



The Effluent Retention System:

A New Era in Sustainable Sharps Waste Treatment

● **THE KEY TO USING YOUR SHARPS WASTE
TO REDUCE YOUR CARBON FOOTPRINT**

Are you aware there's a sustainable alternative treatment solution for hazardous sharps waste?

For decades, fossil fuel-powered high-temperature incineration has been the industry norm for sharps waste, and it's a carbon-intensive process.

But no more!

Sharpsmart has developed and patented the Effluent Retention System – a pre-treatment process for medicinally-contaminated sharps waste.

THIS SOLUTION HAS BEEN HELPING OUR HEALTHCARE PARTNERS TO:



▶ Significantly reduce CO₂e.



▶ Have peace of mind with a guaranteed sharps waste outlet.



▶ Divert high volumes of waste away from high-temperature incineration.



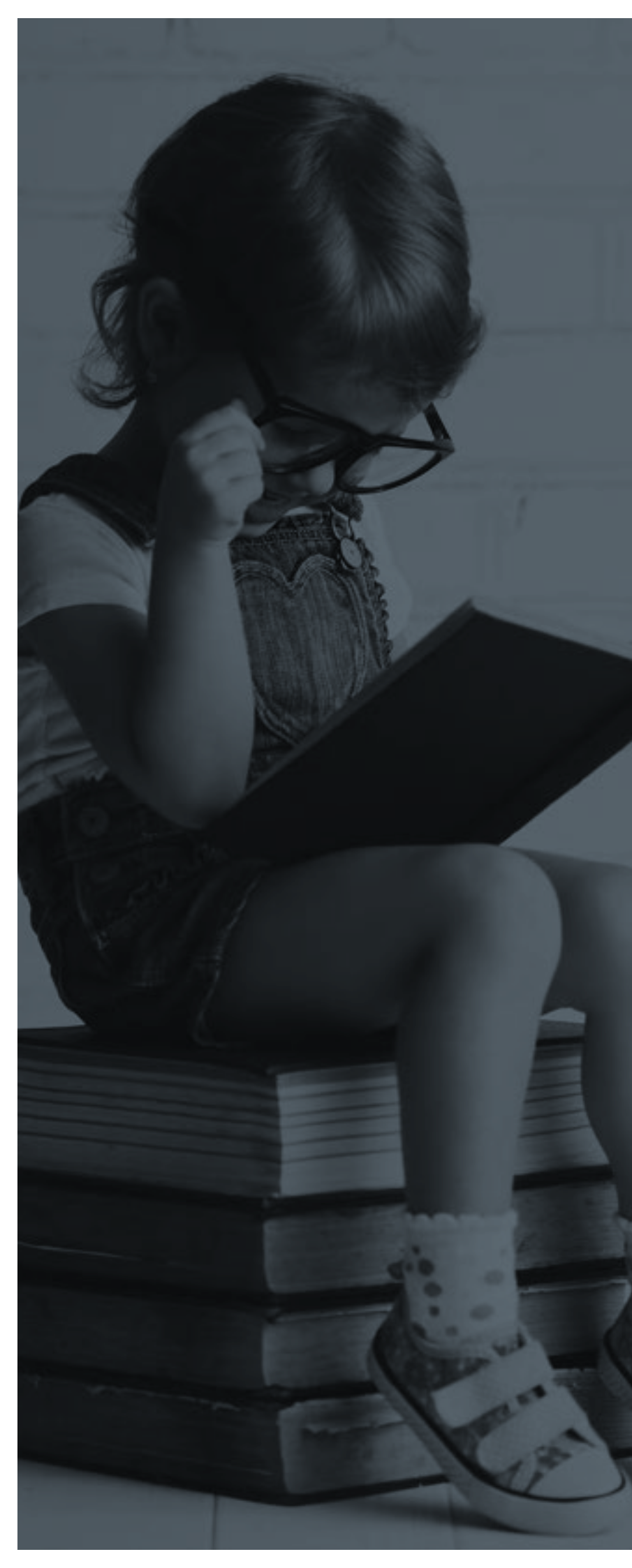
▶ Meet and exceed the 20-20-60 waste split set out in the NHS Clinical Waste Strategy.

