



The Sewage Sludge Treatment Landscape in the UK

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About UKWIR – UK Water Industry Research



UKWIR Research Programmes (Big Questions)



BQ1 - How do we halve Freshwater Abstractions in a Sustainable way by 2050?



BQ2 - How will we achieve zero leakage in a sustainable way by 2050?



BQ3 - How do we achieve zero interruptions to water supplies by 2050?



BQ10 - How do we remove more carbon than we emit by 2050?



BQ11 - How do we embed and maximise a sustainable circular economy within the water sector by 2050?



BQ4 - How do we achieve 100% compliance with drinking water standards (at point of use) by 2050?



BQ5 - How will we deliver an environmentally sustainable wastewater service that meets customer and regulator expectations by 2050?



BQ6 - How do we achieve a sustainable and resilient sewerage and drainage service for communities and the environment by 2050?



BQ7 - How do we achieve zero customers in water poverty by 2030?



BQ8 - How to continue creating positive value through Asset Management decision making?

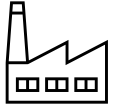


BQ9 - How do we ensure that the regulatory framework incentivises efficient delivery of the right outcomes for customers and the environment?



Biosolids/Bioresources

Treatment of Sewage Sludge in the UK



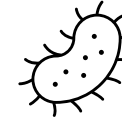
Primary treatment

Generally, wastewater is screened and settled in primary clarifiers to settle out the first portion of sludge.



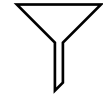
Secondary treatment

Biological processes further degrade organic matter. The resulting secondary sludge is rich in organic material and nutrients.



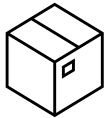
Pathogen reduction

The separated sludge undergoes a treatment step (e.g. anaerobic digestion) at a sludge treatment centre, that lowers pathogen levels to meet regulatory requirements.



Thickening and dewatering

The sludge is thickened, often by centrifuges or belt filter presses to reduce moisture content to around 70 -80%.



Storage

The treated material (Biosolids cake) is stored in permitted areas on site and sometimes further conditioned.



Transport and application

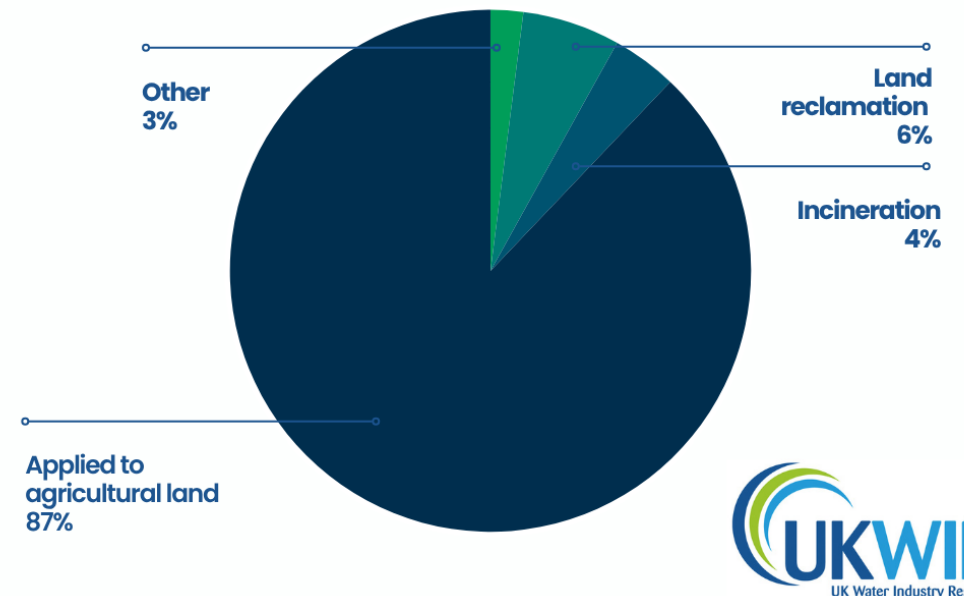
Biosolids are transported to agricultural sites or other approved land uses where they are often stored and then applied according to the regulatory requirements and any local land-application regulations.

