Position Statement on the Recycling of Biosolids to Agricultural Land

Executive summary

- ✓ Biosolids are a valuable source of major plant nutrients (in particular phosphate, sulphur and nitrogen) and stable organic matter.
- ✓ Biosolids recycling to agricultural land is supported by the Government and fits with the waste hierarchy, resource efficiency and the Circular Economy.
- ✓ Potentially Toxic Elements (e.g. heavy metals) are not considered to be a risk in almost all circumstances due to low levels in biosolids.
- ✓ There is no evidence to suggest Persistent Organic Pollutants (POPs) or microplastics pose a significant risk to the environment or human health.
- ✓ Pathogens are well controlled via a multi-barrier approach to food safety and evidence to date suggests biosolids recycling is not an important factor in the development of Anti-Microbial Resistance.
- ✓ The water industry is continuing research into emerging POPs as well as microplastics and other potential contaminants.
- ✓ The water industry continues to work with other sectors to review evidence and focus on the reduction of contaminants at source.
- ✓ Biosolids recycling to agricultural land is a well-controlled activity due to the range of legislative, good practice and other controls that are pulled together in the Biosolids Assurance Scheme, which is independently audited by a UKAS accredited Certification Body, to ensure it is safe, sustainable and provides benefits to crops and the environment.

Who are ABL and what is BAS?

Assured Biosolids Limited (ABL) is an independent not-for-profit organisation which owns and operates the Biosolids Assurance Scheme (BAS). The BAS provides reassurance to food chain stakeholders and the public that BAS Certified Biosolids are safely and sustainably recycled to agricultural land. The UKAS accredited scheme is based on regulations and best practice, is overseen by a Technical Advisory Committee comprised of stakeholders and industry experts, and is audited by a third-party Certification Body to demonstrate that members of the Scheme are conforming to its requirements. The BAS, which currently covers *c*. 100% of biosolids recycled to agricultural land in the UK, provides rigorous controls on source materials, effective treatment, transport, storage and application to land.

Further information on the BAS, biosolids in general, Position Statements on other topics (e.g. microplastics and coronavirus) and contact details (if you have any questions) can be found at https://assuredbiosolids.co.uk

What is Biosolids?

Biosolids is the term used to describe sewage sludge that has been treated to significantly reduce its fermentability and potential hazards. Sewage sludge must be treated by an approved process which has been designed to control microbiological contaminants. All treatment activities must have an individual (site specific) process control plan which has been validated (i.e. subjected to intensive testing) to ensure the biosolids produced will continuously meet the appropriate product standard.

Benefits of biosolids recycling to agricultural land

Phosphate, the oxide form of phosphorus, is a finite, non-renewable natural resource which is essential for crop growth. Phosphorus is a key component of DNA which is found in every cell and phosphorus is also a crucial element in ATP (adenosine triphosphate), the molecule formed during photosynthesis, which provides plants with their energy and is also essential for animals and humans. Given rock phosphate is only mined in a few countries, some of which do not export to the UK, having a sustainable UK source is hugely important. Biosolids is a particularly valuable source of phosphate, with a typical application supplying enough phosphate to meet the requirements of two typical arable crops. It is vital phosphate is used responsibly; if phosphorus gets into watercourses it can cause eutrophication (excessive nutrification) and negatively affect the quality of the receiving waters. Phosphate in biosolids is substantially bound to minerals (e.g. iron or aluminium) or organic matter, therefore is at low risk of phosphate losses. Additionally, the controls in the BAS prevent phosphate overloading to soil and fit with good nutrient management (e.g. the requirements of the Farming Rules for Water).

Nitrogen is essential for plant (and animal) growth, development and reproduction. It is critical for amino acid formation, which produce protein and chlorophyll that plants use to produce energy. Despite nitrogen being one of the most abundant elements, applications of nitrogen typically doubles crop yields. Biosolids contains some nitrogen that is available for immediate crop uptake, but most of the nitrogen is in an organic form, so becomes available over time. It is therefore significantly less likely to leach or volatilise and is a lower risk to water or air quality. Manufactured nitrogen fertiliser is the primary source of plant available nitrogen for crops but with the disadvantage it is produced using vast quantities of fossil fuels (3.5 – 7 kg Co2e per kilogram of nitrogen). Using biosolids in conjunction with manufactured fertilisers will decrease farming's carbon footprint at a time when farmers and government are aiming for zero carbon within the next 20 – 30 years. Importantly, biosolids recycling to agricultural land fits with resource efficiency and the Circular Economy.

Sulphur: due to improvements in air quality sulphur deposition has significantly reduced causing deficiency in sensitive crops (e.g. grass, oilseeds) and all crops depending on soil type and climatic conditions. Research shows biosolids can supply valuable quantities of crop available sulphur helping prevent deficiency and supporting healthy crop growth.

