EUROPEAN COMMISSION
DIRECTORATE-GENERAL JRC
JOINT RESEARCH CENTRE
Institute for Prospective Technological Studies

Integrated Pollution Prevention and Control

Executive Summary of Reference Document on Best Available Techniques for the Waste Treatments Industries

Dated August 2005

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EXECUTIVE SUMMARY

The BAT (Best Available Techniques) Reference Document (BREF), entitled 'Waste Treatments Industries' reflects an information exchange carried out under Article 16(2) of Council Directive 96/61/EC (IPPC Directive). This executive summary describes the main findings, a summary of the principal BAT conclusions and the associated emission/consumption levels. It should be read in conjunction with the preface, which explains this document's objectives; how it is intended to be used and legal terms.

This executive summary can be read and understood as a standalone document but, as a summary, it does not present all the complexities of this full document. It is therefore not intended as a substitute for this full document as a tool in BAT decision making.

Scope of this document

This document, together with other BREFs in the series, is intended to cover the activities described in Section 5 of Annex I of the IPPC Directive, namely 'waste management'. Another BREF covers waste incineration and some thermal waste treatments such as pyrolysis and gasification (point 5.2 of Annex I of the Directive). Although point 5.4 of Annex I includes waste landfills, this document does not cover BAT for landfills.

The Recovery (R) and Disposal (D) (R/D) codes of Annexes II A and II B of Directive 75/442/EEC which refer to the IPPC Directive changed according to the Commission Decision 96/350/EC. Because this last amendment corresponds to the most recent classification of R/D operation codes, the following table reflects, in agreement with the view of the IEF and TWG and following the aim of the IPPC Directive, the type of waste operation codes that are covered in this document.

Waste treatment activity	R/D code 96/350/EC
Use of waste principally as a fuel or other means to generate energy	R1
Solvent reclamation/regeneration	R2
Recycling/reclamation of other inorganic materials (excluding metals and metal compounds covered in other recovery treatments (namely R4)	R5
Regeneration of acids or bases	R6
Recovery of components used for pollution abatement	R7
Recovery of components from catalysts	R8
Oil re-refining or other uses of oil	R9
Exchange of wastes for submission to some recovery operations (numbered R1 to R11)	R12
Storage of wastes pending some recovery operations (numbered R1 to R12) (excluding temporary storage, pending collection, on the site where it is produced)	R13
Biological treatment not specified elsewhere in Annex II of 96/350/EC which results in final compounds or mixtures which are discarded by means of some of the disposal operations (numbered D1 to D12)	D8
Physico-chemical treatment not specified elsewhere in Annex II of 96/350/EC which results in final compounds or mixtures which are discarded by means of some of the disposal operation (numbered D1 to D12) (e.g. evaporation, drying, calcination, etc.)	D9
Blending or mixing prior to submission to some disposal operations (numbered D1 to D12)	D13
Repacking prior to submission to some disposal operations (numbered D1 to D13)	D14
Storage pending any of the disposal operations (numbered D1 to D14) (excluding temporary storage, pending collection, on the site where it is produced)	D15

Waste treatment activities covered in this document

A full 'life cycle assessment' applied to a certain waste can consider all the links in the waste chain as well as the impact of the final product/waste on the environment. IPPC is not intended to address these analyses but focuses instead on installations. For example, minimisation of the amount and/or toxicity of the waste produced at source in industrial installations is intrinsic to IPPC and is covered by each industrial sector BREF (see list on the reverse of the title page of this document). Another example shows that waste management also covers strategic decisions on what type of waste is dealt with in each available waste treatment/process/option or what treatment is given to such a waste. This decision depends on the waste treatment options available at local, regional, national or international level, which also depends on the location where the waste is produced.

Scope of this document should not be interpreted as any attempt to interpret IPPC Directive or any waste legislation.

General information on the waste treatment sector

The waste sector is highly regulated in the EU. For this reason, many legal definitions of terms commonly used in this sector are available. Waste treatment installations contain operations for the recovery or disposal of waste. Waste treatment installations are considered to provide services to society to handle their waste materials and sometimes these treatments generate products. As it is shown in the next table, more than 14000 waste treatment installations exist in the EU. It is clear from the table that the physico-chemical installations represent the majority of WT installations.

Waste treatment	Number of known installations
Physico-chemical treatments	9907
Waste transfer	2905
Biological treatments	615
Preparation and use of waste oil as fuel	274
Waste fuel preparation	266
Inorganic waste treatment (excluding metals)	126
Waste solvent treatment	106
Re-refining of waste oil	35
Activated carbon treatment	20
Recovery of pollution abatement	20
Waste catalyst treatment	20
Waste acid/base treatment	13
TOTAL	**14307**
Note: Figures in this table may be different to actual numbers mainly due to two reasons: On the one hand, these figures underestimate the number of installations in Europe because some EU countries have not reported their number of installations. On the other side, these numbers typically include all capacities so the number of installations falling under IPPC may be lower.	

