

Market Research - PRO-NOX Nitrous Oxide Delivery System

The PRO-NOX nitrous oxide delivery system offers an alternative to pre-mixed nitrous oxide / oxygen gas, commonly known as Entonox and referred to as such in this document, with a number of less-known trade names:

- Entonox® – trademark of BOC (Linde)
- Livopan® – trademark of AGA (Linde)
- Kalinox® – trademark of Air Liquide
- Nitronox® – trademark of Medical Gas
- Alnox™ – trademark of Air Liquide
- Equanox® – trademark of Air Liquide
- Liqui-Med™ – trademark of Praxair Canada
- Oxynox® – trademark of Air Products

I have discussed the system and the principles behind it with customers who are currently using the Viamed infant resuscitation cabinet system on Delivery Suites of NHS Hospitals. I promoted the benefits of the PRO-NOX and received the following feedback and responses:

Benefit: Cost-Saving - O₂ and N₂O are less expensive when purchased as separate gases, compared to pre-mixed cylinders of Entonox.

Responses: Every Delivery Suite that I contacted, and I believe the vast majority, if not all of the Delivery Suites in the UK, use piped Entonox from wall terminals. Crucially, the gas is not metered for usage, so the Delivery Suites do not pay for the gas used from their own budgets. The cost-saving argument carries no weight with Maternity and Delivery Suite managers, as they currently pay nothing towards their gas usage. In contrast, the PRO-NOX system involves a capital financial outlay initially, with ongoing running costs for the cost of cylinder hire and gas, which will then have to be paid from their own budgets.

The way the departmental budget system operates, encourages individual departments to be very mindful of their own expenditure but not necessarily of the Trust as a whole. To successfully implement a change to PRO-NOX system would involve a major policy change from levels above that of the Delivery Suite manager.

Benefit: Safety - Fewer gas tank changes required and lower cylinder inventory.

Responses: End-users never have to concern themselves with cylinder changes as the Entonox is piped to the wall terminals. Introducing the PRO-NOX system *increases* risk for 2 reasons:

- 1) cylinders would have to be changed and stored on the Delivery Suite.
- 2) PRO-NOX requires floor space, whereas Entonox wall terminals do not.

Benefit: Safety - Pre-mixed gases can separate during storage, raising safety concerns. PRO-NOX can only deliver a 50/50 mix due to safety shut-off feature.

Responses: There is no current risk of separation due to the guidelines in place with regards to the design, maintenance and operation of the gas pipeline systems.

Benefit: Safety - Audio and visual alarms to indicate when tank changes are required.

Responses: The Entonox pipeline system is 'always on' and responsibility for this is handled by the Estates Department. Introducing PRO-NOX to a Delivery Suite passes some burden of responsibility to the department itself, with no perceived benefits to the department.

Benefit: Safety - Superior scavenging system to prevent staff exposure to exhaled gases.

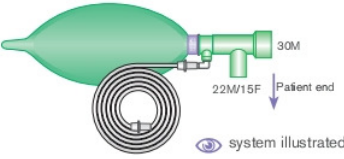
Responses: No scavenging systems are currently employed to directly remove exhaled gases, this concern has been addressed by room ventilation methods to ensure air is cycled regularly. If scavenging is a concern, circuits are already available on the UK market from established suppliers.

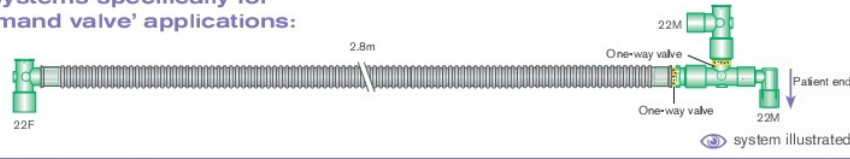
Benefit: PRO-NOX uses an internal demand valve to eliminate exposure to exhaled gases. This protects the demand valve from patient contamination and eliminates the need for demand valve cleaning. Entonox delivery systems use patient held demand valves with only a filter change between patients which does not guarantee cross-contamination prevention.

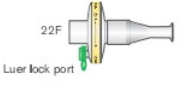
Responses: The demand valve is routinely cleaned between patients and serviced annually, which is considered sufficient as the mouthpiece and filter are changed every patient. The mouthpiece filter from Oxylit is quoted as having Bacterial Efficiency >99.9999%, for the end-users to accept that the filter is not effective enough calls into doubt every filter that they use.

Benefit: PRO-NOX patient circuits prevent cross-contamination and are designed to protect the machine using a one-way valve system.

Responses: Breathing systems with one-way valves for use with remote demand valve applications are already available from established UK suppliers, for example Intersurgical, which has a range of breathing systems dedicated to the administration of Entonox (see fig1).

Breathing systems specifically for 'free flow' applications: 		
2612000	O ₂ /N ₂ O Breathing System with a 2L PVC bag for single use	Box qty. 25
2612001	O ₂ /N ₂ O Breathing System with a 2L latex-free reservoir bag, for repeated use	Box qty. 25

Breathing systems specifically for 'remote demand valve' applications: 		
2620001	O ₂ /N ₂ O breathing system with a mouthpiece and one-way valves, 2.8m	Box qty. 20
2630001	O ₂ /N ₂ O breathing system with mask and one-way valves, 2.8m	Box qty. 20

Breathing attachment for 'hand-held demand valve' applications: 		
1644131	Clear-Guard Midi breathing filter, luer lock port, mouthpiece	Box qty. 50

[fig1]

Conclusions

Whilst Entonox is piped into all delivery rooms, Nitrous Oxide is not. In markets where Nitrous Oxide is piped directly into delivery rooms, the potential savings are obvious, however, where piped Entonox is available, there are no perceived cost savings to the department managers.

Long-term savings on the cost of medical gases could be made if Nitrous Oxide were piped directly into delivery rooms, however, as a decision was made some time ago in the UK to install Entonox pipelines, this would involve a policy change from high up in the NHS and is considered by those we spoke to as a "huge step backwards". Additionally, the cost of installing Nitrous Oxide pipelines would be high and borne by the department, some of which are still awaiting installation of piped air.

We also came across negative attitudes to 'another piece of medical looking equipment' in the birthing environment, which UK hospitals are ever more conscious of moving away from.

Mobile units could be an area where there may be a market, however, most hospitals only keep a few portable Entonox units "just in case". This is quite a competitive market, the main suppliers are BOC, Pneupac, Oxylitres and Therapy Equipment, with one portable Entonox unit available for as little as £350.00. Their infrequent usage in practice would negate any savings on gas.

It is my opinion that the PRO-NOX device is not suited to the current NHS delivery room environment, and whilst there may be niche markets, that is not in line with Viamed's focus at this time.