

Guidance on best available techniques (BAT) conclusions for the production of pulp, paper and board

Foreword to the English translation of the guidance

This English version is a direct translation of the guidance written in Swedish published by the Swedish EPA in June 2018. The guidance has not been adjusted due to any changes after this date.

The intention with this English translation is to contribute to the exchange of experiences and cooperation between Member states so that the PP BATC is applied in a similar way within the EU. By addressing uncertainties and application problems in PP BATC, we hope to contribute for future BAT conclusions, both for the production of pulp, paper and board and for other industrial sectors.

As explained in the foreword below, the Swedish version of this guidance was addressed mainly to the Swedish supervisory and permit authorities, operators and other professionals within the industry. This Guidance does not contain information about the Swedish implementation of IED and BAT-conclusions in general. Neither does the guidance contain general information about of the Swedish Environmental Law system.

However, in order to understand some specific application problems that are addressed in certain parts of the guidance it may be necessary to know that BAT conclusions are implemented in Swedish law by general binding rules. The rules apply to all activities concerned without the need for a new licensing process.

The below mentioned report 6702, Guidance on industrial emissions provisions is unfortunately not available in English. For a brief overview of the Swedish implementation of the BAT conclusions, please refer to the English Summary on page 10 in the report 6702.¹

In addition to the rules implementing the BAT conclusions, IED is implemented in Swedish law by rules on the environmental permitting system and the general rules of consideration in the Environmental Code etc. For an introduction to the Swedish legal system for environmental protection in English, please refer to the Swedish EPA's report 6790, Swedish Environmental Law, which can be downloaded from the Agency's website.²

Stockholm, June 2019
SWEDISH ENVIRONMENTAL PROTECTION AGENCY

¹ <http://www.naturvardsverket.se/Om-Naturvardsverket/Publikationer/ISBN/6700/978-91-620-6702-1/>

² <https://www.naturvardsverket.se/Documents/publikationer6400/978-91-620-6790-8.pdf?pid=21184>

Foreword

The Swedish Environmental Protection Agency (Swedish EPA) has drawn up this guidance regarding the best available techniques reference (BREF) document and the best available techniques (BAT) conclusions for the production of pulp, paper and board, to support the supervisory and permit authorities, operators and other professionals linked to the sector.

The guidance also provides certain information about other BREF documents and BAT conclusions that concern pulp and paper production, known as secondary BREFs.

For general questions about Sweden's implementation of the Industrial Emissions Directive (IED) and general information about the application of IED and BAT conclusions, please refer to the Swedish EPA's report 6702, Guidance on industrial emissions provisions, which can be downloaded from the Agency's website³

During the years 2016-2017, the guidance on BAT conclusions for the production of pulp, paper and board has been referred to county administrative boards, the Swedish Forest Industries Federation and to the Land and Environment courts. A number of opinions were received. A revised version was communicated to the referral bodies in March 2018. Following receipt of further opinions, final work has been conducted to arrive at this final guidance document. During the course of the work, consultation has also taken place on an ongoing basis with the Swedish Forest Industries Federation's environmental committee and with officials at the county administrative boards. There has also been some consultation with the environmental authorities in Finland and Norway.

The guidance has been drawn up by technical officer Olof Åkesson at the Swedish EPA's climate department industrial unit, in collaboration with other legal and technical experts at the Agency.

Stockholm, June 2018

SWEDISH ENVIRONMENTAL PROTECTION AGENCY

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³ <http://www.naturvardsverket.se/Om-Naturvardsverket/Publikationer/ISBN/6700/978-91-620-6702-1/>

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1 Summary

BAT conclusions for the production of pulp, paper and board (PP BATC) were published in the Official Journal of the European Union (OJEU) on 30 September 2014 and shall be followed four years after this date, i.e. as from 30 September 2018. Before this, the BAT conclusions shall be used as references when assessing permit applications.

The scope of the BAT conclusions is the production of paper pulp from timber or other fibrous materials, as well as the production of paper and board where the production capacity exceeds 20 tonnes per day.

In the PP BATC there are various types of BAT conclusions:

- with emission levels (BAT-AEL),
- with consumption levels (BAT-AEPL),
- descriptions of technical equipment or technical solutions.

BAT-AELs, as with other BAT conclusions, shall be used as references in licensing processes according to the Swedish Environmental Code (Chapter 1 Section 13 of the Ordinance on Industrial Emissions). The emission levels in the PP BATC are specified as a range. The upper value in the range is binding unless special derogation has been granted. The lower value in the range indicates what the best installations are able to achieve.

BAT-AELs for emissions to water do not apply to dissolving kraft pulp mills, nor to sulphite pulp mills that produce dissolving pulp or speciality pulp for chemical applications. For these mills, however, other general and production-specific BAT conclusions apply to emissions to water; likewise, BAT conclusions apply to emissions to air and to other environmental aspects.

PP BATC includes BAT conclusions for combustion plants in the form of recovery boilers, lime kilns and dedicated TRS burners. For specific energy boilers with a rated thermal input exceeding 50 MW, BAT conclusions for large combustion plants (LCP BATC) apply. Smaller boilers, 5–50 MW, are covered by the Medium Combustion Plant (MCP) Directive. BAT conclusions for waste incineration (WI BATC) and waste treatment (WT BATC) may also apply to the sector.

BAT-AELs for emissions to water are specified as annual emissions in relation to the production volume (kg/ADt, i.e. kg of pollution per produced tonne of pulp, Air Dry tonnes). BAT-AELs for emissions to air are specified as a yearly average, either as concentration (mg/Nm³) or production-related amount (kg/ADt). For emissions to air, there are also a few BAT conclusions that are specified as daily averages.

The BAT conclusions are divided up such that some are general and apply to all mills, while others are specific to a particular type of production. General BAT conclusions exist in the areas of environmental management systems, materials management and good housekeeping, water and waste water management, energy consumption and

efficiency, emissions of odorous substances, monitoring of process parameters and emissions, as well as waste management.

Specific BAT conclusions exist for the production of kraft pulp, sulphite pulp, mechanical pulp and paper, chemithermomechanical pulp (CTMP), recycled fibres (RCF) and for the production of paper. These BAT conclusions relate to emissions to water, emissions to air, energy consumption and energy efficiency, materials management and waste generation.

In the case of integrated production of pulp and paper, with regard to kraft pulp, sulphite pulp and CTMP, both the BAT-AELs for emissions to water specified for pulp production and the BAT-AELs for paper production shall be taken into account. For mechanical pulp and paper, as well as for paper that is produced from recycled fibres, emissions from both pulp production and paper production are included in the BAT-AEL that is specified for the production type in question.

The waste water treatment at a mill usually comprises one system covering the various types of production that are conducted at the mill. In mills with integrated production of pulp and paper, as well as when several types of pulp or paper are produced, the permitted emissions for each production type are calculated on the basis of the applicable BAT-AEL and production volume. Finally, the emission volumes are added together for each production type, up to a total permitted emission volume for the mill.

2 Summary in the Swedish version

The Swedish version of the guidance contained an English translation of the summary in section.

3 Introduction

This report provides guidance regarding the application of BAT conclusions for the production of pulp, paper and board⁴. The guidance relates mainly to the application of BAT-AELs, as these will constitute binding emission limit values. When reading the guidance, it should be borne in mind that Sweden has chosen to transpose the BAT conclusions through general provisions, whereas in most of the other Member States this is taking place through a licensing process for the individual activity. For example, the Swedish implementation means that there is a need to specify the application of certain BAT conclusions through derogation or alternative values.

We are assuming that the guidance will be read together with the BAT conclusions for the production of pulp, paper and board, which includes all the BAT conclusions. The guidance generally follows the order in which the issues are addressed in the BAT conclusions document.

For general questions about Sweden's implementation of the Industrial Emissions Directive (IED) and the general application of IED and BAT conclusions, please refer to the Swedish EPA's report 6702, Guidance on industrial emissions provisions⁵. The operators' reporting to the supervisory authorities regarding compliance with the BAT conclusions is regulated in the Swedish EPA's regulations (NFS 2016:8) regarding environmental reports. Guidance regarding how reporting of BAT conclusions for IED activities should be carried out can be found in the Agency's "Guidance for the Swedish EPA's regulations on environmental reports"⁶.

The BAT conclusions for the production of pulp, paper and board, as well as the complete BREF document with all the supporting data chapters, can be found on the EIPPCB's website⁷.

When the Swedish EPA refers to the BAT conclusions document in this guidance, we use the term "Chapter X.X". The term "Chapter X.X" is also used for references to the BREF document, but in such cases it is specifically indicated that it is the BREF document that is being referred to. When referring to another part of this guidance, however, we use the term "Section X.X"

Page references are made to the BAT conclusions document as it has been published in the Official Journal of the European Union on 30 September 2014. We also make page references to the combined BREF document⁸, which contains supporting data and

⁴ Commission Implementing Decision of 26 September 2014 establishing the best available techniques (BAT) conclusions, under Directive 2010/75/EU of the European Parliament and of the Council, for the production of pulp, paper and board

⁵ <http://www.naturvardsverket.se/Om-Naturvardsverket/Publikationer/ISBN/6700/978-91-620-6702-1/>

⁶ <http://www.naturvardsverket.se/Stod-i-miljoarbetet/Vagledning/Vagledning/Egenkontroll-miljorapportering/Miljorapportering/>

⁷ <http://eippcb.jrc.ec.europa.eu/reference/>

⁸ Best Available Techniques (BAT) Reference Document for the Production of Pulp, Paper and Board. JRC Science and Policy Reports. 2015

background information to the BAT conclusions. In the body of the text, page references are written as “BAT page XX; BREF page ZZZ”. However, chapter numbers and table numbers are only specified as they are written in the BAT conclusions document. Chapter 1.X.X in the BAT conclusions document corresponds to 8.X.X in the BREF document. Tables 1-21 in the BAT conclusions document correspond to 8.1–8.21 in the BREF document.

In the first part of the guidance, Sections 4-18 cover issues that are common for the sector. Sections 19-23 contain guidance for the BAT that relate specifically to the various types of production (kraft pulp, sulphite pulp, mechanical pulp, CTMP pulp, recycled fibres and paper). Finally, Sections 24 and 25 contain comments in respect of common issues relating to normal operating conditions and other than normal operating conditions, as well as derogations.

4 Terms and explanations

Term	Explanation
ADt	Air Dry tonnes, expressed as 90% dryness
BAT	Best Available Techniques (Art. 3.10 IED)
BAT conclusion	Conclusion regarding best available techniques
BAT conclusions document	Commission decision with sector-specific BAT conclusions (included as a chapter in the current BREF and published in the Official Journal of the European Union)
BAT-AEL	BAT-Associated Emission Level; BAT conclusion with associated emission levels (emission values), often specified as a range (Art. 3.13 IED)
BAT-AEPL	BAT-Associated Environmental Performance Level (Section 3.3. 2012/119/EU) ⁹ . The combined term for BAT conclusions with associated environmental performance levels (values), which can cover: <ul style="list-style-type: none"> • Emission levels (emission values) • Consumption levels (consumption values) • Other levels (e.g. abatement efficiency)
BATC	BAT Conclusions document
BAT conclusion without environmental performance levels	BAT conclusion without associated environmental performance levels (values) (Section 3.3 2012/119/EU). E.g. relating to technical solutions, monitoring, materials management or environmental management systems.
BMT	Best possible techniques, according to Chapter 2 Section 3 of the Swedish Environmental Code.
BOD	Biochemical Oxygen Demand
BREF (BREF document)	BAT Reference Document; BAT reference documents in which the BAT conclusions constitute a chapter

⁹ Commission Implementing Decision 2012/119/EU of 10 February 2012 laying down rules concerning guidance on the collection of data and on the drawing up of BAT reference documents and on their quality assurance referred to in Directive 2010/75/EU of the European Parliament and of the Council on industrial emissions.

CMP	Chemimechanical pulp
CTMP	Chemithermomechanical pulp
COD	Chemical Oxygen Demand
EIPPCB	European IPPC Bureau; European bureau for the production of reference documents under IPPC and IED
OJEU	Official Journal of the European Union
FFA	Ordinance on the incineration of waste (SFS 2013:253)
FMF	Ordinance on medium combustion plants (SFS 2018:471)
FSF	Ordinance on large combustion plants (SFS 2013:252)
FMR	Swedish Environmental Protection Agency's regulations on environmental reports (NFS 2006:9)
Motives for the ordinance	Fm 2013:1 - Ordinance on Industrial Emissions
IED	Industrial Emissions Directive ¹⁰ .
IPPC Directive	Integrated Pollution Prevention and Control Directive ¹¹ .
IUF	Ordinance on Industrial Emissions (2013:250)
LCP BATC	BAT conclusions for large combustion plants
LCP BREF	BREF Large Combustion Plants
MCP Directive	Directive 2015/2193 on the limitation of emissions of certain pollutants into the air from medium combustion plants.
MPF	Ordinance on Environmental Licensing (2013:251)
MPD	County Administrative Board's Environmental Permitting Committee

¹⁰ Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control).

¹¹ Directive 2008/1/EC of the European Parliament and of the Council of 15 January 2008 concerning integrated pollution prevention and control (codified version). Repealed as from 7 January 2014 by Directive 2010/75/EU (IED).

NH ₃	Ammonia
Nm ³ tg	Normal cubic metres of dry gas; calculated gas flow at a temperature of 273.15 K and a pressure of 101.3 kPa.
NO _x	Nitrogen oxides
PP BATC	BAT Conclusions for the production of Pulp, Paper and Board
PP BREF	Best Available Techniques (BAT) Reference Document for the Production of Pulp, Paper and Board
RCF	Recycled fibres
REF	Reference document or reference report that is not a BREF, but that is used as reference for a specific subject area within the BREF process (the works process for producing BREF documents and BAT conclusions)
SO ₂	Sulphur dioxide
SÄ GF/A	Swedish abbreviation for analysis method for determining suspended substances with a glass fibre filter.
Swedish EPA	Swedish Environmental Protection Agency
TOC	Total Organic Carbon
TRS	Total Reduced Sulphur
TSS	Total Suspended Solids
TWG	Technical Working Group; Technical working group comprising representatives from the EU's Member States, affected industries and environmental organisations, which produces proposals for BREF documents and BAT conclusions under the leadership of the EIPPCB.
WI BATC	BAT conclusions for Waste Incineration
WT BATC	BAT conclusions for Waste Treatment
Emissions	Defined in the IED as a direct or indirect release of substances, vibrations, heat or noise from individual or diffuse sources in the installation into air, water or land (Art. 3.4, IED)

5 When do the BAT conclusions start to apply?

The BAT conclusions for the production of pulp, paper and board were published in the Official Journal of the European Union (OJEU) on 30 September 2014. The BAT conclusions shall be applied in full four years after their publication, i.e. on 30 September 2018, which means that BAT-AELs are binding as emission limit values as from this time. Before then, the BAT conclusions shall be used as references during the licensing process.

BAT conclusions for a particular sector are transposed into Swedish law through the transposition of new sections specific to this sector in Chapter 2 of the Ordinance on Industrial Emissions (IUF). BAT conclusions for the production of pulp, paper and board can be found in IUF Chapter 2 Sections 23–24.

In the annual environmental report, the operators shall present an account regarding compliance with the BAT conclusions. This shall be done as from the year of operations after the publication of the BAT conclusions. (Swedish EPA's regulations on environmental reports (NFS 2006:9), Section 4 a, point a.) For pulp and paper production, the first account was produced for the operating year 2015, in the environmental report that was submitted to the supervisory authority not later than 31 March 2016. See also the Swedish EPA's guidance regarding the Agency's regulations on environmental reports.¹²

5.1 Specific issues regarding the years 2018–2019

During 2018, BAT-AELs in the BAT conclusions for the production of pulp, paper and board (PP BATC) will only be binding for the last three months of the calendar year. During 2018 and 2019, the Swedish EPA considers that the emission levels should be applied as follows.

For 2018, the operator can choose between reporting

- a) a part-year average for October–December 2018, or
- b) a calendar year average for the whole of 2018.

If either of the averages a or b complies with BAT-AEL as a yearly average, it can be considered that BAT-AEL for the relevant parameter is met.

If neither of the averages a or b complies with BAT-AEL, the following should be applied:

- c) A first yearly average is calculated for a “broken” full year, i.e. for the period 1 October 2018 – 30 September 2019.
- d) For the 2019 calendar year, the emission value is also calculated as normal for the entire year, 1 January – 31 December.

In this case, both averages need to comply with the emission limit value.

¹² <http://www.naturvardsverket.se/Stod-i-miljoarbetet/Vagledning/Miljorapportering/>

The emission value c for the “broken full year” 2018–2019 can be reported together with the emission value d for the 2019 calendar year in the environmental report for the 2019 operating year.

6 Scope

(BAT page 79; BREF page 777)

The BAT conclusions concern the activities specified in Sections 6.1(a) and 6.1(b) of Annex I to the Industrial Emissions Directive, which entails the industrial production of

- pulp from timber or other fibrous materials

Comment: At sulphite pulp mills, dissolving pulp has long been produced, which is used for the production of textile fibres. For a few years, some kraft pulp mills have also been producing dissolving pulp. It is therefore appropriate to ask whether this pulp production is covered by the BAT conclusions. The processes are largely the same. As regards BAT-AELs for emissions to water, it is noted in particular that dissolving pulp is not included (kraft pulp Tables 1 and 2, sulphite pulp Tables 12 and 13). It is evident from this specific exception that other BAT conclusions do also apply to dissolving pulp, however, which consequently includes both BAT-AELs for emissions to air and BAT conclusions without emission levels.