Organic matter: biosolids is a valuable source of stable organic matter that, following repeated applications, has been shown to improve soil organic matter. Improving soil organic matter levels is only part of the story, as this brings with it numerous other benefits to the farmer including improved soil structure and workability, increased biological activity, increased water holding capacity and reduced soil erosion. Increasing soil organic matter also benefits society more widely, particularly helping agriculture meet its net zero carbon aspirations by sequestering carbon in the soil and also provides other benefits (e.g. flood water attenuation).

Potential disbenefits

Like all organic materials, and even some manufactured fertilisers, biosolids contains small amounts of elements and compounds that need to be managed.

The quantity of **Potentially Toxic Elements (PTEs)** (also known as heavy metals or in certain situations some can be trace elements) applied to agricultural land via biosolids has fallen to levels well below regulatory limits and even below those applied by some livestock manures and therefore in almost all circumstances are not of concern. This is due to the reduction in UK heavy industry over the last 50 years and stringent trade effluent controls; the concentrations of PTEs in biosolids have more than halved from levels in the 1980's.

Persistent Organic Pollutants (POPs) are found throughout the environment from a range a natural and anthropogenic sources (e.g. incomplete combustion, industrial by-products, industrial chemicals, volcanoes, forest fires, pharmaceutical and personal care products-PPCPs). Research to date has shown that biosolids is not a key source of many POPs including polychlorinated biphenyls-PCBs, polycyclic aromatic hydrocarbons-PAHs, polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans-PCDD/Fs. The water industry continues research into emerging POPs (e.g. perfluorochemicals-PFCs, polychlorinated alkanes-PCAs) to ensure biosolids do not present a significant source.

It has been well documented that **microplastics** have been found in all areas of our environment from the depths of the ocean to the air that we breathe. The existence of microplastics in biosolids is a very small part of the overall picture of total plastics production (estimated at >9 billion tonnes to date) and their environmental impact. It appears that the types and quantities of microplastics entering wastewater treatment have almost certainly increased in recent years, primarily due to the growing use of plastics in domestic products combined with a lack of consumer awareness of their fate. The water industry is supporting research to generate a robust evidence-base and action across all sectors to understand the issues and find sustainable solutions including reduction at source and working with customers and others on education programmes. There is currently no evidence to indicate that recycling biosolids to agricultural land poses any significant risk from an environmental and human health perspective.

Concerns around **pathogenic micro-organisms** (e.g. bacteria, viruses, protozoa) led to the creation of the Safe Sludge Matrix and risk assessment work to ensure it was sufficiently robust. The multiple barrier approach (e.g. controls on sewage sludge treatment and biosolids use) in the Safe Sludge Matrix and more recently the BAS, provides robust protection and studies undertaken or published since have not changed this position. Anti-Microbial Resistance (AMR) is an area of scientific interest and it is important research continues on this. Information to date suggests biosolids recycling is not an important factor in the development of AMR in soils.

It is important that research continues, particularly on microplastics and emerging compounds, to ensure biosolids recycling remains safe and truly beneficial. Research programmes like the Chemical Investigation Programme, which is partly funded by the water industry, and other more focused projects such as those investigating microplastics must continue. However, based on the available evidence biosolids recycling in accordance with the BAS is a safe and sustainable activity.

Regulations and codes of practice governing biosolids recycling

The vast majority of the biosolids recycled to agricultural land is done so under the Sludge (Use in Agriculture) Regulations which are over 30 years old. However, numerous controls, which go beyond the scope of the regulations, have been introduced in the intervening years; these include but are not limited to:

- The Safe Sludge Matrix
- Water UK's HACCP guide
- The Code of Practice for the Agricultural Use of Sewage Sludge
- The Biosolids Nutrient Management Matrix (in England and Wales)

Since the Biosolids Assurance Scheme was introduced in 2015, additional controls and restrictions have been added which now go beyond those required by the regulations and Codes of Practice to ensure BAS Certified Biosolids is a quality product and to reassure stakeholders that its recycling to land is safe, sustainable and beneficial.

Potential alternative outlets for biosolids

The most recent data shows that around 87% of sewage sludge is recycled as biosolids to agricultural land, which recycles nutrients, provides organic matter to soil and has the lowest carbon footprint. About 5% is recycled to land restoration which is a good recycling solution, but is limited to selected locations (e.g. restoring former industrial sites or landfill sites) and is typically a one-off application. The remainder is used in industrial processes (e.g. co-combusted in cement kilns), or incinerated. Following the waste hierarchy means recycling should be the preferred option and less sustainable options, such as energy recovery, should be avoided. Modern advanced thermal processes (e.g. pyrolysis, hydrothermal carbonisation) have been investigated for a number of years with some facilities built, but they are operating primarily on an experimental basis.