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Assessment and guidance for the implementation of EU waste legislation in Member States

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REPORT ON EXISTING MINIMUM WASTE TREATMENT REQUIREMENTS IN AT LEAST 15 MS AND RECOMMENDATION FOR POSSIBLE ACTION TO BE TAKEN AT EU LEVEL (WP4)

(D 1.4.4)

11 January 2012

Involved organisations:

BiPRO
Beratungsgesellschaft für integrierte Problemlösungen

umweltbundesamt

bio Intelligence Service

WRc

etc

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1. Work Package 4: Report on assessment of need for action regarding minimum treatment requirements for waste streams / treatment operations

1.1 Background and objectives

Efficient use and recovery of resources is a priority in the European Union and world-wide, therefore international trading of secondary materials for the purpose of resource recovery is permitted. The European Waste Shipment Regulation ((EC) 1013/2006) allows for the export of certain types of collected waste for treatment out of the Community, if managed in an environmentally sound manner throughout the period of the shipment.

Some specific pieces of Community waste legislation allow exports of collected waste for treatment out of the Community and counting the treated waste for the national targets provided that the exported waste is treated in the destination country under "conditions equivalent to those prescribed in the Community". According to Article 49 of the Waste Shipment Regulation, Member States shall take the necessary steps to ensure, that any waste they ship is managed without endangering human health and in an environmentally sound manner throughout the period of shipment and duringits recovery or disposal in the country of destination.

In practice it is often difficult to assess what an environmentally sound treatment process requires, as there are no specific minimum waste treatment requirements. There is a risk that wastes may be exported for competitively priced treatment but then recovered in sub-optimal conditions with respect to environmental and human health protection, threatening the economic viability of certified treatment facilities in Europe that apply BAT.

Directive 2008/1/EC concerning integrated pollution prevention and control, which codifies Directive 96/61/EC, requires waste, industrial and agricultural activities with a high pollution potential to have a permit. This permit can only be issued if certain environmental conditions are met, so that the companies themselves bear responsibility for preventing and reducing any pollution they may cause.

However, the list of activities covered by IPPC is not exhaustive so a number of product and waste stream specific Directives have been generated over the last decade including the ELV, Packaging, WEEE and Battery Directives. Annexes to the respective Directives provide basic - relatively general - requirements for pre-treatment to reduce hazardousness and improve resource efficiency. However, there are no specific minimum waste treatment requirements. Article 27 of the new Waste Framework Directive (Directive 2008/98/ EC) allows the Commission, to set minimum treatment standards for waste activities not covered by Directive 96/91/EC (IPPC) where there is evidence that a benefit would be gained in terms of protecting human health and the environment and where a co-ordinated approach at an European level would be the best option to meet the objective of optimised protection.

The **overall objective of WP4** is to provide guidance on technical minimum treatment standards in the EU, i.e. identifying current gaps in regulation and recommendation for the need of EU wide action regarding minimum treatment standards. The project specification required a preliminary step to assess a broad range of waste streams / treatment operations in order to select candidate wastes and treatments. This status report describes this pre-selection process.

1.2 Introduction to this report

The initial task (working step 4.1) of work package 4 was to identify candidate waste streams / treatment operations with the most urgent need for action regarding treatment standards. Secondly, a prioritisation was accomplished to select those candidates, which then should be subjected to a detailed analysis regarding existing technical minimum requirements.

Based on the outcome of the initial working steps, which were submitted in the form of a status report in July 2010 (Deliverable 1.4.1) and as a part of the Project Interim Report submitted in October 2010 (Deliverable 1.4.2), it was agreed with the Commission Services to further analyse the following waste streams / treatment operations:

- Mechanical treatment of C&D waste
- Mechanical treatment of household & similar wastes
- Biological treatment (composting & anaerobic digestion) of biodegradable waste
- Temporary Storage of wastes related to C&D waste, tires, wastes related to the treatment of household&similar wastes
- Treatment of hazardous waste (identifying, avoiding of dilution, removal of hazardous substances)

The present report is the result of working steps 4.2 to 4.4 and constitutes Deliverable 1.4.4 of the Project.

Below a brief description of the information collection approach and the methodology applied for the elaboration of recommendations (Chapter 1.3) the findings of this task are summarized per individual waste stream / treatment activity (Chapters 1.4 to 1.8):

First, the information collected on existing minimum treatment requirements for the above mentioned waste streams / treatment operations are summarized (initial three sub-chapters).

- General information in particular relating to IPPC/IED relevance
- Information on main environmental impacts
- An overview on the minimum treatment standards identified and their core elements

  (Additional information on existing technical requirements in detail is compiled per waste stream / treatment activity in Chapters 2.1.1 to 2.1.5 (Annex))

This information was already submitted in September 2011 in the form of a status report constituting Deliverable 1.4.3.

Second, based on the collected information different options for possible action related to minimum treatment standards were discussed and assessed (forth sub-chapter).

Finally, based on the assessment of the individual options, recommendations regarding possible action related to establishing EU-wide treatment standards in the context of Article 27 WFD were elaborated (c.f. chapter 1.9).

1.3 Methodology for the detailed investigation of minimum treatment standards for the selected waste streams / treatment operations and elaboration of recommendations

1.3.1 Information collection

For each waste stream / treatment operation information on technical minimum standards was collected based on a comprehensive search of available data sources. In order to compile latest information on treatment requirements, the data search included the following data sources:

- Websites and databases at European and national level
- Contacting national authorities of 16 Member States (AT, BE, CZ, DE, DK, ES, IT, GR, FI, LU, NL, SE, FR, IE, PL, UK).
- Industry (waste treatment industry, recycling associations)
- Scientific Studies (in particular studies on impact assessment of widening the scope of IPPC-Directive)

In addition, use was made of the information collected in the course of the questionnaire survey conducted in WS1 (c.f. Interim Report submitted in October 2010). Details on contacts with Member States representatives and national websites are given in Chapter 2.1 (Annex).

It should be mentioned, that the objective of data collection was a screening of existing standards and approaches but no complete analysis of Member States.

1.3.2 Methodolgy for elaboration of recommendations related to need for action regarding minimum treatment standards in the context of Article 27 WFD

Based on the selected information for the most relevant environmental impacts of the investigated waste treatment activities different options related to establishment of minimum treatment standards were discussed. As a next step the relevance of individual options was assessed using 6 impact categories and the scores explained below:

- Impact on the environment
    - 0 no or adverse effects
    - + relevant improvement
    - ++ highly relevant improvement
- Workers' health and safety
    - 0 no or adverse effects

  - + relevant improvement
  - ++ highly relevant improvement
- Economical aspects
  - 0 no or adverse effects (e.g. investment costs monitoring costs)
  - + positive effects (e.g. commercial opportunities for plant providers, increased revenues for waste outputs of increased quality)
  - ++ very positive effects
- Contribution to environmental policy (indicative)
  - 0 no contribution
  - + relevant contribution
- Relation to expected technological / waste management developments
  - 0 no or negative relationship (i.e. option is not necessary any more due to this developments
  - + positive relationship (i.e. developments will not make the option unnecessary)
- Considerable number of standards available (+)

In order to prioritise the options related to minimum treatment standards for the individual waste treatment activites, the relevance for individual impact categories was cumulated and considered being high, medium or low priority as described below[1]:

+ to ++ (low relevance/priority)

++ to ++++ (medium relevance/priority)

+++++ to +++++ (high relevance/priority)

In a final step, the elaborated options will be delivered for consultation to the waste associations related to the industries which might be concerned by the proposals. The following associations will be addressed:

- FEAD, European Federation of Waste Management and Environmental Services
- Eurofer, European Confederation of Iron and Steel Industries
- Eurometaux, Association of the Non-Ferrous Metals Industry
- CEMBUREAU, European Cement Association
- EURITS, European Union for Responsible Incineration and Treatment of Special Waste

[1] +/0 (was accounted as 0.5 +)

- BIR, Bureau of International Recycling
- EFR, European Ferrous Recycling and Recovery Association
- EUROMETREC, European Metal Trade and Recycling Federation
- EuPR, European Plastics Recyclers
- European Compost Network
- HWE, Hazardous Waste Europe

Comments and remarks will be documented and will be delivered to the Commission services.

1.4 Mechanical treatment of construction & demolition (C&D) waste

1.4.1 General information

Construction and demolition (C&D) waste is one of the largest waste streams generated in the EU - around 450 million tonnes per year - about half of which is recycled **[CEC 2007a]**. C&D waste is landfilled, backfilled, sorted or mechanically treated in order to produce recyclable fractions such as aggregates, metals and wood. As landfill and underground storage are covered by IPPC 96/61/EC and the Landfill Directive 99/31/EC, only mechanical treatment (crushing and sorting) was selected for the investigation. Mechanical treatment was also highlighted by stakeholders as requiring further action.

The main steps in the mechanical treatment of C&D waste are summarized below **[CEC 2007b]**

- Sorting: approximately 75% of C&D waste is inert material such as bricks, stone, concrete, tiles, sand, gravel and other aggregates. A multi-step sorting process is used to separate concrete and masonry debris and finer grained aggregate from the other fractions. Magnets, windshifting, flotation and manual sorting may be used to separate ferrous and non-ferrous metals, wood, plastics, glass, asbestos and gypsum and other material for further treatment, recycling or disposal. An example of a C&D waste sorting process as summarised in Figure 1-1.
- Crushing: size reduction of the waste streams is usually by means of crushers or shredders. The coarser concrete and masonry debris will be crushed and graded, sometimes after a period of temporary storage on site. Gypsum-based materials or asphalt will be crushed as a separate stream. However this may be carried out on the premises of a specialist recycler.
- Storage, handling and transfer of materials could occur at various stages in the mechanical treatment of C&D waste, and as with crushing and sorting, will also generate emissions.

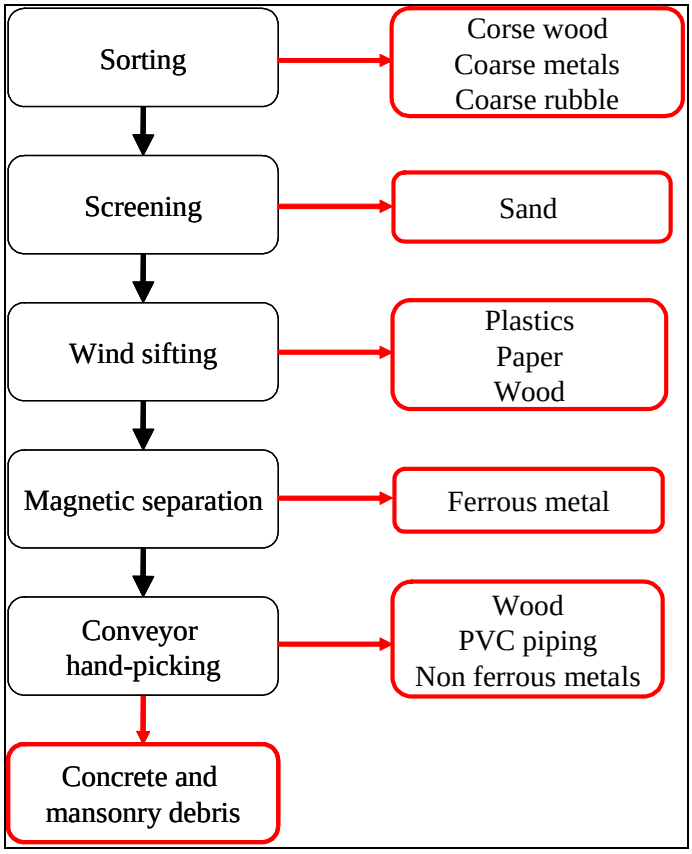

Figure 1-1: Example of construction and demolition waste sorting process (Source: *Factsheet E3* [CEC 2007b], adapted from [Eerland 2003]

There are approximately 4100 sorting operations and 4500 crushing installations in the EU. Approximately half of the crushers are mobile plant **[CEC 2007c]**. The average annual capacity of a crushing unit is 50000 tonnes. However it is calculated that approximately 20% of the crushing units have a small capacity (below 50 tonnes per day) and about 40% have a capacity above 100 tonnes per day (or 25 thousand tonnes per year) **[CEC 2007b]**. None of the separate installations for the treatment of C&D waste are covered by the IPPC/IED directive.

1.4.2 Main environmental impacts

CEC 2007b describes the major risks related to mechanical treatment (crushing, sorting) of C&D waste.

- Air emissions:
  - dust generated from crushing, sorting and storage is the principal environmental impact. Crushing emits about 3.5 times more PM_{10} emissions than sorting. Annual PM_{10} emissions from sorting and crushing operations in the EU are approximately 6.4 kt, which is 80 times more than for the disposal and recycling of hazardous waste and 6.4 times more than the disposal of non-hazardous waste. Dust is also generated from storage operations,

especially in windy conditions;

- gases from combustion engines (sieving machine, crusher and trucks) principally NOx, CO, CO_2 and soot. Additional small releases of combustion gases may arise from the heating of buildings and workspaces;

- Noise and vibration, particularly when the operation is located close to urban areas.
- Dissemination of contaminants such as leachable salts, heavy metals, PCBs, PAHs, hydrocarbons, herbicides, and wood preservers in fractions recovered for recycling or recovery that do not meet certain quality criteria (e.g. secondary aggregates, metal fractions, wood).
- Pollution of surface and groundwater by fuels and lubricants used in the plant and machinery.

In the Commission's staff working document **[CEC 2007[c]]** supporting the impact assessment for the inclusion of sorting and crushing construction & demolition wastes in the proposed Directive on Industrial Emissions and in the accompanying factsheet E3 **[CEC 2007b],** the Commission states that reducing dust emissions would have a positive social impact by reducing impact of the operations on health. However, no BREF exists to determine BAT, so it is not possible to quantify positive impacts of introducing BAT. Approximately half of the C&D installations minimise dust emissions through wetting the material and enclosing the operations. Extending this type of mitigation to other plant would not add significant administrative costs for either operators or competent authorities, as the operations are already permitted, but there would be an economic impact. Such measures would increase costs from a few to 50 € cents/tonne of recycled material compared with treatment costs of 1-6 euro/tonne. However this could be significant in reducing competitiveness with virgin aggregates as the price differential is only 1-2 euros/tonne. The Commission concluded that the sorting and crushing of construction and demolition waste would not be a good candidate for inclusion under the scope of the IPPC Directive. In particular the "cross-media approach of the IPPC may be of limited relevance for a sector with single pollution flow".

1.4.3 Compilation of existing minimum treatment standards

1.4.3.1 Overview

The recommendations / guidelines identified for specific Member States relating to the treatment of C&D wastes were predominantly qualitative.

Further details on key highlights of the standards / guidelines are presented in the Annex. A brief summary of each document is provided in this overview. Table 1-1 below provides an overview on the analyzed documents and their content.

Five relevant standards were identified for **Austria**. The guideline for mobile treatment of mineral construction waste and excavated soil **[BRV 2004]**, ordinance on waste water emissions and waste treatment **[Austrian MOE 1999],** Forum Schall: Standardauflagen for mobile waste treatment plants **[Forum Schall 2003**] and the federal waste management plan **[Austrian MoAFEW 2006**] specify

qualitative and quantitave requirements for air, water and/or noise emissions, and processing of waste inputs. The Guidelines for Recycled Building Materials **[BRV 2007]** specify process requirements for waste outputs only.

In **Belgium**, administrative governance is completely devolved for the 3 regions – Brussels, Wallon and Flanders. However, the requirements seem to be applicable to all three regions in most cases as the region-specific region standards have been promulgated from the Belgian constitution and associated decrees. The Order of the Flemish Government of 1 June 1995 concerning General and Sectoral provisions relating to Environmental Safety **[VLAREM II 2005]** specifies quantitave and qualitative requirements for air, water and noise emissions. VLAREA 2004 is the Order of the Flemish Government for the establishment of the Flemish regulations relating to waste prevention and management and contains qualitative requirements for recycled waste. VLAREM I 1991 is the Order of the Flemish Government of 6 February 1991 concerning Environmental Licences and contains provisions relevant to process requirements and selection of best available technology (BAT). Sustainable construction in Belgium **[BBRI]** and technical requirements for gravel and demolition debris (Normalisatie COPRO PTV 406/00/F) [IVBN 2002] provide additional guidance on waste inputs and outputs respectively.

Two **Finnish** documents were identified: BAT Environmental management in aggregates production **[Finnish MoE 2010]** which specifies requirements for air, water and noise emissions; and Government Decree 591/2006 concerning the recovery of certain wastes in earth construction (Annex 1) **[Virallis 2006]** which provides process related standard on waste outputs from C&D treatment.

The **French** Arrêté du 30/06/97 n° 2517 **[French MoE 1997b]** provides qualitative and quantitative emission related standards for air, water and noise emissions, as well as process requirements and BAT Conception des centres de tri des dechets industriels banals et des dechets de chantiers. ED 948 [INRS 2006] also provides process requirements and BAT guidance,

Of the eight **German** documents related to recovery of C&D wastes, Anforderungen an die stoffliche Verwertung von mineralischen Abfällen - Technische Regeln - der Länderarbeitsgemeinschaft Abfall **[LAGA 2003a]** and Leitfaden zum Umgang mit teerhaltigem Straßenaufbruch **[Baden-Würtemberg MoET 2010]**, specify process requirements or BAT. Handlungshilfe für die Verwertung von Gleisschotter in Baden-Württemberg **[Baden-Würtemberg MoET 2008]** and Anforderungen an die stoffliche Verwertung von mineralischen Abfällen: Teil II: Technische Regeln für die Verwertung 1.2 Bodenmaterial **[LAGA 2003b]** specify requirements for waste inputs and outputs respectively.

Only one relevant document was identified for **Greece**. The Draft presidential decree - ΣΧΕΔΙΟ ΠΡΟΕΔΡΙΚΟΥ ΔΙΑΤΑΓΜΑΤΟΣ ΘΕΜΑ: ''Μέτρα, όροι και πρόγραμμα για την εναλλακτική διαχείριση των αποβλήτων από εκσκαφές, κατασκευές και κατεδαφίσεις (ΑΕΚΚ) **[Greek MoE 2004]** provides generic process requirements for waste treatment.

In **Ireland**, Quarries and Ancillary Activities: Guidelines for Planning Authorities **[Irish DoEHG 2004b]** provides best practice and mitigation measures for air, water and noise emissions and process requirements and BAT. C & D Waste Management: Implementation of International Best Practice in Ireland **[Irish DoEHG 2004a]** provides guidance on waste input and process requirements and BAT.

In **Spain**, Real Decreto 105/2008, de 1 de febrero, por el que se regula la producción y gestión de los residuos de construcción y demolición: Ministerio de la Presidencia 2486. Documentoleys 906 [MoP 2008] provides information on process equirements and BAT.

A series of **UK** national standards relating to C&D treatment **[UK EA 2010a and b, UK EA 2011]** standard rules SR2010No11 and 12 and SR2011No4, as well as **WRAP [2009]** Good practice in construction and demolition materials recovery facilities, provide qualitative guidance on air, water and noise emissions. The quality protocol for the production of aggregates from inert waste [WRAP 2006] provides guidance on process control, waste inputs (limited list of input waste) and outputs (potential aggregate specifications).

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Construction and Demolition Waste Management Practices and their Economic Impacts [Symmonds et al 1999] provide guidance on generic requirements and assessments for process control and BAT.

Standards, guidelines or recommendations related to C&D waste treatment were not identified for the Czech Republic, Denmark, Italy, Luxemburg, Netherlands, Poland and Sweden. This reflects the findings of the questionnaire survey where no technical minimum standards relating to mechanical treatment of C&D wastes were identified for these countries.

Table 1-1: Compilation of the key provisions of minimum treatment standards for mechanical treatment of C&D waste

MS	Standard	Emission related standards			Process related standards			Others
		Air (incl. odour)	Water	Noise	Waste IN	Waste OUT	Process requirements and BAT	
AT	Federal Waste Management Plan **[Austrian MoAFEW 2006]**				O			Different waste type and EWC codes and apply for off-site seperation
AT	Guideline for mobile treatment of mineral construction waste and excavated soil **[BRV 2004]**	Δ	Δ	Δ X	Δ O		Δ	
AT	Guidelines for Recycled Building Materials **[Green Guide 2007]**					X	Δ	
AT	Ordinance on waste water emissions and waste treatment **[Austrian MoE 1999]**		Δ X					
AT	Forum Schall: Standardauflagen for mobile waste treatment plants **[Forum Schall 2003]**			Δ X				Similar requirements for noise emmissions as **BRV 2004** with some amendments
BE	Sustainable construction in Belgium **[BBRI 2000]**				X	Δ X		POP wastes contaminated with PCBs for mechanical treatment - PCB limit concentration for process
BE	Technical requirements for gravel and demolition debris (Normalisatie COPRO PTV 406/00/F) **[IVBN 2002]**					X		Classification of aggregates of recycled C&D waste based on existing standards
BE	Order of the Flemish Government of 6 February 1991 concerning Environmental Licences **[VLAREM I 1991]**						Δ	Classification of processes / treatment companies according to nuisance potential.

BE	Order of the Flemish Government of 1 June 1995 concerning General and Sectoral provisions relating to Environmental Safety **[VLAREM II 2005]**	Δ X	Δ X	Δ X			Δ X	Environmental quality standards and limit values specified for air, water and noise according to type of establishment and activities (Annex 1 of VLAREM 1)
BE	Order of the Flemish Government for the establishment of the flemish regulations relating to waste prevention and management **[VLAREA 2004]**				Δ O	Δ O		Certification of the recycled granulates based on the 'eenheidsreglement'. The eenhiedsreglement certify the environmental quality requirements. The certification is only possible on condition that the recycled granulates meet the technical standards.
BE	Order of the Flemish Government of 14 December 2007 establishing the Flemish soil remediation and protection regulations **[VLAREBO 2007]**					Δ X		
FI	BAT Environmental management in aggregates production **[Finnish MoE 2010]**	Δ X	Δ	Δ				
FI	Government Decree 591/2006 concerning the recovery of certain wastes in earth construction (Annex 1) **[Virallis 2006]**					ΔX		Quality criteria and guidance in Annex 1
FR	Arrêté type - Rubrique n°2515 **[French MoE 1997a]**	Δ X	Δ X	Δ X			Δ	Limit values for treatment processes
FR	Conception des centres de tri des dechets industriels banals et des dechets de chantiers. ED 948 **[INRS 2006]**						Δ	General guidance for design of facility
GE	Kontaminierte Bausubstanz Erkundung, Bewertung, Entsorgung **[BayLfU 2003]**							Guidance on dismantling and handling wastes from contaminated buildings
GE	Teer-/ bitumenhaltige Dachbahnen **[Abfallratgeber Bayern 2007]**							Information sheet on recycling of Tar and bituminous roofing materials
GE	Erste Allgemeine Verwaltungsvorschrift zum Bundes–Immissionsschutzgesetz (TA Luft) Vom 24 **[German MoECNS 2002]**						Δ	Technical Instructions on Air Pollution Control.
GE	Vorläufige Hinweise zum Einsatz von Baustoffrecyclingmaterial **[Baden-Würtemberg MoET 2004]**							

GE	Leitfaden zum Umgang mit teerhaltigem Straßenaufbruch **[Baden-Würtemberg MoET 2010]**						Δ	Recommendation / guidelines for dealing with tarry road construction.
GE	Handlungshilfe für die Verwertung von Gleisschotter in Baden-Württemberg **[Baden-Würtemberg MoET 2008]**				Δ X			Guidance for the recovery of track ballast including limit values
GE	Anforderungen an die stoffliche Verwertung von mineralischen Abfällen - Technische Regeln - der Länderarbeitsgemeinschaft Abfall **[LAGA 2003a]**						Δ	Classification of installations
GE	Anforderungen an die stoffliche Verwertung von mineralischen Abfällen: Teil II: Technische Regeln für die Verwertung 1.2 Bodenmaterial **[LAGA 2003b]**					X		Soil application criteria – leachate concentrations
GR	Draft presidential decree - ΣΧΕΔΙΟ ΠΡΟΕΔΡΙΚΟΥ ΔΙΑΤΑΓΜΑΤΟΣ ΘΕΜΑ: ''Μέτρα, όροι και πρόγραμμα για την εναλλακτική διαχείριση των αποβλήτων από εκσκαφές, κατασκευές και κατεδαφίσεις (ΑΕΚΚ) **[Greek MoE 2004]**						Δ	Generic requirements for waste management and operation of treatment installations.
IE	C & D Waste Management: Implementation of International Best Practice in Ireland **[Irish DoEHG 2004a]**				Δ O		Δ	
IE	Quarries and Ancillary Activities: Guidelines for Planning Authorities **[Irish DoEHG 2004b]**	Δ	Δ	Δ			Δ	Best practice and mitigation measures
ES	Real Decreto 105/2008, de 1 de febrero, por el que se regula la producción y gestión de los residuos de construcción y demolición: Ministerio de la Presidencia 2486. Documentoleys 906 **[MoP 2008]**						Δ X	Maximum quantity (tonnes) generated on the site for separated fractions of C&D waste
UK	Good practice in construction and demolition materials recovery facilities **[WRAP 2009]**	Δ	Δ	Δ				
UK	Standard rules SR2010No11 **[UK EA 2010a]**	Δ	Δ X	Δ				
UK	Standard rules SR2010No12 **[UK EA 2010b]**	Δ	Δ	Δ				
UK	Standard rules SR2011No4 **[UK EA, 2011]**	Δ	Δ X	Δ				

UK	BS 5228:1997 Part 1 *Noise control on construction and open sites* **[BSI 1997]**			Δ				
UK	The quality protocol for the production of aggregates from inert waste **[WRAP 2006]**				O	O		Acceptance criteria include restricted list of inert input wastes. Example aggregate specifications are included to help demonstrate suitability for particular end-uses.
European Commission	Construction and Demolition Waste Management Practices and their Economic Impacts **[Symmonds *et al* 1999]**						Δ	Generic requirements and assessments

X…Specific/quantified provisions (Limit values or quantified recycling/recovery targets)
Δ…Qualitative provisions (incl BAT)
O…Positive/negative lists, descriptive criteria

1.4.3.2 Core elements

Nine standards related to **air emissions** were identified for Austria, Belgium, Finland, France, Ireland and UK. The core element (all standards) was a requirement for suppressing dust emissions such as wheel washing, water spraying, equipment enclosure and avoiding operations in windy conditions. Some standards also specify quantitative limits for dust (e.g. France and Finland) and odour.

Ten standards relating to controlling **water emissions** were identified. Most require prevention of release of potentially contaminated water to surface or groundwater and use of best practice such as use of sealed surfaces, appropriate bunding and run-off collection Limit values for discharge of effluent to the public sewerage system or natural environment are stipulated (temperature, total suspended solids, pH and hydrocarbons).

Eleven standards address prevention of **noise** pollution. Measures range from appropriate site location away from sensitive receptors, noise suppression on equipment, consideration of background noise levels, operation during unsocial hours and the use of regular noise surveys. Specific noise level limits are set by some MS (AT, BE, FR, IE).

Six relevant standards or pieces of legislation providing requirements for **waste input** were identified. Guidance in some MS provides lists of input wastes (AT, UK), limit values to identify potential risk from specific inputs (DE), or guidance on removal of specific contaminants (e.g. asbestos, AT).

Guidance on the **outputs** from C&D treatment have been identified for four MS. Example fraction sizes (BE) and a list of example aggregate specifications (UK) are provided to assess suitability for specific end-uses. Specific concentration limits on contaminants are also provided, as well as a certification of the recycled granulates (BE, FI).

The key **process requirements** are also covered under the emissions sections, the core elements being dust suppression, noise abatement and prevention of release of contaminated liquids to surface or groundwater. Other than these, individual MS provide guidance on general site operations, storage/management of hazardous wastes, separation of C&D waste fractions and applying the waste hierarchy.

1.4.4 Options for EU-wide treatment standards

1.4.4.1 Environmental impact 1: Emissions to the air

Air emissions are one of the major environmental impacts from mechanical treatment of construction and demolition waste by crushing, sorting or other treatments. Air emissions encompass dust / particulates and other air borne pollutants from combustion engines (NOx, CO, CO2, soot) which may contribute to greenhouse gas effects. Factsheet E3 (**CEC 2007b**) estimates that by controlling emissions from installations, the dust emitted into air could be reduced by 75 to 95% thus avoiding emission of 5.7 million tonnes of PM_{10} every year from the current 6.4Mt/yr emissions. To support member state legislation aimed at limiting or minimising air emissions, some options for

improvement at EU level could include: setting limits for dust and pollutants emissions, specifying a requirement for encapsulation of key equipment / areas where air emissions are highest or encapsulation of treatment installations; specifiying abatement solutions such as elevated stacks and robust extraction systems. Two of these options for improvement are discussed below.

Option 1: Prescription of technical requirements related to design and operation for treatment facilities/sites and/or setting limit values for dust and gaseous air emissions

- Impact on the environment (+)

  In 2007, it was estimated that there were approximately 4,100 sorting operations and 4,500 crushing installations for C&D waste in the EU none of which were covered by the IPPC/IED directive. All these facilities emitted dust, particulates and greenhouse gases (GHG) through diffuse or point sources. Dust and particulates were found to be most problematic. Factsheet E3 (**CEC 2007b**) identified the annual emission of PM_{10} dust particulates from sorting and crushing operations in the EU as 6.4 ktonnes per annum, a figure which is 80 times higher than PM_{10} emissions from the disposal of non-hazardous waste. It was calculated that 4.7 tonnes of PM_{10} was generated from crushing activities annually and by controlling this process alone, these emissions could be reduced to 0.3 ktonnes per yr, a 93% reduction. Therefore, taking action to reduce the air emissions from this waste treatment operations will contribute to overall emission reductions by Member States and hence success towards achieving this goal.

- Workers´ health and safety (+)

  Exposure to air emissions could directly or indirectly impact on workers health. The inhalation of particullates has been linked with illness and deaths from heart and lung disease as a result of both short- and long-term exposures. People with heart and lung disease may experience chest pain, shortness of breath, fatigue etc., when exposed to particulate-matter pollutants. Inhalation of particulate matter can increase susceptibility to respiratory infections such as Asthma, chronic Bronchitis, pulmonary oedema, etc. Emitted pollutants could contain substances such as cadmium, arsenic, dioxins and PAHs which are sometimes considered to be carcinogenic. These pollutants could also produce other toxic effects on the central nervous system, liver, kidney, lungs, reproductive organs, etc. Air pollution studies have indicated that certain pollutants such as SO_2 and PM_{10} particulates may increase morbidity and mortality rates at background levels of exposure particularly in susceptible groups (e.g. the elderly)[2].

  Setting concentrations of air emissions from this waste management activity will help to reduce workers exposure to harmful air pollutants and particulates, improve the health of the workforce and hence increase overall productivity.

- Economical aspects (0/+)

  Any policies which require C&D treatment installations to meet specified limits for air emissions may require installation of dust / GHG emissions abatement equipment. These could be expensive especially where they are retrofitted to existing installations rather than included

[2] Rushton Lesley (2003) Health hazards and waste management. British Medical Bulletin, **68**, pp183-197

in the initial design requirements. Estimated costs are 0.5 Euros per tonne of C&D treated by crushing plants (**CEC 2007b**).

It is estimated that around half of all installations already use a variety of emission control techniques, hence the overall financial burdens may be somewhat removed. For those facilities which already have dust abatement equipment, new legislation will, in the short-term, lead to improved revenue while competitors retrofit to comply with the additional requirements. There are also socio-economic benefits from improved health of the workforce which in turn will increase productivity and hence revenue.

- Considerable number of standards available (+)

  From the review of selected Member States III it was identified that Member States have varying standards / guidelines for managing concentrations of air emissions from these installations:

  - Belgium, Finland and France have qualitative requirements for process selection (BAT) and allowable air emissions from C&D treatment installations. There are also quantitative limit concentrations specifed for dust, vapours and gaseous emissions.
  - Austria, Ireland and the UK have qualitative requirements aimed at managing these emissions and which are focused on mitigation or health and safety practices.
  - It was not possible to determine whether Germany and Greece had any existing quantitative or qualitative standards specifically aimed at limiting concentrations of air emissions at these installations.

  Based on the limited information collated, it is highly likely that many of the Member States would need to implement or improve national regulation if stringent or specific limits for air and dust emissions are introduce by the EC. Consequently the degree of change required to comply with new EU limits will vary for installations depending on which Member States they are situated in. However, the lack of harmonised legislation across member states would not have a significant impact on national industry as the market for C&D waste is very local [CEC, 2007b].

- Contribution to environmental policy (+)

  Directive 2008/50/EC on ambient air quality and cleaner air for Europe currently requires Member States to put in place requirements for assessment of ambient air quality in relation to sulphur dioxide, nitrogen dioxide and oxides of nitrogen, particulate matter (PM10, PM2.5), lead, benzene and carbon monoxide.

  As a follow-up to the CAFE (Clean Air for Europe) programme, the European Commission proposed in its Thematic Strategy on Air Pollution to revise its directive on National Emission Ceilings (NEC) Directive to safeguard the achievement of the environmental objectives laid down in this strategy. Currently, the NEC directive focuses on minimisation of acidifying and eutrophying pollutants and ozone precursors in order to improve the protection of human

health and the environment and to achieve the prescribed ambient air quality standards. With the revisions, the aim would be to add ceilings for particulate matter for the period from 2020 onwards whilst updating the national ceilings for other air pollutants. The work is part of the comprehensive review of the EU Air Quality Strategy. NEC Scenario Analysis Report Nr. 8 explores additional emission reductions (beyond the current legislation) that would be necessary for EU Member States to meet the environment and health objectives of the Thematic Strategy under various assumptions.

Requiring specific concentration limits for air emissions from mechanical treatment of C&D wastes within relevant legislation relating to air quality improvement, through a variety of instruments, would help to minimise the emissions attributable to this and hence influence the overall quantities of air emissions across the EU with a view to meeting Europe's overall air quality improvement goals across industry.

- Relation to expected technological developments (+)

  Increasingly, there is a drive, within industry and national government to develop new equipment and techniques which are energy efficient, effective at managing waste streams and/or the emissions from these and cost effective. Linked to this is increased public awareness of the need for environmentally sustainable management of resources. Waste recycling with resource recovery is high on the agenda for many governments. The market drivers of financial benefits from collection of high quality recyclates are also influencing industry practices. Increased effort to recycle or recover materials could lead to increased emissions from these treatment processes. Thus instituting measures aimed at minimising industrial process emissions (especially for dust, GHG and other carcinogenic pollutants) due to the increased recycling activity would be a sensible course of action.

Option 1 (Prescription of technical requirements related to design and operation for treatment facilities/sites and/or setting limit values for dust and gaseous air emissions) is estimated as high priority.

<u>Option 2: Encapsulation of key equipment / areas where air emissions are highest or encapsulation of treatment installations</u>

- Impact on the environment (+)

  C&D mechanical treatment operations with limited encapsulation or abatement measures would emit more pollutants including dust into the air and environment which will in turn impact human or animal health. By identifying BAT and process equipment and requiring suitable equipment to be installed especially in areas where air emissions are highest, the overall pollutions emitted from the installations will be reduced hence reducing the environmental impacts from the given activity.

  Where encapsulation of key equipment is not practical or cost effective, there could be an alternative requirement to encapsulate the treatment installations themselves. While this

could have beneficial effects on reducing environmental impacts, it could adversely affect worker's health due to increased point source emissions concentrated within enclosed units.

Where temporary installations are not covered by BAT, e.g. many mobile crushers, there could be specific requirements for installation of suitable encapsulation structures which would help to minimise air emissions and protect the workforce.

- Workers´ health and safety (0/+)

  Encapsulation of key equipment, areas or the whole installation could help to reduce emissions especially from diffuse sources which are the predominant type of dust emissions observed at these facilities. Conversely, it may increase point source emissions unless encapsulation measures are completely enclosed.

  There is a need for careful consideration when identifying or specifying BAT equipment for these processes as there will be a need to balance reduction in emissions (with the associated improved environmental impacts) with the consequence for workers health and safety. It may be beneficial to consider specifying additional protective equipment for workers.

- Economical aspects (0/+)

  Factsheet E3 (**CEC 2007b**) estimates that around half of all C&D installations are thought to minimise dust emissions through wetting the material and enclosing the operations. It was concluded that extending the above mentioned mitigation / emission control measures to other plants would not add a significant administrative cost for either operators or administrators as the operations are already permitted but the economic consequence would be an increase in the costs of treatment significantly to several euros per tonne possibly making it less competitive compared to virgin aggregates.

  Any EU policies requiring pollution prevention and emission control measures to meet specified limits may involve costs for installations involved in this waste management operation. In general, prevention measures are usually more cost-effective than abatement measures. Installations which already have effective pollution / emission abatement technique (s) may not be financially impacted by new policy requirements provided the existing measures are sufficient to ensure that the installation meets the limits specified. Installations with none or with non existent, insufficient or ineffective emission control measures would require initial financial outlay to bring them up to legislative standards. The financial costs incurred will vary depending on size of installation, requirements of the installation, location and member state regulations, etc. and may impact on the commercial viability of the operation.Considerable number of standards available (+)

  It is widely held that air and dust /particulate emissions can be minimised by pollution prevention and emission control measures. Prevention, which is frequently more cost-effective than control, should be emphasized. Special attention should be given to mitigate the effects where toxic substances associated with air emissions may pose a significant environmental risk. Measures such as improved process design, operation, maintenance, housekeeping, and

other management practices can reduce emissions. For example, by improving combustion efficiency in diesel engines, generation of particulate matters can be significantly reduced. Proper fuel-firing practices and combustion zone configuration, along with an adequate amount of excess air, can achieve lower products of incomplete combustion (PICs).

Factsheet E3 estimates that around half of the 4100 sorting operations and 4500 crushing installations for C&D waste in the EU already use a variety of emission control techniques. Information is not immediately available on the spread of these across the Member States reviewed (WP 4.2). However, it is likely that the majority of already compliant installations will be located in Member States where there are regulatory requirements either limiting air emissions, or requiring process standards / BAT considerations for these installations. Of the Member States for which minimum treatment standards were compiled, specific or quantitative provisions for BAT and process requirements were identified for Belgium only while qualitative requirements were identified for Austria, France, Germany, Greece, Ireland and Spain. For the other Member States, it is possible that there are none specific process / BAT requirements, that they are still under development, or that these requirements are identified in seperate guidelines or regulations indirectly related to waste management legislation (e.g. planning regulations for UK, etc). Within the identified standards, there was a requirement for suppressing dust emissions by abatement measures like wheel washing, water spraying, equipment enclosure and avoiding operating in windy conditions. Limits were also included for dust and odour by some Member States.

In general, it is anticipated that a change in policy will require new regulatory changes or requirements for most Member States. The degree of change required to comply with new EU limits will vary for installations depending on which Member States they are situated in.

- Contribution to European/ international Environmental Policy (+)

  By requiring encapsulated equipment, areas or installations to help prevent or control air emissions from mechanical treatment of C&D wastes, the air emissions attributable to the waste management industry will potentially be reduced and hence enable Member States and the EU achieve its air quality improvement targets .

- Relation to expected technological/ waste management developments (0/+)

  Some common dust abatement / encapsulation equipment available which could be suitable for installations in this sector include: Mechanical dust collectors in the form of dust cyclones, wet scrubbers (water, chemicals) and bag filters; electrostatic precipitators – dry and wet systems; particulate scrubbers; binding and agglomeration systems; water sprayer at dust generation points; proper ventilation systems; and various monitoring devices to measure the concentration of dust in the general body of air. While some to these are common in the industry, others are more novel and may not necessarily be proven in this sector. Further information on BAT techniques for emissions control would need to be developed or collated.

Option 2, is a sub-option of option 1 and ranked as medium priority.

1.4.4.2 Environmental impact 2: Water Emissions

Option 3: Prescription of technical requirements related to design and operation of treatment facilities and/or setting limit values for water emissions

- Impact on the environment (+)

  The direct or indirect discharge of contaminated water, process liquids or other hazardous liquid substances used on-site at C&D installations may cause deterioration in local water quality. For example water emissions from effluent washings, contaminated with biodegradable organic matter, leachable salts and metals may contaminate surface waters, ground waters / aquifers or waste water treatment process waters. There is a need to continually monitor the quality of waste water discharges from these processes / installations to minimise the environmental risks. In addition, as part of the plant operations, containment systems should be put in place to capture, treat (if required) and properly dispose of any discharge liquids so as to prevent groundwater pollution.

- Workers´ health and safety (0/+)

  Loss of volatile compounds from effluents, leachate or process liquids could impact on the health of the workforce and the surrounding population. Contact with hazardous liquids (e.g. irritant or corrosive or carcinogenic) should be mitigated by the use of appropriate personal protective equipment. Compliance with relevant Member States health and safety regulations (e.g. UK Control of substances hazardous to health regulations (COSHH)) should be required for these installations.

- Economical aspects (0)

  No quantitative information has been identified on the levels of investment required to introduce appropriate water pollution measures where there are none. While the introduction of water collection systems would increase commercial opportunities for providers of these systems, they would increase capital expenditure and operational costs, reducing the commercial viability of the treatment facilities.

- Considerable number of standards available (+)

  Specific standards, guidelines or recommendations regarding emission to water for the mechanical treatment of C&D wastes were identified for the following Member States: Austria, Belgium, Finland, France Ireland and UK. In all instances, guidance was provided that outlines the requirements for operation of installations in a manner that aims to prevent any contamination of surface and ground waters. Mostly these require prevention of release of potentially contaminated effluent to surface or ground water and use of best practice techniques like sealed surfaces, appropriate bunding and run-off collection. Most also stipulated limit values for discharge of the effluent to public sewerage systems or the natural environment. These limits mostly related to temperature, total suspended solids, pH and hydrocarbons.

Based on the limited information available, it is highly likely that many Member States would require new or improved regulations to comply with existing water quality directives. Consequently the degree of change required to comply with EU limits will vary for installations depending on which Member States they are situated in.

- Contribution to environmental policy (+)

  It will contribute to

  - the objectives of the Waste Framework Directive (Directive 2008/98/EC) which requires that Member States must ensure that waste is recovered or disposed of without endangering human health and the environment and that the waste amount disposed of is reduced to a minimum by measures and effective tools aimed at minimising waste generation.
  - the objectives of the Water Framework Directive (Directive 2000/60/EC) which aims to establish a new, integrated approach to the protection, improvement and sustainable use of Europe's inland surface waters (rivers and lakes), transitional waters (estuaries), coastal waters and ground water.
  - the objectives of the Urban Waste Water Treatment Directive (Directive 91/271/EEC) which is to protect the environment from the adverse effects of discharges from urban waste water and certain industrial sectors. The directive covers the collection, treatment and discharge of waste water from these sectors.

- Relation to expected technological/ waste management developments (0)

  Measures which lead to reduced pollution of water courses from industrial activity will contribute to the drive towards sustainaibility, pollution prevention and control and more efficient waste management. Limiting potential pollution of water bodies will also limit the effort and costs for clean-up and regulation.

Option 3 (Prescription of technical requirements related to design and operation of treatment facilities and/or setting limit values for water emissions) is ranked as medium priority.

1.4.4.3 Environmental impact 3: Noise and Vibration

<u>Option 4: Prescription of technical requirements related to design and operation of treatment facilities and/or setting limits on noise</u>

- Impact on the environment (+)

  Noise and vibration at levels which exceed background concentrations are sources of nuisance for the neighbouring population and can cause damage that may generate its own environmental impacts. Noise is generally of more concern than vibrations unless the vibrations are sustained and hence considered disruptive.

- Workers´ health and safety (+)

  If appropriate personal protectetive equipment is not worn the work-force may suffer short

term or longer term hearing loss or hearing defects. This could impact on their overall quality of life and cause associated health problems.

- Economical aspects (0/+)

  The introduction of noise abatement systems and routine monitoring would increase commercial opportunities for providers of these services but would impact on operational costs. No quantitative information is available on the level of investment.

- Considerable number of standards available (+)

  We identified eleven quantitative and qualitative standards, guidelines and general information for noise emissions from several Member States including Austria, Belgium, Finland, France, Ireland and the UK. The standards for AT, BE, FR and IE included specific noise level limits for intslallations which undertake mechanical treatment of C&D wastes. Measures identified include: appropriate siting of installations away from sensitive receptors, noise suppression equipment, consideration of background noise levels, operation during unsocial hours and use of regular noise surveys.

  In general, it is anticipated that a change in policy will require new regulatory changes or requirements for most Member States. The degree of change required to comply with new EU limits will vary for installations depending on which Member States they are situated in.

- Contribution to European/ international Environmental Policy (+)

  It will contribute to

  - the objectives of the Waste Framework Directive (Directive 2008/98/EC) which requires that Member States must ensure that waste is recovered or disposed of without endangering human health and the environment and that the waste amount disposed of is reduced to a minimum by measures and effective tools aimed at minimising waste generation.
  - achievement of the objectives of the Directive on the assessment and management of environmental noise (Directive 2002/49/EC) aimed at controlling noise perceived by people in built-up areas, in public parks or other quiet areas in an agglomeration, in quiet areas in open country, near schools, hospitals and other noise-sensitive buildings and areas.

- Relation to expected technological developments (0)

  Less relevant.

Option 4 (Prescription of technical requirements related to design and operation of treatment facilities and/or setting limits on noise) is considered being of medium relevance.

1.5 Mechanical treatment of municipal & similar wastes

1.5.1 General information

Mixed household & similar waste is either incinerated, land-filled or undergoes mechanical treatment, either in combination with biological treatment (MBT) or not. Incineration and land-filling of waste are both covered by the IPPC-Directive 96/61/EC, respectively by the revised IED-Directive 2010/75/EU. Furthermore the Waste Incineration Directive 2000/76/EC and the Landfill Directive 99/31/EC stipulate detailed minimum requirements.

According to 96/61/EC recovery of non-hazardous waste involving biological treatment or physico-chemical treatment waste is within the scope of the Directive, if plant capacities exceed 50t/d. The revised Directive covers also disposal operations of non-hazardous wastes in plants exceeding a treatment capacity of 75 t/d. Pre-treatment of waste for incineration or co-incineration was included in the scope.

Mechanical (pre-)treatment (splitting, sorting, compacting, pre-treatment) of household & similar wastes, if not producing fractions to be used as refused derived fuels (RDF), is not covered. According to the "Study on data gathering and impact assessment for a review and possible widening of the scope of the IPPC Directive" 9 million tonnes of waste derived fuels are produced yearly in more than 270 installations in EU-15" **[EC 2007b]**. However, little information is available to determine whether these installations are stand-alone facilities. The study does not provide information on the share of household & similar waste processed to RDF in plants below the capacity thresholds of the IPPC/IED Directive.

However, it seems that considerable quantities of household & similar wastes are treated in plants with treatment capacities below the threshold. In Austria for example approximately half of the existing MBT-plants are non-IPPC-installations **[Umweltbundesamt 2010]**. Indication is also given for southern European countries, such as Portugal, that a considerable number of plants below the capacity threshold are operated.

In general - as a consequence of policies aiming at diverting waste from landfills - mechanical treatment of household & similar waste is increasing; in particular in New Member States. With 200 million tonnes of household & similar waste arising in the EU-27 in 2008 **[Eurostat 2010]** treatment quantities are considerable.

The main purposes of mechanical (-biological) treatment of household and similar wastes are:

- Conditioning for transport (reduction of volume)
- Material splitting for further processing resulting in
    - Streams for material recovery (metals, plastics, glass, etc.)
    - High calorific fractions to be used for energy recovery in co-incineration plants (RDF,

refuse derived fuel). To achieve high quality RDF pollutants are removed in additional process steps.

- Residual fractions (for disposal)

Processes usually applied comprise: pressing, baling, compacting, crushing and shredding, grinding, magnetic separation, screening, ballistic separation, air-stream separation, eddy-current separation, pneumatic separation, optic sorting, NIR sorting, drying.

1.5.2 Main environmental impacts

Main environmental impacts of the mechanical treatment of household & similar waste comprise the following major risks to environment and health:

- Air emissions:
  - related to the mechanical treatment process: dust, odour, volatile organic compounds, (volatile) heavy metals (Hg, Cd)
  - caused by combustion engines (sieving machine, crusher and trucks) principally NOx, CO, CO_2 and soot. Additional small releases of combustion gases may arise from the heating of buildings and workspaces
  - related to (improper) storage: odour, volatile organic compounds, N_2O
- Water emissions
  - improper storage may cause contaminated run-off water (or process water from initial bio-chemical reactions, if the waste is rich in biodegradable contents)
  - also, leakage of operating liquids may cause soil, surface- and groundwater contamination
- Dissipation of pollutants (heavy metals, flame retardants, hydrocarbons, PAHs, PCB, etc.) into the environment and products, if material fractions destined for further recycling/recovery/disposal processes do not meet certain quality criteria.
- Hygienic problems /infection risks
- Fire; e.g. caused by auto-inflammation of high calorific materials (e.g. RDF)
- Noise

The energy demand for the mechanical processes also makes energy efficiency an important issue.

According to EC **[2007a]** the environmental impact of producing waste derived fuels from MSW depends highly on the type of technology involved. Nevertheless, the study says, when compared to other waste management activities, it has a comparably significant impact on the environment, at

least as far as information on emissions is available. However, no such analyses have been accomplished for mechanical treatment of household & similar waste not aiming in waste derived fuel production.

