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EUREAU Position Paper on Sludge / Biosolids

Introduction

Sludges result from cleaning urban wastewaters and from the production of drinking water, and are inevitable by-products of the wastewater and water treatment processes. Over 12 million tonnes (dry solids) are produced every year in the EU. This is a small fraction of other wastes that are generated in the EU annually (250 million tonnes). However, this figure is increasing as more water and wastewaters are collected and treated to higher and higher standards. As such the production of sludges is a societal issue that the water operators manage on behalf of society in the most sustainable manner. Fortunately, sludge is a resource that can be used in a number of sustainable ways. In essence the production and management of sludges must be completing the human interface with the water cycle and also helping to sustain nutrients cycles, if it is to be sustainable. When sludges are treated so that they may be used beneficially they are known as biosolids.

Opportunities

The strong contribution that biosolids can make in securing the sustainability of resources is widely accepted across the world. This note focuses on the benefits and potential uses of biosolids, the most significant of which could be further realised and protected if user and public confidence can be established and retained. Of the opportunities discussed, soil enhancement is generally considered to be the most sustainable, but this is sometimes not possible and water operators must have a range of options they can use, in line with principles of the waste hierarchy.

Soil enhancement opportunities

Biosolids, the treated form of sewage sludge, have been in use in European agriculture for many years. A safe, sustainable, highly regulated and environmentally sound solution to the increasing challenge of sludge management, biosolids recycling represents a small, but important, percentage of the organic material applied to land. The practice is recognised as the Best Practicable Environmental Option (BPEO) under most circumstances by the EU and many member state Governments.

In addition to agriculture biosolids may be used in: Horticulture, Landfill cover, Forestry, Land reclamation and Erosion management. Further details on all of these opportunities are given in Appendix 1, and the strong links to the EU Thematic Strategy on Soil are reproduced in Appendix 2

The principal benefits of recycling biosolids to agricultural land are:

- Sustainable nutrients recycling;
- Soil conditioning – valuable organic material improving structure and infiltration, reducing run-off, erosion and flooding;
- Utilising the recognised BPEO for the material.

Energy recovery opportunities

Biosolids can be used as a source of energy, reducing dependency on primary fuels. This can be through biogas combustion, incineration with energy recovery, co-combustion in power generation or cement production. As with all options there are pros and cons with energy recovery. Whilst dried sludge has a good calorific value it does produce a lot of ash (circa 30% of sludge is inorganic) and the use of sludge may impact on emission standards and clean-up. The public view of incinerator installations has also been tainted in some member states by experiences with early incineration plants. Further details on these opportunities are given in Appendix 1.

Other opportunities

Sludge and treated biosolids contain some useful material and direct extraction of these valuable materials may be a resource in the future. However, such options are not economically viable at the current time. Further details on these opportunities are also given in Appendix 1.

Issues

Quality

In addition to the beneficial contents, raw (untreated) sewage sludge does contain traces of the substances that are used or produced by society, some of which may be discharged to sewer and retained in the sludge phase. A key and ongoing action for the EU, national governments and for producers and users is to reduce harmful and/or persistent substances at source. Specific EU legislation on the treatment and use of biosolids in agriculture sets the quality standards and conditions under which biosolids can be applied safely on land and a Directive on incineration ensures that when sludge is combusted, emissions are within acceptable limits. The quality of biosolids is monitored regularly to ensure that it meets the required standards and is fit for its intended use. There is a multi-barrier approach that protects raw sludge quality. This includes: source control in manufacturing and products, trade effluent control of discharges to sewer, wastewater treatment, sludge treatment, legislation/best practice on biosolids use and final product quality controls.

Eureau believes that controls on sludge quality are good, but supports initiatives such as the Water Framework Directive that will further improve source control. The quality of sludges needs to be protected to encourage biosolids use in agricultural, but also to prevent problems with other options such as incineration.

Perception

Biosolids use (particularly in agriculture) is subject both to legislation and market forces (farmers and retailers have a choice). As such it is vital that all stakeholders understand the safety and sustainability of the practice. The practice needs sound and proportionate legislation, but it also requires the explicit support of the regulators and better education of public interests. Eureau is keen to work with regulators and others stakeholders to improve mutual understanding and build confidence.

Waste Status

‘Waste’ is perceived as posing a threat to human health or the environment which is different to that posed by substances or objects which are not ‘waste’. Recovering waste leads to the question of when a waste may cease to be a waste because it has been recovered. According to the Waste Framework Directive, recovery of waste occurs when its processing produces a material of sufficient beneficial use to eliminate or diminish sufficiently the threat posed by the original production of the waste. This will generally take place when a person, other than a specialised recovery establishment or undertaking, can use the recovered material as a raw material in the same way as raw materials of non-waste origin. However, the reality is that, whilst this is possible under the legislative arrangements, it is complex and is certainly not encouraged by those arrangements or the interpretation of the courts to date.

