

How to guide organic waste for optimised treatment and recycling

In order to achieve a consistent framework conditions for the recycling of organic waste in Europe ECN is of the opinion that the set of regulatory measures must consider (among others) the following conditions and principles:

- Economic viability (Cost effectiveness)
- Respecting market needs
- Consider environmental criteria for both (i) processing and (ii) use

We herewith provide a proposal for a scheme which may represent a reasonable systematic for treatment and use of the different organic waste streams.

A decision tree relates mainly to qualitative aspects such as

- Potential concentration of diffuse contaminants and pollutants
- Processing criteria like dry matter content, physical stability (structure)
- Range of C/N ratio with respect to rather fermentable or compostable carbon sources, respectively
- Advantages and potential limitations for market outlets and final use
- Existing experience, market response and needs

ECN's WASTE STREAM or INPUT APPROACH:

Based on this background information the main waste streams and types are allocated to the regulatory framework which are

- (i) EU *end of waste* regulation
- (ii) EU *sludge /low quality treated bio-waste* directive
- (iii) NATIONAL *end of waste* or *waste/soil protection* legislation

We herewith discuss some of the preferred options of how to allocate certain waste streams to specific type and level of legislation

1. EoW / End of Waste Regulation – EU PRODUCT regime;

= **Binding quality criteria** which can only be modified by MS with robust health related or environmental justification

o [Quality] Compost

YES for EoW:

→ *Separate collection* must be a prerequisite for any product status of compost, only this creates confidence of the markets and the users.

→ In this context it is important that source separated household waste [*typical 'Brown-bin' or 'Bio-bin' collection regime for separate collection of kitchen and garden waste from private households and similar institutions*] would be identified by an explicit waste code!!!

→ Important regulatory elements

- *Binding POSITIVE LIST [including manure; former foodstuff etc.]*
- *Quality criteria for end product*
- *External quality assurance QAS = obligatory*
- *Standard labelling/compost specifications*
- *Application rules on MS level*
- *Exact definition of point where compost ceases to be waste (monitoring, process control; product declaration, etc.)*
- *Official approval procedure within QAS: "End-of-Waste-Plant"; "End-of-Waste-Quality Compost";*

→ *Basis = Quality assurance concept of the ECN-QAS Manual !*

For the quality standard we recommend to consider the quality standards mentioned in the ECN-QAS Manual - instead of stronger ones in JRC's EoW proposal - as sufficient to describe an end-of-waste standard because they reflect good practice in Europe.¹

o Digestate

YES for EoW:

→ But not elaborated in the same Working Group and not regulated in the same piece of legislation as *compost*.

The EoW definition for compost will be in itself very complex. But here long term experience on qualities and good practice examples exist in many MS. This provides at least a good chance to succeed within a reasonable timeframe.

¹ Developed by JRC in EoW Compost Study

- → Minimum requirements in the framework of a *Quality Assurance System (QAS)* for digestates must be elaborated in advance; knowledge and experience (e.g. range of qualities, the impact of large range of substrates used and treatment technologies as well as market needs) must be collected and evaluated on EU level as an important pre-requisite to define broadly accepted and sustaining *End of Waste criteria* for digestate
 - *Separate collection* must be a prerequisite for any product status of digestates, only this creates confidence of the markets and the users.
 - Important regulatory elements
 - *Binding POSITIVE LIST [including manure and energy crops; former foodstuff etc.]*
 - *Quality criteria for end product*
 - *External quality assurance obligatory*
 - *Standard labelling/ digestate specification*
 - *Application rules on MS level*
 - *Exact definition of point where digestate ceases to be waste (monitoring, process control, product declaration, etc.)*
 - *Official approval procedure within QAS: “End-of-Waste-Plant”; “End-of-Waste-Quality Digestate”;*
- **Municipal sewage sludge & industrial sludges or waste water as source material for EoW compost or digestate**

- **Agro-industrial waste water and sludge**

YES for EoW

→ Sludge stemming from the processing of agricultural products (Agro-industries) should be included in the positive list of a EU EoW regulation for QUALITY COMPOST or QUALITY DIGESTATE = PRODUCT

→ However depending on the process applied additional requirements for the waste materials might be necessary (e.g. no synthetic extraction agents etc.)

- **Municipal waste water & sewage sludge:**

NO for EoW

No inclusion in the EoW positive list even of high quality/certified waste water or sewage sludge.

It would require a complicated additional quality approval regime (even costly analyses for organic pollutants) for each origin of waste water or sludge which would be necessary in order to prevent dilution practices of using contaminated sludges at low proportions in composting and AD.

