CIWEM Chartered Institution of Water and Environmental Management

Policy Position Statement

Wastewater Biosolids Treatment / Use

Purpose

This Policy Position Statement outlines the main issues relating to the treatment and use of wastewater biosolids, taking account of legislation, practicability, risk management, resource conservation, carbon reduction, soil protection, sustainability and other matters of concern to legislators, regulators, the public and other stakeholders, particularly in a UK context.

CIWEM calls for:

1. A consistent and proportionate approach to policy for land application of all organic resources
2. A consistent and proportionate approach to policy for production and use of biogas irrespective of feedstock so as to enable [and not hinder] co-digestion. This should include financial incentives for the renewable energy produced and rules for the land application of digestate.
3. Recognition by Government that the water industry has anaerobic digestion assets and long experience of operating them and electricity generation, which should be exploited for co-digestion.
4. Government bodies to stop treating biosolids adversely, for example the Quality Protocol for Compost excludes biosolids although PAS100 'Specification for compost' on which it is based, permits biosolids.
5. Risk-based approach to legislation at the European level.
6. Recognition that capturing phosphate from wastewater and using it agronomically is a necessity because the world's reserves are being exhausted.

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Context

Wastewater biosolids (sewage sludge) contain organic matter and nutrients recovered from wastewater during its treatment. Water is abstracted, cleaned, used and recovered to complete the urban water cycle. Because most of the chemicals used in society find their way into wastewater (see also Discussion 4, 6 and 7) there is need for risk assessment and risk management. It is not merely the presence that matters; as Paracelsus said 500 years ago "the

dose makes the poison" (i.e. concentration, pathway and receptor). Understandably, sewage is emotive but in reality the risks have been researched extensively and today's practices are soundly based on science. Wastewater treatment has improved the health of people and the water environment. During the 1830s, half the children died before age 5 mainly from diarrhoea, dysentery, typhoid and cholera because water used for drinking was contaminated with sewage; wastewater collection and treatment prevented these deaths. The UK's metropolitan rivers contain more species of fish than at any time since before the industrial revolution because of effective wastewater collection and treatment.

In the 20th century, the world's human population increased from 1.6 billion to 6 bn, 2.6 bn of whom do not have access to sanitation. The UN predicts the rate of increase will slow from 2050 by which time the population will be 9 bn. For the first time in history more people live in urban than rural areas. Food with its embodied nutrients flows from rural to urban areas. Food wastes, excreted organic matter and nutrients are captured into biosolids, which can be used on farms as biofertiliser to complete the nutrient cycles. Sewage sludge can be digested to make biogas or incinerated, both yield renewable energy though net energy from incineration alone is marginal. By retrofitting enhancements to existing digesters there is huge opportunity for co-digesting food and other biodegradable waste as has been practised in Denmark for more than 10 years (Evans et al., 2002).

Phosphate is an essential nutrient and part of the DNA of all organisms, it is thus irreplaceable. It is the least abundant of the major plant nutrients. Adult human excrete 98% of the phosphate consumed in their diets because they are turning over cells rather than laying down new ones. There is already talk of "peak phosphorus" (Cefic, 2008) and predictions that today's resources will be exhausted in 65 years at the current rate of exploitation; we might find another 200 years of reserves (Heffer et al. 2006). Isaac Asimov summarised the consequences of squandering phosphate:

"…life can multiply until all the phosphorus is gone, and then there is an inexorable halt which nothing can prevent…. We may be able to substitute nuclear power for coal, and plastics for wood, and yeast for meat, and friendliness for isolation - but for phosphorus there is neither substitute nor replacement."

"Asimov on chemistry" (June 1974) Doubleday Company, New York

Discussion

7. The collection and treatment of municipal wastewater is one of the most significant contributions to improved public health. Sewage sludge contains the organic matter and nutrients separated from and created during the transformation of wastewater into treated, non-polluting water. Biosolids are the product of treating sewage sludge so that it is safe to use on land.

