



White Paper

Maximising Efficiency and Sustainability in Healthcare Waste Management:

Rectangular Sharps Containers



This white paper explores how rectangular sharps containers enhance healthcare waste management by offering increased capacity, improved safety, and greater sustainability. Independent testing shows significant efficiency gains over round containers, supporting cost savings and environmental goals.

sharpsafe®



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Introduction

A robust sharps disposal system is a critical aspect within healthcare waste management. Failure to provide equipment that complies with the appropriate standards can put healthcare workers, their patients and waste handlers at risk of sharps injuries. Despite advancements and continued focus on sharps safety, sharps injuries remain one of the most common occupational hazards for healthcare workers¹. There are over 3.5 million sharps injuries reported annually by healthcare workers around the globe², which puts considerable financial burden on healthcare practices.

There is increasing pressure on procurement teams to not only choose sharps bins that provide the highest standards of safety but also make significant efforts to minimise the impact on the environment – all while achieving the necessary budget requirements for disposable items.

The shape of a sharp's container plays a crucial role in ensuring safety, efficiency and compliance in the disposal of medical waste.

Considerations such as minimised risk of tipping, controlled access, capacity and storage are all a consideration. The UK became a trailblazer for sustainable healthcare when the NHS became the first health system to commit to Net Zero carbon emissions through the Health and Care Act 2022³. Since this commitment, single-use sharps containers within the UK market have made advancements towards more sustainable manufacturing processes and developed new recycled materials to improve their carbon footprint. However, the shape of the container can itself be more sustainable, with containers being optimally designed to hold more sharps contents per litre, thereby reducing the number of containers needed overall.

This investigation explores the capacity advantages of rectangular sharps containers compared to their round counterparts. By examining design principles, practical applications, and real world benefits, we demonstrate how rectangular containers offer enhanced space utilisation, reduced disposal frequency, and cost savings.

Understanding Sharps Container Design

Sharps containers play an essential role in healthcare settings, ensuring the safe disposal of needles, syringes, and other sharp medical instruments. The ISO standard 23907-1:2013 lays out strict requirements for the design of sharps containers including restrictions around capacity, puncture resistance, design features and labelling requirements. Additionally, all sharps containers must comply with UN3291 testing protocols, which include drop tests to ensure security and leak resistance. All these crucial design constraints put restrictions on the container design and materials that can be used to manufacture the products.

The design impacts not only safety and usability but also operational efficiency and sustainability.

Rectangular and square sharps containers offer several advantages over their round counterparts, particularly in terms of space utilisation and efficiency.

The geometric design of rectangular and square containers allows for better stacking and storage, maximising the use of available space in healthcare settings. This efficient use of space means that more sharps waste can be stored per litre, reducing the frequency of container replacements and thereby lowering overall disposal costs.

Additionally, the flat surfaces of these containers facilitate easier handling and transportation, further enhancing operational efficiency. By optimising the shape of sharps containers, healthcare facilities can achieve significant improvements in both environmental sustainability and cost-effectiveness.

Key Design Factors for Sharps Container Compliance

Ensuring a sharps container meets minimum regulatory standards involves evaluating several critical design elements:



Material Durability

Containers must be made from puncture resistant materials to prevent injuries and leaks. The design should allow for consistent strength across the container, regardless of its shape, and the containers must be able to resist an average of 18N of force and no lower readings than 16N of force to meet the minimum puncture resistance needed for the standards. Studies conducted by Grimmond have argued that optimal puncture resistance for sharps containers should be around 20N to truly minimise the risk of container punctures.⁴ The impact of this restricts the material options for sharps containers.



Capacity Limitations

The ISO 23907-1:2019 standard mandates that the container capacity should never exceed 85%, therefore, there is already restriction on the fill line height of the container. Users may consider this to be wasted space within the lid, however it is essential to ensure that the contents of the container never exceed the aperture and pose a potential risk. This is an important aspect of the container design, having a safe space within the container is an additional feature that prevents contents approaching the aperture allowing for safe disposal of sharps. With this capacity limitation in place it is essential that containers are designed to maximise their space wherever possible. For instance, round containers can often leave unused voids inside the container due to their curved walls, which is especially common when disposing of irregularly shaped items such as scalpels and syringes. In contrast, the design of rectangular containers maximises usable capacity due to straight sides and sharps containers, which are optimal for needle and syringe storage.



Essential Design Features

A well-designed container considers ease of transport and manipulation. This includes ergonomic handles, secure lids, and balanced weight distribution. To meet the ISO standard, the sharp's bin must include a temporary and permanent closure feature, meaning the container is always secure when not in use or being transported between patients. Similarly, containers must have a handle so that contact with the container base is minimised to lower risk of container penetrations.

Compared to round containers, there are some significant benefits to rectangular containers for healthcare settings including:



Stackability and Storage

In high-use areas, such as hospitals wards and A&E, containers are often stored in bulk. Rectangular designs lend themselves to more efficient stacking and storage compared to round designs, which create gaps between units.