In response to mounting stockpiles of hazardous clinical waste, a global pandemic, and an ageing waste treatment infrastructure – **In 2019, Sharpsmart developed an innovative solution to meet the immediate needs of the NHS.**

Read on to learn how our patented technology has redefined sharps waste treatment and caused a paradigm shift in healthcare waste management, using proven results to lay a clear path to a greener future for the healthcare industry.

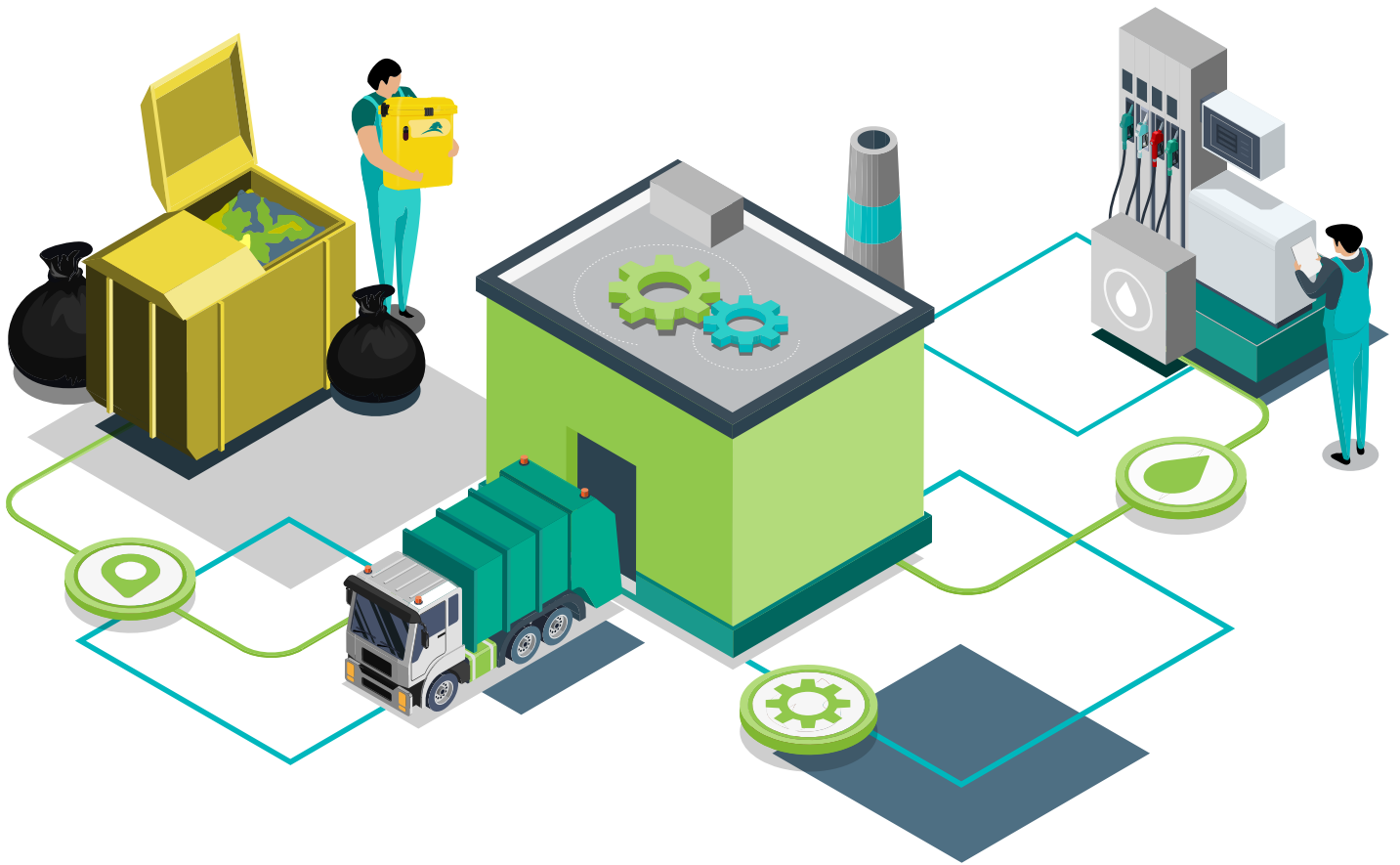
This paper explores the remarkable journey and development of our Effluent Retention System and highlights:

