

WORKING DOCUMENT ON SLUDGE 3RD DRAFT

An EU-initiative to improve the present situation for sludge management should be based on Article 175 EC Treaty and include the following elements:

Definitions

It is proposed to use the definition of sludge suggested by CEN: “mixture of water and solids separated from various types of water as a result of natural or artificial processes”.

- Sewage sludge would then be sludge from urban waste water¹ treatment plants, septic tank sludge would be sludge from septic tanks which contain human excreta and domestic waste water² from single or multiple human dwellings, and industrial sludge would be sludge from the treatment of industrial waste water of the sectors listed in Annex VIII.
- The suggested definition of treated sludge is that of sludge which has undergone one of the treatment processes envisaged in Annex I or a combination of these processes, so as to significantly reduce its biodegradability and its potential to cause nuisance as well as the health and environmental hazards when it is used on land.
- The definitions of forest³ (land with tree crown cover (stand density) of more than about 20% of the area. Continuous forest with trees usually growing to more than about 7 m in height and able to produce wood. This includes both closed forest formations where trees of various storeys and undergrowth cover a high proportion of the ground, and open forest formations with a high continuous grass layer in which tree synusia cover at least 10% of the ground) and reclaimed land (drastically disturbed land that is reclaimed using sludge) will also be introduced.

Use on land

In order to maintain or improve the present rate of recycling of nutrients and organic matter contained in sludge, it will be necessary to broaden the scope of the existing regulations and include the management of sludge in outlets such as silviculture, green areas and reclaimed land.

¹ The definition of ‘urban waste water’ in Directive 91/271/EEC reads: “domestic waste water or the mixture of domestic waste water with industrial waste water and/or run-off rain water”.

² The definition of ‘domestic waste water’ in Directive 91/271/EEC reads: “waste water from residential settlements and services which originates predominantly from the human metabolism and from household activities”.

³ Definition according to FAO guidelines.

- Sludge should be used on land whenever possible and only according to relevant Community or national legislation.
- Sludge should be used when there is an agronomic interest for the crops or the quality of soil can be improved. The application rate is to be adapted to the needs of crops and/or soil taking into account the amount of nutrients present in the soil, the supply of nutrients through the net mineralisation of the reserves in the soil and the addition of nutrients from livestock manure, chemical fertilisers and other organic fertilisers [without prejudice to other relevant Community legislation, in particular Directive 91/676/EEC on nitrates].
- The use of sludge shall be carried out in such a way as to minimise the risk of negative effects to:
 - human, animal and plant health,
 - the quality of groundwater and/or surface water,
 - the long-term quality of the soil, and
 - the bio-diversity of the micro-organisms living in the soil.
- Sludge should not be used in forests. However, Member States may allow the use of sludge in plantations (short-rotation plantations, plantations for growing energy crops, Christmas tree plantations and similar) and for re-afforestation purposes where there is a need for an extra input of nutrients and as long as the provisions of Article 4 of Directive 75/442/EEC are complied with.

Limit values

There would be provisions on concentration limit values for heavy metals and organic compounds.

- The use of sludge in those soils where the concentration of one or more heavy metals exceeds the limit values suggested in Annex II would be prohibited; furthermore, Member States would have to ensure that those limit values are not exceeded as result of the use of sludge.
- If the concentration of one or more heavy metals in sludge is higher than the concentration limits suggested in Annex III or if the concentration of one or more organic compounds in sludge is higher than the concentration limits proposed in Annex IV, the use of sludge should not take place.
- When sludge is mixed with other wastes or products, the above-mentioned provision should apply to both the sludge before mixing as well as to the produced mixture. The mixing of sludge with other wastes or products solely for the purpose of diluting pollutants shall be prohibited.
- The maximum annual quantities of heavy metals set in Annex V that may be added to the soil because of the use of sludge should not be exceeded. An exemption could be envisaged for land reclamation where a one-off large application of sludge is needed

to raise the soil organic matter content and promote biological activity in the soil. Annexes II, III and IV shall still apply.

- The limit values in Annex III and V should be reviewed every six years with a view to achieving the medium and long-term concentrations set out in the paragraph on Prevention of pollution.

