use. This is because there is now much evidence, thanks to the work of many trusts across the UK, that demonstrates medical gas pipeline systems supply far larger quantities of gas than are needed for many clinical areas where use is low.

However, in some cases, such as to quantify the size of a problem to achieve buy-in or build a business case, you may need to establish levels of waste. To do this you can use this resource to understand the data available for you: Approaches to understanding nitrous oxide supply and use. Then to help you measure waste levels and the equivalent waste in tonnes of carbon dioxide equivalent, you can use this tool, Measure and calculate emissions and waste.

Q: Are there survey tools available for assessing clinical use patterns?

A: Yes, a survey has been developed to help survey clinicians to understand use in different areas. You can find this in the project communication templates.

Q: What size cylinders are typically used for portable nitrous oxide delivery systems?

A: For nitrous oxide, E size cylinders are typically used for portable cylinder delivery systems. Other sizes such as F cylinders can be used for some portable systems (e.g., for use with trolleys), however, these are larger.

For nitrous oxide/oxygen mixture portable cylinder sizes commonly includes ED size, that has a capacity of 700 litres.

Review details of gas types and uses here.

Review types of portable cylinder systems here.

Q: What solutions exist when facing supply issues with certain cylinder sizes?

A: Some trusts are experiencing supply issues with size E nitrous oxide cylinders.

Engaging with medical gas suppliers is key to enhance supply and reduce waste, and to enable suppliers to anticipate and manage changing demand for the supply of different cylinder sizes. Trusts should communicate any changes in cylinder demand to suppliers as early as possible.

Several affected trusts are currently considering the use of size F cylinders to support their transition to portable cylinder systems instead but there are also limited

numbers of size F cylinders engaging with your medical gas supplier is critical. Size F cylinders can be used as part of a portable trolley-style system where the cylinder is attached to a trolley with a pressure gauge and regulator. This is feasible, however as size F cylinders are larger than size E, any trolley or processes set up to enable a trolley-style system will need to consider this. This includes carrying, changing and using the cylinder.

Where portable cylinder solutions have been implemented, trusts should review their stock levels of small cylinders and rationalise these where possible.

Q: Is the pressure gauge and pressure regulator universal or are they specific to the type of cylinder?

A: We recommend talking to your medical gas supplier and medical technicians/engineers to find the right equipment for your set-up and cylinders. Our understanding is that universal pressure gauges are available.

The different types of portable cylinder systems can be found here.

Q: How should organisations approach decommissioning piped medical gas systems in PFI buildings?

A: We suggest going ahead on working with clinicians to switch to a portable cylinder system. This can occur independently of the PFI decommissioning process.

For PFI facilities, there are several approaches:

- Use contractual expectations around sustainability and green plans to gain support
- Consider timing changes with contract renewals or renegotiations to minimise financial impact
- Explore opportunities to share costs given the reduced future maintenance needs

It's important to note that you don't need to physically remove the medical gas pipeline system - the focus is on safely switching it off and capping the outlets. This is often a more practical and cost-effective approach.

Key considerations for any facility include:

- Having an authorised person from estates lead the decommissioning
- Taking a systematic approach based on usage assessment
- Properly managing alarms and control panels
- Ensuring terminal units are capped and pipeline sections properly isolated

Some hospitals may need to deactivate entire systems while others can use a phased approach - this depends on your specific infrastructure.

Q: Is decommissioning a medical gas pipeline system and moving to portable cylinders possible in high use clinical areas, such as Maternity?

A: Yes, King's College Hospital is using a portable cylinder system in their maternity unit - see the toolkit page 32 for a case study.

Q: Have there been any concerns raised regarding the storage of cylinders? Is there any national guidance?

A: There are several storage considerations. See page 29 of the nitrous oxide toolkit. Guidance is available from the Specialist Pharmacy Service on all processes supporting secure storage of cylinders.

Continue to optimise systems

Q: How can healthcare services that use portable cylinder systems optimise their use and continue to reduce waste?

A: For settings already using portable cylinders, there are several key optimisation strategies. These are suitable for nitrous oxide and nitrous oxide/oxygen mixture.