Around 53 million tonnes per annum of sewage sludge is collected from about 8,500 wastewater treatment works and processed at around 150 sludge treatment centres

Fate of Biosolids in the UK

- The use of biosolids as a soil conditioner and fertiliser is a long-established activity in the UK.
- Today around 3.5 million tonnes per annum of biosolids are recycled to agricultural land in the UK.
- Biosolids are applied to about 150,000 hectares per annum - 1.3% of the UK's agricultural land.
- There are different forms of biosolids for use on agricultural land:
 - Digested cake – can be stored safely in field heaps before application.
 - Granules & pellets – broadcast on the land.
 - Lime treated cake – containing quick lime or slaked lime, can be stacked in field heaps before application.

The fate of biosolids in the UK



Data used to create this pie chart was from the Biosolids Assurance Scheme website (July 2025)

Benefits of Biosolids to Land

Agricultural perspective

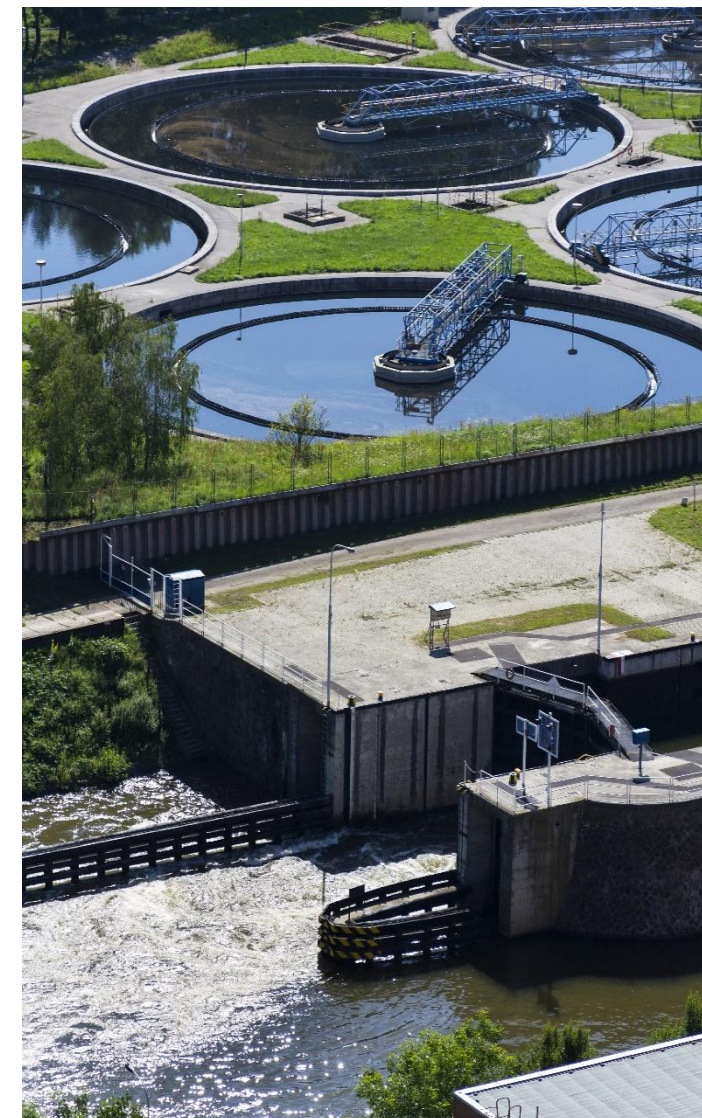
- **Provision of essential plant nutrients** – biosolids supply nitrogen, phosphorus, magnesium, sulphur and trace elements, reducing the need for synthetic fertilisers.
- In 2024/25 biosolids contributed an estimated c.6,000 tonnes of available nitrogen and 40,000 tonnes of phosphate to agriculture in England and Wales.
- **Improvement of soil structure and water-holding capacity** – the organic matter in biosolids increases soil organic carbon, which enhances the soil's ability to retain water thereby supporting crop growth during dry periods.
- **Long-term phosphorus sustainability** – biosolids provide a renewable source of phosphorus, helping to maintain soil health over time.
- **Economic value** – The value of nutrients in biosolids is around £60 million per year, reducing the need for CO₂-intensive manufactured fertilisers.
- **Resilience** – manufactured fertilisers are typically imported from outside of the UK and Ireland.