- ▶ What our patented Sharps Treatment Solution is.
- ▶ How it helped the NHS through the waste crisis and the pandemic.
- ▶ The challenges of creating a new system.
- ▶ How the Effluent Retention System works.
- ▶ The benefits that extend into your future.
- ▶ What our system can help you achieve.
- ▶ How you can take your next step towards a Net Zero future.



A Brief Glossary of Terms:

- ▶ **Closed-Loop:** A self-contained and controlled process where waste materials are treated, processed, and reused within a contained system.
- ▶ **Effluent:** Waste liquid resulting from the treatment of medically-contaminated sharps waste.
- ▶ **Floc:** The solid residue resulting from the sterilisation and condensing stage of our treatment process used to create Solid Recovered Fuel.
- ▶ **ISO-Compliant:** Meeting the requirements, guidelines, and standards set by the International Organisation for Standardisation relevant to a particular industry, process, or product.
- ▶ **Solid Recovered Fuel (SRF):** High-quality alternative to fossil fuel produced from waste.




What Is the Effluent Retention System?

The Effluent Retention System (ERS) is our patented Sharps Treatment Solution that merges environmental responsibility with healthcare efficiency and compliance.

This closed-loop process uses shredding, sterilisation, and a unique Effluent Retention System to ensure there's no discharge of effluents to air or sewer throughout treatment.

Our Effluent Retention System is a sustainable alternative to high-temperature incineration, with the capability of treating over 2 tonnes of hazardous sharps waste per hour and was born from a combination of factors:

- ▶ Our intimate understanding of sharps waste.
- ▶ Our commitment to a safer and more sustainable healthcare industry.
- ▶ Our dedicated support of the NHS and all healthcare professionals, helping you navigate the challenges of healthcare waste.



As Plato once said:
“Necessity is the mother of invention”, **and there was a clear need for a new treatment solution for sharps waste...**

The Healthcare Industry Was in Trouble

Stockpiled waste and ageing treatment infrastructure that couldn't cope with the high volumes of hazardous waste meant a new system was much needed – but creating one had its own challenges.

STOCKPILED WASTE, LIMITED CAPACITY, AND FAILING INFRASTRUCTURE

One of your biggest priorities as a healthcare professional is having the ability to provide uninterrupted care to patients.

But in late 2018, that became significantly more challenging to do...

The sudden cessation of clinical waste treatment contracts with Healthcare Environmental Services Limited (HES) resulted in many NHS organisations being placed into contingency mode.

Thousands of tonnes of sharps and clinical waste destined for high-temperature incineration ended up being stockpiled on-site at hospitals, waste treatment facilities, and transfer stations across the UK.

The real problem was that sharps and other healthcare wastes were continuing to be generated, and **many of you faced the challenge of having no outlet for disposal.**

And then things took a turn for the worse...


After enduring months of emergency measures to combat the stockpiles of hazardous waste across the country that resulted from the forced exit of HES, **another challenge presented itself – COVID-19.**

Just as the stockpiled hazardous waste was beginning to make its way back into circulation for treatment, there was a **significant increase in hazardous waste volumes** across the country in need of treatment.