Traceable/reliable approval/certification scheme on EU level would be very unlikely to achieve!

It would also contradict the principle: “*CLEAN PRODUCTS FROM CLEAN SOURCES*”

BUT: MEMBER STATES would still have the possibility to define national End of Waste criteria at least for differing category "sewage sludge compost" (*as it is the case in Austria*). In this case: Export/Import of SLUDGE COMPOST would be only possible based on bi-lateral agreements between MSs.

2. Bio-waste-Sludge Directive – WASTE regime

- 2nd class COMPOST produced only from materials included in the POSITIVE LIST of the EoW Regulation for COMPOST.

NO for EoW but needed definition within the EU sludge/biowaste directive

This is necessary ...

- To provide a clear and transparent distinction between composts from source separated organic waste streams from those produced from mixed waste (supported by different names).
 - To provide sufficient precautionary concept also for composts of low risk materials which eventually exceed the EoW criteria only by one quality parameter (e.g. one heavy metal limit value) and by only a small percentage.
 - To support all MS in a starting situation with biodegradable waste management with no or very little source separation and composting activities by giving a reasonable qualitative guidance in bio-waste / compost recycling.
 - To provide sufficient flexibility in areas with enhanced background concentrations of heavy metals in soils where the produced compost could be used regionally still under the waste regime.
 - **BUT:** MS may also define an additional national product class of compost as product with another name within a national EoW regulation and for national use only!
 -
- Standard municipal sewage sludge

as foreseen by the draft working paper;

Direct use of **Agro-industrial sludge** in agriculture should be regulated under MS competence.

Otherwise: NO for EoW

- Stabilised MBT material:

- Based on the fact that stabilised MBT materials constitute a non defined sink for all types of pollutants and contaminants as being produced from mixed waste sources which cannot be investigated in detail it constitutes a principle risk if using mixed waste derived materials as soil amendment for food and feeding stuff production.

However individual MSs which have developed a system which allows quality controlled use if MSW compost could provide national standards. But on EU level we consider this as not appropriate.

Therefore we PROPOSE

- Stabilised MBT/Mixed Waste Material: → NO regulation on EU level.
→ should be under the competence of MEMBER STATES
- No need for an End-of-waste regulation because according to latest statements of the Commission Services this material will be excluded from accounting for the WFD recycling targets

o **Manure**

From a legal standpoint, manure qualifies under certain circumstances as waste (if not used directly in agriculture but treated in a waste treatment plant or a biogas plant).

However it should be included in the positive list for anaerobic digestion and composting with *QUALITY COMPOST* or *QUALITY DIGESTATE* as final product.

Manure as such ... there is no need to be regulated under an individual End of Waste regulation!

NO for EoW

- There is no real market for manure outside agriculture which requires an End-of-waste classification
- By integrating manure in the current working process, it is likely that this may constitute a major obstacle to the entire project.
- Manure should be regulated under national or future EU fertiliser legislation

3. Further aspects to consider (among others) are:

- **Common EU methods have to be used for compost/ digestate analysis:** Two European interlaboratory tests (2009 with 6 laboratories in D, B, E, NL, F, UK; and in 2003²) showed very differing results for metals and impurities. Additional assessments should be made to verify the Annex 2-12 of the 2008 JRC report that constitutes that the technical support for the determination of the current EoW proposed thresholds is sufficient.

² ECN (2003): First Comparison of Compost Laboratories in Europe Results of an interlaboratory comparison about analysing methods and examination results of compost in various EU countries, Weimar,

- Product liability → definition of **statistical methods for EoW standards compliance testing**. Are there deviations of individual samples possible? Numerous results from ring-tests would require those deviation rules.
Here some examples for types of tolerated deviations:
 - (A) *Routine compost analysis within the regular compliance testing on behalf of the compost producer.*
 - Option 1: ALL analyses/compost must meet the standard
 - Option 2: In a series of e.g. 4 samples ONE sample may exceed the limit value by 25%
 - Option 3: Up to 6 parallel samples following a standard sampling protocol can be taken and analysed. After eventual elimination of 2 outliers: the mean value of the remaining results must meet the limit value. Maximum Coefficient of Variance 50%
 - (B) *Control sample taken and analysed by competent authority.*
 - What is the consequence if an individual compost sample taken from the market place by the competent authority would exceed the limit value by e.g. 20%
- Product designation/labelling of "[QUALITY] COMPOST" has to indicate clearly that it is produced from clean source separated org. wastes ... in order to prevent market distortion and consumers confusion
The term *QUALITY COMPOST* should be restricted to EoW defined PRODUCTS.
- Definition of BIO-WASTE should be strictly restricted to source separated organic waste as defined in the WFD and further described in details by a positive list of suitable source materials in the EoW regulation !
Any mix-up by means of product designation and misunderstanding with stabilised bio-degradable waste produced in a MBT-like facility from mixed municipal waste must be avoided.
- Harmonisation of the EoW // Bio-waste/sludge regime with the definition of material groups and recycling activities which are accounted for the WFD's recycling targets
- REACH - compost is exempted but not digestate - need to be considered and clarified. Digestate under REACH can undermine the EoW advantages because of negative market reactions and additional administrative REACH burdens