1.5.3 Compilation of existing minimum treatment standards

1.5.3.1 Overview

Treatment standards dedicated to the mechanical treatment / sorting of household & similar waste were identified for Germany and France. Treatment standards for mechanical-biological treatment, such as those established by Germany and Austria include also several provisions for the mechanical treatment. Furthermore, there are standards available for the production of RDF: for Belgium, Finland and the BREF Waste Treatment Industries **[EC 2006]**. Additional requirements for the treatment of household & similar waste are found in more generic documents referring to waste management in general.

According to information provided by Member States national technical minimum standards for the mechanical treatment of household and similar wastes do not exist for the Czech Republic, Denmark, the Netherlands, Sweden, Greece, Italy, Lithuania, Ireland, Poland, Luxembourg and Spain.

Further details on key highlights of the standards / guidelines are presented in the Annex. A brief summary of each document is provided in this overview. Table 1-2 below provides an overview on the analyzed documents and their content.

The **Austrian** Guideline for mechanical-biological treatment of waste **[Austrian MoE 2002a]** describes state-of-the-art for MBT-treatment in Austria, including requirements for the mechanical treatment step. The Ordinance on waste water emissions, waste treatment **[Austrian MoE 1999]** stipulates limit values for waste water emissions from waste treatment plants using biological, physical or chemical processes, including also mechanical treatment, into the natural environment and sewer systems**.**

In the **Belgian** VLAREM II - Order of the Flemish Government concerning General and Sectoral provisions relating to Environmental Safety **[VLAREM 1995]** some prescriptions concerning prevention of dust emission from mechanical handling and processing of dust-producing solid fuels can be found.

A **Finnish** document describing BAT in energy recovery from solid recovered fuels exists **[SYKE 2004]**. However, the described BAT elements refer to an integrated waste management system (including collection, production and use of SRF) rather than specifying detailed requirements for the mechanical treatment processes applied to household and commercial wastes. The national standard "SFS 5875: Solid recovered fuel. Quality control system" **[FSF 2001]** defines the procedure and requirements, by which the quality of recovered fuel, produced for the purpose of energy production can be controlled and reported.

In the **French** "Circulaire DPPR n° 95-007 du 05/01/95" for sorting centres of household and similar industrial and commercial waste **[French MoE 1995]**[3] the French Minister of the Environment addresses the local authorities to facilitate and expedite the processing of applications for authorization of facilities for sorting activities. The Circulaire can be used as a guide for all new installations and extensions (in capacity or by type of waste received) of existing facilities. It includes limit values for emissions into the air (only for dust), water (6 parameters) and limit values for noise. Furthermore there are prescriptions relating to the distance of the installations to other buildings and relating to traffic areas.

The **German** Ordinance on biological treatment of waste (30. BImSchV) **[German MoE 2001]** sets requirements for constructing, equipping and operating of plants where household and similar wastes are treated using biological or a combination of biological and physical processes. Furthermore either biologically stabilized waste to be land-filled or sent to a thermal treatment, high calorific fractions or waste derived fuels or biogas for energy recovery have to be generated. "TA Luft" **[German MoE 2002a]** sets requirements for plants, where waste from households or similar wastes are recovered by sorting. Both documents set qualitative requirements and prescribe limit values for air emissions. The Order on Commercial Waste (GewAbfV) **[German MoE 2002b]** sets rules for so-called "pre-treatment facilities". The Order defines a pre-treatment facility as a facility where mixed commercial wastes and mixed C&D wastes and some other wastes usually generated in the production sector are pre-treated prior to material or energy recovery. Common treatments are sorting, grinding or compacting techniques or techniques for pelletizing. The latter includes descriptive criteria for the waste input. Process requirements defined include a recovery target to be achieved. Limit values for water emissions are set by Annex 23 to the Waste Water Ordinance **[German MoE 1997].** Noise aspects are regulated within the technical guidance on noise "TA Lärm" **[German MoE 1998].**A **UK** series of national standards concerning the treatment of household, commercial and industrial waste in different kind of installations exist **[UK EA 2008a to 2008f].** These standards cover the minimum distance of the facilities to other sites, the total quality of the yearly waste input, noise, vibration and emissions to air and water but do not stipulate any limit values. The "Guide to the Regulation of Outputs from the Mechanical Biological Treatment of Waste" **[UK NIEA 2011a]** inform those involved in the treatment of waste of Northern Irelands Environment Agency´s position on how the outputs from these treatment options will be regulated (waste/non-waste). UK cement industry specifications for substitute waste derived fuels have been published by **Juniper [2005]**.

Chapter 5 of the BREF Waste Treatment Industries **[EC 2006]** describes generic BAT elements (Chapter 5.1) as well as BAT for specific waste treatments (Chapter 5.2). The section "Preparation of waste to be used as a fuel" is relevant for the mechanical treatment of household & similar waste. Generic BAT for the waste treatment sector include requirements for environmental management, elements to improve knowledge of Waste IN and Waste OUT, utility and raw materials management, soil contamination, which were not further considered in this compilation. From BAT related to "storage and handling", to "other common techniques", "air emission treatments", "waste water

[3] Meanwhile repealed by circular from 24/12/2010 on decree amending the nomenclature of waste treatment installations

management" and "management of residues" the most relevant elements with regard to mechanical treatment of household and similar waste were extracted for the purpose of this report. The BREF specifies emission levels associated to the use of BAT in waste treatment. CEN/TS 15359:2006, Solid recovered fuels **[CEN 2006]** provides a classification system for SRF.

Table 1-2: Compilation of the key provisions of minimum treatment standards for mechanical treatment of household & similar waste

MS	Standard	Emission related standards			Process related standards			Others
		Air (incl. odour)	Water	Noise	Waste IN	Waste OUT	Process requirements and BAT	
AT	Guideline for MBT of waste **[Austrian MoE 2002a]**	Δ X	Δ	Δ	O		Δ	
AT	Ordinance on waste water emissions, waste treatment **[Austrian MoE, 1999]**		X					
BE	Flemish Order concerning Environmental Safety **[VLAREM 1995]**						Δ	
DE	30. BImSchV **[German MoE 2001]**	Δ X						
DE	TA Luft **[German MoE 2002]**	Δ X					Δ	
DE	Order on commercial waste **[German MoE 2002]**				O	O	Δ X	
DE	Waste Water Ordinance **[German MoE 1997]**		X					
DE	TA Lärm **[German MoE 1998]**			X				
FI	BAT Energy Recovery from Solid Recovered Fuel **[SYKE 2004]**							BAT for integrated system (waste collection, production and use of RDF)
FR	Circulaire DPPR n° 95-007 du 05/01/95 **[French MoE 1995]**	Δ X	Δ X	Δ X			Δ	
UK	Series of Standard rules: SR2008No1, No3, No4, No14, No15, No18 **[UK EA 2008a to 2008f]**	Δ X	Δ X	Δ	O			
UK	Guide to the Regulation of Outputs from the MBT of Waste **[UK NIEA 2011]**					Δ		
EU	BREF Waste Treatment Industries **[EC 2006]**	Δ X	Δ	Δ	Δ	Δ	Δ	
	Requirements for materials resulting from mechanical treatment (high calorific					O X		

MS	Standard	Emission related standards			Process related standards			Others
	fractions for (co)-incineration)							
EU	CEN/TS 15359:2006, Solid recovered fuels **[CEN 2006]**					Δ O X		
EU	EURITS criteria **[EC 2003]**					X		
FI	Finnish Standard 5875, Solid Recovered Fuel **[FSF 2002]**					Δ O X		
UK	Industry specifications **[Juniper 2005]**					X		
	Requirements for materials resulting from mechanical treatment (residual fractions destined for disposal)**					X		

X…Specific/quantified provisions (Limit values or quantified recycling/recovery targets)
Δ…Qualitative provisions (incl BAT)
O…Positive/negative lists, descriptive criteria

*European and national legally binding and non-binding standards for waste derived fuels (examples are given).
**European and national legislation setting criteria for acceptance at landfills

1.5.3.2 Core elements

Six standards related to **air emissions** were analysed. All of them include qualitative requirements for preventing emissions related to design and operation of the plants. Most of the standards furthermore provide limit values for dust, odour, organic compounds (TOC, VOC) and N_2O[4]. Most relevant for the mechanical treatment are dust and odour. No limit values related to emissions of heavy metals or further hazardous organic compounds were identified. One regulation stipulates a minimum distance of MBT-plants to residential areas. Measures for preventing dust, such as using sprinklers, reducing drop heights, keeping the transport velocity of materials and vehicles low, are described. Working in enclosed areas and encapsulation of relevant plant components such as conveyer belts are requested. Gaseous effluents have to be collected and exhaust gas has to be cleaned. For MBT plants discharge of the exhaust gas via chimneys is prescribed. The standards provide details on measuring and monitoring of the emissions.

Five standards related to **water emissions** were identified, setting at least qualitative requirements. Walls and floorings of containers and waste bunkers and manipulation and storage areas have to be equipped with impermeable surfaces and sealed drainage systems. Direct or indirect discharge of residual water to groundwater is banned. Limit values dedicated to mechanical treatment of household waste are stipulated by French legislation (total suspended solids, BOD_5, COD, pH and hydrocarbons). Three of the five standards analysed (AT, DE, BREF Waste Treatment Industries) provide limit values for waste water discharge or emission levels associated with the use of BAT for organic load and some hazardous heavy metals.

A French law defines limits for **noise** aggravation caused by sorting centres for household and similar industrial and commercial waste.

Two national standards (DE, UK) provide either positive/negative lists or descriptive criteria for the **waste input** into mechanical treatment plants for household & similar waste, were identified. Wastes consisting solely or mainly of dusts, powders or loose fibres or wastes that are in a form which is either sludge or liquid are not allowed as input into plants. Suitable input material is waste from paper and cardboard, glass, textiles, clothes, uncontaminated wood, metals, rubber, cork, ceramics plastics and several waste streams usually being generated at specific production facilities. To protect aggregates from damage it is BAT to remove bulky waste from incoming material.

Apart from generic provisions specified in the BREF Waste Treatment Industries for the production of RDF no standards were identified for the **output waste streams** of mechanical treatment of household & similar waste. In general quality criteria for the waste output depend on the intended use or disposal of the waste streams. For RDF European and national - legally binding and non-binding - standards as well as specifications issued by co-incineration plants (e.g. cement kilns) exist. Key parameters are humidity, calorific value, ash content, chlorine content, aluminum, heavy metals and conveyance properties. Examples are CEN/TS 15359:2006 Solid recovered fuels; specifications

[4] In the light of exhaust air treatment at MBT-plants emissions also NO_2 and dioxins/furanes are limited

and classes **[CEN 2006],** the Finnish Standard 5875, Solid Recovered Fuels **[FSF 2002]** or UK cement industry specifications for substitute waste derived fuels **[Juniper 2005]**. The quality of materials intended for recycling, e.g. their content of impurities, are generally regulated by market prices. Regarding residual fractions destined for land-filling acceptance criteria as stipulated by the Landfill Directive 99/31/EC and by national legislation have to be considered.

Process requirements - apart from those already mentioned under "emissions" - deal mainly with the treatment process itself, internal waste transports, occupational health & safety and fire protection. The following core elements were identified: Mixing of commercial wastes with any other wastes than C&D waste is prohibited. The removal of hazardous wastes is requested. Sorting plants have to achieve a recovery target (85%) on a yearly average. Manual transporting and manual sorting of waste should be prevented. For fire protection mechanical treatment plants shall be separated into several fire-compartments. Their connections shall be secured by protective measures. A further fire-protection measure is the limitation of permitted storage volumes, in particular for RDF. Vehicles and control stations shall be equipped with closed air-conditioned cabins, preventing contamination of climbs and cabins, etc. For the preparation of solid waste fuels the following is BAT: the use of magnetic ferrous and non-ferrous metal separators, NIR technique for the segregation of plastics containing organic chlorine as well as a combination of shredder systems and pelletizers suitable for the preparation of the specified size waste fuel.

1.5.4 Options for EU-wide treatment standards

Below options for minimizing the main environmental impacts of mechanical treatment of municipal & similar wastes are discussed.

1.5.4.1 Environmental impact 1: Emissions to the air

Air emissions result from the mechanical treatment process (in particular dust, odour, volatile organic compounds, (volatile) heavy metals such as Cd, Hg) as well as from storage and handling (in particular odour, dust, VOCs and N_2O)

Further air emissions (combustion gases, principally NOx, CO, CO_2 and soot) are caused by combustion engines (of sieving machines, crushers and trucks, etc.) and may arise from the heating of buildings and workspaces.

The latter are not considered being specifically relevant in the context of this task. For the first, below different options aiming in minimizing emissions to the air are discussed below.

<u>Option 1: Prescription of technical requirements related to design and operation of treatment facilities and/or establishing limit values for air emissions</u>

- Impact on the environment (++)

  By encapsulation of relevant aggregates (sieves, shredders, loading points) and/or complete installations and treatment and appropriate abatement technology emissions, in particular particulate matter, from mechanical MSW-treatment will be reduced.

The amount of MSW being treated mechanically either by MBT or MT in Europe is about 15 to 25 Mio tonnes[5]. Examples for emission factors when using BAT for producing waste derived fuels from mixed non-hazardous wastes are 4.5 g dust per tonne of waste or 2.3 g of total metals per tonne of waste treated. Indication is given that limits for air emissions are not the rule[6].

In particular in Member States, where MSW has comparably high concentrations of hazardous substances because collection systems for hazardous wastes from households are not yet in place or at an initial stage, the effect of prescriptions for controlling air emissions will be high.

Installation of filters and related air suction/ventilation systems on the other hand will increase the need of energy and associated emissions (e.g. from diesel generators)

- Workers´ health and safety (+/0)

  Setting concentrations of air emissions and encapsulating of aggregates will help to reduce workers exposure to harmful air pollutants (dust, volatile heavy metals and organic substances) and lower infection risks. Conversely, it may increase point source emissions unless encapsulation measures are completely enclosed. Thus it might be beneficial to consider protective equipment for workers.

- Economical aspects (0/+)

  This option will lead to investment costs of, operational costs for bag filters, zyclones, etc., costs for the disposal of residual/fine fractions and energy costs as well as costs for monitoring (sampling, analysis). The BREF Waste Treatment Industries **[EC 2006]** specifies the costs for dust filtering using fabric filters with up to 4€ (investment) and 0.25€ (operation and maintenance) per tonne of waste fuel produced[7]. Conversely there are positive effects for providers of plant technology.

- Considerable number of standards available (+)

  Requirements were found in general air emissions standards as well as in standards for treatment of MSW & similar wastes, and in particular in MBT related standards. Member States have established binding limit values for mechanical-biological pre-treatment, which not always apply for plants dedicated to mechanical treatment only. Limitation of dust emissions was found in most of the standards analyzed.

- Contribution to European / international Environmental Policy (Strategies, objectives etc.) (+)

  Limiting emissions from mechanical treatment of MSW would in particular reduce emissions of particulate matter and thus contribute to the Objectives of the Directive on ambient air quality and cleaner air for Europe (2008/50/EC).

[5] According to EC, 2007 the annual production of waste-derived fuels from MSW was estimated to account for about 4 Mio tonnes at mechanical treatment plants and 3.5 Mio tonnes at MBT-plants. According to Eurostat Waste Statistics (2011) in 2008 7.4 Mio tonnes of Sorting residues were subjected to "Energy Recovery" (R1) and further 5.2 tonnes to "Incineration on Land" (D10). Furthermore the ratio waste derived fuels to input is estimated with 50%.

6 According to Umweltbundesamt, 2008 only for 2 of 14 mechanical treatment plants in Austria a limit value for dust was prescribed in the plant permit

[7] Approximately 50% of waste input

- Relation to expected technological / waste management developments (+)

  Both, objectives/principles of the current European waste legislation, such as reducing of biodegradable waste going to landfill (Directive 1999/31/EC) or recycling rates for waste materials from households and similar origins according to the Waste Framework Directive 2008/98/EC, as well as economic factors, such as increased prices for recyclable and combustible waste materials, will lead to an increased relevance of this waste treatment activity.

Option 1 is described as the *prescription of technical requirements related to design and operation of treatment facilities and/or establishing limit values for air emissions*; the option is estimated as as high priority.

Option 2: Introduction of acceptance criteria for waste input

Option 2 might include the definition of suitable input materials and requirements related to the exclusion of particular materials (e.g. wastes consisting solely or mainly of dusts, powders or loose fibres or wastes that are in a form, which is either sludge or liquid). Furthermore, required pre-treatment, such as removal of hazardous wastes or bulky wastes and specifications related to the acceptance procedure might be included (visual inspection, chemical analysis, etc.).

- Impact on the environment (++)

  Control of waste input to be treated in mechanical treatment plants can be seen as an effective means of preventing emissions as the overall content of hazardous substances in the waste is reduced. Furthermore, preventing treatment of e.g. dusty materials will of course positively affect the dust development in the plant.

- Workers´ health and safety (+/0)

  Reduced amounts of unsuitable materials and pollutant loads subjected to crushing and sorting aggregates will lead to reduced exposure of the workers to gaseous pollutants and dust. If the quality of delivered wastes requires manual sorting before entering mechanical treatment, this conversely might lead to increased exposure for those performing manual sorting (e.g. infection risk). Therefore accompanying measures for protection of workers should be considered.

- Economical aspects (0/+)

  Personnel costs for input control and if necessary for pre-sorting as well as for disposal of hazardous wastes might occur. No relevant investment needs. Improved quality of output materials might lead to increased revenues.

- Considerable number of standards available (0)

  Only a few standards (DE, UK) were identified during this task.

- Contribution to environmental policy (Strategies, objectives etc.) (+)

  See above

- Relation to expected technological / waste management developments (0)

  Relevance of waste acceptance criteria for waste input into mechanical sorting plants for MSW and similar waste will get less important with increased establishment of effective systems for separate waste collection from households in Member States, where there are none.

Option 2 regards the *introduction of acceptance criteria for waste input*; it is ranked as medium priority.

1.5.4.2 Environmental impact 2: Emissions to water/soil

Option 3: Prescription of technical requirements related to design and operation of treatment facilities and/or setting limit values for water emissions

In order to prevent the release of contaminated liquids into the environment minimum requirements for treatment sites similar to those prescribed in the EU-Directives for special waste streams (e.g. WEEE - Directive 2002/96/EC or Batteries and Accumulators - Directive 2006/66/EC) could be established, including at least:

- impermeable surfaces, sealed drainage systems and waterproof covering for areas with the provision of spillage collection facilities and, where appropriate, decanters and cleanser-degreasers
- appropriate containers for storage of sorted out recycleables and in particular for hazardous wastes
- equipment for the treatment of water

- Impact on the environment (+)

The impact on the environment depends on the composition of the waste material (e.g. high organic contents, high pollutant loads), on the duration of storage (process waters of initial bio-chemical reactions). Weatherprove covering of treatment and storage areas, as a key element, will lead to low amounts of runoff-water.

- Workers´ health and safety (0)

Less relevant

- Economical aspects (0/+)

Investment needs for technical measures as well as operational costs for waste water cleaning or disposal occurr. Furthermore, costs for sampling and analyzing samples will ocurr. No quantitative information has been identified on the levels of investment required to introduce appropriate water pollution measures where there are none. However, the introduction of water collection systems would increase commercial opportunities for providers of these services but would impact on operational costs.

- Considerable number of standards available (+)

General technical requirements related to design of treatment sites are quite common. For just a

few Member States limit values and qualitative prescriptions related to preventing liquid emissions in particular from mechanical treatment of MSW & similar wastes were identified within this project. Parameters most often limited include organic load (COD, BOD, suspended solids), ph, hydrocarbons and most hazardous heavy metals (As, Hg). Based on that limited information available, it is highly likely that many Member States would require new or improved regulations to comply with existing water quality directives. Consequently the degree of change required to comply with limit values might vary significantly in MS.

- Contribution to further environmental policy (Strategies, objectives etc.) (+)

It will contribute to the objectives of the Water Framework Directive (Directive 2000/60/EC) which aims to establish a new, integrated approach to the protection, improvement and sustainable use of Europe's inland surface waters (rivers and lakes), transitional waters (estuaries), coastal waters and ground water.

- Relation to expected technological / waste management developments (0)

Relevance of prescriptions related to water emissions from mechanical sorting plants for MSW and similar waste will get less important with increased establishment of effective systems for separate collection of biodegradable and hazardous wastes from households in Member States, where there are none.

Option 3, as regards the *prescription of technical requirements related to design and operation of treatment facilities and/or setting limit values for water emissions*; it is ranked as medium priority.

1.5.4.3 Environmental impact 3: Dissipation of pollutants to further (recycling) processes and products via waste outputs

<u>Option 4: Prescription of de-pollution</u>

- Impact on the environment (++)

  Apart from preventing air emissions removal of hazardous wastes from MSW will contribute to lower pollutant contents in recyclable and incinerable waste materials, such es metal fractions or RDF. Thus first diffuse emissions from subsequent storage and transport of waste materials can be reduced. Second, emissions from subsequent recycling processes (e.g. metallurgical plants), in particular if recycling plants are not applying BAT (e.g. outside EU), and contamination of recycled materials (products, e.g. cement) would be reduced.

- Workers´ health and safety (0/+)

  - Reduced amounts of unsuitable materials and pollutant loads subjected to crushing and sorting aggregates will lead to reduced exposure of the workers to gaseous pollutants and dust. If the quality of delivered wastes requires manual sorting before entering mechanical treatment, this conversely might lead to increased exposure for those performing manual sorting (e.g. infection risk). Therefore accompanying measures for protection of workers

should be considered.

- Economical aspects (0/+)

  Personell costs for input control and if necessary for pre-sorting as well as for disposal of hazardous wastes might occur. No relevant investment needs. Additional revenues might be realized due to better quality of the waste streams for recycling/recovery (e.g. for solid recovered fuels).

- Considerable number of standards available (+)

  See Option 2.

- Contribution to environmental policy (Strategies, objectives etc.) (+)

  Contribution to objectives to strategies aiming in removal of pollutants (POPs or heavy metals) from the environment, such as the Stockholm Convention or product relevant legislation related to limiting hazardous substances (e.g. Directive 2002/95/EC or Directive 2000/53/EC).

- Relation to expected technological / waste management developments (0)

  See option 2.

Finally, option 4 described as the *prescription of de-pollution of waste input* is valued as high priority.

1.6 Biological treatment (composting and anaerobic digestion) of biodegradable waste

1.6.1 General information

The following installations are covered by the current IPPC Directive:

- According to Section 5.1 in Annex 1 to the Directive installations for the disposal or recovery of hazardous waste as defined in the list referred in Article 1 (4) of Directive 91/689/EEC, as defined in Annex II A and II B (operations R1, R5, R6, R8 and R9) to directive 2006/12/EC and in Council Directive 75/439/EEC of 16 June 1975 on the disposal of waste oils, with a capacity exceeding 10 tonnes per day

- According to Section 5.3 in Annex 1 installations for the disposal of non-hazardous waste as defined in Annex II A to Directive 2006/12/EEC under headings D8 and D9, with a capacity exceeding 50 tonnes per day

Consequently, if the biological treatment is to be considered a recovery operation in the sense of Article 2 (15) of the Waste Framework Directive of non-hazardous waste as defined by Section 5.1, these installations are outside of the scope of the IPPC Directive.

The IPPC-Directive has recently been recasted. The new so called IED Directive 2010/75/EC covers the following capacity threshold values and activities:

- According to Section 5.1 in Annex 1 to the Directive disposal or recovery of hazardous waste with a capacity exceeding 10 tonnes per day involving one or more of the following activities: a) biological treatment (…);

- According to Section 5.3 a) in Annex 1 to the Directive disposal of non-hazardous waste with a capacity exceeding 50 tonnes per day involving one or more of the following activities, and excluding activities covered by Council Directive 91/271/EEC of 21 March 1991 concerning urban waste-water treatment: (…) i) biological treatment and;

- According to Section 5.3 b) in Annex 1 to the Directive recovery, or mix of recovery and disposal, of non-hazardous waste with a capacity exceeding 75 tonnes per day involving one or more of the following activities, and excluding activities covered by directive 91/271/EEC: (…) i) biological treatment.

In comparison to the IPPC Directive, the most significant change by IED Directive is the introduction of recovery operations of non-hazardous waste, if exceeding the relevant capacity threshold. However, it is expected that a substantial part of composting and anaerobic digestion installations will fall below the capacity thresholds specified in Annex I to the IED Directive and thus could still be relevant to our study.

For the purpose of this chapter, the treatment of biodegradable waste is not considered in case

- the biodegradable waste is considered hazardous waste in the sense of the IED Directive or
- the treatment operation is considered disposal operations in the sense of the Waste Framework Directive and exceeding the threshold of the IED Directive.

According to the Impact Assessment report **[EC 2007e]** there are about 6,000 installations for the biological treatment of biodegradable waste in the EU. About 3,500 of these are composting installations and the rest (~2,500) are anaerobic digestion installations. Most digestion installations are small-scale on-farm units. It was estimated that about 120-150 of these installations are centralised installations with a capacity above the threshold of 50 tonnes per day. The authors further state that all plants with a capacity > 50 tonnes per day are 89% of the composting capacity and 99% of the centralised digestion capacity.

In the green paper on the management of bio-waste in the European Union **[EC 2008]** the total annual arising amount of bio-waste in the EU was estimated to be about 100 MT food and garden waste included in mixed municipal solid waste and up to 37 MT from the food and drink industry.

Many different composting technologies have been developed. Some treatment processes are very simple systems as home -composting or open windrow composting, whereas others can be very sophisticated and use closed systems with continuous control of several parameters as temperature, moisture and oxygen. The latter can be less space demanding, faster, and easier in terms of process emissions control. Effluent water and gases are normally collected and treated to avoid emissions. The products from the composting are aimed to be used as a fertiliser, soil improver, growing media or cover materials e.g. for brownfields or landfills.

Anaerobic digestion is more suitable for treating wet biodegradable waste, including e.g. kitchen, restaurant and food production waste or manure. It produces a gas mixture (mainly methane - 50 to 75% - and carbon dioxide) in controlled reactors **[EC 2008]**. Anaerobic digestion takes place under exclusion of oxygen with the aim to produce methane. This methane can be used in special CHP engines for the generation of heat and electrical energy or can be upgraded to biofuels for vehicles or the public grid. Beside the biogas liquid and solid digestate is produced. The solid digestate can undergo further treatment via composting. The digestate (especially the liquid one) is rich in nutrients and good qualities can be used as liquid or solid fertiliser mainly in agriculture.

Typical input materials for both processes are organic kitchen and garden waste, residues from supermarkets and food production and sewage sludge .

1.6.2 Main environmental impacts

The main environmental impacts from treatment of biodegradable waste are emissions to air and water during the digestion process, whereas the final product can lead to releases to soil. Many

Member States have introduced some general recommendations to keep emissions as low as possible. However detailed information about procedural aspects or limit values is scarce.

Major risks related to **composting** and **anaerobic digestion** of biowaste are:

- Air emissions: especially for open systems, which are often used for composting, odour can be a big problem. Air emissions include the greenhouse gases (in particular CH_4, N_2O), NH_3, dust and VOC, which are produced if too little water and/or oxygen is provided.
- Releases into water: Water in contact with the biodegradable waste can have high contents of heavy metals and organic substances that might contaminate surface water if not treated before release. The process water can also be the source of strong odour.
- Soil contamination by composts and digestates for agriculture use: Uncontrolled use of compost or digestate can lead to increased soil contamination – and sometimes as a consequence groundwater contamination - with heavy metals, PCDD/PCDF, AOX, hydrocarbons, endocrine disruptors, pathogens.
- Energy efficiency: the overall energy balance is relevant for anaerobic digestion aiming in production of energy from biogas
- Noise emissions (from manipulation) are of comparably low relevance

1.6.3 Compilation of existing minimum treatment standards

1.6.3.1 Overview

To note that at EU level, it is discussed to introduce treatment standards in order to safeguard sanitization and output quality thresholds, in the framework of upcoming end-of-waste requirements under the WFD (in preparation) and possibly in the framework of future revised EU Fertiliser Regulation. It can be expected that both regulation will in addition refer to the need to the establishment of a quality management/quality assurance scheme which will include the control of the input, the process management and the output.

Some Member States have prepared guidelines and legislation for the treatment of biodegradable waste. These however, only include relatively general provisions, such as the requirement to keep emissions of particle matter (PM), odour or releases into water as low as possible, without providing more detailed explanations for the means to achieve this or limit values to be met. Other Member States (e.g. France) have set up limit values (odour, noise, water release) and let the operators choose the best technologies and/or plant design to comply with the thresholds.

In some cases advices are more precise. This includes the advices to circulate water, which has been in contact with the biodegradable waste, and to seal water as much as possible due to the strong

odour. A further requirement is the obligation to capture and treat all excess water including rain water before it is released to the environment. There are not many Member States, which have set specific limit values

However, single Member States have prepared national directive or guidelines with detailed parameters and corresponding limit values for biodegradable treatment facilities. The limit values as well as the related reference objects are very different and cannot be represented in overview tables or compared with each other. The different legislations or guidelines of the Member States are therefore summarized separately and only compared with each other if feasible.

Further details on key highlights of the standards / guidelines are presented in the Annex. A brief summary of each document is provided in this overview. Table 1-3 below provides an overview on the analyzed documents and their content.

Austrian legislation Ordinance on waste water emissions, waste treatment **[Austrian MoE 1999]** includes limit values for the drainage of waste water, but they are not specific for biodegradable waste treatment facilities. The Federal Waste Management Plan **[Austrian MoE 2011]** includes a specific section for biodegradable waste regarding air emission and process requirements; however, it does not include specific limit values. More detailed and specific settings can be found in the Ordinance on compost **[Austrian MoE 2001a]** it regulates acceptable input materials for different purposes as well as limit values for different product quality classes. The [**Austrian MoE 2005**] further describes the actual state-of-the-art of composting technologies applied in Austria. It includes also chapters on storage requirements and pre-treatment, quality of input material, emission, technologies and encountered problems. In the **Belgium** Royal Decree **[BE RD 0256B 2007]** limit values are included for the waste input materials for the biodegradable waste treatment. The Order of the Flemish Government **[BE/FL VLAREM II 1995]** and the Order of the Flemish Government **[BE/FL VLAREA]** further include some regulations for waste input for the biodegradable treatment and also include specific limit values for the produced material. The Order **[BE/FL VLAREA]** also provides a calculation and procedure, to avoid an excessive contamination of the soil due to the use of treated biodegradable waste.

The **German** legislation recognises requirements regarding emissions to air and water for the treatment of biological wastes within TA Luft **[German MoECNS 2002]**, the first general administrative regulation for the Federal Pollution Control Act, in its No 5.4.8.5 and 5.4.8.6. The Ordinance on plants for biological treatment of wastes **[German MoE 1998]** covers air releases and includes limit values (see Table 2-47 and Table 2-48) for different substances.

The French Legislation distinguishes two fields for requirements: the Anaerobic Digestion / Composting plant, and the final compost (no current legislation for digestate).

- Requirements for plants are laid down in ICPE legislation (installations classées pour la protection de l'environnement) which sets out a framework with a graded approach for three classes of installations, based on the daily tonnage of input material. Depending on the tonnage, requirements are more and more stringent on noise levels (limit values),

wastewater treatment (limit values for the treated released water), traceability on raw and final materials (documents to be fulfilled, including for composts), and odour (limit values). For Anaerobic Digestion plants, specific requirements for the biogas combustion equipment is added. Plants are controlled by the competent authorities, and have to deliver a periodical activity report.

- Two mandatory standards are in place, [AFNOR 2010 NF U44-051] for all composts except those with sludge, and [AFNOR 2010 NF U44-095] for sludge based composts. The standards include detailed limit values for the output material for heavy metals, pathogens, impurities and other organic substances. Also other limit values for organic matter, that are intended to be spread on land, are provided including among others for N and P2O5 content.

The main regulatory reference in **Italy** is the Environmental Act (D.lgs.152/2006) modified by D.lgs. 4/2008 and d. lgs. 205/2010. The Italian legislation for identification of non-hazardous waste subject to simplified recovery procedure [IT D.M. 5/1998] includes the requirement to BAT to reduce emissions, and a limit value for particle matter (in anaerobic digestion facilities). It further also includes a positive list and maximum amount of biodegradable waste treatable waste in a given facility. Regarding the process conditions some general needs are laid down. The Italian fertilisers law (D.lgs. 75/2010) includes compost quality standards for heavy metals, pathogens, impurities, C/N, organic C and N. Several Italian regions have further adopted local regulations and guidelines for biowaste plant design and management. They include measures for environmental protection such as leachate collection and management, process prescriptions, specifications on biofilter features and performances, emission limits, etc.

The **Polish** Guideline **[SZPADTA 2008]** sets some limit values regarding the nuisance of odour and gives some general and also detailed information regarding the composition of the material for composting anaerobe digestion. Limit values for the treated biowaste are also included as well as general process parameter for a proper treatment.

The **Swedish** Guideline **[NATURVÅRDSVERKET 2003a]** provides some general information to limit air emissions and water releases and also includes some detailed information about the needed time for maturation at a given temperature.

A UK series of national standards concerning the treatment of biodegradable waste exist **[UK EA 2008d], [UK EA 2008e]** and **[UK EA 2008g].** Each of them is quite similar to the rest but differs in details. However these standards cover the minimum distance of the facilities to other sites, the total quality of the yearly waste input, noise, vibration and emissions to air and water (limit values only for incineration unit). The Guidelines for composting and anaerob digestion facilities **[UK EA 2009]** and **[UK EA 2011]** inform about proper waste type inputs for composting and anaerobe digestion whereas document **[UK EA 2010]** informs about the proper process requirements.

Table 1-3: Compilation of the key provisions of minimum treatment standards for biological treatment (composting and anaerobic digestion) of biodegradable waste

MS	Standard	Emission related standards			Process related standards			Others
		Air (incl. odour)	Water	Noise	Waste IN	Waste OUT	Process requirements and BAT	
AT	Waste water emission regulation (Abwasseremissionsverordnung) **[Austrian MoE 1999]**		X					
AT	Austrian draft waste management plan (Bundes-Abfallwirtschaftsplan 2011**) [Austrian MoE 2011]**	Δ					Δ	
AT	Ordinance for the quality requirements on compost from waste (Bundesgesetz 292. Kompostverordnung) **[Austrian MoE 2001a]**				O	X		
BE	Royal Decree establishing product standards for compostable and biodegradable materials **[BE RD 0256B 2007]**				X			
BE/FL	VLAREM II [BE/FL VLAREM II 1995]				O			
BE/FL	VLAREA + appendices **[BE/FL VLAREA]**					X	X	
DE	TA Luft [German MoECNS 2002]	X					X	
DE	Biowaste regulation (Bioabfallverordnung) **[German MoE 1998]**				O	X	X	*Process requirements such as time-temperature profiles, HRT, etc.*
FI	Finland BAT-document (Biokaasun tuotanto Suomalaisessa toimintaympäristössä) **[SYKE 2009]**				O			*BAT for integrated system (waste collection, production and use of RDF)*

MS	Standard	Emission related standards			Process related standards			Others
FR	Code de l'environnement, chapter V (ICPE)	*X*	*X*	*X*	*X*	X		
FR	Amendements organiques Dénominations, specifications et marquage **[AFNOR 2010a]** and Amendements organiques - Composts contenant des matières d'intérêt agronomique, issues du traitement des eaux **[AFNOR 2010b]**					O X		
IT	Identification of hazardous waste subject to simplified recovery procedures under Articles 31 and 33 of Legislative Decree 5 February 1997, No 22 [IT D. M. 5/2/1998]	Δ X			O		Δ X	
PL	Guidance on requirements for composting and fermentation and mechanical-biologixal waste treatment (Wytyczne dotyczące wymagań dla procesów kompostowania, fermentacji i mechaniczno-biologicznego przetwarzania odpadów) (15 December 2008) **[SZPADTA 2008]**	X	Δ		O X	O X	O	
SE	The guideline for Methods for storage, digestion and composting of waste (Metoder för lagring, rötning och kompostering av avfall) **[NATURVÅRDSVERKET 2003a]**	Δ	Δ				X	
UK	Quality protocol for anaerobic digestate **[UK EA 2009]**				O			
UK	Environmental permitting regulation 2010 **[UK EA 2010]**						O	
UK	Standard rules SR2010No14_500t composting biodegradable waste **[UK EA 2008d]**						O X	*Minimum distance to sites (European site, Ramsar site or SSSI)*
UK	Standard rules SR2010No15 Anaerobic digestion facility including use of the resultant biogas **[UK EA 2008e]**						O X	*Minimum distance to sites (European site, Ramsar site or SSSI)*
UK	Standard rules SR2010No16 On-farm anaerobic digestion facility including use of the resultant biogas **[UK EA 2008g]**						O X	*Minimum distance to sites (European site, Ramsar site or SSSI)*

MS	Standard	Emission related standards			Process related standards			Others
UK	Standard permit 2011						X	
UK	Compost, The quality protocol for the production and use of quality compost from source-segregated biodegradable waste **[UK NIEA 2011c]**				O			
UK	Good Practice and Regulatory Guidance on Composting and Odour Control for Local Authorities **[UK DEFRA 2009]**						O X	

X…Specific/quantified provisions (Limit values or quantified recycling/recovery targets)
Δ…Qualitative provisions (incl BAT)
O…Positive/negative lists, descriptive criteria

1.6.3.2 Core elements

Member States provide advices to keep **emissions to air** as small as possible. In many Member States limit values for gas emissions are mostly given for energy production plants which might be part of the anaerobic digestion facility to produce heat and electricity from the produced methane and include parameters as NO_x or CO_2. However such emissions are not considered to be the scope of this document as they are more related to incineration processes than biodegradable waste treatment facilities. A typical requirement to avoid odour nuisance is the request to cover the compost heaps and to follow minimum distances requirements to residential areas. To limit emissions from closed systems used for biodegradable waste treatment, the systems typically have lower pressures than the environment and the gases are treated by abatement technologies such as bio-filters, before they are released to the environment. However, with the proper management of a plant in the first place avoids and reduces emission to air.

In general Member States recommend to keep **emission to water** small and to circulate the water in the process. It is also often mentioned that the process water can have a strong odour and should be kept in closed systems. Excess waste should be treated before leaving the facility. In some Member States specific waste water limit values for composting and anaerobic digestion facilities are provided.

The composting as well as the anaerobic digestion process are in general no processes prone for **noise** production. Therefore no guidance or regulation could be found regarding the emission control for noise.

Especially in case of the production of compost many regulations and guidelines exist to control the **input material**, because in this treatment process the contaminations of the input will directly influence the output quality. In case of other treatment technologies for biodegradable waste, which purpose is for example the production of methane, to generate thermal or electric energy the contaminations of the input material will end up in a by-product. This can further be treated to compost or stabilised to be land-filled. To ensure sufficient high quality compost many Member States implemented systems for an input control, such as limit values or positive lists for biodegradable waste which can be used for the production of good quality compost. Only some Member States such as France, Spain and Portugal allow the organic fraction segregated from mixed municipal solid wastes (MSW) to be composted and further used for forestry or agriculture purposes. Composts from mixed sources tend to have a considerable lower quality and mor impurities (glass, stones, plastic) compared to source separated wastes. Newer MSW composting plants with strong sorting equipment show some improvements.

Although not being the focus of this project and important new developments for a European wide quality approach are in view as follow up of the EU end-of-waste requirement for compost/digestate and the inclusion of organic fertilisers in the revised EU Fertiliser Regulation, some information is given on quality criteria for the **outputs** of biological treatments. To avoid soil contamination several Member States have set limit values for compost. Typical parameters include heavy metals, other

organic substances and micro organisms. Many Member States have established limit values for the produced output materials from biodegradable waste treatment facilities especially for compost facilities. Typical parameters which are regulated are heavy metals (e.g. As, Cd, Cu, Cr, Hg, Ni, Pb, Zn), organic substances (e.g. PAH, PCDD/PCDF, TOC) and pathogenes (e.g. Salmonella).The approaches can vary significantly as different compost quality classes are in place or the limit values are related to applied amounts per hectare field. For heavy metals the limit values are summarized in Chapter 2.1.3 (Annex). It has to be considered that the limit values are related to different matrices and/or framework requirements making direct comparison a sensitive task.

Process requirements: There are many different technologies and variations for the treatment of biodegradable waste. However to receive a product of sufficient quality some general parameters have been identified. For *composting*, the main focus is a sufficient sanitisation. For this purpose minimum maturation times at different processing temperatures are a key factor and provided by several Member States (e.g. 2 weeks at 55 °C or 1 week at 65 °C). Also a sufficient oxygen supply shall be provided for a homogeneous product which can be reached by venting and or turning of the biodegradable waste. This can include the following requirements: for composting

- limitation of anaerobic conditions during the composting process
- thermal isolation of the reactor, sufficient oxygen to cover the biological oxygen demand
- effective use of water

For *anaerobic digestion*, the main focus is to receive a good bio-gas quality for incineration as well as a digestate which can be used as fertilizer or soil improver (hygienisation is required). For this purpose some process parameters and material requirements are recommended. This can include the following requirements for anaerobic digestion:

- complete sealing of the reactor
- effective use of water

However it should be noted that it is also important, that the facility is regulary monitored and approved e.g. by an external quality assurances organisation.

1.6.4 Options for EU-wide treatment standards

It should be noted that all EU regulation should be set a rather flexible framework, in line with the principle of subsidiarity, taking into account local cultural, social and geographical conditions.

1.6.4.1 Environmental impact 1: Emissions to the air

Option 1: Prescription of technical requirements related to design and operation of treatment facilities and/or establishing limit values for air emissions

- Impact on the environment (++)

  Prescription of (technical) requirements related to design and operation of treatment facilities and/or establishing limit values for air emissions will in particular help reduce greenhouse gas emissions and odour nuisance.

  Proper process management is the foremost tool in minimising all types of emissions by respecting criteria like well balanced material mix (C/N; moisture, bulking agents, sorption capacity) sufficient oxygen by means of structure material, frequency of turning or in addition supported by a well designed aeration system. Respecting these process parameters are also effective in minimising GHG emissions.

  Application of enclosed composting systems may lead to significantly reduced GHG emissions compared to open windrow composting (c.f. [Umweltbundesamt 2012], [Cuhls 2011]). Assuming a reduction of 20% and taking into account an estimated potential of separately collected biowaste of 80 Mio tonnes **[Orbit/ECN 2008]**[8] and assuming about 6% therof being composted in small-scale composting plants[9] the reduction potential is estimated to account for more than 50 ktonnes of CO_2-aequivalents.

  According to **[EC 2007e]** by applying BAT methane emissions from anaerobic digestion can be reduced nearly completely, N_2O and NH_3 by 90%, compared to not applying BAT.

  Standards for gas-tight storage tanks for digestate are an example for an effective measure to minimize gaseous emissions (in particular methane) as methane losses from storage tanks for digestate can account for up to 5 to 10%.

  As most anaerobic digestion installations are small-scale on-farm units, even if comprehensive information on the overall capacity of these plants is not available **[EC 2007e]**, prescribing of technical requirements to avoid greenhouse gas emissions seems even more relevant.

  Examples for requirements aiming in reducing odour nuisance are - besides the proper management of the process as a key factor - the covering of compost heaps or air treatment by biofilters.

- Workers´ health and safety (0/+)

- Closed systems, where workers have no direct access and emission control will help to reduce workers exposure to harmful air pollutants (dust, moulds) and to lower infection risks. Conversely, it may increase point source emissions unless encapsulation measures are completely enclosed. However, most relevant is the protection of workers in all plants by

[8] According to **[EC 2008]** the overall potential consists of additional more than 100 Mio tonnes being part of MSW plus up to 37 Mio tonnes of biodegradable waste derived from food and drink industry

[9] According to [**EC 2007e**] currently 10% of composting capacity is at small-scale plants (< 50t/d). 60% (3,500) of all biological treatment plants (6,000) are composting plants.

special measure e.g. encapsulation of the wheel loader drivers cabin incl. a filter system or fresh air for the handsorting cabines. Economical aspects (0/+)

Enclosed systems with emission reduction techniques imply significantly higher costs, both for investment, maintenance and emission control. Investment costs of biological treatment plants vary, depending on the type of installation, the emission reduction techniques used, and the product quality requirements. Costs of 60-150 €/tonne for open composting and 350-500 €/tonne for closed composting and digestion in large-scale installations are stated **[EC 2007e]**.

Conversely gas tight storage tanks can increase the revenues by reducing losses of the produced biogas. Closed systems also imply commercial opportunities for providers of these techniques.

- Considerable number of standards available (0/+)

  A large variety of technical requirements and BAT for minimising air emissions related to design and operation of composting and bio-gas plants is existing (c.f. Annex). Examples are: using enclosed systems for composting or storage of digestate, requesting covering windrows, requesting minimum distances to residential areas, requesting particular abatement technology, such as dust filters or biofilters. Also limit values for odour, greenhouse gases and organic substances, in particular, were established. Setting emissions limit values might not affect several of the Member States, as several have already in place at least indirect standards **[EC 2007e]**. Establishing such prescriptions might affect countries with comparably many small-scale treatment plants not being within the scope of the IED Directive.

- Contribution to environmental policy (Strategies, objectives etc.) (+)

  Emission control from biological treatment aims in particular in reduction of GHG emissions contributing e.g. to the aims of the Kyoto protocol.

- Relation to expected technological / waste management developments (+)

  Both, objectives/principles of the current European waste legislation, such as reducing of biodegradable waste going to landfill (Directive 1999/31/EC), as well as economic factors, such as increased revenues from biogas, increasing prices for fossil fuels, respectively, will in future increase the importance of the topic, in particular for anaerobic digestion plants.

Option 1 is the *prescription of technical requirements related to design and operation of treatment facilities and/or establishing limit values for air emissions*; it is ranked as high priority.

1.6.4.2 Releases into water

<u>Option 2: Prescription of technical requirements and/or setting of limit values for waste water to be discharged</u>

In order to prevent the release of contaminated liquids into the environment minimum requirements for treatment sites similar to those prescribed in the EU-Directives for special waste streams (e.g. WEEE - Directive 2002/96/EC or Batteries and Accumulators - Directive 2006/66/EC)

could be established, including as e key element the request for impermeable surfaces, sealed drainage systems and the request to treat excess water before leaving the facilities. Limit values for nutrients, organic load, heavy metals and organic pollutants could be stipulated.

- Impact on the environment (+)

  Appropriate waste water management will lower discharges of the organic load, nutrients, heavy metals and organic pollutants. It depends on the type of biodegradable waste (e.g. high pollutant loads), on the duration of storage (process waters of initial bio-chemical reactions).

- Workers´ health and safety (0)

  Less relevant

- Economical aspects (0/+)

  Investment needs for technical measures as well as operational costs for waste water treatment or disposal occur. Furthermore, costs for sampling and analyzing samples will occur. Conversely the commercial opportunities for providers of these services increase.

- Considerable number of standards available (0)

  As reported by **[EC2007e]** in the EU, all digestion facilities treating waste must be build on paved ground and collect the waste water in waterproof retention basins. The need for action will highly be dependent on current limit values.

- Contribution to environmental policy (Strategies, objectives etc.) (+)

  Controlling liquid emission would e.g. contributes e.g. to the objectives of the Water Framework Directive (Directive 2000/60/EC).

- Relation to expected technological / waste management developments (0)

  Less relevant

Option 2 is the p*rescription of technical requirements and/or setting of limit values for water emissions*; it is ranked as low priority.

1.6.4.3 Soil contamination by composts and digestates for agriculture use

For preventing soil contamination, quality standards for compost and digestate can be set, as well as quality criteria for waste input material.. These issues are currently also discussed in the light of preparing end-of-waste criteria for compost and digestate from biodegradable waste at JRC level and will also be discussed in the framework of revision of EU Fertiliser Regulation. It was agreed with the Commission Services that quality criteria for compost and digestate should thus not be covered within this project. Quality criteria for waste input material, however – even if being covered in end-of-waste criteria (lists of suitable input materials), are considered here as being relevant for composts/digestates not meeting end-of-waste criteria.

Option 3: Prescription of acceptance criteria for waste input

- Impact on the environment (+)

  In particular exclusion of particular waste types, such as MSW or particular residues from food production rich in heavy metals, will directly contribute to lowering pollutants being introduced to soils.

- Workers´ health and safety (+)

  Exclusion of particular wastes, such as unsorted MSW, which usually contain higher amounts of hazardous or at least problematic wastes, such as medical wastes, will contribute to lowering the risk of infections and injury, when handling biodegradable waste.

- Economical aspects (+)

  If there is a market for high quality compost/digestate is available, improved quality of the waste outputs will lead to increased revenues. Furthermore, costs for compliance testing can be reduced.

- Considerable number of standards available (+)

  Several Member States allow compost production from mixed waste. Positive lists of wastes which may be composted were established. Only a few countries have exclusion criteria for particular wastes.

- Contribution to environmental policy (Strategies, objectives etc.) (+)

  Contribution to strategies aiming in removal of pollutants (POPs or heavy metals) from the environment, such as the Stockholm Convention or legislation related to soil protection.

- Relation to expected technological/waste management developments (0)

  Quality control of waste input into biological treatment processes will get less important as soon as more Member States have established efficient systems for separate collection of bio-waste as requested by the WDF and perform high levels of source separation of hazardous waste and dry recyclables from households.

Option 3 regards the introduction of acceptance criteria of waste input; it is valued as high priority.

