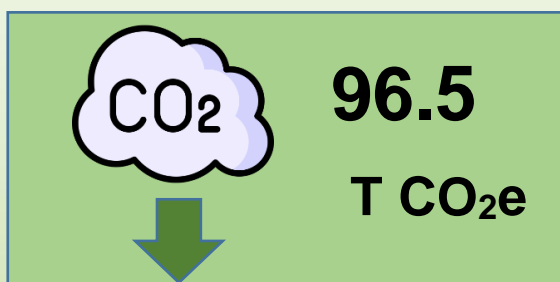


National Green Theatres Programme

Prògram Nàiseanta Lannsaireachd Uaine

Reducing the use of battery-operated Pulse Lavage

March 2024



1. Description of action

1.1 This action seeks to avoid the use of disposable single-use AA battery operated Pulse Lavage Systems across NHS Scotland, identifying that alternative, more environmentally friendly, systems are available.

2. Background

2.1 Pulse lavage is used in cemented procedures to prepare the bone bed, improve fixation strength at the bone-cement interface and reduce the risk of bone cement implantation syndrome¹. It can also be used for high volume irrigation during washouts.

2.2 There are several devices on the market and multiple power source options are available (AC/battery operated/power tool attachment). The most widely used devices in NHS Scotland are battery operated, single-use plastic and require the use and subsequent removal of 8-10 batteries per case prior to disposal. Once removed the batteries may be reused for other purposes but most are disposed of due to fire risk with improper storage. Alkaline batteries are not special (hazardous) waste but should be source-segregated for recycling. Currently, there is an economical dilemma when recycling batteries given that available processes used to reclaim metals require 6-10 times more energy than extracting/refining those metals from ores².

2.3 Data from national procurement demonstrated that 37,521 pulse lavage hand pieces were purchased across NHS Scotland in 2022 with an annual spend of **£702,644.56**.

Table 1: Products purchased in 2022 and battery use

Product	Batteries used in that model	Number Pulse Lavage purchased	Total batteries
A	10	24941	249410
B	8	5670	45360
C	8	6870	54960
D	0	40	0
Total		37521	349730

2.4 The carbon footprint for materials, manufacture, and transport of the 349,730 AA alkaline batteries used in 2022 was **37.42 tCO₂e²**.

¹ Schlegel UJ, Siewe J, Delank KS, Eysel P, Püschel K, Morlock MM, de Uhlenbrock AG. Pulsed lavage improves fixation strength of cemented tibial components. *Int Orthop*. 2011 Aug;35(8):1165-9. doi: 10.1007/s00264-010-1137-y. Epub 2010 Oct 16. PMID: 20953784; PMCID: PMC3167426.

² Ramsey Hamade, Raghid Al Ayache, Makram Bou Ghanem, Sleiman El Masri, Ali Ammouri, Life Cycle Analysis of AA Alkaline Batteries, *Procedia Manufacturing*, Volume 43, 2020. Life Cycle Analysis of AA Alkaline Batteries - ScienceDirect



Figure 1: ECOpulse

Some units have already moved towards more sustainable devices which are currently available on national framework. Woodend Hospital in Aberdeen have implemented the use of a novel pulsatile lavage system called the ECOpulse® (De Soutter Medical Ltd.®, Aylesbury, UK). This device uses the rotatory power tool, which is already opened, to power the pulse lavage with no added burden of sterilisation.

The device utilises the power tool hand piece and as such is composed of less single-use plastic and requires less storage space than other devices. In addition, this model has been independently verified as Carbon Neutral and when introduced in England was associated with carbon and cost savings³.

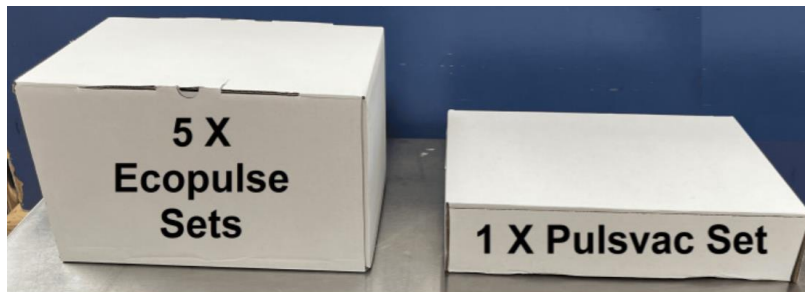


Figure 2: Comparison of packaging of ECOpulse® and Pulsvac sets. Reproduced with permission from Matthew Chan

- 2.5 Nationally **96.5tCO₂e could be saved per annum** by moving from battery operated pulse lavage to ECOpulse®. ECOpulse® is manufactured and distributed in the UK whilst the battery/AC options are distributed from the manufacturer's global distribution centre in the Netherlands. This added distance led to around a 4x increase in carbon emissions from transportation alone⁴.