Obligation for treatment

In order to reduce the likelihood of spreading pathogens into the environment and to build up consumers' confidence, it will be necessary to treat the sludge.

- Sludge that has not been treated according to one of the treatment processes envisaged in Annex I should not be used.
- The competent authority may decide that the obligation of treatment does not apply to those industrial sludges listed in Annex VIII that do not contain potentially pathogenic micro-organisms.
- Sludge from septic tanks, cesspools and similar installations shall be taken to a waste water treatment plant for further treatment. In case of long distances, the competent authority may allow a derogation from the previous requirement on a case-by-case basis and as long as the provisions of Article 4 of Directive 75/442/EEC are complied with. The sludge shall be injected or worked into the soil as soon as it is spread.

Conditions for use on land

Sludge should not be used on soils whose pH is less than 5.0, on water saturated, flooded, frozen or snow-covered ground. Sludge should be spread in such a way as not to cause sludge run-off and minimise soil compaction as well as the production of aerosols.

Sludge may be used if the following conditions are met:

- the load limits set in Annex V are not exceeded (with the possible exception of land reclamation for one-off applications);
- there is an agronomic interest for nutrients or for the improvement of the content of organic matter in soil;
- the quantity of nutrients introduced is adapted to the needs of the crops or the soil according to best practice;
- the use does not cause unreasonable odour nuisance to the nearest dwellings.

Sludge shall be used according to the following table (advanced and conventional treatments are described in Annex I):

	Advanced treatment	Conventional treatment
Pastureland	Yes	Yes, deep injection and no grazing in the six following weeks
Forage crops	Yes	Yes, no harvesting in the six weeks following spreading
Arable land	Yes	Yes, deep injection or immediate ploughing down
Fruit and vegetable crops in contact with the ground	Yes	No. No harvest for 12 months following application
Fruit and vegetable crops in contact with the ground eaten raw	Yes	No. No harvest for 30 months following application
Fruit trees, vineyards, tree plantations and re-forestation	Yes	Yes, deep injection and no access to the public in the 10 months following spreading
Parks, green areas, city gardens, all urban areas where the general public has access	Yes, only well stabilised and odourless sludge	No
Forests	No	No
Land reclamation	Yes	Yes, no access to the public in the 10 months following spreading

Producer responsibility & certification

There should be a provision on producer responsibility and certification which provides that:

- Producers are to be responsible for the quality of sludge supplied (even when a contractor takes care of sludge marketing and spreading) and shall guarantee the suitability of sludge for use. Producers are to analyse the sludge for the agronomic parameters, heavy metals, organic compounds and micro-organisms with the frequency suggested in Annex VI and soils with the frequency and methods suggested in Annex VII.
- Producers shall implement a quality assurance system for the whole process, i.e. control of pollutants at source, sludge treatment, the way that the work is planned and the land evaluated, sludge delivery, sludge application and the communication of information to the receiver of the sludge. The quality assurance system shall be independently audited by auditors duly authorised by the competent authority.
- Analyses are to be carried out by an accredited laboratory which shall be authorised and duly monitored by the competent authority.

Information requirements

Information requirements should include the following elements.

The producer to provide the receiver of the sludge with the

- name and address of the producer;
- name and address of the treatment plant from which the sludge has origin;
- assurance that the quality of supplied sludge fulfils all relevant and applicable requirements;
- copy of the auditor's certificate;
- type of treatment carried out in relation to the list in Annex I and result of the analysis on *Salmonella spp* and *Escherichia Coli* if applicable;
- composition and properties of the sludge in relation to the agronomic parameters suggested in Annex VI;
- results of the analyses on sludge in relation to the heavy metals listed in Annex III and the organic compounds suggested in Annex IV.

The receiver of the sludge shall keep records of and provide the producer with the following:

- information about any other sludge, manure or other wastes that have been applied to the land;
- information about the land that is relevant to preventing water pollution;

- records of fertilisers and agrochemicals used on the land.

The producer to keep a copy of the information sent to the receiver along with the

- name and address of the receiver;
- location of the plot of land on which the sludge is used and its area;
- type of land use;
- treatment, quantity and analysis of sludge supplied for use;
- results of the analysis on the soil on which sludge is applied in relation to the heavy metals suggested in Annex II;
- details of the information supplied by the receivers.

