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Recommendations to preserve and extend sludge utilisation and disposal routes

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Central Secretariat: rue de Stassart, 36 B-1050 Brussels

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Foreword

This document has been prepared by CEN /TC 308, "Characterisation of sludge".

This document is currently submitted to CEN/BT for publication as a CEN Report.

This document has been endorsed by EUREAU[1)].

1) EUREAU is European Union of National Associations of Water Suppliers and Waste Water Services.

Summary

This report has been prepared within the framework of CEN/TC 308 on Characterization of Sludges. The Scope includes sludges from treating municipal, industrial and food processing wastewaters, sludge from treating raw water to make it potable, and other residues having similar potential environmental impacts. The objectives of the report are to analyse the current situation with regard to sludge management in Europe, and to recommend the approaches to preserve and extend sludge use and disposal outlets for the future.

Sludge is the inevitable residue of treating raw potable water and municipal and industrial wastewaters. However, knowledge of the quantities of sludges produced is incomplete. Treatment of these waters is designed to remove unwanted constituents from the water and concentrate them into a small side-stream - “sludge”. The sludge may also contain surplus biomass cultured during biological treatment processes. The objective of treatment is to avoid adverse impacts on the environment and human health when the effluent is discharged into the environment or water is supplied for human consumption. The concentration of beneficial constituents and of pollutants in (and health risks associated with) a sludge depends on the initial quality of the wastewater or raw water, and the extent of treatment required to meet quality standards for effluent discharge, and potable water.

Where effluent quality standards are raised, in order to reduce pollutant loads on the environment, the quantity of sludge produced inevitably increases. To be consistent, the use or disposal of the sludge must also be environmentally acceptable, sustainable and cost-effective. Sludge management typically represents about half of the overall costs of wastewater treatment. Its management will become increasingly complex as environmental standards become more stringent, and if outlets for sludge become more constrained by legislation and public attitudes.

EU policy on waste is to discriminate against disposal and promote waste avoidance, minimisation and recycling. Disposal of sludge to sea was legislated to cease by the end of 1998. Disposal of sludges to landfill, which is currently the major outlet for some sludges in Europe, is widely regarded as unsustainable. Sludge production cannot be avoided (although the quantity can be reduced by treatment) in fact demands for higher effluent quality will generally increase the amount of sludge produced. The only remaining options are recycling or destruction by combustion. Recycling options include use on land as an organic fertiliser or soil conditioner for farming, land restoration, etc. Destruction options include combustion with or without energy recovery, gassification, and using the sludge as a process fuel, with the ash being used or landfilled.

It should always be remembered that many sludges and residues contain beneficial constituents and properties that have very positive environmental advantages. For example recycling phosphate and thus reducing the need to extract primary raw material and extending the life of the planet’s reserves.

Some countries have applied a greater level of precaution into the regulatory controls for some sludges in an attempt to build stakeholder confidence, and this has made sludge management increasingly difficult and costly. Nevertheless, sludge must go somewhere, and the challenge for sludge managers is to secure cost-effective outlets for sludge that are sustainable and protect the environment and human health, and to encourage political and public acceptance of this. This will require improvements in sludge quality and the methods of disposal and recycling, which may be achieved through improved up-stream control of the quality of wastewater treated, the adoption of advanced sludge treatment processes, and perhaps changing the formulation of products and other measures to reduce diffuse inputs or sources.

The opportunities for improving the quality of water and municipal wastewater entering treatment plants are limited. For potable water, the source and quality of raw water is usually fixed to the surface and groundwater resources available locally. For sewage, industrial effluent controls have dramatically reduced point source pollution over the last 30 years (in those countries with effective legislation) to the extent that sludge quality is now increasingly dictated by diffuse pollution of water entering the sewerage system from domestic premises and road run-off, and these sources are inherently difficult to control. Industrial recession can also have a beneficial effect on sludge quality when polluting factories are forced to close. For industrial wastewater treatment, the quality of sludge has been improved through the adoption of production processes that generate less waste, and further improvements are likely through developments in industrial process technologies and integrated pollution prevention and control measures.