Comment: According to Chapter 9 Section 1 of the Ordinance on Environmental Licensing (MPF), pulp production always requires a permit, irrespective of the size of the operation.
- paper or cardboard where the production capacity exceeds 20 tonnes per day.

Comment: If the company has continuous production throughout the year, 20 tonnes per day means approx. 7,000 tonnes per year. This is also the limit for the requirement for a permit for paper production according to Chapter 9 Section 2, MPF.

The BAT conclusions do not apply to:

- production of pulp from non-wood fibrous raw material (e.g. yearly plant pulp)
- stationary internal combustion engines
- combustion plants for steam and power generation other than recovery boilers (kraft pulp recovery boilers and sulphite pulp recovery boilers).
 - *Comment:* In the case of kraft pulp mills, there are often separate boilers for the destruction of odorous gases (“dedicated TRS burners”). These also produce steam. The above text could be interpreted as meaning that these dedicated TRS burners are not covered by the BAT conclusions. In the chapter for the production of kraft pulp, however, there are BAT conclusions and tables specifically for the TRS burners. Dedicated TRS burners are consequently covered by PP BATC.
 - *Comment:* Boilers for steam and electricity generation burning bark, fibre sludge, forest chips, etc., with or without added oil (fossil fuel oil, tall oil, creosote), are not covered by PP BATC. However, information about techniques and environmental performance can be found in PP BREF, Chapter 2.6. Depending on the circumstances, these boilers may be covered by LCP BATC.
- dryers with internal burners for paper machines and coaters.

7 Application of BAT conclusions for other sectors and other regulation under the IED and IPPC directives

This section clarifies how BREF documents that have been adopted under the IPPC directive, REF documents, BAT conclusions and BREF documents for other sectors, as well as certain sectoral ordinances that implement the IED, are applicable in the case of pulp and paper production alongside the main conclusions for the sector in PP BATC. In addition to that which is reported below, there can be additional reference documents that relate to the sector.

7.1 BREFs under IPPC, REFs, BAT conclusions for other sectors

On pages 79–80 of the BAT conclusions document (pages 778–779 in the BREF document), it can be seen which other reference documents may be applicable in the case of pulp and paper production. BAT conclusions in these constitute secondary conclusions. For the following sectors, there are currently (June 2018) BREFs that have been adopted under the IPPC Directive as well as BAT conclusions and BREF documents adopted under the IED.

	IPPC BREF	IED BATC
	adopted	
Industrial Cooling Systems (ICS)	2001	
Emissions from Storage (EFS)	2006	
Energy Efficiency	2009	
Large Combustion Plants (LCP)		2017
Waste Incineration (WI)	2006 ¹³	
Waste Treatments Industries (WT)	2006 ¹⁴	

Reference documents without BAT conclusions, known as REFs, which can relate to pulp and paper production:

	IPPC-REF
	adopted
Economics and Cross-Media Effects (ECM)	2006
General Principles of Monitoring (MON)	2003 ¹⁵

¹³ Work is in progress on a new BREF for waste incineration. Draft 1 published in May 2017.

¹⁴ Work is in progress on a new BREF for waste treatment. Final Draft published in October 2017.

¹⁵ Work is in progress on the reference document REF "Monitoring of emissions from IED installations, ROM". Draft published in June 2017.

The BREF and REF documents are available on the EIPPCB's website¹⁶. The status of the work regarding producing new BAT conclusions and BREFs under the IED is also updated there. At present (June 2018), work is in progress on new BREF documents for WI and WT.

The IPPC Directive has been replaced by the IED. During the licensing process, the BREF and REF documents that were drawn up under the IPPC Directive shall "be used for reference (Chapter 1 Section 13 of the Ordinance on Industrial Emissions) until such time that new BAT conclusions under the IED have been adopted. However, this does not apply to the emission values in these IPPC-BREFs. See also the Swedish EPA's general guidance on industrial emissions provisions, Sections 11.1 and 11.2¹⁷.

For installations where pulp and paper production is the main activity, i.e. the main industrial emissions activity, BAT conclusions in the above mentioned other BREFs and REFs may also apply. These are known as "secondary conclusions" as opposed to the BAT conclusions in the BREF for the main activity, which are known as "main conclusions". However, the secondary conclusions' BAT-AELs are only binding if they had been published at the time when the main BREF was published. As can be seen from the table above, no secondary conclusions had been adopted at the time when PP BATC was adopted. This means that these secondary conclusions will not be binding until four years after the time when new main conclusions (new PP BATC) have been adopted. According to the European Commission's current work plan, the BREF documents will be revised every eight years, which would mean that new BAT conclusions for the production of pulp, paper and board can expect to be adopted in 2022 and would consequently not need to be followed until from 2026. Accordingly, the secondary conclusions could need to be followed from this date.

7.2 Special boilers for steam and/or electricity generation – not waste fuels

Most mills have solid fuel boilers for the generation of steam and electricity. Common fuels include bark, fibre sludge, forest chips, fossil fuel oil and creosote. There are also separate boilers that are fired solely with oil or natural gas. None of these boilers are covered by PP BATC.

7.2.1 Combustion plants with a rated thermal input of 50 MW or more

Combustion plants that have a rated thermal input of 50 MW or more are covered by LCP BATC. For the majority of pulp and paper mills, LCP BATC will constitute secondary conclusions.

Combustion plants with a rated thermal input of 50 MW or more are also covered by the Ordinance on large combustion plants (2013:252) (Section 6). The Ordinance on large combustion plants implements Chapter 3 of the IED. For installations with several combustion plants, Section 36 of the Ordinance on large combustion plants sets out

¹⁶ <http://eippcb.jrc.ec.europa.eu/reference/>

¹⁷ <http://www.naturvardsverket.se/Stod-i-miljoarbetet/Vagledning/Industriutslappsdirektivet--IED/>

rules regarding how the thermal inputs should be added together to arrive at a combined combustion plant. See also the Swedish EPA's guidance on large combustion plants¹⁸.

7.2.2 Boilers with a rated thermal input of less than 50 MW

The intention from the outset was that solid fuel boilers (bark boilers) and other energy boilers with a rated thermal input of 5–50 MW would be included in the scope of PP BREF and that BAT conclusions would be determined. This was changed in the final stage of the work process. The reasons for this were a lack of supporting data as well as the fact that the European Commission had commenced work on drawing up a separate directive for combustion plants of between 1 and 50 MW, Medium Combustion Plants (MCP).

There are consequently no BAT conclusions in PP BATC for boilers of 5–50 MW. However, there is still information about techniques and environmental performance for these boilers in PP BREF, Chapter 2.6. "Steam and power generation in pulp and paper mills". This information can be used as supporting data during the licensing process according to the Environmental Code.

Boilers with a rated thermal input of at least 15 MW are covered by LCP BATC if, according to the summation rules, they are part of a large combustion plant (total rated thermal input of at least 50 MW)¹⁹. For a pulp and paper mill, LCP BATC then become secondary conclusions. For boilers of less than 15 MW, LCP BATC do not apply.

Under certain conditions, boilers with a rated thermal input of less than 50 MW are also covered by the Ordinance on large combustion plants. This may be the case if the combined total rated thermal input for the boilers in the installation amounts to 50 MW. The rules regarding which boilers' thermal inputs are to be added together are set out in Section 36 of the Ordinance on large combustion plants. Similarly for LCP BATC, boilers with a rated thermal input of less than 15 MW are not included. See also the Swedish EPA's guidance on large combustion plants²⁰.

An EU directive on medium combustion plants, the MCP Directive, was adopted on 25 November 2015. The Directive applies to combustion plants with a rated thermal input of at least 1 MW but less than 50 MW (Article 2.1). The MCP Directive also applies to a combination of combustion plants whose rated thermal input is 50 MW or more, if the combination does not constitute a "large combustion plant". The MCP Directive is implemented in Sweden through the Ordinance on medium combustion plants (2018:471). Guidance regarding the MCP Directive and the Ordinance can be found on the Swedish EPA's website.²¹

¹⁸ <http://www.naturvardsverket.se/Stod-i-miljoarbetet/Vagledning/Forbranning/Stora-forbranningsanlaggningar>

¹⁹ LCP BATC pages 3 and 5.

²⁰ <http://www.naturvardsverket.se/Stod-i-miljoarbetet/Vagledning/Forbranning/Stora-forbranningsanlaggningar/>

²¹ <http://www.naturvardsverket.se/Stod-i-miljoarbetet/Vagledning/Forbranning/Medelstora-forbranningsanlaggningar/>

7.3 Recovery boilers

Recovery boilers refer to kraft pulp recovery boilers and sulphite pulp recovery boilers. The recovery boilers are covered by PP BATC.

LCP BATC does not cover recovery boilers, which can be seen from the indent under the heading “Scope” on page 3 in LCP BATC:

“These BAT conclusions do not address the following: ...

- *Incineration in recovery boilers and dedicated TRS burners within installations designed for the production of pulp and paper, as this is covered by the BAT conclusions for the production of pulp, paper and board.”*

The Ordinance on large combustion plants implements Chapter 3 of the IED Directive. The Ordinance covers combustion plants with a total rated thermal input exceeding 50 MW. Guidance regarding the extent to which the Ordinance on large combustion plants applies to recovery boilers can be found in the Swedish EPA’s guidance on the application of the Ordinance on large combustion plants (2013:252) to diesel engines and recovery boilers²².

In the Ordinance on medium combustion plants, the recovery boilers are exempted according to Section 15, point 16.

7.4 Lime kilns

Lime kilns are covered by PP BATC.

LCP BATC does not cover lime kilns, which can be seen from the indent under the heading “Scope” on page 3 in LCP BATC:

“These BAT conclusions do not address the following: ...

- *Incineration in process furnaces or process heaters.”*

Lime kilns are also not covered by the Ordinance on large combustion plants, according to the exceptions in Section 15, point 1.

Section 15 *This Ordinance shall not apply to*

1. *a combustion plant where the combustion products are used for direct heating, drying or other processing of objects or materials,*

Corresponding exemptions are found in the Ordinance on medium combustion plants, Section 15, point 4.

Section 15 *This Ordinance shall not apply to*

4. *combustion plants where the gaseous combustion products are used for direct heating, drying or other processing of objects or materials,*

7.5 Dedicated TRS burners

Combustion equipment for the destruction of strong, odorous gases that arise during kraft pulp production can have various names: “TRS burner”, “Gas boiler”, etc. In PP

²² <http://www.naturvardsverket.se/upload/stod-i-miljoarbetet/vagledning/forbranning/Vagledning-forbranning-dieselmotorer-atervinningspannor.pdf>

BATC they are referred to as “Dedicated TRS burners”. PP BATC applies to these boilers.

LCP BATC does not cover TRS burners, which can be seen from the indent under the heading “Scope” on page 3 in LCP BATC:

“These BAT conclusions do not address the following: ...

- Incineration in recovery boilers and dedicated TRS burners within installations designed for the production of pulp and paper, as this is covered by the BAT conclusions for the production of pulp, paper and board.”*

As regards whether TRS burners are covered by the Ordinance on large combustion plants, Article 28 of the IED specifies which combustion plants are exempted from the scope of Chapter 3. One of these exemptions is

“b) Post-combustion plants, which are intended to clean flue gases through incineration and which are not used as a separate combustion plant.”

These exemptions are transferred to the Regulation on large combustion plants in Section 15, point 2:

“a combustion plant for cleaning gases through incineration and which is not used as a separate combustion plant (post-combustion plant),”

The wording of the IED and the Ordinance on large combustion plants is not entirely clear about which combustion plants are being referred to with the above exemption. In the previous regulation (NFS 2002:26²³, Section 1) there was an equivalent exemption, and it has been normal practice for the TRS burners to be deemed to be covered by this exemption. This conclusion is also strengthened by the fact that the emission limit values in the Ordinance on large combustion plants as regards sulphur dioxide, nitrogen oxides and carbon monoxide are significantly more stringent than the upper, binding limit of BAT-AELs in PP BATC. The Swedish EPA therefore interprets this as meaning that the TRS burners are not covered by the Ordinance on large combustion plants. Emissions from the TRS burners are regulated instead solely through the BAT conclusions in PP BREF.

The Ordinance on medium combustion plants includes an equivalent exemption.

Section 15 This Ordinance shall not apply to ...

5. combustion plants whose main purpose is the cleaning of flue gases from industrial processes,

7.6 Boilers that also burn waste

For boilers at pulp and paper mills that also burn fuel that is classified as waste²⁴, BAT conclusions for large combustion plants will apply in most cases, as LCP BATC covers co-incineration plants. Of course, a further precondition is that, in line with the summation rules in the BAT conclusions, a rated thermal input of at least 50 MW is reached for the combustion plant. Boilers with a rated thermal input of less than 15 MW

²³ The Swedish Environmental Protection Agency's regulations on emissions to the air of sulphur dioxide, nitrogen oxides and dust from combustion plants with a rated thermal input of 50 MW or more. Repealed 18 June 2013.

²⁴ Here we are referring to waste that is covered by the Ordinance on the incineration of waste (2013:253).

are not included in the total and are therefore not covered by LCP BATC. LCP BATC constitute secondary conclusions for pulp and paper mills. This means that these BAT conclusions will not be binding until four years after the next PP BATC have been published.

For boilers that burn waste, the Ordinance on incineration of waste (2013:253) also applies, which implements Chapter IV of the IED. In most cases, the boilers at the pulp and paper mills will be classified as co-incineration plants (Section 7).

At present, there are BAT conclusions for waste incineration that were adopted under the IPPC Directive (2006). Drafts for BAT conclusions for waste incineration under the IED (WI BATC) exist from May 2017 and can be found on the EIPPCB's website²⁵: According to the scope, boilers that to some extent burn waste that is covered by Article 3.31(b) of the IED are not covered. Article 3.31(b) lists:

*“iii) fibrous vegetable waste from virgin pulp production and from production of paper from pulp, if it is co-incinerated at the place of production”, and
“v) wood waste”, with the exception of certain contaminated types of wood waste.*

As this type of fuel in most cases constitutes the majority of the fuel, this scope means that the majority of pulp and paper mills' boilers will not be covered by the future WI BATC. If neither of the above fuels (iii or v) are burned, however, a boiler where e.g. residue from the recovery of recycled fibres, colours from coating or broke that contains plastic polymers (laminated paper) is burned could be covered by WI BATC, which would then constitute secondary conclusions.

Separate guidance concerning waste incineration can be found on the Swedish EPA's website²⁶:

7.7 Waste treatment

BAT conclusions for waste treatment, WT BATC, are currently (February 2018) being drawn up. Drafts for BAT conclusions were published in October 2017²⁷. The BAT conclusions ought to be published during 2018. The scope is specified in two stages. A list of points in Annex I to the IED that are covered is specified first. After that, a list containing a number of exemptions is specified.

In the first stage, the following points from Annex I to the IED are specified for the scope (the points are given here in summary):

- 5.1. Disposal or recovery of hazardous waste with a capacity exceeding 10 tonnes per day.
- 5.3. Disposal of non-hazardous waste with a capacity exceeding 50 tonnes per day.

²⁵ <http://eippcb.jrc.ec.europa.eu/reference/>

²⁶ <http://www.naturvardsverket.se/Stod-i-miljoarbetet/Vagledning/Industri-och-forbranning/Avfallsforbranning/>

²⁷ <http://eippcb.jrc.ec.europa.eu/reference/>: Best Available Techniques (BAT) Reference Document for Waste Treatment. Final draft (October 2017), JRC Science for Policy Report.

- 5.5. Temporary storage of hazardous waste not covered under point 5.4²⁸ with a total capacity exceeding 50 tonnes, excluding temporary storage, pending collection, on the site where the waste is generated.
- 6.11 Independently operated treatment of waste water outside of the installation area not covered by Directive 91/271/EEC²⁹ and discharged by an installation covered by Chapter II³⁰.

In the list of exemptions, the following can occur in pulp and paper mills. These processes are consequently not covered by WT BATC:

- direct recycling of waste as a substitute for raw materials, e.g. recycling of paper (recycled paper)
- processing of slag and bottom ashes
- waste incineration, co-incineration, pyrolysis and gasification
- landfill

Against this background, the Swedish EPA considers that the following examples of processes within pulp and paper mills could be covered by WT BATC:

- pre-treatment of waste for incineration or co-incineration
- treatment of fly ash

BAT conclusions documents are not intended to interpret other EU directives or EU ordinances. WT BATC consequently does not affect the application of EU provisions regarding criteria for what constitutes waste or by-products, or when waste has complied with the end-of-waste criterion. Nor does WT BATC affect what is deemed to be hazardous waste.

