# The risks of sewage sludge spreading on agricultural land and the need to re-evaluate
# Joint briefing, March 2026


## Summary

Sewage sludge, also known as biosolids, contains a complex mix of harmful contaminants that pose a potential risk to the environment and human health.

This briefing summarises the argued benefits and growing concerns regarding the spreading of sewage sludge on agricultural land. It identifies:

- Gaps in the new regulatory framework
- Recommendations to align with the EU Urban Wastewater Directive
- A need to adopt the precautionary principle by introducing a moratorium on sewage sludge spreading while the risks and alternatives are investigated.


## Introduction

The Environmental Rights Centre for Scotland (ERCS) is an environmental law charity and advocates for policy and law reform to improve environmental rights and access to justice.

Fidra shines a light on environmental issues, working with the public, industry and governments to deliver pragmatic, evidence-based solutions to pollution.

The Scottish Government replaced the outdated 1989 Sludge Use in Agriculture regulations with the Environmental Authorisations (Scotland) Amendment Regulations 2025 (new schedule 18), which came into force on 1 November 2025 but concerns over unregulated contaminants remain.[1]

This joint briefing from ERCS and Fidra summarises the argued benefits and growing concerns regarding the spreading of sewage sludge on agricultural land and recommends further investigation into the harms and alternative options for its management.

## What is sewage sludge spreading

Sewage sludge, also known as biosolids, is a by-product of wastewater and sewage treatment. Treated sewage sludge is commonly spread on agricultural land because it contains nutrients that contribute to soil fertility and is viewed as a low-cost and circular use of a waste product.

However, sewage sludge does not just include wastewater from household toilets and drains but waste from a range of different sources, including urban runoff, landfill leachate, and industrial and hospital effluents. The agricultural use of sewage sludge is therefore under increasing scrutiny because it contains potentially hazardous contaminants such as microplastics and PFAS[A] (known as forever chemicals), which are not destroyed during sewage and sewage sludge treatment processes.

These contaminants can build up in receiving soils and enter the water environment, affecting the health of terrestrial and aquatic life. Crop uptake of contaminants can also occur, harming human health.

It is for these reasons that concerned stakeholders are calling for a ban on sewage sludge land spreading until the risks to the environment and human health are thoroughly understood and mitigated.

For example, Jo Hirst and Doreen Goldie have campaigned on this issue since 2009.[2] Fighting Dirty took unsuccessful legal action against the Environment Agency over the removal of a target date for the introduction of its Sludge Strategy.[3] River Action and Greenpeace recently handed over a petition with 60,000+ signatures to the UK Under-Secretary of State for the Environment to 'keep toxic sewage off our farmland'.[4]

These increasing concerns have informed Defra's recent consultation to revise the regulatory framework for sludge applied to agriculture with the following objectives:

1. To make the sludge regulatory framework more agile and responsive to contaminants of concern currently not regulated, such as microplastics, anti-microbial agents and forever chemicals.
2. Clarify requirements related to nutrient application of sludge.
3. To improve oversight of sludge management practices including by increasing resource for regulatory compliance activities.
4. To ban the spreading of untreated sludge on land in all circumstances.[5]

[A] Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS)

## Argued benefits and risks of sewage sludge spreading

### Argued benefits

- **Nutrients for soil:** Sewage sludge provides a low-cost supply of nutrients such as nitrogen, phosphorus and organic matter to farms and reduces Scotland's reliance on environmentally damaging chemical fertilisers. In the UK, around 87% of the 3.6 million tonnes of treated sewage sludge produced annually is recycled to agricultural land. This is roughly equivalent to a saving of £25 million in inorganic fertiliser costs (September 2022 prices).[6] However, sewage sludge only represents approximately 2% of the total tonnage of bulky organic waste materials applied to Scottish land,[7] as higher quality animal manures and slurries are available. This comparison of sewage sludge use in agriculture against other waste materials does not negate the importance of understanding and mitigating environmental risks.[8]

  **Circular economy:** The use of sewage sludge on agricultural land can support a circular economy through nutrient recycling and by diverting a waste product away from landfill and incineration. In 2023/24, Scotland applied 148,458 dry tonnes of sewage sludge to land. 64,583 tonnes of this went to agricultural land and 83,875 to land reclamation (improving brown-field land in forestry and industrial land).[9] In Scotland in 2022, a total of 105,540 dry tonnes of sewage sludge was disposed of: 52,649 tonnes of this went to agricultural land, 26,491 tonnes to composting and land reclamation, 26,021 tonnes were incinerated and 378 tonnes went to landfill.[10] Additionally, SEPA reports that sewage sludge from England and Northern Ireland is used for spreading in Scotland,[11] and in very rare cases Scotland exports sewage sludge to England.[12] In both cases, the amounts are unknown.