1.7 Temporary storage of wastes related to C&D waste, tires and wastes related to the treatment of household & similar wastes

1.7.1 General information

Temporary storage of C&D wastes

Construction and demolition (C&D) waste is one of the largest waste streams generated in the EU - around 450 million tonnes per year - about half of which is recycled **[CEC 2007a].** C&D waste is landfilled, backfilled, sorted or mechanically treated in order to produce recyclable fractions such as aggregates, metals and wood. As landfill and underground storage are covered by IPPC and the Landfill Directive, only temporary storage (below) and mechanical treatment (c.f. Chapter 1.4) were selected for the investigation.

Approximately 75% of C&D waste is inert material such as bricks, stone, concrete, tiles, sand, gravel and other aggregates. A multi-step sorting and crushing process is used to separate and size-reduce concrete and masonry debris, finer grained aggregates, ferrous and non-ferrous metals, wood, plastics, glass, asbestos (best to be removed before demolition) and gypsum and other waste. The materials may be stored temporarily before being sent for further treatment or disposal. CEC 2007b assumed that as storage on C&D processing sites other than crushing sites was likely to be very small, storage need only be considered for crushing plants. On each crushing site, the storage capacity is equivalent to the quantity produced over one year **[UEPG 2006].** Therefore in the EU, C&D waste storage capacity is the same as the annual quantity of inert C&D waste that is crushed, i.e. 182 million tonnes **[CEC 2007b]**.

Temporary storage of wastes from treatment of household wastes

There are a wide variety of treatment options for household waste. The nature and risks of the treatment residues will depend upon the type of process. For example composting and MBT plant will generate biologically stabilized wastes with low levels of metal contamination and combustible organic materials (e.g. RDF). Thermal treatment will generate biologically inert wastes with potentially high levels of heavy metals. No high level (pan European) documents specifically addressing the temporary storage of these materials have been identified.

Temporary storage of tyres

No high level (pan European) documents specifically addressing the temporary storage of these materials have been identified.

1.7.2 Main environmental impacts

Temporary storage of C&D wastes

The risks relating to temporary storage of C&D waste (including handling operations relating to storage) are:

- Air emissions:
  - Dust can be generated from stored C&D wastes, particularly in windy conditions from several sources: loading/unloading of aggregate onto/from storage piles (batch or continuous drop operations) and wind erosion of pile surfaces and ground areas around piles. Using the EPA method for calculating dust emissions from C&D waste storage, 2 tonnes PM10 emissions are generated from the EU annually. This is minor in comparison with dust arising from crushing and sorting operations **[CEC 2007b and EPA 1995]**.
  - Risk of dispersion of asbestos fibres
  - NOx, CO, CO_2, soot and other gases from combustion engines on shovels and trucks used to handle C&D wastes in and out of the storage area. Additional small releases of combustion gases may arise from the heating of buildings and workspaces;
- Noise and vibration caused by vehicles for manipulation etc., particularly when the operation is located close to urban areas.
- Pollution of surface and groundwater by fuels and lubricants used in the plant and machinery.

Temporary storage of wastes from treatment of household wastes

Risks relating to the temporary storage of wastes from treatment of household wastes will depend on the nature of the treatment process. For example odour and volatile organic emissions might be more relevant to storage of residues from mechanical and biological treatment, whereas dust emissions and release of leachable salts and metals may be of greater relevance to residues from thermal treatment.

Taking a generic approach, major risks to environment and health caused by temporary storage of household & similar wastes include:

- air emissions from (improper) storage: odour, volatile organic compounds, N_2O, dust;
- water emissions from improper storage of waste with large biodegradable or leachable salt and metal contents that may contaminate surface waters or process waters; leakage of operating liquids;
- noise; caused by vehicles for manipulation etc.
- dissemination of pollutants (heavy metals, flame retardants, hydrocarbons, PAHs, PCB, etc.) into the environment and products, if material fractions destined for further recycling/recovery/disposal processes do not meet certain quality criteria;
- fire; auto-inflammation in particular of high calorific materials (e.g. RDF);
- hygiene/ infection issues and vermin.

Temporary storage of tyres

Major risks to environment and health caused by temporary storage of tyres include:

- fire (e.g. release of volatile contaminants, smoke obscuring visibility, contamination of surface water from fire fighting liquids, effluent from burnt tyres);
- manual hazards (pile collapse);
- contamination of surface water from run-off

1.7.3 Compilation of existing minimum treatment standards

1.7.3.1 Overview

The recommendations / guidelines identified for specific Member States relating to temporary storage of various wastes were predominantly qualitative. Specific information on storage requirements relating to construction and demolition wastes were identified for Austria. The standards identified for Belgium, France and UK were more general / non-specific and covered a wide range of wastes including organic wastes, tyres and batteries. There was no available information on specific treatment standards relating to temporary storage for Finland, Ireland and Poland. However some information was gleaned from the documents collected for these countries on best practice guidelines which could be applicable for this waste operation.

Further details on key highlights of the standards / guidelines are presented in the Annex. A brief summary of each document is provided in this overview. Table 1-4 below provides an overview on the analyzed documents and their content.

Three standards were identified for **Austria** of relevance to this treatment operation. The guideline for mobile treatment of mineral construction waste and excavated soil **[BRV 2004]** and the federal waste management plan **[Austrian MoAFEW 2006**] specify provisions for emissions to air or water, and processing / storage of waste inputs. The Guidelines for Recycled Building Materials **[BRV 2007]** process requirements for waste inputs only.

In **Belgium**, administrative governance is completely devolved for the 3 regions – Brussels, Walloon and Flanders. However, the requirements seem to be applicable to all three regions in most cases as the region-specific region standards have been promulgated from the Belgian constitution and associated decrees. It was possible to obtain limited information for Walloon province **[Walloon MoR 2004]** and more extensive information on standards available in Flanders province **[VLAREA 2004, VLAREM I 1991 – there have been numerous updates in the meantime and Vlarem II]**. VLAREA 2004 is the Order of the Flemish Government for the establishment of the Flemish regulations relating to waste prevention and management and contains qualitative requirements for air and water emissions, waste inputs and process requirements. VLAREM I 1991 is the Order of the Flemish Government of 6 February 1991 concerning Environmental Licences and contains, amongst others qualitative requirements for the reuse of waste products in specific applications. There was an additional document “Flanders - Convent on waste tyres in Belgium **[OVAM 2010]”** which is

meant to specify requirements for collection of waste tyres. The information contained in this document was not available for review.

A **Finnish** document containing general information regarding the need for recovery of waste tyres was identified.

The **French** Arrêté du 30/06/97 n° 2517 **[French MoE 1997b]** specifically bans the spreading of untreated wastewater, sludge and waste collected or leached from storage facilities. There are qualitative recommendations for control and minimisation of air emissions as well as limit values for noise emissions from the storage facilities or during periods of operation.

The **German** TA Luft **[German MoECNS 2002]** is the first general administrative regulation for the Federal Pollution Control Act. It details qualitative requirements and identifies key parameters that need to be controlled to minimize air and water emissions. There is also a requirement for closure of containers for storage and transport.

In **Ireland,** no specific standards were found on temporary storage operations. However, a study conducted and reported by RPS consultants on behalf of the Environment Protection Agency **[Irish EPA 2008]** details some best practice guidelines for storage of wastes although this is mainly on storage of wastes in residential dwellings.

For **Netherlands**, the National Waste Management Plan 2002-2012 (NWMP): Part 1 Policy framework **[Netherland MoHPE 2007]** contained general information on the need for authorization for waste storage and to provide an indication of periods of storage before disposal and recovery

Similarly, the **Polish** standards PN-M- 49010:1996 2 and PN-M- 49011:1996 **[Polish Chancellery of the Sejm 2006]** specify dimensions for temporary storage bins.

In **Spain**, the Order ITC/2632/2010 of October 5th for updating the Annex III and amending various sections and appendices of Annexes V and VI of the Royal Decree 551/2006, of May 5th, for regulating transport operations of dangerous goods by road in Spanish territory **[Ministry of Industry 2010]** makes mention of a list of orders relating to packaging and transportations of dangerous goods.

There are a series of **UK** national standards relating to temporary storage operations **[UK EA 2011, UK EA 2010c to g]**. The standard rule SR2011No4: Treatment of waste wood for recovery **[UK EA 2011]** permits an operator to store and treat waste wood from a variety of sources at a specified location. The other standards [UK EA 2010c to g] apply to exemptions for storage of wastes under different conditions. All these standards require appropriate storage in a secure manner so as to minimise risks.

Standards, guidelines or recommendation regarding temporary storage of wastes related to C&D waste, tires, and waste related to the treatment of household and similar waste was not identified for the Czech Republic, Denmark, Greece, Italy, Luxemburg and Sweden.

Table 1-4: Compilation of the key provisions of Temporary storage of wastes related to C&D waste, tires, and waste related to the treatment of household and similar waste

MS	Standard	Emission related standards			Process related standards			Others
		Air (incl. odour)	Water	Noise	Waste IN	waste OUT	Process requirements and BAT	
AT	Guideline for mobile treatment of mineral construction waste and excavated soil **[BRV 2004]**	Δ	Δ.		Δ.O		Δ.X	Requirements for the technical design and operation of sites for temporary storage.
AT	Guidelines for Recycled Building Materials **[Green Guide 2007]**				Δ.			
AT	Federal Waste Management Plan **[Austrian MoAFEW 2006]**	Δ	Δ.		Δ.		Δ.	
BE	Belgisch Staatsblad - 08/25/2004 – MONITEUR Walloon Government order laying down the conditions relating to operating sites for temporary storage of construction or demolition of unsorted waste (as mentioned in rubrique 45.92.01 Section 45.92.01) **[Wallon MoR 2004]**	Δ.	Δ.		Δ		Δ.	
BE	Order of the Flemish Government for the establishment of the Flemish regulations relating to waste prevention and management **[VLAREA 2004]**						Δ	
BE	Order of the Flemish Government of 6 February 1991 concerning Environmental Licences **[VLAREM I 1991]**				Δ		Δ X	
BE	Flanders - Convent on waste tyres in Belgium **[OVAM 2010]**							Waste tyres to be collected with the convent.

FI	No. 1246 Government Decision on the recovery and disposal of discarded tyres October 12, 1995 **[Finnish MoE 1995]**							General information regarding recovery of waste tyres
FR	Arrêté du 30/06/97 n° 2517 **[French MoE 1997b]**	Δ		X				Spreading of wastewater, sludge and waste is banned.
GE	Erste Allgemeine Verwaltungsvorschrift zum Bundes–Immissionsschutzgesetz(TA Luft) Vom 24 **[German MoECNS 2002]**	Δ	Δ				Δ	First General Administrative Regulation for the Federal Pollution Control Act
IE	Organic waste management in apartments **[Irish EPA 2008]**	Δ	Δ	Δ	Δ		Δ.	Factors that affect the location are listed.
NL	National Waste Management Plan 2002-2012 (NWMP): Part 1 Policy framework **[Netherland MoHPE 2007]**							General information on storage.
PL	Dimensions of bins PN-M- 49010: 1996 and PN-M- 49011: 1996 **[Polish Chancellery of the Sejm 2006]**							Standard dimensions for temporary storage bins.
ES	Order ITC/2632/2010 of October 5th, for updating the Annex III and amending various sections and appendices of Annexes V and VI of the Royal Decree 551/2006, of May 5th, for regulating transport operations of dangerous goods by road in Spanish territory **[Ministry of Industry 2010]**							List of orders re packaging and transportations of dangerous goods.
UK	Standard rules SR2011No4: Treatment of waste wood for recovery **[UK EA 2011]**	Δ.	Δ.	Δ.			Δ. X	Standard rule permitting operator to store and treat waste wood at specified location.
UK	S1 – Storage of waste in secure containers **[UK EA 2010c]**				Δ.O		Δ.X	This is an exemption that allows you to store specific waste streams in secure containers at a different place to where the waste was produced.
UK	S2 – Storage of waste in a secure place **[UK EA 2010d]**				Δ.O		Δ. X	This is an exemption that allows to store specific waste streams at a secure place at a different place to where the waste was produced

UK	Non- Waste Framework Directive (NWFD) exemptions – Temporary storage of waste at a place controlled by the producer **[UK EA 2010e]**				Δ.		Δ.X	This is an exemption that allows the temporary storage of any waste pending its collection, at a place controlled by the waste producer.
UK	Non- Waste Framework Directive (NWFD) exemptions – Temporary storage at a collection point **[UK EA 2010f]**				Δ.O		Δ. X	This is an exemption that allows you to temporarily store any waste at a collection point for purposes of recovering or disposal elsewhere.
UK	Non- Waste Framework Directive (NWFD) exemptions – Temporary storage at the place of production **[UK EA 2010g]**						Δ.X	This is an exemption that allows you to temporarily store any waste at the place of production, pending its collection.
UK	The Waste Management Licensing Regulations (Northern Ireland) 2003 **[NIEA 2003]**				Δ.		Δ.X	

X…Specific/quantified provisions (Limit values or quantified recycling/recovery targets)
Δ…Qualitative provisions (incl BAT)
O…Positive/negative lists, descriptive criteria

1.7.3.2 Core elements

Some standards relating to **air emissions** were identified for several Member States. All of these standards were qualitative requirements relating to the design and operation of the temporary storage facilities in a way that minimises dust, odour and visual nuisance. Although there were no specified emission limit values, most of the standards require control of emissions to an acceptable standard and for storage containers to be located away from the prevailing wind direction. In the UK, there is a specific requirement to produce a site management plan which specifies control measures for operation of the site.

Qualitative standards relating to **water emissions** were also identified for several Member States. The requirements relate to the design and operation of the temporary storage facilities in a way that prevents contamination of surface and ground waters. There is a general requirement for the operator to take necessary design measures to reduce the risk of contamination including use of containers, sealing of the storage area, surface water collection system, adequate drainage, etc.

There was very limited information on standards for **noise** emissions. Three standards containing mainly qualitative information were identified. One of these standards **[French MoE 1997]** contained quantitative limit values for noise emissions. In all documents, there is a requirement to minimise noise pollution by restricting storage related activities or requiring appropriate measures in the management plan to minimise noise and vibration.

There was very limited information on **process standards for waste inputs** which are temporarily stored. Standards were found for three MS only and these were mainly qualitative. Some of the information contained related to requirements for separation of the materials by grade during storage, storage locations for different wastes and characteristics (including temperature and flashpoint) of temporarily stored wastes.

It has not been possible to identify any member state standards or relevant information on process standards for **waste outputs** which are temporarily stored. The activity “storage”, however, usually does not lead to considerable changes of waste input.

There was some information on process requirements and **BAT** relating to temporary storage of wastes and these contained specific recommendations as outlined below. In general, there is a requirement for the wastes to be stored securely, for a limited time and not exceeding a given quantity per year.

1.7.4 Options for EU-wide treatment standards

1.7.4.1 Environmental impact 1: Emissions to the air

Option 1: Prescription of technical requirements elated to design and operation of treatment facilities and/or setting limit values for air emissions

- Impact on the environment (+)

  Dust emissions to air from the **temporary storage of C&D waste** are minor in comparison to the emissions from C&D waste sorting and crushing operations (see section 1.2). However, dust can be generated from stored C&D wastes, particularly in windy conditions from loading and unloading aggregate onto or from storage piles (batch or continuous drop operations) and wind erosion of pile surfaces and ground areas around piles. The finest particles (<10 µm, PM10) have the potential to travel the greatest distances. The storage, handling and transfer of materials on C&D sites are excluded from the IPPC directive and the BREF on emissions from storage (EC 2006]. However, requirements to cover the storage area, encapsulate conveyors and spray affected areas with water (with or without additives) as specified in BAT and guidance documentation and detailed in Workpackage 4: Status Report III would be expected to improve local air quality **[CEC 2007b]**.

  On each C&D crushing site, the storage capacity is equivalent to the quantity produced over one year [UEPG 2006][10]. Therefore in the EU, C&D waste storage capacity is the same as the annual quantity of inert C&D waste that is crushed, i.e. 182 million tonnes **[CEC 2007b]**[11]. Using the EPA method for calculating dust emissions from C&D waste storage from the loading and unloading of trucks, 2 tonnes PM_{10} emissions are generated from the EU annually. This is minor in comparison with dust arising from crushing and sorting operations (CEC, 2007a and EPA 1994) and in comparison with the 1000 tonnes annual PM_{10} emissions from installations for the disposal of non-hazardous wastes [EPER, 2004]. No specified emission limits for C&D storage operations have been identified.

  Risks relating to the temporary storage of wastes from treatment of household wastes will depend on the nature of the treatment process. For example odour and volatile organic emissions might be more relevant to storage of residues from mechanical and biological treatment, whereas dust emissions and release of leachable salts and metals may be of greater relevance to residues from thermal treatment. No high level (pan European) documents specifically addressing the temporary storage of these materials have been identified.

  Principal sources of some of the greenhouse emissions associated with temporary storage of relevant waste will be:

  - exhaust from combustion engines of mobile plant associated with C&D waste

transport (NOx, CO, CO_2, as well as soot) and from boilers for the heating of buildings and workspaces;

- tyre fires which will release toxic fumes containing volatile contaminants and smoke which will obscure visibility; and
- volatile organic compounds and N_2O emissions can arise from the improper storage of household waste at treatment sites.

- Workers´ health and safety (+)

  Exposure to air emissions could directly or indirectly impact on workers health. Common consequences include increased risk of bronchial diseases such as asthma, farmer's lung or other allergies. Setting concentrations of air emissions from this waste treatment activity will help to reduce workers exposure to harmful air pollutants and particulates, improve the health of the workforce and hence increase overall productivity.

  CEC [2007a] and the accompanying Factsheet E3 [CEC 2007b], state that reducing dust emissions from C&D waste sorting and crushing operations would have a positive social impact by reducing health impacts. However, the Commission concluded that the sorting and crushing of C&D waste would not be a good candidate for inclusion under the scope of the IPPC Directive. The same conclusion would be expected to apply to temporary storage where the emissions and therefore health risks are considerably lower from C&D waste storage than for crushing and sorting operations.

- Economical aspects (0)

  The profit margin of recycled C&D aggregate is estimated to be between 0.4 and 0.9 euros per tonne based on the turnover for the sector in Europe [CEC, 2007]"..

  Belgian experience [OVAM 2011a] indicates that water-spraying and half-covered storage of inert C&D wastes can sometimes be economically feasible. However, in general the costs of installing water-spraying and encapsulation infrastructure to C&D storage operations would have a negative impact on competitiveness of the producer of the recycled aggregate relative to that of virgin aggregate [CEC, 2007b].

  While the benefits of the action would be to increase the market for the suppliers and installers of such equipment, action may also make the economics for C&D waste recycling unsustainable.A requirement to fully encapsulate temporarily stored household waste to reduce emissions of volatile compounds and odours, and to provide permanent cover for tyres, will result in increased capital and maintenance costs for the operations.

- Considerable number of standards available (+)

  No standards, guidelines or recommendation for process requirements, including best available techniques for the temporary storage of relevant wastes were identified for the following member states: Czech Republic, Denmark, Greece, Italy, Luxemburg and Sweden. Standards relating to minimising air emissions were identified for several Member States including Austria, Belgium, France, Ireland, the Netherlands and the UK. All of these standards

were qualitative requirements relating to the design and operation of the temporary storage facilities in a way that minimises dust. Although there were no specified emission limit values, most of the standards require control of emissions to an acceptable standard, for storage containers to be located away from the prevailing wind direction or the need for authorization for waste storage and to provide an indication of periods of storage before disposal and recovery.

For C&D waste storage, the lack of harmonised legislation across member states would not have a significant impact on national industry as the market for C&D waste is very local [CEC, 2007b].

- Contribution to environmental policy (strategies, objectives etc.) (+)

  The emissions of dust from storage of C&D waste, tyres and municipal waste treatment are not quantified, or in the case of C&D waste storage, minor in comparison with C&D crushing and sorting operations. However, even a small reduction in air emissions would contribute to the air emission reduction target for the EU of 8% of 1990 levels of all air emissions by 2012 and potential reduction of EU VOC-emissions of 10%.

  The increased waste recycling targets that are embedded in current European waste legislation, (e.g. for C&D wastes and recyclable components from household wastes (2008/98/EC)), will drive the increase for treatment and associated temporary storage of these materials. As the quantity of stored wastes increases, so does the relative significance of their environmental impacts.

- Relation to expected technological / waste management developments (+)

  Recovery and recycling of C&D waste, tyres and household waste would be expected to increase in line with EU and national targets. As the market size increases, so would the number of key players, driving down costs through competition. However, it is more likely that legislative requirements rather than reducing operational costs and the operators's desire to be 'good neighbours' would be a driver for innovative environmental protection techniques.

Option 1, the *prescription of technical requirements elated to design and operation of treatment facilities and/or setting limit values for air emissions* is considered being of medium relevance.

1.7.4.2 Environmental impact 2: Water pollution

<u>Option 2: Prescription of technical requirements related to design and operation of treatment sites and/or setting limit values for the releases of emissions to surface and groundwater</u>

- Impact on the environment (+)

  The direct or indirect discharge of contaminated water from the storage operations, whether leakage from stored materials on site (e.g. clearing fluids or fuel), or leaching of the stored wastes themselves, may cause a deterioration in local water quality. For example water emissions from improper storage of waste with large biodegradable or leachable salt and metal contents may contaminate surface waters or process waters.

- Workers´ health and safety (0)

  Loss of volatile compounds from effluents, leachate or process liquids could impact on the health of the workforce and the surrounding population. However for storage of the wastes of interest these consequences are considered to be of minor relevance.

- Economical aspects (0/+)

  No quantitative information has been identified on the levels of investment required to introduce appropriate water pollution measures where there are none. However, the introduction of water collection systems would increase commercial opportunities for providers of these services but would impact on operational costs.

- Considerable number of standards available (0/+)

  Specific standards, guidelines or recommendation regarding emission to water for the temporary storage of wastes related to C&D waste, tires, and waste related to the treatment of household and similar waste were not identified for the following member states: Czech Republic, Denmark, Finland, France, Greece, Italy, Luxemburg, Netherlands, Poland, Spain and Sweden.

  Austria, Belgium, Germany, Ireland and UK all provide guidance that outlines the requirements for storage areas that need to be met in order to prevent any contamination of surface and groundwaters. These include requirements for impermeable surfaces, surface water collection system (prohibition of direct discharge to soil/water) or to be roofed).

- Contribution to environmental policy (Strategies, objectives etc.) (+)

  It will contribute to

  - the objectives of the Waste Framework Directive (Directive 2008/98/EC) which requires Member States to ensure that waste is recovered or disposed of without endangering human health and the environment and that the waste amount disposed of is reduced to a minimum by measures and effective tools aimed at minimising waste generation.
  - the objectives of the Water Framework Directive (Directive 2000/60/EC) which aims to establish a new, integrated approach to the protection, improvement and sustainable use of Europe's inland surface waters (rivers and lakes), transitional waters (estuaries), coastal waters and ground water.
  - the objectives of the Urban Waste Water Treatment Directive (Directive 91/271/EEC) which is to protect the environment from the adverse effects of discharges from urban waste water and certain industrial sectors. The directive covers the collection, treatment and discharge of waste water from these sectors.

- Relation to expected technological / waste management developments (+)

  The market for the temporary storage of wastes would be expected to increase in line with targets for the recycling of relevant wastes, driving down costs through competition. However, it is more likely that legislative requirements, would be a driver for innovative environmental

protection techniques, rather than declining operational costs,

Option 2, the prescription of technical requirements related to design and operation of treatment sites and/or setting limit values for the releases of emissions to surface and groundwater is considered being of medium relevance.

1.7.4.3 Environmental impact 3: Noise and vibration

Option 3: Prescription of technical requirements related to design and operation of treatment facilities and/or setting limits on noise

- Impact on the environment (0)

  Noise and vibration at levels which exceed background concentrations are sources of nuisance for the neighbouring population and can cause damage that may generate its own environmental impacts. For storage activities is noise and vibration is considered being of minor relevance.

- Workers´ health and safety (0/+)

  If appropriate personal protetective equipment is not worn the work-force may suffer short term or longer term hearing loss or hearing defects.

- Economical aspects (0)

  The introduction of noise abatement systems and routine monitoring would increase commercial opportunities for providers of these services but would impact on operational costs. No quantitative information is available on the level of investment.

- Contribution to environmental policy (Strategies, objectives etc.) (+)

  The Waste Framework Directive (Directive 2008/98/EC) requires Member States to ensure that waste is recovered or disposed of without endangering human health and the environment and that the waste amount disposed of is reduced to a minimum by measures and effective tools aimed at minimising waste generation.

  The Directive on the assessment and management of environmental noise (Directive 2002/49/EC) aims to controlled noise as perceived by the population in built-up areas and in quiet areas, and other noise-sensitive buildings and areas.

- Relation to expected technological / waste management developments (+)

  A legislative driver for reducing noise and vibration at temporary storage sites is more likely to be effective than the operators' desires to be 'good neighbours', as the market increases in line with increased recycling targets and costs decrease through competition.

- Considerable number of standards available (+)

There was very limited information on standards for noise emissions. Three standards containing mainly qualitative information were identified for France, Ireland and the UK. The French standard [French MoE 1997] contained quantitative limit values for noise emissions. In all these documents, there is a requirement to minimise noise pollution by restricting storage related activities or requiring appropriate measures in the management plan to minimise noise and vibration. However, no standards, guidelines or recommendation regarding emission of noise for the temporary storage of wastes related to C&D waste, tires, and waste related to the treatment of household and similar waste were identified for: Austria, Belgium, Czech Republic, Denmark, Finland, Germany, Greece, Italy, Luxemburg, Netherlands, Poland, Spain and Sweden.

- Relation to expected technological / waste management developments (0)

  Less relevant.

Option 3, the prescription of technical requirements related to design and operation of treatment facilities and/or setting limits on noise is ranked of low priority.

1.8 Handling and management of hazardous wastes (focusing on identifying, avoiding of dilution, removal of hazardous substances)

1.8.1 General information

Hazardous waste arisings are relatively low but potentially very damaging to both the environment and human health. Several EU Directives set standards for the managing and treatment of hazardous waste focusing on either **general issues or specific waste streams**. The main provisions are set in the following Directives:

- The **Waste Framework Directive** (Dir. 2008/98/EC, afterwards referred to as WFD) defines general provisions for the safe handling and treatment of waste to reduce the risk imposed by different types of waste. It incorporates the former Directive 91/689/EEC on **hazardous waste** and former Directive 75/439/EEC on the disposal of **waste oils**. Thus, besides general obligations valid for all waste types, requirements for hazardous wastes are set in particular in Art. 17 (control of hazardous wastes), Art. 18 (mixing ban), Art. 19 (labelling) and Art. 35 (record keeping for hazardous waste). Article 21 includes provisions for waste oils.
- The **Directive on batteries and accumulators** (Dir. 2006/66/EC) defines besides other requirements (separate collection, placing at the market) in Annex III, Part A minimum requirements for treatment and recycling of batteries and accumulators.
- The use of hazardous substances is regulated by the Directive on the restriction of the use of certain hazardous substances in **electrical and electronic equipment** (Directive 2002/95/EC, called RoHS; to be replaced with effect of 3 January 2013 by Directive 2011/65/EU) requiring for heavy metals (e.g. lead, mercury, cadmium) and flame retardants (e.g. PBB and PBDE) not to be used in EEE. The sister Directive on waste electrical and electronic equipment (WEEE) (Dir. 2002/96/EC) includes obligations regarding design, collection and treatment of the waste of such equipment. Art. 6 defines the obligation for using BAT treatment and recycling technologies.
- Standards for **mining wastes** are covered by the Directive on the management of waste from extractive industries (Dir. 2006/21/EC).
- The Directive on **end-of-life vehicles (ELVs)** (Dir. 2000/53/EC) includes obligations regarding the waste management and treatment of ELVs. Article 6 states that “hazardous materials and components shall be removed and segregated in a selective way so as not to contaminate subsequent shredder waste from end-of-life vehicles”.
- Regulation (EC) No 850/2004 of the European Parliament and of the Council of 29 April 2004 on **persistent organic pollutants (POPs)** contains provisions on waste containing POPs in its Article 7, notably that waste consisting of, containing or contaminated by any substance listed in Annex IV of that Regulation shall be disposed of or recovered, without undue delay and in accordance with Annex V, part 1 of that Regulation in such a way as to ensure that the POPs content is destroyed or irreversibly transformed so that the remaining waste and releases do not exhibit the

characteristics of POPs (to note that Article 7(4) of that Regulation contains derogations to that the principle set out by Article 7(2)).

- Directive 96/59/EC on the disposal of polychlorinated biphenyls and polychlorinated terphenyls (**PCB/PCT**) includes requirements for the disposal of wastes including PCB/PCT.
- Particular **wastes from the titanium dioxide industry** are regulated in Directive 92/112/EWG; especially the disposal of such wastes into water bodies, sea or ocean; however, the provisions have been currently integrated into the Directive on industrial emissions (integrated pollution prevention and control) (Dir. 2010/75/EU).
- **Packaging and packaging wastes** is regulated by Directive 94/62/EC. Considering hazardous wastes, the Directive sets out in Annex II that noxious and other hazardous substances shall be reduced in packaging material in order to minimize emissions, ash or leachate when packaging wastes is incinerated or landfilled.

A variety of **treatment methods** of hazardous wastes exist. Several of them are regulated by following EU Directives:

- For both operations provisions, especially regarding permitting, are provided in the Directive concerning integrated pollution prevention and control (IPPC) (Dir. 2008/1/EC). All treatment and recovery facilities are within the scope of the directive if the capacity exceeds 10 tonnes per day. The provisions of the Directive have been incorporated recently into the Directive 2010/75/EU on **industrial emissions** (integrated pollution prevention and control). The hazardous wastes treatments, covered by the Directive 2010/75/EU, are listed in points 5.1, 5.2b, 5.4, 5.5 and 5.6 of its annex 1. These activities give a good picture of the existing hazardous waste treatments operations.
- In addition, the **BREF on waste treatment operations**[12] (for hazardous and non-hazardous waste), in which activities from point 5.1 are included, could give useful indications with adaptations for regulation of non IED installations [BREF WT 2006].
- The Directive on the **incineration of waste** (Dir. 2000/76/EC) includes emission limit values for all kind of wastes including hazardous waste in order to prevent air, soil and water pollution. The provisions have been also included into the IED.
- The Directive on the **landfill of waste** (Dir. 99/31/EC) stipulates detailed minimum requirements for the permitting, design, management and after-care of landfills. It requires that hazardous wastes generally should be disposed of in hazardous waste landfills and that wastes can only be accepted if meeting certain criteria and limit values as set out in Annex II of the Directive.

The purpose of the summary of the treatment standards for the treatment of hazardous waste therefore is, to concentrate on **hazardous wastes not directly relevant under the IED-scope.** In addition, larger facilities covered by the IPPC/IE Directive are out of the major focus of the investigations. Hence, standards available in EU Member States have been identified focusing on:

- the Identification of hazardous waste

[12] note that that document is soon to be revised. Findings of the revision process may be lead to a revision of the findings of this document.

- avoiding of the dilution of such wastes, and
- the removal of hazardous substances from such wastes.

Provisions based on EU legislation addressing those three issues are shortly highlighted in the following:

EU provisions on identifying hazardous waste

Following recital 16 WFD "**the classification of waste as hazardous waste** should be based, inter alia, on the Community legislation on chemicals, in particular concerning the classification of preparations as hazardous, including concentration limit values used for that purpose." Hazardous waste thereof "means waste which displays one or more of the hazardous properties listed in Annex III of the WFD (Art. 3(2))[13]. Further, a list including wastes and hazardous wastes is maintained, called European Waste Catalogue[14] "in order to encourage a harmonized classification of waste and ensure the harmonized determination of hazardous waste within the Community". In the list wastes classified as hazardous are marked with an asterisk (*). Thorough **record keeping** supports further identification of hazardous wastes and the detection of imposed risks of such wastes. Therefore Art 35 of the WFD requires that the producers of hazardous waste as well as the waste collector and transporter, dealers and brokers of hazardous waste and relevant treatment establishments and undertakings have to keep a record of the hazardous waste including information on quantity, nature and origin of the waste.

EU provisions on ban of the mixing of hazardous waste (including dilution) (Art. 18 of WFD)

As a principle (note that exemptions are possible), keeping wastes segregated facilitates any required treatment. A lot of problems could be prevented, when an appropriate separation at the source (at production site of the waste) is executed. The key is to segregate incompatible wastes by placing them in separate areas constructed of suitable materials. In some cases if stored together, incidents such as leaks could result in a mixing of incompatible wastes. Different chemical reactions could then occur, with some reactions potentially producing excessive pressure and/or heat, thus posing fire or explosion hazards. Others could produce toxic fumes or gases.

Beside the general obligation of the EU Member States to encourage the **separation of hazardous compounds** from waste streams, Member States shall achieve environmentally sound management (recital 28). Art. 18 of the WFD concretises that "Member States take the necessary measures to ensure that hazardous waste must be "**not mixed**, either with other categories of hazardous waste or with other waste, substances or materials". Mixing shall include the dilution of hazardous substances. For hazardous wastes treatment, derogations can be made on Member State level for

[13] Attribution of the hazardous properties 'toxic' (and 'very toxic'), 'harmful', 'corrosive', 'irritant', 'carcinogenic', 'toxic to reproduction', 'mutagenic' and 'eco-toxic' is made on the basis of the criteria laid down by Annex VI, to Council Directive 67/548/EEC. Whereas this Directive is stepwise replaced and repaled by CLP Regulation (EC) 1272/2008, this part of Annex III is consequently to be modified until 2015

[14] COMMISSION DECISION of 3 May 2000 replacing Decision 94/3/EC establishing a list of wastes pursuant to Article 1(a) of Council Directive 75/442/EEC on waste and Council Decision 94/904/EC establishing a list of hazardous waste pursuant to Article 1(4) of Council Directive 91/689/EEC on hazardous waste

facilities provided with a permit allowing such mixing, in case there adverse impacts to health and environment do not increase and the mixing operation is conform to as best available techniques. Besides, particular standards and requirements regarding the dilution of hazardous waste have not been delivered by the Member States.

EU approach on the removal of hazardous substances

The majority of hazardous waste is either incinerated (including co-incineration) or landfilled (including underground disposal). Both operations may take place in combination with pre-treatment activities such as (as defined in the IE Directive):

- biological and physico-chemical treatment;
- blending or mixing and repacking prior to submission to any of the other activities listed
- solvent reclamation/regeneration;
- recycling/reclamation of inorganic materials other than metals or metal compounds;
- regeneration of acids or bases and
- recovery of components used for pollution abatement;
- recovery of components from catalysts;
- oil re-refining or other reuses of oil;
- surface impoundment

As standards for larger operations (exceeding 10 t per day), incinerations and landfilling are set in the different EU Directives (see above), the Member State specific information has especially been screened with respect to treatment standards related to smaller treatment operations allowing the removal of hazardous substances including the treatment options listed above. Treatment standards for biological treatment, i.e. for MBT were summarised in chapter 1.6 and will not covered again in this section.

Member State documents were evaluated when available in English, French, German or Spanish.

Further, the technical requirements for all these treatment operations, except for incineration and landfilling, are set up in [BREF WT 2006]. Some BAT, after adaptation, could be considered to define minimum requirement standards for non IED installations.

1.8.2 Main environmental impacts

Environmental impacts regarding the identification of hazardous waste

Keeping wastes segregated greatly facilitates any required treatment. A lot of waste treatment problems could be prevented, when an appropriate separation at the source (at production site of the waste) is executed. The identification of hazardous waste is a pre-requisite for keeping specific wastes separated and to avoid environmental impacts from non separation. Such impacts are due to emissions from waste treatment operations and from dilution of hazardous substances in waste and recycled products and related emissions to the environment.

Environmental impacts and mixing/blending operations

The mixing of hazardous waste might be useful for some treatment operations as it ensures an appropriate chemical and physical quality as well as safe handling and storage. These operations improve environmental and safety protection. According to Article 18 of the WFD, they should be permitted with strict conditions.

In addition, these practices should not be confused with operations aiming at declassifying a hazardous waste into a non-hazardous waste as referred in Article 7.4 of the WFD. ("the reclassification of hazardous waste as non-hazardous waste may not be achieved by diluting or mixing the waste with the mail of lowering the initial concentrations of hazardous substances to a level below the thresholds for defining waste as hazardous").

. Comments about hazardous waste composition and environmental impacts of hazardous waste management"

Hazardous waste composition is very variable and the potential range of components that might be present is enormous. Due to such variance in components and composition, there are very few common emissions from hazardous waste management operations since each site has a slightly different combination of unit operations, and accepts a different range of wastes based on local circumstances.

The main environmental impacts can be considered similar in the hazardous and non-hazardous waste treatment sector. There are certainly specific aspects, particularly a high content of hazardous substances in hazardous waste, which can lead to more severe adverse environmental impacts due to hazardous waste treatment operations. The [BREF WT 2006] gives an overview of the main environmental issues in the waste treatment sector (see [BREF WT 2006], section 1.4):

Air emissions

Most waste installations have emissions to air of carbon dioxide, ammonia and particulate matter. Certain organic substances can be commonly identified at almost every site and it is worth noting that most sites create some kind of particulate emission simply through handling products. Issues such as odour and volatile organic compounds are also relevant. Other contaminants that might be found at some sites are hydrogen chloride, ammonia, amines, hydrogen sulphide. Other components that may occur are PAHs and dioxins mainly because they are imported with the waste to be treated. These are a problem from both a health and an environmental point of view.

Water emissions

Most waste installations declare an emission of

- total nitrogen and total phosphorus (from physico-chemical treatments and biological treatments),
- organic chemicals (e.g. BOD, COD, TOC, hydrocarbons, phenols, BTEX from waste oil treatments, waste solvent treatments and energy systems),
- chlorinated compounds (e.g. AOX from waste solvent treatments) and
- metals (e.g. As, Cd, Cu, Hg, Ni, Sn, Zn from biological treatments, common storage and handling of waste, physico-chemical treatments of metal extraction, finishing waste, fine chemicals and organic manufacture and waste oil treatments).

Waste outputs

Generally, the output from waste treatment installations is a treated waste. However, those outputs can be differentiated in two types. One type refers to the treated waste (typically representing the main part of the output) that in some cases can be recycled, recovered or re-used elsewhere. The other type is represented by the waste generated by the treatment process itself.

Soil and groundwater contamination

In the past, unprecautionary handling of wastes has been at the origin of land contamination, as has been the case in almost all industrial sectors. As is the case in many other industries, the waste treatment industry is not currently an activity which leads to land contamination. According to the process and the type of wastes used, prevention actions have been developed such as retention, impermeabilisation, and underground water monitoring, in order to prevent and control soil and groundwater contamination."

However good standards exist on European and national level to avoid or reduce the environmental impacts described above to a large extend. In particular the application of best available technologies listed in [BREF WT 2006] is a good basis for reducing the impacts.

1.8.3 Compilation of existing minimum treatment standards

1.8.3.1 Overview

Details on the Member States key provisions and standards / guidelines are presented in the Annex. A brief summary of the documents is provided in this overview. The table below provides an overview on the analyzed documents and their content.

Minimum standards regarding the identification of hazardous waste

The recommendations and guidelines related to correct identification (including recommendations on record keeping) are mostly qualitative and focus on

- Steps of identifying and discerning hazardous waste;
- Precise documentation of all relevant parameters and results of analyses;
- Registration in the national register;
- Documentation and record keeping according to the EU standards and along the waste management chain starting with the waste producer;
- Proper labelling according to EU and international standards.

Details on the Member States key provisions of the standards / guidelines are presented in the Annex. A brief summary of each document and relevant results is provided in this overview.

Minimum standards regarding hazardous waste management

The recommendations / guidelines identified for specific Member States relating to the treatment of hazardous waste were predominantly qualitative and included general requirements.

Provisions identified covered the following aspects:

- Provisions and recommendations for safe storage of hazardous waste materials including separate storage;
- Requirements for suitable packaging and containers to be used for storage and transport;
- Provisions for secure places to store hazardous waste (e.g. in regard to the building);
- Recommendations on how to deal with receptacles which are leaking;
- Recommendations on how to deal with emptied packaging, tanks, containers etc. that contained hazardous waste;

- Advises related to specific hazardous wastes, e.g. solvent wastes;
- Provisions during collection and transport to keep the waste separated;
- Restriction of the number of collectors and related authorisation and measures to ensure that requirements are duly observed and their fulfilment can be more easily controlled by competent authorities.
- Acceptance criteria for incoming waste at establishments for storage and treatment;
- Hazardous waste types officially permitted for treatment according to national legislation or guidance;
- References made to applicable BAT;
- Sector specific provisions and recommendations for treatment;
- Emission limit values applicable for waste treatment facilities.

Table 1-5: Compilation of the key provisions of minimum treatment standards for treatment of hazardous waste

MS	Standard	Standards related to identification of hazardous waste	Standards related to avoidance of dilution	Removal of hazardous substances							Others
				Emission related standards			Process related standards				
				Air (incl. odor)	Water	Noise	Specification of Waste IN	Quality criteria for waste OUT	Process requirements	BAT to be taken into account	
AT	[Austrian MoE 1996]				X						
BE	[VLAREM II 2005]	Δ	Δ				Δ		Δ		
CZ	[Czech, MoE, 2005]		Δ	O	O		O				
CZ	[Czech MoE, 2008]	O	Δ					Δ	Δ		
DE	[German MoE 1989]		Δ				Δ O				
DE	[German MoE 2002]	Δ		Δ X					Δ	Δ	
DE	[German MoE 1997]	X	X		X						
DE	[German Bundestag 1994]							Δ	Δ	Δ	
DE	[German MoE 2002b]		Δ				O		Δ		
ES	[Spanish MoE 1998]	Δ	Δ				Δ				
ES	[Spanish MTAS and INSHT 2000]	Δ	Δ				Δ				

MS	Standard	Standards related to identification of hazardous waste	Standards related to avoidance of dilution	Removal of hazardous substances							Others
				Emission related standards			Process related standards				
				Air (incl. odor)	Water	Noise	Specification of Waste IN	Quality criteria for waste OUT	Process requirements	BAT to be taken into account	
FR	[French MoE 2011]						Δ		Δ		
LU	[Luxembourg MoE 1996]	Δ	Δ								
NL	[Netherland MoHPE 2007]	Δ	Δ							Δ	
PL	[Poland MoE 2006]							X Δ		Δ	
UK	[UK EA 2004]									X	
UK	[UK EA 2005a]	O X									
UK	[UK EA 2005b]	O	Δ						Δ O		
UK	[UK EA 2010h]								Δ		
UK	[UK EA 2011c]								X		
UK	[UK EA 2011d]		Δ	Δ			O Δ		Δ		
UK	[UK EA 2011b]		Δ							Δ	
UK	[UK EA 2010i]								X O		

MS	Standard	Standards related to identification of hazardous waste	Standards related to avoidance of dilution	Removal of hazardous substances							Others
				Emission related standards			Process related standards				
				Air (incl. odor)	Water	Noise	Specification of Waste IN	Quality criteria for waste OUT	Process requirements	BAT to be taken into account	
EU	[BREF Waste Treatment Industries]			Δ X	Δ	Δ	Δ	Δ	Δ	Δ X	

X…Specific/quantified provisions (Limit values or quantified recycling/recovery targets)
Δ…Generic provisions (incl. BAT)
O…Positive/negative lists, descriptive criteria

1.8.4 Options for EU-wide treatment standards

The following chapter describes and discusses the options for minimizing the main environmental impacts of hazardous waste management and removal operations.

1.8.4.1 Environmental impact 1 and 2: Emissions to the air, water and soil

Most waste installations declare emissions to air (e.g. carbon dioxide, ammonia, particulate matter, certain organic substances and other contaminants) and water (e.g. nitrogen, phosphorus, organic chemicals, chlorinated compounds and metals). Unprecautionary handling of hazardous wastes has been at the origin of land contamination, as has been the case in almost all industrial sectors.

To prevent emissions to an extend critical for human health and the environment, EU legislation includes several requirements regarding the handling and management of hazardous waste either referring to specific hazardous waste streams (i.e. waste oils, batteries and accumulators, WEEE, mining wastes, ELVs, packaging wastes, wastes containing PCB/PCT and wastes from the titanium dioxide industry) or referring to specific treatment operations (i.e. for incineration and landfilling of hazardous wastes). Further, the WFD includes requirements regarding the control of hazardous waste (Art. 17), mixing ban (Art. 18), labelling (Art. 19) and record keeping of hazardous waste (Art. 21).

One option is the introduction of acceptance criteria for certain treatment operations in order to accept only waste of which the facilities is capable to treat under safe conditions for human health and the environment (option 1), a second option the application of Article 18 of the WFD (option 2).

<u>Option 1: Introduction of acceptance criteria for treatment operations</u>

Acceptance criteria contain of specified acceptance procedures for incoming wastes at a facility and usually set out limit values for certain components/substances of the incoming waste fractions. The application of acceptance criteria is determined to maintain emissions from a waste treatment facility at an acceptable level for the environment. Therefore, acceptance criteria depend on the technical feasibility of the plant to remove/reduce the hazardous potential of the waste and the technical equipment incorporated to avoid environmental pollution to air, water and soil. Acceptance criteria are introduced in European waste legislation e.g. to landfill operations regarding the different landfill classes. However, for other treatment facilities aiming at removal of hazardous substances such criteria are not set on EU level. In Member States such criteria might be included in the license/ permit of the facility or are set for certain operations like the storage in civic amenity sites, transport, re-packing and pre-treatment

However, a catalogue of acceptance criteria for certain treatment operations (e.g. pretreatment operations for particular hazardous waste) at EU level is not introduced.

Proposals by concerned industry can be one basis for the definition of such criteria.

Acceptance criteria, if developed, should be under the industrial responsibility. They should take into account the technical characteristics of the related installation concerned, its geographical location, local environmental conditions and BAT available.

- Impact on the environment (+)
- Workers´ health and safety (+)

  Part of the acceptance criteria are acceptance procedures at the facility accepting the waste. This includes instructions to the workers in what procedures to accept the waste and what kind of safety measures to follow at each step. Further the introduction of limit values would ensure that only wastes will be accepted where the facility and the workers are prepared for technically and under the aspect of safety precautions. Thus the implementation of acceptance criteria will ensure safe handling and managing of hazardous waste, reducing the risk for workers.

- Economical aspects (0)

  To proof compliance with the acceptance criteria, the waste producer would have to perform laboratory analysis of the waste. Further, the necessary equipment and procedures at the site would have to be installed by the operator of the facility. However, on MS level for the treatment of hazardous waste, criteria are mostly set in the permit of the plant and the producer already has to inform the operator about the characteristics of the waste (including e.g. information on waste code, physical-chemical properties, chemical composition, volume and weight). Thus, additional investments are expected to be manageable; new market potential however are not expected.

- Considerable number of standards available (+)

  All EU Member States would be affected by a unified introduction of acceptance criteria for hazardous treatment operations in European waste legislation.

- Contribution to environmental policy (Strategies, objectives etc.) (0)

  Big influence to European and international environmental policy are not expected.

- Relation to expected technological / waste management developments (0)

  To a large extend the measure will not help to stipulate technological development as the general treatment methods for removing hazardous waste are not influenced and testing methods are already in place.

Option 1 as the *introduction of waste acceptance criteria for incoming hazardous wastes* can be summed up as medium priority.

Option 2:

Application of mixing ban (including general prohibition of dilution)

Article 18 of the WFD stipulates that wastes must be "not mixed, either with other categories of hazardous waste or with other waste, substances or materials", except a derogation exists on Member State level. Member States are obliged to take necessary measures to define the conditions of derogation.

- Impact on the environment (+)

  Mixing (including dilution) of wastes solely for degrading the hazardous potential (and without related permits under derogation conditions) leads to an increase of the overall negative environmental impact, as hazards – which would have to be treated/removed from the waste stream in particular treatment operations – are introduced to the environment (regardless if this is in diluted form or not).

- Workers´ health and safety (0)

  The influence on the workers' safety and health conditions is estimated as positive. If hazardous waste is mixed without any permit then traceability and transparency becomes more difficult and consequently knowledge of what is being handled is more difficult – this increases the risk for workers.

- Economical aspects (+)

  For those Member States applying a mixture of treatment options, specific treatment operations for hazardous waste streams are in place. Thus, high investments are not to be expected, provided the implementation of article 18 . However, the measure will not enhance market potentials e.g. for output material.

- Considerable number of standards available (+)

  Most of the EU Member States might be affected as the prohibition of dilution of hazardous waste is not yet introduced into national waste legislation.

- Contribution to environmental policy (Strategies, objectives etc.) (0)

  On a general level, option 2 will not contribute to European and international environmental policy.

- Relation to expected technological / waste management developments (0)

  As technologies for the removal of pollutants in waste are applied already, the, the extension of the definition of 'mixing ban' or the explicit prohibition of dilution will not foster technology development.

Option 2 as the explicit *prohibition of dilution* is ranked as is ranked as medium priority.

1.8.4.2 Environmental impact 3: Dissipation of pollutants to further (recycling) processes and products via waste outputs

The output on treated hazardous waste in the various processes can be divided into the treated waste (main part), which can in some cases be reused and the waste generated by the treatment process. As input material – the different hazardous wastes – differs a lot in composition, also the output contains a different set of components and contaminants.