Demand surged and with it, the price of clinical waste incineration increased, in some cases doubling. This high demand also resulted in limited capacity as **the ageing clinical waste incinerator infrastructure failed to keep up** with the additional volumes.

It takes around 2-3 years to build, permit, and commission a clinical waste incinerator and with the amount of waste already stockpiled and continuing to be generated, the future looked bleak for the industry for years to come.





“**Our company was founded on innovation** to meet the immediate needs of the healthcare industry industry – we needed to return to this.

THE CHALLENGES OF CREATING A NEW SHARPS TREATMENT SYSTEM

It wasn't only the NHS struggling to find outlets for their clinical waste and hitting the brick wall of limited capacity, we were also having to navigate the complexities of sourcing treatment outlets for sharps waste.

To overcome the many arising challenges, Sharpsmart set about designing a system that could not only treat the majority of sharps waste produced by our 100-plus hospital partners, but also **support you on your route to becoming the world's first Net Zero National Health Service.**

At the time our industry was struggling through the waste crisis of 2018, treating medicinally contaminated sharps through a process other than high-temperature incineration (HTI) was unheard of – there were no alternatives available.

HTI was the only approved process for sharps waste treatment in England and Wales and this posed several problems which Sharpsmart would need to solve in order to create a new sharps treatment system:

- ▶ Firstly, no pharmaceuticals or pharmaceutically contaminated liquid/vapour can be released into the environment when treating Sharps.

- ▶ The effluent containing medicines, whether in liquid or steam form, must not be discharged to the atmosphere (in the case of droplets of pharmaceuticals contained in steam vapour) or to the sewer (in the case of pharmaceuticals in liquid form).
- ▶ The Hazardous Property (HP) 9 infectious Code of sharps waste, determines that only hazardous incineration can be used to dispose of the sharps, preventing the use of larger capacity Energy from Waste (EfW) incinerators.
- ▶ The healthcare sharps waste must be rendered unusable and unrecognisable (as healthcare waste) to allow a change of European Waste Classification (EWC), and therefore opening up possible alternative recovery outlets for the floc.

We knew that as a healthcare waste management company, we needed to take action to meet your needs and the needs of the entire healthcare industry.

But as an environmentally driven company that holds true to our foundational values, we could not, and would not endorse high-temperature incineration as the only solution.

Our company was founded on innovation to meet the immediate needs of the healthcare industry – we needed to return to this.



An Industry Re-Defining Solution

With the problems we were facing as an industry clearly identified, Sharpsmart took a proactive approach to develop an innovative solution for treating sharps waste that delivers a substantially reduced environmental impact whilst also maintaining compliance.

The solution we designed – Our Patented Effluent Retention System.

WHY WE DECIDED OUR SYSTEM NEEDED A PATENT

Following a detailed search for non-incineration technologies for the treatment of infectious and medicinally contaminated Healthcare Sharps (EWC 180103*/09), we discovered that there was no technology in existence that could remove the infectious content without discharging condensed steam (containing the remaining pharmaceutical content) to drain or steam exhaust to atmosphere.

It was obvious to the Sharpsmart Engineering Design team that in order to meet the environmental requirement to contain pharmaceuticals transferred to the effluent and the remaining treated floc, there would be considerable engineering development work.

We identified a need for a novel and unique design to enable full effluent retention to take place – eliminating air and drain pollution with pharmaceutical residue.

Since the modern technology would be unique and novel there was a considerable financial capital investment and we determined that the unique process should be patented to provide protection and enable us to invest in the installation of the system in all of our clinical waste treatment facilities.

Sharpsmart undertook the process of patenting the novel effluent retention process and the patent was granted in April 2019 (UK Patent No. 2572265).

The process of modifying permits within our remaining permitted sites and upgrading the processes to include the patented system is now well underway.