²⁸ Relates to landfills

²⁹ Council Directive 91/271/EEC of 21 May 1991 concerning urban waste water treatment

³⁰ IED activities

8 Different types of BAT conclusions

PP BATC includes various types of BAT conclusions:

- with emission levels (BAT-AEL)
- with consumption levels or other quantified values (BAT-AEPL)
- description of technical equipment or technical solution

According to the Swedish EPA's regulations on environmental reports (NFS 2006:9) Section 4 a, the environmental report shall present an assessment of how the activity complies with the BAT conclusions. Guidance on how this should take place can be found both in the Swedish EPA's general guidance on industrial emissions provisions³¹ (Section 10.4) and in the Agency's guidance on the Swedish EPA's regulations on environmental reports³².

8.1 The term "techniques"

(BAT page 80; BREF page 777)

Under the heading "General considerations" in the BAT conclusions document, it is stated that it is not a requirement to use the techniques specified in the BAT conclusions. The descriptions of the techniques are neither prescriptive nor exhaustive. Other techniques may be used that ensure at least an equivalent level of environmental protection.

It should be emphasised that the term "techniques" does not solely refer to the technical installation itself. According to Article 3.10(a) of the IED, the definition is as follows:

"techniques" includes both the technology used and the way in which the installation is designed, built, maintained, operated and decommissioned;"

The Swedish translation of this is somewhat cryptic, as the word "teknik" is present both in what is to be defined and in the definition. It is clearer in the English version, where a distinction is drawn between the terms "techniques" and "technology".

"techniques" includes both the technology used and the way in which the installation is designed, built, maintained, operated and decommissioned;"

8.2 BAT-AELs

According to Chapter 1, Section 13 of the Ordinance on Industrial Emissions, the emission levels that are specified in the BAT conclusions, BAT-AELs, shall be used as references when assessing permit conditions according to the Swedish Environmental Code. BAT-AELs are specified as a range. According to Chapter 1, Section 8 of the Ordinance on Industrial Emissions, the upper value is binding and shall be complied

³¹ Guidance on industrial emissions provisions. <http://www.naturvardsverket.se/Stod-i-miljoarbetet/Vagledning/Industriutslappsdirektivet-IED/>

³² Guidance on the Swedish Environmental Protection Agency's regulations on environmental reports. <http://www.naturvardsverket.se/Stod-i-miljoarbetet/Vagledning/Egenkontroll-miljorapportering/Miljorapportering/>

with under normal operating conditions, unless special derogation has been granted. The lower value is intended to show what the best installations in the sector are able to achieve under normal operating conditions. It is usually the case that different installations have achieved the lowest emissions for different parameters. During the assessment that is to be carried out of what are to be considered best possible techniques (BMT), according to Chapter 2 Section 3 of the Swedish Environmental Code, BAT-AELs constitute supporting data alongside other information. The starting point for the BMT assessment ought to be the lower value in the BAT-AEL range. The development of techniques after the supporting data was collected for the BAT conclusions may mean that BMT, up to and including the time in question, are lower than the lower end of the BAT-AEL range. This shall then be subject to an assessment of reasonability according to Chapter 2 Section 7 of the Swedish Environmental Code.

In the application of a specific case, it should be borne in mind that the primary collection of supporting data, which has subsequently been used for determining BAT-AELs, took place back in 2007–2008 (there have been some supplements since then, however). The BAT conclusions are static until the next revision is carried out. The development of best possible techniques takes place continually, however, and the differences between the BAT conclusions and BMT can there be expected to increase over time.

In the report of how BAT-AELs are complied with, measured emissions from the activity ought to be recalculated and specified in the unit in which the BAT-AELs are specified. In the case of integrated pulp and paper mills and where several types of pulp are produced, a calculation and a summation are required in order to arrive at the emission value that shall be met by the combined production in the mill. It is important that this calculation is also reported, so that it is clear to the supervisory authority how it has been performed. See more about calculations in Section 24 below.

8.3 BAT conclusion without emission levels

As stated in Chapter 1, Section 10 of the Ordinance on Industrial Emissions, consideration shall be given to BAT conclusions that include precautions other than emission levels when assessing whether an industrial activity is being operated in accordance with the requirement for best possible techniques according to Chapter 2, Section 3 of the Swedish Environmental Code. According to Chapter 1, Section 13 of the Ordinance on Industrial Emissions, consideration shall also be given to these BAT conclusions when assessing permit conditions according to the Swedish Environmental Code.

For the techniques specified in the BAT conclusions for pulp, paper and board, it is stated, with slightly different wording, that BAT are to “use a suitable combination of the techniques specified below”. This means that it is not necessary for all techniques to be used. Other techniques that ensure an equivalent level of environmental protection may also be used (cf. “General considerations”, page 80 in the BAT conclusions document).

In conjunction with the licensing process and in the environmental report, an operator shall detail how it fulfils the demand to use a technique that corresponds to the technique specified in the BAT conclusions.

8.3.1 BAT conclusions with techniques where there are also BAT-AELs

Some BAT conclusions in PP BATC contain both BAT-AELs and techniques that comply with BAT. In the opinion of the Swedish EPA, in such BAT conclusions, in order for the BAT conclusion to be deemed met, it is essential that the technical solution ensures an emission level that does not exceed the upper BAT-AEL value. For these BAT conclusions too, however, it is necessary for the techniques that are described to be used as references during the licensing process according to the Swedish Environmental Code, in which case more far-reaching requirements may be stipulated.

8.3.2 BAT conclusions solely with techniques

Some of the BAT conclusions in PP BATC only contain descriptions of techniques, i.e. there are no BAT-AELs in the BAT conclusion. These BAT techniques are not binding either. In most BAT conclusions, this is formulated such that BAT are to “use a combination of the techniques” that are specified. In some BAT conclusions, however, wordings are used other than those included in BAT, for example:

“implement and adhere to an environmental management system (EMS) that incorporates all of the following features” (BAT 1)

“In order to reduce fuel and energy consumption.... use technique (a) and a combination of the other techniques” (BAT 6)

“In order to reduce emissions of pollutants... use all of the techniques given below” (BAT 14)

“When further removal of organic substances, nitrogen or phosphorus is needed, BAT is to use tertiary treatment...” (BAT 15)

“In order to prevent pollution risks when decommissioning a plant, BAT is to use the general techniques given below.” (BAT 18)

In conjunction with the licensing process and in the environmental report, an operator shall also detail how it complies with BAT conclusions using only techniques³³. As there is no direct link to a particular BAT-AEL, it is not possible to use BAT-AELs to determine whether the BAT conclusion is complied with or not. If the operator has selected techniques other than those specified as BAT, it must demonstrate that the selected design ensures at least equivalent environmental protection.

In certain BAT conclusions, it is stated that the applicability for the BAT technique is limited under certain conditions. The operator should demonstrate to the supervisory authority in the specific case in question that this is the case.

If it is deemed reasonable and after an assessment in accordance with Chapter 2, Section 7 of the Environmental Code, the supervisory authority may stipulate requirements in

³³ <http://www.naturvardsverket.se/Stod-i-miljoarbetet/Vagledning/Miljorapportering/>

the form of injunctions whereby the operator must use techniques that correspond to BAT. However, more stringent demands may not be stipulated in a matter that is already regulated in a permit according to the Environmental Code. In such cases, a reassessment of the permit has to be initiated. Only BAT-AELs may restrict the scope of the permit.

8.3.3 BAT conclusions with numerical values

In the BAT conclusions document there are BAT conclusions that contain numerical values, but that do not constitute BAT-AELs. These BAT conclusions with numerical values therefore do not constitute binding emission limit values, but shall be used as references during the licensing process. They shall also be verified in the same way as other BAT conclusions without emission levels.

PP BREF contains the following BAT conclusions with numerical values, which do not constitute BAT-AELs:

- Effluent flow for dry debarking (Chapter 1.1.3, BAT 4, page 86; page 784)
- Effluent flow “at the point of discharge after treatment” (Chapter 1.1.3, BAT 5, page 87; 785)
- Concentration of BOD (oxygen consumption during biological decomposition of waste water) after treatment (kraft pulp, Chapter 1.2.1 page 96 (page 793), sulphite pulp 1.3.1 page 106 (page 801), mechanical pulp, CMP and CTMP pulp 1.4.1 page 110 (page 806), recycled fibres 1.5.2 page 113 (page 809) and papermaking 1.6.1 page 116 (page 811)).
 - *Comment:* The BOD concentration can be perceived as an emission value and consequently as a BAT-AEL. However, the wording is open (“is expected to be low (around 25 mg/l as a 24-hour composite sample)”). It was also clear, when the wording was adopted at the concluding TWG meeting, that the intention with the value was that it should act as an operating control, not an emission value with the status of BAT-AEL.

Note that operators in the environmental report shall present an assessment of how they also comply with these BAT conclusions. As the BAT conclusion contains a numerical value, a corresponding numerical value for the installation should be presented. Reference can be made to the other parts of the environmental report, e.g. the text section.

9 Alternative and parallel BAT-AELs

9.1 BAT-AELs specified for the same averaging period but different units

In some cases, BAT-AELs for emissions to air have been specified for the same averaging period but in different units, i.e. both as concentration (mg/Nm³) and as production-related amount (kg/ADt pulp, kg/tonne paper). In such cases, it is specified (BAT conclusions document page 80; BREF document page 778) that only one of the two values needs to be met, i.e. either concentration (mg/Nm³) or production-related emission amount (kg/ADt pulp, kg/tonne paper).

In order for two BAT-AELs to be considered alternatives, they must relate to the same parameter. This can be open to interpretation in certain cases, and is commented on in greater detail in the relevant sections.

BAT-AELs that are affected by this relate to the production of kraft pulp and are as follows.

<i>BAT</i>	<i>Table</i>	<i>Process</i>	<i>Parameter</i>	<i>Commented on in the guidance, Section</i>
21	3	Recovery boiler	SO ₂ , TRS, Gaseous S	19.2.6.1
22	4	Recovery boiler	NO _x	19.2.6.2
23	5	Recovery boiler	Dust	19.2.6.3
24	6, 7	Lime kiln	SO ₂ , TRS, Gaseous S	19.2.7.1
26	8	Lime kiln	NO _x	19.2.7.2
27	9	Lime kiln	Dust	19.2.7.3
28	10	TRS burner	SO ₂ , TRS, Gaseous S	19.2.8.1
29	11	TRS burner	NO _x	19.2.8.2

9.2 BAT-AELs specified with different averaging periods

In some cases, BAT-AELs have been specified both as daily average (concentration, mg/Nm³) and as yearly average (production-related amount, kg/ADt pulp, kg/tonne paper) for the same emission parameter. There is no exemption that would mean that it is sufficient to comply with either the short-term value or the long-term value. This means that BAT-AELs specified as daily average and as yearly average apply in parallel and that both shall be met.

BAT-AELs with both daily average and yearly average exist for the production of kraft pulp (BAT 21; Table 3) and sulphite pulp (BAT 36 and 37; Tables 14 and 15).

10 Calculation of emission levels

10.1 Emissions to water

(BAT page 80; BREF page 778)

10.1.1 Daily average

For emissions to water, there is no BAT-AEL specified as a daily average. The definition of daily average is therefore only of significance for the calculation of yearly averages and possibly for the BAT-AEPL that is specified for BOD after treatment (25 mg/l).

As a general rule, daily average shall be based on flow-proportional composite samples. The composite sample is analysed and only one test result is then generated during the 24-hour period, which thereby constitutes the daily average. The definition provides an opportunity to use time-proportional sampling, if the flow can be demonstrated to be sufficiently stable. In order for time-proportional sampling to be accepted, the operator should in particular demonstrate to the supervisory authority the forms that variations in flow and concentration can take and that time-proportional sampling gives a correct picture of the extent of the emissions.

In footnote 1 (page 80; page 778), it is stated that other sampling procedures may be necessary in special cases, e.g. grab sampling. However, the Swedish EPA finds it difficult to see how grab sampling would be necessary or acceptable other than in temporary cases, such as when regular sampling equipment is out of order.

10.1.2 Yearly average

Yearly average is defined as follows (BAT conclusions document, page 80; page 778):

“Average of all daily averages taken within a year, weighted according to the daily production, and expressed as mass of emitted substances per unit of mass of products/materials generated or processed.”

This definition is a little difficult to understand. It can be described and calculated more easily as “the sum of the emission amount during the year divided by the sum of production during the year”.

If it becomes necessary to exclude part of the year as “other than normal operating conditions”, both the emission amount and the production amount during the period of “other than normal operating conditions” need to be registered in order subsequently to be deducted when calculating the emission value that is to be compared with BAT-AEL.

According to the definition, the yearly average shall be calculated on the basis of the “daily averages”. At Swedish mills, it has been normal practice to take 24-hour daily samples from Monday–Thursday, and then a composite sample from Friday–Sunday, which will then cover 72 hours. The reason for this is savings in terms of personnel during weekends. The 72-hour samples are consequently not entirely in accordance with

the BAT conclusions. In order to calculate the emission amount from Friday–Sunday, the concentration in the 72-hour sample is used together with the waste water flow during the 72 hours that the sample encompasses. Using the method of calculating the yearly value recommended above by the Swedish EPA, there is then no difference in the final result compared to if the three 24-hour periods are analysed individually. However, the variations in the emissions over the three days will not be evident when taking a weekend composite sample, which is the case if a composite sample is analysed every day. Weekend samples may also mean that disruptions in operations are discovered later than would have been the case with daily samples. In order to ensure that operational disruptions resulting in increased emissions are discovered quickly, continuous monitoring of conductivity and pH in the waste water is both common practice and recommended. See also BAT 8 II, where BAT are specified for process parameters that are important for emissions to water, including continuous monitoring of water flow, temperature and pH value.

In our judgement, 72-hour weekend samples may also be accepted in future.

10.2 Emissions to air

(BAT page 81; BREF page 779)

10.2.1 Daily average and average over the sampling period

Definition of “Daily average”

“Average over a period of 24 hours based on valid hourly averages from continuous measurement.”

Definition of “Average over the sampling period”

“Average value of three consecutive measurements of at least 30 minutes each.”

The BAT-AELs that are specified as daily averages relate to concentration, mg/Nm³ and can be found in Table 3 (kraft pulp) and Tables 14 and 15 (sulphite pulp). There is also a BAT-AEL for concentration where the averaging time is the sampling period in Table 15 (sulphite pulp).

As the flue gas flow can vary over a 24-hour period, the daily average should be calculated with reference to the flue gas flow over each hour, in order thereby to achieve a flow-proportional daily average for the concentration. The calculation is performed as follows:

$$C_d = \frac{c_1 * q_1 + c_2 * q_2 + \dots + c_{24} * q_{24}}{q_1 + q_2 + \dots + q_{24}}$$

where

C_d = daily average for the concentration of the pollution

c_1, c_2, \dots, c_{24} = pollution concentration during hour 1, 2 up to and including hour 24

q_1, q_2, \dots, q_{24} = flue gas flow during hour 1, 2 up to and including hour 24

The calculation means that the emitted amount is calculated in the numerator, which is given the unit kg/day. The total flue gas volume during the day is calculated in the denominator, with the unit Nm³/day. By dividing the total emission amount by the total flue gas volume during the day, this arrives at a flow-weighted average for the concentration during the day, in the unit mg/Nm³.

In the above formula, the number of hours has been set at 24 for the sake of clarity. If, during the course of the day, there has been an operational stoppage or if there have been other than normal operating conditions, such hours shall be excluded. For hours with “other than normal operating conditions”, both the emission amount and the production amount during the period of “other than normal operating conditions” shall be registered and then deducted.

The calculation of “average over the sampling period” should take place in a corresponding manner to the daily average. As regards the length of the measurement period, it is specified as “at least 30 minutes”, which is consequently a minimum. An assessment should be carried out in the individual case in question regarding how long the measurement period should be, giving consideration to the variation in emissions over the period. Nothing is specified regarding the length of time between each measurement period. The starting point ought to be that the measurements should be spread evenly over the year, bearing in mind variations and the occurrence of different operating conditions, in order to achieve as representative an emission value as possible.

A BAT-AEL specified as daily average shall be included for every day during the year, apart from those whole days or parts of days when there have been other than normal operating conditions. The same applies to a BAT-AEL specified as “average over the sampling period”, which shall be complied with over all sampling periods, excluding other than normal operating conditions.

10.2.2 Yearly average

PP BREF includes yearly averages specified as:

- concentration, mg/Nm³
- amount related to production, kg of pollution per tonne of product (ADt or tonne of paper)

“Yearly average” for emissions to the air is defined (page 81; page 779) as follows:

“In the case of continuous measurement: average of all valid hourly averages.”

“In the case of periodic measurements: average of all ‘averages over the sampling period’ obtained during one year.”

10.2.2.1 YEARLY AVERAGES FOR CONCENTRATION

BAT-AEL as yearly averages specified as concentration, mg/Nm³, can be found in Tables 3-9, 10 and 11 (kraft pulp) as well as 14 and 15 (sulphite pulp). For some of the parameters in these tables, “continuous” is specified for the measurement in BAT 9, whereas for other parameters “periodic or continuous” measurement is specified, and for one parameter only “periodic”.

According to the definition of yearly average (page 81; page 779), in the case of continuous measurement, the yearly average shall be calculated as the average of all valid hourly averages. In the case of periodic measurements, it is stated that the yearly average shall be calculated as an average for all “averages over the sampling period” over one year.