Better Alignment with Wall and Work Surfaces

Rectangular containers fit flush against walls, counters, or other flat surfaces, maximising space efficiency in tight or crowded work environments. This allows for better organisation and reduces wasted space compared to round containers, which often need bulky trolleys in larger sizes as they cannot be securely fastened to walls.



An Independent Study – Round vs Square

Selecting the right sharps container requires more than just theoretical assumptions – it demands rigorous, unbiased evaluation to ensure the chosen solution meets real world needs.

Independent testing plays a vital role in this process. By objectively assessing key performance metrics such as capacity, durability, and safety, these studies provide credible evidence that healthcare teams can rely on to make informed decisions. Unlike internal evaluations, independent testing eliminates potential biases, ensuring results are based on standardised, replicable methodologies.

The findings from a recent independent study comparing the capacity of rectangular and round sharps containers are data-driven insights and shed light on how container design impacts waste management efficiency, offering healthcare facilities valuable guidance for optimising their operations.

The Study

An independent study conducted by **Surgical Material Testing Laboratory (SMTL)** in August 2024 evaluated the capacity differences of rectangular and round sharps containers.

The testing focused on four sizes of sharps containers to ensure most areas of healthcare were represented in the study.

Test Methodology

- 1 Sharps containers were assembled as per manufacturer's instructions.
- 2 Once assembled the containers were placed onto a stable surface for testing.
- 3 1ml, 2ml, and 5ml needles and syringes were assembled.
- 4 The needle/syringe assembly was held vertically by the syringe barrel over the centre of the sharps container aperture and level with the top of the aperture. The assembled device was then allowed to drop into the container under gravity.

- 5 Devices were added to the sharp's container in the repeating order of 1ml, 2ml, 5ml, 5ml, 2ml, 1ml etc. until the fill line was breached.

- 6 The number of devices introduced into the sharps container was counted using a calibrating hand tally counter.

- 7 Testing was performed on triplicate samples.



The Test Findings

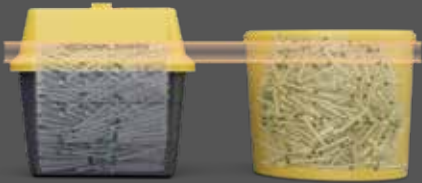
3L Comparison

The 3L Sharpsafe® with a usable capacity of 2.21L was tested against a round 2.5L container with a usable capacity of 2.21L.

The results were as follows:

3L Comparison				
	Sharpsafe	Round	Variance	%
1	41	33	8	19.51%
2	41	39	2	4.88%
3	37	30	7	18.92%
Mean	40	34	6	15.00%
Std. Dev	2	5		

15.00%
greater mean capacity across triplicate samples



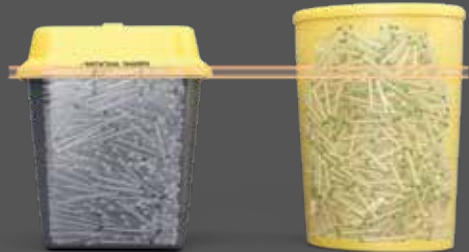
5L Comparison

The 5L Sharpsafe® with a usable capacity of 4.3L was tested against a round 5L container with a usable capacity of 3.98L.

The results were as follows:

5L Comparison				
	Sharpsafe	Round	Variance	%
1	81	82	-1	-1.23%
2	76	75	1	1.32%
3	80	75	5	6.25%
Mean	79	77	2	2.53%
Std. Dev	3	4		

2.53%
greater mean capacity across triplicate samples



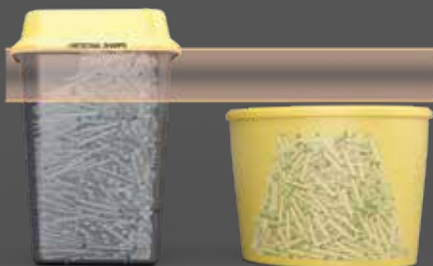
7L Comparison

The 7L Sharpsafe® with a usable capacity of 5.85L was tested against a round 7L container with a usable capacity of 5.8L.

The results were as follows:

7L Comparison				
	Sharpsafe	Round	Variance	%
1	125	84	41	32.80%
2	121	79	42	34.71%
3	118	78	40	33.90%
Mean	121	80	41	33.88%
Std. Dev	4	3		

33.88%
greater mean capacity across triplicate samples



Large Container Comparison

For the test between the largest containers, the largest container available for each range was selected. A 30L Sharpsafe® with a usable capacity of 27.07L was tested against a round 22L container with a usable capacity of 17.86L. These sizes were chosen purely as they are the largest current sizes for sharps containers.

The results were as follows:

22L Comparison				
	Sharpsafe	Round	Variance	%
1	416	338	78	18.75%
2	385	368	17	4.42%
3	434	342	92	21.20%
Mean	412	349	63	15.29%
Std. Dev	25	16		

15.29%
greater mean capacity across triplicate samples



Evaluation

The test results provide clear evidence of the capacity advantages that rectangular Sharpsafe® containers offer over round containers across various sizes.