One option to avoid the further dissipation of pollutants is the introduction of quality protocols for treated hazardous waste (option 3).

Option 3: Introduction of quality criteria for material output from treatment of hazardous waste

Quality criteria for the output material of facilities removing hazardous substances have not been set by EU waste legislation and are not delivered from EU Member States so far.

In this context, it is a further option to s*tipulate the elaboration of quality criteria for output material* for the most common processes aiming at the removal of hazardous wastes or/and most common waste stream, e.g. in form of quality protocols.

Quality Protocols are currently used e.g. in the UK to define which specific wastes can be regarded as having ceased to be waste according to the WFD (end-of waste criteria). They are currently applied e.g. for gypsum waste, glass, plasterboards, lubrication oil and others.

The Quality Protocol sets out quality criteria for such waste regarding the further use. Producers and users are not obliged to comply with the Quality Protocol. If they do, they can declare the output as a product instead of waste. This will however not affect the licensing/permitting procedure for the facility[15]. Similar quality criteria could be elaborated for other hazardous waste streams, in particular such streams used in further processes on European level or stipulation could be made to provide such protocols on national level.

- Impact on the environment (+)

  Remaining risk potential of treated waste would be more predictable when fulfilling quality standards. Industry would try to comply with the standards and accordingly adopt enhanced treatment technologies; thus the negative environmental impact would decrease.

- Workers´ health and safety (0/+)

  The influence on the workers' safety and health conditions are estimated as not relevant in the treatment process, as the incoming conditions of the waste are not tackled with this measure. However it could be argued that the workers' safety and health conditions in other processes (e.g. further treatment processes, processes where output is used, etc.) could be increased, as the output material is of higher quality and lower contamination

- Economical aspects (+)

  The quality criteria further aims to provide increased market confidence in the quality of

[15] http://www.environment-agency.gov.uk/business/topics/waste/32154.aspx

products made from waste and so might encourages recovery and recycling or particular waste streams.

- Considerable number of standards available (+)

  Most of the Member States would be affected, as the use of quality criteria is not the standard procedure.

- Contribution to environmental policy (Strategies, objectives etc.) (0)

  Option 3 will not at a general level contribute to European and international environmental policy.

- Relation to expected technological / waste management developments (+)

  Technologies will be further adopted to reach the quality standards, therefore, a positive effect to the development of such technologies can be expected.

Option 3 as the *introduction of quality criteria* for output material is ranked as high priority.

1.9 Summary of options related to minimum treatment standards and their priority

The table below gives an overview on the individual options related to minimum treatment requirements discussed above and summarizes the impact on the environment aspects of workers' health and safety as well as economical aspects. Furthermore, the relation to expected future technological/waste management developments was evaluated. The application of the scores used for assessing individual categories as well as the approach for ranking the individual options according to their overall relevance are described in Chapter 1.3.2.

For **mechanical treatment of construction and demolition wastes**, prescribing prevention and abatement technology related to air emissions and/or setting limit values for exhaust air as well as introducing waste acceptance criteria is considered the highest priority for action. Prescribing prevention and abatement measures and/or setting limits for emission of pollutants to water or for noise/ vibrations as well as requesting encapsulation of aggregates or whole installations were considered to be considered of medium priority.

For **mechanical treatment of MSW and similar waste** prescribing prevention and abatement technology related to air emissions and/or setting limit values for air emissions as well as prescribing depollution of waste input are considered to be highly relevant. Introduction of waste acceptance criteria in general and prescription of technical requirements related to liquid emissions and/or setting limit values are considered of lower priority.

For **biological treatment (composting and anaerobic digestions) of biodegradable wastes** it is considered that prescription of key (technical) requirements related to design and operation aiming at reduction of gaseous emissions, including energy efficiency as well as acceptance criteria for waste input (which can include a list of materials suitable), particularly in order to prevent soil pollution by subsequent use of compost or digestate are of high relevance. This is in particular true for anaerobic digestion. Prescription of energy efficiency standards for anaerobic digestion plants are considered of medium and establishing technical requirements related to releases into water and/or setting limit values for contamination of waste water to be discharged of lower priority.

For **temporary storage of wastes** prescribing prevention and abatement technology related to air emissions and/or setting limit values for air emissions were considered of higher relevance than prescribing prevention and abatement technology related to water emissions.

For the setting of standards regarding the **management and treatment of hazardous waste** (focusing on identifying, avoiding of dilution, removal of hazardous substances), the elaboration of quality criteria including conditions for outcoming wastes of reduction/removal processes is seen as a promising option to be further elaborated on EU or Member State level. Also the introduction of acceptance criteria for certain operations and the ban of dilution of hazardous wastes (by specifying the definition of 'mixing of wastes' or the introduction of a separate definition is a option to reduce emissions and risks from the management and handling of hazardous wastes. The combination of of

the last two options would be most efficient; the introduction of waste acceptance criteria would support the explicit prohibition on dilution of hazardous waste.

Table 1-6: Overview on options for setting technical minimum standards (Coulours of rows indicate overall relevance/priority)

Waste treatment activity	Main environmental impact	Option for setting minimum treatment standards	Impact on the environ-ment	Workers´ health and safety	Eco-nomical aspects	Considerable number of standards available	Contribution to environmental policy	Relation to expected technological / waste management developments
Mechanical treatment of C&D waste	Emissions to the air	1) Prescription of technical requirements for treatment sites and/or setting limit values for dust and gaseous air emissions	+	+	0/+	+	+	+
		2) Encapsulation of key equipment / areas where air emissions are highest or encapsulation of treatment installations	+	0/+	0/+	+	+	0
	Water emissions	3) Prescription of technical requirements for treatment sites and/or setting limit values for water emissions	+	0/+	0	+	+	0
	Noise and vibration	4) Prescription of technical requirements for treatment sites and/or setting limits on noise	+	+	0/+	+	+	0
	Dissipation of pollutions	5) Introduction of waste acceptance criteria for waste input	+	+	0	+	+	+
Mechanical treatment of MSW and similar waste	Emissions to the air	1) Prescription of prevention and abatement technology and/or setting limit values	++	0/+	0/+	+	+	+
		2) Introduction of waste acceptance criteria for waste input	+	0/+	0/+	0	+	0
	Emissions to water/soil	3) Prescription of technical requirements for treatment sites and/or setting limit values	+	0	0/+	0/+	+	0
	Dissipation of pollutants via material output	4) Prescription of de-pollution of waste input	++	0/+	0/+	+	+	0

Waste treatment activity	Main environmental impact	Option for setting minimum treatment standards	Impact on the environ-ment	Workers´ health and safety	Eco-nomical aspects	Considerable number of standards available	Contribution to environmental policy	Relation to expected technological / waste management developments
Composting and anaerobic digestion of biodegradable waste	Emissions to the air	1) Prescription of technical requirements related to design and operation of treatment facilities and/or setting limit values	++	0/+	0/+	+	+	+
	Releases into water	2 Prescription of technical requirements related to design and operation of treatment facilities and/or setting limit values	+	0	0/+	0	+	0
	Soil contami-nation via compost and digestate	3) Introduction of waste acceptance criteria for waste input	+	+	+	+	+	0
Temporary Storage of waste related to C&D waste, tyres and MSW wastes	Emissions to the air	1) Prescription of technical requirements related to design and operation of treatment facilities and/or setting limit values	+	+	0	+	+	+
	Water emission	2) Prescription of technical requirements related to design and operation of treatment facilities and/or setting limit values	+	0	0/+	0/+	+	+
	Noise and vibration	3) Prescription of technical requirements related to design and operation of treatment facilities and/or setting limits	0	0/+	0	+	+	0
Hazardous wastes	Emissions to the air/ water	1) Introduction of waste acceptance criteria for the relevant treatment processes	+	+	0	+	0	0
		2) Explicit prohibit dilution of waste for all waste management operations	+	0	+	+	0	0
	Dissipation of pollutants via material output	3) Introduce quality criteria for output material from hazardous waste treatment	+	0/+	+	+	0	+

Explanation of overall relevance/priority:
High (+++++/++++++) Medium (+++/++++) Low (+/++)

The application of the scores and determining overall relevance is described in Chapter 1.3.2

1.10 Final Conclusions and Recommendations for possible action to be taken at EU level

The main outcome of working package 4 are prioritized fields of action related to, and options for establishing technical minimum standards for waste treatment on a European level (Article 27, Waste Framework Directive). The analyzed options are mainly based on already existing standards. Table 1-7 summarizes the options according to their priority.

Table 1-7: Overview on options for technical minimum standards for waste treatment

	High Priority	Medium Priority	Lower Priority
Mechanical treatment of C&D waste	Prescription of technical requirements for treatment sites and/or setting limit values for dust and gaseous **air emissions**	**Encapsulation** of key equipment / areas where air emissions are highest or encapsulation of treatment installations	
		Prescription of technical requirements for treatment sites and/or limit values related to **water emissions**	
	Introduction of waste acceptance criteria for **waste input**	Prescription of technical requirements for treatment sites and/or setting limits on **noise**	
Mechanical treatment of municipal & similar waste	Prescription of technical requirements and/or setting limit values for **air emissions**	Prescription of technical requirements for treatment sites and/or setting limit values related to **water emissions**	Prescription of technical requirements for treatment sites and/or setting limits on **noise**
	Prescription of de-pollution of **waste input**	Introduction of waste acceptance criteria for **waste input**	
Biological treatment of biodegradable waste	Prescription of key technical requirements related to design and operation of the process and establishing limit values for **air emissions**		Prescription of technical requirements and/or setting of limit values for **water emissions**
	Introduction of waste acceptance criteria for **waste input**		
Temporary Storage of C&D waste, tires and waste related to the treatment on MSW	Prescription of technical requirements for treatment sites and/or setting limit values for **dust and gaseous emissions**	Prescription of technical requirements for treatment sites and/or limit release of **emissions to surface and groundwater**	Prescription of technical requirements for treatment sites and/or setting limit values for **noise**
Handling and Management of Hazardous Wastes	Introduce quality criteria for **output material** from hazardous waste treatment	Introduce acceptance criteria for **waste input** to particular treatment operations	
		Explicit **prohibition of dilution**	

The categorisation of options (high/medium/low priority) was made on the basis of on overall information about impacts on the environment, workers health and safety and economical aspects. Furthermore, expected future technological/waste management developments were taken into consideration. A comprehensive (quantitative) impact assessment of individual options, however, was beyond the scope of this study.

Options considered of **the highest relevance/priority** include:

- Prescription of key technical requirements related to design and operation (prevention measures, abatement technology, standards for energy efficiency standards) and/or setting limit values for gaseous emissions for:
    - Mechanical treatment of municipal & similar waste as well as of C&D waste
    - Biological treatment of biodegradable wastes, in particular for anaerobic digestion
    - Temporary storage of C&D waste, tyres and wastes from treatment of
- Introduction of acceptance criteria for waste input into:
    - mechanical treatment plants for municipal & similar waste
    - composting and anaerobic digestion plants
    - mechanical treatment of C&D waste
- Introduction of quality criteria for output material from hazardous waste treatment
    - For treatment processes (e.g. de-pollution processes) for particular hazardous wastes

Further options considered of **medium relevance/priority** include:

- Prescription of technical requirements related to design and operation of treatment facilities and/or setting limit values for liquid emissions from
    - mechanical treatment of municipal & similar waste and
    - storage of C&D waste, tires and wastes related to the treatment of household & similar wastes
- Introduction of acceptance criteria for particular treatment operations for hazardous wastes
- Prescription of technical requirements related to design and operation of treatment facilities and/or setting limit values for noise from mechanical treatment of C&D waste
- Prohibition of dilution of hazardous wastes

For the waste streams / treatment activities analysed within this study there are considerable differences in the amount of available information; both, on the actual treatment capacities being outside the scope of the IED Directive, and on environmental impacts, including emissions and emission reduction potential associated to particular standards. Whereas biological treatment is comparably well documented, for mechanical treatment of municipal & similar waste and C&D waste

information is comparably scarce. This is in particular true for handling of hazardous wastes and temporary storage.

When establishing binding standards for the mechanical treatment of municipal & similar waste and C&D waste, it is thus recommended to collect more detailed information on number and capacity of plants below the capacity thresholds of the IED Directive, on requirements of existing plant permits and types and qualities of waste treated, on regional aspects, etc.

To note that guidance in this field, and particularly any guidance adopted under Article 27 WFD, also may have impacts on waste shipments. Article 49 of Waste Shipment Regulation (EC) 1013/2006 makes reference to EU standards on several occasions:

- Article 49(1) stipulates that waste to be shipped within the EU must be managed without endangering human health and an in environmentally sound manner; the requirements of Article 13 of WFD and other Community legislation have to be respected;
- Article 49(2) of that Regulation states that the standard of management "in an environmentally sound manner" is also applied in case of exports from the Community, and that "environmentally sound management may, inter alia, be assumed as regards the waste recovery or disposal operation concerned, if the notifier or the competent authority in the country of destination can demonstrate that the facility which receives the waste will be operated in accordance with human health and environmental protection standards that are broadly equivalent to standards established in Community legislation".

Standards discussed in this document may be relevant both for shipments subject to the notification procedure of Article 3(1) of Waste Shipment Regulation (e.g. in case of hazardous wastes listed on Annex A to Basel shipped for recovery or interim recovery) and the Article-18-procedure (Article 3(2) of Waste Shipment Regulation), namely applicable for recovery or interim recovery of "green" listed waste.

To prevent adverse effects to the environment and human health, EU legislation includes already several requirements regarding the handling and management of waste either referring to specific waste streams or referring to specific treatment operations (incineration and land-filling). Further, the WFD includes requirements regarding management of hazardous waste and management of bio-waste. The latter, however, does not provide specific treatment requirements going beyond the request that treatment fulfils high level environmental protection. In particular the IED Directive and the relevant BREFs provide the framework for environmental sound waste treatment activities. Apart from mechanical treatment of (non-hazardous) C&D waste, all other analysed waste streams / treatment activities might be covered by its scope, if plants exceed capacity thresholds.

It is thus recommended to also strengthen the implementation and enforcement of existing legislation regarding waste handling and management, including.

- Intensifying monitoring and follow-up of implementation of existing legislative requirements into Member States legislation (implementation of WFD, water and air protection legislation, etc.)

- Monitoring the practical enforcement of these legal pieces, in particular, by monitoring of permitting systems, performance of controls and inspections, etc.
- Enhancing practical enforcement of the relevant legislation on Member State level through support of awareness-raising of authorities, information exchange between experts, information platforms and material, etc.

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[VLAREM II 2005]
Order of the Flemish Government of 1 June 1995 concerning General and Sectoral provisions relating to Environmental Safety

2 Annex

2.1 Details on minimum treatment standards

2.1.1 Treatment standards for the mechanical treatment of construction & demolition (C&D) waste

2.1.1.1 Emission related standards (air incl. odour)

Nine standards related to **air emissions** were identified for Austria, Belgium, Finland, Finland, France, Ireland and UK. The core element (all standards) was a requirement for suppressing dust emissions such as wheel washing, water spraying, equipment enclosure and and avoiding operations in windy conditions. Some standards also specify quantitative limits for dust (e.g. France and Finland) and odour.

General

A number of dust reduction and suppression measures are available in both virgin and secondary aggregate production and are listed in **CEC 2007b** for reducing or preventing dust emissions from crushing, sorting and storage. These include:

- techniques to reduce dust emissions: wet suppression systems, extraction and collection of dust, fabric filters or high efficiency wet collectors, transfer to closed installations;
- techniques to prevent dust emissions: enclosure/encapsulation of screening installations, enclosure of crushing plant;
- techniques to reduce environmental impact from open storage **[EC 2006]**: spraying of water with or without additives, self-erecting covers;
- techniques to reduce environmental impact from enclosed storage **[EC 2006]**: The BAT for enclosed storage is to apply dust abatement techniques.
  - BAT for silo: to apply a proper design to provide stability and prevent the silo from collapsing.
  - BAT for sheds: to apply proper designed ventilation and filtering systems and to keep the doors closed.
- techniques to reduce environmental impact from handling **[EC 2006]**, for handling solid C&D waste, the BATs are to: postpone handling in windy conditions; reduce discontinuous transport and transport distances; reduce the drop height and to choose the best position during discharging into a truck; adjust the speed of vehicles on-site; apply hard surfaces to the roads; clean the roads that are fitted with hard surfaces; clean the tyres of vehicles; moisten drift sensitive and wettable products by water spraying with or without additive, using water

curtains and jet spraying; minimise the speed of decent; minimise the free fall height of the products.

- techniques to reduce environmental impact from transfer on conveyors **[EC 2006]**. For conveyor and transfer chutes, the BATs are to: design appropriately the conveyor transfer chutes; use lateral wind protection; spray water and jet spraying at the transfer points; clean conveyor belt; close conveyor when highly drift sensitive material; apply housing of existing belt conveyor for highly and moderate drift sensitive materials; use extraction system for closed conveyor belts.

Austria

The Austrian Guideline for mobile treatment of mineral construction waste and excavated soil **[BRV 2004]** sets requirements for the operation of mobile treatment plants for non-hazardous mineral C&D waste. Specifically it identifies emission-related practices and measures to prevent dusts being transported such as cleaning tyres, wetting roads, etc.

Belgium

The order of the Flemish Government of 1 June 1995 concerning General and Sectoral provisions relating to Environmental Safety **[VLAREM II 1995]** details various environmental quality standards and relative policy tasks relating to air, waste water and noise emissions.

- Chapter 4 of the order includes the general environmental conditions for the classified establishments identified in **VLAREM1 1991**.
- Chapter 5 specifies the environmental conditions per section of annex I of VLAREM I (i.e. by sector for classified establishments).

Further information relating to air quality can be found in the relevant appendices listed below. The limit values identified are included within the summary table.

- Appendix 1.1.2 contains an indicative list of the major pollutants that must be taken into account if they are relevant for setting down the emission limit values in air and water.
- Appendix 2.5.2. Environmental quality standards for particulate fallout
- Appendix 4.4.2. General emissions limit values for air (with measuring methods).
- Appendix 4.4.3. AIR: measuring frequencies.

Finland

BAT Environmental management in aggregates production **[Finnish MoE 2010]** recommends emission values for dust particles in air during processing of wastes. It also contains emission-related recommendations relating to water and noise. Defined values for air emissions include:

- Dust particles may have a diameter less than more than 100 microns micrometers (micron).

- Total suspended particulate matter in the air (TSP) to be measured as respirable particles (PM10) and inhalable fine particles (PM2. 5).

France

The French Arrêté type - Rubrique n°2515 **[French MoE 1997a]** on crushing crushing, screening, bagging, spraying, cleaning, sieving, mixing rock, rocks, minerals and other natural or artificial mineral products specifies limit values for emissions to air, water and noise. Air emissions specified include:

- Gaseous emissions must be within specified limit values at normal conditions (temperature 273 K and pressure 101.3 kPa). Concentrations are expressed after deducting the water vapor and measured as described in section 6.3.
- Gaseous emissions to the air should not contain more than 150 mg/Nm³ of dust.
- The emissions point must be at least 3 m higher than the building that are built within a 15 m radius.

Ireland

The document – Quarries and Ancillary Activities Guidelines for Planning Authorities **[Irish DoEHG 2004b]** recommends best practice/ mitigation measures to minimize dust deposition and improve air quality. It identifies some key sources of dust generation within quarries including:

- the stripping of topsoil
- the excavation of sand and gravel
- the crushing and screening of aggregates
- ancillary activities such as concrete mixing
- the transport of sand, gravel and finished products (point emissions)
- wind which can carry dust particles well beyond the site boundaries
- fine materials from lorries can be deposited along public roads (fugitive emissions).

- To manage the activities, a first step is preventing dust creation at source. Where practicable, earth stripping or moving should not be carried out in periods of dry and windy weather unless suitable mitigation measures are implemented, and dust should be prevented from escaping from enclosed equipment by means of filters or other appropriate means.
- As far as possible, dust-generating activities should be located away from dust-sensitive land uses. Such activities should be placed in areas where maximum protection can be obtained from topography, woodland or other features, or in areas where prevailing winds will blow dust away from sensitive areas/uses.
- In addition, some mitigation measures include

  - paving road surfaces within the site where a negative impact on a noise-sensitive receptor is likely;
  - water spraying of conveyors/conveyor transfer points, stockpiles and roads;
  - wheel washing of vehicles leaving the site, covering of fine dry loads or spraying of loads prior to exiting the site, and if necessary regular cleaning of public roads in the vicinity of the entrance;
  - appropriate maintenance of vehicles and machinery;
  - landscaped mounds on the periphery of the site and around storage areas.

UK

Good practice in construction and demolition materials recovery facilities **[WRAP 2009]** identifies emissions related risks at waste C&D processing facilities. It also identifies good practice in some facilities which may be beneficial in managing these risks.

Dust in the air, usually produced by vehicle movements, is a key problem for C&D MRFs, particularly in dry weather. When inhaled, fine particulate matter can be dangerous to human health, but it can be reduced in several ways.

- sorting equipment such as trommels or vibratory screens should be fitted with functioning airfiltering units alternatively, water misters fitted to the shed roof can be used;
- some MRFs favour the use of time-delay inorganic foam suppressants sprayed directly onto waste;
- as much of the dust is created by vehicle movements, water-dowser trucks could be used regularly to dampen down roads.

In the UK, there are also a series of national standards concerning the treatment of waste to produce produce soil, soil substitutes, aggregates or waste wood for recovery in different kind of installations **[UK EA 2010a and b, UK EA 2011]**. Although there are no specific limit values, there is a requirement that emissions from the activities shall be free from odour at levels likely to cause pollution outside the site, as perceived by an authorised officer of the Environment Agency, unless the operator has used appropriate measures, including, but not limited to, those specified in any approved odour management plan, to prevent or where that is not practicable, to minimise, the odour. These rules apply to activities for the storage of wastes pending treatment, recycling or reclamation of organic and inorganic wastes. These standard rules are applicable to different EWC waste codes.

Table 2-1: Compilation of limit values for emissions into the air for BE

		BE	
Substance	**Unit**	**VLAREM II**	
Appendix 4.4.2. General emission limit values for air			
total dust, including fine dust, with a mass flow of*:			
≤ 200 g/h	mg/Nm3	150	
200 to 500 g/h - to 31 December 2011	mg/Nm3	150	
201 to 500 g/h - from 1 January 2012	mg/Nm3	20	
500 or more g/h - to 31 December 2011	mg/Nm3	50	
501 or more g/h - from 1 January 2012	mg/Nm3	20	
From the above, mentioned emission limit value of 20 mg/Nm³ for the parameter "total dust, including fine dust" can, in conformance with Article 1.2.2.1 of VLAREM II, be derogated from. The individual derogating emission limit value may, in this case, only amount to a maximum of 50 mg/Nm³.			
the following vaporous or gaseous inorganic substances, at a mass flow per substance of 10 g/h or more:			
arsenic(III) hydride	mg/Nm3	1	
- cyanogen chloride	mg/Nm3	1	
- carbonyl chloride	mg/Nm3	1	
- phosphorus hydrides	mg/Nm3	1	
the following vaporous or gaseous inorganic substances, at a mass flow per substance of 50 g/h or more:			
- bromine and its vaporous or gaseous compounds, expressed in hydrogen bromide	mg/Nm3	5	
- chlorine	mg/Nm3	5	
- hydrogen cyanide	mg/Nm3	5	
- fluorine and its vaporous or gaseous compounds, as expressed in hydrogen fluoride	mg/Nm3	5	
- hydrogen sulphide	mg/Nm3	5	

		BE	
Substance	**Unit**	**VLAREM II**	
vaporous or gaseous inorganic chlorine compounds (not including cyanogen chloride), at a mass flow of 25 g/h or more	mg/Nm3	30	
the following vaporous or gaseous inorganic substances, at a mass flow per substance of 5 kg/h or more:			
- SOx (expressed in SO2)	mg/Nm3	500	
- NOx (expressed in NO2)	mg/Nm3	500	
- CO (originating from production plants with fully oxidative combustion processes, including post-combustion)	mg/Nm3	100	
the following substances, at a mass flow of 0.5 g/h or more:			
benzo(a)pyrene	mg/Nm3	0.1	
- dibenz(a,h)anthracene	mg/Nm3	0.1	
- naphthalen-2-amine	mg/Nm3	0.1	
- beryllium and its compounds in inhalable form, expressed in Be	mg/Nm3	0.1	
- chromium VI compounds, such as calcium chromate, expressed in Cr	mg/Nm3	0.1	
- ethyleneimine	mg/Nm3	0.1	
the following substances, at a mass flow of 5 g/h or more:			
- arsenic trioxide and arsenic pentoxide, expressed in As	mg/Nm3	1	
- arsenic acids and their salts, expressed in As	mg/Nm3	1	
- chromiumIII, strontium chromate and zinc chromate, expressed in Cr	mg/Nm3	1	
- 3,3-dichlorobenzidine	mg/Nm3	1	
- dimethyl sulphate	mg/Nm3	1	
- nickel (nickel metal, nickel sulphide and sulphide ores, nickel oxide and nickel carbonate, nickel tetracarbonyl), expressed in Ni	mg/Nm3	1	
the following substances, at a mass flow of 25 g/h or more:			
- propenenitrile	mg/Nm3	5	
- benzene	mg/Nm3	5	
- 1,3-butadiene	mg/Nm3	5	
- 1-chloro-2,3-epoxypropane (epichlorohydrin)	mg/Nm3	5	
- 1,2-dibromoethane	mg/Nm3	5	
- 1,2-epoxypropane	mg/Nm3	5	
- ethylene oxide	mg/Nm3	5	
- hydrazine	mg/Nm3	5	
- vinyl chloride	mg/Nm3	5	
the following organic substances, at a mass flow of 100 g/h or more:			
- ethanal	mg/Nm3	20	
- propenoic acid	mg/Nm3	20	
- alkyl lead compounds	mg/Nm3	20	
- phenylamine	mg/Nm3	20	
- benzyl chloride	mg/Nm3	20	
- biphenyl	mg/Nm3	20	
- chloroacetaldehyde	mg/Nm3	20	
- chloroethanoic acid	mg/Nm3	20	
- chloromethane	mg/Nm3	20	
- alpha-chlorotoluene	mg/Nm3	20	
- ortho-dichlorobenzene	mg/Nm3	20	
- 1,2-dichloroethane	mg/Nm3	20	
- 1,1-dichloroethylene	mg/Nm3	20	
- dichlorophenols	mg/Nm3	20	
- diethylamine	mg/Nm3	20	
- dimethylamine	mg/Nm3	20	
- 1,4-diethylene dioxide	mg/Nm3	20	
- ethyl acrylate	mg/Nm3	20	
- ethylamine	mg/Nm3	20	
- phenol	mg/Nm3	20	
- methanal	mg/Nm3	20	
- 2-furaldehyde	mg/Nm3	20	
- metylphenols	mg/Nm3	20	
- methyl propenoate	mg/Nm3	20	

		BE	
Substance	**Unit**	**VLAREM II**	
- methylamine	mg/Nm3	20	
- 4-methyl-m-phenylene diisocyanate	mg/Nm3	20	
- methanoic acid	mg/Nm3	20	
- nitrobenzene	mg/Nm3	20	
- nitrocresols	mg/Nm3	20	
- nitrophenols	mg/Nm3	20	
- methylnitrobenzenes	mg/Nm3	20	
- 2-propenal	mg/Nm3	20	
- pyridine	mg/Nm3	20	
- 1,1,2,2-tetrachloroethane	mg/Nm3	20	
- tetrachloromethane	mg/Nm3	20	
- thiols (mercaptans)	mg/Nm3	20	
- thioethers	mg/Nm3	20	
- 2-methylphenylamine	mg/Nm3	20	
- 1,1,2-trichloroethane	mg/Nm3	20	
- trichloromethane	mg/Nm3	20	
- trichlorophenols	mg/Nm3	20	
- triethylamine	mg/Nm3	20	
- xylenols (except 2,4-xylenol)	mg/Nm3	20	
the following organic substances, at a mass flow of 2,000 g/h or more:			
- ethanoic acid	mg/Nm3	100	
- 2-butoxyethanol	mg/Nm3	100	
- butyraldehyde	mg/Nm3	100	
- chloorbenzeen	mg/Nm3	100	
- 2-chlorobuta-1,3-diene	mg/Nm3	100	
- isopropyl chloride	mg/Nm3	100	
- cyclohexanone	mg/Nm3	100	
- para-dichlorobenzene	mg/Nm3	100	
- 1,1-dichloroethane	mg/Nm3	100	
- di(2-ethylhexyl) phtalate	mg/Nm3	100	
- M,N-dimethylformamide	mg/Nm3	100	
- 2,6-dimethyl-4-heptanone	mg/Nm3	100	
- 2-ethoxyethanol	mg/Nm3	100	
- ethylbenzene	mg/Nm3	100	
- furfuryl alcohol	mg/Nm3	100	
- 2,2-iminodiethanol	mg/Nm3	100	
- alpha-methyl styrene	mg/Nm3	100	
- (1-methylethyl)benzene	mg/Nm3	100	
- 2-methoxyethanol	mg/Nm3	100	
- methyl acetate	mg/Nm3	100	
- methylcyclohexanone	mg/Nm3	100	
- methyl formate	mg/Nm3	100	
- methyl methacrylate	mg/Nm3	100	
- naphthalene	mg/Nm3	100	
- propanal	mg/Nm3	100	
- propanoic acid	mg/Nm3	100	
- styrene	mg/Nm3	100	
- tetrachloroethylene	mg/Nm3	100	
- tetrahydrofuran	mg/Nm3	100	
- methylbenzene	mg/Nm3	100	
- 1,1,1-trichloroethane	mg/Nm3	100	
- trichloroethylene	mg/Nm3	100	
- trimethylbenzene	mg/Nm3	100	
- ethenyl ethanoate	mg/Nm3	100	
- 2,4-xylenol	mg/Nm3	100	
- xylene isomers	mg/Nm3	100	
- carbon disulphide	mg/Nm3	100	
the following organic substances, at a mass flow of 3,000 g/h or more:			
- propanone	mg/Nm3	150	
- alkyl alcohol	mg/Nm3	150	

		BE	
Substance	**Unit**	**VLAREM II**	
- 2-butanone	mg/Nm3	150	
- butyl acetate	mg/Nm3	150	
- chloroethane	mg/Nm3	150	
- dibutyl ether	mg/Nm3	150	
- dichlorodifluoromethane	mg/Nm3	150	
- 1,2-dichloroethylene	mg/Nm3	150	
- dichloromethane	mg/Nm3	150	
- diethyl ether	mg/Nm3	150	
- diisopropyl ether	mg/Nm3	150	
- dimethyl ether	mg/Nm3	150	
- ethyl ethanoate	mg/Nm3	150	
- ethane-1,2-diol	mg/Nm3	150	
- 4-hydroxy-4-methylpentan-2-one	mg/Nm3	150	
- methyl benzoate	mg/Nm3	150	
- 4-methyl-2-pentanone	mg/Nm3	150	
- N-methyl-2-pyrrolidone	mg/Nm3	150	
- alkenes (except for 1,3-butadiene)	mg/Nm3	150	
- alkanes (except for methane)	mg/Nm3	150	
- pinenes	mg/Nm3	150	
- trichlorofluoromethane	mg/Nm3	150	
the following inorganic particulate substances, at a mass flow of 1 g/h or more: (*)			
- cadmium and its compounds (expressed in Cd)	mg/m3	0.2	
- mercury and its compounds (expressed in Hg)	mg/m3	0.2	
- thallium and its compounds (expressed in Tl)	mg/m3	0.2	
the following inorganic particulate substances, at a mass flow of 5 g/h or more:(*):			
- arsenic and its compounds (expressed in As)	mg/m3	1	
- nickel and its compounds (expressed in Ni)	mg/m3	1	
- selenium and its compounds (expressed in Se)	mg/m3	1	
the following inorganic particulate substances, at a mass flow of 25 g/h or more: (*):			
- antimony and its compounds expressed in Sb	mg/m3	5	
- lead and its compounds expressed in Pb	mg/m3	5	
- chromium and its compounds expressed in Cr	mg/m3	5	
- cobalt and its compounds expressed in Co	mg/m3	5	
- easily soluble cyanide and its compounds expressed in CN	mg/m3	5	
- easily soluble fluoride and its compounds expressed in F	mg/m3	5	
- copper and its compounds expressed in Cu	mg/m3	5	
- manganese and its compounds expressed in Mn	mg/m3	5	
- platinum and its compounds expressed in Pt	mg/Nm3	5	
- vanadium and its compounds expressed in V	mg/Nm3	5	
- tin and its compounds expressed in Sn	mg/Nm3	5	
the following fibrous silicates (asbestos):			
- actinolite		In keeping with the method laid down in the appendix to the order of the Flemish Government of 14 December 1988 on the stipulation of measures to prevent and counteract air pollution by asbestos	
- amosite (brown asbestos)			
- anthophyllite			
- chrysotile (white asbestos)			
- crocidolite (blue asbestos)			
- tremolite			
as expressed in asbestos, at a waste gas flow of:			
- 5.000 m3/hour or more	mg/Nm3	0.1	
- < 5.000 m3/hour	mg asbestos per hour	500	
Appendix 2.5.2. Environmental quality standards for particulate fallout			
		Guide value	**Limit value**
deposited non-hazardous substances (as monthly average)	mg/m2/day	350	650
lead (as annual average)	µg	250	3000

		BE	
Substance	**Unit**	**VLAREM II**	
	Pb/m2/day		
cadmium (as annual average)	µg Cd/m2/day	20	-
thallium (as annual average)	µg Tl/m2/day	10	-

2.1.1.2 Emission related standards (water)

Ten standards relating to controlling water emissions were identified. Most require prevention of release of potentially contaminated water to surface or groundwater and use of best practice such as use of sealed surfaces, appropriate bunding and run-off collection Limit values for discharge of effluent to the public sewerage system or natural environment are stipulated by French legislation (temperature, total suspended solids, pH and hydrocarbons).

Austria

The Austrian guideline for mobile treatment of mineral construction waste and excavated soil **[BRV 2004]** sets requirements for the operation of mobile treatment plants for non-hazardous mineral C&D waste. Specifically it identifies emission-related practices and measures to prevent dusts being transported such as cleaning tyres, wetting roads, etc.

The national Austrian Ordinance on wastewater emissions and waste treatment **[Austrian MoE 1999]** sets limit values for waste water emissions to rivers and sewer systems. Annex A comprises a list of requirements (26 parameters) for waste treatment plants applying physical treatment processes. These are detailed in the summary table.

Belgium

The order of the Flemish Government of 1 June 1995 concerning General and Sectoral provisions relating to Environmental Safety **[VLAREM II 1995]** details various environmental quality standards and relative policy tasks relating to air, waste water and noise emissions.

- Chapter 4 of the order includes the general environmental conditions for the classified establishments identified in **VLAREM I**.
- Chapter 5 specifies the environmental conditions per section of annex I of **VLAREM I** (i.e. by sector for classified establishments).

Further information relating to waste water emissions can be found in the relevant appendices listed below. The limit values identified are included within the summary table.

- Appendix 1.1.2 contains an indicative list of the major pollutants that must be taken into account if they are relevant for setting down the emission limit values in air and water.
- Appendix 4.2.5.2. Article 4 lists the emission limit values (with measuring methods) for discharges of industrial waste water (values included in table)
- Appendix 5.3.2. details sectoral discharge conditions for industrial waste water (number 2 – asbestos, page 134) (values included in table)

Finland

BAT Environmental management in aggregates production **[Finnish MoE 2010]** details some emissions-related recommendations relating to water and noise. The document recommends that

certain parameters be identified before action taken. These include: pH, total nitrogen, COD, conductivity and turbidity.

France

The French Arrêté type - Rubrique n°2515 **[French MoE 1997a]** on crushing crushing, screening, bagging, spraying, cleaning, sieving, mixing rock, rocks, minerals and other natural or artificial mineral products specifies limit values for emissions to air, water and noise. In addition, it specifies process related requirements for handling and storage of treatment waste water prior to discharge.

- Section 2.10 specifies that storage of liquid likely to pollute water or soil must be of a capacity of the largest volume: 100 % of the capacity of the largest tank and 50 % of the overall capacity of the associated tanks. There are also further recommednations for the storage of liquids.

- Section 5.5 relates to various discharge limits including:

  - Process and washing waters from all installations, excluding installations for the pre-production of cement products, should be recycled in the production.
  - Without damage to the agreement of discharge to the public network (art. L 35-8 du code de la santé publique), effluents must be treated (as necessary) to comply with the limit values on raw effluent prior to settlement and filtration and prior to mixing with other effluents.
  - In all cases, before discharge to the natural environment or to public sewerage systems, these limit values must be met: temperature <30° C, total hydrocarbons - 10 mg/l if the daily load is greater than 100 g/d.
  - In the case of discharge to public sewerage system with wastewater treatment works, a pH of 5.5 – 9.5 (the limit value may vary depending on the sewerage network) and suspended solids content of 600 mg/l is required.
  - In the case of discharge to the natural environment or to public sewerage system without WwTWs, a pH of 5.5 – 9.5 and suspended solids content of < 100 mg/l (if the daily load is < 15 kg/d) or 35 mg/l (if the daily load is > 15 kg/d) is required.
  - The concentration limit values must be complied with as daily average concentrations. Any instantaneous value must not be greater than double the limit value.

Ireland

The Quarries and Ancillary Activities Guidelines for Planning Authorities **[Irish DoEHG 2004b]** recognises that the quantity, physical and chemical quality of surface waters and groundwaters may be affected by quarrying activities. For example:

- flows can be increased or decreased and may be contaminated by runoff or dust from the quarry;
- the removal of topsoil, overburden and aggregates may affect the quality of water recharging of an aquifer, and
- excavation below the water table may lead to de-watering of adjacent watercourses and wells.

The guidelines specify that: any existing Aquifer Protection Plan prepared by the local authority should be consulted. In addition, “wet working” of sand and gravel will enable aggregates to be dredged from below the watertable without the need for de-watering.

UK

The WRAP document on good practice in construction and demolition materials recovery facilities **[WRAP 2009]** identifies emissions related risks at waste C&D processing facilities. It also identifies good practice in some facilities which may be beneficial in managing the risks from emissions to water. The document is focused on activities at Material Recovery Facilities (MRFs) and recognises that these MRFs can indirectly impact on the wider environment in terms of high energy and water consumption, through congestion resulting from skip-trucks, oil spillages from stored fuel for vehicles, and greenhouse gas emissions. The document details mitigations such as:

- reduction of the harmful impacts of oil spillages by storing fuel in properly bunded areas and by fitting underground fuel interceptors to remove oil from water run-off before it enters sewers;
- collection and storage of rainwater for use in dust-suppression;
- generation of renewable energy using on site using biomass boilers, gasification plants or wind turbines;
- use of local waterways or rail-links for transporting materials;
- use of power factor correction;
- avoid multiple handling of waste and where possible operate fuel-efficient equipment.

The series of national standard rules **[UK EA 2010a and b, UK EA 2011]** relating to the treatment of waste to produce soil, soil substitutes, aggregates or waste wood for recovery contains non-specific information on requirements for permitted actitives. The permitted activities shall not be within:

- 500 metres of a European Site 1, Ramsar site or a Site of Special Scientific Interest (SSSI) nor within a specified Air Quality Management Area (AQMA).
- 10 metres of any watercourse;
- 50 metres of any spring or well, or any borehole not used to supply water for domestic or food production purposes; and
- 250 metres of any well, spring or borehole used to supply water for domestic or food production purposes.

In addition, the operator shall submit a deployment form to the Environment Agency prior to the activity commencing.

General requirements for all installations treating soil, soil substitutes, aggregates and waste wood for recovery are:

- no point source emissions into surface waters or groundwaters are allowed;
- emissions of substances not controlled by emission limits (excluding odour) shall not cause pollution;
- the operator shall not be taken to have breached this rule if appropriate measures, including, but not limited to, those specified (table 3.1 of the standard rules) and in any approved emissions management plan, have been taken to prevent or where that is not practicable, to minimise, those emissions;

- when located within groundwater Source Protection Zone 1 or 2, the specified wastes shall be stored and treated on an impermeable surface with a sealed drainage system unless the risk assessment submitted with the deployment form demonstrates that the risk can be controlled using alternative measures;
- when located outside groundwater Source Protection Zones 1 or 2 all permitted wastes shall be stored and treated on hard-standing or on an impermeable surface with sealed drainage system unless the risk assessment submitted with the deployment form demonstrates that the risk can be controlled using alternative measures.

In addition for these installations (excluding mobile treatment plants) under the emissions of substances not controlled by emission limits rule:

- liquids may be discharged into a foul sewer subject to a consent issued by the local water company;
- liquids may be taken off-site in a tanker for disposal or recovery;
- clean surface water from roofs, or from areas of the site that are not being used in connection with storing and treating waste, may be discharged directly to surface waters, or to groundwater by seepage through the soil via a soakaway.

Table 2-2: of limit values for emissions into the water for Austria

		AT
Substance	**Unit**	**Austrian MoE 1999**
pH		6.5-8.5/6.5-10
Temperature	°C	30/35
Algae toxicity		8/b
Bacterial toxicity		4/b
Daphnia toxicity		4/b
Fish toxicity		2/b
Filterable substances	mg/l	30/150
Al	mg/l	2/ Limited by filterable substances
As	mg/l	0.1/0.1
Ba	mg/l	5/5
Pb	mg/l	0.5/0.5
Cd	mg/l	0.1/0.1
Cr tot	mg/l	0.5/0.5
Cr VI	mg/l	0.1/0.1
Co	mg/l	1/1
Fe	mg/l	2/limited by filterable substances
Cu	mg/l	0.5/0.5
Ni	mg/l	1/1
Hg	mg/l	0.01/0.01
Ag	mg/l	0.1/0.1
Zn	mg/l	2/2

		AT
Substance	**Unit**	**Austrian MoE 1999**
Sn	mg/l	2/2
Total chlorine (Cl2)	mg/l	0.4/0.4
NH4-N	mg/l	10/f
Chloride (Cl)	mg/l	Limited by toxicity/-
CN	mg/l	0.1/0.1
Fluoride (F)	mg/l	10/20
NO2-N	mg/l	1/10
Ptot (P)	mg/l	2/-
SO4	mg/l	-/g
Sulfide (S)	mg/l	0.1/1
Sulfit (SO3)	mg/l	1/50
TOC	mg/l	40/h
COD[1]	mgO2/l	120/i
BOD5[2]	mgO2/l	20/-
AOX (Cl)	mg/l	0.5/1.5
Non-volatile hydrophylic substances	mg/l	20/150
Hydrocarbons	mg/l	10/20
POX (Cl)	mg/l	0.1/0.1
Phenol index	mg/l	0.1/10
Tensides	mg/l	1/b
BTXE	mg/l	0.1/0.1

[1] (of raw influent; in case of rejection into the natural environment (or in a group without sewerage station treatment) / in the case of discharge to a sewage system equipped with a collective treatment plant)
[2] (of raw influent; in case of rejection into the natural environment (or in a group without sewerage station treatment) / in the case of discharge to a sewage system equipped with a collective treatment plant)
a) to be limited if necessary
b) no adverse effects on sewage treatment plant.
f) limit values are to be decided case-by-case in danger of odour nuisance or of corrosion of materials in the sewer system or sewage treatment plant
g) to be limited case by case taking into account materials and ratios in sewer systems
x) for waste water predominantly containing un-dissolved an-organic substances

Table 2-3: Compilation of limit values for emissions into the water for Belgium

		BE
Substance	**Unit**	**VLAREM II**
Appendix 4.2.5.2. Article 4, Emission limit values (with measuring methods) for discharges of industrial waste water		
Organoleptic parameters		
Colour	E*ab	1
Inorganic parameters		
General inorganic parameters		
Temperature	°C	

		BE
Substance	**Unit**	**VLAREM II**
electrical conductivity		
Acidity	pH unit	
Flashpoint	°C	> 40
flow rate		
Elements		
NB: unless otherwise specified, these figures always relate to the total concentration.		
Arsenic	µg/l	15
Chromium	µg/l	10
Copper	µg/l	25
Lead	µg/l	25
Nickel	µg/l	10
Silver	µg/l	10
Zinc	µg/l	25
Cadmium	µg/l	2
Mercury	µg/l	0.25
Iron	µg/l	50
manganese	µg/l	20
selenium	µg/l	5
barium	µg/l	10
antinomy	µg/l	20
tin	µg/l	40
aluminium	µg/l	100
cobalt	µg/l	10
molybdenum	µg/l	20
titanium	µg/l	20
cerium	µg/l	100
phosphorus	µg/l	150
boron	µg/l	200
Anions		
chloride	mg/l	25
sulphate	mg/l	25
nitrate	mg/l	0.5
	mg N/l	0.1
nitrite	mg/l	0.1
	mg N/l	0.03
orthophosphate	mg/l	0.15
	mg P/l	0.05
dissolved fluoride	mg/l	0.2
total inorganically bound fluoride	mg/l	0.2
free cyanide	mg/l	0.01
sulphite	mg/l	0.2
dissolved sulphide	mg/l	0.2
acid soluble sulphide	mg/l	0.2
chromium VI	mg/l	0.01
free chlorine	mg/l	0.1

		BE
Substance	**Unit**	**VLAREM II**
total chlorine	mg/l	0.1
Group parameters		
settled solids	ml/l	0.1
suspended solids	mg/l	2
BOD	mg O2/l	3
COD	mg O2/l	7
Kjeldahl nitrogen	mg/l	2
total nitrogen (TON)	mg/l	2
total cyanide	mg/l	0.01
TOC	mg/l	10
Cations		
ammonium	mg/l	0.25
	mg N/l	0.2
Organic parameters		
Phenols:		
phenol	ng/l	200
2-chlorophenol	ng/l	100
3-chlorophenol	ng/l	100
4-chlorophenol	ng/l	100
o-cresol	ng/l	100
m-cresol	ng/l	100
p-cresol	ng/l	100
2,6-dimethylphenol	ng/l	100
o-ethylphenol	ng/l	100
2,4-dimethylphenol	ng/l	100
2,5-dimethylphenol	ng/l	100
p-ethylphenol	ng/l	100
m-ethylphenol	ng/l	100
3,5-dimethylphenol	ng/l	100
2,3-dimethylphenol	ng/l	100
3,4-dimethylphenol	ng/l	100
nonylphenol	ng/l	100
bisphenol A	ng/l	100
2,4-dichlorophenol	ng/l	100
2,5-dichlorophenol	ng/l	100
2,3-dichlorophenol	ng/l	100
2,6-dichlorophenol	ng/l	100
3,5-dichlorophenol	ng/l	100
3,4-dichlorophenol	ng/l	100
4-chloro-3-methylphenol	ng/l	100
4-chloro-3,5-dimethylphenol	ng/l	100
2,4,6-trichlorophenol	ng/l	100
2,4,6-trichlorophenol	ng/l	100
2,4,5-trichlorophenol	ng/l	100
2,4,6-trichlorophenol	ng/l	100

		BE
Substance	**Unit**	**VLAREM II**
2,4,6-trichlorophenol	ng/l	100
2,4,6-trichlorophenol	ng/l	100
2,3,4,6-tetrachlorophenol	ng/l	100
2,3,4,6-tetrachlorophenol	ng/l	100
2,3,4,6-tetrachlorophenol	ng/l	100
pentachlorophenol	ng/l	100
2-isopropylphenol	ng/l	100
2,3,5-trimethylphenol	ng/l	100
Monocyclic aromatic hydrocarbons (MAH)		
BTEXS:		
benzene	µg/l	1
toluene	µg/l	1
xylenes	µg/l	1
ethylbenzene	µg/l	1
styrene	µg/l	1
other:		
isopropylbenzene	µg/l	1
propylbenzene	µg/l	1
1,3,5-trimethylbenzene	µg/l	1
tert-butylbenzene	µg/l	1
1,2,4-trimethylbenzene	µg/l	1
sec-butylbenzene	µg/l	1
p-isopropyltoluene	µg/l	1
n-butylbenzene	µg/l	1
Polycyclic aromatic hydrocarbons		
naphthalene	ng/l	100
acenaphthylene	ng/l	100
acenaphthene	ng/l	100
fluorine	ng/l	100
phenanthrene	ng/l	100
anthracene	ng/l	100
fluoranthene	ng/l	100
pyrene	ng/l	100
benzo(a)anthracene	ng/l	100
chrysene	ng/l	100
benzo(b)fluoranthene	ng/l	100
benzo(k)fluoranthene	ng/l	100
benzo(a)pyrene	ng/l	100
indeno(1,2,3-cd)pyrene	ng/l	100
dibenz(a,h)anthracene	ng/l	100
benzo(g,h,i)perylene	ng/l	100
Chlorinated aromatic amines		
o-chloroaniline		
m-chloroaniline		
p-chloroaniline		