The yearly average for concentration should be calculated in a corresponding manner to that described above in Section 10.2.1 when calculating the daily average for concentration. In order to obtain a flow-proportional yearly average in this way, the calculation – the integration – shall cover all the operating hours over the year, according to the following formula:

$$C_{year} = \frac{c_1 * q_1 + c_2 * q_2 + \dots + c_{8760} * q_{8760}}{q_1 + q_2 + \dots + q_{8760}}$$

where

C_{year} = yearly average for the concentration of the pollution

$c_1, c_2, \dots, c_{8760}$ = pollution concentration during hour 1, 2 up to and including hour 8760

$q_1, q_2, \dots, q_{8760}$ = flue gas flow during hour 1, 2 up to and including hour 8760

In the above formula, the number of hours has been set at 8,760 for the sake of clarity, i.e. all the hours in the year. If, during the course of the year, there has been a stoppage in operations or if there have been other than normal operating conditions, such hours shall be excluded. For hours with “other than normal operating conditions”, both the emission amount and the production amount during the period of “other than normal operating conditions” must be registered and then deducted.

In the case of periodic measurement, a corresponding calculation is performed for each measurement period. For final calculation of the yearly average, the emission amounts for all the various measurement periods are added together and divided by the total air flow.

10.2.2.2 YEARLY AVERAGES FOR PRODUCTION-RELATED AMOUNT

Yearly averages for production-related amount are specified in the unit kg/ADt or kg/tonne of paper. As set out above, according to the definition (page 81; page 779), the yearly average for emissions to the air shall be calculated as the average of all the hourly averages.

The emission amount is calculated by means of concentration and air flow being multiplied for each hour (kg/hour), after which all the values for the year are added together to arrive at an annual emission (tonnes/year). The production amount is then calculated for the whole year (ADt/year or tonnes of paper/year). Finally, the emission amount is divided by the total production during the year, after which a specific emission value is obtained (kg/ADt or kg/tonne of paper). Formula:

$$U_{year} = \frac{c_1 * q_1 + c_2 * q_2 + \dots + c_{8760} * q_{8760}}{P_{year}}$$

where

U_{year} = emitted amount of emissions per year relative to the production volume

$c_1, c_2, \dots, c_{8760}$ = pollution concentration during hour 1, 2 up to and including hour 8760

$q_1, q_2, \dots, q_{8760}$ = flue gas flow during hour 1, 2 up to and including hour 8760

P_{year} = amount of pulp or paper produced per year

In the above formula, the number of hours has been set at 8,760 for the sake of clarity, i.e. all the hours in the year. If, during the course of the year, there has been a stoppage in operations or if there have been other than normal operating conditions, such hours shall be excluded. For hours with “other than normal operating conditions”, both the emission amount and the production volume during the period of “other than normal operating conditions” must be registered and then deducted, in order to be compared with BAT-AEL.

When periodic measurements are applied, the production volume during the measurement period must be registered and production-related emissions (kg/ADt, kg/tonne of paper) for the measurement period must be calculated. A precondition, however, is that the pulp production is in relation to the operation at the combustion unit being measured. For example, if a combustion unit (recovery boiler, lime kiln, dedicated TRS burner) is running at “half-speed” during measurement, while pulp production is being conducted at full speed, the emission value arrived at is too low. On the other hand, if the combustion unit is running at full speed but pulp production is low, the emission value will be too high.

The results from the periodic measurements may then be used for calculating the yearly average.

10.2.3 Excess oxygen

(BAT pages 80-81; BREF page 778)

The emission levels in the form of concentrations, mg/Nm³ dry gas, apply at a given oxygen content. The formula on page 81 (page 778) is used to convert the actual oxygen content during measurement to the oxygen content at which BAT-AEL is specified. For the production of kraft pulp, the oxygen content in BAT-AELs for recovery boilers and lime kilns is set at 6%, while the oxygen content for a dedicated TRS burner is set at 9%. For recovery boilers at sulphite pulp mills, on the other hand, the oxygen content is

specified as 5%. The various oxygen contents that have been selected do not fully reflect normal oxygen contents in actual operations. The recovery boilers' oxygen content is normally lower than 6%. The oxygen content in TRS burners is usually higher than in other boilers, which is why the higher oxygen content for TRS burners is justified in practical terms. In the opinion of the Swedish EPA, there are no objective grounds for the sulphite boilers' oxygen content being set at 5%, other than that the oxygen content has been specified as 5% in the supporting data for sulphite boilers.

In Sweden, permit conditions according to the Environmental Code for emissions from recovery boilers and lime kilns have previously often failed to include any specification of oxygen content. In such cases, this means that the permit condition according to the Environmental Code applies at the actual oxygen content as observed at the time of the measurement. As BAT-AELs now have a specified oxygen content, the oxygen content must be registered and conversion performed to 6% oxygen. The same applies to the recovery boilers, although the conversion then shall be to 5% oxygen content.

11 Materials management and good housekeeping

(Chapter 1.1.2, BAT page 85; BREF page 783)

The chapter “Materials management and good housekeeping” generally applies to all production types.

In BAT 2 a–g, a number of techniques are specified as BAT for the handling of chemicals in the production process. These BAT relate both to the selection of chemicals that are used, as well to measures for minimising emissions to the surroundings. More information and facts can be found in the BREF document, Chapter 2.3.2, pages 65-71:

- 2.3.2.1 Use of basic chemicals and chemical additives
- 2.3.2.2 EU regulations on the storage, handling and use of chemicals
- 2.3.2.3 Storage, handling and use of chemicals

BAT 3 a–c specifically address the use of chelating agents. More information can be found in the BREF document:

- 2.9.9 Reduction of emissions from the use of chelating agents in peroxide-based bleaching technologies
- 3.4.6 Removal of chelating agents by modest alkaline biological treatment or its recovery by use

Chapter 2.9.9 in the BREF document addresses how to follow up the use and emissions of chelating agents, how the process conditions affect the need for chelating agents, as well as presenting which biodegradable alternatives exist for the commonly used chelating agents EDTA and DTPA (BAT 3a, b and c). Chapter 3.4.6 highlights methods for reducing emissions of EDTA/DTPA, either through biological waste water treatment or through recovery of the chelating agent, “kidney” (BAT 3 b).

12 Water and waste water management

(Chapter 1.1.3, BAT pages 86-87; BREF pages 784-785)

This chapter generally applies to all production types. However, BAT 4 only applies to activities that handle wood as the raw material, i.e. cannot be applied to non-integrated paper mills.

BAT 4 (BAT page 86; BREF page 784) specifies techniques, points a–e, for reducing the generation and the pollution load of waste water from wood storage and preparation.

BAT 4 also specifies BAT-AEPL for the effluent flow from “dry debarking”, 0.5–2.5 m³/ADt. The effluent flow that is specified is the same for all types of pulp production.

The wood yield (tonne of produced pulp per tonne of wood) differs substantially between different pulp types. For example, the wood yield for kraft pulp is normally 40–50%, while for mechanical pulp it can be more than 90%. This means that even though the effluent flow from debarking is the same calculated per tonne of wood (or calculated per m³fub = cubic metres of timber measured under bark, which is the method normally used for wood consumption), the effluent flow for the production of chemical pulp will be approximately double that observed during the production of mechanical pulp.

BAT 5 (BAT page 86; BREF page 784) states that in order to reduce fresh water use and generation of waste water, BAT is to close the water system to the degree technically feasible in line with the pulp and paper grade produced. This can be carried out through a combination of the techniques specified in points a–g.

BAT 5 (BAT page 87; BREF page 785) specifies BAT-AEPL for total effluent flow at “the point of discharge after waste water treatment”. Here, the values are specified for each pulp type and for paper production.

A smaller amount of waste water can enable more extensive treatment and reduced pollution emissions. Energy consumption and chemical consumption can also be reduced if water usage and effluent flow are reduced. However, excessive closure of the process can cause problems with high levels of non-process substances and incrustations (coatings), as well as problems with bacteria and foaming.

At some mills, not all waste water is routed to a treatment plant. Instead, through containment and similar, i.e. measures at the source, the waste water’s pollution content has been reduced so that it can be released out into the receiving water without external treatment. This non-treated waste water should also be included in the waste water amount to which BAT-AEPL relates, however. Cooling and sealing water does not need to be included in the waste water flow, however.

Additional comments regarding various types of waste water can be found in Section 17.

13 Energy consumption and efficiency

(Chapter 1.1.4, BAT pages 87-88; BREF pages 785-786)

BAT 6, points a–j, contains general BAT conclusions for energy consumption and energy efficiency. More specific technical BAT conclusions for each type of pulp and paper production can be found in the specific chapters for each production type. See comments below in Sections 19-23.

In the previous BREF from 2001 for the production of pulp and paper, under the IPPC Directive, numerical values were also specified for what were considered to be BAT for the consumption of thermal energy or the consumption of electricity. Such BAT conclusions are not present in the new BREF document under the IED.

The previous proposals for the new BREF included BAT conclusions with consumption values specified for energy usage. These BAT-AEPLs were later removed, however. The reason was said to be that far too few Member States had contributed with consumption data from their installations, and that there was a lack of clarity regarding how the energy consumption should be calculated. In the final BREF document, it is highlighted as a particular deficiency that BAT-AEPLs in respect of energy consumption have not been able to be specified, and that there is a need to gather information using a harmonised method during the next review of PP BREF (Chapter 9 of the BREF document).

Data regarding energy consumption and assessments of what can be deemed possible to achieve as regards the consumption of heat and electricity are now only present in the supporting data chapters for each sector. This supporting data has consequently not been deemed to be sufficient to specify BAT-AEPLs, but can nevertheless be taken into consideration during the licensing process according to the Environmental Code, in order to judge which levels can be considered best possible techniques.

As regards energy efficiency, there is an earlier “horizontal” BREF from 2009, which has been adopted under the IPPC directive. Horizontal refers to the fact that it applies to several sectors, which means that it is more general than the sector-specific BREFs.

Overall information about energy usage and energy production at pulp and paper mills can be found in the following chapters in the BREF document.

- 2.5 Energy consumption in pulp and paper mills
- 2.6 Steam and power generation in pulp and paper mills

More specific background information for BAT 6 can be found in the following chapters (headings and BAT conclusions are presented in abbreviated form).

BAT	Technique	BREF	BREF
6	<i>In order to reduce fuel and energy consumption</i>	chapter	pages
6 a	Energy management systems	2.9.5	125-128
6 b	Incineration of residues from production with a high calorific value		
6 c	Heat and power	2.9.6.1.2.2 2.9.6.3	89-91 136-141
6 d	Use excess heat for the drying of biomass, preheating of boiler water, heating of buildings, etc.	2.9.6.1.4	131-133
6 e	Thermo compressors	2.9.6.1.2	129-130
6 f	Insulate pipe fittings	2.9.6.1.3	131
6 g	Energy-efficient vacuum systems for dewatering	2.9.6.1.1 2.9.6.2.1	129 134
6 h	High efficiency electrical motors, pumps and agitators	2.9.6.2.2	134-135
6 i	Frequency inverters for fans, compressors and pumps	2.9.6.2.3	135-136
6 j	Match steam pressure levels with actual pressure needs		

14 Emissions of odour

(Chapter 1.1.5, BAT pages 88-89; BREF page 786)

BAT 7 specifies techniques for preventing and reducing the emission of odorous compounds originating from the waste water system. The BAT conclusion is divided up into techniques

- I. Applicable for odours related to water systems closure
- II. Applicable for odours related to waste water treatment and sludge handling

The wording of the text means that the production types to which BAT is to be applied can seem unclear. There is an introductory paragraph for the chapter which refers to process-specific techniques at kraft and sulphite pulp mills, which is reproduced in the specific chapters for these production types. The first BAT conclusion, I a, begins with the wording “Design paper mill processes, ... etc.”.

The Swedish EPA interprets this as meaning that the intention of the reference in the introductory paragraph is solely to indicate that, in other parts of the BAT document, there are further BAT techniques specifically for kraft and sulphite pulp mills. However, BAT 7 applies to all types of pulp and paper production.

As regards BAT 7 I a, the text can be interpreted as meaning that this is referring to paper mills in the first instance, although in practice the technique ought to apply to pulp production as well. BAT I b and c, as well as BAT 7 II, should also be applied generally.

15 Monitoring and measurement

(Chapter 1.1.6, BAT pages 89-91; BREF pages 787-788)

BAT 8-11 specify what are BAT in respect of ranges for monitoring and measurement.

- BAT 8 Key process parameters for emissions to water and air
- BAT 9 Emissions to air
- BAT 10 Emissions to water
- BAT 11 Emissions to air of diffuse total reduced sulphur emissions

These BAT conclusions do not contain emission levels and are consequently not binding. However, they should be used as a starting point for self-monitoring and inspection programmes. The specified measurement frequencies and measurement methods have been drawn up so that they can form the basis for calculations of BAT-AELs as daily and yearly averages.

15.1 Emissions to air

(BAT 8 and 9, BAT page 90; BREF page 787)

15.1.1 Periodic or continuous measurement

For the process parameters in BAT 8:I, it is stated that monitoring shall take place through continuous measurement. This relates to standard parameters that are applied at most installations.

For the emissions parameters in BAT 9, it is stated in certain cases that the monitoring frequency can be “Periodic or continuous”. Periodic measurement often takes place for a short period, typically for around an hour, and provides a snapshot of the emissions situation. How representative this is depends on how often periodic measurement takes place and how much the emissions vary. The advantage of continuous measurement is that it includes all variations in the process, and that it is thereby possible to achieve a considerably more reliable and accurate determination of emissions over time. Continuous measurement also provides knowledge about how emissions are affected by various operating parameters and consequently the potential for control in order to minimise emissions. Continuous measurement instruments obviously entail an investment cost, as well as requiring maintenance and calibration. On the other hand, there is less investment for in-house manual measurements and for inspection measurements by measurement consultants. As regards dust, there are differing opinions about the reliability of continuous measurement instruments.

An operator’s obligation to monitor the activity is based on Chapter 26 Section 19 of the Environmental Code. There are also provisions in the Ordinance on operator self-monitoring (1998:901) and in the Swedish EPA’s regulations on measurement (2000:15). The latter also contains general advice.

More detailed information about how monitoring is to be performed is usually documented in a separate monitoring programme. Some monitoring may also be

specifically regulated through separate conditions in the activity's permit according to the Environmental Code. It is not definite that the conditions prescribed in the activity's permit according to the Environmental Code are the same parameters and specified in the same way as the BAT-AELs that apply to the activity. The operator should therefore, in consultation with the supervisory authority, conduct a review of the monitoring programme and the procedures for monitoring and inspection and, with the BAT conclusions 8-11 as reference, implement the required changes. There may also be grounds, in those cases where conditions regarding measurement and inspections are prescribed during the licensing process, to adapt these Environmental Code conditions according to the measurement requirements stipulated in the BAT conclusions.

15.1.2 NO_x and SO₂

According to BAT 9a, measurement of NO_x and SO₂ shall take place continuously in the case of recovery boilers.

For lime kilns and dedicated TRS burners, measurement is specified as being periodic or continuous. In order to incorporate process variations that affect emissions, continuous measurement ought to be required. In the experience of the Swedish EPA, NO_x and SO₂ are measured using continuously monitoring instruments at most lime kilns and TRS burners, although not at all. If continuous measurement instruments are not available, the frequency of periodic measurements is obviously important. Measurement on a few occasions per year usually provides insufficient knowledge about the true extent of the emissions.

15.1.3 Dust

According to BAT 9b, the monitoring frequency for recovery boilers and lime kilns is specified as "Periodic or continuous". According to the BAT conclusion, both types of measurement are acceptable.

The frequency that can be approved for "periodic" is not specified. The periodic measurement frequency at Swedish mills varies from once per year to several times per month. In larger installations, the starting point for manual measurement can be once per month. The measurement frequency ought to be adapted according to the extent of the variation from one measurement to another, as well as the margin to BAT-AELs or the installation's conditions in the Environmental Code permit. It may also be important to ensure even operation through another type of operational monitoring.

Continuous measurement of dust at recovery boilers has been considered technically difficult and unreliable within the sector. There are a number of Swedish mills that have installed continuous dust monitoring devices for both recovery boilers and lime kilns. However, none of the mills state that they use the continuous monitoring devices for verifying compliance with conditions. Instead, they are used for internal monitoring and operational control, and can help to optimise the supply of power to the electrostatic precipitators and achieve an adequate cleaning result with reduced electricity consumption. In the experience of the Swedish EPA, there is measurement equipment on the market that works satisfactorily, at least for new boilers and electrostatic precipitators. To the best of the Agency's knowledge, no evaluations have been carried

out regarding the reliability of the measurement equipment over time nor of how well the equipment works in older boilers and electrostatic precipitators. For boilers with a scrubber as a clarification step, a separate measurement problem arises in the form of flue gases containing water droplets after the scrubber. However, measurement equipment is available that can cope with this too, although at a higher cost.