Increased Capacity Across Most Sizes

The results consistently demonstrate that rectangular Sharpsafe® containers outperform round containers in terms of capacity utilisation:

3L Containers

The Sharpsafe® container shows a 15% mean increase in capacity compared to its round counterpart, with individual results varying between 4.88% and 19.51%.

5L Containers

The capacity mean difference was minimal at 2.53%, however the rectangular shape designed performed comparably.

7L Containers

The capacity advantage becomes more pronounced with larger containers, with a mean increase of 33.88% and minimal variation between tests.

Large Containers (30L vs. 22L)

Sharpsafe® containers held 15.29% more sharps waste on average, offering significant benefits in high-volume settings.



- **3L Containers**
15% increase
- **5L Containers**
2.53% increase
- **7L Containers**
33.88% increase
- **Large Containers**
15.29% increase

The results of the largest container comparison reveal a notable 15.29% capacity advantage for the 30L rectangular container over the 22L round container, though this variance is smaller than might be expected given the significant difference in their usable capacities (27.07L vs. 17.86L).

This suggests that factors such as sharps distribution within the containers, test loading techniques, and the round container's relative efficiency in space utilisation may have influenced the outcome. While the rectangular container's capacity benefits remain clear, the findings highlight opportunities for design optimisation in larger models to further enhance capacity utilisation and maximise operational and environmental advantages.



15.29%

Sharpsafe® containers held 15.29% more sharps waste on average.

*30L vs. 22L

The Importance of Maximising Capacity in Containers

Maximising the capacity within clinical sharps containers should be top of the agenda for any procurement or waste manager. There are several environmental benefits, which firstly help towards our ambitious goals within healthcare to minimise harm to the environment. Furthermore, there is a direct benefit for health boards and trusts alike. Facilities can benefit from a reduction in the disposal frequency with higher-capacity containers. There are also operational efficiencies and an increased focus on compliance with sharps disposal legislation.

It is important to consider these points in more detail:

Enhancing Operational Efficiency

Optimising the shape of sharps containers is vital for maximising their capacity per litre, which in turn streamlines waste management processes in healthcare settings. Containers that can hold more contents per litre require fewer changes, saving valuable staff time and minimising workflow disruptions. This improved efficiency allows healthcare professionals to focus on patient care, rather than frequent container replacements.

Boosting Safety and Compliance

Using containers that hold more per litre decreases the likelihood of overfilling, a critical factor in preventing needlestick injuries and ensuring compliance with regulatory standards. By minimising the need for frequent handling and disposal,

high capacity containers also reduce the risk of accidents, protecting healthcare workers and maintaining a safer environment. This helps facilities comply with the N.I.C.E guidelines for sharps safety as well as compliance with Health and Safety (Sharp Instruments in Healthcare) Regulations 2013.⁵

Achieving Cost Savings

High-capacity sharps containers lead to significant cost savings across multiple areas. Facilities can reduce procurement costs by purchasing fewer containers and minimise waste disposal expenses by requiring fewer pickups or collections. Additionally, fewer containers mean less storage space and reduced logistical demands, lowering overall operational expenses.

Promoting Sustainability

Maximised container capacity supports sustainability goals by reducing the environmental impact of sharps waste management. Fewer trips for waste collection mean lower carbon emissions. Crucially, reducing the number of containers used contributes to lower amounts of plastic waste sent into incineration or for alternative treatment.

Optimising Space Utilisation

Larger capacity containers are especially valuable in space limited healthcare environments. Fewer containers mean less storage space is needed, freeing up room for other critical operations. Additionally, reduced container movement improves overall organisation and handling in dynamic clinical settings.

Conclusion

The findings presented in this paper clearly demonstrate the transformative potential of rectangular sharps containers for healthcare waste management. By offering increased capacity, these containers address critical challenges faced by healthcare providers, including reducing sharps injuries, optimising operational efficiency, and achieving cost savings.

Moreover, transitioning to rectangular containers aligns with broader healthcare sustainability goals. With fewer containers required, organisations can significantly reduce their environmental impact by lowering plastic waste generation and minimising transportation and incineration emissions. This shift supports initiatives like the NHS's commitment to achieving Net Zero carbon emissions, paving the way for more environmentally responsible healthcare systems.

Healthcare procurement teams must balance compliance, cost-effectiveness, and sustainability in their decisions. The data presented in this paper provides strong evidence that rectangular containers like Sharpsafe® deliver on all three fronts. By adopting these innovative designs, healthcare facilities can meet safety standards, manage budgets more effectively, and contribute to a more sustainable future.

The case for rectangular sharps containers is not just one of convenience but a necessary evolution in the management of healthcare waste. Moving forward, adopting these solutions will play a pivotal role in modernising waste disposal practices and improving overall healthcare operations.

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