Reported waste treatment installations in the EU

Applied techniques, emissions and consumptions in the waste treatment sector

This document provides an updated picture of the technical and environmental situation of the waste treatment sector covered. It contains a brief technical description of the activities and processes found in the sector and is complemented by the actual emissions and consumptions found in the installations. More concretely, the information in this document describes:

- commonly applied techniques such as generic management of installations, reception, acceptance, traceability, quality assurance, storage and handling, energy systems
- biological treatments such as anaerobic and aerobic digestion and off-site biotreatment of soil
- physico-chemical treatments applied to waste waters, waste solids and sludges
- recovery of materials from waste such as regeneration of acids and bases, catalysts, activated carbon, solvents and resins as well as re-refining of waste oils
- preparation solid/liquid waste fuel from non-hazardous and hazardous waste
- emission abatement treatments to air, waste water and residues generated in the WT installations).

This document also identifies the key environmental issues for the waste treatment sector. These are related with air emissions, emission to water, waste and soil contamination. However, due to the variety of waste treatments and types of waste involved, not all types of emissions are relevant for all waste treatments. For example, the emissions from the physico-chemical treatment of waste water are mainly related to waste water and the regeneration of activated carbon is mainly related to air emissions. These types of specifities are shown in this document and can guide the reader to recognise the main environmental issues for each type of installation.

Techniques to consider in the determination of BAT

940 techniques are actually included and considered in the determination of BAT. Some other techniques may not been included simply because information has not been provided. The techniques included have been analysed following the same outline. Such an analysis is reported for each technique with a brief description, the achieved environmental benefits, the cross-media effects, the operational data, the applicability and economics. In some cases, the driving force for implementation has been explored and examples of WT installations using such techniques are reported. The analysis of the techniques ends with the reference literature supporting the data in Chapter 4. The techniques have been structured in eight sections. The first one is related to generic techniques and the last three are related to end-of-pipe techniques applied in the sector. The four middle sections refer to different specific waste treatments.

Due to the high number and variety of techniques considered in the determination of BAT, it is challenging to provide a short summary. The following table was constructed in order to give a snapshot of the techniques considered in the determination of BAT within this document. The table shows for each type of waste treatment identified in this document, the number of different types of techniques. Four different categories have been identified. The first category relates to techniques for the improvement of the environmental performance of the waste treatment itself, or techniques for the prevention of contamination or the management of the waste treatment facility. The other three categories relate to a) techniques for the abatement of air emissions, b) techniques for the abatement of water emissions and c) treatment of solid residues generated during the waste treatment process as well as techniques for the control and prevention of soil contamination. In many cases, it is difficult to include some techniques in one specific category. The number of techniques in the next table do not relate with the number of sections within a section. There are many cases in this document where more than one technique is included in one section.

Type of waste treatment	Number of techniques applied to				TOTAL
	waste treatment, prevention and management	air emissions	waste water	solid residues	
Common techniques	296	26	16	31	**369**
Biological treatments	41	58	3	4	**106**

Physico-chemical treatments	133	17	4	6	**160**
Recovery of materials	44	44	19	7	**114**
Preparation of waste fuel	39	16	0	0	**55**
Air abatement treatments		57			**57**
Waste water treatments			52		**52**
Residue management				27	**27**
TOTAL	**553**	**218**	**94**	**75**	**940**

Techniques to consider in the determination of BAT

From the table above it can be easily calculated that more than half of the techniques are related to the improvement of the environmental performance of waste treatments, prevention or management techniques. The rest of the techniques are mainly devoted to the abatement of air emissions representing close to a quarter, and the rest more or less equally distributed between treatment of waste water and treatment of solid residues. From the other perspective, it can be calculated that more than a third of the techniques are considered common techniques. For the four different type of specific treatment identified, physico-chemical treatment is the section which contains the most techniques.

Best available techniques for the waste treatment sector

This document contains the determined Best Available Techniques (BAT) for the waste treatment sector. These relate to the most relevant environmental issues and typically relate to emissions from normal operation. In some situations, BAT conclusions on emissions from incidents and (major) accidents are also reported.