Effectively, recovery of sludge occurs with advanced sludge treatment, yet the products are still classed as wastes. This poses problems in terms of how recycling practices are perceived and especially with co-combustion, which must then meet waste incineration standards. EUREAU supports the need for a review of the Waste Framework Directive and particularly the definitional issues. The safe and sustainable use of secondary resources should be encouraged and not hindered.

Conclusions

We all demand a clean water environment – this results in more sludges being produced. Treated biosolids products are, therefore, continuously produced and continuously available, in greater amounts as more sewage is collected and treated. EUREAU relies on co-operation with all members of society in order to achieve the goals set for clean waters, for the production of safe drinking water, and to build consensus on the safe and sustainable use of biosolids.

Biosolids have a number of valuable constituents - nutrients, organic matter, etc – and a calorific value that make it suitable for a range of uses. Biosolids could even be processed to provide a flexible range of products appropriate for the intended use. More research and development is needed in this field. The quality of biosolids has progressively improved over the years, especially as manufacturing industry has declined/restructured and management and control over its discharges to sewer intensified. Biosolids local quality is predictable and uniform, due to the scale of sludge collection and treatment.

Biosolids has been subject to close legislative control and careful management. Consistent achievement of environmental standards, conformity with established codes of good practice and recording/publication of performance details, has verified good operational performance. Indeed, biosolids application to land has a long tradition of excellent environmental performance. Nonetheless, operators still look for improvements to ensure performance and control will continue to ensure substantial safeguards for the environment, for water resources, the public and specific sectors of the community such as food and agricultural interests. In summary, biosolids is a valuable resource particularly for fertiliser, soil conditioning and energy purposes and has the potential to make an important contribution towards a more sustainable society.

Appendix 1

Opportunities for Soil enhancement, energy recovery and materials recovery

Soil enhancement opportunities

Agriculture

The agricultural use of biosolids is linked to the fertilising value of the nutrients, nitrogen and phosphorus. 1-5 % of dry matter is phosphorous and 1-5% is nitrogen. Depending on treatment, the organic matter content ranges from 30-80 % of dry matter. Other compounds present in biosolids of agriculture value are potassium, sulphur, magnesium, sodium and elements like boron, cobalt, and selenium. Biosolids improves soil chemistry (nutrients, pH balance, trace elements), gives better physical characteristics (improved organic matter, water holding capacity, irrigation, stability and workability) and enhances biological activity (greater water retention and aeration stimulating root growth, increased worm and micro-organisms populations). The net effect is improved soil quality and agricultural yields.

Biosolids also contain potential contaminants as traces. These are limited by threshold values set out in regulations, ensuring that biosolids can be used safely in agriculture. Biosolids is also used in agriculture indirectly, for example after addition of lime. These treatments are particularly suitable for certain soils and allow applications to land over different times or terrains than otherwise would be the case. Biosolids can be used to enhance the growth of industrial (e.g. flax) or energy (e.g. biomass) crops. Biosolids also increase the water holding capacity of soils.

Horticulture

Biosolids can be thermally processed or composted using crop residues or municipal solid wastes, green or wood processing wastes etc. The products are aesthetically acceptable and suitable for soil conditioning and fertiliser applications in situations where direct biosolids application might not be acceptable or practicable, such as in gardens, public parks and highway verges.

Soil erosion management

Biosolids is an excellent source of organic matter for poor quality soils and can make a substantial contribution to reducing soil erosion.

Land restoration and reclamation

The surface of derelict and disturbed land is often deficient in organic matter and usually deficient in nitrogen and phosphorus. On some sites, cover materials would need to be brought in and then converted into suitable topsoil for sustaining plant growth. Biosolids contains the organic matter and fertiliser value to provide a stable medium for the site and to help plants establish.

Landfill cover

Biosolids can be used as daily and final cover for landfill sites, providing a consistent blanket that serves to reduce nuisance during on-going operations and ultimately to restore the filled site for subsequent beneficial use.

Forestry

Some soils are more suitable for developing woodlands, such as coppicing to produce energy crops and wood products (fencing etc). Biosolids improves tree growth by providing appropriate nutrients. The use of biosolids is very beneficial to fertilise and improve forestry soils.