The producer has to keep the above-mentioned information for at least ten years and has to report annually to the competent authority. This information, in an aggregated form, shall provide the basis for the consolidated report to be sent to the Commission.

This information, in an aggregated form, shall be available upon request to the general public.

Member States shall communicate to the Commission the competent authority responsible for the implementation and monitoring of these provisions on their territory. The Commission shall include this information in the consolidated report.

Code of practice

A part from obligatory requirements, it could be envisaged to set up codes of good practice for the use of sludge in the different outlets. Such codes would be implemented by producers on a voluntary basis.

The codes should contain certain provisions covering as a minimum the following items:

For all outlets:

- measures to be taken for not impairing the quality of groundwater;
- measures and precautions to be taken in order to prevent the leaching from sludge which is stored before use;
- periods in which the use of sludge is not suitable because of weather conditions.

For use in agriculture and silviculture:

- the sludge shall be used when there is an agronomic interest for growing of crops or for the improvement of the soil;
- the sludge nutrient load, especially as regards nitrogen and phosphorous, shall be taken into account when the amount of fertilisers needed by crops is calculated;

- periods in which spreading of sludge is not suitable because crops would not benefit from the supplied organic matter or nutrients.

Prevention of pollution

A very important element in a global strategy to ensure the long term availability for the beneficial use of sludge would be to engage in an active reduction of pollution in waste water. It could be envisaged to draw up detailed plans for reducing the amount of potentially hazardous substances, materials, elements or compounds that end up in the sewer, and therefore in sewage sludge, because of their presence in cleaning products, detergents, cosmetics, medicines, animal fodder, pipes, amalgam fillings or others.

These plans should aim at:

- reducing the quantities of potentially hazardous substances, materials, elements or compounds that end up in sewage sludge so that it complies with the concentration limits for heavy metals and organic compounds as suggested for the beneficial use of sewage sludge;
- maximising the share of sewage sludge suitable for beneficial use as well as minimising the quantities of heavy metals and organic compounds released into the environment;
- inform consumers of the composition of the products, substances or materials that could end up in the sewer and how to dispose of them in a way which does not pollute waste waters.

These plans should aim at reducing the overall amount of potentially hazardous substances and elements in waste water and sludge, with a view to achieving in the Community these medium and long-term targets for the 90-percentile of sewage sludge:

Elements	Medium term (about 2015)		Long term (about 2025)	
	Limit values for concentrations of heavy metals in sludge for use on land (mg/kg dm)	Limit values for amounts of heavy metals which may be added annually to soil, based on a ten year average (g/ha/y)	Limit values for concentrations of heavy metals in sludge for use on land (mg/kg dm)	Limit values for amounts of heavy metals which may be added annually to soil, based on a ten year average (g/ha/y)
Cd	5	15	2	6
Cr	800	2 400	600	1 800
Cu	800	2 400	600	1 800
Hg	5	15	2	6
Ni	200	600	100	300
Pb	500	1 500	200	600
Zn	2 000	6 000	1 500	4 500

The measures taken in drawing up such plans shall be part of the periodic report which is to be sent to the Commission. In particular, the report shall contain information on implemented policy measures, implemented concrete measures, achieved improvements, and implemented consumer advisory services.

Committee procedure

In the implementation and monitoring of sludge management, the Commission will be helped by a Committee of representatives of the Member States. This Committee will have the possibility of adapting the Annexes to the technological progress, in particular the definitions of suitable treatments in Annex I.

Annex I: Sludge treatment processes

Advanced treatments (hygienisation)

- Thermal drying ensuring that the temperature of the sludge particles is higher than 80°C with a reduction of water content to less than 10% and maintaining a water activity above 0.90 in the first hour of treatment;
- Thermophilic aerobic stabilisation at a temperature of at least 55°C for 20 hours as a batch, without admixture or withdrawal during the treatment;
- Thermophilic anaerobic digestion at a temperature of at least 53°C for 20 hours as a batch, without admixture or withdrawal during the treatment;
- Thermal treatment of liquid sludge for a minimum of 30 minutes at 70°C followed by mesophilic anaerobic digestion at a temperature of 35°C with a mean retention period of 12 days;
- Conditioning with lime reaching a pH of 12 or more and maintaining a temperature of at least 55°C for 2 hours;
- Conditioning with lime reaching and maintaining a pH of 12 or more for three months.