		BE
Substance	**Unit**	**VLAREM II**
2,3-dichloroaniline		
2,4-dichloroaniline		
2,5-dichloroaniline		
2,6-dichloroaniline		
3,5-dichloroaniline		
3,4-dichloroaniline		
Pesticides		
Organochloropesticides (OCP)		
a-hexachlorocyclohexane (a-HCH)	ng/l	100
I-hexachlorocyclohexane (I-HCH)	ng/l	100
y-hexachlorocyclohexane (y-HCH, lindane)	ng/l	100
6-hexachlorocyclohexane (6-HCH)	ng/l	100
aldrin	ng/l	400
isodrin	ng/l	400
dieldrin	ng/l	400
endrin	ng/l	1000
telodrin	ng/l	400
hexachlorobenzene (HCB)	ng/l	100
heptachlor	ng/l	500
heptachlor epoxide	ng/l	400
a-endosulphan	ng/l	400
I-endosulphan	ng/l	400
endosulphan sulphate	ng/l	400
trans-chlorodane	ng/l	100
cis-chlorodane	ng/l	100
o,p'-DDD	ng/l	100
o,p'-DDT	ng/l	100
o,p'-DDE	ng/l	100
p,p' -DDD	ng/l	100
p,p' -DDT	ng/l	100
p,p' -DDE	ng/l	100
2,3,5,6-tetrachlorenitrobenzene (tecnazene)	ng/l	100
pentachloronitrobenzene (quintozene)	ng/l	400
methoxychlor	ng/l	100
Organophosphorus pesticides (OPP)		
azinphos-ethyl	ng/l	50
azinphos-methyl	ng/l	50
bromophos	ng/l	50
bromophos-ethyl	ng/l	50
chlorfenvinphos	ng/l	50
chlorpyrifos	ng/l	50
chlorpyrifos-methyl	ng/l	50
diazinon	ng/l	50
dichlorvos	ng/l	50

		BE
Substance	**Unit**	**VLAREM II**
dimethoate	ng/l	50
ethoprophos	ng/l	50
fenitrothion	ng/l	50
fenthion	ng/l	50
fonofos	ng/l	50
malathion	ng/l	50
methidathion	ng/l	50
mevinfos	ng/l	50
parathion-ethyl	ng/l	50
parathion-methyl	ng/l	50
pirimiphos-methyl	ng/l	50
terbufos	ng/l	50
Nitrogen pesticides		
triazine type herbicides		
atrazine	ng/l	50
cyanazine	ng/l	50
desethylatrazine	ng/l	50
desisopropylatrazine	ng/l	50
hexazinone	ng/l	50
prometryn	ng/l	50
propazine	ng/l	50
sebutylazine	ng/l	50
simazine	ng/l	50
terbutryn	ng/l	50
terbutylazine	ng/l	50
urons (phenylurea) and anilides		
alachlor	ng/l	200
chlorotoluron	ng/l	200
diuron	ng/l	200
isoproturon	ng/l	200
linuron	ng/l	200
metabenzthiazuron	ng/l	200
metabromuron	ng/l	200
metazachlor	ng/l	200
metolachlor	ng/l	200
metoxuron	ng/l	200
monolinuron	ng/l	200
Other nitrogen pesticides		
chloridazon (pyrazon)	ng/l	200
trifluralin	ng/l	200
Acid herbicides		
(2,4,5-trichlorophenoxy) acetic acid (2,4,5-T)	ng/l	200
(2,4-dichlorophenoxy) acetic acid (2,4-D)	ng/l	200
2,4-DB4-(2,4-dichlorophenoxy) butane acid (2,4-DB)	ng/l	200

		BE
Substance	**Unit**	**VLAREM II**
bentazon	ng/l	200
dichlorprop	ng/l	200
fenoprop (2,4-TP)	ng/l	200
fluroxypyr	ng/l	200
MCPA	ng/l	200
MCPB	ng/l	200
mecoprop (MCPP)	ng/l	200
Polychlorinated biphenyls (PCB)		
PCB 28	ng/l	20
PCB 52	ng/l	20
PCB 101	ng/l	20
PCB 118	ng/l	20
PCB 138	ng/l	20
PCB 153	ng/l	20
PCB 180	ng/l	20
Polychlorinated terphenyls (PCT)		
Volatile organic halogens		
dichlorodifluormethane	µg/l	10
chloromethane	µg/l	10
vinylchloride	µg/l	10
bromomethane	µg/l	10
chloroethane	µg/l	10
trichlorofluoromethane	µg/l	10
1,1-dichloroethane	µg/l	10
dichloromethane	µg/l	10
1,2-dichloroethene,trans	µg/l	10
1,1-dichloroethane	µg/l	10
2,2-dichloropropane	µg/l	10
1,2-dichloroethene,cis	µg/l	10
bromochloromethane	µg/l	10
chloroform	µg/l	10
1,1,1-trichloroethane	µg/l	10
1,1-dichloropropene	µg/l	10
carbon tetrachloride	µg/l	10
1,2-dichloroethane (EDC)	µg/l	10
trichloroethylene (TRI)	µg/l	10
1,2-dichloroethane	µg/l	10
dibromomethane	µg/l	10
bromodichloromethane	µg/l	10
1,3-dichloropropene, cis	µg/l	10
1,3-dichloropropene, trans	µg/l	10
1,1,2-trichloroethane	µg/l	10
tetrachloroethylene (PER)	µg/l	10
1,3-dichloropropane	µg/l	10
dibromochloromethane	µg/l	10

		BE
Substance	**Unit**	**VLAREM II**
1,2-dibromoethane	µg/l	10
chlorobenzene	µg/l	10
1,1,1,2-tetrachloroethane	µg/l	10
bromoform	µg/l	10
1,1,2,2-tetrachloroethane	µg/l	10
bromobenzene	µg/l	10
1,2,3-trichloropropane	µg/l	10
2-chlorotoluene	µg/l	10
4-chlorotoluene	µg/l	10
1,3-dichlorobenzene	µg/l	10
1,4-dichlorobenzene	µg/l	10
1,2-dichlorobenzene	µg/l	10
1,2-dibromo-3-chloropropane	µg/l	10
Moderately volatile organic halogens		
hexachloroethane	ng/l	100
1,3,5-trichlorobenzene	ng/l	100
1,2,4-trichlorobenzene	ng/l	100
1,2,3-trichlorobenzene	ng/l	100
hexachlorobutadiene (HCBD)	ng/l	200
1,2,3,5-tetrachlorobenzene	ng/l	200
1,2,4,5-tetrachlorobenzene	ng/l	200
1,2,3,4-tetrachlorobenzene	ng/l	200
2-chloronaphthalene	ng/l	200
1-chloronaphthalene	ng/l	200
pentachlorobenzene	ng/l	200
Anionic surfactants		
alkylbenzene sulfonates (LAS and ABS): C10-C14	µg/l	40
alkylsulphates (AS): C10-C18	µg/l	20
alkylether sulphates (AES): C10-C15, nEO where n = 1-4	µg/l	60
α-olefin sulphonates (AOS): C12-C18	µg/l	80
Non-ionogenic surfactants		
alcoholethoxylates (AE)	µg/l	20
alkylphenolethoxylates (APE)	µg/l	20
fatty acid ester ethoxylates (FAE)	µg/l	20
Cationic surfactants (indiv.)	µg/l	10
Organofluorine compounds		
nonafluoropentanoic acid (PFPA)	ng/l	100
undecafluorohexanoic acid (PFHxA)	ng/l	100
tridecafluoroheptanoic acid (FHpA)	ng/l	100
pentadecafluoroctanoic acid (PFOA)	ng/l	100

		BE
Substance	**Unit**	**VLAREM II**
heptadecafluorononanoic acid (PFNA)	ng/l	100
nonadecafluorodecanoic acid (PFDA)	ng/l	100
perfluorundecanoic acid (PFUnA)	ng/l	100
perfluorododecanoic acid (PFDoA)	ng/l	100
nonafluoro butansulfonyl acid (PFBS)	ng/l	100
tridecafluoro hexansulphonyl acid (PFHxS)	ng/l	100
heptadecafluoro octansulphonyl acid (PFOS)	ng/l	100
perfluoro decansulphonyl acid (PFDS)	ng/l	100
perfluorooctansulphonamide (PFOSA)	ng/l	100
Brominated fire inhibitors		
BDE-28	ng/l	20
BDE-47	ng/l	20
BDE-99	ng/l	20
BDE-100	ng/l	20
BDE-153	ng/l	20
BDE-154	ng/l	20
BDE-209	ng/l	1000
HBCD	ng/l	100
DBDPE	ng/l	1000
Petroleum ether extractable materials	mg/l	10
Extractable organic halogens (EOX)	g Cl/l	5
Adsorbable organic halogens (AOX)	g/l	20
Purgeable organic halogens (POX)	g/l	10
Mineral oil with gas chromatography	g/l	100
Perchloroethylene extractable apolar materials	mg/l	0.4
Biological parameters		
Ecotoxicity		
Acute toxicity to the water flea	toxic unit	<1
Acute toxicity to fish	toxic unit	<1
Growth inhibition test for single-celled algae	toxic unit	<1
Inhibition of bioluminescence in Vibrio fischeri	toxic unit	<1
Appendix 5.3.2. Sectoral discharge conditions for industrial waste water		
asbestos (use of asbestos and working with asbestos-containing product, as defined in article 4.7.0.1. of this order - installations referred to in subheadings 20.3.2. and 30.5. of the classification list)		
subsector 1: use of asbestos	-	-

		BE
Substance	**Unit**	**VLAREM II**
i. with the production of asbestos paper or board the waste water must be fully recycled; only during ordinary cleaning and maintenance activities is the discharging of waste water allowed; these waste waters must meet the effluent standards specified in these regulations;		
the liquid waste originating from establishments of subsector 1 is not considered as waste water		
ii. discharges into surface water:		
lower limit pH	Sörensen	6.5
upper limit pH	Sörensen	9
temperature	°Celsius	30
suspended solids	mg/l	30
settleable solids	mg/l	0.5
CCL4 extractable substances	mg/l	5
detergent	mg/l	3
BOD	mg/l	25
iii. discharging in sewer systems:		
lower limit pH	Sörensen	6
upper limit pH	Sörensen	9.5
temperature	°Celsius	45
measurement	mm	10
suspended solids	mg/l	30
petroleum ether extr. substances	mg/l	500
subsector 2: working with asbestos-containing products, such as installations which process asbestos-cement products, particularly by hardening, painting, refinement or mechanical treatment.		
i. discharging in surface water:		
lower limit pH	Sörensen	6.5
upper limit pH	Sörensen	9
temperature	°Celsius	30
suspended solids	mg/l	30
settleable solids	ml/l	0.5
CCL4 extractable substances	mg/l	5
detergent	mg/l	3
oil and fat		nvo
BOD	mg/l	25
COD	mg/l	700
petroleum ether extr. substances	mg/l	10
total phosphorus	mg P/l	10
Kjeldahl nitrogen	mg N/l	50
ammoniacal nitrogen (NH4)	mg N/l	25
ii. discharging in sewer systems:		
lower limit pH	Sörensen	6
upper limit pH	Sörensen	9.5
temperature	°Celsius	45
measurement	mm	10
suspended solids	mg/l	30
COD	mg/l	700

		BE
Substance	**Unit**	**VLAREM II**
petroleum ether extr. substances	mg/l	500
total phosphorus	mg P/l	10
Kjeldahl nitrogen	mg N/l	50
ammoniacal nitrogen (NH4)	mg N/l	25
iii. the emission limit values indicated in (i) and (ii) apply for a specific reference volume of the effluent of:		
1 m³ per tonne of treated product for existing establishments;		
0.8 m³ per tonne of treated product for new establishments;		
subsector 3: establishments which manufacture asbestos cement or products on the basis of asbestos cement		
i. all waste water originating with the manufacture of asbestos cement is to be recycled; if recycling is not economically feasible, the necessary measures must be taken to ensure that the elimination of asbestoscontaining liquid waste does not result in the pollution of the aquatic environment or other environmental constituents, in particular the air; these liquid waste materials are not considered as waste water;		
in particular, for each installation covered by the environmental licence the volume of the discharges into the aquatic environment or the total quantity of suspended matter discharged per tonne of product must be specified, taking into account the specific situation of the installation; the waste waters must also comply with the following effluent standards:		
ii. discharges into surface water:		
lower limit pH	Sörensen	6.5
upper limit pH	Sörensen	9
temperature	°Celsius	30
suspended solids	lmg/l	30
settleable solids	ml/l	0.5
CCL4 extractable substances	mg/l	5
detergent	mg/l	3
BOD	mg/l	25
chromium VI	mg/l	0.3
iii. discharging in sewer systems:		
lower limit pH	Sörensen	6
upper limit pH	Sörensen	9.5
temperature	°Celsius	45
measurement	mm	10
suspended solids	mg/l	45
suspended solids	mg/l	30
petroleum ether extr. substances	mg/l	500
chromium VI	mg/l	0.3
iv. the aforementioned emission limit value for suspended particulates as daily average is applicable for the point at which the waste water leaves the installation;		
with the exception of that specified for the level of suspended particulates as daily average, the pH, the temperature and measurement, the emission limit values indicated in point ii) and point iii) apply for a specific reference volume of the effluent of:		
0.5 m³ per tonne of manufactured product for existing establishments;		
0.3 m³ per tonne of manufactured product for new establishments;		

Table 2-4: Compilation of limit values for emissions into the water for France

		FR
Substance	**Unit**	**French MoE 1997a**
temperature	°C	< 30
pH		5.5 – 9.5 (1,2,3,7)
total hydrocarbons	mg/l	10 (4)
Suspended solids	mg/l	600 (2)
	mg/l	<100 (3,5)
	mg/l	35 (3,6)

(1) general requirements
(2) discharge to public sewerage system with wastewater treatment works
(3) discharge to the natural environment or to public sewerage system without WwTWs
(4) daily load of 100 g/d
(5) daily load is < 15 kg/d
(6) daily load is > 15 kg/d
(7) the limit value may be different depending on the sewerage network

2.1.1.3 Emission related standards (noise)

Eleven standards address prevention of noise pollution. Measures range from appropriate site location away from sensitive receptors, noise suppression on equipment, consideration of background noise levels, operation during unsocial hours and the use of regular noise surveys. Specific noise level limits are set by some MS (AT, BE, FR, IRL).

Austria

The Austrian guideline for mobile treatment of mineral construction waste and excavated soil **[BRV 2004]** sets requirements for the operation of mobile treatment plants for non-hazardous mineral C&D waste. It includes limit values and recommendations on best practice for operation of these installations including:

- to control noise in residential areas, plants are only allowed to operate between 6.00 and 20.00;
- the mobile plants have to be equipped with a working hour counter;
- the distance to residential areas shall be large, such that the requested noise emission and free dispersion of noise does not exceed a guranteed emission value of LA, eq = 60 db;
- the distance to hospitals and recreation areas shall be large, such that the requested noise emission and free dispersion of noise does not exceed a guranteed emission value of LA, eq = 50 db;
- if the above mentioned emission values are exceeded, one or more of these remediation measures have to be provided – earth walls, encapsulation of engines, OR reduction of crash sounds by using rubber or plastics coatings in cones and chutes.

Another document – Forum Schall: Standard requirements for mobile waste treatment plants **[Forum Schall 2003]** is a non-binding guideline setting standard requirements for mobile waste treatment plants. It is aimed at developing a unique country-wide approach to permitting. The limit values are similar to the recommendations in **BRV 2004** with some amendments. Specifically,

- the applicable distance for acoustic emissions from residential areas assuming free sound propagation is an exposure value of LA, eq = 60 dB, but at least 150m;
- the applicable distancefor acoustic emissions from hospitals and recreation areas assuming free sound propagation is an exposure value of LA, eq = 50 dB, but at least 500m.

Belgium

The order of the Flemish Government of 1 June 1995 concerning General and Sectoral provisions relating to Environmental Safety **[VLAREM II 1995]** details various environmental quality standards and relative policy tasks relating to air, waste waster and noise emissions.

- Chapter 4 of the order includes the general environmental conditions for the classified establishments identified in VLAREM1.
- Chapter 5 specifies the environmental conditions per section of annex I of **VLAREM I** (i.e. by sector for classified establishments).

Further information relating to noise emissions can be found in the relevant appendices listed below. The limit values identified are included within the summary table.

- Appendix 2.2.1. Environmental quality standards for noise in open air (Also Appendix 4.5.4).
- Appendix 2.2.2. Guideline values for noise observed indoors.
- Appendix 4.5.5. Guide values for fluctuating, incidental, impulsive and intermittent noise in the open air caused by establishments classified as nuisance producing.

Finland

BAT Environmental management in aggregates production **[Finnish MoE 2010]** identifies a need to minimise noise emissions in these activties.

France

The French Arrêté type - Rubrique n°2515 **[French MoE 1997a]** on crushing crushing, screening, bagging, spraying, cleaning, sieving, mixing rock, rocks, minerals and other natural or artificial mineral products specifies limit values for emissions to air, water and noise. In addition, it specifies process related requirements for handling and storage of treatment waste water prior to discharge.

Section 8.1 – Noise limits requires that the facility is built, equipped and operated in such a way that its operation cannot cause noise emission, transmitted by air or structure-borne, likely to jeopardize the health or safety of neighborhood or be a nuisance for it. The noise emitted from the installation must not be greater than the values in the noise aggravation zones. Specifically,

- level of background noise in noise aggravation zones (including noise from the installation) shall be between >35dB(A) and ≤ 45dB(A) during the daytime and > 45 dB (A) at night;
- limit value of noise aggravation from 7.00 to 22.00, except Sundays and bank holidays shall be 6 dB (A) during the daytime and 5 dB (A) at night;
- limit value of noise aggravation from 22.00 to 7.00 and Sundays and bank holidays shall be 4 dB (A) during the day and 3 dB (A) at night;

- in addition, the level of noise at the limit of the property where the installation is located should not be greater than 70 dB (A) during day time and 60 dB (A) during night time when the installation is working, except if the residual noise for the considered period is above this limit;
- where the specific noise of the installation has a specific tonality (as defined in point 1.9 of the appendix to « arrêté du 23 janvier 1997 » regarding the limit of noise emissions in the environment from ICPE at a permanent or cyclic level) the duration cannot exceed 30% of the period for which the installation is running in each of the period as defined in the limit table.

Ireland

The Quarries and Ancillary Activities Guidelines for Planning Authorities **[Irish DoEHG 2004b]** recommends that where there are noise-sensitive uses in the vicinity of a quarry, such as dwellings, schools, hospitals, places of worship or areas of high amenity, the amount of noise emissions should be minimised. It makes the following observations and recommendations:.

- The sensitivity to noise is usually greater at nighttime (between 20.00 pm to 08.00 am) than during the day by about 10 Db (A).
- Many quarries are situated in areas of low background noise and it is appropriate to consider this when setting noise limits.
- In general, it can be expected that complaints will result where the noise from quarrying and associated activities are between 5 to 10 dB above the background noise levels.
- In areas of higher background noise levels the irish EPA recommends that ideally, if the total noise level from all sources is taken into account, the noise level at sensitive locations should not exceed a Laeq (1 hour) of 55 dB(A) by daytime and a Laeq (15 minutes) of 45 dB(A) by nightime.
- Audible tonal or impulsive components in noise emissions (e.g. the reversing siren on a lorry, required for safety reasons) can be particularly intrusive, and such components should be minimised at any noise-sensitive location.
- It may be necessary to raise the noise limits to allow temporary but exceptionally noisy phases in the extraction process, or for short-term construction activity which cannot meet the limits set for routine operations, e.g. the construction of baffle mounds, which bring long-term environmental benefits.
- The developer may be required to carry out noise surveys to measure noise levels at the site boundary near sensitive locations, as agreed in advance with the planning authority. Surveys should be carried out in accordance with the EPA's "Environmental Noise Survey – Guidance Document" (2003).
- Noise monitoring should be carried out on a quarterly basis (or as otherwise agreed), and commenced prior to the commencement of development. The results should be reported to the planning authority within 3 weeks (or as agreed). 95% of all noise measured shall comply with the specified limit values. No individual noise measurement should exceed the limit values by more than 2 dB (A).

UK

The WRAP document on good practice in construction and demolition materials recovery facilities **[WRAP 2009]** identifies emissions related risks at waste C&D processing facilities. To minimise pollution, it recommends that noise from sorting equipment, mechanical grabs, forklift trucks,

bulldozers and other plant can be reduced by installing white noise filters or silencers. In addition, MRFs should also implement policies – communicated with signage - preventing vehicle movements and plant operation at unsocial hours.

The standard rules **[UK EA 2010a and b, UK EA 2011]** relating to the treatment of wastes to produce soil, soil substitutes, aggregates or the treatment of waste wood for recovery in different kind of installations requires that emissions from the activities shall be free from noise and vibration at levels likely to cause pollution outside the site, as perceived by an authorised officer of the Environment Agency, unless the operator has used appropriate measures, including, but not limited to, those specified in any approved noise and vibration management plan, to prevent or where that is not practicable, to minimise, the noise and vibration.

The British standard document BS 5228:1997 Part 1 *Noise control on construction and open sites* **[BSI 1997]** provides guidance on relevant noise and vibration control legislation for construction and demolition including road construction and maintenance projects.

Table 2-5: Compilation of limit values for noise in Austria

		AT	AT
Substance	**Unit**	**BRV 2004**	**Forum Schall 2003**
daily maximum operation duration	hrs	11	8:00 to 18:00, Monday to Friday
distance for noise dispersion/ emission from residential areas	dB	60	60
distance for noise dispersion/ emission from residential areas	m		at least 150m
distance for noise dispersion/ emission from hospitals and recreation areas	dB	50	50
distance for noise dispersion/ emission from hospitals and recreation areas	m		at least 500m

Table 2-6: Compilation of limit values for noise in Belgium (Flanders Region)

		BE		
Substance	**Unit**	**VLAREM II**		
		daytime	**evenings**	**nighttime**
Appendix 2.2.1. Environmental quality standards for noise in open air [(1)]				
ALSO Appendix 4.5.4. Guide values for the specific noise in the open air of establishments classified as nuisance-producing.				
Rural areas and areas for residential recreation	dB	40	35	30
Areas or parts of areas at a distance of less than 500 m from industrial areas not mentioned in point 3° or from areas for municipal facilities and public utilities	dB	50	45	45
Areas or parts of areas at a distance of less than 500 m from areas for artisanal companies and small and medium-sized businesses, from commercial areas or from exploitation areas, during exploitation	dB	50	45	40
Residential areas	dB	45	40	35
Industrial areas, commercial areas, areas for municipal facilities and public utilities and exploitation areas during exploitation	dB	60	55	55
bis° Agrarian areas	dB	45	40	35
Recreation areas, with the exception of areas for residential recreation	dB	50	45	40

		BE		
Substance	**Unit**	**VLAREM II**		
All other areas, with the exception of: buffer zones, military land and areas for which guide values are laid down in special orders	dB	45	40	35
Buffer zones	dB	55	50	50
Areas or parts of areas at a distance of less than 500 m from exploitation areas intended for gravel mining, during exploitation	dB	55	50	45
Appendix 2.2.2. Guideline values for noise observed indoors				
rural areas and areas for residential recreation	dB	30	25	25
industrial areas, commercial areas, areas for municipal facilities and public utilities and exploiting areas during exploitaion	dB	36	31	31
residential and all other areas with the exemption of those in 1° and 2° above	dB	33	28	28
Appendix 4.5.5. Guide values for fluctuating, incidental, impulsive and intermittent noise in the open air caused by establishments classified as nuisance producing (2)				
Nature of the noise- guide values expressed in Laeq,1s in dB (A)				
- fluctuating	dB	AV +15	AV +10	AV +10
- incidental	dB	AV +15	AV +10	AV +10
- impulsive	dB	AV +20	Av +15	Av +15
- intermittent	dB	AV +20	Av +15	Av +15

(1) Note: If an area comes under two or more points in the table above, the highest environmental quality standard is applicable in the area.
(2) Applicable value (AV) for new plants: the guide value in appendix 4.5.4 decreased by 5; for existing plants : the guide value in appendix 4.5.4.

Table 2-7: Table: Compilation of limit values for noise in France

		FR	
Substance	**Unit**	**French MoE 1997a**	
		daytime	**nighttime**
Level of background noise in noise aggravation zones (including noise from the installation)	dB (A)	>35dB(A) and ≤45dB(A)	> 45 dB (A)
Limit value of noise aggravation from 7.00 to 22.00, except Sundays and bank holidays	dB	6 dB (A)	5 dB (A)
Limit value of noise aggravation from 22.00 to 7.00, and Sundays and bank holidays	dB	4 dB (A)	3 dB (A)
level of noise at the limit of the property where the installation is located no greater than	dB	70 dB (A)	60 dB (A)

Table 2-8: Compilation of limit values for noise in Ireland

		IE	
Substance	**Unit**	**Irish DoEHG 2004b**	
		daytime	**nighttime**
noise level at sensitive locations should not exceed a Laeq	dB	55 (in 1hr)	45 (in 15 mins)

2.1.1.4 Specifications for Waste IN

Six relevant standards or pieces of legislation were identified. Guidance in some MS provides lists of input wastes (AT, UK), limit values to identify potential risk from specific inputs (DE), or guidance on removal of specific contaminants (e.g. asbestos, AT).

Austria

The Austrian Federal Waste Management Plan 2006 **[Austrian MoAFEW 2006]** contains guideline information on asbestos removal and treatment operations. It specifies that where there is subsequent off-site separation of the collected mixed fraction, the mixed fraction is to be classified as waste type SN 91206 "Waste from building sites (excl. rubble)" or code 17 09 04 "Mixed building and demolition waste. The document contains information on:

- guidelines on asbestos removal (e.g. from flooring and wall covering);
- recommedations for treatment of C&D wastes containing PCBs in transfer stations;
- requirement of separate collection of different fractions for building wastes;
- provisions for treatment of waste wood, substantial quantities of plastic windows or pipes, asbestos cement products, and sorted fractions of replacement fuels (such as non-segregated contaminated plastic waste, other than packaging waste, contaminated paper & cardboard, organic insulating and sound-proofing materials, treated woods, organic composite building materials, etc);

The limit values specified for treatment of waste wood are included within the summary table.

The Austrian guideline for mobile treatment of mineral construction waste and excavated soil **[BRV 2004]** sets requirements for the operation of mobile treatment plants for non-hazardous mineral C&D waste. It includes recommendations on the types and quality of inputs allowed for treatment in addition to some of the process requirements:

- accepted inputs are restricted to mono-fractions and impurities-free non-hazardous C&D wastes. Impurities could include wood, metals, plastics, asbestos- and gypsum-containing wastes, tar-containing waste and other hazardous waste;
- impurities (with the exception of iron metals if not easily segregatable) have to be removed before feeding the mobile plant;
- a list of input wastes include
  - concrete
  - bricks
  - mixture of tiles, bricks and ceramics
  - mixtures of bituminous waste, soil and stones, dredging material, track ballast, mixed C&D waste, concrete demolition waste, bitumen/ asphalt, excavated soil, and road construction waste.
- On receipt of the Wate IN, a visual inspection is required and if necessary the material has to be separated as well.

Belgium

The Belgian order of the Flemish Government for the establishment of the Flemish regulations relating to waste prevention and management [**VLAREA 2004]** is the legislation that specifies the levels of contaminant heavy metals and other pollutants that can be present in a waste material to be aceptable for reuse. It also indicates which other parameters have to be fulfilled (eg: treatment according to Copro or Benor certificate). Chapter I (items 54 to 60) of the legislation also specifies general provisions and definitions specific to treatment of C&D wastes.

Germany

The German document - Vorläufige Hinweise zum Einsatz von Baustoffrecyclingmaterial – **[Baden-Würtemberg MoET 2004]** are preliminary notes on the use of recycled building materials material**.** Section 5/9, table 1 specifies the demands on the environmental quality of recycled building materials. The information provided in this table are assigned allocation values (Z1.1, Z1.2 and Z2). The document allows for an exceedance of the assigned values (on a case-by-case basis) where it can be demonstrates that there is limited risk where the environmental limits are exceeded. Specific limit / allocation values for different parameters of interest are included in the summary table. The specifications apply to the Baden-Würtemberg region only.

Another document - Handlungshilfe für die Verwertung von Gleisschotter in Baden-Württemberg **[Baden-Würtemberg MoET 2008]** is the guidance for the recovery of track ballast. The act applies only to aid the recovery of ballast and its subfractions in technical buildings specified and are linked to the "Preliminary Notes on the use of recycled building materials" above. Table 2, section 4 of the document lists the limit values (included in summary table).

Ireland

C & D Waste Management: Implementation of International Best Practice in Ireland **[Irish DoEHG 2004a]** is a published paper which examines the potential beneficial uses of specific fractions of CDW in earthworks and unbound pavement layers in road construction in Ireland. In terms of processing of processing of C&D wastes, there is a reference to Annex A of EN 13285 which provides guidance on the description of mixtures containing recycled aggregates. It specifies that the composition of mixtures containing recycled aggregates should be determined by visual sorting into: crushed rock aggregates, gravel aggregates, concrete and other hydraulically bound mixtures, slags (including type if known), bricks, masonry and concrete blocks, calcium silicate masonry, lightweight aggregates, crushed or reclaimed asphalt, organic contaminants wood, plastic etc.

UK

Within the UK, the Waste and Resources Action Programme (WRAP) have produced a quality protocol for the production of aggregates from inert waste **[WRAP 2006]**. Input wastes to the protocol include aggregate recovered from C&D wastes. A revised document has been issued for consultation in 2011, but still aims to:

- help identify the point at which the inert waste used to produce recovered aggregates has been fully recovered, ceases to be a waste and becomes a product.
- provide assurance that recovered aggregate products conform to standards common to both recovered and primary aggregates.

The protocol requires the implementation of a factory control process and an inspection and testing scheme, including demonstration of suitability for a particular end use of the outputs. Acceptance

criteria for incoming wastes are also specified. These include restriction on the types of input wastes to the scheme. The list of wastes considered to be inert waste for the purpose of the Protocol include wastes listed as inert for the purposes of the landfill directive e.g. waste glass based fibrous materials (10 11 03), glass packaging (15 01 07), concrete including solid dewatered concrete process waste (17 01 01), bricks (17 01 02), tiles and ceramics (17 01 03), mixtures of concrete, bricks, tiles and ceramics (17 01 07), glass (17 02 02) soils and stones including gravel (17 05 04), crushed rock, sand, clay, road base and planings, and track ballast (17 05 08), glass (19 12 05), glass (20 01 02), soils and stones restricted to parks waste (20 02 02), assuming that they are free from contamination.

Table 2-9: Specification of waste inputs in Austria

		AT
Substance	**Unit**	**FWMP, 2006**
Standards for wood		
Arsenic	mg/kg DS	1.2
Lead	mg/kg DS	10
Cadmium	mg/kg DS	0.8
Chromium	mg/kg DS	10
Copper	mg/kg DS	10
Mercury	mg/kg DS	0.05
Zinc	mg/kg DS	140
Chlorine	mg/kg DS	250
Fluoride	mg/kg DS	15
PCP	mg/kg DS	1.5
PCB1)	mg/kg DS	1
Σ PAH	mg/kg DS	1

Table 2-10: Specification of waste inputs in Belgium

		BE
Substance	**Unit**	**BBRI 2000**
POP wastes contaminated with PCBs for mechanical treatment - PCB limit concentration for process	ppm	50

Table 2-11: Specification of waste inputs in Germany

		GE			GE		
Substance	**Unit**	**Baden-Würtemberg MoET 2004**			**Baden-Würtemberg MoET 2008**		
allocation values		**Z1.1**	**Z1.2**	**Z2**	**Z1.1**	**Z1.2**	**Z2**
hydrocarbons C10-C25 (C10-C40)	mg/kg	300 (600)	300 (600)	1000 (2000)			
hydrocarbons C10-C22 (C10-C40)	mg/kg				300 (600)	300 (600)	1000 (2000)
Polycyclic aromatic hydrocarbons (PAHs)	mg/kg	10	15	35	5	15	20
EOX	mg/kg	3	5	10			
PCB_6	mg/kg	0.15	0.5	1			

		GE			GE		
Substance	**Unit**	**Baden-Würtemberg MoET 2004**			**Baden-Würtemberg MoET 2008**		
Arsenic	µg/l	15	30	60	15	30	60
Lead	µg/l	40	100	200	40	100	200
Cadmium	µg/l	2	5	6	2	5	6
Chromium total	µg/l	30	75	100	30	75	100
Copper	µg/l	50	150	200	50	150	200
Nickel	µg/l	50	100	100	50	100	100
Mercury	µg/l	0.5	1	2	0.5	1	2
Zinc	µg/l	150	300	400	150	300	400
Phenols	µg/l	20	50	100			
Chloride	mg/l	100	200	300			
Sulfate	mg/l	250	400	600			
pH		6.5 to 12.5	6 to 12.5	5.5 to 12.5	6.5 to 12.5	6 to 12.5	5.5 to 12.5
Electr. Conductivity	µS/cm	2500	3000	5000	2500	3000	5000
Herbicides (by itself)	µg/l				0.1	0.2	1
Sum of the herbicides and degradation products	µg/l				0.5	1	5

2.1.1.5 Quality criteria for Waste OUT

Limited guidance on the outputs from C&D treatment have been identified for four MS. Example fraction sizes (BE) and a list of example aggregate specifications (UK) are provided to assess suitability for specific end-uses, Specific concentration limits on contaminants are also provided (BE, FI)

Austria

The Austrian guidelines for recycled building materials **[Green Guide 2007]** specifies quality criteria (summary table) and processing requirements for the recovery and re-use/ recycling of hydraulically or bituminuos bound and unbound mineral demolition wastes. These wastes include granular asphalt, granular concrete, granular asphalt/concrete mix, mixed granular concrete –asphalt- stone and mixed granular stone-concrete-asphalt. It details the fields of application, general requirements for recovery and processing, storage conditions deisgnations, engineering properties and applications for the recycled outputs. The document also lists some applicable norms / technical guidelines which apply to this process.

Belgium

Sustainable construction in Belgium **[Belgian Building Research Institute, 2000]** is a document identifying possible applications for various treatment outputs based on the fraction / particle size. There is a specification for each type of process (in table below). Some of the key requirements identified are:

- Examples of outputs include concrete aggregates, sieve and crushed sand, crushed masonry and recycled asphalt aggregates.
- Examples of fraction sizes for concrete aggregates are 80/200, 0/80, 0/56, 0/40, 0/20, 20/40, 4/32.

- Examples of fraction sizes for crushed masonry are 0/56
- POP waste contaminated with PCB for mechanical treatment should have a PCB limit of 50ppm

The Technical requirements for gravel and demolition debris (Normalisatie COPRO PTV 406/00/F) **[IVBN 2002]** specifies the categorisations of various aggregates of recycled construction and demolition wastes / debris based on existing standards. These categories apply to crushed concrete aggregates, debris masonry and mixed debris but do not apply to recycled asphalt debris. Requirements in the document include the following:

- The aggregates can be derived from a variety of treatment processes including fragmentation, separation, sieving and washing of debris from C&D.
- They can be used as aggregates provided they meet a series of conditions contained in exiting legislation.
- They can originate from
    - new contruction, renovation and demolition of buildings and structures;
    - the installation, repair and demolition of roads, railways, airstrips, etc; OR
    - manufacturing and concrete production processes
- The technical requirements also specify that the aggregates cannot contain elements whose nature, shape, size and content can be harmful to use, for example lumps of clay, coal, lignite, coke, plant materials, organic waste, harmful salts, soluble or insoluble shale, asbestos-cement, etc.

The Belgian order of the Flemish Government for the establishment of the Flemish regulations relating to waste prevention and management [**VLAREA 2004]** specifies the levels of contaminant heavy metals and other pollutants that can be present in a waste material to be aceptable for reuse. It also indicates which other parameters have to be fulfilled (eg: treatment according to Copro or Benor certificate). Limit values detailed are presented in the summary table. Further relevant information can be found in:

- Appendix 4.1. List of waste materials considered suitable for use as secondary raw materials – Section 2. Use in or as a building material.
- Chapter IV, section II, Article 4.2.2 Conditions for use in or as a building material (table are contained in Appendix 4.2.2).

The order of the Flemish Government of 14 December 2007 establishing the Flemish soil remediation and protection regulations **[VLAREBO 2007]** deals specifically with allowable liits of specific parameters in soild derived from C&D and related processed. Appendix V specifies limit values of parameters of concern for free use of excavated soil. Appendix VI specifies limit values for parameters of concern to enable the use of excavated soil as soil for building sites or in a fixed form product on unsubmerged land. Appendix VII specifies leachability concentration limits values to enable the the use of excavated soil as soil for building sites or in a fixed form product.

Finland

The Government Decree concerning the recovery of certain wastes in earth construction 591/2006 (Annex 1) **[Virallis 2006]** is a regulation which aims to promote the recovery of waste by defining the conditions under which the requirements of the Environmental Protection Act (86/2000) for achieving of an environmental permit are met. Annex 1 of the decree defines the scope of wastes, allowable concentrations of certain harmful substances and solubility limits. Table 1 of the Annex identifies the imit values for any waste which is made from demolished concrete structures or new construction and the concrete industry (Waste codes: 10 13 14, 17 01 01 and 19 12 12). Process requirement for the concrete waste is crushing to achieve a maximum of 150 mm particle sizes. The quality criteria are included in the summary table.

Table 2-12: Quality criteria for Waste outputs in Austria

		AT		
Substance	**Unit**	**Green guide, 2007**		
Quality classes for building materials according to environmental engineering aspects				
		Quality Class A+	**Quality Class A**	**Quality Class B**
Eluate content:				
pH value		7.5 - 12.5[2]	7.5 - 12.5[2]	7.5 - 12.5[2]
Electrical Conductivity	mS/m	150[1],[2]	150[1],[2]	150[1],[2]
Chromium $_{total}$	mg/kg TS	0.3	0.5	0.5
Copper	mg/kg TS	0.5	1	2
Ammonium-N	mg/kg TS	1	4	8
Nitrite-N	mg/kg TS	0.5	1	2
Sulphate-SO4	mg/kg TS	1500	2500	5000
KW index	mg/kg TS	1	3	5
Total content:				
Σ16 PAH according to EPO	mg/kg TS	4	12	20

1) If the pH value ranges between 11.0 and 12.5 the limit value for electri conductivity is 200 mS/m
2) If the value is exceeded, please see point 7.5.2

Table 2-13: Quality criteria for Waste outputs in Belgium (General)

		BE	BE		
Substance	**Unit**	**BBRI 2000**	**IVBN 2002**		
Uses of concrete aggregate based on fraction size					
for filling material	particle size	80/200			
sub-base and base in road construction, landfilling, realisation of unhardened parking areas	particle size	0/80			
	particle size	0/56			
	particle size	0/40			
	particle size	4/32			
recycling as aggregates in lean concrete	particle size	0/20			
	particle size	20/40			
	particle size	4/32			
crushed masonry					

		BE	BE		
Substance	**Unit**	**BBRI 2000**	**IVBN 2002**		
landfilling, and unhardened parking areas	particle size	0/56			
Nature of aggregates of demolition debris and recycled buildings					
			Aggregate debris- Concrete	**Aggregate debris- mixed**	**Aggregate debris- masonry**
Content of crushed concrete and stone materials determined under Schedule 1	% mass		>90	>40	<40
Content of masonry debris determined by Annex 1	% mass		<10	>10	>60
Content of other types of stone materials produced artificially, determined according to Annex 1	% mass		<5	<10	<10
Content in hydrocarbon materials determined under Schedule 1	% mass		<5	<5	<5
Stone-free content materials determined under Schedule 1	% mass		<0.5	<1	<1
Content of organic materials determined by Annex 1	% mass		<0.5	<0.5	<0.5

Table 2-14: Quality criteria for Waste outputs in Belgium (Flanders Region) – Soils

		BE
Substance	**Unit**	**VLAREBO 2007**
Appendix V. Values for free use of excavated soil on unsubmerged land		
HEAVY METALS AND METALLOIDS (1)		
Arsenic	mg/kg DM	35
Cadmium	mg/kg DM	1.2
Chromium (2)	mg/kg DM	91
Copper	mg/kg DM	72
Mercury	mg/kg DM	1.7
Lead	mg/kg DM	120
Nickel	mg/kg DM	56
Zinc	mg/kg DM	200
MONOCYCLIC AROMATIC HYDROCARBONS		
Benzene	mg/kg DM	0.3
Toluene	mg/kg DM	1.6
Ethylbenzene	mg/kg DM	0.8
Xylene	mg/kg DM	1.2
Styrene	mg/kg DM	0.32
CHLORINATED HYDROCARBONS		
Dichloromethane	mg/kg DM	0.05
Tetrachloromethane	mg/kg DM	0.04
Tetrachloroethene	mg/kg DM	0.28
Trichloroethene	mg/kg DM	0.26
Monochlorobenzene	mg/kg DM	1
1,2-dichlorobenzene (3)	mg/kg DM	14
1,3-dichlorobenzene (3)	mg/kg DM	16

		BE
Substance	**Unit**	**VLAREBO 2007**
1,4-dichlorobenzene (3)	mg/kg DM	1.6
Trichlorobenzene (4)	mg/kg DM	0.2
Tetrachlorobenzene (4)	mg/kg DM	0.04
Pentachlorobenzene	mg/kg DM	0.2
1,1,1-trichloroethane	mg/kg DM	4
1,1,2-trichloroethane	mg/kg DM	0.08
1,1-dichloroethane	mg/kg DM	0.08
Cis + trans-1,2-dichloroethene	mg/kg DM	0.16
CARCINOGENIC CHLORINATED HYDROCARBONS		
1,2-dichloroethane	mg/kg DM	0.06
Vinyl chloride (chloroethene)	mg/kg DM	0.06
Trichloromethane (Chloroform)	mg/kg DM	0.06
Hexachlorobenzene	mg/kg DM	0.06
POLYCYCLIC AROMATIC HYDROCARBONS		
Naphthalene	mg/kg DM	0.8
Benzo(a)pyrene	mg/kg DM	0.3
Fenantrene	mg/kg DM	30
Fluoranthene	mg/kg DM	10.1
Benzo(a)anthracene	mg/kg DM	2.5
Chrysene	mg/kg DM	5.1
Benzo(b)fluoranthene	mg/kg DM	1.1
Benzo(k)fluoranthene	mg/kg DM	0.6
Benzo(ghi)perylene	mg/kg DM	35
Indeno(1,2,3-cd)pyrene	mg/kg DM	0.55
Anthracene	mg/kg DM	1.5
Fluorene	mg/kg DM	19
Dibenz(a,h)anthracene	mg/kg DM	0.3
Acenaphtene	mg/kg DM	4.6
Acenaphtylene	mg/kg DM	0.6
Pyrene	mg/kg DM	62
CYANIDES (5)	mg/kg DM	
Free cyanide	mg/kg DM	3
Non-chlorine oxidisable cyanide	mg/kg DM	3
OTHER ORGANIC SUBSTANCES		
Hexane	mg/kg DM	0.6
Heptane	mg/kg DM	10
Octane	mg/kg DM	30
Mineral oil	mg/kg DM	300
Methyltertbutylether	mg/kg DM	1
Polychlorinated biphenyls (7 congeners) (6)	mg/kg DM	0.033
(1) In order to take the soil characteristics into account while comparing the concentrations of arsenic, cadmium, copper and zinc in the unsubmerged land with the values for the free use of the excavated soil, the values for the free use of the excavated soil are converted to levels of clay, organic material and pH(KCl) of the sample to be examined. If the excavated soil has undergone a treatment by which the clay and organic material levels are reduced, then the testing is carried out on the treated excavated soil		

		BE
Substance	**Unit**	**VLAREBO 2007**
Appendix VI. Values for the use of excavated soil as soil for building sites or in a fixed form product on unsubmerged land		
HEAVY METALS AND METALLOIDS		
Arsenic	mg/kg DM	250
Cadmium	mg/kg DM	10
Chromium	mg/kg DM	880
Copper	mg/kg DM	375
Mercury	mg/kg DM	5
Lead	mg/kg DM	1250
Nickel	mg/kg DM	250
Zinc	mg/kg DM	1250
MONOCYCLIC AROMATIC HYDROCARBONS		
Benzene	mg/kg DM	0.5
Toluene	mg/kg DM	15
Ethylbenzene	mg/kg DM	5
Xylene	mg/kg DM	15
Styrene	mg/kg DM	1.5
POLYCYCLIC AROMATIC HYDROCARBONS		
Naphthalene	mg/kg DM	20
Benzo(a)pyrene	mg/kg DM	7.2
Fenantrene	mg/kg DM	30
Fluoranthene	mg/kg DM	40
Benzo(a)anthracene	mg/kg DM	30
Chrysene	mg/kg DM	320
Benzo(b)fluoranthene	mg/kg DM	30
Benzo(k)fluoranthene	mg/kg DM	30
Benzo(ghi)perylene	mg/kg DM	35
Indeno(1,2,3-cd)pyrene	mg/kg DM	30
OTHER ORGANIC SUBSTANCES		
Hexane	mg/kg DM	1
Heptane	mg/kg DM	25
Octane	mg/kg DM	90
Mineral oil	mg/kg DM	1000
Extractable organic halogen compounds (EOX)	mg/kg DM	10
Polychlorinated biphenyls (1)	mg/kg DM	0.5
OTHER SUBSTANCES		
Cyanides (2)	mg/kg DM	
Free cyanide	mg/kg DM	5
Non-chlorine oxidisable cyanides	mg/kg DM	12
1) The seven indicator PCBs (congeners) are PCB28, PCB52, PCB101, PCB118, PCB138, PCB153 and PCB180.		
(2) Free cyanides must be understood as: the inorganic bound cyanides. Non-chlorine oxidisable cyanides are understood as: the sum of the alkali metal iron cyanides (K4Fe(CN)6) and the metal iron cyanides (Fe4(Fe(CN)6).		

		BE
Substance	**Unit**	**VLAREBO 2007**
Appendix VII. Leachability values for the use of excavated soil as soil for building sites or in a fixed form product in unsubmerged land		
HEAVY METALS AND METALLOIDS		
Arsenic	mg/kg DM	0.2
Cadmium	mg/kg DM	0.015
Chromium	mg/kg DM	0.1
Copper	mg/kg DM	0.2
Mercury	mg/kg DM	0.003
Lead	mg/kg DM	0.4
Nickel	mg/kg DM	0.4
Zinc	mg/kg DM	0.7
(1) The leachability is determined with the shake test, method CMA 2/II/A.19.		

Table 2-15: Quality criteria for Waste outputs in Belgium (Flanders Region) – general C&D wastes

		BE
Substance	**Unit**	**VLAREA 2004**
Appendix 4.2.2. Conditions relating to composition for use in or as a building material		
METALS (1) (total concentration)		
Arsenic (As)	mg/kg DM	250
Cadmium (Cd)	mg/kg DM	10
Chromium (Cr)	mg/kg DM	1250
Copper (Cu)	mg/kg DM	375
Mercury (Hg)	mg/kg DM	5
Lead (Pb)	mg/kg DM	1250
Nickel (Ni)	mg/kg DM	250
Zinc (Zn)	mg/kg DM	1250
(1) The concentration applies for the metal and its compounds expressed in metal		
MONOCYCLIC AROMATIC HYDROCARBONS (total concentration)		
Benzene	mg/kg DM	0.5
Ethylbenzene	mg/kg DM	5
Styrene	mg/kg DM	1.5
Toluene	mg/kg DM	15
Xylene	mg/kg DM	15
POLYCYCLIC AROMATIC HYDROCARBONS (total concentration)		
Benzo(a)anthracene	mg/kg DM	35
Benzo(a)pyrene	mg/kg DM	8.5
Benzo(ghi)perylene	mg/kg DM	35
Benzo(b)fluoranthene	mg/kg DM	55
Benzo(k)fluoranthene	mg/kg DM	55
Chrysene	mg/kg DM	400

		BE
Substance	**Unit**	**VLAREA 2004**
Phenanthrene	mg/kg DM	30
Fluoranthene	mg/kg DM	40
Indeno(1,2,3cd)pyrene	mg/kg DM	35
Naphthalene	mg/kg DM	20
OTHER ORGANIC SUBSTANCES (total concentration)		
Extractable organohalogen compounds (EOX)		10
Hexane	mg/kg DM	1
Heptane	mg/kg DM	25
Mineral oil	mg/kg DM	1000
Octane	mg/kg DM	90
Polychlorinated biphenyls (PCB)	mg/kg DM	0.5
Appendix 4.2.2.B Conditions for use as non-shaped building material		
METALS (leachability)		
Arsenic (As)	mg/kg DM	0.8
Cadmium (Cd)	mg/kg DM	0.03
Chromium (Cr)	mg/kg DM	0.5
Copper (Cu)	mg/kg DM	0.5
Mercury (Hg)	mg/kg DM	0.02
Lead (Pb)	mg/kg DM	1.3
Nickel (Ni)	mg/kg DM	0.75
Zinc (Zn)	mg/kg DM	2.8
(1) leachability is determined by means of the column test, WFC method 2/II/A.9.1. The leachability measured with the column test is calculated on the basis of a standard application with the height of the building material at 0.7 m and a specific weight of 1550 kg/m3. For calculation of the height of use see appendix 4.2.2.C.		
Appendix 4.2.2.C Emission limit values for soil		
ELEMENT (maximum emission in mg/m2 over 100 years) (1) (2)		
Arsenic	mg/m2	285
Cadmium	mg/m2	12
Chromium	mg/m2	555
Copper	mg/m2	255
Mercury	mg/m2	8.2
Lead	mg/m2	609
Nickel	mg/m2	136
Zinc	mg/m2	924
1) Calculation of the immission values from emission values determined on the basis of the column test for non-shaped building materials		

Table 2-16: Quality criteria for Waste outputs in Finland

		FI					
Substance	**Unit**	**Virallis 2006**					
		Basic characterisations			**Quality control investigations1**		
		Content	**Leaching (L/S = 10 l/kg) Covered structure**	**Leaching (L/S = 10 l/kg) Paved structure**	**Content**	**Leaching (L/S = 10 l/kg) Covered structure**	**Leaching (L/S = 10 l/kg) Paved structure**
Limit values for concrete chippings (Waste codes 10 13 14, 17 01 01 and 19 12 12)							
PCB[2]	mg/kg DM	1			1		
PAH[3]	mg/kg DM	20					
TOC[4]	mg/kg DM	30,000					
DOC[5]	mg/kg DM		500	500			
Antimony (Sb)	mg/kg DM		0.06	0.06			
Arsenic (As)	mg/kg DM	50	0.5	0.5	50		
Barium (Ba)	mg/kg DM		20	20			
Cadmium (Cd)	mg/kg DM	10	0.02	0.02	10	0.02	0.02
Chrome (Cr)	mg/kg DM	400	0.5	0.5	400	0.5	0.5
Copper (Cu)	mg/kg DM	400	2	2	400	2	2
Mercury (Hg)	mg/kg DM		0.01	0.01			
Lead (Pb)	mg/kg DM	300	0.5	0.5	300	0.5	0.5
Molybdenum (Mo)	mg/kg DM		0.5	0.5			
Nickel (Ni)	mg/kg DM		0.4	0.4			
Vanadium (V)	mg/kg DM		2	2			
Zinc (Zn)	mg/kg DM	700	4	4	700		
Selenium (Se)	mg/kg DM		0.1	0.1			
Fluoride (F-)	mg/kg DM		10	10			
Sulphate (SO42-)	mg/kg DM		1,000	3,000		1,000	3,000
Chloride (Cl-)	mg/kg DM		800	800			

[1] Cf. Section 2 in Annex 2 of Ministry of the Environment (2006).
[2] Polychlorinated biphenyls, total quantity of con-generics 28, 52, 101, 118, 138, 153 and 180.

