

Supporting Handout: Instrument Cleaning, Reprocessing and Carbon Reduction

A concise resource to accompany Chris Helson's presentation and the transcript, video and slides from the GHC Innovation and Sustainability Hub session on 30 July 2026.

Purpose: This handout summarises the main issues raised in the presentation on instrument cleaning, reprocessing and carbon reduction, with emphasis on reducing single-use instruments, improving pre-cleaning, strengthening inspection, protecting staff, increasing capacity and lowering environmental impact.

Summary

The presentation argues that instrument cleaning is both a patient safety requirement and a major sustainability opportunity. Surgical instruments require sterilisation because they pass the blood barrier, while many clinical instruments require high-level disinfection. Across both categories, large numbers of single-use stainless steel instruments are still purchased, used once and discarded. The presentation highlights two linked opportunities: reducing single-use devices where safe reusable routes can be developed, and reducing the carbon, water, detergent, energy and workforce burden of reprocessing through validated automation and smarter inspection.

Key Takeaways

- **Single-use instruments carry high embedded carbon:** Stainless steel scissors, tweezers and other devices require material, manufacturing, packaging, transport and disposal, yet many are used once and incinerated or landfilled.
- **Reuse can reduce lifecycle impact:** The presentation cited evidence that switching from single-use to reusable products can reduce carbon footprint by around 50% across the product lifecycle.
- **Manual pre-cleaning is resource intensive:** Current sink-based processes use warm water, detergent, staff time and PPE, and expose staff to aerosols, sharps and contamination.
- **Cleaning quality affects capacity:** Failed cleaning leads to rewash, using additional water, energy, detergent, labour and machine capacity.
- **Automation can improve consistency:** Automated pre-cleaning systems may reduce cleaning time, eliminate detergent use, reduce exposure risk and improve validation.
- **Point-of-use pre-cleaning may protect instruments:** Cleaning closer to theatre can reduce drying, corrosion and the burden on central sterile services.
- **Inspection is a second major opportunity:** Visual inspection can miss contamination, especially in hard-to-see areas, so smart scanning and image processing may strengthen assurance.

Issues Identified in Current Practice

- **Single-use clinical and surgical instruments are a significant waste stream.** The presentation highlighted that the NHS buys approximately 5.6 million pairs of single-use scissors each year, with no routine recycling route described.
- **Reusable pathways are not yet available for many clinical instruments.** Central sterilisation units can reprocess surgical instruments, but the presentation noted a gap for many clinical instruments that are currently treated as single use.
- **Pre-cleaning is difficult to control manually.** Staff may be working at sinks for long periods with hot or warm water, detergents, PPE and contaminated sharp instruments, creating safety, recruitment and consistency challenges.
- **Delayed cleaning increases difficulty and damage.** Blood, saline and proteins can dry or harden onto instruments; chlorides can begin to corrode stainless steel and create infection control and instrument-life concerns.
- **Rewash creates avoidable demand.** When instruments fail inspection after washing and disinfection, contamination can become harder to remove and the process consumes additional resources.
- **Manual inspection has limits.** Contamination can remain hidden in instrument joints, tips or distal ends even when an instrument appears clean under normal visual checks.

Requirements for Safe and Sustainable Reprocessing

- **Validated cleaning performance:** Any new process must demonstrate reliable removal of contamination before disinfection or sterilisation.
- **Infection prevention approval:** Reprocessing pathways must be developed with IPC, sterile services, clinical teams and procurement.
- **Appropriate separation of instrument categories:** Surgical instruments, clinical instruments and devices with different patient-risk profiles need suitable cleaning, disinfection or sterilisation routes.
- **Workforce safety:** New systems should reduce exposure to aerosols, sharps, contamination, awkward posture and repetitive manual work.
- **Operational fit:** Technology must work within theatre, transport, washroom, clean-room and central sterile services workflows.
- **Measurement and assurance:** Outcomes should include cleaning quality, rewash rates, water and detergent use, energy, time, carbon, cost, staff experience and instrument damage.

Evidence and Examples from the Presentation

Theme	Example or Evidence Presented	Implication
Single-use instruments	The NHS was described as buying around 5.6 million pairs of single-use scissors each year.	High-volume stainless steel waste represents a major carbon, cost and resource issue.
Reusable alternatives	A systematic review was cited showing around 50% average lifecycle carbon reduction when switching from single-use to reusable products.	Reducing single use can support net zero goals where safe reprocessing routes are available.
Manual pre-cleaning	The current sink process was described as using 30–40 litres of warm water, detergent and around 12 minutes per instrument set.	Manual cleaning consumes resources and creates workforce exposure and capacity constraints.
Automated pre-cleaning	The Tiny Air system was described as using cold mains water, no detergent and around 2 minutes per set.	Automation may improve throughput, consistency, staff safety and environmental performance.
Rewash reduction	A deployment in Glasgow was reported to reduce rewash by 80%.	Reducing failed cleaning can release capacity and avoid repeated resource use.
Carbon comparison	A comparative life cycle analysis was described as showing a 93% lower carbon impact than Medisafe ultrasonic machines for the pre-wash stage.	Process innovation can reduce emissions as well as improve cleaning reliability.
Smart inspection	Scanning and image processing identified contamination not visible in standard visual inspection.	Inspection technology may improve assurance and reduce the risk of hidden contamination progressing.

Sustainability Implications

The sustainability case is based on reducing single-use stainless steel waste, avoiding unnecessary incineration or landfill, cutting water and detergent use, reducing energy demand, extending instrument life and lowering rewash. The presentation also noted that sterilisation packaging creates a substantial single-use plastic burden, with NHS spending on sterilisation wrap described as around £13.7 million per year. This means carbon reduction needs to address both the instruments themselves and the wider reprocessing pathway.

Prospective Actions

- **Map current single-use instrument volumes:** Identify high-use items such as scissors, tweezers, suture-removal packs and procedure sets, including cost and disposal routes.
- **Review opportunities for reusable alternatives:** Prioritise products where clinical suitability, infection prevention requirements and reprocessing routes can be assessed.
- **Measure baseline reprocessing demand:** Collect data on pre-cleaning time, water, detergent, energy, rewash, staffing and bottlenecks.
- **Pilot automated pre-cleaning:** Test resource use, cleaning quality, staff safety, throughput and rewash reduction against current manual or ultrasonic processes.
- **Explore point-of-use pre-cleaning:** Consider theatre-side trials where long delays before cleaning contribute to drying, corrosion or high rewash.

- **Prepare for smart inspection:** Identify instruments and features where contamination is difficult to detect and consider how image-based inspection could support assurance.
- **Build a whole-life business case:** Include procurement cost, carbon, waste, water, detergent, energy, staff time, instrument lifespan, capacity and avoided rewash.
- **Share learning across teams:** Link sterile services, IPC, procurement, sustainability and clinical teams so that safety, compliance and environmental goals are considered together.

Areas to Consider

- Which single-use instruments generate the highest carbon, waste and cost burden locally?
- Are there safe reusable alternatives already available, and what prevents adoption?
- What are the current rewash rates and where in the pathway do failures occur?
- Could point-of-use pre-cleaning reduce delays, corrosion or workload in central sterile services?
- What evidence would IPC, sterile services and procurement need before changing practice?
- How can carbon, waste and capacity benefits be included in future business cases?