The BAT identified are summarised in the following table. This table cannot be properly understood if the full BAT section is not read and then cannot be used as a decision making tool. The main reason is that each BAT conclusion contains numerous details mainly relating to when the BAT conclusion is applicable. Consequently, it is essential to consult the entire BAT chapter. Some facts can be extracted from the BAT chapter:

- BAT conclusions for the waste treatment sector are set out at two levels. One level deals with generic BAT conclusions, i.e. they are generally applicable to the whole sector. The other level contains more specific BAT conclusions, e.g. those for the various types of specific processes and activities identified in the scope. So, the BAT for any specific type of waste treatment installation are a combination of the 'generic' elements generally applied and the 'activity specific' elements applicable to the particular case. In some cases, other BREF documents can give guidance and then form part of the list of documents that need to be considered when analysing a specific installation. As an example, BAT for re-refining waste oil contains the BAT elements numbered from 1 to 64 plus 95 to 104. On top of that, it may be considered that other BREF documents related to the issue may give extra guidance. Another example is that BAT for liquid waste fuels from hazardous waste contain the BAT elements from 1 to 64, 117 to 121 and 129 to 130
- some of the BATs are based on concrete techniques or technologies
- some BATs have been identified to be related to hazardous waste. Such techniques have been highlighted following a similar strategy to that used in the European waste list of the waste framework Directive
- in the determination of BAT in this sector, some associated emission levels following the use of BAT have been identified. These relate to emissions of volatile organic compounds and particulate matter to air, and water parameters such as chemical oxygen demand, biological oxygen demand and heavy metals. Moreover, emissions to air of odour and ammonia have been identified for mechanical biological treatment and emissions to water of hydrocarbons and phenols have been identified for waste oil treatment.

Category	Identified BAT elements on
Generic BAT	

Category	Identified BAT elements on
Environmental management	1. environmental management systems 2. provision of full details of the activities carried out on-site 3. having a good housekeeping procedure in place 4. having a close relationship with the waste producer/customer 5. the availability of qualified staff
Improve the knowledge of the waste input	6. having a concrete knowledge of the waste input 7. implementing a pre-acceptance procedure 8. implementing an acceptance procedure 9. implementing different sampling procedures 10. having a reception facility
Waste output	11. analysing the waste output
Management systems	12. the traceability in waste treatment 13. mixing/blending rules 14. segregation and compatibility procedures 15. the efficiency of waste treatment 16. accident management plan 17. incident diary 18. noise and vibration management plans 19. decommissioning
Utilities and raw material management	20. energy consumption and generation 21. energy efficiency 22. internal benchmarking 23. the use of waste as a raw material
Storage and handling	24. generic storage techniques 25. bunding 26. pipework labelling 27. storage/accumulation of waste 28. generic handling techniques 29. bulking/mixing techniques of packaged waste 30. the segregation guide for storage 31. the techniques to handle containerised waste
Other common techniques not mentioned before	32. using extractive vents during crushing, shredding and sieving operations 33. encapsulating the crushing and shredding of special waste 34. washing processes
Air emission treatments	35. the use of open topped tanks, vessels and pits 36. enclosing systems with extraction to suitable abatement plants 37. sized extraction systems for some storage and treatments 38. the operation and maintainance of the abatement equipment 39. scrubber systems for major inorganic gaseous releases 40. leak detection and repair procedures 41. reducing emissions of volatile organic compounds and particulate matter to the air

Category	Identified BAT elements on
Waste water management	42. water use and the contamination of water 43. effluent specification being suitable for the on-site effluent treatment system or discharge criteria 44. avoiding the effluent by-passing the treatment plant systems 45. collectioning waste waters 46. segregrating waste waters 47. having a full concrete base in all the treatment areas 48. collecting rainwater 49. re-using treated waste waters and rainwater 50. daily checking on the effluent management system and maintainance of a log 51. identifing the main hazardous constituents of the treated effluent 52. the appropriate WW treatment techniques for each type of waste water 53. increasing the reliability of control and abatement performance to waste waters 54. the main constituents of treated waste water 55. discharging of the waste water 56. the emission levels on chemical and biological oxygen demand and heavy metals associated to the use of BAT
Management of the process generated residues	57. residue management planning 58. using re-usable packaging 59. re-using drums 60. having an inventory of the waste on-site 61. re-using waste
Soil contamination	62. providing and maintaining the surface of operational areas 63. the impermeable base and drainage 64. minimising site and underground equipment
BAT for specific types of waste treatments	
Biological treatments	65. the storage and handling in biological systems 66. waste types and separation processes 67. techniques for anaerobic digestion 68. reducing the air emissions of dust, nitrogen oxides, sulphur oxides, carbon monoxide, hydrogen sulphide and volatile organic compounds when using biogas as fuel 69. the techniques for mechanical biological treatments 70. reducing the emissions of odour, ammonia, nitrous oxide and mercury from mechanical biological treatments 71. reducing the emissions to water of total nitrogen, ammonia, nitrate and nitrite
Physico-chemical treatments of waste waters	72. the techniques in physico-chemical reactors 73. additional waste water parameters needing to be identified 74. neutralisation process 75. the precipitation of the metals 76. the break-up of emulsions 77. oxidation/reduction 78. waste waters containing cyanides 79. waste waters containing chromium (VI) compounds 80. waste waters containing nitrites 81. waste waters containing ammonia 82. air abatement during filtration and dewatering processes 83. flocculation and evaporation 84. cleaning of sieving processes
Physico-chemical treatment of solid wastes	85. the insolubilisation of amphoteric metals 86. the leachability of inorganic compounds 87. restricting the acceptance of wastes to be treated by solidification/immobilisation 88. enclosed systems 89. abatement systems in charging and unloading 90. solid wastes to be landfilled

