

Introduction to Biosolids



Biosolids is the term used to describe sewage sludge that has been through an approved and robustly monitored treatment process allowing it to be recycled to agricultural land.



Recycling Biosolids to land is recognised by the UK Government and European Union as being the best practicable environmental option in most circumstances, as they provide valuable quantities of nutrients and stable organic matter to agricultural soils.

Annually, United Utilities (UU) recycled, around 345,000 wet tonnes of Biosolids on to 18,000 hectares of agricultural land over 1,000 farms, in our Northwest region. Biosolids recycling is tightly controlled and regulated and we are proud to achieve 100% compliance on all of our Biosolids applications over last 5 years.

Treatment and quality assurance

All of our sewage sludge is treated to required standards before recycling to agricultural land as Biosolids. We employ number of treatment technologies including Advanced Anaerobic Digestion (AAD), Anaerobic Digestion (AD) or lime stabilisation to produced Biosolids in below two standards for different crop types. These treatment process are closely monitored following Hazards Analysis and Critical Control (HACCP) regulations.

Enhance standards

99.9999%
pathogen reduction

Conventional standards

99%
pathogen reduction

United Utilities Biosolids recycling activities are managed by Agriculture Services team. Our Agriculture Advisors

are experienced and FACTS (Fertiliser Advisors Certification and Training Scheme) qualified. We work together to help lower the fertiliser input cost of our farming customers while improving overall soil quality and fertility through Biosolids.

You will be introduced to your agricultural advisor who will assist you throughout the process from initial field assessment to spreading. Our team regularly visit stockpiles and make sure they are safe and sound. Our intention is to ensure that Biosolids recycling to agriculture is safe and sustainable.

Our Biosolids products and recycling process are certified by Biosolids Assurance Scheme (BAS) (<https://assuredBiosolids.co.uk>) which provides the quality assurance of the Biosolids to all farming stakeholders including British Retail Consortium (BRC). As part of BAS certification, our recycling process is independently audited by NSF Certification UK Limited. During last annual audits, our recycling process has continually been recognised as outstanding. We are proud to say that UU Biosolids products are 100% BAS certified.

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Product supply

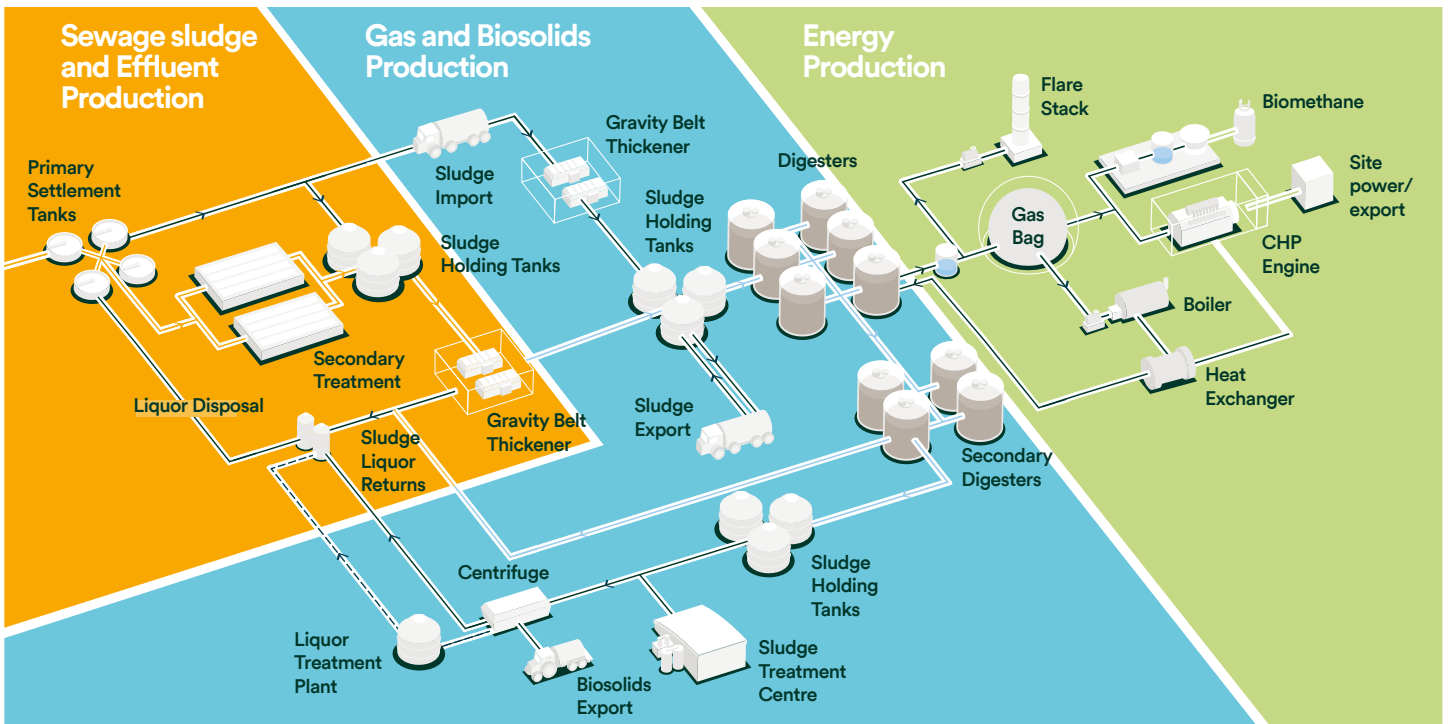
- UU Biosolids product are treated to high standard to comply with UK/EU legislations, voluntary agreements, codes and it is delivered free of charge to farmers.
- Our products are cost-effective source of nitrogen, phosphate, sulphur, magnesium, potassium and other trace elements and will reduce your reliance on mineral fertilisers.

