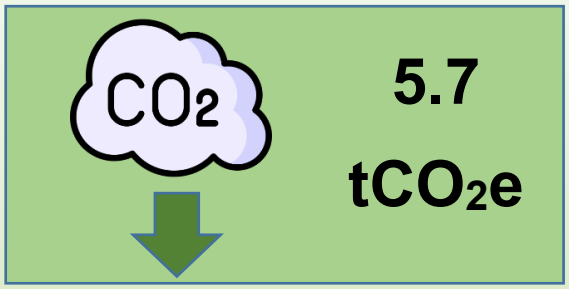
Centre for Sustainable Delivery

NHS SCOTLAND

Green Healthcare Scotland
National Green Renal Programme

Opportunity for Change:
Recycling Dialysate Canisters

October 2026





1. Description of action

1.1 This action aims to support renal colleagues across NHS Scotland to implement the recycling of dialysis canisters within their health board.

2. Background

2.1 Dialysate solution is used in haemodialysis machines in a counter-current system against the blood to allow removal of salts, waste products, and water. Dialysate is available either from a central tank, or single-patient canisters. The choice depends on availability of central tank, and if specific electrolyte composition is required for the patient. Canisters are composed of High-Density Polyethylene (HDPE).

2.2 In Scotland, dialysate is almost entirely purchased from Fresenius, in 5L canisters (1:44 concentrate), with each canister made from 259g HDPE. The main contributors to the carbon footprint of these canisters are their manufacture, transport, and waste disposal[1]. This results in a higher carbon footprint than alternative options such as dialysate bags, which are available but more expensive, or central acid delivery. A life cycle analysis (LCA)[1] estimated the 'cradle to grave' carbon footprint of a 6L dialysate canister is 6.18 kgCO_2e. This includes emissions associated with manufacturing the HDPE and dialysate, transport, and disposal of the canisters. This is corroborated by 2024 UK BEIS greenhouse gas (GHG) conversion factors HDPE manufacture. The greatest carbon footprint, and financial cost, occurs when used canisters enter the clinical waste stream. Disposal through the residual waste stream (black bag) has a lower carbon footprint, although this varies depending on factors such as the distance the waste travels for processing and the method of disposal (*Appendix 1*).

2.3 While reducing the number of patients on canisters and switching to central acid delivery where possible should remain a priority, dedicated recycling waste streams should be introduced for the canisters. In the meantime, while recycling systems are being established, or in units where recycling is not feasible, clinics should ensure canisters are disposed of through the residual waste stream rather than the clinical waste stream. This provides an immediate reduction in both carbon emissions and disposal costs.

2.4 A case study in Leeds, Yorkshire, estimated that 19,344 canisters amount to 5 - 5.6 tonnes of plastic waste annually. By changing the disposal route from the infectious waste stream to recycling, the service reduced carbon emissions by an estimated 2.8 – 3.1 tonnes CO_2e emissions annually and achieved costs savings of between £1,800 – £2,000. The team quantified canister usage, canister weight, and environmental impact, and identified barriers to recycling.[2]

2.5 Rizan et al (2020) estimated and compared the carbon footprint of hospital waste streams using activity data from 3 UK hospitals, using methods in accordance with the Greenhouse

Gas Accounting Sector Guidance for Pharmaceutical Products and Medical Devices. The study found that recycling had the lowest carbon footprint, generating between 21 - 65 kg CO_2e per tonne of waste. This was followed by low temperature incineration with energy from waste, which generated 172 - 249 kg CO_2e per tonne. When waste was decontaminated using an autoclave prior to low temperature incineration, the carbon footprint increased to 569 kg CO_2e. The highest carbon footprint was disposal of waste via high temperature incineration at 1074 kg CO_2e/t (Figure 1). NHS data also shows that the financial cost of waste streams mirror that of the carbon footprint.[3]