- Empower porters to monitor and report any unusual increases in cylinder usage
- Regular reviews at Medical Gas Committee meetings
- Ensure equipment is turned off after each use
- Use cylinders until completely depleted before replacement
- Remove attachments (like demand valves) when not in active use
- Regular equipment checks for damage, particularly O-rings and attachments
- Maintain clear protocols for staff handling cylinders

We recommend looking at the section in the toolkit 'Continue to optimise systems'

Q: How do you ensure that the portable cylinders are fully empty, whilst maintaining patient safety, outcomes and clinical effectiveness?

A: Specifically for nitrous oxide when it is used as an anaesthetic in the theatre setting, some clinicians understandably fear running out of gas part way through a procedure, without the continuous supply from the manifold or medical gas pipeline system. However, many trusts have found this can be managed well with clear training and procedures. In clinical areas with low volumes of nitrous oxide use, cylinders may last for many months if not longer.

Teams should prepare for replacement of nitrous cylinders and should define the conditions at which a small nitrous oxide cylinder (size E or F) is considered “empty” and in need of exchange.

For some, “empty” could be defined when a low-pressure alarm sounds on the anaesthetic machine, while others might prefer to use each E-cylinder until it is completely empty with no residual nitrous oxide gas/pressure.

Ultimately, the timing of E-cylinder exchange should be at the discretion of the clinician at the point of care. The key message is that portable cylinder systems are safe and can be managed through preparation and standard operating procedures.

See page 43 of the toolkit.

Additionally, Anaesthetist James Dalton (james.dalton1@nhs.net) from University Hospitals Sussex NHS Foundation Trust can provide further insights on best practices for complete depletion in clinical settings.

Q: How can I ensure that environmental impacts of portable cylinder systems are reduced as much as possible?

A: A part of our guidance on reducing waste is supporting clinicians to completely deplete cylinders before they are sent back to the medical gas supplier (see page 43 of the toolkit).

We also recommend using all stock before changing supply system. This means as little gas as possible is sent back and therefore vented into the atmosphere.

Some stakeholders raise concerns about supplier practices based on MHRA regulations whereby following return of cylinders, suppliers may release gas to the atmosphere. Our approach focuses on minimising this impact through complete depletion before return.

Q: What is a “pressure drop test”, and what needs to be in place before this can be completed?

A: A pressure drop test as per the HTM with the system closed and isolated. If the gas might be needed for the duration of the test (e.g. in high use areas like maternity), a back-up portable system will need to be available.

Regardless of need for leak testing, this test should be part of yearly system maintenance checks to ensure safe medical gas pipeline systems.

Pages 39 and 40 of the toolkit covers more information.

Q: How can I find out more about capture and destruction of nitrous oxide?

A: In most cases, the main contributor to emissions is nitrous oxide waste released before clinical usage. Catalytic destruction technologies do not address this pre-clinical waste, which can account for up to 99% of supplied gas.

If trusts do consider implementing catalytic destruction technology, they should carefully assess the costs, practicality and potential benefits within their specific clinical context. In any case, it is helpful to identify what contributes the most waste in the system and tackle this first, before exploring potential ways to tackle further waste streams. As mentioned, in most cases where this has been investigated, upstream waste – waste that occurs in how the gas is supplied rather than waste at point-of-use – is the biggest contributor.

Q: If you move the manifold nearer to a high clinical use area, how do the logistics work of delivering and collecting the large cylinders work - how do you mitigate the risks?

A: We recommend that any redesign of a pipeline system is carefully considered with estates and facilities teams. Redesigning might not work for your trust but it is also an opportunity to explore. See page 41 of the toolkit.

Technical questions

Q: What is the timeline for updates to nitrous oxide delivery/management reviews in HTM 02-01?

Health Technical Memorandum 02-01 (HTM 02-01) is currently being reviewed and updated. Further information on timescales will be shared in due course.

See page 9 of the nitrous oxide toolkit for further information on HTM 02-01.

Q: Are there plans to measure nitrous oxide/oxygen mixture usage rates in maternity settings nationally?

A: There are no current plans to measure national nitrous oxide usage rates in specific clinical settings, due to challenges in data capture and availability.