15.1.4 TRS

15.1.4.1 TRS FROM RECOVERY BOILER, LIME KILN AND TRS BURNER

At Swedish kraft pulp mills, total emissions of reduced sulphur compounds (TRS) are not a common condition parameter for recovery boilers, lime kilns or TRS burners. However, it is common to have conditions for emissions of hydrogen sulphide (H_2S), often specified as the proportion of the operating time that a particular content level may be exceeded. Hydrogen sulphide makes up part of TRS. Otherwise, TRS is made up principally of methyl mercaptan, dimethyl sulphide and dimethyl disulphide. Carbon monoxide (CO) is also measured continuously at some mills and used as an indirect measure of the level of H_2S .

According to BAT 9c, TRS shall be measured continuously in recovery boilers, while for lime kilns and TRS burners, periodic or continuous measurement is specified. If strong gases are incinerated in the lime kiln, this is a particular reason to implement continuous measurement in the lime kiln.

Measurement equipment that is currently installed for the measurement of H_2S will probably need to be supplemented in order to measure TRS.

If an operator wants to use H_2S as a control parameter, it is necessary to clarify the link between H_2S and TRS, regardless of whether measurement is being performed continuously or periodically. It is necessary to determine what level of H_2S corresponds with the upper, binding level of the BAT-AEL for TRS. This probably varies from plant to plant, and requires parallel measurements to be performed for a sufficient period of time. If a value for H_2S can be determined in this way, this should be viewed as an alternative value according to Chapter 1 Section 15 of the Ordinance on Industrial Emissions. The operator consequently needs to apply for an alternative value at the MPD or, in conjunction with a licensing process, at the Land and Environment Court.

The link between CO and TRS is probably less certain than between H_2S and TRS. Nevertheless, if it is deemed to be sufficiently clear, the same applies as for TRS, i.e. the operator should conduct parallel measurements to ascertain the maximum CO level at which it has been determined that BAT-AELs for TRS are met. An application for an alternative value subsequently needs to be submitted to the MPD or the Land and Environment Court.

15.1.4.2 TRS IN RESIDUAL WEAK GASES (DIFFUSE SOURCES)

Monitoring and measurement of residual weak gases, “diffuse emissions”, is mentioned both in BAT 9c and in BAT 11. This refers to sulphurous gases that are not released via recovery boilers, lime kilns, TRS burners or back-up combustion chambers (flares). The monitoring frequency in BAT 9 is specified as “Periodic”, with no detailed specification

of how often measurement should take place. BAT 11 states that BAT are intended to “regularly monitor and estimate diffuse TRS emissions from relevant sources”.

In the experience of the Swedish EPA, emissions from diffuse sources can vary considerably from one time to another. Identification of potential points of discharge should be carried out as comprehensively as possible. The identification of diffuse emissions should be conducted on a number of occasions and under different operating conditions so that it is possible to acquire sufficient knowledge about where in the installation diffuse emissions take place. If, following these initial measurements, it is determined that the majority of the emissions originate from a limited number of points of discharge, ongoing regular measurements can focus on these. Other less important sources can then be measured less frequently, to check that the previous emission levels have not changed. When significant changes have been made in the process, the relevant part of the process should be checked specifically with regard to TRS emissions.

The matter of how measurements are to be carried out is often handed over to the supervisory authority. In permits according to the Environmental Code that have been issued in recent times, where the measurement frequency has been regulated in the conditions, this has been specified as four³⁴ times/year.

Most kraft pulp mills have separate systems for the collection of weak gases. If these collected gases are incinerated in a recovery boiler, lime kiln or TRS burner, they will be included in the measured emissions for the combustion equipment in question. However, if they are processed in another way, such as in a scrubber, they will need to be measured separately. As this then relates to a larger, combined emission source, this is equivalent to other individual sources as regards measurements. The measurement of such a source is not expressly specified in BAT 9. In the opinion of the Swedish EPA, the continued measurement of such a source is justified in most cases.

In some mills, emissions of “diffuse sulphur” have been calculated through a mass balance based on the sulphur content in the constituent raw materials compared to outgoing products and flue gases. The difference, which would then constitute the amount of released diffuse sulphur, will then comprise a comparison between two larger numbers in order to determine one considerably smaller number. According to the Swedish EPA, the level of uncertainty within such a calculation is far too large to be acceptable.

15.1.5 Emissions of sulphur compounds when regular combustion equipment is not in operation

Strong and weak sulphur-containing gases are incinerated at Swedish mills, either in a dedicated TRS burner, a lime kiln or a recovery boiler. In the event of operational disruptions or when one of these combustion installations is not available, back-up systems must be available according to BAT 20b. This may entail the gas flow being

³⁴ Land and Environment Court, Umeå District Court, 18.12.2012, M 1726-12; Land and Environment Court, Vänersborg District Court, 30.09.2015, M 683-14; Land and Environment Court, Nacka District Court, 11.02.2016, M 1420-07.

reconnected to another of the above combustion units. It may also entail the gases being incinerated in a special combustion chamber, in a gas flame (flare) or being routed through an alkaline scrubber. If none of the back-up systems can be used, it is possible for gases to be routed directly out to the atmosphere.

If such instances are considered to constitute “other than normal operating conditions”, they will not be included in the emission that must comply with BAT-AEL. However, the emissions may be significant. Pursuant to BAT 20c for kraft pulp mills, the loss of the combustion system and the resulting emissions shall be registered. A method that is to be used to determine emissions in such cases of operational disruptions should be included in the activity’s inspection programme. More information on this subject can be found in the BREF document, Chapter 2.2.2.2.6, pages 60-62.

15.2 Emissions to water

(BAT 8 and 10, BAT page 90; BREF page 788)

The BAT conclusions document does not state specific analysis methods for the various parameters. Instead, BAT 10 states the following about emissions to water:

“BAT is to carry out the monitoring of emissions to water, as indicated below, with the indicated frequency and according to EN standards. If EN standards are not available, BAT is to use ISO, national or other international standards that ensure the provision of data of an equivalent scientific quality.”

BAT 8:II specifies monitoring of process parameters for emissions to water, including continuous measurement of water flow, temperature and pH value. Continuous measurement of pH can, together with conductivity (the latter is not mentioned among the process parameters in BAT 8:I), act as an “alarm” regarding abnormal events with temporarily raised emissions.

BAT 10 specifies monitoring frequency for emissions to water. Note that the ranges that are specified relate to the interval at which analysis is to be conducted. As stated on page 80 below the heading “Averaging periods for emissions to water”, sampling shall take place as flow-proportional composite samples over a sampling period of 24 months. See also the comments above in Section 10.1.2 regarding 72-hour weekend composite samples. The frequency of sampling and analysis are described in further detail in the BREF document in Chapter 2.2.2.1.2, pages 43-46.

15.2.1 COD and TOC

In BAT 10a, COD and TOC are specified as alternatives to each other. Footnote 1 states that it has become more common to replace COD with TOC, but that if TOC is measured, a correlation between the two parameters should be established for the specific emission source.

Even if both COD and TOC are related to the waste water’s content of organic substances, they are separate parameters. When analysing COD, a measurement is performed of the amount of oxygen that is consumed during the oxidation of organic

material, as well as of inorganic substances. The TOC analysis measures the amount of organically bound carbon.

In the tables containing BAT-AELs for each production process (Chapters 1.2-1.6 of the BAT conclusions), only COD is specified as an emission parameter. If an operator wants to replace the BAT-AEL that is specified for COD with an emission value for TOC, it is necessary to determine the value of TOC that will be considered to correspond with the upper, binding level of the BAT-AEL for COD. This TOC value should be viewed as an alternative value according to Chapter 1 Section 15 of the Ordinance on Industrial Emissions.

The operator consequently needs to apply for an alternative value at the MPD or, in conjunction with a licensing process, at the Land and Environment Court.

In order to establish the correlation between COD and TOC, it is necessary for the individual mills to conduct an extensive series of parallel measurements of COD and TOC, including existing operational situations.

When determining COD, mercury is included in the analysis chemicals. According to Section 9 of the Chemical products (handling, import and export prohibitions) ordinance (1998:944), there is a general prohibition on the use of mercury. According to Section 11, however, the Swedish Chemicals Agency may grant exemptions from this prohibition. To date, there is not considered to be any mercury-free method for COD analysis that can replace the current method. The Swedish Chemicals Agency has therefore granted an exemption from the prohibition. The current exemption applies up to and including 19.12.2019³⁵.

15.2.2 BOD

The parameters for emissions to water include “BOD₅ or BOD₇”. BAT 10 specifies that measurement should take place once a week.

In the BAT conclusions for each pulp type and for paper production, it is stated that “The BOD concentration in the treated effluents is expected to be low (around 25 mg/l as a 24-hour composite sample)” (kraft pulp BAT 19, sulphite pulp BAT 33, mechanical pulp and paper BAT 40, recycled fibre BAT 45 and paper BAT 50). As has already been covered in Section 8.3, this is a BAT-AEPL, i.e. not a BAT-AEL. The emission content is consequently not binding, but is nevertheless a value that shall be taken into consideration during the licensing process and during supervision.

In Sweden, BOD₇ is used as the standard method, i.e. that the analysis is performed after a seven-day incubation period and biological decomposition. However, a large number of other countries within the EU only apply a five-day incubation period, i.e. BOD₅. As the decomposition is allowed to continue for two days longer with BOD₇ analysis compared to with BOD₅ analysis, the BOD₇ value will be slightly higher than BOD₅. However, the ratio (conversion factor) between BOD₇ and BOD₅ will differ for

³⁵ KIFS 2017:7, appendix 3, point 3

different types of waste water, depending on the period of time required for decomposition. The BREF document refers to a ratio where $BOD_7/1.16 = BOD_5$ ³⁶. However, this relates to untreated waste water from debarking, and cannot be deemed to apply to biologically treated waste water. For untreated domestic waste water, the literature generally states that BOD_5 is approx. 15% lower than BOD_7 . For treated domestic waste water, however, the difference is considered to be insignificant.³⁷ On this basis, the Swedish EPA considers that, for biologically treated industrial forest waste water, a content of 25 mg/l can be used as BAT-AEPL with the analysis of BOD_7 .

BOD provides a measure of the amount of readily degradable organic material in the waste water. In permits according to the Environmental code, conditions for BOD are seldom prescribed nowadays. Instead, it has been considered sufficient to prescribe conditions for COD or TOC , which provide a measure of the total amount of organic material in the waste water. The measurement of BOD may however be justified as a way of checking that the biological treatment is working as it should, i.e. that degradable organic material is being broken down. A BOD content of more than 25 mg/l would consequently indicate that the operation of the biological treatment is not taking place satisfactorily. Another reason for measuring BOD is if the receiving water body is sensitive, where high emissions of readily degradable oxygen-consuming substances risk the generation of low oxygen levels in the nearby receiving water body.

15.2.3 TSS

In the BAT conclusions, the term “TSS” (Total Suspended Solids) is used, which is defined in the Chapter on abbreviations (page 84; page 781) as

“Total suspended solids (in waste water). Suspended solids consist of small fibre fragments, fillers, fines, non-settled biomass (agglomeration of microorganisms) and other small particles.”

Analysis questions are raised in Chapter 2.2.2.1.3 of the BREF document. The BREF authors consider that the analysis methods in the Member States comply with ISO standards and do not differ appreciably. Table 2.3 (page 47 in the BREF document) presents e.g. the analysis methods for TSS that are used in Finland, Germany and Portugal. Finland and Germany use SÄ GF/A with a 1.6 µm filter, while in Portugal the filter is 1.7 µm.

Sweden also uses SÄ GF/A³⁸ as the standard method for analysing suspended solids. Susp70 has previously been used as an analysis method, and is still used in some mills. With the Susp70 method, a significantly smaller amount of the suspended material is captured, with the result that a lower analysis value is obtained that does not reflect the environmental impact. The Swedish EPA considers that SÄ GF/A is the analysis parameter that should be applied to determine TSS.

³⁶ Chapter 3.2.2.5.1, Table 3:7.

³⁷ HVMFS 2016:17. Swedish Agency for Marine and Water Management's general advice on small sewer systems for domestic wastewater.

³⁸ Swedish standard SS-EN 872:2005 Water quality – Determination of suspended solids – Method by filtration through glass fibre filters.

In the Environmental Code permit for some kraft pulp mills, the emissions from the causticising department are excluded as regards the conditions for suspended substances. The reason for this is that the emissions largely comprise inorganic substances, lime, i.e. calcium carbonate. On the other hand, the lime contains a considerable amount of phosphorus and constitutes a particle emission that can cause turbidity in the receiving water body. According to the information that the Swedish EPA has received from a number of kraft pulp mills, emissions from the causticising department are included in most cases in the Environmental Code permit's conditions, as well as in the supporting data that has formed the basis for the BAT conclusions. The Agency's opinion is therefore that the causticising department's emissions of suspended solids shall be included in the emissions that need to comply with BAT-AELs for TSS.

15.2.4 Chelating agents (EDTA, DTPA)

BAT 10f specifies a monitoring frequency of one a month. In addition, it can be noted that BAT 3a also specifies that the amount of chelating agents released to the environment shall be determined through periodic measurements.

15.2.5 AOX

BAT 10g specifies how often AOX shall be measured for different types of pulp and paper production. The table is rather difficult to understand, but can be read as follows

Production type	Monitoring frequency	Monitoring associated with BAT no.	Exemption
Bleached kraft pulp	Once a month	19	
Sulphite pulp	Once every two months	33	TCF bleaching and NSSC production
Mechanical pulp	Once every two months	40	CTMP, CMP
Recycled fibres	Once every two months	45	
Paper	Once every two months	50	

Footnote 5 regarding paper production states

“Not applicable to plants that provide evidence that no AOX is generated or added via chemical additives and raw materials.”

The wording can be perceived as far-reaching and places stringent demands on operators in order for the supervisory authority to approve AOX not being measured.

As regards BAT-AEL for paper production, it is stated in Tables 20 and 21 (BAT 50) that the specified BAT-AEL applies to “decor and wet strength paper”. It is then open to discussion whether the measurement requirement in BAT 10g only applies to the production of these paper types. The heading in Table 10, “Monitoring associated with”, can argue in favour of this. The Swedish EPA considers, however, that it is more logical from an environmental perspective to work on the basis of footnote 5 to BAT 10 g, i.e. that measurement of AOX should be conducted if there is a risk of AOX being generated, even though the wording in Table 20 or 21 means that paper production is not covered by BAT-AEL for AOX.

16 Waste management

(Chapter 1.1.7, BAT pages 91-92; BREF page 789)

The BAT conclusions for waste management apply generally to all types of production.

BAT 12 a–e specifies techniques for waste management that constitute BAT. There are no BAT-AELs.

General supporting data for BAT in respect of all production types can be found in the BREF document, Chapters

- 2.8 Overview of production residues and solid waste
- 2.9.8 Prevention, minimisation, recycling and treatment of process residues – minimising solid waste to landfill

See also Section 7.7 above, which addresses the extent to which activities involving the production of pulp, paper and board as their main activity will be affected by BAT conclusions for waste treatment (WT BATC).

17 Waste water – specific issues

17.1 Waste water that is covered by BAT-AEL

Discharge water from pulp and paper mills can be of various types, for example:

- waste water that is processed in biological treatment (e.g. from bleach plant, dirty condensates, spills from the cooking plant, etc.),
- waste water that has undergone chemical precipitation and sedimentation/flotation,
- waste water that has only undergone sedimentation (e.g. from paper machines),
- waste water with no treatment at all, but that is still contaminated (e.g. from causticising)
- cooling water
- sealing water
- run-off water from timber and chip stockpiles

The Swedish EPA considers that the BAT conclusions should be interpreted such that BAT-AEL refers to all waste water, regardless of what treatment it has undergone or where it comes from. Some reservations should be made, however.

Cooling water: Cooling water that passes through the mill in a closed system is not normally contaminated, and therefore does not need to be included in waste water emissions.

Sealing water: Sealing water is not normally contaminated either, and should therefore also not be included in BAT-AEL. For sealing water, there is a risk of it being contaminated due to operational defects. In such cases, this should be viewed as “other than normal operating conditions”. If a particular sealing water is normally contaminated to a certain extent, it should be viewed as waste water and be included in the water that has to comply with BAT-AEL. It should be borne in mind that seals can wear over time, and that the sealing water thereby becomes contaminated. Mills should ensure that this does not happen through preventive maintenance and inspections. Monitoring in the form of measuring pH and conductivity can produce signs of leakage.

Run-off water from chip and bark stockpiles can be contaminated through leaching and material that follows along in the event of heavy rain. BAT 4 (page 86) specifies techniques for reducing the generation of waste water and contaminants from wood storage and preparation. BAT conclusion 4e specifies “Collecting of contaminated run-off water from the wood yard and separating out suspended solids effluent before biological treatment” as a BAT technique. As regards applicability, it is stated that “Applicability may be restricted by the degree of contamination of run-off water (low concentration) and/or the size of the waste water treatment plant (large volumes)”.