### Risks

- **Toxic contaminants**: Sewage sludge is a sink for pollutants removed from domestic and industrial wastewater during treatment processes. It contains pharmaceuticals, microplastics, PFAS, heavy metals, bisphenols, PCBs,[B] parabens, pathogens, antibiotic-resistant bacteria and antibiotic-resistance genes. Aside from the monitoring of a handful of heavy metals and the removal of pathogens during sewage sludge treatment, complex mixtures of contaminants remain and are released into the environment where they can accumulate and contaminate food chains.[13]

[B] Polychlorinated biphenyls

In 2025, the U.S Environmental Protection Agency published a draft Sewage Sludge Risk assessment which found that PFOS and PFOA[C] concentrations in sewage sludge can exceed their acceptable levels for human health risks.[14]

PFAS are incredibly persistent and can be highly mobile, meaning they can easily accumulate in soils, drinking water supplies or crops. This leads to exposure for both wildlife and humans, which is associated with a variety of adverse health effects.[15]

- **Environmental impact**: There is growing concern that continuous sludge application may lead to long-term soil degradation, water pollution and harm to biodiversity.

  In 2025, the James Hutton Institute reported a 1450% increase in microplastic levels in soil samples after four years of repeated application.[16] A 2025 Defra report recommended reducing sewage sludge application by 50-95% by 2030 as a measure to tackle microplastics.[17] Similarly, the James Hutton Institute found that microplastic buildup in receiving soils occurs after as few as two applications of sewage sludge, having an acute impact on soil biota and potentially reducing soil nutrient cycling and health. Their report also highlights the cocktail effect, where a complex mixture of chemical contaminants, such as those found in sewage sludge, may exacerbate any risks to soil or human health.[18]

  Beyond the contaminants in sewage sludge, its application to land also contributes to the loss of nutrients (nitrogen and phosphorus) into rivers through runoff, erosion and leaching.[19] This can cause eutrophication and the occurrence of algal blooms that block sunlight and lower oxygen production for aquatic life, killing them. Almost a quarter of the sludge storage sites identified in Scotland were within nitrate vulnerable zones, areas designated to protect surface and groundwaters from nitrate pollution.[20] Water quality improvements expected under the Farming and Water Scotland rules, supported by tighter Environmental Authorisations Regulations enforcing organic fertiliser (including sludge) applications based on soil and crop needs, should be carefully scrutinised.[21]

  PFAS has been connected to immunotoxicity in otters and has been found in the livers of otters in England and Wales. The PFAS was sourced from effluent from wastewater treatment works and runoff from land treated with sewage sludge.[22]

- **Odours and public health risk**: Residents living near land where sludge is spread often report foul odours, respiratory issues, and concerns about potential health effects from airborne contaminants or contaminated crops.

[C] Perfluoro octane sulfonate (PFOS) and Perfluorooctanoic acid (PFOA) – types of PFAS

These concerns are prominent in Scotland, with public complaints resulting in the Scottish Government's odour emissions assessment in 2018.[23] The assessment provided recommendations for the practice of sewage sludge spreading to agricultural land to decrease the adverse effects of odours on nearby residents, but the recommendations were not adopted in the amended 2025 regulations.

- **Poor regulation and enforcement**: There have been a number of issues raised by the public on sewage sludge spreading.

  In 2013 and 2014, complaints were made concerning the storage, spreading and odour of sewage sludge. As a response, the Sludge Review, 2016 was published, listing a number of recommendations to improve sewage sludge regulations in Scotland.[24]

  However, since the Sludge Review, there has been limited progress to address residents' concerns. A Freedom of Information request in 2021 by Jo Hirst and Doreen Goldie resulted in the release of a previously unpublished five-part risk assessment report on sewage sludge commissioned by the Scottish Government[25] which included the following: Project summary, [26] Human Health Risk Assessment of Potentially Hazardous Agents in Land-Applied Sewage Sludge,[27] Odour Emissions Assessment,[28], Sewage sludge processing systems in Scotland, [29] Community Concerns regarding the Impacts on Human Health and the Environment arising from the spreading of Sewage Sludge to land.[30] No action was taken by the Scottish Government following the completion of these reports.