The process shall be initially validated through a 6 Log₁₀ reduction of a test organism such as *Salmonella Senftenberg W 775*.

The treated sludge shall not contain *Salmonella spp* in 50 g (wet weight) and the treatment shall achieve at least a 6 Log₁₀ reduction in *Escherichia Coli* to less than 5·10² CFU/g.

Conventional treatments

- Thermophilic aerobic stabilisation at a temperature of at least 55°C with a mean retention period of 20 days;
- Thermophilic anaerobic digestion at a temperature of at least 53°C with a mean retention period of 20 days;
- Conditioning with lime ensuring a homogenous mixture of lime and sludge. The mixture shall reach a pH of more than 12 directly after liming and keep a pH of at least 12 for 24 hours;
- Mesophilic anaerobic digestion at a temperature of 35°C with a mean retention period of 15 days;
- Extended aeration at ambient temperature as a batch, without admixture or withdrawal during the treatment period^(*);
- Simultaneous aerobic stabilisation at ambient temperature^(*);

^(*) The minimum time length of the treatment shall be laid down by the competent authority taking into consideration the prevailing climatic conditions in the area where the treatment plant is located.

- Storage in liquid form at ambient temperature as a batch, without admixture or withdrawal during the storage period^(*).

The sludge treatment shall at least achieve a 2 Log₁₀ reduction in *Escherichia Coli*.

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The relevant process parameters shall be monitored at least daily, and preferably continuously if practicable. Records shall be kept and made available upon request to the competent authority for inspection purposes.

European standards for the monitoring of these treatment processes shall be developed. If CEN standards are not available and until they are developed, ISO, international or national standards shall apply.

When the competent authority of the concerned Member State is satisfied that a treatment process not listed in this Annex is capable of achieving the same results as the listed treatments, it shall inform the Commission thereof. The Commission, after evaluation of the information provided, may seize the Committee of representatives of Member States. If the opinion of the Committee is positive, the treatment process shall be included in this Annex.

[Without prejudice to other relevant Community legislation, in particular Directive 90/667/EEC on animal waste.]

Annex II: Limit values for concentrations of heavy metals in soil

Elements	Limit values (mg/kg dm)			
	Directive 86/278/EEC 6<pH<7	5≤pH<6	6≤pH<7	pH≥7
Cd	1 – 3	0.5	1	1.5
Cr	-	30	60	100
Cu	50 – 140	20	50	100
Hg	1 – 1.5	0.1	0.5	1
Ni	30 – 75	15	50	70
Pb	50 – 300	70	70	100
Zn	150 – 300	60	150	200

When the concentration value of an element in a specific land area is higher than the concentration limit as set in the table, the competent authority may still allow the use of sludge on that land on a case-by-case basis and after evaluation of the following aspects:

- uptake of heavy metals by plants,
- intake of heavy metals by animals,
- groundwater contamination,
- long term effects on bio-diversity, in particular on soil biota.

The areas of land with higher heavy metal concentrations shall be monitored and the possibility of using sludge shall be subject to a periodical assessment by the competent authority.

Annex III: Limit values for concentrations of heavy metals in sludge for use on land

Elements	Limit values (mg/kg dm)		Limit values (mg/kg P)
	Directive 86/278/EEC	Proposed	Proposed
Cd	20 – 40	10	250
Cr	-	1 000	25 000
Cu	1 000 – 1 750	1 000	25 000
Hg	16 – 25	10	250
Ni	300 – 400	300	7 500
Pb	750 – 1 200	750	18 750
Zn	2 500 – 4 000	2 500	62 500

The sludge producer may choose to observe either the dry matter related or the phosphorus related limit values.