BAT conclusion 4e can be interpreted such that the BAT is normally that run-off water from the wood yard is collected and treated in a biological treatment plant. In the experience of the Swedish EPA, however, this is not common at Swedish pulp mills. In many cases, run-off water is also not included in the Environmental Code permit’s emission conditions. The cause of this may be that the run-off water generally has a low

content of organic material and occurs irregularly, which can have an adverse impact on biological treatment. However, this irregular impact may be avoided to some extent by means of an equalising basin. A clarification step in the form of sedimentation or filtration in order to remove suspended solids prior to emissions to the receiving water body is a simpler method of treating run-off water from the wood yard. This issue ought to be assessed according to the rule in Chapter 2 Section 7 of the Environmental Code during the licensing process or, if the issue is not addressed in the permit, within the framework of supervision. The BAT conclusion is then to be taken into account.

17.2 Waste water that is treated in a plant shared with another activity

Large-scale process industries that are covered by the IED usually have a separate facility for treating waste water, whereupon the waste water is routed to the receiving water body after treatment. Within certain sectors and at smaller installations, however, it is sometimes the case that the IED activity routes its waste water to an external treatment facility, which may be a different industrial activity or a municipal waste water treatment plant.

This matter is addressed in Chapter 2, section 3, subsection 2 of the Ordinance on Industrial Emissions. “In the case of waste water that is treated in a treatment plant that also processes waste water from other sources, the treatment that takes place in the treatment plant may be applied instead to that which is stated in the conclusion, if this does not entail a greater pollution load on the environment.”. This is elaborated in the general guidance regarding industrial emission provisions (Swedish EPA Report 6702, page 32) and in the motives for the Ordinance on Industrial Emissions (pages 54–55).

At most Swedish pulp and paper mills, the waste water is treated in a separate treatment plant specifically for the mill, i.e. that only receives waste water from the mill and that has the mill as its principal. In a few cases, waste water from a pulp or paper mill is transferred to a municipal treatment plant or to another industrial activity’s treatment facility. It is also sometimes the case that the mill itself receives waste water from another industrial activity or receives municipal spill water.

In PP BATC, the tables with BAT-AELs for emissions to water use the wording “BAT-associated emission levels for the direct waste water discharge to receiving waters ... etc.”. The same or similar wording is included in BAT conclusions documents for other sectors, while in other additional sectors there are separate BAT-AELs for indirect or direct emissions to water. The text presented in PP BATC has been interpreted such that BAT-AELs only apply in the event the treatment takes place in the installation where the emissions arise. If the waste water is treated in an external treatment plant, the BAT-AELs that are applicable to the sector where the treatment takes place would apply instead. If the treatment takes place at a municipal treatment plant that is covered by the Urban Waste Water Directive, only the requirements according to the Urban Waste Water Directive would apply.

This application contains a number of particular difficulties for waste water from the production of pulp, paper and board.

PP BATC specifies BAT-AELs relative to the production amount, i.e. the emission value is specified in the unit “kg per ton of pulp” or “kg per tonne of paper”. This differs from most other IED sectors and from the Urban Waste Water Directive, where the emission levels are set as concentration or level of treatment. It is consequently not possible, directly through BAT-AELs in other sectors or in the Urban Waste Water Directive, to determine whether the pulp or paper mill’s emissions comply with BAT-AELs.

At a pulp or paper mill, there are often several waste water streams that are treated differently depending on the degree and type of pollution. For example, certain waste water streams can be routed to biological treatment while other waste water streams are only treated through sedimentation. Following internal process measures, some waste water may still contain some pollution yet be sufficiently clean to be released into a receiving water body without separate treatment. The mill’s combined emissions comprise the sum of these waste water fractions. In such a case, if the biological treatment takes place at an external treatment plant, the principal for biological treatment will only be responsible for the emission fraction that takes place via this treatment plant. Only the principal for the pulp and paper mill can reasonably have responsibility for the total emissions to water generated by the mill, calculate their extent and assess how they relate to BAT-AELs. From a competition perspective, it is important for the various pulp and paper mills to be allocated responsibility for their emissions in a corresponding manner.

It can also be noted that, in PP BATC, there are BAT-AELs for AOX, a parameter that is not regulated in the Urban Waste Water Directive nor in BAT conclusions for most other sectors.

The emissions to which the pulp or paper mill gives rise via an external treatment plant can be calculated by working on the basis of the amount of emissions that the mill has supplied to the external treatment plant, and for each parameter reducing the original pollution amount from the industry by the total degree of pollution in the treatment plant. One source of faults may be that waste water that is sent to the joint treatment plant may vary in nature and be treated to varying degrees. One particular problem is how the emissions of phosphorus and nitrogen are to be calculated, as nutrients are added to the biological treatment plant in certain cases in order to aid the breakdown of organic material. One way of calculating the extent of the emissions may then be to work on the basis of the pollution concentration in the combined outgoing waste water and, with the aid of the industrial activity’s share of the flow, to calculate its emissions.

An equivalent argument can be put forward in the opposite situation, i.e. that a mill receives waste water from another industrial activity or municipal spill water. In such a case, it would be necessary to calculate the emissions that can be attributed to other activities and deduct this amount from the treatment plant’s total emissions, in order to arrive at a value for emissions from the mill.

In summary, it can be stated that, with the current wording of PP BATC, it is difficult to apply BAT-AELs in an environmentally viable and competitively equivalent manner at

plants where waste water treatment takes place jointly with another activity. In such cases, the decisive regulation should therefore need to be the conditions in the activities' permits according to the Environmental Code.

17.3 Waste water – content in incoming fresh water

In Sweden, we usually have fresh water with a low pollution content. It is therefore usually of little importance whether or not the amount of pollution in the fresh water is deducted from the amount of pollution in outgoing waste water. During the licensing process according to the Environmental Code, it is normal practice not to make any deduction.

As regards the most significant part of the waste water emissions, i.e. that which passes via a biological treatment plant or other secondary and tertiary treatment, the level of pollution in the incoming fresh water is, in most cases, of marginal significance for the outgoing content to the receiving water body. Exceptions may occur, however. For example, this could be the case if the levels of nitrogen and phosphorus are high in the fresh water, and if these are so firmly bound to organic material that they cannot be absorbed as nutrients by the micro-organisms in the biological treatment plant. In order to take this into consideration, however, this needs to be demonstrated in the case in question.

If non-contaminated cooling or sealing water is added in the waste water pipeline after biological treatment, but before the point where the emissions are measured, there may be grounds to make deductions for the incoming content in the fresh water. However, this requires that the pollution content and flow in the incoming cooling and sealing water are measured separately in parallel with the emission measurements.

18 Footnotes

18.1 Footnotes that provide scope for higher values.

A large number of the tables with BAT-AELs contain footnotes which, with varying wording, provide scope for higher values in a total of nineteen cases.

In one (1) footnote, it is stated that, under certain conditions, a higher specified value will apply:

“For mills with a waste water flow between 5 and 10 m³/t, the upper end of the range is 0.008 kg/t” (Recycled fibres, emissions to water, phosphorus, BAT 44, Table 18, footnote 2)

In 11 footnotes for 11 emission parameters, it is stated that, under certain conditions, the emission level can increase up to a certain specified value. Example:

“For mills producing pulp with high strength, stiffness and high purity properties (e.g. for liquid packaging board and LWC), emission level of AOX up to 0.25 kg/ADt may occur.”

(Bleached kraft pulp, emissions to water, AOX. BAT 19, Table 1, footnote 5)

“For an existing recovery boiler equipped with an ESP approaching the end of its operational life, emission levels may increase over time up to 50 mg/Nm³ (corresponding to 0.4 kg/ADt).”

(Kraft pulp, recovery boiler, emissions to air, dust. BAT 23, Table 5, footnote 1)

“Where at existing plants a switch to staged incineration is not feasible, emission levels up to 1,000 mg/Nm³ (corresponding to 0.2 kg/ADt) may occur.”

(Kraft pulp, TRS burner, emissions to air, NO_x. BAT 29, Table 11, footnote 1)

The footnotes are part of the BAT conclusion. This means that when it is stated in a footnote that “a higher emission value may occur under certain specified circumstances”, BAT-AELs cover the higher value that is specified in the footnote. One precondition, however, is that the criteria that are specified in the footnote are met in the individual case in question. In order for a higher BAT-AEL value to be accepted, the operator should show the supervisory authority that it meets the criteria to which the footnote relates.

In five footnotes for 10 emission parameters, it is stated that certain preconditions can lead to higher emission levels, although without any specification of the emission level that may be accepted.

“A compact biological waste water treatment plant can result in slightly higher emission levels.”

(BAT 19, emissions to water, nitrogen and phosphorus. Table 1, footnote 2, bleached kraft pulp. Table 2, footnote 2, unbleached kraft pulp)

“When biodegradable or eliminable chelating agents cannot be used due to pulp quality requirements (e.g. high brightness), the emissions of total nitrogen

might be higher than this BAT-AEL and should be assessed on a case-by-case basis.”

(BAT 40, emissions to water, nitrogen. Table 16, footnote 2, mechanical pulp and paper. Table 17, footnote 1, CTMP pulp)

“Mills having special characteristics, such as a high number of grade changes (e.g. of ≥ 5 per day as a yearly average) or producing very light-weight speciality papers (≤ 30 g/m² as yearly average) might have higher emissions than the upper end of the range.”

(BAT 50, Table 21. Speciality paper, emissions to water, COD, TSS, nitrogen, phosphorus, AOX.)

In the event it is specified in the footnote that certain preconditions can lead to higher values, but without a specific higher value being stated, it is the opinion of the Swedish EPA that the emission value stated in the table applies as the emission limit value. In order for a higher emission limit value to be able to be followed, a derogation must be granted. As a background to this method of addressing the issue, the BAT conclusions in most Member States take place through individual licensing, where the implementation of footnotes is part of the assessment that forms the basis for permit conditions. As implementation in Sweden takes place through general regulations, there would be no decision on how the footnote should be applied without a derogation procedure.

That which is specified in the footnote regarding the installation's technical properties constitutes supporting data when assessing an application for a derogation. Derogations must be applied for from the MPD or the Land and Environment Court in conjunction with the licensing process.

The individual footnotes and the exemptions are commented on in greater detail in the sections for each production type.

18.2 Footnotes that specify in which part of the BAT-AEL range a particular production process should lie

Some BAT-AELs contain footnotes in the table, specifying that, under certain conditions, the emission value should be in the lower or the upper part of the range. These footnotes are of no significance as to whether the operator should be deemed to have complied with BAT-AELs in accordance with the Ordinance on Industrial Emissions. The upper limit specified as a BAT-AEL still applies as a binding emission limit value. However, the footnote may be of significance when BAT-AELs are to be used as references for conditions during the licensing process according to the Environmental Code.

Footnotes of this type can be found in the following BAT-AELs

Production type	BAT no.	Table no.	Footnote no.	Parameter
Kraft pulp	BAT 21	Table 3	footnote 1	SO ₂
Kraft pulp	BAT 2	Table 4	footnote 1	NO _x
Paper	BAT 49	Table 20	footnote 1	COD
Speciality paper	BAT 49	Table 21	footnote 2	COD

19 Kraft pulp

(Chapter 1.2, BAT pages 94-104; BREF pages 792-799)

Chapter 1.2 only applies to the production of pulp at a kraft pulp mill. For mills that have integrated production of kraft pulp and paper production, the BAT conclusions for paper production in Chapter 1.6 also apply. For integrated mills, BAT-AELs for kraft pulp in Chapter 1.2 shall be added together with BAT-AELs for paper production in Chapter 1.6.

19.1 Waste water and emissions to water

(Chapter 1.2.1, BAT pages 94-96; BREF pages 792-793)

19.1.1 Bleached and unbleached pulp

BAT 19 specifies BAT-AELs for the production of bleached pulp in Table 1 and unbleached pulp in Table 2. There is no definition of “bleached” or “unbleached” pulp in the BAT conclusions document. The BAT conclusions document does define modified cooking, oxygen delignification and bleaching methods (Chapter 1.7.2.1 Process integrated techniques). Further information can be found in the BREF document (3.1.7 Bleaching). Against this background, bleaching ought to refer to that which takes place in a bleach plant after cooking and any oxygen delignification. This means that BAT-AELs for bleached pulp may only be used if, by means of a bleaching stage, the kappa number has been lowered/the brightness has been increased after the point in the process where cooking and any oxygen delignification have taken place.

An alternative method might have been for “bleached” and “unbleached” to have been defined according to the brightness of the finished pulp. However, this is not specified in the BAT conclusions document.

19.1.2 Dissolving pulp

BAT 19 (page 95; page 792) specifies that BAT-AELs in Tables 1 and 2 are not applicable for kraft pulp mills that produce dissolving pulp. For these mills too, however, the BAT conclusions without emission levels that are found in BAT 19 apply, which include techniques, reference waste water flow and BOD concentration in the treated waste water. As regards reference waste water flow, it should be noted that, due to a lower wood yield, dissolving pulp produces approx. 25% higher specific values, all other factors being equal.

19.1.3 BOD

For BOD, it is stated that “The BOD concentration in the treated effluents is expected to be low (around 25 mg/l as a 24-hour composite sample)”. The specified level is not a binding BAT-AEL. For additional comments about the need to monitor and measure BOD, see Section 15.2.2 above.

19.1.4 Nitrogen and phosphorus

BAT-AELs for emissions of nitrogen and phosphorus from the production of bleached and unbleached kraft pulp are shown in the following table.

	Yearly average	Yearly average	Reference
	kg/ADt	kg/ADt	
	Total nitrogen	Total phosphorus	
Bleached kraft pulp	0.05–0.25 ²⁾	0.01–0.03 ²⁾	Table 1 (page 95)
Unbleached kraft pulp	0.1–0.2 ²⁾	0.01–0.02 ²⁾	Table 2 (page 96)

Footnote 2 to the tables states:

“A compact biological waste water treatment plant can result in slightly higher emission levels.”

19.1.4.1 WHAT IS “A COMPACT BIOLOGICAL WASTE WATER TREATMENT PLANT”?

Chapter 1.7.2.2, page 125 (page 820), contains the following description of compact biological treatment.

”a) Aerobic treatment,
biofilm/activated sludge (compact biological treatment plant). This technique consists in combining moving bed carriers with activated sludge (BAS)”.

The BREF document contains an additional description in Chapter 2.9.11.2.1, page 171. As there are many variants regarding the way biological treatment is formulated, as well as combinations of different techniques, there may well be uncertainty regarding the extent to which the footnote is to be applied for a particular treatment plant.

19.1.4.2 TREATMENT RESULTS

A number of compact biological treatment plants have been built at Swedish mills in recent years. These are considered to have benefits in that they take up less space and have relatively low energy consumption. According to the wording of the footnote, there is no clear upper limit for BAT-AELs.

Many mills produce both bleached and unbleached kraft pulp, as well as other pulp types. Integrated mills also produce paper. It is only at those mills that produce one and the same product that it is easy to determine the extent of emissions generated by the production of kraft pulp specifically, calculated in kg/ADt. In order to gain an understanding of a kraft pulp mill’s emission levels for nitrogen and phosphorus, the Swedish EPA has compared the mill’s total emissions (tonnes per year) with the “permitted BAT amount”, calculated in tonnes of emissions per year. This is calculated using the extent of the mill’s production of the relevant types of pulp and paper (tonnes of pulp or tonnes of paper per year) as well as upper BAT-AELs (tonnes of nitrogen or phosphorus per tonne of pulp or paper). (See also page 80 in the BAT conclusions document (page 778) and section 24 in this guidance regarding adding together BAT-AELs). At all mills, emissions from kraft pulp production dominate, which is why the calculations provide a good picture of how BAT-AELs for the production of kraft pulp can be achieved. The calculations show that, as regards both nitrogen and phosphorus, the vast majority of mills achieve BAT-AELs even with a compact biological treatment plant. In 2015, only a few mills had emissions around or above BAT-AELs.

In those cases where a mill has difficulties achieving BAT-AELs for nitrogen and phosphorus, the reason for this should be specifically investigated. There may be several reasons, and it is not definite that the cause of higher emissions is related to the mill having a “compact biological treatment plant”. An initial step ought to be optimising the supply of nutrients with the aid of more advanced measurements and control systems. As regards nitrogen, the use of wet strength agents or chelating agents may be contributory causes. Insufficient removal of suspended solids can also generate excessively high emissions of nitrogen and phosphorus. It should only be appropriate to go further and take into consideration footnote 2 regarding “slightly higher emission levels” if the company can demonstrate that the compact design of the biological treatment plant is giving rise to such difficulties in getting down to the upper value specified in the tables that this cannot be compensated with reasonable measures.

19.1.4.3 APPLICATION OF FOOTNOTE 2

Footnote 2 in Tables 1 and 2 does not contain any specified upper emission value that shall be followed as an emission limit value. The Swedish EPA interprets this as meaning that, even for plants with a compact biological treatment plant, the upper values in the ranges in Tables 1 and 2 shall be complied with in accordance with Chapter 1 Section 8 of the Ordinance on Industrial Emissions. In order for a higher emission limit value to be able to be applied, a derogation must be granted.

There is no specific statement or supporting data in the BAT conclusions document or in the BREF document in order to determine the extent of the deviation from BAT-AEL that may be permitted with reference to the footnote. The wording should nevertheless indicate that it is a small deviation that is being referred to. This is supported by the review that the Swedish EPA has conducted based on the mills’ environmental reports for 2015. There are few instances of limits being exceeded, and in some of these cases the operator states that measures will be implemented to comply with BAT-AELs according to the value in the table.