  In 2022, ERCS submitted a representation to Environmental Standards Scotland on the failure to implement the Sludge Review. Environmental Standards Scotland responded that no action would be taken because a consultation on new sewage sludge legislation was soon to be published.[31]

## Do the new regulations go far enough?

Almost 10 years after the Sludge Review was published, the Environmental Authorisations (Scotland) Amendment Regulations 2025 were introduced to consolidate and simplify Scotland's complex environmental regulatory regimes (water, waste, radioactive substances and Pollution Prevention Control).

The new regulations include a new schedule for sewage sludge application (new schedule 18), which adopts a number of recommendations from the Sludge Review. However, we have highlighted that the regulations still do not go far enough to address concerns over monitoring and enforcement, the duty to carry out animal health inspections, and understanding the risks of all toxic contaminants in sewage sludge.[32]

Since the Environmental Authorisations (Scotland) Amendment Regulations 2025 came into force, the EU Sewage Sludge Directive (87/278/EEC)[33] has been updated under the revised

Urban Wastewater Directive (EU) 2024/3019, taking effect in August 2027.[34] The new directive highlights the need to:

- Systematically monitor microplastics when sludge is recycled in agriculture.[35]
- Adopt a methodology for measuring PFAS in urban wastewater from which sewage sludge is derived.[36]
- Mandatory additional treatment to remove micropollutants from treated wastewater.[37]
- Strengthen the polluter-pays principle by ensuring that those responsible for pollution bear 80% of the quaternary wastewater treatment costs for remediating it.[38]

The EU also introduced a new Directive on Soil monitoring and Resilience in September 2025.[39] This directive highlights the need to monitor soil contaminants that could pose a risk to health and the environment. These include pesticides, PFAS and microplastics, all of which are introduced through the spreading of sewage sludge.

The EU Sewage Sludge Directive contaminants list urgently needs updating, but given the increasing concerns, some progressive countries have introduced restrictions and / or bans on the use of sewage sludge in agriculture. Appendix 1 provides a list of these.

## Challenges to banning sewage sludge spreading

While banning sludge use in agriculture and land reclamation may reduce environmental and health risks, it raises several challenges.

- **Waste disposal**: Without land application, sewage sludge must be disposed of through alternatives such as incineration or landfill, both of which carry their own environmental impacts and are more costly. When sewage sludge spreading was banned in the US state of Maine in 2022, the material went to landfill due to the lack of incineration facilities. This resulted in landfills reaching capacity and being expanded in size.[40]

  Incinerating sewage sludge would increase greenhouse gas emissions. The amount of waste incinerated in Scotland in 2024 has increased 14.7% since 2023 and has more than tripled since 2011 (354%), producing more than one million tonnes of carbon dioxide.[41] Incinerating all sewage sludge in 2024 would have added 4.5% to the total tonnage of incineration waste.[42]

- **Nutrient loss**: Sewage sludge contains nutrients that could otherwise reduce the need for synthetic petrochemical fertilisers, which themselves are known to contain harmful chemicals, including PFAS. Banning agricultural sewage sludge use may lead to increased reliance on non-renewable mined minerals and fossil-fuel-based fertilisers.

- **Financial and infrastructure limitations**: Remediation technology for hard-to-destroy chemicals such as PFAS is largely still in development and is expensive.[43]

Unfortunately, the current alternatives to applying sewage sludge to land are incineration and thermal conversion.[44] These outlets, coupled with the extraction of nutrients, metals and energy are currently the only safer alternative disposal routes that enable destruction of contaminants such as PFAS (requiring temperatures of at least 850 °C). Unintended consequences include air pollution, ash disposal via land or landfill, greenhouse gas emissions, and the associated health risks.

### Summary

The recycling of sewage sludge to land might seem to offer a circular solution to waste management, but the presence of emerging contaminants has led to increasing scrutiny and concerns over risks and their mitigation. However, international examples highlight feasible alternatives and challenges associated with them that can be overcome.

## Conclusion and recommendations

We need to adopt the precautionary principle and reevaluate the risks of sewage sludge to environmental and human health. Source control of contaminants is the preferred option to avoid contamination of waste in the first place and to avoid the need for increased incinerator capacity.