[3] Polyaromatic hydrocarbons, total amount of compounds (anthracene, acenaphthene, acenaphthylene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, dibenzo(a,h)anthracene, phenanthrene, fluoranthene, fluorene, indeno(1,2,3-c,d)pyrene, naphthalene, pyrene, chrysene).
[4] Total quantity of organic carbon.
[4] Dissolved organic carbon.

Table 2-17: Quality criteria for Waste outputs in Germany

		GE			
Substance	**Unit**	**LAGA 2003a**			
		Z 0/ Z 0*			
Classification criteria for use of recycled building material in soil applications - leachate concentrations in the soil material					
pH		6.5 to 9.5			

		GE			
Substance	**Unit**	**LAGA 2003a**			
Electr. Conductivity	µS/cm	250			
Chloride	mg/l	30			
Sulfate	mg/l	20			
Cyanide	µg/l	5			
Arsenic	µg/l	14			
Lead	µg/l	40			
Cadmium	µg/l	1.5			
Chromium total	µg/l	12.5			
Copper	µg/l	20			
Nickel	µg/l	15			
Mercury	µg/l	<0.5			
Zinc	µg/l	150			
Phenol Index	µg/l	20			
		Z 0 (Sand)	**Z 0 (Clay/ silt)**	**Z 0 (Ton)**	**Z 0***
Classification values for use in soil applications - solid content in the soil material					
Arsenic	mg/kg TS	10	15	20	15 [(2)]
Lead	mg/kg TS	40	70	100	140
Cadmium	mg/kg TS	0.4	1	1.5	1 [(3)]
Chromium total	mg/kg TS	30	60	100	120
Copper	mg/kg TS	20	40	60	80
Nickel	mg/kg TS	15	50	70	100
Thallium	mg/kg TS	0.4	0.7	1	0.7 [(4)]
Mercury	mg/kg TS	0.1	0.5	1	1
Zinc	mg/kg TS	60	150	200	300
TOC	(% Mass)	0.5 (1.0) [(5)]	0.5 (1.0) [(5)]	0.5 (1.0) [(5)]	0.5 (1.0) [(5)]
EOX	mg/kg TS	1	1	1	1 [(6)]
Hydrocarbons	mg/kg TS	100	100	100	200 (400) [(7)]
BTX	mg/kg TS	1	1	1	1
LHKW	mg/kg TS	1	1	1	1
PCB_6	mg/kg TS	0.05	0.05	0.05	0.05
PAH16	mg/kg TS	3	3	3	3
Benzo(a)pyren	mg/kg TS	0.3	0.3	0.3	0.6

1) maximum solid content for the backfilling of excavations under certain boundary conditions (see "Exceptions to the rule" for the backfilling of excavations in No. II.1.2.3.2)
2) The value of 15 mg / kg of soil material is for the texture of sand and clay / silt. For floor material of the clay soil, the value is 20 mg / kg
3) A value of 1 mg / kg of soil material is for the texture of sand and clay / silt. Soil material for the clay soil, the value is 1.5 mg / kg
4) The value of 0.7 mg / kg of soil material is for the texture of sand and clay / silt. For floor material of the clay soil, the value is 1.0 mg / kg
5) For a C: N ratio> 25 is assigning a value of 1% by mass.
6) In case the cause must be investigated.

7) The specified values apply for mapping hydrocarbon compounds with a chain length of C10 to C22. The total content determined according to E DIN EN 14 039 (C10 to C40), total may not exceed the value indicated in parentheses.

2.1.1.6 Process requirements and BAT to be taken into account

The key process requirements are also covered under the emissions sections, the core elements being dust suppression, noise abatement and prevention of release of contaminated liquids to surface or groundwater. Other than these, individual MS provide guidance on general site operations, storage/management of hazardous wastes, separation of C&D waste fractions and applying the waste hierarchy.

Austria

The Austrian guideline for mobile treatment of mineral construction waste and excavated soil **[BRV 2004]** sets out process related recommendations for the operation of mobile treatment plants for non-hazardous mineral C&D waste. It specifies that:

- Sorted asbestos- or tar-containing wastes and other hazardous have to be stored in appropriate containers.
- For prevention of unnecessary generation of dust the following measures are recommended:
  - regular wetting of roads and stored material;
  - digit rate on unsecured areas;
  - Cleaning of impurities in particular of the exits;
  - Tyres of vehicles have to be checked with regard to impurities and cleaned if necessary;
  - Construction of earth walls.
- To prevent adverse effects caused by emission of operational liquids into the earth, the following measures have to be taken:
  - Sealed collection basin;
  - Emergency shut-down;
  - Holding of oils and absorbents;
  - Holding of fire protection appliances
- Additionally, for mobile treatment plants there are requirements including:
  - specifications on the design and dimension of the site,
  - requirements for surface waste water collection and
  - technical specifications relating to machines, waste management and environmental technology requirements, and Health and safety.

The Austrian guidelines for recycled building materials **[Green Guide 2007]** specify requirements for plant operations and BAT including the following:

- the delivered materials have to be pre-sorted separately in order to classify them according to their quality.
- If in doubt about processing requirements, the respective material should either be classified in a lower quality class or sorted.

- Operation of mobile treatment plants is allowed from Monday to Friday 08:00 bis 18:00.
- The system must not be operated on public holidays.
- The total duration of operation may not exceed 100 hours for each location in a calendar year.
- Exemptions are possible if the operator can prove that the distance from the nearest inhabited place to the plant is greater than the prescribed minimum distance in the permit.
- For inspection purposes the mobile treatment plant has to be equipped with an operating hours' counter and an operations diary which must be constantly located at the mobile treatment plant and available for inspection by the Authority.
- The operating diary must contain at least, the dates of erection and closing of the treatment plant, the exact name the location and operating hours per calendar day.
- The mobile treatment plant must be a minimum distance to residential areas of 150 meters.
- The mobile treatment plant must be a minimum distance to hospitals, recreational areas and nature conservation areas of 500 meters.
- The location of mobile treatment plants must be chosen so that it is at least 500 meters apart from the previous location.

Belgium

According to the order of the Flemish Government of 6 February 1991 concerning Environmental Licences **[VLAREM I 1991]**, a company / installation is classified as class 1, 2 or 3. Class 1 is the class that can cause the most nuisance. Each company can be given different numbers indicating which sections are applicable to the company. These sections indicate the type of company, the maximum/minimum storage/ capacity/power; the kind of discharge in the sewage or waterway, etc. These classifications can be found in in Annex 1 of **VLAREM I**. Specific sub-sections of this document also detail additional information on process management:

- Section 2.2.1c on storage and sorting of waste materials by type, either manually or with use of hand tools – details the class/ type of treatment operations, storage capacity and application for soil outputs.
- Section 2.2.2a and b on storage and useful application of waste materials – details the class / type of treatment operation, storage capacity and the application of soil outputs.

The order of the Flemish Government of 1 June 1995 concerning General and Sectoral provisions relating to Environmental Safety **[VLAREM II 1995]** sets out recommendations in different sub-sesctions on process requirements and BAT. Some key recommendations in the document include:

- Monitoring installations for waste water discharges should be either an open channel or a closed conduit device (Appendix 4.2.5.1 page 68).
- Control and assessment of measurement results for discharges of industrial waste water – stipulated minimum measuring frequencies (Appendix 4.2.5.2 page 71).
- Appendix 2.8. – Categories of industrial activities referred to in article 2.8.0.3 of title II of VLAREM (3.2 –Installations for the production of asbestos and the manufacture of asbestos-based products; 5.3° Installations for the disposal of non-hazardous waste).

- Chapter 5.2, Subsection 5.2.2.4. Establishments for the storage and treatment of specific non-hazardous solid waste materials.
- Section 4.4.2, Article 4.4.2.1. Specification for BAT techniques / code of practice for the design, build and operation of installations.
- The installations are to be operated and equipped with means to reduce emissions corresponding to the best available techniques.
- The emission-reducing measures must be aimed both at a reduction of the mass concentration as well as the mass flow rates or mass ratios of the air pollution originating from the installation.

Spain

Real Decreto 105/2008, de 1 de febrero, por el que se regula la producción y gestión de los residuos de construcción y demolición: Ministerio de la Presidencia 2486 **[MoP 2008]** is the Spanish royal decree which regulates the production and management of construction and demolition waste. It specifies that the construction and demolition waste must be separated into the following fractions, where, individually for each of these fractions, the expected amount of generation for the whole work exceeds the following amounts: Concrete - 80 t; Bricks, tiles, ceramic - 40 t; Metal - 2 t; Wood - 1 t; Glass - 1 t; Plastics - 0.5 t; Paper and cardboard - 0.5 t.

France

The French Arrêté type - Rubrique n°2515 **[French MoE 1997a]** on crushing crushing, screening, bagging, spraying, cleaning, sieving, mixing rock, rocks, minerals and other natural or artificial mineral products specifies some process related requirements for handling and storage of treatment waste water prior to discharge.

Conception des centres de tri des dechets industriels banals et des dechets de chantiers ED 948 **[INRS 2006]** relates to the design of sorting plants for industrial waste and construction waste.

Germany

Erste Allgemeine Verwaltungsvorschrift zum Bundes–Immissionsschutzgesetz (TA Luft) Vom 24 **[German MoECNS 2002]** relates to technical Instructions on Air Pollution Control. Section 5.4.8.11 lists some structural and operational requirements for different waste treatment facilities. It also includes limit values for several substances as organic substances of odour intensive substances.

Leitfaden zum Umgang mit teerhaltigem Straßenaufbruch **[Baden-Würtemberg MoET 2010]** contain guidelines for dealing with tarry road construction. The requirements are specific for the Baden Würtemberg region of Germany.

Anforderungen an die stoffliche Verwertung von mineralischen Abfällen - Technische Regeln - der Länderarbeitsgemeinschaft Abfall **[LAGA 2003a and b]** are the technical rules/ requirements for the recycling and reuse of mineral waste.

Greece

The draft presidential decree of Greece **[Greek MoE 2004] m**easures the terms and schedule for the alternative management of waste from excavation, construction and demolition (EECCA). The purpose of the Decree is to implement the provisions of Articles 12 and 13 of Law 1650/1986 and Articles 15,16,17, 18 and 24 of Law 2939/2001 as the priority prevention of waste from building

operations, technical infrastructure projects, excavations, natural and technological disasters and in addition the reuse, recycling and other forms of recovery to reduce the quantity and hazardous waste disposal in accordance with the objectives and general principles of Law 2939/2001 (Articles 1 and 4) and to improve the environmental performance of all operators involved in construction and engineering and especially the operators directly involved in the management of these materials. This decree applies to waste from excavation, construction and demolition regardless of their shape, volume, weight or the individual materials that are synthesized. This is without prejudice to existing national and EU legislation on health and safety requirements, air emissions and noise controls, and protection of soil and water.

The following wastes are excluded from the scope:

- Waste from excavation, construction and demolition waste from Chapter 17 of the European Waste Catalogue Annex 1.B of Article 17 of the Ministry No 50910/2727/2003 CMD, marked with an asterisk (*) and characterized as potentially hazardous in accordance with Decision 2001/118/EC (OJ L 47/16-2-2001). The management of these wastes will be in accordance with relevant provisions of existing legislation to manage hazardous waste.
- excavation and demolition materials from industrial or other contaminated areas and to prior use of hazardous substances or materials in quantities or concentrations such as to constitute a risk to health and the environment, the management of which is determined by the relevant provisions of existing legislation on hazardous waste.
- soil and inert waste resulting from prospecting and extraction, processing, further processing and storage of mineral resources, as well as quarrying and construction concrete

UK

In the UK, WRAP has produced a quality protocol for the production of aggregates from inert waste **[WRAP 2006]** including aggregate recovered from C&D wastes. A revised document has been issued for consultation in 2011. The protocol requires the implementation of a factory control process, acceptance criteria and an inspection and testing scheme, including demonstration of suitability for a particular end use for the outputs. A list of test methods (e.g. specifications for different types of aggregates) are appended to demonstrate suitability for a particular end use.

Ireland

C & D Waste Management: Implementation of International Best Practice in Ireland **[Irish DoEHG 2004a]** specifies that the management of C&D waste should reflect the waste management hierarchy, with waste prevention and minimisation being the first priority succeeded by reuse and recycling. During site clearance and reconstruction works, there are numerous opportunities for the beneficial reuse and recycling of the demolition materials. The subsequent use of recycled materials in reconstruction works also reduces the quantities of waste which ultimately needs to be consigned to landfill sites. It also recommends that full advantage should be taken of all opportunities for the reuse of construction materials.

EU

Construction and Demolition Waste Management Practices and their Economic Impacts **[Symmonds *et al* 1999]** is an EC commissioned report which sought to address the typology and classification of C&DW, the relationships between its origins and characteristics, the question of hazardousness, and other characteristics which make certain components of C&DW suitable for separate collection. It

sets out the major economic and administrative considerations which drive decisions on re-use and recycling of C&DW.
Descriptions of processes and best practice guidance related to different site types are identified together with where and by whom it has been documented to provide a practical overview of the subject. Estimates of C&DW arisings and a summary of the measures which each Member State has taken to influence the level of re-use and recycling are given. Practical findings and conclusions related to the economics of C&DW re-use and recycling are presented together with conclusions as to which interventions (at EU, national and local level) are most likely to result in predictable and positive outcomes. There are 13 detailed technical Annexes to the report.
Four key conditions were identified which must be met before C&DW recycling could be expected to reach significant levels:

- landfills must be well managed, unauthorised tipping subject to sanctions
- landfill costs must be significant, especially for hazardous/mixed waste
- crushing/sorting facilities must be available
- C&DW-derived aggregates must be accepted in place of primary aggregates

2.1.2 Treatment standards for the mechanical treatment of municipal & similar wastes

2.1.2.1 Emission related standards (air incl. odour)

Six standards related to **air emissions** were identified. All of them include qualitative requirements for preventing emissions related to design and operation of the plants. Most of the standards furthermore provide limit values for dust, odour and organic compounds (TOC, VOC), NO_2 and dioxins/furanes. Most relevant for the mechanical treatment are dust and odour. No limit values related to emissions of heavy metals or hazardous organic compounds were identified. One regulation stipulates a minimum distance of MBT-plants to residential areas. Measures for preventing dust, such as using sprinklers, reducing drop heights, keeping the transport velocity of materials and vehicles low, are described. Working in enclosed areas and encapsulation of relevant plant components such as conveyer belts are requested. Gaseous effluents have to be collected and exhaust gas has to be cleaned. For MBT plants discharge of the exhaust gas via chimneys is prescribed. The standards provide details on measuring and monitoring of the emissions.

Austria
The national Guideline for the mechanical-biological treatment of waste **[Austrian MoE 2002a]** in Chapter 6 sets emission-related requirements for waste delivery installations, for the mechanical treatment and physical material separation, for storage as well as for internal transportation of waste and raw materials are defined:

- Off-load facilities, feed or receiving bunkers and other facilities for delivery, transport and storage of waste materials shall be installed in enclosed areas, whereby suction in the area of loading, unloading and storage has to guarantee air pressure being less than atmospheric pressure. The extracted gas has to be sent to an emission control supply.

- Aggregates for the mechanical treatment or for physical material separation of waste in- or output (for example, for crushing, sizing, grading, mixing, homogenizing, dewatering, drying, pelletizing, compression) shall be encapsulated. If an exhaust gas-tight design is not or only partially possible, particularly at feeding, discharge or transfer points, the exhaust streams of these devices shall be captured as far as possible and subjected to exhaust gas treatment.
- The above mentioned exhaust air streams might be used for aerating the biological process (for MBT-plants)
- The conveying and storage systems for dust-releasing wastes shall be designed and operated in such a way, that no relevant diffuse emissions are released. For transportation of dust-releasing wastes closed containers must be used.
- If the use of roads may cause dust emissions, the roads in the area of the plant shall have a top layer of asphalt paving materials, cement concrete or equivalent materials and shall be cleaned according to the degree of contamination. It has to be ensured that significant contamination of the vehicles leaving the plant is avoided or removed, for example by wheel washing facilities or regular cleaning of the roads.

Chapter 6.6 stipulates emission limit values for dust, odour, TOC, NO_2, ammonia and dioxins/furans and requests that taking into account the technology used and type of waste to be treated in addition to the mentioned substances any greenhouse gas emissions, such as N_2O have to be considered in permitting.

Specifications for measuring and monitoring of emissions into the air are provided in Chapter 7

- Analytical methods for determining continuous and individual emissions.
- Measures in case of disruption in operation are defined (Information of competent authority, competent authority defines duration for how long operating under these circumstances may continue.

Furthermore discharge conditions for the exhaust air (Chapter 6.7) are defined. The exhaust air (from the biological but also the mechanical treatment) shall be discharged via one or more chimneys. The height of the chimney has to guarantee, that unacceptable effects to the neighbourhood are avoided. The location of the plant, the meteorological and topographical conditions have to be taken into account.

Belgium

In chapter 5.6 of VLAREM II - Order of the **Flemish** Government concerning General and Sectoral provisions relating to Environmental Safety **[VLAREM 1995]** the production of solid fuels is outlined. The provisions of this chapter are not applicable to the bagging of solid fuels if this is not accompanied by sorting and/or screening to separate the solid fuels. Some prescriptions concerning prevention of dust emission in mechanical handling and processing of dust-producing solid fuels can be found – however without limit values. With the loading and unloading of dust-producing solid

fuels, if necessary and where technically possible with the application of the best available techniques, one or several of the following techniques are applied:

1. methods for dust prevention such as:

    a. sprinklers;

    b. adaptation to changes in discharge height - if possible automatically - of the drop height at the places of deposit;

    c. keeping the transported material's exit speed at the discharge pipe outlets as low as possible, e.g. by making use of swing valves;

2. dust removal and extraction techniques:

    a. applied at the fixed supply, transfer and removal places for grabs, power shovels and other handling appliances;

    b. at the discharge pipe outlets and chutes of loading or unloading facilities.

In Article 5.6.2.1. it is prescribed that machines, handling appliances or other devices for the mechanical treatment or processing – including reducing, sorting, mixing and forming into briquettes - of dust-producing solid fuels must be enclosed. Insofar as dustproof performance of these activities is not possible, in particular at the supply, removal and transfer places, dust-containing gaseous effluents must be collected and transferred to dust removal facilities. For transportation at the establishment of dust-producing solid fuels, closed installations such as conveyor belts, elevators or drag train conveyors must be used. Insofar as the enclosure prescribed above is not or only partly possible, the dust-containing gaseous effluent must be collected and removed to dust removal facilities.

France

“Circulaire DPPR n° 95-007 du 05/01/95” for sorting centres of household and similar industrial and commercial waste **[French MoE 1995]** should be used as a guide for all new installations and extensions (in capacity or type of waste received) of existing facilities. Gases discharged into the atmosphere should not exceed 100 mg/Nm³ dust. If the mass flow is greater than 1 kg/hour, the limit value is 50 mg/Nm³ dust. In Article 46 it is foreseen that installations that are likely to produce smoke, gas and dust emissions are equipped with apparatus to collect and direct emissions as much as possible (apparatus to be accessible for monitoring). The point of emissions (=outlet of the chimney) must be as far as possible from inhabited areas. The chimneys must not be equipped with facilities for obstruction of diffusion (like “Chinese hats”). The point of emissions must be at least 3 m higher than other buildings within a 15 m radius.

Germany

The Ordinance on biological treatment of waste 30.BImschV **[German MoE 2001]** stipulates a minimum distance of MBT-plants to residential areas of 300 m (§3). Paragraph 4 of the Order stipulates emission-related requirements for waste delivery, treatment, material separation, storage and transport. Those are nearly identical with requirements set in Chapter 6 of **[Austrian MoE 2002a]** as described above. Paragraph 6 sets limit values for emissions of dust, odour, TOC, N_2O, and dioxins/furans (c.f.Table 2-18). Discharge conditions for the exhaust air (§7) and Provisions on measuring and monitoring (Part 3) are similar to those from **[Austrian MoE 2002a]** described above**.**

The following generic requirements related to design and operation of plants for sorting of household & similar wastes are requested by The „Technische Anleitung zur Reinhaltung der Luft – TA Luft“ **[German MoE 2002]**:

- Facilities shall be constructed and operated (including transports) in a manner that dust emissions are avoided
- Emissions shall be collected at the source and the exhaust air shall be treated in a waste gas cleaning facility.

Dust emissions may not exceed 10 mg/Nm^3 is specified.

UK

The UK series of national standards concerning the treatment of household, commercial and industrial waste in different kind of installations **[UK EA 2008a to 2008f]** cover emissions to air in general (without setting of limit values). The rules determine that emissions of substances not controlled by emission limits (excluding odour) shall not cause pollution. Emissions from the activities shall be free from odour at levels likely to cause pollution outside the site. **[UK EA 2008a, 2008b and 2008d]** provide that the permitted activities are not carried out within 200 resp. 500 metres of a European Site16, Ramsar site17 or a Site of Special Scientific Interest (SSSI)18. According to [UK EA 2008c, 2008e and 2008f] the permitted activities must not be carried out within 500 metres of any residential property or workplace. The Standard rules SR2008No3_5kte - household, commercial and industrial waste transfer station with treatment **[UK EA 2008b and 2008f]** prescribes that the permitted activities must not be carried out within a specified Air Quality Management Area (AQMA). A “specified AQMA” means an air quality management area within the

[16] “European Site” means Special Area of Conservation or candidate Special Area of Conservation or Special Protection Area or proposed Special Protection Area in England and Wales, within the meaning of Council Directives 79/409/EEC on the conservation of wild birds and 92/43/EEC on the conservation of natural habitats and of wild flora and fauna and the Conservation (Natural Habitats &c) Regulations 1994.

[17] Internationally designated “Ramsar sites” are dealt with in the same way as European sites as a matter of government policy and for the purpose of these rules will be considered as a European Site.

[18] *“SSSI*” means Site of Special Scientific Interest within the meaning of the Wildlife and Countryside Act 1981 (as amended by the Countryside and Rights of Way Act 2000).

meaning of the Environment Act 1995 which has been designated due to concerns about particulate matter in the form of PM10.

EU

Chapter 5 of the BREF Waste Treatment Industries **[EC 2006]** describes generic BAT elements (Chapter 5.1) as well as BAT for specific waste treatments (Chapter 5.2). Among generic BAT elements related to preventing or controlling the emissions mainly of dust, odours and VOC and some inorganic compounds in waste treatment ("Air emissions treatments") and related to "other common techniques, the following elements are most relevant for mechanical treatment of household & similar wastes:

- 38. correctly operate and maintain the abatement equipment, including the handling and treatment/disposal of spent scrubber media
- 40. have leak detection and repair procedures in place in installations a) handling a large number of piping components and storage and b) compounds that may leak easily and create an environmental problem (e.g. fugitive emissions, soil contamination). This may be seen as an element of the Environment Management System.
- 32. perform crushing, shredding and sieving operations in areas fitted with extractive vent systems linked to abatement equipment when handling materials that can generate emission to air (e.g. odours, dust, VOCs)

Furthermore emission levels associated to the use of BAT (using a suitable combination of preventive and/or abatement techniques) for VOC and dust are specified.

Table 2-18: Compilation of limit values for emissions into the air emissions levels associated to BAT

		AT	DE	DE	FR	EU
Substance	**Unit**	Guideline for MBT **[Austrian MoE 2002a]**	30.BImschV **[German MoE 2001]**	TA Luft **[German MoE 2002]**	Circulaire DPPR n° 95-007 du 05/01/95 **[French MoE 1995]**	BREF Waste Treatment Industries **[EC 2006]****
Total dust	mg/Nm^3	10 mg/m^3	30[b] / 10[a]	10	100/50[f]	5 - 20
Odour	GE/Nm^3	500	500	500		
Organic compounds (TOC)	mg/Nm^3	40[b] / 20[a]	40[b] / 20[a]	20		7 – 20[y]
Organic compounds (TOC)	g/t waste	100[c]	55[c]			

$NO_2^{*,z}$	mg/Nm^3	100[a]/150[b]				
N_2O	g/t		100[c]			
NH3	mg/Nm^3	20				
Dioxins/furanes*,z	ng/Nm^3	0.1	0.1[e]			

GE…Geruchseinheiten (odour concentration)
a…daily average
b…half-hour average
c…monthly average
e…none of the respective means
f…if mass flow > 1 kg/h
y… VOC, For low VOC loads, the higher end of the range can be extended to 50
z…if due to the applied gas treatment technology its generation can not be excluded
* in general not relevant for mechanical treatment processes
**emission levels associated to the use of BAT

2.1.2.2 Emission related standards (water)

Several standards related to **water emissions** were identified, setting at least qualitative requirements. Walls and floorings of containers and waste bunkers and manipulation and storage areas have to be equipped with impermeable surfaces and sealed drainage systems. Direct or indirect discharge of residual water to groundwater is banned. Limit values dedicated to mechanical treatment of household waste are stipulated by French legislation (total suspended solids, BOD_5, COD, pH and hydrocarbons). 3 thereof (AT, DE, BREF Waste Treatment Industries) provide limit values for waste water discharge or emission levels associated with the use of BAT for organic load and some hazardous heavy metals.

Austria

The Guideline for MBT of waste **[Austrian MoE 2002a]** Chapter 6.8 provides that walls and floorings of containers of waste bunkers and manipulation and storage areas have to be equipped with impermeable surfaces. Further waste water requirements are applicable to the biological treatment step but are not relevant for the mechanical treatment process. Regarding emission limit values for waste water discharged the guideline references to the following standard.

The Ordinance on waste water emissions, waste treatment **[Austrian MoE 1999]** sets limit values for waste water emissions into natural environments and sewer systems. Annex A comprises requirements (26 parameters) for waste treatment plants applying physical treatment processes (c.f. Table below).

France

The French "Circulaire DPPR n° 95-007 du 05/01/95" for sorting centres of household and similar industrial and commercial waste **[French MoE 1995]** includes limit values for water emissions. In Article 42 it is prescribed that without prejudice to the agreement of discharge to the public network (art. L 35-8 du code de la santé publique), effluents must be treated, as necessary, to comply with the limit values specified for discharge into the natural environment and sewer systems prior to dilution. The limit values for pH, temperature, COD, BOD5 and hydrocarbons are specified in the Table below. Direct or indirect discharge of residual water to groundwater is banned (Article 43).

Germany

The German Waste Water Ordinance **[BMU 1997]** provides very similar limit values to those prescribed in Autrian MoE 2002a

UK

In the UK series of national standards concerning the treatment of household, commercial and industrial waste in different kind of installations **[UK EA 2008a to 2008f]** cover emissions to water in general (without setting of limit values). The rules do not allow any point source emission into surface waters or groundwater. However, under the emissions of substances not controlled by emission limits rule: Liquids may be discharged into a sewer or taken off-site in a tanker. Clean surface water may be discharged directly to surface or groundwater waters. Emissions of substances not controlled by emission limits shall not cause pollution. Waste shall be stored and treated on an impermeable surface with sealed drainage system.

EU

According to Chapter 5.1 of the BREF Waste Treatment Industries **[EC 2006]** the following generic BAT elements are related to waste water management in waste treatment:

- 42. reduce the water use and the contamination of water by (see Sections 4.1.3.6 and 4.7.1) by applying site waterproofing and storage retention methods, b. carrying out regular checks of the tanks and pits especially when they are underground, c. applying separated water drainage according to the pollution load (roof water, road water, process water), d. applying a security collection basin, e. performing regular water audits, with the aim of reducing water consumption and preventing water contamination, f. segregating process water from rainwater.

- 43. have procedures in place to ensure that the effluent specification is suitable for the on-site effluent treatment system or discharge

- 44. avoid the effluent by-passing the treatment plant systems

- 45. have in place and operate an enclosure system whereby rainwater falling on the

processing areas is collected along with tanker washings, occasional spillages, drum washings, etc. and returned to the processing plant or collected in a combined interceptor

- 46. segregrate the water collecting systems for potentially more contaminated waters from less contaminated water
- 47. have a full concrete base in the whole treatment area, that falls to internal site drainage systems which lead to storage tanks or to interceptors that can collect rainwater and any spillage. Interceptors with an overflow to sewer usually need automatic monitoring systems, such as pH checks, which can shut down the overflow
- 48. collect the rainwater in a special basin for checking, treatment if contaminated and further use
- 49.maximise the re-use of treated waste waters and use of rainwater in the installation
- 50. conduct daily checks on the effluent management system and to maintain a log of all checks carried out, by having a system for monitoring the effluent discharge and sludge quality in place
- 53. implement measures to increase the reliability with which the required control and abatement performance can be carried out (for example, optimising the precipitation of metals)
- 54. identify the main chemical constituents of the treated effluent (including the make-up of the COD) and to then make an informed assessment of the fate of these chemicals in the environment
- 55. only discharge the waste water from its storage after the conclusion of all the treatment measures and a subsequent final inspection

Furthermore emission levels associated to the use of BAT are specified (c.f. Table below)

Table 2-19: Compilation of limit values for emissions into the water

		AT (and DE)	FR	EU
Substance	**Unit**	Ordinance on waste water emission, waste treatment**, [Austrian MoE 1999] (environment/sewer)**	Circulaire DPPR n° 95-007 du 05/01/95 **[French MoE 1995] (environment/sewer)**	BREF Waste Treatment Industries **[EC 2006]**
pH		6.5-8.5/6.5-10	5.5 – 8.5 (9.5/i)	
Temperature	°C	30/35	< 30	

		AT (and DE)	FR	EU
Substance	**Unit**	Ordinance on waste water emission, waste treatment**, [Austrian MoE 1999] (environment/sewer)**	Circulaire DPPR n° 95-007 du 05/01/95 **[French MoE 1995] (environment/sewer)**	BREF Waste Treatment Industries **[EC 2006]**
Algae toxicity		8/b		
Bacterial toxicity		4/b		
Daphnia toxicity		4/b		
Fish toxicity		2/b		
Total suspended solids	mg/l		100/h ; 600/g	
Total suspended solids	kg/d		20/h	
Filterable substances	mg/l	30/150		
Al	mg/l	2/ Limited by filterable substances		
As	mg/l	0.1/0.1		< 0.1
Ba	mg/l	5/5		
Pb	mg/l	0.5/0.5		
Cd	mg/l	0.1/0.1		< 0.1 – 0.2
Cr tot	mg/l	0.5/0.5		
Cr VI	mg/l	0.1/0.1		< 0.1 – 0.4
Co	mg/l	1/1		
Fe	mg/l	2/limited by filterable substances		
Cu	mg/l	0.5/0.5		
Ni	mg/l	1/1		
Hg	mg/l	0.01/0.01		0.01 – 0.05
Ag	mg/l	0.1/0.1		
Zn	mg/l	2/2		
Sn	mg/l	2/2		
Heavy metals (Cu, Cr, Pb, Zn, Ni)	mg/l			0.1 - 1
Total chlorine (Cl_2)	mg/l	0.4/0.4		
NH_4-N	mg/l	10/c		
Chloride (Cl)	mg/l	Limited by toxicity/-		

		AT (and DE)	FR	EU
Substance	**Unit**	Ordinance on waste water emission, waste treatment**, [Austrian MoE 1999] (environment/sewer)**	Circulaire DPPR n° 95-007 du 05/01/95 **[French MoE 1995] (environment/sewer)**	BREF Waste Treatment Industries **[EC 2006]**
CN	mg/l	0.1/0.1		
Fluoride (F)	mg/l	10/20		
NO2-N	mg/l	1/10		
Ptot (P)	mg/l	2/-		
SO4	mg/l	-/d		
Sulfide (S)	mg/l	0.1/1		
Sulfit (SO3)	mg/l	1/50		
TOC	mg/l	40/e		
COD	mgO_2/l	120/f	300 / 2000	2 - 120
COD	kg/d		120 / -	
BOD_5	mgO_2/l	20/-	100 / 800	2 -20
BOD_5	kg/d		100 / -	
AOX (Cl)	mg/l	0.5/1.5		
Non-volatile hydrophylic substances	mg/l	20/150		
Hydrocarbons	mg/l	10/20	10/h; 10/g	
POX (Cl)	mg/l	0.1/0.1		
Phenol index	mg/l	0.1/10		
Tensides	mg/l	1/b		
BTXE	mg/l	0.1/0.1		

a) to be limited if necessary
b) no adverse effects on sewage treatment plant
c) limit values are to be decided case-by-case in danger of odour nuisance or of corrosion of materials in the sewer system or sewage treatment plant
d) to be limited case by case taking into account materials and ratios in sewer systems
e) The discharge of wastewater in accordance with § 1 Para 4 is only permitted if the aerobic biological degradation is greater than 60% (verified in a so called “Abbautest”- degradation test). This requirement does not apply if the wastewater in accordance with § 1 Para 4 is pre-cleaned prior to discharge so that its TOC is not
greater than 300 mg / l.
f) footnote “e” shall apply mutatis mutandis with the proviso that the COD of the wastewater after

		AT (and DE)	FR	EU
Substance	**Unit**	Ordinance on waste water emission, waste treatment**, [Austrian MoE 1999] (environment/sewer)**	Circulaire DPPR n° 95-007 du 05/01/95 **[French MoE 1995] (environment/sewer)**	BREF Waste Treatment Industries **[EC 2006]**
pre-cleaning is not greater than 900 mg / l. g) in case of discharge to sewerage system with WwTW h) in case of discharge to the natural environment (or discharge to sewerage system without WwTW) i) in case of chemical neutralization				

2.1.2.3 Emission related standards (noise)

Regarding noise only one standard was identified setting requirements related to noise caused by mechanical treatment plants going beyond the generic request that treatment activities shall not cause nuisance through noise:

France

The "Circulaire DPPR n° 95-007 du 05/01/95" for sorting centres of household and similar industrial and commercial waste **[French MoE 1995]** includes limit values for noise. According to Article 50 installations must be designed, built, equipped and operated in such a way, that noise and vibrations do not endanger health and safety of neighbourhood or impair the quiet of the area.

There is noise pollution if the noise is measured above 35dB(A) - including the noise of the installation and if the noise aggravation generated from the installation is greater than:

5 dB(A) from 7.00 to 21.00 except Sundays and public holidays

3 dB(A) from 21.00 to 7.00 including Sundays and public holidays

Noise aggravation is defined as the difference between the noise level when the installation is operated and when it is off. Measurements are carried out at the limit of the property or within the property if there is a claim from a person living or working onsite (measurement according to « arrêté du 20 août 1985 »). Article 51 determines that noise emissions from vehicles or motorised equipment should comply with current regulations. The use of other acoustic devices that could disturb the neighbourhood is forbidden except for preventing/notifying of a major accident onsite. Technical rules from the appendix of circulaire n° 86-23 du 23 juillet 1986 regarding the emissions of mechanical vibrations for ICPE installations (ICPE= "installation classée pour la protection de l'environnement"= a facility classified for the protection of the environment; a facility "requiring supervision") should be applied (Article 52).

2.1.2.4 Specifications for Waste IN

Standards identified provide either positive/negative lists or descriptive criteria for the waste input into mechanical treatment plants for household & similar waste. Exclusion was found for wastes consisting solely or mainly of dusts, powders or loose fibres or wastes that are in a form which is either sludge or liquid. The positive lists identified include wastes containing the following materials: paper and cardboard, glass, textiles, clothes, uncontaminated wood, metals, rubber, cork, ceramics plastics and several waste streams usually being generated at specific production facilities. Positive lists for treatment in MBT-plants are less relevant as the take into consideration the suitability for the biological treatment part. To protect aggregates from damage it is BAT to remove bulky waste from incoming material.

Germany

Paragraph 4 of the German Order on commercial waste (GewAbfV) **[German MoE 2002]** requires that mixed commercial wastes (municipal solid waste except those from private households) being destined for pre-treatment do not contain other than the following wastes materials: paper and cardboard, glass, textiles, clothes, uncontaminated wood, metals, rubber, cork, ceramics plastics and several waste streams usually being generated at specific production facilities, listed in the Annex to the Order (=Keeping separate). Organisational measures have to be taken by the waste generators to minimize impurities with other than the mentioned wastes.

UK

The series of rules of the UK Environment Agency **[UK EA 2008a], [UK EA 2008b]** and **[UK EA 2008c]** require, that wastes having any of the following characteristics shall not be accepted at installations for treatment of household, commercial and industrial waste: Consisting solely or mainly of dusts, powders or loose fibres or wastes that are in a form which is either sludge or liquid.

EU

According to Chapter 5.2 of the BREF Waste Treatment Industries **[EC 2006]** for the preparation of solid waste fuels from non-hazardous waste BAT is to visually inspect the incoming waste to sort out the bulky metallic or non-metallic parts. The purpose is to protect the plant against mechanical destruction (122.)

2.1.2.5 Quality criteria for Waste OUT

Apart from generic provisions specified in the BREF Waste Treatment Industries for the production of RDF no standards were identified for the **output waste streams** of mechanical treatment of household & similar waste.

In general quality criteria for the waste output depend on the intended use or disposal of the waste

streams. For RDF European and national legally binding and non binding standards as well as specifications issued by co-incineration plants (e.g. cement kilns) exist. Key parameters are humidity, calorific value, ash content, chlorine content, aluminum, heavy metals and conveyance properties. Examples are CEN/TS 15359:2006 Solid recovered fuels; specifications and classes **[CEN 2006],** the Finnish Standard 5875, Solid Recovered Fuels **[FSF 2002]** or UK cement industry specifications for substitute waste derived fuels available in **[Juniper 2005].**

The quality of materials intended for recycling, e.g. their content of impurities, are generally regulated by market prices.

Regarding residual fractions destined for land-filling acceptance criteria as stipulated by the Landfill Directive 99/31/EC and by national legislation have to be considered.

FI

The Finnish national standard "SFS 5875: Solid recovered fuel. Quality control system" **[FSF 2002**] defines the procedure and requirements, by which the quality of recovered fuel, produced for the purpose of energy production can be controlled and reported unambiguously. The standard covers the whole chain of supply from the source-separation of wastes to the delivery of recovered fuel.

Table 2-20: Quality classes according to [FSF 2002]

Parameter	Unit	Quality classes		
		I	II	III
Chlorine	Weight-%	< 0,15	< 0,5	< 1,5
Sulphur	Weight-%	< 0,2	< 0,3	< 0,5
Nitrogen	Weight-%	< 1,0	< 1,5	< 2,5
Potassium and Sodium	Weight-%	< 0,2	< 0,4	< 0,5
Aluminium (metalic)	Weight-%	- 1)	- 2)	- 3)
Mercury	mg/kg	< 0,1	< 0,2	< 0,5
Cadmium	mg/kg	< 1,0	< 4,0	< 5,0

1) Metallic aluminium is not allowed, but accepted within the limits of reporting precision
2) Metallic aluminium ist minimized by source-separation and by the fuel production process
3) Metallic aluminium content is agreed separately.

UK

Industry specifications for substitute waste derived fuels in cement kilns are available for the UK and were reported in the course of a market assessment of MBT outputs by **Juniper [2005].**

Table 2-21: UK industry specifications for substitute waste derived fuels in cement kilns [Source Juniper 2005]

Parameter	Unit	Value
Calorific value	MJ/kg	23-29
Moisture content	%	Not specified
Ash content		Not specified

S	%	< 0.3
Cl	%	< 2
F/Br/I	%	< 0.5
As	ppm	< 50
Cd, Tl	ppm	< 4
Co	ppm	< 100
Cr	ppm	< 200
Cu	ppm	< 600
Hg	ppm	< 20
Mn	ppm	< 250
Ni	ppm	< 50
Pb	ppm	< 500
Sb	ppm	< 50
Sn	ppm	< 100
V	ppm	< 50
Sb, As, Cr, Co, Cu, Pb, Mn, Ni, Sn, V	ppm	< 1800

The "Guide to the Regulation of Outputs from the Mechanical Biological Treatment of Waste" **[UK NIEA 2011]** produced by the Northern Ireland Environment Agency (NIEA) inform those involved in the treatment of waste of NIEA's position on how the outputs from these treatment options will be regulated (waste / non-waste). The ferrous and non-ferrous metal output from MBT plant will generally cease to be waste when formed into ingots, sheets or coils of steel. Referring to the fraction "glass" the facts of each case must be considered. However, generally the point at which glass ceases to be waste is likely to be when either glass containers or fiberglass, fine glass material such as sand substitute, glass abrasive and fluxing agents, aggregate to recognised standards (e.g. for use in glassphalt) ready for use by or sale to the final consumer or decorative crushed glass ready for sale to the final customer. The output "high heat value fraction" (RDF) comes in several forms: crude and loose; shredded; or shredded and compressed into dense fuel pellets. The Northern Ireland Environment Agency considers RDF (e.g. fuel derived from waste) a waste and remains waste until it is burned as fuel. Importantly, installations burning waste as fuel must comply not only with the Waste Framework Directive (WFD) but also with the requirements of the Waste Incineration Directive (WID).

EU

The standard CEN/TS 15359:2006, Solid recovered fuels **[CEN 2006]** provides a classification system for SRF. It is based on 3 key properties (lower heating value, chlorine and mercury) and allows a classification of SRF into 5 classes.

Table 2-22: Classification system for SRF [Source: CEN 2006]

			1	2	3	4	5

Lower heating value (LHV)	Mean	MJ/kg (ar)	≥ 25	≥ 20	≥ 15	≥ 10	≥ 3
Chlorine (Cl)	Mean	% (d)	≤ 0.2	≤ 0.6	≤ 1.0	≤ 1.5	≤ 3.0
Mercury (Hg)	Median	mg/MJ (ar)	≤ 0.02	≤ 0.03	≤ 0.08	≤ 0.15	≤ 0.50
	80^{th} percentile	mg/MJ (ar)	≤ 0.04	≤ 0.06	≤ 0.16	≤ 0.30	≤ 1.00

EURITS (European Association of Waste Thermal Treatment Companies for Specialised Waste) has published criteria for waste co-incinerated in cement plants as substitute fuel **[EC 2003].**

Table 2-23: EURITS criteria for substitute fuels in cement co-firing applications [Source: EC 2003]

Parameter	Unit	Value
Calorific value	MJ/kg	15
Cl	%	0.5
S	%	0.4
Br/I	%	0.01
N	%	0.7
F	%	0.1
Be	mg/kg	1
Hg/Ti	mg/kg	2
As, Se, (Te), Cd, Sb	mg/kg	10
Mo	mg/kg	20
V, Cr, Co, Ni, Cu, Pb, Mn, Sn	mg/kg	200
Zn	mg/kg	500
Ash content (excl Ca, Al, Fe, Si)	%	5

Among generic BAT elements related to process residues specified in Chapter 5.1 of the BREF Waste Treatment Industries **[EC 2006]** the following might be relevant for mechanical treatment processes:

- 57. have a residue management plan as part of the Environmental Management System including basic housekeeping techniques and internal benchmarking techniques
- 58. maximise the use of re-usable packaging (drums, containers, IBCs, palettes, etc.)
- 59. re-use drums when they are in a good working state. In other cases, they are to be sent for appropriate treatment
- 60. keep a monitoring inventory of the waste on-site by using records of the amount of wastes received on-site and records of the wastes

For the preparation of (non-hazardous) waste to be used as fuel (Chapter 5.2), BAT is to:

- 117. try to have a close relationship with the waste fuel user in order that a proper transfer of the knowledge of the waste fuel composition is carried out
- 118. have a quality assurance system to guarantee the characteristics of the waste fuel produced
- 119. manufacture different type of waste fuels according to the type of user (e.g. cement kilns, different power plants), to the type of furnace (e.g. grate firing, blow feeding) and to the type of waste used to manufacture the waste (e.g. hazardous waste, municipal solid waste)

2.1.2.6 Process requirements and BAT to be taken into account

Those process requirements and BAT elements associated with emission prevention are discussed in the respective sub-chapters.

Process requirements identified deal with the treatment process itself, internal waste transports, occupational health & safety and fire protection. The following core elements were identified. Mixing of commercial wastes with any other wastes than C&D waste is prohibited. The removal of hazardous wastes is requested. Sorting plants have to achieve recovery target (85%) on a yearly average. Manual transporting and sorting of waste should be prevented. For fire protection mechanical treatment plants shall be separated into several fire-compartments and the connections shall be secured by protective measures. A further measure is the limitation of permitted storage volumes, in particular for RDF. For ensuring a medically beneficial air at workplaces vehicles and control stations shall be equipped with closed air-conditioned cabins, preventing contamination of climbs and cabins, etc.

For the preparation of solid waste fuels BAT provisions were identified: The use of magnetic ferrous and non-ferrous metal separators, NIR technique for the segregation of plastics containing organic chlorine as well as a combination of shredder systems and pelletizers suitable for the preparation of the specified size waste fuel.

Austria

Process requirements are stipulated in the guideline for MBT of waste **[Austrian MoE 2002a]**.

The following requirements related to internal waste transports (Chapter 6.3) are set:

- Contamination with dust and seeds at work places shall be avoided. Care has to be taken for a punctual reduction of dust and seed emissions at hand-over points.
- Waste shall not be transported manually
- Large drop heights should be prevented
- Emissions of noise, odour and vibration shall be minimized

- Protection of accidents caused by moving parts of aggregates, by vheicles or by falling stuff has to be secured.

Recommendations for fire protection and explosion prevention (Chapter 9.2) comprise:

- Fragmentation of the entire plant into several fire-compartments and securing the connections between fire zones by protective measures, such as cable insulation, fire dampers in ventilation ducts and fire-resistant doors.
- Limitation of permitted storage volumes, in particular for waste derived fuels
- Storage of hazardous household-waste and flammable liquified gases in with appropriate conversion or distance to potential sources of fire, so that in case of disaster (maximum possible fire) an uncontrolled heating of the materials or containers is not possible.

The following provisions related to occupational health and safety (Chapter 9.1) are given:

- Requirements for manual sorting
  - MBT-plants shall have separate locations for individual work areas and have a high level of automation. In particular sorting of valuable materials and impurities should be conducted using complete automation.
  - Permanent manual sorting of wastes consisting predominantly of easily degradable components, in particular of household & similar wastes, is not allowed. Exempted are manual removal of bulky waste in cases of accidents. The manual sorting of any other wastes has to be avoided as far as possible.
- technical and organizational requirements for vehicles and control stations
  - Loaders etc and control stations of machines and systems have to be equipped with closed air-conditioned cabins with suitable filters or air supply system when operating in areas where increased bacterial contamination and dust are expected.
  - The air in the cabin must be medically beneficial. The effectiveness of a protective ventilation or forced ventilation must be demonstrated by appropriate test methods. Filters should be serviced and changed regularly. Machinery and vehicles with cabs must be equipped with technical devices to reduce the contamination of the climbs.
  - The cleaning of the cabins has to be ensured by appropriate measures. The inside surfaces of cabins and control stations being permanent work places must be designed so that they are easy to clean and shall not have spaces, in which biological agents can be deposited difficult to access. Cavities have to be filled if necessary before using or sealed. A maintenance and cleaning schedule has to be drawn and carried out taking into account the manufacturer's instructions. Mobile equipment and vehicles with cabs shall be parked only in uncontaminated areas of the plant. Doors and windows should be kept closed during operation. Entries and exits in the contaminated areas have to be reduced as far as possible.
- Air at workplaces (Measures against moulds)

Reference to the German Committee for Occupational Safety and Health (LASI) is given. Mould concentrations of 5,000 CFU / m³ (technical guiding concentration) are considered as sanitary harmless. Recommendations for measures in case of excess are given.