**Annex IV: Limit values for concentrations of organic compounds and dioxins
in sludge for use on land**

Organic compounds	Limit values (mg/kg dm)
AOX ¹	500
LAS ²	2 600
DEHP ³	100
NPE ⁴	50
PAH ⁵	6
PCB ⁶	0.8

Dioxins	Limit values (ng TE/kg dm)
PCDD/F ⁷	100

¹ Sum of halogenated organic compounds.

² Linear alkylbenzene sulphonates.

³ Di(2-ethylhexyl)phthalate.

⁴ It comprises the substances nonylphenol and nonylphenoethoxylates with 1 or 2 ethoxy groups.

⁵ Sum of the following polycyclic aromatic hydrocarbons: acenaphthene, phenanthrene, fluorene, flouranthene, pyrene, benzo(b+j+k)fluoranthene, benzo(a)pyrene, benzo(ghi)perylene, indeno(1, 2, 3-c, d)pyrene.

⁶ Sum of the polychlorinated byphenils components number 28, 52, 101, 118, 138, 153, 180.

⁷ Polychlorinated dibenzodioxins/ dibenzofuranes.

Annex V: Limit values for amounts of heavy metals which may be added annually to soil, based on a ten year average

Elements	Limit values (g/ha/y)	
	Directive 86/278/EEC	Proposed
Cd	150	30
Cr	-	3 000
Cu	12 000	3 000
Hg	100	30
Ni	3 000	900
Pb	15 000	2 250
Zn	30 000	7 500

The competent authority may decide to allow an increase in the loading rate for copper and zinc on a case by case basis for those plot of land that are copper or zinc-deficient and if it has been proven by qualified expert advice that there is a specific agronomic need for the crops.

Annex VI: Sampling frequency

The following parameters shall always be analysed in order to characterise the composition of sludge:

- dry matter and organic matter^(*);
- pH;
- primary nutrients: nitrogen (as total N and NH₄-N), phosphorus (P), potassium (K).

For agricultural and similar uses, the following parameters shall also be analysed in order to characterise the agronomic value of sludge:

- secondary nutrients: calcium (Ca), magnesium (Mg), sulphur (S);
- micro-nutrients: boron (B), cobalt (Co), iron (Fe), manganese (Mn), molybdenum (Mo).

As a minimum, the frequency of analysis for sludge shall be as in the following table. The analyses shall be carried out at regular intervals during the year.

Quantity of sludge produced per year and per plant (tonnes of dm)	Minimum number of analyses per year				
	Agronomic parameters	Heavy metals	Organic compounds	Dioxins	Micro-organisms
< 250	2	2	-	-	2
250 – 1 000	4	4	1	-	4
1 000 – 2 500	8	4	2	-	8
2 500 – 4 000	12	8	4	1	12
> 4 000	12	12	6	1	12

Sludge shall be assumed to be conform to the concentration limit values for heavy metals, organic compounds, dioxins and micro-organisms if, for each concentration limit considered individually, the 90-percentile of the samples within a twelve-month period are at or below the threshold value and if the 10-percentile of the samples exceed only one threshold value and by less than 50%.

^(*) Dry matter and organic matter shall be evaluated from the measurements of dry residue and loss on ignition.

The competent authority may decide on a case-by-case basis to allow a reduction of the frequency of the analysis of any of the pollutant parameters (heavy metals, organic compounds, micro-organisms) if in a two-year period it has been shown that each measured value of the parameter is consistently below 75% of the threshold limit.

The competent authority may decide on a case-by-case basis to allow a reduction of the frequency of the analysis of any of the agronomic parameters if in a two-year period it has been shown that each measured value of the parameter deviates for less than 20% from the average.

The competent authority may decide on a case-by-case basis and whenever justified on the analysis of pollutants other than those listed in Annexes II and IV and on the analysis of micro-organisms other than those listed in Annex I.

For those pollutants (heavy metals, organic compounds, micro-organisms) that are either not present at all or present only in negligible quantities in the industrial waste water of the sectors listed in Annex VIII, the competent authority shall decide on the parameters and the frequency of the analyses to be carried out. It shall inform the Commission thereof.

Annex VII: Analysis and sampling

The soil shall be analysed before the first use of sludge on land and every ten years thereafter for the following parameters:

- pH;
- cadmium, chromium, copper, mercury, nickel, lead and zinc.