8. Wastewater biosolids treatment / use in the EU takes place within the framework of the relevant directives (CEC, 1986 and CEC, 1991), implemented as national regulations, which may in turn be complemented and amplified by national Codes of Practice. In the UK these are the 1989 Sludge Use in Agriculture Regulations and the 1996 Code of Practice; these are similar to the "guidelines" (STC5, 1976 and STC20, 1981) that they

replaced. Thus there is more than 30 years' experience of using this risk management model successfully and with no evidence of adverse effect.

9. When biosolids cannot be used on land, the only significant alternative is thermal destruction, of which incineration is the most established method; within the regulatory controls it is safe. Disposal at sea was banned in 1998 and landfilling is restricted within the EU. In general these alternatives currently squander the phosphate in biosolids. However phosphate could be extracted before incineration and/or the ash could be stored pending the time when extracting phosphate from it becomes economically viable.

10. All of the chemicals used in society can be found in urban wastewater at some concentration and therefore risk of excess must be managed. A fundamental principle of risk management was enunciated 500 years ago by Paracelsus: "the dose makes the poison". For there to be a risk, there has to be a chain of transmission from a source via a pathway to a receptor that can deliver a harmful dose. If the dose delivered is too small to be harmful; if there is no pathway; if there is no receptor, there is no risk. When considering the source (see also 6 and 7), one should recognise that some hazardous substances are persistent and can accumulate in soil (if there is a succession of applications of biosolids) and that an accumulated substance might biodegrade or its bioavailability might change over time.

11. In 1998, an agreement was reached between Water UK, farmers, landowners and the British Retail Consortium, which developed additional guidelines for the use of biosolids in agriculture. The agreement has been adopted across the UK. As a consequence sludge is treated according to the principles of HACCP (Hazard Analysis Critical Control Point) and biosolids are applied according to the "Safe sludge Matrix".

12. The inputs of potential pollutants at point sources to sewer (i.e. factories discharging into the urban wastewater collection system) have been effectively controlled over the last 30 years so that their concentrations in biosolids have been dramatically reduced. For most wastewater treatment works further reductions are now limited by contributions from diffuse sources such as dental amalgam (mercury), cosmetics (zinc) and plumbing (copper).

13. The manufacture, marketing and use of the substances considered most dangerous (e.g. PCBs) has been reduced or eliminated by legislation. They do not find their way into biosolids because the source has been eliminated.

14. The risk to health (i.e. the risk of pathogen transmission) is controlled by biosolids treatment and/or restrictions on how land is used after biosolids have been applied and the time delays before harvesting, grazing, etc.,

15. The risk of adverse environmental impact from potentially toxic elements when biosolids are used on agricultural land is controlled through the soil limit values set in the Sludge Regulations. These limit values are based on sound science and are reviewed on the basis of continuing R&D. CIWEM encourages continuation of long-term field trials into the safety of these limit values.

16. Compliance with the Sludge Regulations and the Nitrates Directive are (Cross Compliance) obligations of the Single Payment Scheme of the Common Agricultural

Policy introduced in 2004 (Evans, 2005). However regulatory policy in the UK has not taken the opportunity of this complementary requirement to simplify regulation.

17. Biosolids treatment and their use or disposal account for approximately half of the total cost of wastewater treatment.

18. Biosolids contain organic matter and plant nutrients separated from wastewater and concentrated during its treatment.

19. The use of biosolids on land completes nutrient cycles and conserves organic matter. It feeds the soil and promotes better structure and life within the soil. It is thus a component of sustainable development.

20. Using biosolids on land to complete the phosphate cycle is especially important.

21. The use of biosolids on land is, in many cases, the Best Practicable Environmental Option (BPEO).

22. When biosolids are used on land, they substitute for part of the mineral fertiliser needs of crops, and because of the gradual release properties of the nutrients the crops are frequently healthier and therefore need fewer applications of crop protection chemicals.

Key Issues

23. CIWEM considers the term "sewage sludge" is really a misnomer because 40%, or more, of the solids are excess biomass that has grown during the wastewater treatment process and that was not originally present in the sewage. CIWEM considers it should be replaced with the term "wastewater biosolids" or “biosolids”.