***In the interim, a moratorium on the agricultural use of sewage sludge should be introduced until such a time that contaminant levels are acceptable for sewage sludge to be used as a beneficial nutrient and organic matter-rich material.***

In the Scottish Government's consultation paper to amend the Environmental Authorisations (Scotland) Regulations 2018, the proposed amendments stated, "In line with the Scottish Government's commitment to remain aligned, where possible, with EU law, we intend to await the results of this review and will consider further potential amendments to the 2018 regulations as appropriate as a consequence of any new EU legislation."[45]

With the Urban Wastewater Directive (EU) 2024/3019 set to take effect in August 2027, we recommend:

- Stop all imports of sewage sludge to Scotland.
- **Introduce a moratorium while the risks and alternatives to sewage sludge land spreading are investigated.**

- In line with the Urban Wastewater Directive (EU) 2024/3019, introduce monitoring of microplastics and PFAS in wastewater and mandate quaternary treatment of wastewater to remove micropollutants such as pharmaceuticals.
- Monitor and investigate the potential harm of unregulated known and emerging contaminants in sewage sludge and wastewater. Expand testing to include PFAS, microplastics, pharmaceuticals and other contaminants of concern (e.g. flame retardants, anti-microbial agents and bisphenols).
- In line with the Urban Wastewater Directive (EU) 2024/3019, introduce extended producer responsibility scheme, where producers of products that release micro-pollutants into urban wastewater must fund at least 80% of the costs of quaternary treatment to remove these pollutants.
- Invest in source control measures to reduce harmful contaminants (e.g. full ban of PFAS chemicals).

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# Appendix 1: Countries which have introduced bans or restrictions

- **Netherlands** (banned in 1995): Banned agricultural spreading of sewage sludge due to concerns about hazardous substances and pathogens. The waste is incinerated but has been exported to the UK in the past. An FOI request revealed that 27,500 tonnes were shipped to the UK in February 2020.[46]
- **Switzerland** (banned in 2006): Introduced a phased ban of sewage sludge due to concerns about persistent pollutants. In 2003 spreading on fodder crops and vegetables was banned. In 2006, spreading on all other types of cultivation was banned. In some individual cases this ban was delayed till 2008.[47] The waste is incinerated. In 2016, the recovery of phosphorus from sewage sludge was made mandatory before incineration.[48]
- **United States**: Regulations vary by state, with some states imposing bans or restrictions on the use of sewage sludge. These bans or restrictions are due to PFAS contamination of soil, groundwater and the potential increased cancer risks from consuming milk, fruits and vegetables from where sewage sludge was applied.[49] Currently, there are no federal regulations for PFAS in sewage sludge. The U.S Environmental Protection Agency is currently conducting a risk-based assessment of PFAS in sewage sludge.[50]

  States with bans include:
  - Maine (2022).[51]
  - Connecticut (2024).[52]
  - Vermont (2025) – A Bill is currently under consideration.[53]
- US States with restrictions include:

| State | Year restriction was introduced | Mandatory PFAS[D] monitoring of sewage sludge | PFAS threshold in sewage sludge that prohibits spreading | PFAS source reduction | Awareness raising of PFAS in sewage sludge for farmers | Other |
|---|---|---|---|---|---|---|
| **Michigan**[54] | 2021 | x | x | x | x | |
| **Colorado**[55] | 2023 | x | Triggers Source Control Program[56] | x | | |
| **Massachusetts**[57] | 2023 | x | Developing | | | Agricultural PFAS Relief Fund for farmers who have suffered losses due to PFAS contamination |
| **New York**[58] | 2023 | x | x | | | |
| **Maryland**[59] | 2024 | x | x | | | No new permits for sewage sludge spreading |
| **Mississippi**[60] | 2024 | x | x | | | |
| **Oklahoma**[61] | 2024 | | | | | Warning label on products derived from PFAS contaminated sewage sludge |
| **Wisconsin**[62] | 2024 | x | x | x | x | |

    - In 2025 and 2026, several Bills in multiple states have been introduced to set varying controls on PFAS in sewage sludge. Their progress is actively tracked.[63]
- Other countries which are tightening restrictions on the use of sewage sludge are: **Germany** restricts spreading and has strict contaminant limits[64] and will make phosphorus recovery from municipal sewage sludge mandatory in 2029;[65] **France, Spain** and **Italy** now mandate monitoring PFAS and microplastics in sludge;[66] **Denmark**

[D] Regulations regarding PFAS are specific to PFOS and PFOA

has a limit for PFAS in sludge;[67] In **Sweden** introduced strict quality requirements and support for phosphorus recycling and pollution control.[68]

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