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A range of sludge treatment options is available to improve sludge quality and processes have been developed and adopted as necessary, according to local circumstances and legal requirements. These generally focus on reducing the content of water, odour and pathogens in sludge. Technologies are emerging for the removal of contaminants, such as heavy metals, but they are expensive and are therefore not a practicable option at present. In order to secure outlets for sludge in the near future, advanced treatment of sludge may increasingly be required, for instance to have assured pathogen removal, or to produce sludge of high dry solids content to improve the flexibility of use options as a fuel or as a high quality soil additive. These choices will be largely driven by legislation and customer and public pressures, and depend in part on an entrepreneurial management approach. High quality sludge products have a market value, offering the possibility of increased revenues in the future, and this will be an additional incentive to achieve quality assured sludge products, provided that legislation and controls permit such developments.

Currently, only the use of sewage sludge in agriculture is controlled by specific legislation. There are no comparable regulations on the recycling of other sludges, animal manures or organic wastes despite the fact that they are likely to incur the same environmental problems, although they may be subject to more general environmental legislation. Some countries have some integration of environmental standards for sludge and waste use, but none is comprehensive. A uniform and comprehensive approach is urgently needed at the EU level to ensure that all sludges, animal manures and organic wastes are subject to the same consistent control measures. The benefit of this is would be that the environmental loads from some major sources of potential environmental contamination would be controlled and accounted for. One very unfortunate consequence of the present inconsistencies is so called sludge tourism (i.e. the transboundary movement of sludges to regions with less stringent environmental controls).

In a similar way a consistent approach to emissions to atmosphere from all combustion processes (power stations, incinerators, brickworks, cement plants, etc.) and of dust is recommended. These processes can have wide-reaching impacts. Globally atmospheric deposition is the dominant of some elements or pollutants.

In addition to global environmental impacts it is important that the loadings on specific sites are considered to ensure the sustainable use of those sites.

The quantity of sewage sludge produced is very small in relation to other residuals that may be used on land and that have similar potential environmental impacts, but it is the only strictly regulated residue throughout Europe, with specific requirements for quality, monitoring, record keeping and reporting. Such controls are entirely consistent with the avoidance of environmental pollution and risk to public health, but it is now inconsistent that other sludges are not similarly controlled. This is particularly true for livestock wastes, which are by far the single largest source of organic waste (more than 60%). Despite particular examples such as the Nitrate Directive, there is no comprehensive EU control strategy for livestock wastes, but it is the cause of significant pollution, and it is time that this inconsistency was corrected.

Europe has been rocked by food scares. Even though there is no evidence of disease transmission when sewage sludge has been used according to current legislation, absence of evidence is not the same as absence of effect, and it is time that process standards for stabilisation and sanitisation for all sludges used on soils where food is grown are more closely defined so as to avoid another food scare. This is partly a matter of science, but public perception is another very real concern in this area. It should be remembered that no link has ever been proved between disease transmission and the proper use of sewage sludge in accordance with current controls. However a particular concern is “new” pathogens that are starting to appear in some countries, some examples are brown rot in potatoes, which was thought to be restricted to warm climates but is now in Northern Europe, *E. coli* O157, which is tolerated by sheep and cattle but highly infective of humans, and *Salmonella typhimurium* DT104, which can display multi-antibiotic resistance. In order to control these “emerging” organisms and the “traditional” ones, consistent rules for the management of all sludges are needed. Appropriate hygiene standards for sludges can be achieved through adopting quality assured processes which can reliably reduce pathogen numbers to the desired low levels. This is now the approach being developed in the US for livestock wastes, and it is an appropriate approach for all wastewater treatment sludges in Europe, including livestock wastes.

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Recommendations

The principal recommendation of this report is that, not withstanding subsidiarity, consistent application of the principles of control are necessary at the European level, to regulate the quality and use of all water cycle sludges (including some other residuals) that have similar potential environmental effects. The development of such measures should consider, and would subsequently support, the following key issues, not in any order of priority :

— give confidence to sludge producers to invest in appropriate technologies to achieve safe, secure and sustainable sludge management ;

— reinforce the precautionary principle in a practical and enabling manner consistent with sustainable development ;

— encourage quality assurance with independent audit and accreditation of sludge use and disposal in order to avoid mistakes and to build confidence in the processes ;

— avoid transboundary problems and market distortions in sludge use and disposal ;

— develop and promote integrated co-treatment of sludges and other organic wastes ;

— promote material cycle integration, with the priority on sludge use on land to conserve organic matter and complete nutrient cycles, combustion as an energy source, or material use such as animal feed, etc. while discriminating against disposal options (material cycle exclusion) ;

— promote acceptance of sludge management and use by all stakeholders ;

— encourage/require improved reporting and publication of data about the use and disposal of sludges to encourage improvement by peer comparison and to promote stakeholder confidence by transparency.