24. Although the use of biosolids in agriculture is regulated, there is no EU framework for the use of biosolids in forestry or for land restoration. A more serious deficiency is with regard to the spreading of manures and other residuals on land. They can have similar environmental effects to biosolids, but the quantities used are 40 times greater than biosolids. Whilst supporting land application, CIWEM considers that it is inconsistent to regulate 5% and not the remaining 95% and encourages the Commission to reduce this inconsistency by increasing the range of residuals and to consider them consistently.

25. CIWEM applauds the work of water utilities in the UK in using such a large proportion (80% in 2005 for England and Wales) of the biosolids on land to conserve organic matter and complete nutrient cycles.

26. There is no documentary evidence of adverse effects on public health where biosolids treatment and use have conformed to existing legislation.

27. CIWEM considers no stakeholder should inhibit land application of biosolids unless they have clear objective scientific evidence of harm and challenges them to present such evidence.

28. Nuisance may result if the operation of wastewater treatment works or biosolids recycling sites cause offensive odours or disruptive vehicle movements. However, implementation of good practice can bring about substantial amelioration and often elimination of such problems. CIWEM encourages everybody involved with using organic resources on land to use practices that do not cause offence.

29. Whilst there are relatively few complaints about land application of biosolids, odour is the root of nearly all of them; CIWEM calls on Ofwat and water companies to move to treatments and practices that do not cause odour nuisance and do not bring land application into disrepute.

30. CIWEM considers that any future policy changes should be proportionate to risk and that their potential climate change impacts should be balanced against potential benefits. In general, increases in treatment standards have a consequential climate change impact.

31. CIWEM commends the application of HACCP (Hazard Analysis and Critical Control Point) to the whole source-control, treatment and use process.

32. In CIWEM's view it is essential that the use of biosolids on land remains an option for the recovery of biosolids. Other routes, notably incineration and other methods of thermal destruction, may be necessary in some situations but they are generally much more expensive and squander phosphate unless additional conservation measures are employed. Landfill capacity should not be wasted on materials that can be used beneficially.

33. CIWEM considers that the known risks from controlled use of biosolids on land are very small; however, CIWEM considers that if there are risks they should be borne by the producer of the biosolids (or other organic soil treatments) and not by the landowner.

34. CIWEM commends the British Retail Consortium (as lead body for the UK food industry) and Water UK (representing the water utilities in UK) for negotiating agreement on the use of biosolids in agriculture. CIWEM considers this was a world milestone. It commends the commitment to continuous improvement in operation and to subjecting its operations to independent audit. CIWEM recommends biosolids recyclers to continue to take proactive measures to build and ensure stakeholder acceptance and confidence.

Conclusions

CIWEM considers that, in general, wastewater biosolids treatment and use are being performed efficiently in the United Kingdom. However, to ensure environmental, animal and human health are protected, to guarantee the continued availability of agricultural land for the beneficial use of biosolids and other residuals, and to meet current and future stakeholder concerns, there should be a consistent framework of controls for all residuals applied to land.

CIWEM considers the anaerobic digestion assets and operational experience in the water industry could and should be used for co-treating other organic residuals and biomass to produce biofertiliser and biogas. CIWEM recommends government and regulators to remove the regulatory barriers that currently inhibit co-digestion.

The use of biosolids and other organic resources on land should be viewed from the perspective of the soil rather than from the origins of the materials. It is important to move to a holistic view of all aspects of organic resource production, use, soil protection, countryside stewardship, water protection, air protection and crop and livestock production. There is considerable opportunity to simplify the regulatory regime by taking account of the cross

compliance requirements of the single farm payment scheme. The EU requires the Sludge Directive be applied to sewage sludge but does not preclude its application to other organic resources. CIWEM considers there is scope for simplified, proportionate, science-based regulation of all organic resources and for co-treatment.

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Note: CIWEM Policy Position Statements (PPS) represents the Institution's views on issues at a particular point in time. It is accepted that situations change as research provides new evidence. It should be understood, therefore, that CIWEM PPS's are under constant review and that previously held views may alter and lead to revised PPS's. PPSs are produced as a consensus report and do not represent the view of individual members of CIWEM.

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