Energy recovery opportunities

Biogas from sludge digestion

Biosolids has an organic content that can be transformed into or used as a fuel. A combination of technologies - digestion, drying and incineration - makes this possible. Through sludge digestion biogas is produced that can be used as green energy. Biogas can be used on the site of the wastewater treatment plant for heating or for process purposes. Another use of this biogas is for remote heating of the houses in the vicinity of the treatment plant. On other occasions it is converted into electricity distributed through national grids. Biogas can also be converted into a green vehicle fuel and be used by buses, trucks and cars that are adapted for fossil gas fuel.

Incineration

Mono and co-incineration have an important existing role to play in sludge management. Some sludges are less suitable for use in soil enhancement and some geographic locations do not have land outlets within economically sustainable transport distances.

Sludge has a good calorific value, but as with other materials, energy recovery options involving sludge will require abatement of emissions to air and handling facilities for residual products. Mono-incineration of mechanical dewatered sludge can be autothermic, which is not requiring any additional fuel.

Co-combustion

Co-combustion in plants not originally built for waste uses dried biosolids as secondary fuel. Examples are cement kilns and power plants. Dried biosolids has a calorific value comparable with that of brown coal. The co-combustion of one ton dried biosolids avoids nearly one ton of CO2 emissions. Incineration of dried biosolids produces the same result.

Advanced combustion

Sludge can also be gasified or pyrolysed to produce a fuel which can be substituted for gas or oil in power generation.

Aggregate production

Physical and chemical properties make biosolids suitable for a range of aggregate products, although some of these are currently not economically viable. A number of products could be derived directly from biosolids or in an admixture with other materials. These include building materials such as bricks and lightweight aggregate material. The biosolids both support the combustion processes and contribute inorganic material to the final products.

Extractable materials opportunities

Various contents of biosolids could, theoretically, be extracted for use. These components include grease, metals such as silver or platinum, proteins, phosphorus, nitrogen, vitamins and coagulants. Usually the concentrations are so low, and the processing costs so high compared with conventional production methods, that they are not commercially viable at this time.

Ash from incineration is a potential source of phosphorus for fertiliser manufacture, a potential material for building blocks and aggregate and as a raw material in the cement industry.

Appendix 2
Links with EU Thematic Strategy for Soil Protection

The sustainability of biosolids recycling is also recognised in the reports from the technical working groups established under EU's Thematic Strategy for Soil Protection.

Conclusions from Task Group 4 Exogenous Organic Matter: (EUR 21319 EN/3) (EOM is defined as all organic matter that is returned to the soil for the purpose of growing crops, improving soil quality and in restoring or reclaiming land for future use. Current estimates are that in excess of 1.6 billion tonnes are produced in the EU each year, from which 61% is animal wastes, 25% crop residues, 7% industrial wastes and 7% urban and municipal wastes (sewage sludge, biowastes and green wastes). It is estimated that biosolids represent approximately 1%, industrial wastes 2% and animal manure and slurries 97% in terms of weight of material spread on land.

1. The application of EOM on soil is in principle recommended if it is of an appropriate quality and if it is applied according to good practices.

2. If these two requisites are fulfilled, the application of EOM is recommended because it can contribute to maintaining adequate soil organic matter levels and to managing soil organic matter and assist with reducing soil erosion particularly in areas where degradation of soil is an issue. It can supply stable and non-stable organic matter to soils in support of important soil functions.

3. Contrary to mineral fertiliser that does not contain organic matter; the application of EOM can also enhance biological activity in soil, which induces better aggregation and/or better porosity of soils.

4. The application of EOM can thus improve tilth and workability, increases buffer capacity, may reduce nutrient leaching, improves water retention, etc. of treated soil.

5. All of which impinge upon savings of energy, savings of non-renewable resources (such as mineral phosphates), protection of organic soils from peat production (as compost can be added to soil improvers and growing media, replacing partially peat) and sustainable management of croplands.

6. The application of EOM is also recommended because it can close nutrient cycles, contribute to reduce nutrient leaching and less reliance on non-renewable materials such as mineral phosphates. EOM contains nutrients (mainly nitrogen and phosphorus) in different forms, quantities and availability according to the type of EOM.

7. Applying composted EOM to soils should be recommended because it is one of the effective ways to divert carbon dioxide from the atmosphere and convert it to organic carbon in soils, contributing to combating greenhouse gas effect.

8. Composting or anaerobic digestion of animal manure and slurry together with straw, green wastes or other EOM, in vulnerable areas, could also be useful to move the excess of nutrients from surplus nitrogen areas to deficient areas. Through composting or anaerobic digestion a

stabilised organic amendment, whose weight is reduced (to 1/5 – 1/4 of the raw materials for composting), is obtained, which makes storage possible and transport easier.

9. The application of limed biosolids, which brings organic matter, should also be recommended as a mineral amendment to correct soil pH.