The priority in securing sustainable management of all sludges is establishing consistent standards based on sound scientific principles that protect human, animal and plant health and the environment (including soil and its fauna and flora). This would include formulating appropriate sludge quality standards and an appropriate strategy for maintaining sludge use and disposal during the period whilst they are phased in. Such standards would lead to industry developing the technologies by which these can be achieved reliably and cost-effectively.

There has been a huge amount of scientific research into the effects of sludges, especially sewage sludge. Development of an integrated approach should be based on risk assessment. Quality standards should be set according to the precautionary principle, to ensure environmental protection and sustainable development. The exercise should also be conducted in the context of expansion of the EU and the situation of the new members. There should be a commitment to the necessary research and operational surveillance to establish the rigorous scientific basis for standards and technologies that are appropriate for securing sludge use for the long term future. A new regulatory regime should be designed to encourage and enable beneficial use of sludges in line with the EU waste strategy, to ensure the integration of sludge within material cycles, and should discriminate against disposal. This should be backed by quality assurance with independent audit to avoid mistakes and validate compliance. Independent accreditation is also desirable to give confidence to the processes.

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1 Introduction

Increased material flows in the environment are a natural consequence of development, however, for sustainable growth the flows particularly of wastes have to be managed in order to conserve resources and protect the environment.

The promotion of sustainable growth respecting the environment is one of the primary objectives of the Treaty on European Union. Article 130 r (1) of the Treaty lays down that action by the Community relating to the environment shall be based on :

— the precautionary principle ;

— the principles of preventive action ;

— rectification of environment damage at source ;

— the polluter should pay.

The principles of preventative action require that the European Community must first address itself to waste avoidance and minimisation before considering waste recovery, recycling and how waste should ultimately be disposed of if none of the previous options are feasible. The basic principle of action must be to support and ameliorate the valuable components in wastes and reduce the presence of harmful substances.

CEN/TC 308 “Characterization of Sludges” considers that water cycle sludges are part of the material flows. These sludges include :

1) Wastewater sludge/sewage sludge of household and municipal origin ;

2) Industrial organic wastewater sludge from :

   — potato processing ;

   — slaughterhouses ;

   — sugar beet processing ;

   — animal food production ;

   — dairy farming ;

   — livestock farming ;

   — fish processing and canning ;

   — tanneries ;

   — pulp and paper industries ;

   — olive oil production ;

   — pharmaceutical production ;

   — fruit and vegetable processing and canning ;

   — soft drinks production breweries ;

   — vinification ;

   — alcohol and alcoholic liquors production ;

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- gelatine and glue production ;
- malt factories ;
- margarine and fat production ;
- starch production ;
- biological production of drugs ;
- other ;

3) Water works sludges ;

4) Sludges from the sewerage network ;

5) Cesspool and septic tank sludges (night soil).

The implementation of the Urban Waste Water Treatment Directive (91/271/EEC) will dramatically increase the amount and quality of municipal and industrial wastewater treatment throughout the European Union. Inevitably, the production of sludge will increase and this will require appropriate treatment and disposal. However, this is occurring over a period when there is a number of important changes to European and national waste management policies that will impact all of current sludge use and disposal options. The challenge of the next 10-20 years is to identify the sustainable balance between sludge production, recycling and disposal, and the protection of human and environmental health in an affordable, sustainable and acceptable manner.

Identifying secure and cost-effective disposal and use outlets for sludges (and wastes in general) in the European Union, which are also publicly and politically acceptable, has become an increasingly difficult and complex issue. Some outlets will be prohibited (such as sea disposal from the end of 1998) and all other outlets are facing increasing restrictions (agriculture, landfill and incineration), yet the amount of sludge produced in the EU is increasing rapidly, by at least 50% by 2005. Public expectations of environmental protection are high and the principle of recycling is widely acknowledged as sensible, yet the use of sludge, particularly sewage sludge, barely achieves public acceptability.