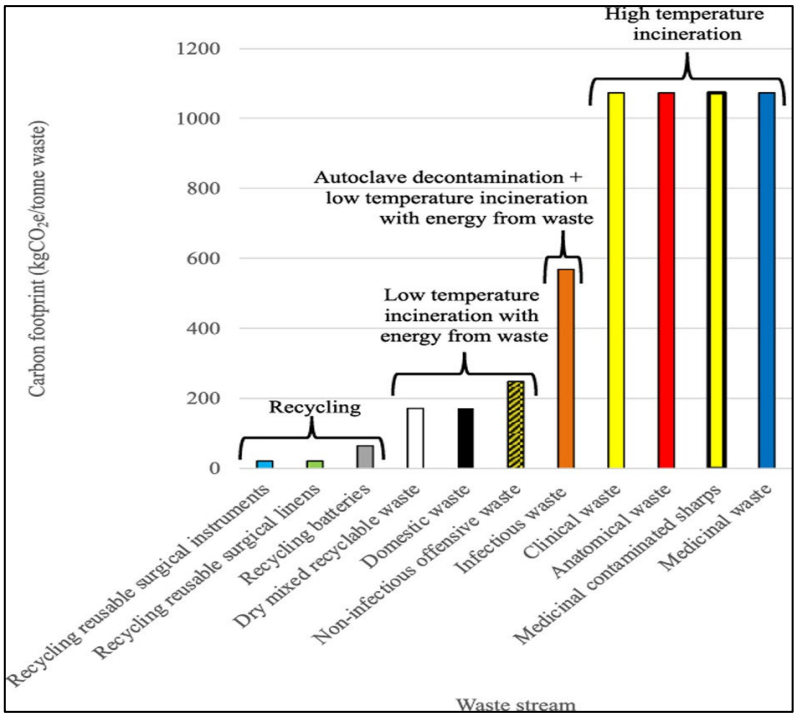


Figure 1. Carbon footprint per waste stream (Rizan et al, 2020)

2.6 Some potential co-benefits from the implementation of this action may include:

- Using the opportunity to flag the high financial and carbon cost of canisters, and review if patients could switch to central acid instead.
- Utilising the opportunity to promote wider waste segregation across all Renal Dialysis Unit (RDU) staff.
- Recycling may extend beyond canisters to other HDPE plastic, providing wider benefits. If your Health Board already recycles HDPE, please let us know by contacting cfsdghs@nhs.scot.
- Staff development: consider identifying a lead individual who will engage with Waste Management Officers to plan, implement, and audit the change.

3. Who needs to be involved in this change?

3.1 Engaging relevant stakeholders early in this process to ensure broad support for this action is vital. These groups will include:

- Discussion with your Waste Management Officer (WMO), this is a priority and must take place before this action is progressed in your Health Board. They will advise on segregation, bins, and local waste contracts
- Estates and Facilities Teams
- Renal Dialysis Unit Staff
- Sustainability and Environmental Leads
- Porters and Domestic staff
- Finance colleagues (to request or track financial spend/savings)

3.2 The below points may be helpful for communication with relevant stakeholders when discussing this change:

- Advise staff that the canister must be empty before entering waste stream. Any remaining dialysate must be poured down the sluice with water to a ratio of 1:10.
- Advise staff to not replace cap, as this can go in residual waste.
- Ensure staff know where to store canisters for recycling, this is usually a dedicated cage.
- Ensure staff know WMO contact for troubleshooting, e.g. forgetting to place canisters in recycling cage or leaving dialysate in or cap on, porters not collecting when full, or being unsure where to transport to.

4. Boundaries

4.1 The table below identifies the boundaries for this action:

In scope	Out of scope
• HDPE canisters for dialysate concentrate	• Other consumables

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

5.1 This change involves the implementation of dialysis canister recycling within local renal units. This is already happening in certain units and this document aims to support wider adoption among the remaining units across NHS Scotland.

5.2 Implementation will be tailored to local context:

- To estimate the environmental benefits of the change, confirm with your WMO whether residual waste (black bag waste) is already being sorted downstream to recover recyclable plastics.

- Your WMO or Estates colleagues can assess whether there is sufficient space to store canisters awaiting collection for recycling. Where space is limited, a compactor may be an option.
- Your WMO can review the Renal Dialysis Unit layout to identify a suitable location for a recycling cage, ensuring it does not affect fire safety or accessibility requirements.

5.3 Because WMOs play a key role in implementing dialysis canister recycling, the contact details for each Health Board's WMO are provided in Appendix 2.

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

6.1 The potential co-benefits of implementing this change have been noted below for reference. Please note, these are estimated savings and require validation at a future measurement meeting.

Outcome	Potential Benefits
Carbon reductions	5.7 tCO_2e
Financial savings	£32,860 per year, see Appendix for calculations
Staff experience	Improved clarity on recycling requirements, leadership development

6.2 Health Boards may want to investigate a separate waste stream for HDPE, with the potential to sell the HDPE. Local costs and prices for this may vary.

7. Risks and issues

7.1 During the development of this action, 4 risks have been identified to date. These are outlined below along with the mitigation strategies required and must be considered when reviewing the potential of this action in your health board.