United Utilities deliver Biosolids **FREE** across:



Our treatment process

The diagram below shows the full process of producing Biosolids, from wastewater arrival to Biosolid export. United Utilities also produces gas and energy during the sludge treatment process.



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AgricultureServices@uuplc.co.uk

Biosolid spreading advice



Biosolids are a valuable source of essential plant nutrients and organic matter.



The application of Biosolids to agricultural land is recognised as safe, sustainable and the best practice environmental option for sludge disposal. Biosolids applications are heavily regulated, however our Biosolids Assurance Scheme (BAS) accredited process will safe guard for all aspects of Biosolids use from cradle to grave.


Following our comprehensive compliance checks, including soil testing, field risk assessments and field mapping etc, our FACTS qualified advisors will issue you a "Permit to Transport" document covering all the field your requested for Biosolids, please make sure you follow these advice.

When you are ready to spread your Biosolids, it is extremely important that you inform UU Agriculture services. It would be easy as a quick call to your local Agricultural Advisor or sending us a quick e-mail. Your spreading notifications will also help us to liaise with our local officers from Environmental Health or Environmental Agency etc. and record the spreading information on our system.

Biosolids must be applied to agricultural land in conformance with relevant regulations and good practice to protect the environment from potential diffuse pollution and to minimise any odour nuisance. You must use the field risk map/s supplied by United Utilities for your current year and not spread on the high risk areas highlighted in red. Please also make sure you follow the guidelines listed below.

Biosolids spreading guidelines

- Biosolids must be applied only within the "Sludge fields" boundaries identified on the field maps provided by United Utilities.
- The amount of Biosolids spread on a given field must not exceed the permitted tonnage. The consistency of the spread must be maintained throughout.
- Biosolids must not be applied within 10 metres of a surface water course (CoGAP).
- Biosolids must not be applied within 50 metres of a spring, well or borehole used for human consumption or for dairies (CoGAP).
- Biosolids must not be applied to agricultural land that is waterlogged, flooded, frozen hard or snow-covered (CoGAP).
- Within Nitrate Vulnerable Zones (NVZs), Biosolids must not be applied to agricultural land that has slope of >12 degrees where there is a significant risk of nitrogen getting into surface water.

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- On bare land or stubble, liquid Biosolids must be incorporated into the soil within 6 hours of application. Sludge cake or granules must be incorporated within 24 hours of application where practicable to minimise the potential for odour nuisance and surface runoff into water courses (CoGAP). The time of application and arrangements for incorporation must be recorded.
- Biosolids field applications must be located at suitable distances (depending on Biosolids condition, prevailing wind direction, etc.) from domestic, public, recreational and industrial properties so as not to cause odour nuisance (Code of Practice).
- Biosolids must not be applied between March and August in advance of stock fodder crops (not including maize for silage) for consumption before winter frosts.