Any process requirements associated with emission prevention are discussed in the respective sub-chapters (c.f. chapters 2.1.2.1 and 2.1.2.2).

Germany

Paragraph 5 of the Order on commercial waste (GewAbfV) **[German MoE 2002]** provides requirements for so-called pre-treatment facilities for household and similar waste accomplishing e.g. separating and sorting of metals, foils or other impurities and valuables, dewatering, homogenizing or mixing, grading or sorting using screens, air-separation or hydraulic segregation, pelletizing, drying, pressing or grinding.

- Mixing of commercial wastes with any other waste than mixed C&D waste is not allowed.
- Recovery target of 85 mass% for mixed commercial wastes and mixed C&D wastes (mean value per calendar year). Furthermore details on the calculation of the recovery rate are given. The recovery rates have to be calculated monthly. If in 2 months the recovery rate achieved accounts for less than 75% the competent authority has to be informed and measures have to be described. Furthermore requirements related to the approval of further treatment of the outputs by subsequent treatment facilities are specified (e.g. necessity of approval within a time period of 30 days) (§9).
- Hazardous wastes have to be sorted out during the process. However no details (quantifications, assessment) are specified.

EU

According to Chapter 5.2 of the BREF Waste Treatment Industries **[EC 2006]** for the preparation of solid waste fuels from non-hazardous waste BAT is to

- 123. use magnetic ferrous and non-ferrous metal separators. The purpose is to protect the pelletisers as well as fulfill the requirements of the final users
- 124. make use of the NIR technique for the sorting out of plastics. The purpose is the reduction of organic chlorine and some metals which are part of the plastics
- 125. use a combination of shredder systems and pelletisers suitable for the preparation of the specified size waste fuel.
  For some installations preparing solid waste fuels from source-separated waste streams, the use of some or all of the above-mentioned techniques may not be necessary to comply with BAT

Some of the generic BAT-elements regarding storage and handling in waste treatment might be

relevant for the mechanical treatment of household and similar wastes as well.

- 24. apply the following techniques related to storage :
    - a. locating storage areas away from watercourses and sensitive perimeters, and in such a way so as to eliminate or minimise the double handling of wastes within the installation
    - b. ensuring that the storage area drainage infrastructure can contain all possible contaminated run-off and that drainage from incompatible wastes cannot come into contact with each other
    - c. using a dedicated area/store which is equipped with all necessary measures related to the specific risk of the wastes for sorting and repackaging laboratory smalls or similar waste. These wastes are sorted according to their hazard classification, with due consideration for any potential incompatibility problems and then repackaged. After that, they are removed to the appropriate storage area
    - d. handling odorous materials in fully enclosed or suitably abated vessels and storing them in enclosed buildings connected to abatement
    - e. ensuring that all connections between the vessels are capable of being closed via valves. Overflow pipes need to be directed to a contained drainage system (i.e. the relevant bunded area or another vessel)
- 27. take measures to avoid problems that may be generated from the storage/accumulation of waste. This may conflict with BAT number 23 when waste is used as a reactant
- 28.apply the following techniques when handling waste

  a. having systems and procedures in place to ensure that wastes are transferred to the appropriate storage safely

  b. having in place a management system for the loading and unloading of waste in the installation, which also takes into consideration any risks that these activities may incur. Some options for this include ticketing systems, supervision by site staff, keys or colour-coded points/hoses or fittings of a specific size

  c. ensuring that a qualified person attends the waste holder site to check the laboratory smalls, the old original waste, waste from an unclear origin or undefined waste (especially if drummed), to classify the substances accordingly and to package into specific containers. In some cases, the individual packages may need to be protected from mechanical damage in the drum with fillers adapted to the packaged waste properties

  d. ensuring that damaged hoses, valves and connections are not used e. collecting the exhaust gas from vessels and tanks when handling liquid waste

f. unloading solids and sludge in closed areas which are fitted with extractive vent systems linked to abatement equipment when the handled waste can potentially generate emission to air (e.g. odours, dust, VOCs)

g. using a system to ensure the bulking of different batches only takes place with compatibility testing

2.1.2.7 Others

Finland

The Finnish document describing BAT in energy recovery from solid recovered fuels exists **[SYKE 2004]** defines BAT elements, which however refer to the integrated waste management system (including collection, production and use of SRF) rather than to the mechanical treatment processes of household and commercial wastes as such. Such integrated systems are considered BAT under the following circumstances:

•Source separation of household waste makes collection of clean waste fractions, like paper, cardboard, glass, metals etc., possible for extensive material recovery.

•Processing industrial and commercial waste and the energy fraction of household waste to SRF produces a fairly clean fuel fraction. Several of the reject streams of the process, i.e. metals and non-ferrous metals, can be recovered. Biological residues and fines are used for composting. The process can be optimised for material recovery and for removing harmful components, like chlorine and aluminium, with regard to efficient fluidized bed combustion.

- High steam values and consequently high power production efficiency is achieved, which can be obtained when the share of SRF in fluidised bed combustion is kept on a level of 10-20.

2.1.3 Treatment standards for the biological treatment (composting and anaerobic digestion) of biodegradable waste

2.1.3.1 Emission related standards (air incl. odour)

Member States provide advices to keep emissions to air as small as possible. In case of closed systems it is recommended to keep the pressure inside below the ambient pressure and to treat collected gases by abatement technologies as bio-filters. Concrete limit values for gas emission are mostly given for incineration plants which are part of the anaerobic digestion facility to produce heat and electricity from the produced methane and include parameters as NO_x or CO_2. However such emissions are not considered to be the scope of this document as they are more related to

incineration processes than biodegradable waste treatment facilities.

A typical requirement to avoid odour nuisance is the request to cover the compost heaps and to follow minimum distances requirements to residential areas.

To limit emissions from closed systems used for biodegradable waste treatment, the systems typically have lower pressures than the environment and the gases are treated by abatement technologies such as bio-filters, before they are released to the environment.

Austria

It is stated that anaerobic digestate should be kept gas sealed and the remaining gases should be energetically used. **[AUT ADWMP 2011]**

Germany

The German Federal Pollution Control Act, TA Luft **[German MoECNS 2002]** specifies that emissions from composting plants with a capacity exceeding a throughput of 3,000 t/y and ananerobic digestion plants exceeding a throughput of 10,000 t/y should be reduced to acceptable standards. Information such as the distance from residential buildings are given and facilities should be closed if possible. Limit values for are provided in the following table [German MoECNS 2002].

Table 2-24: Limit values for biodegradable waste treatment facilities [German MoECNS 2002]

	Composting plant	Anaerobigc digestion plant
Distance to residantal building for closed plants [m]	300	300
Distance to residantal building for open plants [m]	500	500
Odour concentration [GE/m³]	500 (for plant capacities exceeding 30 t/day)	500
Total particle matter [mg/m³]	10	10

Italy

The acceptance, storage and treatment of biodegradable waste shall be performed in closed systems. Best available technology shall be used to limit emissions and odour of the process. The limit value of particle matter is 10 mg/m³. The emission levels included in section V of D. lgs.152/2006 must be consideredAlso in case of composting regulated in Article 16 of the annex 1 the particle matter (PM) as well as odour emission shall be kept as small as possible by use of adequate technology. [IT D.M. 5/2/1998]

Poland

The odour concentration should not exceed 500-6000 jz/m³ and 1-20 mg NH3/m³. **[SZPADTA 2008]**

Sweden

The main process of digestion and composting should be done in closed form in such a way that collection formed by gas and liquid is possible. Exhaust air should be purified to an acceptable level and control of exhaust treatment should be included.

Formed gas at the main process by digestion should primarily be utilized or, if this is not reasonable, the flared or treated in the environmentally similar manner. This advice also applies to the digestion of sewage sludge. [NATURVÅRDSVERKET 2003a]

2.1.3.2 Emission related standards (water)

In general Member States recommend to keep emission to water small and to circulate the water in the process. It is also often mentioned that the process water can have a strong odour and should be kept in closed systems. Excess waste should be treated before leaving the facility. In some Member States specific waste water limit values for composting and anaerobic digestion facilities are provided.

Austria

Limit values for drainage waste water for different temperatures are provided in chapter 2.1.1.2. (Table: Compilation of limit values for emissions into the water for Austria) This limit values are not specific for biodegradable waste treatment facilities. **[Austrian MoE 1999].**

Poland

Emissions to water shall be reduces as far as possible, including total nitrogen, ammonia, nitrite and nitrate [SZPADTA 2008].

Sweden

Leachate should be collected and reintroduced to the process and purified to acceptable levels before discharge to the recipient. The acceptable level should be assessed based on local conditions. Typically no leachate occurs spontaneously in post-processing and storage of finished compost. Provided that the compost is covered so that rain does not reach the material, there is no reason to recommend areas with leachate collection in remediation and after storage. **[NATURVÅRDSVERKET 2003a]**

2.1.3.3 Emission related standards (noise)

The composting as well as the anaerobic digestion process are in general no processes prone for noise production. Therefore no guidance or regulation could be found regarding the emission control for noise.

2.1.3.4 Specifications for Waste IN

Especially in case of the production of compost many regulations and guidelines exist to control the input material, because in this treatment process the contaminations of the input will directly influence the output quality.

In case of other treatment technologies for biodegradable waste, which purpose is for example the production of methane, to generate thermal or electric energy the contaminations of the input material will end up in a by-product. This can further be treated to compost or stabilised to be land-filled.

To ensure sufficient high quality compost many Member States implemented systems for an input control, such as limit values or positive lists for biodegradable waste which can be used for the production of good quality compost. On the other hand there are some Member States such as France, Italy, Spain and Portugal, which allow residual municipal solid wastes (MSW) to be used for composting. It is common knowledge that composts from mixed sources are of low quality.

Austria

For compost the [**Austrian MoE 2001a**] Annex 1, part 1, table 1 includes a positive list for input material. Additionally limit values are provided for the input material of sewage sludge in Annex 1 Part 1 Table 2 and 2 **[Austrian MoE 2001a]**..

The limit values for sewage sludges for compost or quality sewage sludge compost are provided in the following table **[Austrian MoE 2001a].**

Table 2-25 Limit values for sewages sludge used to produce compost or quality sewage sludge compost [Austrian MoE 2001a]

Parameter	Limit values for compost [mg/kg d.w.]	Limit values for quality sewage sludge compost [mg/kg d.w.]
Zn	2,000	1,200
Cu	500	300
Cr	300	70
Ni	100	60
Pb	200	100
Cd	3	2
Hg	5	2

The Annexes of Austrian legislation provide a set of positive lists for different product qualities some also includes limit values as in case of bark, which lindane content shall not exceed 0.5 mg/kg d.m.

One of this lists includes additives which can be used for the production of any type of compost, including limit values (Annex 1 Part 4 Table 3 of **Austrian MoE 2001a]**. This list includes substances as chalk, ash or powdered clay.

Belgium

Organic matter content must be greater than 50% by weight of dry matter. The organic matter content is defined as the volatile solid fraction following calcining at 550°C to constant weight. The dry matter (DM) is defined following drying at 105°C until a constant weight is obtained. Limit values for heavy metals and other hazardous substances are given in Table 2-26. [BE RD 0256B 2007]

Table 2-26 Limits on heavy metals and other hazardous substances in biodegradable and compostable material [BE RD 0256B 2007]

Element	ppm on d.m.
Zn	< 150
Cu	< 50
Ni	< 25
Cd	< 0.5
Pb	< 50
Hg	< 0.5
Cr	< 50
Mo	< 1
Se	< 0.75
As	< 5
F	< 100

Belgium/Flanders

Section 5.2.2.3. of VLAREM II includes information which types of biodegradable wastes can be accepted at different installations e.g. installations for the composting or organic biological industrial wastes or installation for the composting of vegetable, fruit and garden (GFT-waste). [BE/FL VLAREM II 1995]

Finland

The finish Guideline provided information, which materials the biogas plant can process:

- sewage sludge from municipal and industrial sewage from the
- Vegetable waste, by-products and biomass
- Animal by-products:

- Category 3: Food waste and other by-products category 3
- Category 2: manure and other by-products of category 2

[FI BAT document]

Germany

The German Legislation Ordinance on the recycling of biodegradable waste provides in its annex a positive list of waste input materials. [German MoE 1998].

Italy

Fertilisers law (D.lgs 75/2010) provides a list of acceptable biowaste for compost production

Poland

The Polish Guideline provides some information regarding the composition of the used material.

The content of organic matter should be at least 60 % of dry matter in the process of composting and anaerobic digestion, where the main objective of the process is to produce organic fertilizers, which shall contain over 30 % of organic matter. Where the aim is to produce a product to support the cultivation of plants or biological waste disposal, the content of organic matter should be at least 40 % dry matter.

The hydration of waste must be brought to the optimum level for the processing technology used, which is 45-60% for the aerobic process, up to 70% for composting process, above 60% for the fermentation of dry and above 85% for the wet digestion.

For the biological processes the waste mixtures should have proper proportion. The recommended values C / N ratio is about 25-35 and the C / P ratio is approximately 100. For organic fertilizers a minimum nitrogen content in the processed mixture should be not less than 0.3% of dry matter, a phosphorus content of not less than 0.2% d.m. (as P_2O_5) and a potassium content of not less than 0.2% of d.m. as K_2O. During the biological treatment monitoring of the above mentioned contents of N, P, K should be performed.

To fulfil the limit values of the treated biodegradable waste it has to be considered that the concentration of heavy metal increases during the treatment step by a factor of 1.5 to 2. It is indicated that those limit values will only be met if source separated materials are used for treatment. Limit values for mixture of waste, for biological processing are provided in Table 2-27. [SZPADTA 2008]

Table 2-27 maximum metal content in the mixture of waste for biological processing and permissible metal content of fertilizers and plant support [PL Compost Guidance 2008]

	Limit value [mg/kg]	
Heavy metal	Maximum recommended in the waste prior to biological treatment	Acceptable in organic fertilizer or Adjuvant crops
Cd	≤ 3	≤ 5
Cr	≤ 65	≤ 100
Cu	-	-
Hg	≤ 1	≤ 2
Ni	≤ 40	≤ 60
Pb	≤ 90	≤ 140

Zn	-	-

United Kingdom

Annex B of the Quality protocol provides a positive list for biowaste types which are acceptable for the production of quality digestate and compost. This list does not include MSW except separately collected fractions. [UK EA Anaerobic digestion 2009], [UK NIEA 2011]

2.1.3.5 Quality criteria for Waste OUT

To avoid soil contamination several Member States have set limit values for compost. Typical parameters include heavy metals, other organic substances and micro organisms.

Many Member States have established limit values for the produced output materials from biodegradable waste treatment facilities especially for compost facilities. Typical parameters which are regulated are heavy metals (e.g. As, Cd, Cu, Cr, Hg, Ni, Pb, Zn), organic substances (e.g. PAH, PCDD/PCDF, TOC) and pathogenes (e.g. Salmonella). The approaches can vary significantly as different compost quality classes are in place or the limit values are related to applied amounts per hectare field. For the heavy metal the limit values are summarized in Table 2-28, however, due to the explained reasons a direct comparison should be done with great care.

Table 2-28: Heavy metal limit value overview

MS	As	Cd	Cu	Cr	Hg	Ni	Pb	Zn
AT [mg/kg d.m.]*		0.7	70	70	0.4	25	45	200
BE [mg/kg d.m.]	5	0.5	50	50	0.5	25	50	150
BE/FL [mg/kg d.m.]	150	6	375	250	5	50	300	900
FR [mg/kg d.m.]	18	3	300	120	2	60	180	600
DE [mg/kg d.m.]***		1	70	70	0.7	35	100	300
PL [mg/kg]		5		100	2	60	140	

* Austria has different quality classes the provided limit values belong to the highest quality
** In Belgium the limit value refers to the input material. The concentration of the output material can be by a factor of 1.5 to 2 higher.
*** In Germany the limit values are related to the used amounts per ha and year. The provided limit values refer to an amount of 30 tonnes / hectar within 3 years.

Austria

The compost is differentiated in to three quality classes with limit values provided in Table 2-29 and Table 2-30 [**Austrian MoE 2001a**]..

Additional limit values which have to be considered are related to the further use and are provided in Table 2-31 of this document.

For anaerobic digestion it is stated that the input material as well as the process shall result in a digestate which can be recycled. If the digestate cannot be recycled it shall be incinerated. [**Austrian MoE 2001a**]

Table 2-29: Heavy metal limit values for different quality class composts [Austrian MoE 2001a]

	Quality class A+	**Quality class A**	**Quality class B*)**
Parameter	Limit value [mg/kg d.m.]	Limit value [mg/kg d.m.]	Limit value[mg/kg d.m.]
Cd	0.7	1.0	3.0
Cr	70	70	250
Hg	0.4	0.7	3.0
Ni	25	60	100
Pb	45	120	200
Cu	70	150	500
Zn	200	500	1,800

Table 2-30: Other limit values for quality class B MSW compost [Austrian MoE 2001a]

	Quality class B
Parameter	Limit value [mg/kg d.m.]
AOX	500
Mineral oil hydrocarbons	3,000
PAK (16)	6
PCB	1
Dioxin	50 ng TE/kg d.m.

Table 2-31: Other limit values depending on the use of the compost. [Austrian MoE 2001a]

Parameter	**Use**	**Limit value**
Organic Substances	Agriculture, landscaping, recultivation of landfills, Biofilter	≥ 20% d.m.
Electric conductivity	Bagged cargo, use in hobby gardens	3 mS/cm
Particle size	Agriculture, landscaping, recultivation of landfills,	40 mm
Σ Fibres > 2mm	Agriculture	0.5 % d.m.
Σ Fibres > 2mm	Landscaping, recultivation of landfills,	1 % d.m.
Plastic > 2mm	Agriculture	0.2 % d.m.
Plastic > 2mm	Landscaping, recultivation of landfills,	0.4 % d.m.
Plastic > 2mm	Agriculture	0.02 % d.m.

Plastic > 2mm	Landscaping, recultivation of landfills,	0.04 % d.m.
Metal	Agriculture	0.2 % d.m.
Glass	Agriculture, grassland, (including ski piste), fruit- vegetable gardening, viniculture, gardening, use in hobby gardens, plantation	0.2 % d.m.
Growing test with cress	Bagged cargo, use in hobby gardens, plantation, additive for soil preparation	15 weight % or 25 volume % compost: fresh plant mass: ≥ 100 % of comparison substrate, germination rate: ≥ 95%, germination delay: 0 days; 30 weight % or 50 volume % compost: fresh plant mass: ≥ 90 % of comparison substrate, germination rate: ≥ 90%, germination delay: 0 days;
Germinable seeds + grow able plant parts	Bagged cargo, gardening, use in hobby gardens	≤ 3 plant seeds /litre

Belgium/Flanders

In the VLAREA Document [BE/FL VLAREA] Flanders has regulated several limit values and procedures. The limit values cover metals, monocyclic aromatic hydrocarbons, polycyclic aromatic hydrocarbons and other organic substances. These limit values refer on the one hand to the composted material and to the other hand to the permissible soil dosage. Furthermore a formula and a set of Tables is provided to determine the maximum values for treated sludge to be used as soil

Information regarding the limit value are provided in Table 2-32 to Table 2-35 including maximum levels of pollutants of metals in fertiliser or soil improving substances, monocyclic aromatic hydrocarbons, polycyclic aromatic hydrocarbons and other organic substances.

Table 2-36 to Table 2-39 include conditions for maximum permissible soil dosage of metals, monocyclic aromatic hydrocarbons, polycyclic aromatic hydrocarbons and of other organic substances

For sludge the parameters dry substance, degree of acidity, organic substance, nitrogen and diphosphorus pentoxide have to be analysed.

It is stated that the use of treated sewage sludge is prohibited:

- on grassland that is grazed, or on fields for the cultivation of fodder crops if the fodder crops are harvested before the ending of a waiting period of at least 6 weeks;
- on vegetable and fruit plantings, with the exception of the planting of fruit trees, during the growth period;
- on soils that are intended for the cultivation of vegetables or fruits which are normally in direct contact with the soil and which are normally consumed raw, during a period of 10 months before harvesting and during the harvest itself;

- in areas that according to prevailing municipal land use plans correspond to one of the land uses listed under land-use type I. of VLAREBO, city gardens and all urbanised places accessible for public.

Maximum concentrations in reference soil are listed in Table 2-40 of this document.

Maximum values for treated sludge to be used as soil depend on the measured concentration of clay and organic material in representative samples of the waste. The conversion of the maximum values takes place on the basis of the formula:

M(x,y)=M(10,2)+(x-10)*B+(y-2)*C

Where:
M.....maximum value with a clay level of x % or 10% and a level of organic material of y % or 2 %;
x.....level of clay in the sample of the waste;
y.....level of organic material in the sample of the waste;
$M_{(10,2)}$....maximum value in reference soil, i.e. with 10 % clay and 2% organic material (table of numeric values in Table 2-40)
B and C..coefficients dependent on the metal in questions as specified in Table 2-41.

The formula may only be used in the following conditions:

- The measured clay content level must be between 1 and 50 %;
- The measured organic matter content level must be between 1 and 50 %

If the measured clay content is below 1%, the calculation must be performed with a presumed clay content level equal to 1%. If the measured clay content is over 50 %, the calculation must be performed with a presumed clay content level equal to 50 %.

If the measured organic materials content is below 1%, the calculation must be performed with a presumed organic materials content level equal to 1%. If the measured organic materials content is over 20 %, the calculation must be performed with a presumed organic materials content level equal to 20 %. [BE/FL VLAREA]

Table 2-32: Composition conditions, maximum levels of pollutants [BE/FL VLAREA]

Metals	
Parameters	Total concentration [mg/kg d.m.]
As	150
Cd	6
Cr	250
Cu	375
Hg	5

Pb	300
Ni	50
Zn	900

Table 2-33: Limit values for monocyclic aromatic hydrocarbons in fertilizer or soil improving substances [BE/FL VLAREA]

Monocyclic aromatic hydrocarbons	
Parameters	Total concentration [mg/kg d.m.]
Benzene	1.1
Ethylbenzene	1.1
Styrene	1.1
Toluene	1.1
Xylene	1.1
Benzene	1.1

Table 2-34: Limit values for polycyclic aromatic hydrocarbons in fertilizer or soil improving substances [BE/FL VLAREA]

Polycyclic aromatic hydrocarbons	
Parameters	Total concentration [mg/kg d.m.]
Benzo(a)anthracene	0.68
Benzo(a)pyrene	1.1
Benzo(ghi)perylene	1.1
Benzo(b)fluoranthene	2.3
Benzo(k)fluoranthene	2.3
Chrysene	1.7
Phenanthrene	0.9
Fluoranthene	2.3
Indendon(1,2,3cd)pyrene	1.1
Naphthalene	2.3

Table 2-35: Limit values for other organic substances of fertilizer or soil improving substances [BE/FL VLAREA]

Other organic substances	
Parameters	Total concentration [mg/kg d.m.]
Monochlorobenzene	0.23
Dichlorobenzene	0.23
Trichlorobenzene	0.23

Other organic substances	
Parameters	Total concentration [mg/kg d.m.]
Tetrachlorobenzene	0.23
Pentachlorobenzene	0.23
Hexachlorobenzene	0.23
1,2 – dichlorobenzene	0.23
Dichloromethane	0.23
Trichloromethane	0.23
Trichloroethane	0.23
Tetrachloromethane	0.23
Tetrachloroethane	0.23
Vinylchloride	0.23
1,1,1-trichloroethane	0.23
1,1,2-trichloroethane	0.23
1,1-dichloroethane	0.23
Cis + trans 1,2 -dichloroethane	0.23
Hexane	5.5
Heptane	5.5
Octane	5.5
Extractable organohalogen compounds (EOX)	20
Mineral oil	560
Polychlorinated biphenyles (PCB as Σ 7 congeners)	0.8

Table 2-36: Conditions for maximum permissible soil dosage for metals [BE/FL VLAREA]

Metals	
Parameters	Total concentration [mg/kg d.m.]
As	300
Cd	12
Cr	500
Cu	750
Hg	10
Pb	600

Ni	100
Zn	1,800

Table 2-37: Conditions for maximum permissible soil dosage for monocyclic aromatic hydrocarbons [BE/FL VLAREA]

Monocyclic aromatic hydrocarbons	
Parameters	Total concentration [mg/kg d.m.]
Benzene	2.2
Ethylbenzene	2.2
Styrene	2.2
Toluene	2.2
Xylene	2.2
Benzene	2.2

Table 2-38: Conditions for maximum permissible soil dosage for polycyclic aromatic hydrocarbons [BE/FL VLAREA]

Polycyclic aromatic hydrocarbons	
Parameters	Total concentration [mg/kg d.m.]
Benzo(a)anthracene	1.36
Benzo(a)pyrene	2.2
Benzo(ghi)perylene	2.2
Benzo(b)fluoranthene	4.6
Benzo(k)fluoranthene	4.6
Chrysene	3.4
Phenanthrene	1.8
Fluoranthene	4.6
Indendon(1,2,3cd)pyrene	2.2
Naphthalene	4.6

Table 2-39: Conditions for maximum permissible soil dosage for other organic substances [BE/FL VLAREA]

Other organic substances	
Parameters	Total concentration [mg/kg d.m.]
Monochlorobenzene	0.46
Dichlorobenzene	0.46
Trichlorobenzene	0.46
Tetrachlorobenzene	0.46

Other organic substances	
Parameters	Total concentration [mg/kg d.m.]
Pentachlorobenzene	0.46
Hexachlorobenzene	0.46
1,2 – dichlorobenzene	0.46
Dichloromethane	0.46
Trichloromethane	0.46
Trichloroethane	0.46
Tetrachloromethane	0.46
Tetrachloroethane	0.46
Vinylchloride	0.46
1,1,1-trichloroethane	0.46
1,1,2-trichloroethane	0.46
1,1-dichloroethane	0.46
Cis + trans 1,2 -dichloroethane	0.46
Hexane	11
Heptane	11
Octane	11
Extractable organohalogen compounds (EOX)	40
Mineral oil	1120
Polychlorinated biphenyles (PCB as Σ 7 congeners)	1.6

Table 2-40: Maximum concentration in reference soil [BE/FL VLAREA]

Metals	
Parameters	Total concentration [mg/kg d.m.]
As	22
Cd	0.9
Cr	46
Cu	49
Hg	1.3
Pb	56
Ni	18

Zn	162

Table 2-41: Parameters for conversion formula [BE/FL VLAREA]

Metals		
Parameters	B	C
As	0.5	0
Cd	0.03	0.05
Cr	0.6	0
Cu	0.3	0
Hg	0.0046	0
Pb	0.3	2.3
Ni	0.2	0.3
Zn	1.1	2.3

France

The France Guideline sets some values which have to be taken into account, such as limit values for heavy metals, pathogens, impurities, other organic substances and micro organisms, which are provided in Table 2-42 to Table 2-46.

Organic matter that is intended to be spread on land can contain mineral soil improver, but some conditions should be considered:

- Composts should not contain matter from water or sewage treatment
- The following limits apply to total concentrations :
  - N, P_2O_5, K_2O < 3 % fresh matter
  - N+P_2O_5+K_20 < 7 % fresh matter
- Compulsory compliance: organic matter > 20 % and 25 % d.m.,
- Dry matter > 30 % fresh matter,
- C/N > 8
- N-NH_4 + $N0_3$ + urea < 33 % N total
- Compulsory characterisation:
  - D.m., organic matter, pH
  - N total and organic N in % fresh matter (with N tot = N orga + N-NO_3 + N-NH_4+Nurea)
  - P_2O_5, K_2O, MgO total concentration
  - mineralization test for N and C (NF U 44-163)
  - biochemical fractionation and biologic stability : ISB (NF 44-162)

[AFNOR 2006]

Table 2-42: Heavy metal limit values [AFNOR 2006]

Heavy metal	Limit value	
	mg/kg d.m.	mg/kg organic matter
As	18	
Cd	3	
Cr	120	
Hg	2	
Ni	60	
Pb	180	
Se	12	
Cu	300	600
Zn	600	1200

Table 2-43: Limit values for pathogens (on gross product) classified by product usage (all but vegetable growing // vegetable plants) with indication of analysis methodology reference [AFNOR 2006]

	All crops except gardening	Vegetable crops	Analytical method
Hellminth eggs	Absent in 1.5 g	Absent in 1.5 g	XP X 33-017
Salmonella	Absent in 1 g	Absent in 25 g	NF V 08-052 NF EN ISO 6579
	All crops except gardening	Vegetable crops	Analytical method

Table 2-44: Limit values for impurities [AFNOR 2006]

Impurities	Limit value
Films + PSE > 5mm	< 0.3% d.m.
Other plastics < 5mm	< 0.8% d.m.
Glass < 2mm	< 2.0% d.m.

Table 2-45: Average annual flow limits over 10 years and maximum limits for other organic substances [AFNOR 2006]

PAH	Flow limit [g/ha/year]	Content limit [mg/kg d.m.]
Fluoranthene	6	4
Benzo(b)fluoranthene	4	2.5
Benzo(a)pyrene	2	1.5

Table 2-46 Values on micro organisms

Micro organism	Reference value	Content limit [mg/kg d.m.]
Eschrichia coli	10^2 /g fresh matter	NF V 08-053
Enterococcus	10^4 /g fresh matter	NF EN ISO 7899-1

Germany

The German regulation [German MoE 1998] includes several limit values for the waste output material of biodegradable waste in relation to its use.

The content of impurities especially glass, plastic metal > 2mm shall not exceed 0.5 % of the dry matter. The content of stones > 5 mm shall not exceed 5 % of the dry matter. The Regulation provides in Annex 1 of the Ordinance a positive list of biowastes and possible mineral additives which can be used.

In the Legislation two application amounts have been used for the determination of limit values. One application amount is < 20 t d.m. per ha within 3 years and the other is < 30 t d.m. per ha within 3 years. For each of the two application amounts maximum limit values for heavy metal content of the compost have been set. The limit values are provided in Table 2-47 and Table 2-48. [German MoE 1998]

Table 2-47: Treated biowaste shall not exceed the f following limit values if they are used in amounts up to 20 tonnes per hectare within 3 years. [German MoE 1998]

Heavy metal	Limit value [mg/kg] d.m.
Cd	1.5
Cu	100
Cr	100
Hg	1
Ni	50
Pb	150
Zn	400

Table 2-48 Treated biowaste shall not exceed the following limit values if they are used in amounts up to 30 tonnes per hectar within 3 years. [German MoE 1998]

Heavy metal	Limit value [mg/kg] d.m.
Cd	1
Cu	70
Cr	70
Hg	0.7
Ni	35
Pb	100
Zn	300

Italy

Fertilisers law (D.lgs 75/2010) provides compost standards.

Poland

The Poland Guideline [SZPADTA 2008] sets some limits values for input as well as output materials for the biodegradable treatment facilities and also distinguishes between materials considered as fertiliser and soil improver by setting different limit values for nutritions.

Limit values for the treated biowaste are provided in Table 2-49 and Table 2-50 . [SZPADTA 2008]

Table 2-49 Maximum metal content in waste mixture for biological processing and permissible metal content of fertilizers and plant support [SZPADTA 2008]

	Limit value[mg/kg d.m.]	
Heavy metal	Maximum recommended in the waste prior to biological treatment	Acceptable in organic fertilizer or Adjuvant crops
Cd	≤ 3	≤ 5
Cu	≤ 65	≤ 100
Cr	-	-
Hg	≤ 1	≤ 2
Ni	≤ 40	≤ 60
Pb	≤ 90	≤ 140
Zn	-	-

Table 2-50 : Quality requirements for organic fertilizers and soil improver [SZPADTA 2008]

	Fertilizer [mg/kg d.m.]	Soil improver [mg/kg d.m.]
Organic content	≥ 30 % d.m.	
Cd	≤ 5	≤ 5
Cu	-	-
Cr	≤ 100	≤ 100
Hg	≤ 2	≤ 2
Ni	≤ 60	≤ 60
Pb	≤ 140	≤ 140
K_2O	≥ 0.2	-
P_2O_5	≥ 0.2	-
N	≥ 0.5	-

2.1.3.6 Process requirements and BAT to be taken into account

There are many different technologies and variations for the treatment of biodegradable waste. However to receive a product of sufficient quality some general parameters have been identified.

For composting, the main focus is a sufficient sanitisation. For this purpose minimum maturation times at different processing temperatures are a key factor and provided by several Member States. Also a sufficient oxygen supply shall be provided for a homogeneous product which can be reached by venting and or turning of the biodegradable waste.

For anaerobic digestion, the main focus is to receive a good bio-gas quality for incineration as well as a digestate which can be used as fertilizer or soil improver. For this purpose some process parameters and material requirements are recommended.

Austria

Food oil and fat shall be collected with as little odour and leachate emissions as possible. They shall be reused in lubricant production, for biodiesel with glycerine production or for saponification with glycerine production. Product of the fat separator shall be reused as biofuel, secondary raw material for the production for soap or lubricant production or biogas production [Austrian MoE 2011]. The Guideline [Austria MoE 2005] further contains some information concerning sanitation (temperature time regime).

Belgium/Flanders

The Flemish VLAREA [BE/FL VLAERA] requests that treated sludge must have undergone at least one of the following treatments to be classified as treated purification sludge:

- Mesophilic anaerobic fermentation at 35 °C for an average renewal time of 15 days.
- Liquid storage at ambient temperature in a batch, without addition or extraction during the 3-month storage period. The sludge must at least reach a factor 100 reduction for Escherichia coli;
    - Simultaneous, i.e. in the same basin as the waste water treatment itself, with a sludge load ≤ 0.06 kg BOD/kg sludge/day or a volume load ≤ 0.25 kg BOD/m³/day;
    - Separately, i.e. in a separate basin for this purpose with a hydraulic renewal time of 10 days
- Addition of lime to obtain a homogenous mixture of lime and sludge. The mixture reaches pH > 12 immediately after the addition of lime and is to maintain the pH value of at least 12 over a 24 hour period;
- Thermal drying to guarantee a sludge particle temperature over 80°C with a reduction of water content to less than 10%

Germany

- According to [German MoECNS 2002] composting plants and anaerobic digestion facilities exceeding a set throughput are requested to have minimum distances to settlement areas. Further constructional and process requirements are provided. in Annex 2 of the Ordinance on the recycling of biodegradable waste [German MoE 1998]. It includes detailed process parameters for time and temperature requirements including pH values and moister content.

Italy

According to Article 16 of the Annex 1 to Decreto Ministeriale 5/2/ composting of biodegradable waste should last at least 90 days and a sufficient oxygen supply shall be given for an aerobic process. For a complete bio-oxidation the compost shall be sufficiently turned and/or vented. The compost has to exceed a temperature of 55 °C for at least 3 days. [IT D.M. 5/2/1998]

Poland

The Polish document [SZPADTA 2008] provides some guideline for the proper process control for biodegradable waste treatment.

During the methane production the following indications should be followed:

- recirculating as much water as possible
- processing under thermophilic conditions
- measuring of TOC, CSB, N and P
- measuring of the digestate and biogas

The emissions of NOx, SOx, CO, H_2S and VOC should be as little as possible by using adequate abatement technologies.

MBTs shall fulfil the following conditions:

- complete sealing of the reactor
- limitation of anaerobic conditions during the aerobic process
- effective use of water
- thermal isolation of the reactor, stabilisation of the biological oxygen demand
- limitation of the produced process gas (2500-8000 m^3/Mg)
- homogenisation of the waste
- limitation of the emissions in water
- continuous control of parameter for biological decomposition and measured emissions
- limitation of ammonia emission through optimisation especially by the C/N ratio in the waste

In Table 2-51 the advised temperatures and times are provided.

Table 2-51 Composting conditions required to ensure waste hygienization [SZPADTA 2008]

Composting method	Temperature [°C]	Time	Number mass compost turned
Windrow composting	55	2 weeks	5
Windrow composting	65	1 week	2
Closed system composting	60	1 week	

Sweden

The Swedish guideline **[NATURVÅRDSVERKET 2003a]** gives some support for the proper handling of biodegradable waste.

The storage of biodegradable waste should normally not be longer than one day during warmer month and seven days during colder months. During the pre-treatment process the compost quality can be increased by shredding, magnetic separation, sifting, sorting and mixing with additives. To avoid odour the biodegradable waste can be covered or by adding additives.

In case compost shall be used on soil, a high maturity of the product should be reached.

Regarding the sanitisation of compost, Salmonella as an appropriate indicator is considered alongside the process parameters. To avoid re-infection and re-growth there is a need to clean and disinfect the vehicle and containers arriving with the waste if they are also used for run-off of finished compost or digestion.

Examples of suitable process conditions for digestion and composting are provided in Table 2-52 and Table 2-53**. [NATURVÅRDSVERKET 2003a]**

Table 2-52 Defined parameters for anaerobic digestion and composting [NATURVÅRDSVERKET 2003a]

	Anaerobic digestion	Composting
Moister	60-95%	During intensive phase 35-60%
Structure and porosity	Not relevant	Desirable balance, which provide large surface area for organisms to work on, and good structure which allows oxygenation.
Oxygen	Absence of oxygen is a prerequisite, particularly in methane formation step.	Oxygen supply is essential and is influenced by moisture, texture, porosity and forced aeration.
Mixing	Speeds up the process by creating surfaces and prevents crust formation on the surface	If the material is mixed during the process facilitated oxygen supply and a homogeneous degradation. Excessive or frequent mixing may impair the structure and thereby prevent oxidation.
Carbon / nitrogen ratio	Can vary within a wider range compared with composting. Too high ammonium concentrations can influence the process negatively.	Carbon content should be approximately 20-30 times higher than that of nitrogen. At higher ratio the rate of degradation decreases and at lower ratio nitrogen depletion increases.
pH	In the first decomposition steps the pH can be between 5 and 7, while methane production requires a pH value of 7 to 8. In one-step processes should be more than pH 7	Should be about 7-8 for optimal digestion. Low pH prevents the desired degradation while high pH increases the risk of nitrogen removal.
Temperature	should normally be either around 35 °C or 55 °C for optimal digestion. 35 C provides a more stable process, while 55 °C provides an effective sanitation and faster degradation.	During the main composting, the temperature should be around 50-60 °C for an optimum decomposition rate
Maturity	Organic material does not break down in the same extent of composting. The product is in a more soluble form. Digestate is normal therefore less stable than compost.	A measure of the extent of degradation. The treatment will determine reached maturation.

Table 2-53 Minimum requirements for time and temperature for different treatment technologies [NATURVÅRDSVERKET 2003a]

Class	Treatment method	Parameter	Circumstances
A	Thermophilic digestion	Temperature: 55 ° C Exposure: 6 hours (Can be performed as sanitation before digestion)	All materials must meet the specified Temperature: at least 7 days at 55 ° C
A	Wet composting	Temperature: 55 ° C	All materials must meet the

		Exposure: 6 hours (Can be performed as sanitation before digestion)	specifiedTemperature: at least 7 days at 55 ° C
A	Closed composting	55 °C for 7 days; 60 °C for 5 days; 65 °C for 3 days; 70 °C for 1 days;	All materials must meet the specified temperature. The moisture content should be 35 - 60%.
B	Open composting	55 °C for 7 days; 60 °C for 5 days; 65 °C for 3 days; 70 °C for 1 days; After maturing for at least 6 months after the main process and before use.	The specified parameters must be met. The moisture content should amount to 35-60%

United Kingdom

Specific process conditions are set for anaerobic digestion destined for use in agriculture and burning of resultant biogas.

The total quantity of waste treated or stored at any one time does not exceed 1,250 cubic metres, that the minimum retention time for water in the digester is 28 days and that any gas resulting from the operation is collected and then burnt in an appliance either with an aggregate net thermal input of less than 0.4 megawatts or that the appliance is for the purpose of producing energy.

For anaerobic digestion not for use of agriculture and burning of resultant biogas, specific conditions are set. The total quantity of waste treated or stored at any one time shall not exceed 50 m^3, the minimum retention time for the waste in the digester is 28 days and any gas resulting from the operation is collected an then burnt in an appliance either with an aggregate net thermal input of less than 0.4 megawatts or that the appliance is for the purpose of producing energy.

For treatment of kitchen waste in a wormery specific conditions are set. The total quantity of water treated over any 12 month period does not exceed 6 tonnes and the treatment results in a stable sanitised vermicompost that can be applied to land for the benefit of agriculture or to improve the soil structure or nutrients in land. [UK EA 2010]

The total quantity of waste that can be accepted at any site must not exceed 75,000 tonnes per year for anaerobic digestion facilities [UK SR2010 No15] and [UK SR2010 No16]; 500 t for biodegradable waste facilities [UK SR2010 No15].

The permitted activities must not be carried out within 500 metres of a European Site2, ramsar site or a Site of Special Scientific Interest (SSSI) (excluding any SSSI designated solely for geological features). All storage and treatment of waste solids, liquids and sludges shall also not be within:

- 10 metres of any watercourse

- 50 metres from any spring or well, or from any borehole not used to supply water for domestic or food production purposes, and

- 250 metres from any spring or well or from any borehole used to supply water for domestic or food production purposes.

These standard rules do not allow any emission into surface waters or groundwater except clean water from roofs and parts of the site not used for waste activity including storage of wastes. [UK EA 2008d], [UK EA 2008e], [UK EA 2008g]

For anaerobic digestate facilities the following measures shall be considered [UK EA 2008e]:

- All waste solids, liquids and sludges shall be stored and processed on an impermeable surface with a sealed drainage system. Wastes shall be stored or treated within enclosed containers, reactor vessels or enclosed well ventilated buildings fitted with a biofilter and/or scrubbing system. The biofilter must be specifically designed to minimise the release of odour, bioaerosols and microorganisms and maintained for the process undertaken and be fit for purpose.

- All storage and process tanks shall be located on an impermeable surface (a permeability of at least 10-9 m/s) with sealed construction joints within a bunded area. The bunded area shall have a capacity at least 110% of the largest vessel or 25% of the total tank volume, whichever is the greater. Bunds shall be regularly inspected to ensure that bunds filled by rainwater are regularly emptied. Connections and fill points should be within the bunded area and no pipework should penetrate the bund wall. Underground tanks shall have secondary containment and appropriate leak detection.

- Digestate shall be stored within covered containers or covered lagoons and should be of a design and capacity fit for purpose. Lagoons shall have a free board of 750 mm.

- Gas engine stack height shall be no less than 3 metres.

- All biogas condensate shall be discharged into a sealed drainage system.

- Emissions of unburned biogas and the operation of the auxiliary flare shall be minimised. Any significant emissions of unburned biogas (including the operation of the pressure relief valves associated with biogas storage) and the operation of the auxiliary flare shall be recorded.

For closed system composting facilities the following measures shall be considered [UK EA 2008d] and [UK EA 2008g]:

- The storage, physical treatment, composting and maturation of wastes shall take place only in a contained system on an impermeable surface with sealed drainage system.

- Where the composting or maturation of wastes takes place in any form of contained system it shall be fitted with a bio-filter and/or equivalent abatement system. The bio-filter and/or equivalent abatement system shall be specifically designed to minimise the release of odour, bioaerosols and micro-organisms and maintained for the process undertaken and be fit for purpose

For open system composting facilities the following measures shall be considered [UK EA 2008g]:

- The storage, physical treatment, composting and maturation of wastes shall take place on hardstanding subject to the paragraph below.
- When located within groundwater Source Protection Zone 1 or 2 the storage, physical treatment, composting and maturation of wastes shall take place only on an impermeable surface with sealed drainage system.

Parameters for good composting and odour control are given in Table 2-54. Minimum Performance for raw materials receipt, delivery and feedstock preparation are listed in Table 2-55. Composting options for different waste types are given in Table 2-56. Odour control options through design and operation and through active odour abatement are provided in

Table 2-57. [UK DEFRA 2009]

Table 2-54 Minimum Performance – raw materials receipt delivery and feedstock preparation [UK DEFRA 2009]

Waste Type	Degree of Containment		Odour Control requirements
	Open	Enclosed	
Green waste	✓		• Raw materials management • Adjust moister content and C;N ratio • Process as soon as possible
Sewage sludge		✓	
Kitchen waste (ABP)		✓	
Slaughterhoues (ABP)		✓	

Table 2-55 Composting options for different waste types [UK DEFRA 2009]

Waste Type	Compost Method							Odour Control requirtements
	Open Windrow	Aerated windrow	Enclosed windrow	Batch or continous	Vertical compost units	Rotating drum	Agitated bins	
Green waste	✓	✓	✓	✓	✓	✓	✓	• Maintain O_2, moisture, pH conditions with ideal range
Sewage sludge		✓	✓	✓	✓	✓	✓	
Kitchen waste (ABP)			✓	✓	✓	✓	✓	
Slaughterhoues (ABP)			✓	✓	✓	✓	✓	

Table 2-56 Odour control options through design and operation [UK DEFRA 2009]

Process stage	Odour control Options
Raw material – green waste (external storage)	• Good raw material management and • Good site design and management to avoid anaerobic activity
Raw material – all other types (internal storage)	• Good raw material management • Good site design and management in avoid anaerobic activity • Maintain building under negative pressure: and • Treat ventilated air using suitable odour control system

Feedstock preparation	• Maintain aerobic conditions including turning and oxygen monitoring; and • Rapid incorporation into aerobic composting process
Open windrow	• Maintain O_2, moister, temperature, pH conditions within ideal range
Other composting types	• Maintain O_2, moister, temperature, pH conditions within ideal range; and • Treat residual prcess air using a suitable odour control system
Maturation	• Maintain aerobic conditions; • If necessary enclose operation; and • Treat ventilated air using a suitable odour control system
Leachate	• Cover store; • Remove solids; • Aerate liquor • Avoid atomising sprays when wetting compost; and • Location to take account of sensitive receptors

Table 2-57 Odour control options through active odour abatement

Emission sources	Examples of control techniques
Ventilated air from raw materials area, and enclosed process or aerated static windrows	Vent to suitable arrestment plant: Biofilters; Scrubbers/biofilters; and Location to take account of sensitive receptors.
Emissions from odour arrestment plant	Final dispersion to minimise adverse impact at sensitive receptors

2.1.4 Treatment standards for the temporary storage of wastes related to C&D waste, tires and wastes related to the treatment of household & similar wastes

2.1.4.1 Emission related standards (air incl. odour)

Some standards relating to air emissions were identified for several Member States. All of these standards were qualitative requirements relating to the design and operation of the temporary storage facilities in a way that minimises dust, odour and visual nuisance. Although there were no specified emission limit values, most of the standards require control of emissions to an acceptable standard and for storage containers to be located away from the prevailing wind direction. In the UK, there is a specific requirement to produce a site management plan which specifies control measures for operation of the site.

Austria

The Austrian BRV-Temporary Storage of mineral recycled building material **[BRV 2004]** outlines measures to prevent dusts emissions which include e.g. cleaning tyres, wetting roads etc.

The Federal Waste Management Plan 2006 **[Austrian MoAFEW 2006]** specifies requirements for storage of construction and demolition including wood wastes. Wastes have to be stored and collected separately. Storage locations which are specified to be yards of construction companies,

but also collection and sorting areas are to be clearly marked. Those areas need to be protected from wind to limit emission of dust. This could be achieved by low fall height, enclosed chutes, moisturising of input materials but also covering containers. If fast evaporation of volatile compounds from stored wastes is predicted then those wastes have to be stored in closed with cleaning of the exhausted air is to be provided.

Belgium

The Wallon Belgisch Staatsblad - 08/25/2004 – MONITEUR **[Wallon MoR 2004]** is an order setting conditions for temporary storage at construction and demolition wastes sites. Section 2 states that the nuisance especially with regard to dust and visual impact to neighbouring area need to be limited. Storage areas need to be located in such a way that the spread of dust due to wind is minimal.

France

The French Arrêté 30/06/97 n° 2517 **[French MoE 1997]** is an order that identifies the general requirements for the protection of exterior storage areas from weather condition, particularly wind. Wastes can be stabilised, if that is not possible, then storage areas must be sheltered. Fine particles (<80 µm) have to be in containers, bags or closed in buildings. Air escaping such buildings need to be treated to remove dusts.

Germany

The German Federal Pollution Control Act **[MoECNS 2002]** specifies that emissions for substances stored should be reduced to acceptable standards. The following parameters are important: nature and properties of solids and their compounds (eg hazardousness and toxicity), possible effects on soils and waters, but also possible formation of explosive dust/ air mixtures. Information on the distance from residential buildings is given. Containers used for storage and transport are required to be closed. When necessary the usage of dust-binding agents is recommended.

Ireland

A study completed by RPS on behalf of the Irish Environment Protection Agency titled “Organic waste management in apartments” **[Irish EPA 2008]** focused on the issue of organic waste management at apartments in Ireland and made a health and safety improvement recommendation that bin storage areas need to have adequate ventilation so that the odour emissions potential is minimised. It also contained qualitative recommendations on management of emissions from various sources arising from storage of wastes.

UK

The standard rule (SR2011No4) on treatment of waste wood for recovery specified for England and Wales **[UK EA 2011]** identifies specific requirements for waste wood storage and treatment. In particular, it requires that:

- Emissions of substances not controlled by emission limits (excluding odour) shall not cause pollution.
- According to standard the operator needs to take appropriate measures specified and

approved by management plan, however not limited, to minimise emissions.

2.1.4.2 Emission related standards (water)

Qualitative standards relating to water emissions were also identified for several Member States. The requirements relate to the design and operation of the temporary storage facilities in a way that prevents contamination of surface and ground waters. There is a general requirement for the operator to take necessary design measures to reduce the risk of contamination including use of containers, sealing of the storage area, surface water collection system, adequate drainage, etc.