Council Directive 75/442 EEC on waste, as amended by Council Directive 91/156/EEC, sets out the following objectives for waste management to be adopted by Member states :

- increased prevention and reduction of waste through the development of clean technologies as well as of products that can be used or recycled ;
- recycling and recovery of waste as secondary raw material ;
- use of waste as a source of energy ;
- recovery and disposal of waste without endangering human health or the environment.

Where the production of waste cannot be avoided, the second priority of EC Directive 75/442 EEC is the use of waste as secondary raw material or for energy production. The use of ”sludges for utilisation” constitutes an instrument of importance to both waste management and national economies. The measures taken to this end intend that :

- amounts of waste are reduced, thus reducing the reliance on landfill disposal ;
- primary raw materials and energy are conserved and, hence, the pressures on the environment and the landscape are eased.

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The general waste management policy of the EC is summarised by the hierarchy which gives priority to waste avoidance and minimisation, recycling and recovery of materials and energy, and considers landfill disposal as the least favoured option. The basis of a Community strategy for sludge could be the positive adoption, through policy and action, of the principles of this hierarchy, since this is conceived to be the basis of sustainable development. Since sludge production cannot be avoided if effluent and water quality standards are to be met, then minimising the quantity of sludge for recycling is the highest feasible objective within this hierarchy.

Usefulness is a essential principle of Directive 75/442/EEC, and both harmlessness and usefulness are prerequisites for the use of wastes.

In different European countries, there are various initiatives to maximise the use of sludges but there are no uniform guidelines or measures. TC 308 was founded due to the lack of, and differences in, technical guidelines on the investigation and evaluation of waste for recycling. Working Group 3 of TC 308 was established to establish uniform principles for the future utilisation of sludges and specifically to undertake the following :

— identify appropriate contacts within each country covered by CEN ;

— develop a questionnaire to derive information on type, quality and outlets of sludges ;

— identify current and prospective sustainable methods of reducing, handling, utilisation and disposal of sludges ;

— produce a report to CEN on recommendations to preserve and extend sludge utilisation and improve other disposal routes.

This report addresses the last and considers issues of sludge quality criteria, classification for disposal/utilisation options, quality assurance, comparison with other wastes and the development of a European strategy on sludge. More detailed recommendations are provided by specific codes of practice developed by Working Group 2 (listed in Annex A).

TC 308 defines sludge qualities and the factors which control them. The TC does not set out limit values when defining qualities, although the principles may be established by which appropriate standards may be set. There is scope to extend the range of standard methods available for measuring sludge quality. Sludge quality criteria can be used to classify sludge as to its suitability for particular use or disposal option and this has been undertaken by allocating priorities to particular properties according to outlet. Assignment of numerical standards must be done locally, but within the EU framework, because of the complex social, political, geographical, climatic and scientific factors which determine where they are set.

It is imperative that the suitability of all types of sludge for use and disposal, and their associated potential environmental impacts, are evaluated according to uniform criteria. Impacts in this context do not necessarily imply readily quantifiable “damage”, they also refer to increases in the background concentrations of contaminants throughout the environment, which may lead to an overall degradation of the environmental quality, possible unforeseen and long-term impacts, and positive environmentally enhancing aspects. Hence the need for a precautionary approach to setting standards to protect air, water and soil to ensure sustainable development.

Providing residue/waste producers and recyclers, and the competent authorities with relevant and uniform guidelines will help ensure that pollutants are not purposefully, or as a side effect of use, channelled into the ecosystem by way of dilution or non-specific binding. A uniform framework would also ensure that the most appropriate sludge management option can be selected for local conditions that not only provides consistent environmental protection but also avoids unnecessarily stringent restrictions that could prejudice sludge recycling and force sludge to be disposed of in a less sustainable manner.

Thus the priority must be to :

— improve the sustainability of existing outlets ;

— ensure optimum sludge utilisation in the future ;

— find new useful outlets.

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