Further:

- The rate and timing of Biosolids applications should be same as previously agreed with UU. If you missed the planned spreading window, you should inform United Utilities with revised intended date of spreading. Biosolid stockpiles must spread within 12 months from first delivery date.

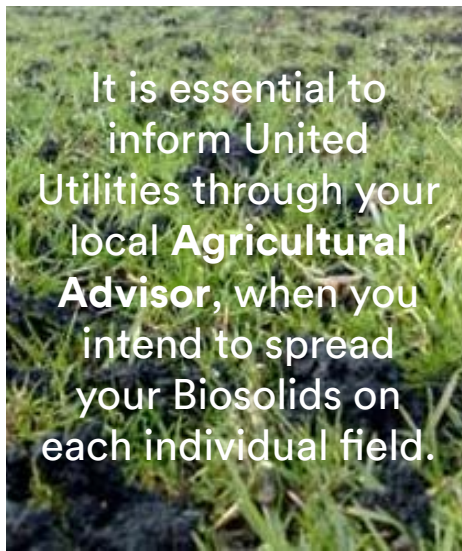
- Biosolids field applications must be undertaken using suitable equipment and trained operators. If you allow Biosolids to enter rivers, streams, or other watercourses, you may be committing a pollution offence.

Spreader Calibration

Uneven spreading of organic manures or spreading into field margins can cause a range of potential issues such as:

- Uneven crop growth
- Lodging (from over application) and diseases
- Reduced yields and poor/uneven crop quality at harvest
- More risk of transferring nutrients to water courses at field margins causing pollution.
- More risk of causing botanical changes in hedgerows and field margins

Spreading fertiliser and organic manures as uniformly and accurately as possible is a requirement in NVZs. **Therefore, spreader calibration (e.g. discharge rate, bout-width, and forward speed) is a very important part of Biosolids spreading process.**



Soil Organic Matter and Biosolids



Soil Organic Matter (SOM) is one of the key determining factors for soil fertility, crop health, yield and vitality. Biosolids are a valuable source of Organic Matter.



“UK soils are reaching crisis point; leading researchers predicting there are only 100 harvests left, while some experts blame poor soil health for the wheat yield plateau. Soil degradation is a huge cost for farming – estimated at up to £1.4bn/year in the Parliamentary Report – Securing UK Soil Health (2015). The two main problems, are soil compaction and the loss of organic matter, accounting for 80% of that figure.”

Benefits of SOM

- Soil organic matter is a vital component of productive soils, it helps to bind soil mineral particles of sand, silt and clay into crumbs (or aggregates) improving soil structure and workability.
- Organic matter can hold up to 20 times its weight in water and can therefore directly affect soil water retention properties, improving soil water holding capacity, water infiltration and reducing surface runoff.
- Organic matter increases soil cation exchange capacity (CEC) and has a number of important functions in terms of crop nutrient provision. It also improves the ability of a soil to resist pH change (buffering capacity).
- Organic matter provides food for the living organisms within the soil. It also enhances soil biodiversity and activity which can help farmers in many ways including efficient nutrient cycling and suppression of pest and diseases.

The amount of soil organic matter depends on a number of factors including soil type, climate and farming system. Low organic matter soils are more vulnerable to compaction and structural damage, which can result in poor crop growth and yields. Organic matter additions to agricultural soils provide many long-term benefits for farmers.

Biosolids are a valuable source of available plant nutrients and organic matter, which can benefit soil structure and fertility. Applying Biosolids to agricultural land is an important means of replenishing and maintaining soil organic matter levels. This is central to the maintenance of soil quality and fertility, and sustainable crop production.

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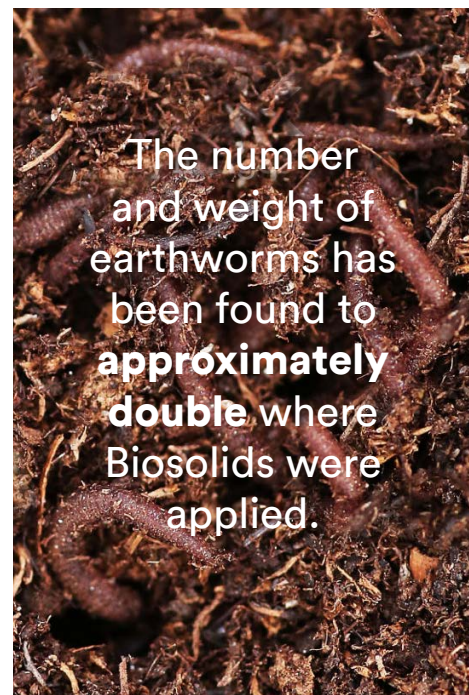


Biosolids and SOM

Based on an application of 250 kg total N/ha (the maximum field N rate permitted in NVZs), a typical digested Biosolids cake application will supply 3-4 t/ha of organic matter.