The representative soil sample for analysis shall be made up by mixing together 25 core samples taken over an area not exceeding 5 hectares which is farmed for the same purpose. In case of large agricultural exploitations and subject to the approval of the competent authority, the core samples may be taken over an area of 20 hectares which is farmed for the same purpose. The samples must be taken to a depth of 25 cm unless the depth of the surface soil is less than that value; however, the sampling depth in the latter case must not be less than 10 cm.

Sampling and analysis of the relevant parameters shall be carried out as given by CEN standards. If CEN standards are not available and until they are developed, ISO, international or national standards shall apply.

Methods for soil examination:

Parameter	Title	Reference(*)
Sampling	Soil quality – Sampling – Part: 1: Guidance on the design of sampling programmes	ISO/DIS 10381-1
	Soil quality – Sampling – Part: 4: Guidance on the design of sampling programmes	ISO/DIS 10381-4
Soil texture (clay and organic matter content)	Soil quality - Simplified soil description	ISO 11259
	Soil quality – Determination of particle size distribution in mineral soil material – Method by sieving and sedimentation	ISO 11277
	Soil quality – Determination of organic and total carbon after dry combustion (elementary analysis)	ISO 10694
pH	Soil quality – Determination of pH	ISO 10390
Heavy metals	Soil quality - Extraction of trace elements soluble in aqua regia	ISO 11466
	Soil quality – Determination of cadmium, chromium, cobalt, copper, lead, manganese, nickel and zinc – Flame and electrothermal atomic absorption spectrometric methods	ISO 11047
Nitrogen	Soil quality – Determination of nitrate nitrogen, ammonium nitrogen and total soluble nitrogen in air-dry soils using calcium chloride solution as extractant	ISO 14255
Phosphorus	Soil quality – Determination of phosphorus – Spectrometric determination of phosphorus soluble in sodium hydrogen carbonate solution	ISO 11263

(*) Latest available edition.

Methods for sludge examination:

Parameter	Title	Reference(*)
Sampling	Water quality – Sampling - Part 13 : Guidance on sampling of sludges from sewage and watertreatment works	EN/ISO 5667P13
Dry matter	Characterization of sludge - Determination of dry residue and water content	prEN 12880
Organic matter	Characterization of sludges - Determination of the loss on ignition of dry mass	prEN 12879
pH	Characterization of sludge - Determination of pH-value of sludges	EN 12176
Nitrogen	Characterisation of sludges - Determination of Kjeldahl nitrogen	prEN 13 342
Phosphorus	Determination of phosphorus compounds	prEN 13 346
Potassium		
Heavy metals	Characterisation of sludges Aqua regia extraction methods - Determination of trace elements and phosphorus	prEN 13 346
Secondary nutrients and micro-nutrients		(prEN 13 346)
Salmonella Seftenberg W775		
Salmonella spp		
Escherichia Coli		
AOX		[ISO 15009]
LAS		
DEHP		
NPE		
PAH		[ISO 13877]
PCB		[CD 10382]
PCDD/F		

(*) Latest available edition.

Annex VIII: Industrial sectors

The code in the entries refers to the European Waste Catalogue adopted on 20 December 1993 with Commission Decision 94/3/EC.

1. 02 02 04 sludges from on site effluent treatment from the preparation and processing of meat, fish and other foods of animal origin [without prejudice to other relevant Community legislation, in particular Directive 90/667/EEC on animal waste]
2. 02 03 05 sludges from on site effluent treatment from fruit, vegetables, cereals, edible oils, cocoa, coffee [, tea] and tobacco preparation, processing; conserve production; tobacco processing [; yeast industry]
3. 02 04 03 sludges from on site effluent treatment from sugar processing
4. 02 05 02 sludges from on site effluent treatment from the dairy production industry
5. 02 06 03 sludges from on site effluent treatment from the baking and confectionery industry
6. 02 07 05 sludges from on site effluent treatment from the production of alcoholic and non-alcoholic beverages (excluding coffee, tea and cocoa)
7. 03 03 06 fibre and paper sludge
8. 04 01 06 sludges containing chromium from the leather industry
9. 04 01 07 sludges free of chromium from the leather industry