Here's a peek behind the curtain at how it works...

HOW THE EFFLUENT RETENTION SYSTEM WORKS

Our Effluent Retention System is a closed-loop treatment process that uses cutting-edge technology to seamlessly transform hazardous sharps waste into unrecognisable, non-hazardous floc that can be used as fuel to offset the use of natural resources and reduce carbon footprint.

The process can be easily broken down into three simple steps:



1. Sterilisation

It begins with the waste being put through our sterilisation process.



2. Condensing

Steam from the initial waste sterilisation process is diverted through the Effluent Retention Process and condensed using 'non-contact' heat exchanger cooling water.

The clean side water (heated to around 80 degrees centigrade) can be used as clean wash water for our Washsmart reusable sharps container cleaning system and as pre-heated water for the steam-raising plant.

The condensed process water, which following the process is non-hazardous water potentially containing non-hazardous pharmaceutical residues, is collected in IBCs or bulk tanks and used by large Energy-from-Waste (EfW) incinerators as cooling water.



3. Processing

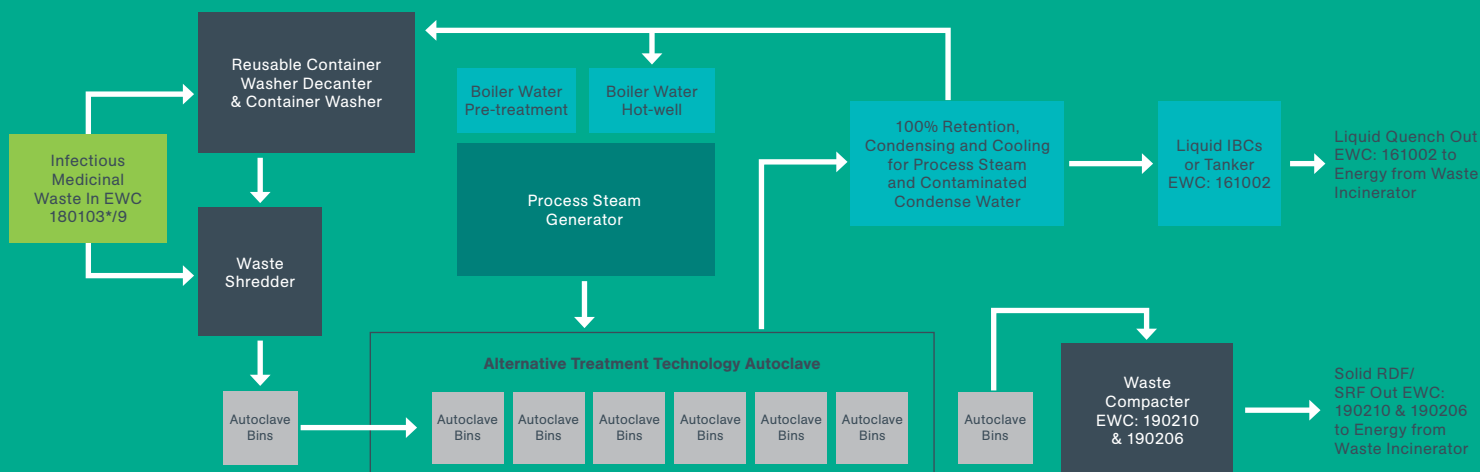
The solid residue (floc) from the plant is processed into a solid recovered fuel, used by cement kilns and power plants as a fossil fuel replacement.



Result

Sharpsmart's unique and patented treatment process renders sharps waste non-hazardous – opening up greater incineration capacity as EfW facilities throughout the UK and Europe now become acceptable as the mode of destruction for the non-hazardous unrecognisable floc, or its use as an SRF.

Plant & Process Layout for Alternative Treatment of Infectious Hazardous Medicinal Healthcare Waste



WHAT SHARPS WASTE CAN OUR SYSTEM PROCESS?