The Swedish EPA considers that the details specified in footnote 2 can constitute supporting data when assessing an application for derogation from BAT-AELs for nitrogen and phosphorus. The fact that a mill has a compact biological treatment plant is a factor that could constitute grounds for derogation, with regard to the plant’s technical properties. See also comments regarding footnotes of this kind in Section 18.1 above.

In the event of a derogation assessment, which emissions are to be permitted within the framework of what can be deemed “slightly higher emission levels” should be determined on the basis of the conditions in the individual case in question. However, the expression itself should not refer to any more significant exceedances. In an application for a derogation, there may be additional reasons other than the design of the biological treatment plant that are cited, whereupon these grounds must be assessed together when determining whether, and if so, what higher emission value will be allowed.

19.1.5 AOX

In Table 1 (BAT page 95; BREF page 792) specified as BAT-AEL for AOX, 0-0.2 kg/ADt

Footnote 5 states however:

“For mills producing pulp with high strength, stiffness and high purity properties (e.g. for liquid packaging board and LWC), emission level of AOX up to 0.25 kg/ADt may occur.”

Operators should demonstrate to the supervisory authority that the pulp is of the type which means that higher AOX levels cannot be avoided.

19.2 Emissions to air

(Chapter 1.2.2, BAT pages 96-102; BREF pages 793-798)

19.2.1 Dissolving pulp

For emissions to air, there is no exemption for the production of dissolving pulp, which is why BAT-AELs and other BAT conclusions apply in the same way as for other kraft pulp. However, it can be noted that, due to the lower wood yield, the specific emissions will be approx. 25% higher for dissolving pulp than for paper pulp, all other factors being equal.

19.2.2 Strong and weak gases; back-up systems

BAT 20 states that, for strong and weak odorous gases, there shall be collections systems and that the gases shall be incinerated. Incineration can take place in the recovery boiler, the lime kiln or in a dedicated TRS burner. To ensure the constant availability of incineration for odorous strong gases, back-up systems shall be installed. Lime kilns can serve as back-up systems for recovery boilers. Further back-up systems that are mentioned include “flares” and “package boilers”. As regards applicability, it is stated (page 97; page 793) that “The applicability of incineration might be limited for safety reasons, and in this case wet scrubbers could be used.”.

If the gases are incinerated in a recovery boiler, lime kiln or dedicated TRS burner, the emissions will be calculated together with the emissions from the relevant incineration equipment. If they are treated in a different way, however, such as in a scrubber, the residual emissions after the scrubber will be included in “residual weak gases”.

When incinerating weak gases (as well as strong gases) in a recovery boiler, lime kiln or TRS burner, TRS oxidises to SO₂, after which the sulphur dioxide can be absorbed in a wet scrubber. The use of wet scrubbers directly on the TRS-containing gases results in less effective removal, as only water soluble components can be removed. For strong gases, wet scrubbers are generally not a sufficiently effective treatment method for getting down to acceptable emission levels.

When switching between these systems, there may be periods when the emissions are released directly to the ambient air, admittedly for short periods, but at high contents.

The issue here is what should be viewed as “normal operating conditions” and “other than normal operating conditions” in back-up systems. When switching over e.g. from a recovery boiler to a lime kiln or from a lime kiln to a TRS burner, the Swedish EPA considers that it is not reasonable to view the lime kiln’s or the TRS burner’s continued emissions as emissions under “other than normal operating conditions”. However, the higher values that are permitted when incinerating strong gases can be applied to lime kilns during the temporary period when they are included as back-up systems.

In the judgement of the Swedish EPA, it can be reasonable to consider emissions via back-up scrubbers, back-up combustion chambers or flares, as well as the time for switching between different systems, as “other than normal operating conditions”. As these emissions may constitute a significant portion of the combined emissions of sulphur, it is important for the time when such emissions are taking place to be registered, and for there to be a verified method for calculating the extent of these emissions during the registered period. Such calculations are required in order for the total emissions to be able to be presented, which is normally regulated in the permit according to the Environmental code. BAT 20c specifies that such a system for registering and calculating emissions must be available in the event of the unavailability of the incineration system.

In order to avoid odour-related nuisance, permits according to the Environmental Code contain conditions regarding availability for the incineration of strong gases, normally set at 99 or 99.5%. At such times, incineration using a flare is also included. However, incineration with a flare does not entail any reduction in sulphur emissions, only that TRS is converted to SO₂. For this reason, irrespective of whether or not conditions are included in the permit regarding the availability of incineration, it is important for the period with other than normal operating conditions to be limited, in order to restrict emissions of sulphur and for the activity to be deemed to comply with BAT.

19.2.3 Residual weak gases, “diffuse” emissions of sulphur

The BAT-AEL for TRS (total amount of reduced sulphur) in emitted residual weak gases is 0.05–0.2 kg S/ADt (page 97; page 793). No averaging time is specified and the interpretation is not obvious. Bearing in mind that supporting data is preferably based on annual values, it is most likely that BAT-AELs will be applied as a yearly average. On the other hand, a yearly average enables the occurrence of periods with significant odour-related nuisance, and there may therefore be grounds to view this as a value that shall not be exceeded during any individual measurement. It appears to be possible for the supervisory authority to make the interpretation that is considered most reasonable in the individual case in question. Regardless of which interpretation is arrived at, it can generally be stated that the exceeding of a limit during an individual measurement should lead to measures being taken to guarantee that, during continued operations, the BAT-AEL is not exceeded. In order to check that the measures have had an effect, new follow-up measurements should be performed.

The term “Residual weak gases” is defined on page 82 (page 779):

“Weak gases that are emitted in ways other than through a recovery boiler, a lime kiln or a TRS-burner”.

In everyday language, these emissions are referred to as “diffuse emissions”, as they relate to emissions from a large number of small emission sources spread over the mill area.

As regards the measurement of residual weak gases, see the above comments relating to BAT 9 regarding the monitoring of emissions to the air, in Section 15.1.4.2.

Dissolver off-gases containing sulphur are emitted from the recovery boiler’s dissolving tank. In the case of newer recovery boilers, the dissolver off-gases are directed back to the recovery boiler and will then be included in the sulphur emissions from the recovery boiler. If the dissolver off-gases are not directed back to the recovery boiler, they may be diverted to the weak gas system and be treated together with other weak gases. They may also be directed separately out into the atmosphere after the scrubbers and droplet removal. In the opinion of the Swedish EPA, sulphur emissions with the dissolver off-gases should be included in the emission value for “residual weak gases” in both of these latter cases,

19.2.4 Alternative and parallel BAT-AELs for emissions to air

BAT-AELs for emissions to air are specified in Tables 3–11. The tables contain

- daily averages for individual parameters specified as concentration (mg/Nm³)
- yearly averages for individual parameters specified as concentration (mg/Nm³)
- yearly averages for individual parameters specified as production-related amount (kg/ADt)
- yearly averages for the sum of two parameters specified as production-related amount (kg/ADt)

Under each table, footnotes provide additional information about the application of BAT-AELs in various situations. See Section 18 above regarding how footnotes should be interpreted.

19.2.5 More than one combustion unit of the same type

Some mills may have more than one recovery boiler or more than one lime kiln. In principle, there could also be more than one TRS burner at a single mill, although the Swedish EPA is not aware of this being the case.

The question can then be raised as to whether BAT-AELs are to apply to each combustion unit (recovery boiler, lime kiln, TRS burner) individually, *or* whether BAT-AELs are to apply to each recovery boiler, each lime kiln and each TRS burner.

BAT-AELs for recovery boilers can be found in Tables 3, 4 and 5. In all the tables, the heading is formulated as BAT-AELs for “a recovery boiler”. Correspondingly for lime kilns in Tables 6, 7, 8 and 9, it is specified in the heading that BAT-AELs refer to “a lime kiln”. From this, the Swedish EPA draws the conclusion that BAT-AELs apply separately for each combustion unit. This is also in accordance with the BAT conclusions’ purpose to ensure the use of the best available techniques.

However, there may be cases where it is difficult to distinguish emissions from each individual combustion unit, e.g. in the event of shared flue gas ducts. Such situations should be resolved in the individual case in question through an application for an alternative value.

19.2.6 Recovery boiler

19.2.6.1 SO₂, TRS AND GASEOUS SULPHUR

(BAT 21, Table 3, BAT page 97; BREF page 794)

The Swedish EPA's interpretation is that, for SO₂ and TRS, the following apply as BAT-AELs

- If strong gases are not incinerated in the recovery boiler

daily average , mg SO ₂ /Nm ³	<i>and</i>	yearly average, mg SO ₂ /Nm ³ <i>or</i> yearly average, total gaseous S, kg/ADt
daily average, mg TRS/Nm ³	<i>and</i>	yearly average, mg TRS/Nm ³ <i>or</i> yearly average, total gaseous S, kg/ADt

- If strong gases are incinerated in the recovery boiler

daily average, SO ₂ , mg/Nm ³	<i>and</i>	yearly average, SO ₂ , mg/nm ³ and yearly average, TRS, mg/Nm ³ <i>or</i> yearly average, total gaseous S, kg/ADt and yearly average, TRS, mg/Nm ³
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The daily averages for SO₂ and TRS apply in parallel with the yearly averages for SO₂ and TRS, i.e. both daily and yearly averages shall be complied with.

The question then is whether the yearly averages specified as concentration (mg/Nm³) are to be considered parallel or alternative to the yearly averages specified as production-related amount (kg/ADt). The yearly averages as concentration are specified separately for SO₂ and TRS. As production-related amount, however, SO₂ and TRS are merged into "gaseous S (TRS-S + SO₂-S)", with a common value. When strictly applied, the yearly averages for concentration and production-related amount cannot thereby be considered parallel, as it is not the same parameter.

The reason for SO₂ and TRS being regulated separately is that the substances have different environmental effects. SO₂ acts through acidification and can produce health effects at high concentrations, although this latter situation is uncommon in Sweden. TRS primarily entails a local environmental impact, as it is made up of highly odorous compounds. Odour-related nuisance to a greater or lesser extent is common in the vicinity of kraft pulp mills. The consequence of whether the yearly average for "gaseous sulphur" would constitute an alternative to the separate yearly averages for SO₂ and TRS would be that the operator can comply with BAT-AELs as yearly averages with relatively high TRS emissions, provided that SO₂ are not too high. The TRS emissions could then result in odour-related nuisance. Provided the daily averages can be applied,

however, this would not be a problem as odour-related nuisance can be absorbed better by the daily average for TRS than by a yearly average.

For the daily average for TRS, however, there is a footnote 4 which states:

“The range is applicable without the incineration of odorous strong gases”.

On the contrary, the footnote means that if strong gases are incinerated in the recovery boiler, there will not be a BAT-AEL for TRS specified as a daily average. The yearly average will be the only one that regulates TRS emissions separately. In this case, the Swedish EPA’s conclusion is that the separate yearly average for TRS, specified as mg/Nm³, shall apply in parallel with the totalled yearly average for gaseous sulphur (TRS-S + SO₂-S), specified as kg/ADt.

However, if strong gases are not incinerated in the recovery boiler, and thereby the exemption according to footnote 4 is not applicable, the totalled yearly average for gaseous sulphur can be viewed as an alternative to the separate yearly averages for SO₂ and TRS. Sufficiently low emissions of TRS are then ensured through the daily value for TRS.

19.2.6.2 NO_x

(BAT 22, Table 4, BAT page 98; BREF page 795)

BAT-AEL applies as

yearly average	mg NO _x /Nm ³	or	kg NO _x /ADt
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19.2.6.3 DUST

(BAT 23, Table 5, BAT page 99; BREF page 795)

BAT-AEL applies as

yearly average	mg dust/Nm ³	or	kg dust/ADt
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As yearly values for recovery boilers with a new dust abatement system or in the event of major refurbishment of dust abatement, 10-25 mg/Nm³ (6% O₂) or 0.02-0.20 kg/ADt apply as BAT-AELs.

For recovery boilers with an existing dust abatement system, 10–40 mg/Nm³ (6% O₂) or 0.02-0.3 kg/ADt apply as BAT-AELs. Footnote 1 to the table states however:

“For an existing recovery boiler equipped with an ESP approaching the end of its operational life, emission levels may increase over time up to 50 mg/Nm³ (corresponding to 0.4 kg/ADt).”

The terms “new plant” and “existing plant” are defined in the Chapter “Definitions” (page 81; page 779):

New plant: A plant first permitted on the site of the installation following the publication of these BAT conclusions or a complete replacement of a plant on the existing foundations of the installation following the publication of these BAT conclusions.

Existing plant: A plant which is not a new plant.

An “Existing dust abatement system” is thus the dust abatement system that has been taken into operation not later than 30 September 2014. Dust abatement systems that are taken into use after this date are classified as “new”.

For recovery boilers with dust abatement systems taken into operation not later than 30 September 2014, 10–40 mg/Nm³ or 0.02–0.3 kg/ADt will apply as BAT-AEL. If it can also be deemed that the electrostatic precipitator “is approaching the end of its operational life” then, according to footnote 1, emission levels up to 50 mg/Nm³ equivalent to 0.4 kg/ADt may be permitted.

When the dust abatement system in a recovery boiler is replaced or undergoes major refurbishment, it will end up in the category “new or major refurbishment”. For the recovery boiler in question, the range 10–25 mg/Nm³ will then apply as BAT-AEL.

What is considered to be a “major refurbishment” is not described in the BAT conclusions document. A refurbishment that is only intended to restore the electrostatic precipitator to its original function should hardly be considered a “major refurbishment”. In order for it to be classed as a “major refurbishment”, the Swedish EPA judges that the design must have been changed in some way, e.g. through an expansion of the size of the chamber or through the addition of further chambers. It is possible to refurbish parts of an electrostatic precipitator, one or more chambers. On the basis of the share of the gas flow that passes via a refurbished or old filter chamber, a proportional calculation can be performed regarding which BAT-AEL is to apply.

The term “is approaching the end of its operational life” is not defined either. The operational life of an electrostatic precipitator can vary considerably. An increase in production and consequently a heavier load on the recovery boiler can reduce the operational life, as can insufficient maintenance, of course. However, an electrostatic precipitator can normally be operated for 15–25 years before any major refurbishment is required. At this time, it may be necessary to replace the electrostatic precipitator’s fittings, i.e. emission electrodes and precipitator plates. The Swedish EPA considers that a reasonable interpretation is that, for electrostatic precipitators installed before 30 September 2014, the content is permitted to amount to 50 mg/Nm³ (or 0.4 kg/ADt) from the time when the electrostatic precipitator is approx. 15 years old.

Dissolver off-gases are emitted from the recovery boiler’s dissolving tank. In newer recovery boilers, the dissolver off-gases are returned to the recovery boiler or collected and treated in the weak gas system. At many mills, however, the dissolver off-gases are routed separately out into the atmosphere, often after treatment in a scrubber and droplet removal. If the dissolver off-gases are routed back to the recovery boiler, the dust will be returned to the recovery boiler and be included in its emissions. The question then is how the dissolver off-gases’ dust emissions will be viewed if they are routed in a separate chimney directly to the ambient air. In our judgement, it has not been the intention that the dust from separate emissions of dissolver off-gases should be counted together with emissions from the recovery boiler. The consequence of this is that those mills where the dissolver off-gases are not routed back to the recovery boiler will be given a larger emissions framework overall than the mills where the dissolver off-gases are routed back to the recovery boiler, which can be considered to be distorted. In these

cases, the regulation of dust emissions with dissolver off-gases may take place through conditions in permits according to the Environmental Code.

19.2.7 Lime kiln

For lime kilns, as regards NO_x and dust, there are BAT-AELs specified both as concentration, mg/Nm³, and as production-related amount, kg/ADt. The emission levels are fundamentally alternatives to one another. They have been set with the intention of corresponding to the same technical level, i.e. BAT.

It is sometimes the case that lime is regularly removed from chemical circulation in order to avoid concentrations of non-process substances in the process. The need to do this depends on the extent to which the mill's water circulation is closed. Non-process substances can also be regulated in other ways, normally by means of electrostatic precipitator dust from the recovery boiler being discharged to waste water. If the mill then purchases quicklime to replace lime that has been removed from the circulation, this means that the re-burning of lime is less extensive in relation to pulp production compared to the case if all lime were to be burned and recirculated. However, if unburned lime is purchased and then burned in the mill's own lime kiln, the extent of lime re-burning in relation to pulp production is unchanged.

At some mills, the lime kiln may be a limiting factor as regards production, in which case the mill may purchase quicklime in order to increase its production. Pulp production will then be greater than with equivalent lime re-burning.

The use of purchased quicklime, i.e. reduced lime re-burning in relation to pulp production, means that the emissions from the lime kiln calculated per produced amount of pulp will be less, despite the fact that the lime kiln's emissions performance has not changed. It is thus easier to comply with the production-related BAT-AELs that are specified in the unit kg pollution/ADt. However, the emission levels specified as concentration, mg/Nm³, are not affected in the same way.