Description of risk or issue	Mitigation / action plan
If canisters still contain dialysate, recycling may be compromised	Ensure staff are aware of local WMO guidance. Compliance should be monitored through audit or informal review processes
Busy staff teams may find segregation time-consuming, leading to low uptake of this action	Ensure the process for recycling canisters is straightforward and easy for staff to follow
Renal units not having sufficient space to store empty canisters	Early discussion between RDU, Estates, and Waste Management teams to review spacing requirements
Local waste classification may default all items from clinical areas as potentially infectious, even if technically clean	Your WMO should discuss with infection prevention team to address any

	misclassification. CfSD can facilitate if required

8. Implementation guidance

8.1 By embracing this change, your site will contribute to NHS Scotland's commitment to achieving net-zero emissions by 2040, as outlined in the NHS Scotland Climate Emergency & Sustainability Strategy 2022–2026.

8.2 Below, Green Healthcare Scotland provides guidance on practical steps you can take to implement this change within your area. If you require any further information or guidance, please contact the Green Healthcare Scotland programme team at: cfsdghs@nhs.scot.

Local Sustainability Group:	
1.	Engage your Waste Management Officer to review the Opportunity for Change and assess what it means for your local context.
2.	Provide Green Healthcare Scotland programme team with initial validated information/local targets.
3.	Facilitate a discussion with the wider staff responsible for implementing the change and those directly impacted by it, ensuring collaboration and shared understanding. When addressing any concerns, it can be helpful to refer to the Scottish Waters Trade Effluent Agreement for guidance and/or reassurance.
4.	Agree a local implementation plan with WMO and estates.
5.	Implement local plan.
6.	Provide quarterly data, as per measurement plan, to Green Healthcare Scotland programme team.
7.	Monitor implementation of action.

9. Measurement

9.1 Measurement discussions regarding this action will be progressed at the upcoming quarterly measurement validation cycle with each Health Board individually as appropriate.

10. Appendices

10.1 **Appendix 1: Supporting Data**

On the next page is a table showing the estimated potential carbon savings, shown in the highlighted green column, as well as the financial avoidance.

Health Boards	No. of canisters 2023-'24 ♦	HDPE in tonnes *	**Recycling associated emissions tCO_2e**	**Clinical Waste associated emissions tCO2e**	**Carbon saving tCo_2e**	Mixed recycling financial cost	Clinical waste (Yellow) financial cost	Cost avoided
Factor		292 grams / canister	**4.65358 $kgCO_2e$ / tonne ^**	**172 $kgCO_2e$ / tonne [3]**		GBP 50.00 / tonne +	GBP 982.56 / tonne +	
Ayrshire and Arran	24,013	7.012	**0.033**	**1.206**	**1.173**	350.59	6,889.51	6,538.92
Borders	2,433	0.710	**0.003**	**0.122**	**0.119**	35.52	698.05	662.52
Dumfries and Galloway	10,830	3.162	**0.015**	**0.544**	**0.529**	158.12	3,107.21	2,949.09
Fife	14,060	4.106	**0.019**	**0.706**	**0.687**	205.28	4,033.92	3,828.64
Forth Valley	190	0.055	**0.000**	**0.010**	**0.009**	2.77	54.51	51.74
Greater Glasgow and Clyde	33,492	9.780	**0.046**	**1.682**	**1.637**	488.98	9,609.11	9,120.12
Highland	1,579	0.461	**0.002**	**0.079**	**0.077**	23.05	453.03	429.97
Lanarkshire	360	0.105	**0.000**	**0.018**	**0.018**	5.26	103.29	98.03
Lothian	10,932	3.192	**0.015**	**0.549**	**0.534**	159.61	3,136.47	2,976.87
NSS Financial Services	12,447	3.635	**0.017**	**0.625**	**0.608**	181.73	3,571.14	3,389.41
Tayside	5,017	1.465	**0.007**	**0.252**	**0.245**	73.25	1,439.42	1,366.17
Western Isles	1,897	0.554	**0.003**	**0.095**	**0.093**	27.70	544.26	516.57
TOTAL	117,250	34	**4.813**	**5.889**	**5.729**	1,761.85	34,622.47	32,860.62

♦ figures provided by Fresenius Medical Care (UK) Ltd data
* based on 6L canisters which have been discontinued as a result of the successful change to 1:44 dialysate concentrate
^ UK Government GHG conversion factors
+ figures provided by National WMO Consortium

10.2 Appendix 2: Waste Management Officer Contact Details

Below is the list of each health board's Waste Management Officers (WMOs). Your WMO must be consulted before progressing this action. Accurate as of 6 October 2026.