Category	Identified BAT elements on
Physico-chemical treatment of contaminated soil	91. the control of excavations 92. determining the suitability of the process to be applied 93. collecting and controlling equipment 94. the efficiency achieved during the processes
Re-refining of waste oils	95. controling of incoming materials 96. checking chlorinated solvents and polychlorinated biphenyls 97. condensation for the gas phase of the flash distillation units 98. abatement during the loading and unloading of vehicles 99. different abatements when chlorinated species are present 100. thermal oxidation 101. vacuum systems 102. using the residues from vacuum distillation or thin film evaporators 103. highly efficient re-refining processes of waste oil 104. waste water emission values for hydrocarbon and phenols
Regeneration of waste solvents	105. controlling of incoming materials 106. evaporating the residue
Regeneration of waste catalysts	107. using bag filters 108. using sulphur oxide abatement systems
Regeneration of waste activated carbons	109. quality control procedures 110. the origin of the waste activated carbons 111. using a kiln for the treatment of industrial carbons 112. using an afterburner for the regeneration of industrial carbons 113. using an afterburner for the regeneration of potable water and food grade active carbons 114. using a flue-gas treatment train 115. scrubbing systems 116. waste water treatment plants
Preparation of waste to be used as fuel	117. transferring the knowledge of the waste fuel composition prepared 118. quality assurance systems 119. manufacturing different type of waste fuels 120. waste water treatments 121. safety aspects
Preparation of solid waste fuels from non-hazardous waste	122. visually inspecting the incoming wastes 123. using magnetic ferrous and non ferrous metal separators 124. using near-infrared techniques 125. the preparation of the waste fuel at the correct size
Preparation of solid waste fuels from hazardous waste	126. drying or heating operations 127. mixing and blending operations 128. the abatement of particulates
Preparation of liquid waste fuels from hazardous waste	129. using heat-exchange units external to the vessel 130. the homogeneity of the liquid fuel

BATs for the waste treatment sector

Emerging techniques

This document also includes the techniques identified by the TWG that have not yet been commercially applied and are still in the research or development phase. However, because of the implications they may have in the waste treatment sector, they have been included here to raise awareness for any future revision of this document.

Concluding remarks

From the beginning of the information exchange process, it has been clear that there are different conceptions of what waste treatment installations should and should not be in this document. Moreover, it has been detected that some installations will be only partially affected by IPPC. Due mainly to these facts, a considerable amount of expert time has been dedicated to try to solve and understand these issues and, therefore, expert time dedicated to determination of BAT for the sector was restricted. This issue has probably restricted the amount of conclusions reached in the information exchange. Additionally, different views on the structure of this document were also discussed at the two plenary meetings (kick-off meeting and final meeting).

There are some views that the scope of this document should have covered all waste treatment activities now available in the waste sector. Their view was based on three rationales: first, the technical characteristics of such additional treatments are very similar if not equal to some of the treatments covered in this document; secondly they maintain that such issues may benefit the competitiveness of some waste treatments not covered by IPPC because such installations may be allowed to operate at less stringent environmental standards than required by BAT; and third it may be interpreted that because these treatments are not covered, no BAT can be determined and that they cannot run under BAT conditions.

A high level of consensus was reached on the BAT chapter. However, there are some views on the coverage of this document claiming that the scope of this document needs to be enlarged to include other waste treatments not covered in this actual document.

In preparation for review of this document, all TWG members and interested parties should continue to collect data on the current consumption and emission levels and on the performance of techniques to be considered in the determination of BAT.

The EC is launching and supporting, through its RTD programmes, a series of projects dealing with clean technologies, emerging effluent treatment and recycling technologies and management strategies. Potentially these projects could provide a useful contribution to future reviews of this document. Readers are therefore invited to inform the EIPPCB of any research results which are relevant to the scope of this document (see also the preface of this document).