Benefits of Biosolids to Land

Water Industry Perspective

- **Carbon sequestration potential** – the addition of organic matter to soil can store carbon, contributing to climate-change mitigation efforts.
- **Regulatory compliance and environmental protection** – land application is generally recognised as the best practicable environmental option in most circumstances, and is governed by legislation and codes of practice, ensuring food safety and environmental quality.
- **Economic and market benefits for water utilities** – recycling biosolids to land supports the water industry's resource recovery strategy and can provide a stable revenue stream.
- **Supports circular economy principles** - by returning essential nutrients and organic matter directly to soils.
- **Renewable Energy** – anaerobic digestion of sludge in the UK currently produces significant amounts of methane gas which generates enough renewable electricity to supply over 200,000 homes.



Biosolids Assurance Scheme

Assurance scheme for UK Biosolids recycling to agriculture



Source: Biosolids Assurance Scheme website

Biosolids Assurance Scheme:

- Ensures a single standard for biosolids compliance across all water companies, including external annual audits of processes.
- Provides integrity and confidence to farmers and markets.
- UKAS accredited Certification Body and scheme, which gives confidence to end-users of the products (farmers).
- Allows amendments to be incorporated to continuously improve an already high standard.
- Maintaining BAS accredited status is crucial as it is a requirement for farmers under the Red Tractor Assurance Scheme for their crops.

Pressures on Biosolids to Land



- The use of biosolids in agriculture is facing growing media and public scrutiny.
- This is largely due to the presence of emerging chemical substances in biosolids.
- This presents a growing possible risk to the long-term viability of biosolids use in agriculture, with implications for public and consumer confidence, and possible future tightening of regulatory controls.
- This may also lead to a reduction in the available land bank to recycle biosolids.
- Research is being undertaken to understand the challenges, opportunities and consequence of this.
- Research into alternatives to biosolids use in agriculture is also ongoing.

Understanding the way forward

Research on Biosolids to Land

- UKWIR's work on the impact and benefits of recycling biosolids to agricultural land began in 1994 with a series of projects assessing long-term soil fertility.
- Research since has covered diverse topics including good practice guidance, benefits to soil quality, effects on soil microbial activity, carbon sequestration and GHG emissions and the detection and risks of pathogens in biosolids.
- We're currently investigating the presence of trace substances in biosolids through the multi-phased National Chemical Investigations Programme (CIP) to design and implement research investigations to help better understand the chemical content of sludge, looking at a wide range of chemical substances, including:
 - Heavy metals
 - PFAS and PFOS
 - Microplastics
 - Persistent organic chemicals (POPs)
 - Antibiotic resistance genes
- We are also supporting research to better understand and quantify risks from substances of emerging concern in biosolids and what this means in the wider context of other sources.
- UKWIR research reports can be found at <https://ukwir.org/water-industry-research-reports>



Understanding the way forward

Research into Alternatives to Biosolids to Land

Circular Economy Opportunities

- The industry is also exploring how wastewater and biosolids can play a part in a circular economy, moving beyond a waste disposal model and considering biosolids as a valuable resource stream
- UKWIR research has investigated alternative strategies including advanced thermal conversion (ATC) technologies such as pyrolysis and gasification. This has been further explored by the Water Industry through the Water Innovation Fund (<https://waterinnovation.challenges.org/>)

Transforming Bioresources – the Benefits of Biochar

- The project is investigating biochar production as an alternative to conventional biosolids management practices. Biochar is a charcoal-like product that can be created from sewage by-products, it has several potential benefits, including improving soil fertility, sequestering carbon, and reducing greenhouse gas emissions.

Sewage sludge gasification

- This project explores advanced thermal conversion (ATC) gasification as an alternative approach to biosolids to land. This will investigate the technical and economic viability of gasifying 100% sewage sludge and provide the water industry with the confidence to exploit the technology globally.



Understanding the way forward

Research into Alternatives to Biosolids to Land

PyroPlas: Transforming sewage sludge to sustainable transport fuels and materials

- This project will convert wastewater sludge into high-value sustainable fuel, biochar and carbon. The project will also be investigating the removal of harmful forever chemicals and microplastics. This advanced system will help deliver net-zero and provide a novel approach to generate value from waste.

ALL-Streams HTO

- This project will explore the value proposition of HTO (hydrothermal oxidation) as an alternative bioresources strategy for the water industry in England & Wales.



**Thank you for listening
Any Questions?**