Health Board	Name	Title	Contact Information
NHS Ayrshire & Arran	Graeme Meldrum	Waste Manager	graeme.meldrum@aapct.scot.nhs.uk
NHS Borders	Dave Bradon	Waste Fleet Manager	dave.bradon@nhs.scot
NHS Dumfries and Galloway	Ryan Jack	Estates	ryan.jack@nhs.scot

NHS Fife	Jordan Morrison	Operations Waste Manager	jordan.morrison@nhs.scot
	Caroline Quinn	Part-time Operational Waste Manager	caroline.quinn1@nhs.scot
NHS Forth Valley	Mark Craske	Waste Management Officer	Mark.craske@nhs.scot
NHS Golden Jubilee	Leila Loder	Waste Management Officer	leila.loder@gjnh.scot.nhs.uk
NHS Grampian	Neil Duncan	Waste Manager	neil.duncan3@nhs.scot
NHS Greater Glasgow & Clyde	Paul Allan	Operational Waste Manager	paul.allan5@nhs.scot
NHS Highland	Steven Miller	Waste and Resource Manager	steven.miller3@nhs.scot
NHS Lanarkshire	Debbie Dickie	Technical Services Manager	debbie.dickie@lanarkshire.scot.nhs.uk
	Diane Hunter	Acting Head of Technical Services	diane.hunter@lanarkshire.scot.nhs.uk
NHS Lothian	Priscile Morgan	Waste Assurance Manager	priscile.morgan@nhs.scot
NHS Orkney	Gary Drever	CDU and Waste Manager	gary.drever@nhs.scot
NHS Shetland	Jamie Watt	Waste Management Officer / Porter	jamie.watt@nhs.scot
NHS Tayside	Joyce Anderson	Operational Waste Manager	joyce.anderson1@nhs.scot
NHS Western Isles	Donnie Smith	Environmental & Statutory Compliance Officer	donnie.smith@nhs.scot

11. Acknowledgements

11.1 The successful completion of this Opportunity for Change was made possible by the expertise of various stakeholders across NHS Scotland and beyond. We specifically acknowledge the following colleagues for their time and dedication to this action:

- Pauline Upson - Senior Regional Manager, Fresenius Medical Care (UK) Ltd
- Ruth Innes - Sustainability Manager (Waste and Resource Efficiency), NHS Scotland Assure
- Wendy Rayner - Head of NHS Circular Economy Programme, Scottish Government
- Eleanor Murray - Green Renal Clinical Lead (Scotland), NHS Greater Glasgow and Clyde
- Robert Ker - ST6, Renal and General Internal Medicine and Scottish Clinical Leadership Fellow, Centre for Sustainable Delivery
- Yorkshire and Humber Kidney Network
- Green Healthcare Scotland Programme Team
- National Green Renal Programme Specialty Delivery Group Members

12. References

Martinez-Cadenas, R., et al. (2025) 'Impact of the Type of Dialysate Acid Concentrate Container on the Environmental Footprint of Hemodialysis Centers', *Am J Kidney Dis*, 86(5), pp.616-623. [Online] Available at: https://pubmed.ncbi.nlm.nih.gov/40738182/ [Accessed: 08 August 2026]

Rizan, C., et al. (2021) '*The carbon footprint of waste streams in a UK hospital*', Journal of Cleaner Production, 286. [Online] Available at: https://www.sciencedirect.com/science/article/abs/pii/S0959652620354925. [Accessed: 08 August 2026] doi.org/10.1016/j.jclepro.2020.125446 [Accessed: 08 August 2026]

Travers, L., et al. (2021) *Reducing unnecessary carbon in haemodialysis by recycling acid concentrate canisters*. [Online]. Available at: https://www.ukkidney.org/sites/default/files/documents/Recycling%20acid%20canisters%20in%20Leeds.pdf [Accessed: 08 August 2026]

13. Version Control

Version	Date (YYYY MM DD)	Amendment	Author	Approver
0.1	2025 09 03	Opportunity for Change drafted, shared with internal team for review	IJ	EM
0.2	2025 09 06	Opportunity for Change, edited and approved by EM	EM	EM
0.3	2025 11 28	Opportunity for Change updated to new template, references updated and content checked	IJ	LM
1.0	2026 09 02	Included specific talking points provided by WMOs	DZ	SC

1.1	2026 09 23	Corrected a sentence which was set in a different typeface and a handful of sentence structure edits to improve legibility.	DZ	SC