- Organic matter inputs from repeated Biosolids applications increase the plant available water capacity of soils, which improves the ability of crops to withstand periods of drought and can decrease the need for irrigation water, particularly on drought prone soils.
- Repeated Biosolids applications can increase soil water infiltration rates, thereby improving topsoil drainage properties, and reducing the risks of surface water run-off (hence flooding) and soil erosion.

- The number and weight of earthworms has been found to approximately double where Biosolids were applied. Earthworms have a major influence on soil quality, breaking down and incorporating organic material, improving soil structure and allowing water and oxygen to move through the soil. Biosolids can play an important role in improving soil quality by promoting earthworm numbers.²



¹ Farmers Weekly 30 October 2015.

² Biosolids, Soil Quality and Fertility. Final Report 2013/215; Nicholson, F., Taylor, M., Bhogal, A., McGrath, S. and Withers, P.

Biosolids and Heavy metals



Heavy metal concentrations in modern day Biosolids are much lower than in the past.

Application of Biosolids to agricultural land is safe and sustainable and recognised as the Best Practicable Environmental option by the EU and UK Government¹.

Agriculture application of Biosolids are strictly regulated by EU/UK sludge regulations. United Utilities Biosolids recycling process is robust; we repeatedly achieved 100% environmental compliance for agriculture recycling and aim to continue this in the future.

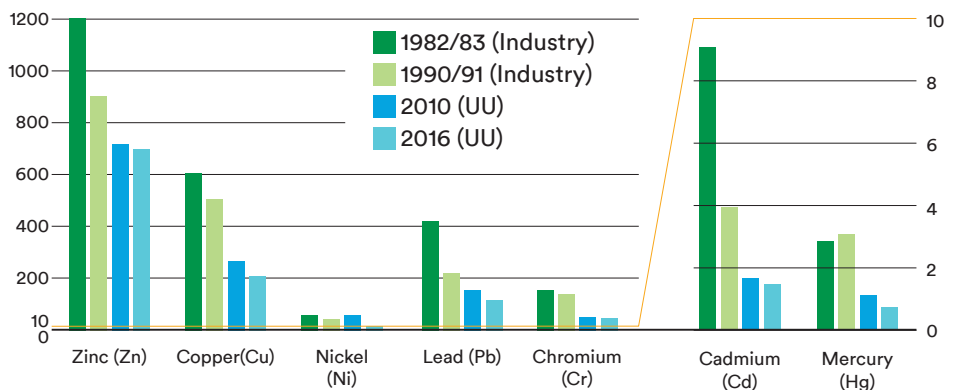
Biosolids and Heavy metals

Heavy metals, also known as potentially toxic elements (PTEs) are present in Biosolids as a result of road run-off, domestic and industrial inputs to the urban wastewater collection system. However, heavy metal concentration in modern day Biosolids are much lower than in the past due to more stringent environmental regulations and associated source control.

The graph below demonstrates 1980/90s industry wide heavy metal levels in Biosolids and recent metal levels in UU products, they evidence a declining trend. (Graph 1)