Austria

The Austrian BRV-Temporary Storage of mineral recycled building material **[BRV 2004]** outlines the requirements for storage areas that need to be met in order to prevent any contamination of surface and ground waters. The storage sites are required to either be equipped with an impermeable surface and surface water collection system or to be roofed. Design requirements and water collection design criteria are given. The Federal Waste Management Plan 2006 **[Austrian MoAFEW 2006]** outlines requirements for storage of construction and demolition including wood wastes including avoidance of washing out which can be done by such measures as roofing over storage areas, using containers or sealing of the storage area and treatment of the precipitation running off.

Belgium

The Wallon Belgisch Staatsblad - 08/25/2004 – MONITEUR **[Wallon MoR 2004]** states that the operator shall take all the necessary measures to reduce the risk of contamination of soil and water by runoff. The discharge of liquid waste, directly or indirectly in the soil or groundwater, sewers and collectors is prohibited.

Germany

The German Federal Pollution Control Act **[MoECNS 2002]** requires emissions for substances stored to be reduced to acceptable standards. The following parameters are important: nature and properties of solids and their compounds (eg hazardousness and toxicity), possible effects on soils and waters, but also possible formation of explosive dust/ air mixtures.

Ireland

The Irish EPA study of Organic waste management in apartments **[Irish EPA 2008]** recommends that a waste storage area have to have a water supply (to clean bins) and adequate drainage for water run-off and spillages

UK

Standard rule (SR2011No4) on treatment of waste wood for recovery for England and Wales **[UK EA 2011]** contains some quantitative limits as well as qualitative provisions that prohibit any point source emission into surface water or groundwater. Discharges to sewer system are allowed (subject

to permits from Water Company) or need to be taken off site in a tanker. Clean surface water from roofs, or from areas of the site that are not being used in connection with storing waste, may be discharged directly to surface waters, or to groundwater by seepage through the soil via a soak away. Additional requirements are that the activities:

- cannot be carried out within 500 metres of a European Site1, Ramsar site or a Site of Special Scientific Interest (SSSI),
- shall not be within – 10m of any watercourse, 50m from any spring or well or any borehole not used to supply water for domestic or food production purposes; and 250m from any well, spring or from any borehole used to supply water for domestic or food production purposes

2.1.4.3 Emission related standards (noise)

There was very limited information on standards for noise emissions. Three standards containing mainly qualitative information were identified. One of these standards **[French MoE 1997]** contained quantitative limit values for noise emissions which are provided in the table below. In all documents, there is a requirement to minimise noise pollution by restricting storage related activities or requiring appropriate measures in the management plan to minimise noise and vibration.

France

The French Arrêté 30/06/97 n° 2517 **[French MoE 1997b]** sets limits of noise. These limit values are included in the table below.

Ireland

The Irish EPA study [**Irish EPA 2008]** recommends that due to noise and safety concerns glass recycling on site might not be provided.

UK

Standard rule (SR2011No4) on treatment of waste wood for recovery for England and Wales **[UK EA 2011]** requires that emissions from the activities (storage and treatment of wood wastes) shall be free from noise and vibration at levels likely to cause pollution outside the site, unless the operator has used appropriate measures to minimise the noise and vibration.

Table 2-58: Compilation of limit values for noise

		FR
Substance	**Unit**	
If level of background noise in noise aggravation zones(including noise from the installation) is >35dB(A) and <=45dB(A), limit value of noise aggravation from 7.00 to 22.00, except Sundays and bank holidays	dB	6
If level of background noise in noise aggravation zones(including noise from the installation) is >45dB(A), limit value of noise aggravation from 7.00 to 22.00, and Sundays and bank holidays	dB	4
If level of background noise in noise aggravation zones(including noise from the installation) is >35dB(A) and <=45dB(A), limit value of noise aggravation from 7.00 to 22.00, except Sundays and bank holidays	dB	5

If level of background noise in noise aggravation zones(including noise from the installation) is >45dB(A), limit value of noise aggravation from 7.00 to 22.00, and Sundays and bank holidays	dB	3
In addition, the level of noise at the limit of the property where the installation is should not be greater, when the installation is working, during day time except if the residual noise for the considered period is above this limit.	dB	70
In addition, the level of noise at the limit of the property where the installation is should not be greater, when the installation is workingduring night time, except if the residual noise for the considered period is above this limit.	dB	60

2.1.4.4 Specifications for Waste IN

There was very limited information on process standards for waste inputs which are temporarily stored. Standards were found for three MS only and these were mainly qualitative. Some of the information contained related to requirements for separation of the materials by grade during storage, storage locations for different wastes and characteristics (including temperature and flashpoint) of temporarily stored wastes. More detail is provided below.

Austria

The Austrian BRV-Temporary Storage of mineral recycled building material **[BRV 2004**] requires pre-sorting of wastes and wastes containing tar to be removed.

The Guidelines for Recycled Building Materials (Green Guide) **[BRV 2007]** requires recycled building materials to be stored separately according to grades and quality classes.

The Federal Waste Management Plan 2006 **[Austrian MoAFEW 2006]** specifies requirements for storage of construction and demolition including wood wastes. It requires that:

- the storage areas or collection containers for the different fractions be clearly marked to avoid incorrect allocation;
- sorted building waste may only be stored on a solid surface; and
- the storage area need to be secured and unauthorized access prohibited.

Belgium

The Wallon Belgisch Staatsblad - 08/25/2004 – MONITEUR **[Wallon MoR 2004]** requires pre-sorting of wastes prior to storage.

The Order of the Flemish Government for the establishment of the Flemish regulations relating to waste prevention and management **[VLAREA, 2004]** recommends that scrapped batteries should be stored indoors with liquid-proof floors or in weather-resistant, sealed and acid-resistant containers.

UK

The standards on S1 – Storage of waste in secure containers **[UK EA 2010c],** S2 – Storage of waste in a secure place **[UK EA 2010d]** and NWFD exemptions – Temporary storage of waste at a place controlled by the producer [UK EA 2010e] all require pre-sorting of the stored wastes.

The NWFD exemptions – Temporary storage at the place of production **[UK EA 2010g]** specifies that

the waste must not contain or consist of any asbestos or any substance that has a flash point of less than 21°C.

NWFD exemptions – Temporary storage at a collection point **[UK EA 2010f]** requires a secure container at collection point.

2.1.4.5 Quality criteria for Waste OUT

It has not been possible to identify any member state standards or relevant information on **standards for waste outputs** which are temporarily stored.

2.1.4.6 Process requirements and BAT to be taken into account

There was some information on process requirements and BAT relating to temporary storage of wastes and these contained specific recommendations as outlined below. In general, there is a requirement for the wastes to be stored securely, for a limited time and not exceeding a given quantity per year.

General

There are several techniques for reducing environmental impacts from the management of construction and demolition waste. The main techniques involved wetting the material and in closing the installations **[CEC 2007b]**, including:

- techniques to reduce environmental impact from open storage **[EC 2006]**: spraying of water with or without additives, self-erecting covers;
- techniques to reduce environmental impact from enclosed storage **[EC 2006]**: The BAT for enclosed storage is to apply dust abatement techniques.
  - BAT for silo: to apply a proper design to provide stability and prevent the silo from collapsing.
  - BAT for sheds: to apply proper designed ventilation and filtering systems and to keep the doors closed.
- techniques to reduce environmental impact from handling **[EC 2006]**, for handling solid C&D waste, the BATs are to: postpone handling in windy conditions; reduce discontinuous transport and transport distances; reduce the drop height and to choose the best position during discharging into a truck; adjust the speed of vehicles on-site; apply hard surfaces to the roads; clean the roads that are fitted with hard surfaces; clean the tyres of vehicles; moisten drift sensitive and wettable products by water spraying with or without additive, using water curtains and jet spraying; minimise the speed of decent; minimise the free fall height of the products.

- techniques to reduce environmental impact from transfer on conveyors **[EC 2006]**. For conveyor and transfer chutes, the BATs are to: design appropriately the conveyor transfer chutes; use lateral wind protection; spray water and jet spraying at the transfer points; clean conveyor belt; close conveyor when highly drift sensitive material; apply housing of existing belt conveyor for highly and moderate drift sensitive materials; use extraction system for closed conveyor belts.

The EC report **[EC 2007[a]]** and the accompanying Factsheet E3 **[EC 2007d],** state that reducing dust emissions from C&D waste sorting and crushing operations would have a positive social impact by reducing health impacts. However, the Commission concluded that the sorting and crushing of C&D waste would not be a good candidate for inclusion under the scope of the IPPC Directive. The same conclusion would be expected to apply to temporary storage where the emissions and therefore health risks are considerably lower from storage than for crushing and sorting operations.

Austria

The Federal Waste Management Plan 2006 **[Austrian MoAFEW 2006]** requires that storage areas or collection containers for the different fractions of construction and demolition including wood wastes are clearly marked to avoid incorrect allocation. The storage area must be secured and non-unauthorized access provided.

Austrian BRV-Temporary Storage of mineral recycled building material **[BRV 2004]** also requires storage areas to be secured and its access to be restricted.

Belgium

The Wallon Belgisch Staatsblad - 08/25/2004 – MONITEUR **[Wallon MoR 2004]** requires waste to be stored in storage areas clearly marked and reserved exclusively for this purpose.

The order of the Flemish Government relating to waste prevention and management [VLAREA, 2004] recommends the storage of scrapped batteries in an indoor location with liquid-proof floors or in weather-resistant, sealed and acid-resistant containers.

The order of the Flemish Government of 6 February 1991 concerning Environmental Licences **[VLAREM I, 1991]** contains specific information on temporary storage of waste related to the treatment of C&D wastes, household, tyres and similar wastes pending collection on the site where waste is generated. It specifies that sorting of waste materials by type are required. Information on storage capacity and useful application of waste materials is also provided.

In Vlarem I, an installation for treatment or storage is classified as class 1, 2 or 3. Class 1 is the class that can cause the most nuisances. Each company can be given different numbers indicating which sections are applicable to the company. These sections indicate the type of company, the maximum/ minimum storage/ capacity/ power; the kind of discharge in the sewage or waterway, etc. These classifications can be found in in Annex 1 of VLAREM I

Germany

The German Federal Pollution Control Act **[MoECNS 2002]** requires containers used for storage and

transport to be closed.

Ireland

The Irish EPA study [Irish EPA 2008] specifies that waste storage facilities need to be designed at the development stages and there should be dedicated bin stores for large residential schemes in particular.

UK

Standard rule (SR2011No4) on treatment of waste wood for recovery for England and Wales **[UK EA 2011]** sets quantities of wastes stored (and subsequently treated). This can't be more than 75,000 tonnes/year.

The standards on S1 – Storage of waste in secure containers **[UK EA 2010c]** and S2 – Storage of waste in a secure place specify conditions of storage and quantities and time periods for storage of different types of wastes.

The standards – temporary storage of waste at a place controlled by the producer **[UK EA 2010e]** and temporary storage at a collection point **[UK EA 2010f]** – both require wastes to be stored in a secure place. Liquid waste must be stored in a container with secondary containment such as a bund. Examples of treatments on the waste to help with storage and collection are given in the "What else do I need to know?" sections. The limits time and the conditions of storage are provided

The NWFD exemptions – Temporary storage at the place of production **[UK EA 2010g]** provides examples of treatments on the waste to help with storage and collection. The limits time and the conditions of storage are provided

The Northern Ireland exemption – Paragraph 41 for temporary storage of waste, including WEEE, pending its collection at the place where it is produced **[NIEA 2009]** specifies that liquids waste needs to be stored in a secure container and the total volume of that waste does not at any time exceed 23,000 litres. In any other case the waste is stored in a secure container and the total volume of that waste does not exceed 80 cubic metres; or the waste is stored in a secure place.

2.1.4.7 Others

Belgium

Waste tyres are collected in Flanders in accordance with the Covenant on waste tyres [OVAM 2010]. Although there is a website link, further information on this covenant was not immediately accessible.

Finland

The Finnish Government decision on the recovery and disposal of discarded tyres October 12, 1995 has a general requirement regarding recovery of waste tyres **[Finnish MoE 1995].**

Ireland

In the Irish EPA study **[Irish EPA 2008]** some of the factors that would affect the location of the

storage area in the block of flats were identified as space, noise, visual amenity, security, access and resident demand.

Netherlands

National Waste Management Plan 2002-2012 (NWMP): Part 1 **[Netherland MoHPE 2007]** is a policy framework which contained general information on the need for authorization for waste storage and to provide an indication of periods of storage before disposal and recovery.

Poland

The Polish standards PN-M- 49010:1996 2 and PN-M- 49011:**1996 [Polish Chancellery of the Sejm 2006]** specifies dimensions for temporary storage bins.

UK

Standard rules SR2011No4: Treatment of waste wood for recovery **[UK EA 2011]** is a list of rules permitting operator to store and treat waste wood at specified location.

S1 – Storage of waste in secure containers **[UK EA 2010c]** and S2 – Storage of waste in a secure place [UK EA 2010d] are exemptions that allow the storage of specific waste streams at a secure place/ in secure containers at a different place to where the waste was produced, before the waste is transported to another site for recovery.

Non- Waste Framework Directive (NWFD) exemptions – Temporary storage of waste at a place controlled by the producer **[UK EA 2010e]** is an exemption that allows the temporary storage of any waste (other than unbonded asbestos and any substances that have a flash point of less than 21°C), pending its collection, at a place controlled by the waste producer.

"Non- Waste Framework Directive (NWFD) exemptions – Temporary storage at a collection point **[UK EA 2010f]** allows the temporary storage of waste, (other than asbestos or any substances that have a flash point of less than 21°C), at a collection point for the purposes of recovering or disposing of the waste elsewhere.

Non- Waste Framework Directive (NWFD) exemptions – Temporary storage at the place of production **[UK EA 2010g]** is an exemption that allows to temporarily storage any waste at the place of production, pending its collection.

2.1.5 Treatment standards for the treatment of hazardous wastes (focusing on identifying, avoiding of dilution, removal of hazardous substances)

2.1.5.1 Identifying hazardous wastes

Several standards for Czech Republik, Germany, Luxembourg, the Netherlands, Spain and the United Kingdom related to the identification of hazardous waste have been acknowledged. Regarding identification the provisions described are similar to the provisions on EU level. Some documents however describe in more detail how to identify hazardous waste. Provisions are also made for

record keeping and the maintenance of a register for the recording of information on hazardous wastes Also the BREF document on waste treatment include very valuable provisions to enhance identification of hazardous waste.

Czech Republic

According to **[Czech MoE, 2008]** hazardous waste has to be compliantly labeled observing national and international regulation and shall bear a hazardous waste pictogram.

Waste producers and licensed persons managing hazardous waste are obliged to prepare a hazardous waste identification form and to display the aforesaid in hazardous waste management locations).

Germany

Note that only regulations at *Bund* level have been considered, additional provisions may be laid down at *Länder* level. For certain hazardous waste streams (e.g. on medical waste), the expert group *Bund-/Länder Arbeitsgemeinchaft Abfall* (LAGA) has issued guidance.

Ordinance on Waste Treatment Records **[German MoE 2006]** provides for keeping and use of records of proper waste management, consignment notes, handover certificates and record books. (*Nachweisverordnung - NachwV*)

[German MoE 2002] provides for assignment of wastes to a certain waste class, reference to the list of dangerous goods in § 4a Abs. 1 of the Regulation for the protection against dangerous substances (*Verordnung zum Schutz vor gefährlichen Stoffen – GefStoffV*).

Waste Catalogue Ordinance **[German MoE 2001]** specifies the designation of waste and the classification of wastes as requiring or not requiring particular monitoring according to the risks they pose, in line with EU List of Waste *(Abfallverzeichnis-Verordnung - AVV)*.

The German Waste Water Ordinance **[MoE 1997]**: Annex (48) defines the requirements and standards for the use of certain hazardous substances (e.g. concentrations in g/tonnes in samples).

Luxembourg

[Luxembourg MoE 1996] sets out obligations related to the inventory and identification of hazardous waste. Such obligations apply to the waste producer and all involved hazardous waste management actors including waste treatment facilities. Further, the producer is obliged to hold and regularly update a register on his hazardous waste composing information on quantity, nature, origin, envisaged treatment etc.

A standard register is provided for waste producers concerned by the Environmental Administration Services. The information registered for the waste has to be kept at least for 3 years. During storage, the hazardous waste has to be packaged and labelled accordingly.

The Netherlands

General information on Dutch notification and registration system was provided; such primary data is used as a basis for enforcement in **[Netherland MoHPE 2007]**. A national implementing body has been established with the SenterNovem/Waste Management Implementation agency for notification and registration.

Spain

The management of hazardous waste (including collection, storage, treatment and transport) is subject to licensing by the environmental authority of the autonomous regions **[Spanish MoE 1998]**. The activities of transport of hazardous waste require a specific identification paper in compliance with the requirements of the regulations on the transport of hazardous goods.

Operators carrying out activities of collection and storage of hazardous waste shall bear the same record of documents as required for those who carry out recovery and disposal activities of other waste types. The documentation required shall contain the number, nature, origin, destination, frequency of collection, means of transport and method of recovery or disposal of a specific waste. The documentation shall be made available to the public administrative bodies when requested.

The documentation shall be available for five years. In addition, the operators that carry out activities of collection, storage, recovery or disposal of hazardous waste shall determine measures of security, protection and emergency plan for the prevention of risks. In addition, the operators that carry out activities of collection, storage, recovery or disposal of hazardous waste shall determine measures of security, protection and emergency plan for the prevention of risks.

Also **[Spanish MTAS and INSHT 2000]** contains several annexes related to identification systems of hazardous waste, instructions for the use of identification codes and control and monitoring forms. The information to be provided for the labeling of hazardous waste is provided in detail and covers different packaging (e.g. containers) and information to be included in the label (identification code of the waste, name, address and phone number of the holder of the waste, date of packaging, nature of the risks resulting from the contained). In order to indicate the nature of the risks standardized pictograms have to be used for the labeling (e.g. T for toxic, F for flammable etc.).

When more than one indicator of risk has to be allocated to a packaged waste, additional criteria need to be observed such as the optional inclusion of indicators of risk of noxious and corrosive waste and inflammable and oxidant.

The label shall be firmly fixed on the container and has a minimum size of 10 x 10 cm.

The producer of this hazardous waste has to keep a register with data on the quantity, nature, identification number according to the applicable codes, origin, methods and places of treatment, as well as the dates for the generation and transfer of the waste. In addition, the producer has to register and keep the documents of waste acceptance of the treatment installations and disposal facilities. The documents have to be kept at least for five years. During the same period the producer has to keep the examples of the document of control and monitoring from the origin and destination of the waste.

The register has to include the following data:

- origin of the waste, indicating whether these come from own generation or import

- quantity, nature and code of identification of the waste
- date of assignment of the same.
- date and description of the pretreatments
- date of commencement and termination of the temporary storage
- date and number of the tariff heading in the case of import of hazardous waste
- date and description of treatment and disposal operations
- frequency of collection and transportation

United Kingdom

[UK EA 2005a] (applying to England only) implements the European Waste List applying the six-digit code for the waste. Properties and characteristics of dangerous substances classified as hazardous waste in certain cases depend on a set of concentration limit values.

[UK EA 2005b] implements the EU Hazardous Waste (now included in the WFD) and describe categories or generic types of hazardous waste, constituents and properties of wastes which render them hazardous based on the former Directive.

A clearly arranged summary of **[UK EA 2005a]** and **[UK EA 2005b]** with regard to the steps of identifying and discerning hazardous wastes is given in **[UK EA 2005c]** (and commonly updated for England, Wales, Scotland and Northern Ireland in **[UK EA 2008h]**).

EU

The identification of hazardous waste is related to the characterisation of the composition of waste which is treated at each specific waste treatment facility. The BREF document on waste treatment **[BREF WT 2006]** lists the following procedures serving for the identification of hazardous wastes:

- **Waste composition characterisation;** this can be done e.g. by analysing the waste source sectors and typical waste arisings and composition from the sectors which deliver their waste to the corresponding waste treatment facility. Such information can provide useful indications on the content of hazardous.
- **Pre-acceptance procedure;** systems and procedures can be put in place to ensure that wastes are subject to the appropriate technical appraisal to ensure the suitability of the proposed treatment route. Specific pre-acceptance techniques and procedures applied to assess wastes are listed in [BREF WT 2006section 4.1.1.2]). Of particular relevance are e.g. procedures and techniques such as
  - providing details on the nature of the process(es) producing the waste
  - providing chemical composition of waste, its handling requirements and its hazards
  - providing and analysing a representative sample(s) of the waste from the production process producing such waste from the current holder
- **Acceptance procedure;** when the waste arrives at the treatment facility, on-site verification and compliance testing enables to confirm the identity and description of the waste and the

consistency with the pre-acceptance information and proposed treatment method. Some acceptance techniques and procedures applied are listed in [BREF WT 2006 section 4.1.1.3]) e.g.:

- not accepting wastes at the installation unless a clearly defined treatment method and disposal/recovery route is determined, together with there being sufficient capacity available at the installation before the waste is accepted. Other than pure product chemicals and laboratory smalls, no wastes should be accepted at the installation without sampling, checking and testing being carried out. Reliance solely on the written information supplied is not acceptable and physical verification and analytical confirmation is required.
- implementing of sampling procedures
- enforcing requirements that the waste is accompanied by information describing the physical and chemical composition, hazard characteristics, the presence of incompatible substances and any handling precautions. Hazardous wastes also need to be accompanied by consignment notes and this information should specify the original waste producer
- having clear and unambiguous criteria for the rejection of wastes and reporting all non-conformances
- utilising a laboratory with suitably accredited test methods to carry out the analyses
- checking the details of the waste code according to the European Waste List
- using a risk assessment procedure to select and, if necessary, to perform analysis of the waste.

- **Sampling**; sampling is typically based on a risk approach considering the hazardousness of the waste as well as the knowledge of the previous waste holder. Several issues to be considered in a good sampling procedure are listed in [BREF WT 2006, section 4.1.1.4])
- **Reception procedure**; there is usually a reception area for incoming waste where visual checks are made against the special waste consignment note and where some further sampling is undertaken before the waste is allocated. Sites tend to sample specific waste streams. Some good environmental practices applied to reception facilities are listed in [BREF WT 2006, section 4.1.1.5].

2.1.5.2 Avoiding of dilution of hazardous wastes

Following the "Report on the Implementation of Directive 91/689/EEC on Hazardous Waste" from 2009 [EU 2009], all EU Member States implemented the necessary measure for enforcing the mixing ban for hazardous wastes. However several Member States set additional requirements to avoid the dilution of hazardous waste, in particular focusing on separate storage. However particular standards and requirements regarding the dilution of hazardous waste have not been delivered by the Member States.

Belgium

For different sectors producing hazardous waste, packaging and correct labeling requirements are indicated in **[VLAREM II 2005]** to be observed during temporary storage of waste materials in anticipation of their collection and treatment. The provisions cover all types of waste except inert waste. For the treatment of waste materials, preference should be given to the processing methods specified below in decreasing order of priority:

- reuse of products;
- recycling of materials;
- energy recovery;
- incineration without energy recovery.

Only in case the best available techniques do not allow any of the aforementioned treatment method, the waste shall be landfilled at a licensed establishment.

In addition, to these general treatment requirements, hazardous waste specific requirements are defined:

- Hazardous waste materials must be regularly removed from the establishment for processing; the removal should be performed in such a way that no waste can spread outside the establishment;
- Liquid hazardous waste materials and waste oils have to be stored separately and may not be mixed in anticipation of their collection in receptacles resistant to corrosion or any other deterioration by the products they contain.
- Receptacles containing solvent-containing products or waste must be kept well sealed.
- Cleaning cloths soaked with organic solvents must be kept in closed containers after use.
- Waste materials containing asbestos fibres or dust must be treated, packed or covered while respecting local conditions and in such a way that no asbestos particles can be released into the environment.

Further, under **[VLAREM II 2005]** establishments for storage and treatment have to store hazardous waste in an impervious compartmentalised container ("secure space for hazardous household waste") or in a closed storage space, in accordance with the approved work plan. Further, a sufficient number of spare receptacles and absorbing material must be kept available at the establishment. In case a receptacle containing hazardous household waste is leaking, the receptacle or its contents are transferred to another suitable receptacle immediately and any spilled liquid is cleared. Empty contaminated recipients and contaminated absorbing material has to be removed with the hazardous household waste.

At establishments for the storage and treatment of hazardous waste and industrial wastes not indicated elsewhere additional provisions have to be observed by the operator to avoid the mixing of hazardous waste:

- “Hazardous waste must be stored in a compartmentalised storage site, possibly complemented by fixed containers or tanks for liquid wastes. The waste may only be stored in the compartments, containers or tanks designated for this purpose, in accordance with the approved work plan. Hidden pipes and/or connecting ducts between tanks or containers are prohibited.
- The spaces where liquid waste is treated and/or stored must be constructed in such a way that any liquids leaked from the receptacles or spilled accidentally are collected. The floors,

receiving drains, sumps and bund are impermeable and chemically inert with respect to the liquids they may come into contact with. Unless specified otherwise in the environmental licence, the capacity of the sumps or the bund must at least be equal to the quantity of liquids stored in the compartment concerned.

- Exceptionally hazardous waste materials, in particular compressed gases and substances that may ignite spontaneously are to be stored in a separate building, spatially separated from other buildings, storage spaces and plants. Minimum distances for this spatial separation may be imposed in the environmental licence.
- Containers, drums, tanks and receptacles containing waste materials that should be stored spatially separated because of their nature and characteristics, may not be located together in one bund.
- The containers, holders, tanks and other receptacles:

  1. are clearly labeled with the nature of the individual wastes and the relevant danger symbols;

  2. are constructed and placed in such a way that easy and representative sampling of the contents is possible;

  3. are protected in such a way that accidents and leaks during the pumping over of the waste materials are avoided as much as possible." **[VLAREM II 2005]**

Czech Republic

Following **[Czech MoE, 2005]** waste storage must meet the basic requirements that wastes must be separated from each other and sealed to avoid mixing respective waste types and to prevent release into the surrounding environment. The storage of hazardous wastes must meet the same technical and safety requirements as storage of substances, preparations and products of the same hazardous properties.

According to **[Czech MoE, 2008]** diluting or mixing waste for the purpose of compliance with criteria for its acceptance in a landfill and mixing hazardous waste with other hazardous waste or other waste is prohibited (apart from exceptional cases subject to approval by the regional authority with competence for the waste management location, where mixing hazardous waste with other hazardous waste or other waste is allowed).

Germany

[German MoE 1989] requests that solvents (no distinction of hazardous and non-hazardous ones) have to be kept separately and not mixed with other solvents or other wastes after use. Further, when the distributor takes back solvents after use (obligation), they have to be undiluted. Declaration on type of use and main substance must be attached.

The German Waste Water Ordinance **[MoE 1997]** defines in Annex 27, section D the requirements for mixing of different waste waters with each other (within the requirements for the chemical and physical treatment of waste and recycling of waste oil).

Within Paragraph 5 of the Order on commercial waste (GewAbfV) **[German MoE 2002b]** requirements for so-called pre-treatment facilities for household and similar waste are included. §5 (2) requires that all hazardous wastes have to be sorted out during the process and carried to a proper recovery or disposal. However no details (quantifications, assessment) are specified.

Luxembourg

[Luxembourg MoE 1996] requires that during storage, the hazardous waste has to be packaged and labeled accordingly to the applying standards in this field. During collection and transport, the hazardous waste must be labeled in accordance with the applying standards and packaged in watertight containers and in a perfect state of maintenance.

The Netherlands

In **[Netherland MoHPE 2007]** generic data is provided in regard to the separate collection and separation of hazardous waste. The document included information addressing also enterprises on hazardous waste separation, separate storage and separate removal.

Further, general information on the system of collection authorisations was provided. Such systems are created only if required for effective management of a specific category of waste. The collection of the categories of small hazardous waste (SHW), spent oil and ship-generated waste (broken down into waste that comes or does not come from cleaning operations) is permitted only with authorisation granted by the Minister for Housing, Spatial Planning and the Environment. For three categories of waste, including small hazardous waste, the number of collectors by means of an authorisation system is restricted to ensure that

- by limiting the number of collectors of spent oils can a processing facility be created at minimum standard level in the Netherlands;
- by limiting the number of collectors can it be ensured that small quantities of hazardous waste can also actually be collected separately and reuse of small batches is also commercially possible.

The storage of small quantities of hazardous waste and spent oils for which collection authorisation is needed is generally allowed only for collection authorisation holders; and municipalities' SCW and SHW depots.

The Waste Landfill Site and Landfill Ban Decree implements parts of the EC Directive on the landfill of waste, specifying that the period for storage prior to recovery is a maximum of 3 years. Further, it is stated that mixing is not allowed unless explicitly and specifically laid down in a collector's, treatment provider's or processor's authorisation. The principles are laid down in accordance with the provisions of the WFD.

Spain

Regarding violations of waste legislation **[Spanish MoE 1998]** specifies that the:

- mixing of different categories of hazardous waste or of those that do not have such consideration are classified as very serious violation; serious violation provided that the result of this has been a damage to the environment or human health;

- delivery, sale or transfer of hazardous waste to natural or legal persons which are not covered by the national or regional waste legislation as well as the acceptance of the same in different conditions which appear in the corresponding authorizations is classified as a very serious violation and serious violation;
- omission of needed plans for the safe management of hazardous waste is classified as a very serious violation and serious violation;
- lack of labelling or incorrect labelling or partial packaging of hazardous waste is classified as a serious violation.

The producers and operator of hazardous waste need to observe packaging requirements for hazardous waste **[Spanish MTAS and INSHT 2000]**. The requirements include that the packaging is closed and built of materials which are not susceptible of being attacked by the contents or form of the waste transported or stored. In addition, the packaging and their closures shall be solid and resistant to respond safely to the necessary manipulations and will be maintained in good condition, free from structural defects. The containers containing hazardous waste in form of gas which is compressed, liquefied or dissolved under pressure shall comply with the special legislation existing in the field. Further, the packaging and storage of hazardous waste shall be in a form that avoids generating heat, explosions, ignition, and formation of toxic substances or any negative effects on its management.

Further, the storage of hazardous waste shall be in a special storage area for such waste until its subsequent treatment. The storage of waste and the necessary facilities for the same shall comply with legislation and technical standards to be applied. The waste producer may store the waste for a maximum time of six months if not otherwise permitted.

United Kingdom

[UK EA 2005b] includes the prohibition on mixing non-hazardous waste without a permit; duty to separate mixed wastes.

According to **[UK EA 2010h]** T4 – preparatory treatments (baling, sorting, shredding etc.) are generally not allowed for all hazardous wastes.

[UK EA 2011b] emphasizes that anyone mixing or diluting hazardous waste has to hold an appropriate permit and the activity must comply with Best Available Techniques (BAT). While operations authorized under IPPC, this requirement will be applied to all permitted mixing activities (i.e. new permits issued after April 2011 and existing authorizations on their first review).

In **[UK EA 2011d]** the new guidance when applying for a new permit for a clinical waste facility, highlights that the mixing of clinical (infectious) waste with non-infectious waste during the treatment process may not be appropriate, according to the principles of the Hazardous Waste Directive.

EU

[**BREF WT 2006**] requests as one of the action taken within the reception procedure for accepting hazardous waste , is to immediately segregate wastes, to remove possible hazards due to incompatibility, which could result in the waste failing to meet acceptance criteria.

2.1.5.3 Emission related standards (air incl. odour)

Detailed information on emission related standards regarding removal operations of hazardous waste have not been delivered by the Member States. Only for Germany and the United Kingdom the below stated provision have been identified.

Germany

In **[German MoE 2002]** it is specified for sorting facilities of household waste that dust emissions may not exceed 10 mg/m^3.

United Kingdom

[UK EA 2011d] describes the appropriate measures for monitoring emissions of clinical waste treatment activities.

2.1.5.4 Emission related standards (water)

Regarding water emisssion standards for operations removing hazardous wastes information on requirements have been stated for Austria and Czech Republic as explained below.

Austria

The indicated emission limit values for water in **[Austrian MoE 1996]** do not apply to waste water from physical chemical treatment or biological treatment of waste as they are to be defined in separate legal pieces. However, in case such limit values are not set for certain substances for which limit values are defined in the Ordinance on waste water emissions and waste treatment **[Austrian MoE 1999].** The limits values are indicated in the chapter on treatment standards for C & D waste (see chapter 2.1.1).

Czech Republic

For the evaluation of waste leachability, the procedure of sampling of wastes and limit values of indicators of respective leachability classes are specified in **[Czech MoE, 2005]**.

2.1.5.5 Emission related standards (noise)

No provisions have been found issuing noise as a problem.

2.1.5.6 Specifications for Waste IN

Compared to other standards, provided information on standards regarding the incoming wastes is good. In particular Belgium and the United Kingdom give some provisions including acceptance procedures and information on wastes which are allowed to be accepted at a facility.

Belgium

[VLAREM II 2005] provides some specifications in regard to the establishments (e.g. civic amenity sites) for the storage and separation of hazardous household waste are made. Only small quantities of hazardous wastes from households may be stored at such establishments. Further, hazardous waste of industrial origin may be accepted if its nature, composition and quantity is comparable with hazardous household waste provided this does not impede the normal operation of the installation for the storage and sorting of hazardous household waste at civic amenity sites.

At establishments for storage and treatment of hazardous waste, only hazardous household and industrial wastes can be accepted when explicitly indicated in the environmental licence of the facility, and in compliance with the provisions of the applicable legislation. If it is not specified in the environmental licence which waste types can be stored and treated at the facility, the licence is limited to the waste indicated in the application for the licence.

Czech Republic

[Czech MoE, 2005]: When receiving waste, the facility operator shall ensure the tasks of visual inspection, random check and recording of amount and characteristics of the wastes accepted for management. The record shall include, in case of hazardous wastes, also information on the hazardous properties. The contents of identification sheet of hazardous waste are specified the decree.

France

In France, installations in charge of transport, repacking and pre-treatment including storage of industrial waste are obliged to follow legally binding technical instructions **[French MoE 2011]**. Installations which receive small quantities of specific waste (max. 30 litres) and certain establishments which are specialised to accept and pre-treat very small quantities of a certain waste, e.g. from laboratories, pharmaceutical products etc. the waste material can be very hazardous and is often not correctly identified. Therefore, the establishment accepting such waste must have the specific competence to accept and treat such waste.

Germany

Paragraph 4 of the German Order on commercial waste **[German MoE 2002b]** requires that mixed commercial wastes (municipal solid waste except those from private households) being destined for pre-treatment do not contain other than the wastes materials explicitly listed here and several waste

streams usually being generated at specific production facilities, listed in the Annex to the Order (keeping separate). In all categories substances are excluded if containing or polluted with hazardous substances. Organisational measures have to be taken by the waste generators to minimize impurities with other than the mentioned wastes.

Spain

[Spanish MTAS and INSHT 2000] requests the waste producer has to deliver a document with the waste characteristics to the waste treatment operator for the acceptance of the waste. The document has to include at least the following information:

- identification code
- physical-chemical properties
- chemical composition
- volume and weight
- origin

The operator of the treatment installation has to accept and confirm the receipt of the waste within one month. In case of rejection, the operator has to deliver a justification to the waste producer within the same time. Within ten days after acceptance of the waste for treatment, the operator may require additional information from the waste producer, e.g. samples. The acceptance document has to include the date of receipt of the waste, the identification number of the acceptance of the control and monitoring document delivered. For monitoring, the same identification number has to be used for the waste.

United Kingdom

The new guidance when applying for a new permit for a clinical waste facility **[UK EA 2011d]**, lists the following waste types permitted for treatment:

Table 2-59: Waste types (hazardous wastes only) permitted for treatment (permitted activity D9: physico-chemical treatment) [UK EA 2011d, p. 15]

Waste code	Description
18	Wastes from human or animal health care and/or related research (except kitchen and restaurant astes not arising from immediate health care)
18 01	wastes from natal care, diagnosis, treatment or prevention of disease in humans
18 01 03* [1)]	**wastes whose collection and disposal is subject to special requirements in order to prevent infection**
18 02	wastes from research, diagnosis, treatment or prevention of disease involving animals
18 02 02* [1)]	**wastes whose collection and disposal is subject to special requirements in order to prevent infection**
[1)] In addition, the following wastes are specifically excluded from waste treatment activities: (i): **Any waste** containing waste medicines and chemicals, waste contaminated with cytotoxic and cytostatic medicines, anatomical waste (identifiable human or animal tissue arising from healthcare), or dental	

amalgam;
(ii): **Sharps boxes** containing any of the excluded wastes from (i) and (iii) or sharps that are contaminated with pharmaceuticals in any quantity (including syringes that are fully discharged, partially discharged or undischarged).
(iii): **Biohazard waste :** Any waste known or likely to contain ACDP Hazard Group 4 biological agents; any waste from a containment level 3 laboratory: and all microbiological cultures from any source, and, any potentially infected waste from pathology departments and other clinical or research laboratories (Unless autoclaved before leaving the site of production).

Table 2-60: Permitted waste types for steam treatment in autoclaves and subsequent maceration [UK EA 2011d, p. 21]

Waste code	Description
18	Wastes from human or animal health care and/or related research (except kitchen and restaurant astes not arising from immediate health care)
18 01	wastes from natal care, diagnosis, treatment or prevention of disease in humans
18 01 03* (with or without 18 01 09)	**medicinally contaminated infectious sharps/syringes** [1)]
18 02	wastes from research, diagnosis, treatment or prevention of disease involving animals
18 02 02* (with or without 18 02 08)	**medicinally contaminated infectious sharps/syringes** [1)]

[1)] These entries are limited to medicinally contaminated sharps/syringes (including those that are fully, partially, or un-discharged) and do not include other pharmaceutical or pharmaceutically contaminated wastes.

[UK EA 2011d] describes in detail the standards and measures, mandatory for all permitted activities at facilities that treat clinical waste. Waste acceptance is made up of two separate stages of procedures referred to as waste pre-acceptance and waste acceptance.

Contrary to **[UK EA 2011d]**, for existing facilities that have conditions in their permits that relate directly to S5.06 and/or Appendix 6 (alternative treatment plant and transfer station installation permits), the new guidance will not take effect until the permit valid. Therefore, Appendix 6 **[UK EA 2004]** will still be applicable (without major differences to the new guidance).

2.1.5.7 Quality criteria for Waste OUT

There was limited no information provided regarding the quality criteria for the output of wastes of treatment facilities.

2.1.5.8 Process requirements and BAT to be taken into account

Regarding process requirements and BAT almost all assessed documents include information. The documents include information on hazardous waste types officially permitted for treatment

according to national legislation or guidance; references to applicable BAT documents, sector specific provisions and recommendations for treatment and the reference to emission limit values.

Belgium

[VLAREM II 2005] requests for the treatment of waste materials, preference should be given to the processing methods specified below in decreasing order of priority:

- reuse of products;
- recycling of materials;
- energy recovery;
- incineration without energy recovery.

Only in case the best available techniques do not allow any of the aforementioned treatment method, the waste shall be landfilled at a licensed establishment. In addition, to these general treatment requirements, hazardous waste specific requirements are defined:

- Hazardous waste materials must be regularly removed from the establishment for processing; the removal should be performed in such a way that no waste can spread outside the establishment;
- Liquid hazardous waste materials and waste oils have to be stored separately and may not be mixed in anticipation of their collection in receptacles resistant to corrosion or any other deterioration by the products they contain.
- Receptacles containing solvent-containing products or waste must be kept well sealed.
- Cleaning cloths soaked with organic solvents must be kept in closed containers after use.
- Waste materials containing asbestos fibres or dust must be treated, packed or covered while respecting local conditions and in such a way that no asbestos particles can be released into the environment.

Further, the delivery, acceptance and separation of hazardous household waste at storage and separation facilities is permitted only under supervision of the operator or his authorised representative. The operator must have adequate qualifications in chemistry and sufficient knowledge of the characteristics and dangers of the chemicals that may be accepted and of the relevant safety regulations. The operator has to inform the supervisory official of his authorised representative's name in written form.

The treatments which may be performed on the waste shall be specified in the environmental licence of a treatment facility. In case such information is not specified in the environmental licence, only the treatments specified in the application are allowed.

The hazardous household waste material accepted at storage and treatment facilities, first has to be stored in a way that any risk is avoided and shall be separated and sorted according to the chemical

composition, nature or characteristics of the different waste materials. The containers or recipients have to be clearly labeled with the nature of the individual wastes and the relevant danger symbols.

Czech Republic

[Czech MoE, 2008]: A waste producer and licensed person who has, during the previous two years, managed hazardous waste in quantities exceeding 100 tons of hazardous waste per year is obliged to ensure professional waste management through a qualified person (referred to as the "waste manager"). The duties, responsibilities and requirements of this waste manager are described in Section 15. The further obligations of waste producers with regard to waste are described in Section 16, e.g. to verify the hazardous properties of waste and to manage waste according to its actual properties.

France

[French MoE 2011] defines that the highest pollution prevention requirements shall be applied to the operator. In order to operate in a harmonised way, the operator is obliged to have agreements with the operators of disposal centres and to provide all information on the waste to the next operator. In addition, a register with details on the transactions of a specific waste is maintained for monitoring. Further a product may not be stored more than 90 days on the site, the total stock of products must be less than the amounts received in the previous two months at any time.

Germany

The following generic requirements related to design and operation of plants for sorting of household & similar wastes are requested by the **[German MoE 2002]** are:

- Facilities shall be constructed and operated (including transports) in a manner that dust emissions are avoided
- Emissions shall be collected at the source and the exhaust air shall be treated in a waste gas cleaning facility.

In **[German Bundestag 1994]** general principles and requirements for fulfilling the waste hierarchy, duties for plant operators, including specific requirements for hazardous wastes. Competences for hazardous wastes are established in § 41. Annex III lists 12 general criteria to be taken into respect when defining the best available technology.

Paragraph 5 of **[German MoE 2002b]** provides requirements for so-called pre-treatment facilities for household and similar waste accomplishing e.g. separating and sorting of metals, foils or other impurities and valuables, dewatering, homogenizing or mixing, grading or sorting using screens, air-separation or hydraulic segregation, pelletizing, drying, pressing or grinding. All hazardous wastes have to be sorted out during the process and carried to a proper recovery or disposal operations (§5 (2)). However no details (quantifications, assessment) are specified.

The Netherlands

[Netherland MoHPE 2007] refers to the minimum standards related to hazardous waste; which have been incorporated in the Dutch sectors plans in Part 2 of the NWMP In 2011 more than 80 sector plans are available in Dutch providing more detailed information on process requirements for hazardous waste (see http://www.lap2.nl/sectorplannen_09.asp). In addition, it was referred to the specific directives, decisions, reports and memoranda relating to the management of specific hazardous waste. An example of minimum standards to be applied in the Netherlands is given for contaminated soil and dredged material.

Poland

To prevent waste and develop waste management systems, the 2010 National Waste Management Plan for Poland **[Poland MoE 2006]** sets general goals to implement environmentally friendly and economically effective methods for utilization of hazardous waste based upon the best available techniques (BAT) and to complement this, e.g. by collection and monitoring measures.

United Kingdom

Part 5 of **[UK EA 2005b]** describes the requirements to notify premises and Part 6 the obligations for the movement of hazardous waste: Consignment codes, documents, procedures. Part 7 describes all obligatory records and returns during waste transports and activities, including disposal and recovery.

[UK EA 2011c] sets out the Environment Agency's regulatory position on the low risk waste activities (only within England and Wales). The Low Risk Initiative has been set up to identify low risk waste operations that are not exempt from environmental permitting but which do not justify enforcement. Where any activity has the capacity to store or treat more than 10 tonnes of hazardous waste for disposal or for some specified operations for recovery, the activity will not benefit for the Low Risk positions. In case no other quantity is specified for specific activities, a limit of 1,000 tonnes is the maximum that may be treated and stored at any one time. If an activity will involve more than 1,000 tonnes of waste the Environment Agency must be consulted before any waste activity begins to check that this guidance still applies.

[UK EA 2011d] describes the mandatory validation of treatment standards and measures for clinical waste treatment activities (D9).

[UK EA 2010i] describes for a set of waste types, among them a few hazardous ones, several specified purposes and their specific quantitative limits.

In **[UK EA 2004]** are defined the BAT in every stage of treatment of hazardous waste procedure. The areas covered are pre-acceptance procedures to assess waste, acceptance procedures when waste arrives at the installation, waste storage, treatment - general principles, immobilisation. Secondary liquid fuel, oil processing, biological process, carbon absorption , wet air oxidation, air stripping,

settlement drum washing, crushing, shredding and cutting, Road tanker washing, Sludge treatment and disposal etc.

2.2 Overview on information gathered in the course of detailed investigation of the five selected waste streams / treatment operations

Table 2-61: Contacts and sources used in the course of information collection

MS	Institution/ Contact person	Web-sources
AT	AEA (Umweltbundesamt)	• www.umweltnet.at • www.brv.at • www.bmwfj.gv.at • www.oewav.at
BE	Tom Snijkers Policy team Europe – OVAM tom.snijkers@ovam.be +32 15 284 193	• http://navigator.emis.vito.be/milnav-consult/consultatie;jsessionid=E5D75A765A3AF8D92CABA10744A57A54?language=en • http://translate.google.co.uk/translate?hl=en&langpair=fr%7Cen&u=http://environnement.wallonie.be/legis/pe/peintegr031 • http://www.feredeco.be/legislation.htm • http://translate.googleusercontent.com/translate_c?hl=en&langpair=fr%7Cen&u=http://www.feredeco.be/pdf/legislation/PTV%2520406.pdf&rurl=translate.google.co.uk&usg=ALkJrhhPheubE9DoJ7CEmEmYag-wPF1oXg • http://www.ejustice.just.fgov.be/cgi/article.pl
CZ		Reference Information Centre of the Ministry of Environment (RIC MoE): http://www.mzp.cz/C125670400839A8E.nsf/pages/czlegen
DE	Umweltbundesamt info@uba.de	• www.umweltbundesamt.de
DK	Danish Ministry of Environment bjk@etc.mim.dk; chrfi@etc.mim.dk; LETCA@MST.DK; lgr@mst.dk; bagge@mst.dk; maaja@mst.dk; pejoe@mst.dk.	• http://www.mim.dk/eng/ • http://www.mst.dk/English/
ES		• http://www.camarazaragoza.com/medioambiente/leyescat.asp • http://ec.europa.eu/youreurope/business/doing-business-responsibly/keeping-to-environmental-rules/spain/index_en.htm
FI	Ministry of the Environment (Jarmo Muurman jarmo.muurman@ymparisto.fi + 358 50 365 8872; Ari Seppanen	• www.ymparisto.fi • www.jly.fi/index.php (Finnish Solid Waste Association) • www.ekokem.fi/portal/fi/julkaisut/jatealan_o

	ari.seppanen@ymparisto.fi; +358 40 548 7275) Finnish Solid Waste Association (Markku Salo markku.salo@jly.fi +358 9 2780 0770) Ekokem Oy Ab (no response) export@ekokem.fi, +358 10 7551 000 (no response)	hjeet/
FR	No direct contacts. All information from Google searches	• http://www.aliapur.fr/modules/movie/scenes/home/ • http://www2.ademe.fr/servlet/KBaseShow?sort=-1&cid=96&m=3&catid=14663 • http://www2.ademe.fr/servlet/KBaseShow?sort=-1&cid=96&m=3&catid=12614
GR		• www.elinyae.gr/el/index.jsp
IE	No direct contacts. All information from Google searches	
IT	Passerini Tullia Passerini.Tullia@minambiente.it 0039 065722-5278 gasparrini.giuliana@minambiente.it Federico.foschini@apat.it Rosana.laraia@apat.it	http://www.minambiente.it/home_it/index.html?lang=it
LU	WORK IN PROGRESS	WORK IN PROGRESS
NL	Ministry of Housing, Spatial Planning and Environmental Management (VROM) (Kees Den Herder +31 70 339 39 39, kees.denherder@minvrom.nl)	Google searches for documents
PL	Ms Beata Klopotek Ministry for the Environment of the Republic of Poland +48 22 57 92 798 beata.klopotek@mos.gov.pl Mr Krzysztof Czarnomski Institute of Enviromental Protection - Waste Management Department +48 22 625 10 05 krzysztof.czarnomski@ios.edu.pl	Google searches for documents

	Mr Marek Matwiejczyk Poland Institute for Ecology of Industrial Areas (IETU) +48 32 254 00 15 mat@ietu.katowice.pl	
SE	Swedish Environemtal Protection Agency (David Hansson David.Hansson@naturvardsverket.se + 46 10 698 10 37; Catarina Östlund, Catarina.Ostlund@naturvardsverket.se +46-106981047; Jan Christiansson, Jan.Christiansson@naturvardsverket.se +46-106981250)	Google searches for documents
UK	No direct contacts. All information from Google searches	• http://www.environment-agency.gov.uk/business/topics/permitting/118404.aspx • http://www.environment-agency.gov.uk/business/topics/permitting/36414.aspx • http://www.netregs.gov.uk/netregs/businesses/62063.aspx • http://www.sepa.org.uk/waste/waste_regulation/application_forms/exempt_activities/paragraph_12.aspx

Contact details:

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Fax: +49-89-18979052
URL: http://www.bipro.de