Our Sharps Waste Treatment System was designed to process sharps waste under [European Waste Codes](#):

- ▶ EWC 180103*
- ▶ EWC 180103*/09

Knowing what the Effluent Retention System is and how it works isn't quite enough on its own to demonstrate the ingenuity of the process – to do that, you'll want to know what the benefits of the system are.

Benefits That Extend Into Your Future

Our Effluent Retention System offers benefits that have helped redefine the sustainability landscape of the healthcare industry and revolutionised sharps waste disposal and treatment.

VALIDATING SHARPS WASTE FOR ALTERNATIVE TREATMENT

As we touched on briefly earlier, high-temperature incineration has been the only accepted and compliant process of treating medicinally-contaminated sharps for a long time – a practice that we couldn't endorse and remain true to our values as a company.

The biggest benefit of our Effluent Retention System is the fact that it renders sharps waste non-hazardous, unrecognisable, and validates it for alternative treatment at Energy-from-Waste facilities.

A SUSTAINABLE ALTERNATIVE WITH UNLIMITED POTENTIAL

The Sharpsmart facility where our patented treatment system is located, Stoke-on-Trent, currently has a permitted capacity of 8,000 tonnes per annum.

We developed the technology with the ability to be retrofitted to most industry Alternative Treatment Systems designed for infectious waste treatment.

Our contracted partner for solid recovered fuel (SRF) has unlimited capacity outlets for the floc we're producing – meaning the Sharpsmart Effluent Retention System is officially a genuine high-volume alternative to HTI and a viable contingency for the current ageing High-Temperature Incinerator Infrastructure in the UK.

Our business and investment plan includes further installations to our facilities in the North East and South East of England by the end of 2023.

We're creating more capacity so you never have to deal with a healthcare waste crisis like that of 2018 again.

Revolutionising Sharps Waste Disposal & Treatment

As a company, we cut our teeth with the creation and provision of the world's safest sharps waste containment system, but we were never going to stop there – we're no one-hit wonder.

For as long as there are healthcare professionals like yourself who need safer and more sustainable solutions, we'll continue innovating.

Between our Sharpsmart reusables (the only ISO-compliant reusable sharps containers on the market) and our Effluent Retention System, both the disposal and treatment of sharps waste has been revolutionised.

And that's without taking into account the many other innovations and initiatives we've brought around in harmony with our ongoing mission of making healthcare safer.



Driving Change That Delivers Results for You

We've calculated the carbon footprint of our Effluent Retention System and the results are extraordinary – putting Sharpsmart in the position of providing the world's safest sharps container and the most sustainable sharps waste treatment.

WHAT CAN OUR EFFLUENT RETENTION SYSTEM HELP YOU ACHIEVE?

Since we developed our Effluent Retention System and got it up and running in December 2019, we've processed over 8,300 tonnes of sharps waste.

That's an approximate weight equivalent to 1660 ambulances!

We have processed over 8,300 tonnes of sharps waste

That's an approximate weight
equivalent to **1660 ambulances!**



SharpSMART has calculated the carbon footprint of our Effluent Retention Process using the methodology set out in the 2021 article by Rizan et al: [The Carbon Footprint of Waste Streams in a UK Hospital – ScienceDirect](#).

The calculation adds the emissions attributable to the pre-treatment of healthcare waste – with SharpSMART’s Effluent Retention Process this is applicable to medicinally-contaminated sharps.

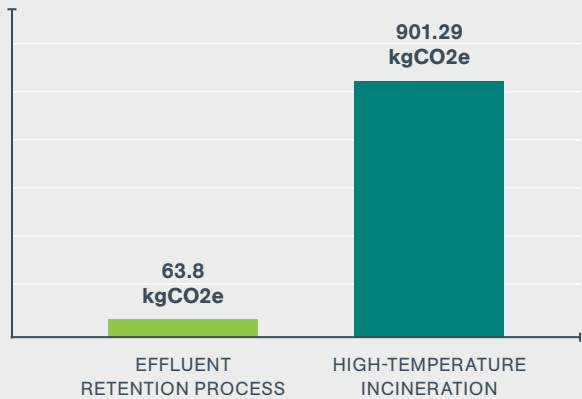
Transportation of waste to the facility and final treatment of material via low-temperature incineration for energy recovery is outside of the system boundary.