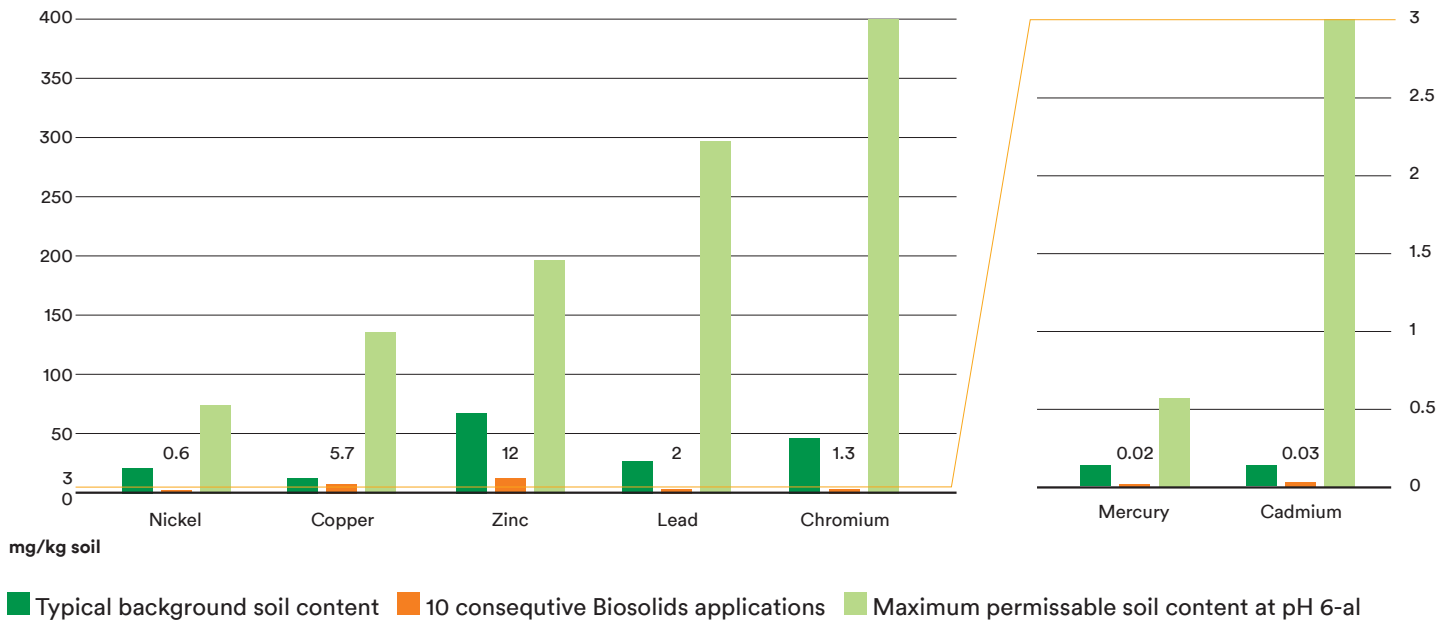
Long-term field studies indicate the low levels of metal additions to soil through Biosolids applications in relation to the amount already exist

Graph 1: Levels of PTEs in Biosolids (mg/kg ds)
Water UK, 2006¹; UU, 2017



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Graph 2: The effect of ten consecutive Biosolids applications in relation to typical background soil content and maximum permissible concentrations for PTEs
Water UK, 2010



in typical background soil (Graph 2)². With this small impact, it is highly unlikely any of your fields would exceed soil heavy metal permissible limits even with repeated Biosolids applications for several decades at a typical rate of 250kg N/Ha.

To minimise the heavy metal impact from Biosolids, UK water industry co-operatively impose a very comprehensive approach; conducting regular analyses for both soil and sludge products. 11 metals are monitored; as well as the 7 above, Arsenic (As), Selenium (Se), Fluoride (F), and Molybdenum (Mo) are also included.

Heavy metals are present in varying amounts in other organic as well as inorganic fertilisers, and mineral phosphate fertilisers contain 9 times more cadmium than Biosolids³. It should also be acknowledged that the presence of heavy metals such as Cu, Zn, Ni, Mo (micronutrients) can be beneficial in some soils.

Our approach

Agriculture applications of our Biosolids are managed to ensure that there are no adverse effects to the soil, plant, or entire food chain. We have a very strict control on heavy metals and UU Biosolids products are regularly analysed in order to ensure that the products are safe and suitable for agricultural application.

Prior to an application of Biosolids, a thorough field assessment will be carried out by our well experienced, FACTs qualified AgriculturAdvisors. Soil samples are taken to ensure that heavy metal levels are below maximum permissible concentrations and Biosolids will only be spread once associated soil analysis are passed as suitable.



1 Water UK, 2006. Recycling of Biosolids to Lands- Revised Biosolids Briefing pack, Water UK, London.

2 Water UK, 2010. Recycling of Biosolids to Agricultural Lands- Final report, Water UK, London.

3 ADAS, 2018. Sources and impact of past, current and future contamination of soils - Appendix 1: heavy metals, ADAS, UK