However, the ECOpulse® may not be suitable in some centres due to the compatibility issues with the power tools. In these instances, it would be prudent to consider moving to the AC version of the battery-operated models if available. Some units have already started this work.

- 2.6 The potential carbon savings from switching to alternative pulse lavage systems have been provided to health boards.

3. Who needs to be involved in this change locally?

- 3.1 In order to implement this Action it is recommended that the following groups should be consulted and involved:
- Surgeons
 - Theatre Managers/Staff
 - ODP and Scrub Nurses
 - Procurement Staff
 - Waste managers

³ Reducing Carbon Footprint of Disposable Pulse Lavage Systems in Total Hip and Knee Arthroplasty - PMC (nih.gov)

⁴ Pulse Lavage - Other - Disposables - Products | deSoutter Medical (de-soutter.com)

4. Boundaries

4.1 The table below identifies the boundaries for this action:

In scope	Out of scope
<ul style="list-style-type: none"> Pulse lavage for use in Orthopaedic procedures requiring preparation of bone prior to cementation 	<ul style="list-style-type: none"> Pulse lavage used for soft tissue procedures where power tools would not normally be opened

5. What is the change and how will it be implemented?

- 5.1 Encouraging the phasing out of battery-operated pulse lavage in favour of AC powered or power tool driven alternatives.
- 5.2 Trials are being organised for ECOpulse® in NHS Golden Jubilee and NHS Highland to assess the suitability of this device for use locally.
- 5.3 Theatre procurement leads are encouraged to speak to suppliers about AC power alternatives and business models to include supply of AC power adapters to facilitate a cost neutral transition.

6. What are the potential co-benefits of this change?

6.1

Outcome	Potential Benefits
Carbon Savings	96.5tCO2e
Cost Savings	0
Staff experience	<ul style="list-style-type: none"> Less time spent removing and segregating batteries at the end of the case <p><u>ECOpulse® specific</u></p> <ul style="list-style-type: none"> Reported to be quieter improving communication and training experience⁴. Smaller and requires 2.5x less storage space than alternatives, providing more space in theatre storesⁱ.

7. Risks and Issues

7.1 As part of the development of this action there has been two risks identified to date, outlined below:

Description of risk or issue	Mitigation / Action Plan
The ECOpulse® p30 series is compatible with De Soutter power tools and the p31 series is directly compatible with Stryker® power tools. Adaptors exist to use the ECOpulse® system with other power	Where power tools are not compatible AC pulse lavage could be implemented

Description of risk or issue	Mitigation / Action Plan
systems but this would require purchasing of multiple adapters which must be sterilised and reprocessed reducing the environmental benefit.	
ECOpulse® "CARBON NEUTRALITY CERTIFICATE" only refers to offsetting an amount of 60tCO ₂ e which would be equivalent to one year Net Zero if all pulse lavage in Scotland was ECOpulse®.	De Soutter must provide evidence of ongoing Net Zero certification.

8. Implementation Guidance

- 8.1 The opportunity for change highlights the importance of implementing this action. This change will help your site and NHS Scotland achieve net-zero emissions by 2040 as stated in NHS Scotland's Climate Emergency & Sustainability Strategy 2022-2026.
- 8.2 Below the National Green Theatres Programme has provided guidance on how you can implement this change within your area. If you require any further information or guidance, please contact the National Green Theatres programme team on: cfsdgreentheatres@gjnh.scot.nhs.uk

Local Sustainability or Green Theatre Group:	
1.	Review opportunity for change and validate what this means locally.
2.	Provides National Green Theatre Programme Team with validated information/local targets.
3.	Convene a discussion with the staff who need to implement it and those who are impacted by the action.
4.	Understand what the opportunity is for implementing the action locally: work already undertaken and challenges.
5.	Agree a local implementation plan.
6.	Implement local plan.
7.	Provide data as per measurement plan.
8.	Monitor implementation of action.