4. Tables

Table 1 presents a systematic allocation of sources materials/wastes to

1. product category
2. piece and type of legislation
3. level of competence

Table 2 proposes and compares limit values for bio-waste products as a basis for reasonable classification.

Table 3 gives an overview on compost and digestate qualities (to be completed if need be!).

Table 1: Possible structure of regulations for bio-waste and sludge

INPUT MATERIAL	TYPE OF PRODUCT	LEVEL AND TYPE OF REGULATION	QUALITY CRITERIA	USE	MONITORING	NATIONAL DEVIATIONS
Source segregated bio-/garden waste; commercial and (agro-)industrial sources; manure Sludge from WWTP from agro industries → POSITIVE LIST	QUALITY COMPOST = PRODUCT	EU Regulation on <u>END OF WASTE</u> CRITERIA	Regulation on end of waste criteria for <u>QUALITY</u> COMPOST	No specific restrictions on EU level To be defined by MS	Quality assurance obligatory Only in production phase	Stricter criteria only if justified by health and environmental arguments
	COMPOST = WASTE	EU Revised <u>Bio-waste Sludge Directive</u> <u>MINIMUM</u> CRITERIA	Minimum criteria: COMPOST	No specific restrictions on EU level; To be defined by MS	Quality assurance eventually voluntary During production and documentation of compost application	Detailed application rules and also national END of WASTE regulation possible
	QUALITY DIGESTATE = PRODUCT ¹⁾	EU Regulation on <u>END OF WASTE</u> CRITERIA	Regulation on end of waste criteria for <u>QUALITY</u> DIGESTATE	No specific restrictions on EU level To be defined by MS	Quality assurance obligatory Only in production phase	Stricter criteria only if justified by health and environmental arguments
	DIGESTATE = WASTE	EU Revised <u>Bio-waste Sludge Directive</u> <u>MINIMUM</u> CRITERIA	Minimum criteria: DIGESTATE	No specific restrictions on EU level; To be defined by MS	Quality assurance eventually voluntary During production and documentation of digestate application	Detailed application rules and also national END of WASTE regulation possible
STANDARD Sewage sludge	Municipal Sludge = WASTE	EU Revised <u>Bio-waste Sludge Directive</u> <u>MINIMUM</u> CRITERIA	Minimum quality criteria for (sewage) sludge and sludge compost	Allowed to be used in agriculture, however not on soils subject to high risk of contamination	Quality assurance obligatory During production and use on soils; also periodic monitoring of soils	Detailed application rules
	Sludge or Bio-Solids Compost = WASTE					For Sludge COMPOST national END of WASTE regulation possible
Mixed waste (with or without sludge)	Stabilised organic fraction of Mixed waste / MBT process = WASTE	MS <u>National regulation</u>	To be defined by MS	To be defined by MS	To be defined by MS	---

1) Should be elaborated as a SEPARATE TASK with in the End of Waste definitions of the EC/JRC in parallel but not together with QUALITY COMPOST. See arguments above. Also here minimum requirements for a quality assurance scheme for QUALITY DIGESTATE must be elaborated and required.

Table 2: Set of limit values within the different quality definitions for compost, stabilised MBT material and sludge.

