NuGreen

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NuGreen Innovate UK Knowledge Transfer Partnership:

Diverting Clinical Waste from Incineration Through Innovative Recycling

The healthcare and construction industries together account for an estimated 63% of global greenhouse gas emissions, underscoring the significant environmental pressures created by essential services and infrastructure. Within the UK, the NHS alone produces around 156,000 tonnes of clinical waste every year, much of which is processed through incineration. While incineration has traditionally been the default method for handling clinical waste due to safety concerns, and fuel source for electricity, it comes with substantial environmental and public health consequences. The emissions generated contribute to poor air quality, which is linked to respiratory and cardiovascular illnesses. This, in turn, increases patient numbers and places additional strain on the NHS, ultimately creating more clinical waste and perpetuating a cycle of environmental and operational harm. Breaking this cycle is essential for both planetary and public health and is what we aim to achieve.

Our Innovate UK Knowledge Transfer Partnership (KTP) with Leeds Beckett University is reshaping how the UK approaches healthcare waste management. The project challenges the long-standing assumption that clinical waste must be incinerated by developing a safe, circular, and low carbon- alternative that diverts waste away from disposal and repurposes it as a valuable construction material. If deployed across the entire offensive waste stream of the NHS, our innovation has the potential to save up to 16,902 tonnes of CO_2e annually. This represents a meaningful contribution to the UK's legally binding netzero- commitments and supports the creation of cleaner, healthier communities nationwide.

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At the core of the project is an innovative recycling and material transformation process. Clinical waste is first sterilised and treated to meet stringent safety requirements. Once rendered inert, it is processed into a high performance, low carbon aggregate that can be used in a range of construction applications, including asphalt and concrete. This approach provides a practical, scalable alternative to the extraction of virgin aggregates. Given that the global construction sector consumes an estimated 25–30 billion tonnes of sand each year, a finite and increasingly scarce resource, the introduction of a recycled aggregate not only reduces embodied carbon but also alleviates pressure on fragile natural ecosystems and global sand reserves. This innovation presents a significant opportunity for the construction sector to adopt sustainable material alternatives without compromising technical performance. By reducing reliance on virgin sand and supporting carbon reduction strategies, the project offers clear environmental and commercial benefits.

Research and laboratory testing, so far, have produced highly promising results, particularly in concrete applications. Trials have demonstrated the potential to achieve a compressive strength class of C40, indicating that our innovation meets performance requirements suitable for the most widely used compression strength of concrete globally.

For the NHS, which faces rising waste processing costs, growing regulatory pressures, and operational constraints, the benefits are multidimensional. Our solution offers a more resilient and cost effective waste management pathway that can reduce disposal costs, mitigate environmental health impacts, and enhance the sustainability of NHS estates and infrastructure development. It supports the NHS's broader ambitions under the Greener NHS programme and provides a replicable model for other healthcare systems worldwide.

This KTP demonstrates the value of industry academic collaboration in transforming longstanding environmental challenges into resource efficient, commercially viable, and low carbon opportunities. By rethinking clinical waste not as a liability but as a resource, we are helping to drive a circular, sustainable future for both the NHS and the wider UK construction sector.

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