The carbon footprint of gas, electricity, and water used in the Effluent Retention Treatment process is summarised in the following table:

EFFLUENT RETENTION PROCESS INPUT	QUANTITY	CARBON FOOTPRINT (KGC02E)
Water supply (cubic metres)	908	136
Electricity KWh	72,001	15,288
Gas (cubic metres)	735,508	135,613
TOTAL		151,037
		Carbon footprint (kgCO2e/tonne)
Material processed (tonnes)	2,366	63.8

This data was collected from monthly meter readings during the period September 2022 – July 2023 (inclusive), and the carbon footprint of each input has been calculated using the [BEIS Greenhouse Gas Reporting Conversion Factors \(2021\)](#).

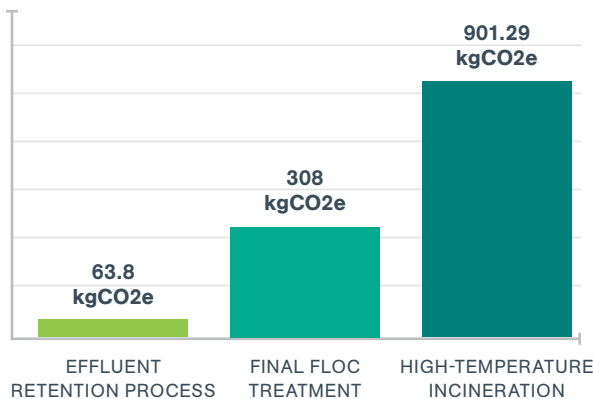
For comparison, the carbon footprint of high-temperature incineration is recorded as 901.29 kgCO2e/tonne according to the [NHS England Clinical Waste Strategy](#).



THE CARBON FOOTPRINT OF OUR FLOC

Once our treatment of the sharps waste is complete and the floc is processed into a solid recovered fuel, it’s sent on to our contracted partner to be used as fuel.

The carbon footprint of the final treatment of the floc material, as a replacement for fossil fuels to provide energy, is 308 kgCO2e per tonne – according to the [2022 annual report from Tolvik UK Energy from Waste Statistics](#).



The World's Safest, Most Sustainable Sharps Waste Management

We hope you've enjoyed this paper, and that you now have a better understanding of the sustainable alternative treatment option for your hazardous sharps waste.

Despite various challenges along the way and after decades of reliance on fossil fuel-powered high-temperature incinerators with no energy recovery method, our Effluent Retention System has become another game-changing solution we can proudly put our name (and our patent) to.

The benefits of this system are redefining the industry, significantly reducing carbon emissions compared to traditional treatment methods and aligning harmoniously with NHS targets and the Clinical Waste Strategy.

Our ongoing investment into sustainable solutions is paying off and Sharpsmart is now in the position of providing the world's safest sharps waste containment system, and the most environmentally-friendly treatment solution for sharps waste.

And the truth is, you can't get either of those things anywhere else.



Take Your Next Step Towards Net Zero

Now you may be thinking, the benefits are appealing and the results look impressive, but what does it mean for me?

We've got you covered.

We can generate a Personalised Impact Report for you based on the data from your facility to show you the CO₂e reductions you can achieve through our Effluent Retention System.

Take your next step towards Net Zero and a greener future for the healthcare industry.

GET IN TOUCH FOR ASSISTANCE WITH UNDERSTANDING AND IMPROVING YOUR CARBON FOOTPRINT



**NET
ZERO**
TOGETHER