Contaminants [mg/kg dm]	ORGANIC FARM- ING ³ (FROM HOUSEHOLD WASTE)*	EU Eco-labels ^{4*}	END OF WASTE CRITERIA		PROPOSED LIMITS OF WORKING DOCUMENT FOR A REVISED SLUDGE DIRECTIVE		
			Proposal by JRC A)	Proposal by ECN	Proposal by ECN Biowaste Com- post	EC 1 st draft pro- posal sludge	EC 1 st draft pro- posal stabilised MBT Material
Cd	0.7	1	1.5	1.3	2.0	10	3
Cr (total)	70 (total) 0 (Cr VI)	100	100	60	70	1,000	300
Cu	70	100	100	200 ^{B)}	200 ^{B)}	1,000	500
Hg	0.4	1	1	0.45	0.7	10	3
Ni	25	50	50	40	70	300	100
Pb	45	100	100	130	150	500	200
Zn	200	300	400	600 ^{B)}	600 ^{B)}	2,500	800
PAH (or benzo-a- pyrene)**		-				6 (2)	6 (2)
Impurities ≥2mm [% dm]		0.5%	0.5%	0.5%	1%	--	2%

A) by JRC EoW Compost Study;

B) Cu and Zn can be also seen as trace-nutrients; Concentrations of Cu > 110 and Zn > 400 must be declared on the labelling or accompanying papers. See also Am-linger et al. 2004. Heavy metals and organic compounds from wastes used as organic fertilisers and ECN e.V., 2010: Quality Assurance Scheme – Quality Manual., Oelde.

³ 2092/91/EC

⁴ 2007/64/EC and 2006/799/EC

Table 3 & 4: Overview on compost & digestate qualities (to be completed if need be with data from other countries as far as available).

COMPOST	FRANCE : MIXED WASTE / MBT STABILISED MATERIAL (2007 DATA)			FRANCE : 2 BIOWASTE COMPOST PLANTS / SE- PARATE COL- LECTION	GERMANY BIOWASTE COM- POST [2010]		BELGIUM/FLANDERS VFG Compost [2010]	
	FR 75%ILE N=97	FR 95%ILE N=97	FR NFU 44051		Range of mean values [2009]	DE 75%ILE N=2638	DE 95%ILE N=2638	BE 75%ILE N=42
CONTAMINANT:								
Cd	1.4	1.7	3	0.3 - 0.4	0.55	0.81	1	1.2
Cr (total)	54	70	120	17 - 28	27	41	37	39
Cu	152	179	300	58 - 65	53	80	56	62
Hg	0.6	0.9	2	0.1 - 0.3 -	0.15	0.24	0.20	0.20
Ni	31	41	60	9 - 18	17	30	17	18
Pb	138	162	180	32 - 32	43	69	77	93
Zn	476	566	600	128 -192	195	270	266	289
PAH (or benzo-a-pyrene)**	benzo-a-pyrene: MEAN: 0.10% n=40		(1.5) mg/kg dm		---	---	---	---
Impurities ≥2mm [% dm]	Total: Plastics only: n=16	1.44% 0.34%	A)	0,08 - 0,87 % 0,04 - 0,27 %	Total (mean): 0.20%: [2007]		0.3	0.5

A) Limits of NFU 44051: Plastic films >5mm (< 0.3% DM); Other plastics >5mm (< 0.8% DM) Glass + Metals >2mm (< 2.0% DM)

Data Source: GERMANY: BGK/Leiffert – personal communication; BELGIUM/Flanders: VLACO/Vandenauweele – personal communication;
FRANCE: stabilised MBT- material: Veolia/Copin – personal communication // Biowaste compost: 2 individual composting plant – personal communication

DIGESTATE	GERMANY DIGESTATE LIQUID [2010]		GERMANY DIGESTATE SOLID [2010]		SWEDEN DIGESTATE LIQUID [2009]		BELGIUM/FLANDERS DIGESTATE LIQUID [2010]	
	DE 50%ILE N=504	DE 90%ILE N=504	DE 50%ILE N=69	DE 90%ILE N=69	SE 75%ILE N=16	SE 95%ILE N=16	BE 75%ILE N=72	BE 95%ILE N=72
Contaminants								
Cd	0.34	0.6	0.6	1.2	0.35	0.64	0.5	0.95
Cr (total)	13	29	19	43	14	26	21	36
Cu	72	174	46	78	129	279	130	210
Hg	0.09	0.23	0.12	0.46	0.08	0.31	0.08	0.23
Ni	11	23	13	25	12	25	14	18
Pb	6	29	29	52	6.5	14.2	10	15
Zn	311	564	231	362	408	575	428	582
PAH (or benzo-a-pyrene)**	---	---	---	---				---
Impurities ≥2mm [% dm]	0	0.01	0.06	0.3			0.02	0.02

Data Source: GERMANY: BGK/Leiffert – personal communication; BELGIUM/Flanders: VLACO/Vandenauweele – personal communication; SWEDEN: Avfall Sverige /Blom – personal communication