



The use of alum sludge and sewage sludge as a soil improver on Barra



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Request:

Can alum sludge and sewage sludge be used as soil improvers for beneficial use on the isle of Barra, instead of transporting off the island for land fill disposal? I understand that there are issues of soil erosion on the island, and they are wondering if alum sludge could be of beneficial use in this situation.

What we really need to know is what are the regulatory risks and constraints associated with the beneficial use of sludge and would the proposed use be beneficial?

Initially, I simply need your advice on the regulatory risks, whether or not there is a case for beneficial use of Sludge on the Island and what the best way forward might be to progress such a project.

Response:

Sludge as a soil improver

A key guiding principle is that *the use of organic wastes as a fertiliser should only be used on land that would normally be fertilised as part of its management regime* otherwise it becomes a waste disposal route rather than a beneficial recycling activity. This is paramount to both the external perception of the activity and to environmental protection.

Alum sludge is composed of aluminium hydroxide. This material should not be too soluble in most soils. Aluminium minerals are already major components of soils. The solubility of these minerals and therefore aluminium concentration is mainly controlled by soil pH. Therefore aluminium is not likely to be a problem.

Whether the alum sludge is safe or not will depend upon the concentrations of contaminants in the water being purified. If there are potentially toxic element present such as Zn and Cu, soil suitability to receive the sludge would have to be assessed. Although this material may not be subject to the Regulations controlling the use of sewage sludge, it is recommended that for materials with enhanced metal levels, they provide a measure of good practice.

Adding alum sludge to soil is likely to induce P deficiency in plants, because of the high sorption capacity of freshly precipitated aluminium hydroxide to adsorb P. However the waste water may contains variable amounts of P. Therefore more information on the P content would be needed to predict the impact on soil P.

If alum sludge is added to acid soils it may raise soil pH, because the pH of the sludge is probably in the region 6.5-7.0 (the pH of minimum solubility of aluminium hydroxide). This may run the risk of leaching Al and SO₄ to streams and subsequent acidification.

Overall, given the unknown proposed application rates and soil types, it is likely to have detrimental, and no beneficial, effects in anything other than minimal application rates. If it were added to agricultural, alkaline sandy soils derived from shelly sand on Barra it may cause problems for crop nutrient, trace element uptake and trace element bioavailability. In addition, much of the more accessible land to which the material might be applied is machair which usually lies in designated sites, which have strict management agreements and thereby potentially limiting the application of this material. Further work would be required to investigate this. Normally the reuse of such materials to

land requires evidence of 'agricultural or ecological improvement' and it could be argued that recycling activity would be detrimental to the high conservation value of these sites.

Sewage sludge has more obvious benefits for use as a soil improver due to its significant proportions of nitrogen, phosphorus and organic matter. Such organic matter can improve the water retaining capacity and structure of some soils, particularly when applied as dewatered sludge cake.

Regulatory Controls

In addition to beneficial organic matter, both alum and sewage sludge may contain discharges from industrial effluent, food processing wastes as well as urban run-off. As such, sludge could contain traces of contaminating substances, some of which can be phytotoxic or toxic to animals or humans at certain concentrations in the soil or in food. Sludge applications to land therefore are subject to regulations preventing the potential build-up of Potentially Toxic Elements (heavy metal and organic contaminants) in the soil, e.g. restricting the amount of heavy metals that might be applied to a soil with a certain pH value. There is also a risk of leaching or direct runoff of constituent components to surface or ground water. The degree of risk, as with the benefits, depends on the constituents of the product; the soil characteristics that the sludge is being applied to and the connectivity of potentially amended areas to ground and surface waters. Sludge also contains pathogenic bacteria, viruses and protozoa together with other parasites which could create a potential hazard to the health of humans, animals and plants. Alum sludge would likely contain relatively low heavy metal contents and pathogens (depending on the nature of the waste water being treated) but would still need to be assessed prior to use to determine total allowable amendment.

To limit the potential negative impact of the above, sludge applications to farmland are subject to a number of international and national regulations, supported by guidance documents. Generally these cover:

- Pre-treatment (reduction of the water content in sludge, reduction of organic substances, reduction of pathogens)
- Restriction on the amount of heavy metals
- Restriction on the amount of dry solids and heavy metals spread per unit of land and time
- Restriction on the content of heavy metals in the soil on which sludge is spread, and requirements for the pH of the soil
- Restriction on the amount of nutrients added to the soil (nitrogen and phosphorus)
- Restriction on the choice of crops
- Restricted access conditions to farmland on which sludge is spread
- Legislative compliance control

Directive 86/278/EEC on Sewage Sludge in Agriculture: seeks to encourage the use of sewage sludge in agriculture and to regulate its use in such a way as to prevent harmful effects on soil, vegetation, animals and humans. However, the use of sewage sludge on agricultural land is not permitted unless specific requirements are fulfilled. The Directive aims at avoiding the accumulation of toxic substances, especially heavy metals which may reach excessive levels in the soil after a number of applications. The Directive specifies rules for the sampling and analysis of sludges and soils as well as record keeping.

Sludge (Use in Agriculture) Regulations 1989 (as amended): regulates the recycling of sewage sludge to agricultural land in the UK and controls the build-up of Potentially Toxic Elements (PTEs). Responsibility rests with the producer for compliance with The Sludge Regulations in regard to the analytical testing of the sludge. Compliance is gained by:

- Analysing sludge and soil prior to spreading.
- Avoiding applying sewage sludge to soils with a pH of less than 5.0.
- Following all mandatory stock grazing, cropping and harvesting restrictions.

The statutory controls on the application of sewage sludge to agricultural land must be complied with in order to be eligible for the Single Farm Payment.

Waste Management Licensing Regulations 1994, (as amended): allow certain non-agricultural wastes to be applied to agricultural land. The operations do not need a waste management licence, but are controlled under exemptions registered with SEPA. Any non-agricultural wastes not listed in Appendix 4 would require a waste management licence in respect of spreading to land. The Waste Management Licensing Amendment (Scotland) Regulations 2004 SSI 275 amends 1994/1056 to set out waste management licensing exemptions for activities including storing and spreading sludge, land reclamation, recovery operations at sewage treatment works, and composting biodegradable waste. Compliance is gained by:

- Proving to SEPA that land treatment activities benefit agriculture or improve ecology.
- Providing supporting information to SEPA.
- Keeping appropriate records for 2 years.

Best practice exists to prevent pollution and aid environmental protection, notably soil. The guidance that exists in **the Code of Practice for Agricultural Use of Sewage Sludge** and **the Code of Practice for the Management of Agricultural and Horticultural Waste** should be adhered to.

Water UK and the British Retail Consortium (BRC) have developed the **Safe Sludge Matrix**. It consists of a table of crop types, together with guidance on the minimum acceptable level of treatment for any sewage sludge which may be applied to that crop or rotation. The Matrix does not allow raw or untreated sewage sludge to be used on agricultural land for food production. Undigested sludge should not be used on land used for food crops.

In the case of **statutory conservation sites** (e.g. SSSIs or NNRs) or other areas with a conservation, archaeological or historic value, imported wastes should not be applied without prior notification to Scottish Natural Heritage (SNH).

Next steps:

To progress this work next steps may include; a review of the reasoning behind the proposal; further clarification of the source of waste water and its likely trace substances; and a review of soil suitability, agricultural land use and application rates to ensure compliance with the relevant legislation is possible.

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