The underlying precondition for the BAT-AEL for the lime kiln that is specified in the unit kg/ADt is that there is a direct relationship between the lime kiln's operations, i.e. that the amount of lime that is re-burned is proportional to the production of kraft pulp. A particular amount of purchased lime that only corresponds to the need for bleeding out of non-process substances can be said to be included in the process conditions. However, this ought to be equivalent to just a few per cent of the lime flow. In the event of more extensive use of purchased quicklime, the conditions no longer exist for applying the production-related emission value, and the emissions will not reflect the lime kiln's technical environmental standard. In such cases, it is only the BAT-AEL that is specified as concentration, mg/Nm³, that applies and that shall consequently be met.

19.2.7.1 SO₂, TRS AND GASEOUS SULPHUR

(BAT 24, Table 6 and BAT 25, Table 7, BAT pages 99-100; BREF page 796)

Tables 6 and 7 contain the following BAT-AELs

yearly average	SO ₂	mg/Nm ³	Table 6
yearly average	TRS	mg/Nm ³	Table 7
yearly average	Gaseous S (TRS-S + SO ₂ -S)	kg S/ADt	Table 6

One issue that is a matter of interpretation is whether the yearly averages for gaseous sulphur (TRS-S + SO₂-S) in Table 6, specified as production-related amount, can be viewed as alternatives to the yearly averages for concentration of SO₂ and for TRS in Table 7 *or* whether both the production-related amounts for gaseous sulphur in Table 6 *and* the concentration values for SO₂ and TRS in Tables 6 and 7 are to apply in parallel.

SO₂ and TRS have different levels of significance from an environmental perspective. For SO₂, at least in Sweden, the most important impact is regional acidification. The problem with TRS, on the other hand, is that it is made up of extremely odorous compounds and can therefore be disruptive in the immediate surroundings. If it were sufficient to comply with BAT-AEL for the combined emissions of gaseous sulphur, it would be possible, in the event of low SO₂ emissions, to have high, odorous TRS emissions and still comply with BAT-AEL. This argues that the concentration values should apply in parallel with the production-related amounts.

However, a yearly average for the content of TRS is a blunt method for regulating emissions with disruptive odours. In order to protect against odour-related nuisance, it would have been more appropriate to use a daily average, in the same way as for the recovery boiler. The absence of a daily value may have been due to the fact that, in the supporting data for the BAT conclusions, there was a consistent lack of data containing emission values at a daily level. In the absence of BAT-AELs as daily values, a BAT-AEL for TRS as a yearly value still entails a restriction as to the highest permitted TRS emissions for shorter periods as well.

The Swedish EPA's conclusion is that all BAT-AELs in Tables 6 and 7 apply in parallel with each other and must be met.

Please note that, for SO₂ and for gaseous sulphur in Table 6, different BAT-AELs apply when strong gases (including methanol and turpentine) are incinerated in the lime kiln or not.

For TRS in Table 7, footnote 1 states: "For lime kilns burning strong gases (including methanol and turpentine), the upper end of the AEL range may be up to 40 mg/Nm³".

If strong gases are only incinerated in the lime kiln for parts of the year, e.g. in the event of operational disruptions in other regular incineration of strong gases (recovery boiler or dedicated TRS burner), the higher value should only be applied during the part of the year when strong gases are actually being incinerated in the lime kiln. To calculate the yearly average, the time during which strong gases are incinerated in the lime kiln

should be registered and used as supporting data for assessing which BAT-AEL is to apply as a yearly average.

19.2.7.2 NO_x

(BAT 26, Table 8, BAT page 101; BREF page 797)

BAT-AEL applies as

yearly average	mg NO _x /Nm ³	or	kg NO _x /ADt
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When using liquid fuels, footnote 1 states that higher emission levels “may occur” when using vegetable fuels. Examples of these include turpentine, methanol and tall-oil. A corresponding exemption exists for gaseous fuels in footnote 2. “Non-condensable gases” are given as an example.

It can be noted that there is no BAT-AEL for the incineration of solid fuels in a lime kiln, such as sawdust or pellets. The reason for this is that, at the time when the BREF document was drawn up, there were only a few lime kilns that used solid fuels and there was therefore not considered to be enough supporting data.

At Swedish kraft pulp mills, it is unusual not to use one of the fuels mentioned in footnotes 1 and 2. As a result, for the vast majority of mills, the higher emission levels listed in one of the footnotes will apply. If the type of fuel varies during the year, the yearly average should be calculated in relation to the length of time each fuel combination has been used, e.g. time when only fossil fuel oil has been used and time when vegetable fuels have been used.

19.2.7.3 DUST

(BAT 27, Table 9, BAT page 101; BREF page 797)

BAT-AEL applies as

yearly average	mg dust/Nm ³	or	kg dust/ADt
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As yearly values for lime kilns with a new dust abatement system or in the event of major refurbishment of dust abatement, 10–25 mg/Nm³ (6% O₂) or 0.005–0.02 kg/ADt apply as BAT-AELs.

For lime kilns with an existing dust abatement system, 10–30 mg/Nm³ (6% oxygen) or 0.005–0.03 kg/ADt apply as BAT-AELs. Footnote 1 to the table states however:

“For an existing lime kiln equipped with an ESP approaching the end of its operational life, emission levels may increase over time up to 50 mg/Nm³ (corresponding to 0.05 kg/ADt).”

The terms “new plant” and “existing plant” are defined in the Chapter “Definitions” (page 81; page 779):

New plant: A plant first permitted on the site of the installation following the publication of these BAT conclusions or a complete replacement of a plant on the existing foundations of the installation following the publication of these BAT conclusions.

Existing plant: A plant which is not a new plant.

An “Existing dust abatement system” is thus a dust abatement system that has been taken into operation not later than 30 September 2014. Dust abatement systems that are taken into use after this date are classified as “new”.

For lime kilns with dust abatement systems taken into operation not later than 30 September 2014, 10–30 mg/Nm³ or 0.005–0.03 kg/ADt will apply as BAT-AELs. If it can also be deemed that the electrostatic precipitator “is approaching the end of its operational life” then, according to footnote 1, emission levels up to 50 mg/Nm³ equivalent to 0.05 kg/ADt may be permitted.

When the dust abatement system for a lime kiln is replaced or undergoes major refurbishment, it will end up in the category “new or major refurbishment”. For the lime kiln in question, the range 10-25 mg/Nm³ or 0.005-0.02 kg/ADt will then apply as BAT-AELs.

With regard to what should be viewed as a “major refurbishment” and what is meant by the term “is approaching the end of its operational life”, the Swedish EPA interprets these in the same way as for recovery boilers (see comments in Section 19.2.4.3 above regarding recovery boilers).

19.2.8 TRS burner

19.2.8.1 SO₂ AND TRS

(BAT 28, Table 10, BAT page 102; BREF page 798)

Table 10 contains the following BAT-AEL.

yearly average	SO ₂	mg/Nm ³
yearly average	TRS	mg/Nm ³
yearly average	Gaseous S (SO ₂ -S + TRS-S)	kg/ADt

A corresponding reasoning can be put forward to that set out above regarding lime kilns, see Section 19.2.5.1. If the total BAT-AEL for gaseous sulphur (TRS-S + SO₂-S) is interpreted as an alternative to the separate BAT-AELs for SO₂ and TRS, this would provide the potential for high TRS values resulting in odour-related nuisance. The opinion of the Swedish EPA is that this is not reasonable, and that instead all the values in Table 10 apply in parallel with each other and shall be met.

It should be noted that BAT-AEL for TRS burners applies at 9% oxygen content. The measurement values must be converted to this oxygen content.

19.2.8.2 NO_x

(BAT 29, Table 11, BAT page 102; BREF page 798)

BAT-AEL applies as

yearly average	mg NO _x /Nm ³	or	kg NO _x /ADt
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According to Table 11, 50–400 mg/Nm³ (9% oxygen) or 0.01–0.1 kg/ADt apply for TRS burners as BAT-AEL for NO_x. It should be noted that BAT-AEL for TRS burners applies at 9% oxygen content. The measurement values must be converted to this oxygen content.

Footnote 1 to the table states however:

“Where at existing plants a switch to staged incineration is not feasible, emission levels up to 1,000 mg/Nm³ (corresponding to 0.2 kg/ADt) may occur.”

As stated in the footnote, it is not enough that the TRS burner is now not designed with staged incineration in order for a higher BAT-AEL value to be applied. It is also required that it “is not feasible” to convert the boiler in order to achieve this. In an individual case, there should consequently be specific technical difficulties giving rise to particularly high costs in order to consider that it “is not feasible” to switch to staged incineration. A lack of space inside a building has been cited by the sector as one possible reason. In this case, it should be investigated whether the TRS burner can be relocated or whether it is possible to create new space adjacent to the existing position of the burner. In those cases where the footnote is cited, the operator should report to the supervisory authority any technical and financial preconditions for switching to staged incineration, as well as the reduction in NO_x emissions that could be achieved. It is then the task of the supervisory authority, in the event the table’s basic values cannot be achieved, to assess whether the reasons are sufficient for the footnote’s higher value to apply as BAT-AEL for the TRS burner in question.

19.3 Waste

In Chapter 1.2.3, BAT 30 contains a BAT conclusion specifically for waste within kraft pulp production, which states that BAT is to recycle dust from recovery boiler’s electrostatic precipitator. However, it is stated that recirculation may be limited due to the presence of non-process substances in the dust.

The BREF document describes the waste types that occur in Chapter

- 3.3.26 Integrated waste management concept.

No specific comment is provided for BAT 30. However, the matter of electrostatic precipitator dust is touched on in Chapters 3.4.3 and 3.4.7. Electrostatic precipitator dust from the recovery boiler consists primarily of sodium sulphate. This is normally returned to the process and reused as a cooking chemical. Non-process substances (e.g. chlorine and potassium) may accumulate in the chemical circulation, however, which can cause deposits and corrosion in the recovery boiler and in other process equipment. Electrostatic precipitator dust may then need to be removed from the cycle and be sent for disposal. This normally takes place by means of the dust being discharged to waste water (“bleeding out”). Samples of electrostatic precipitator dust can also be taken in order to regulate the sulphur balance in the process. Emissions of electrostatic precipitator dust are of most significance as they contain significant amounts of cadmium at some mills. The need for bleeding out can be reduced by means of the electrostatic precipitator dust being leached, or through bleeding out of non-process substances in other parts of the process. Emissions of metals when bleeding out

electrostatic precipitator dust can also be reduced through chemical precipitation, although this is currently only applied at a few Swedish mills, however. There is no BAT conclusion that addresses these measures. This matter may consequently be handled during the licensing process according to the Environmental Code.

19.4 Energy consumption and efficiency

(Chapter 1.2.4, BAT pages 103-104; BREF page 799)

Background information to the BAT techniques in BAT 31 and 32, as well as examples of consumption levels, can be found in the BREF document in Chapters

- 3.1.11 Chemical and energy recovery system
- 3.2.2.3 Energy consumption
- 3.3.27 Measures for increased energy efficiency
- 3.4.1. Enhanced generation of electricity, biomass-based products and the utilization of excess heat

Some more specific information for BAT conclusions 31 a-q can be found in Chapter 3.3.27 of the BREF document, and in Chapter 3.3.27 for BAT conclusions 32 a-g.

20 SULPHITE PULP

(Chapter 1.3, BAT pages 104–109; BREF pages 800-804)

Chapter 1.3 only applies to the production of pulp. For sulphite mills that have integrated pulp and paper production, the BAT conclusions for paper production in Chapter 1.6 also apply. The BAT-AEL values for sulphite pulp in Chapter 1.3 shall be added together with the BAT-AEL values for paper production in Chapter 1.6.

20.1 Waste water and emissions to water

(Chapter 1.3.1, BAT pages 104-106; BREF pages 800-801)

20.1.1 Dissolving pulp

As regards emissions to water, it is specified that BAT-AELs in Tables 12 and 13 (pages 105–106; page 801) are not applicable for mills that produce dissolving pulp or speciality pulp for chemical applications. However, the BAT conclusions without emission levels that are found in BAT 33 apply to such mills too, including techniques, reference waste water flow and BOD concentration in the treated waste water.

20.2 Emissions to air

(Chapter 1.3.2)

20.2.1 Dissolving pulp

For emissions to air, there are no exemptions for mills that produce dissolving pulp or speciality pulp for chemical applications. BAT-AELs thus also apply to these mills.

20.2.2 NO_x from recovery boiler

(BAT 36, Table 14, BAT page 107; BREF page 802)

BAT-AEL applies as

daily average, mg NO _x /Nm ³	and	yearly average, mg NO _x /Nm ³
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It should be noted that BAT-AEL for NO_x applies at 5% oxygen content. The measurement values must be converted to this oxygen content.

Footnote 1 to the table also states:

“For ammonium-based mills, higher emission levels of NO_x may occur: up to 580 mg/Nm³ as daily average and up to 450 mg/Nm³ as yearly average.”

The Swedish EPA’s interpretation is that, for ammonium-based mills, BAT-AELs comprise the values that are specified in the footnote.

20.2.3 NH₃ from recovery boiler

(BAT 36, Table 14, BAT page 107; BREF page 802)

BAT-AEL applies as

yearly average, mg NH₃/Nm³

This is the only BAT-AEL in the entire BAT document that addresses emissions of ammonia, NH₃. The reason is that for recovery boilers, SNCR (selective non-catalytic reduction) is considered to be the BAT for the reduction of nitrogen oxides. See also BAT 36c, which also specifies restrictions for when SNCR may be applicable. The purpose of a BAT-AEL for ammonia is to avoid excess emissions of unreacted ammonia.

The BAT-AEL is specified at 5% oxygen content and the measurement values must be converted to this oxygen content.

20.2.4 Dust from recovery boiler

(BAT 37, Table 15, BAT pages 107-108; BREF page 803)

BAT-AEL applies as

average during the sampling period, mg dust/Nm³

Note that BAT-AEL is specified as “average during the sampling period”. This is defined under the heading “Averaging periods for emissions to air” on page 81 (page 779) as “Average value of three consecutive measurements of at least 30 minutes each”.

BAT-AEL is specified as 5–20 mg/Nm³. However, footnote 1 to the table contains the following exemption:

“For recovery boilers operated in mills using more than 25% of hardwood (potassium-rich) in raw materials, higher dust emissions up to 30 mg/Nm³ may occur.”

The level that is specified in the footnote, 30 mg/Nm³, consequently applies as BAT-AEL on condition that the criterion “more than 25% of hardwood” is met.

Footnote 2 contains a further exemption which states that the BAT-AEL for dust does not apply for ammonium-based mills.

20.2.5 SO₂ from recovery boiler

(BAT 37, Table 15, BAT page 108; BREF page 803)

BAT-AEL applies as

daily average, mg SO₂/Nm³ and yearly average, mg SO₂/Nm³

BAT-AEL for SO₂, at 5% oxygen, is specified in Table 15 at:

daily average, mg SO ₂ /Nm ³	100–300
yearly average, mg SO ₂ /Nm ³	50–250

Footnote 4 to Table 15 contains the following exemption:

“For existing multistage venturi scrubbers, higher emissions of SO₂ up to 400 mg/Nm³ as a daily average value and up to 350 mg/Nm³ as a yearly average may occur.”

“Existing” refers to venturi scrubbers that have been installed prior to 30 September 2014. For these, the footnote allows higher BAT-AELs than in other cases.

20.3 Energy consumption and efficiency

(Chapter 1.3.3, BAT pages 108-109; BREF page 804)

Regarding energy consumption and energy efficiency, there are technical BAT for sulphite pulp production in BAT 38 and 39. Some technical BAT refer to the actual production of pulp, while others refer to the operation of the recovery boiler, i.e. the sulphite pulp recovery boiler.

Background information to the BAT techniques in BAT 38 and 39, as well as examples of consumption levels, can be found in Chapters 4.1.4, 4.2.2.3 and 4.3.24 of the BREF document.

20.4 NSSC PULP

(Chapter 1.3, BAT pages 104-109; BREF pages 800-804)

Chapter 1.3 of the BAT conclusions, “BAT conclusions for the sulphite pulping process”, also applies to NSSC pulp unless otherwise specified.

20.4.1 Emissions to water

Technical BAT in respect of emissions to water (BAT 33) also apply to NSSC pulp, to the extent they are applicable to the production of NSSC pulp.

For emissions to water, there are particular BAT-AELs for NSSC pulp (BAT 33, Table 13, BAT page 106; BREF page 801).

20.4.2 Emissions to air

As regards emissions to air, there are no specific values for NSSC pulp, and also no exemptions. The Swedish EPA’s interpretation is therefore that BAT-AELs for emissions to air also apply to NSSC production.

At the two Swedish mills that produce NSSC pulp, however, the process is integrated with the production of kraft pulp. The recovery of red liquor (the spent liquor from NSSC production) is integrated with the recovery of black liquor from kraft pulp production, known as cross recovery. The recovery takes place in a recovery boiler whose design and function, as well as the nature of the emissions, are comparable with a recovery boiler at a mill that only produces kraft pulp. Lime kilns and TRS burners serve the production of both kraft pulp and NSSC pulp.

One possible approach could be to use BAT-AEL for the sulphite boiler (BAT 37, Table 15) and, in combination with BAT-AEL for the recovery boiler (BAT 21, 22 and 23), calculate a weighted BAT-AEL with the aid of each pulp type's share of the total pulp production. However, this interpretation entails a large number of difficulties during application, for example because the BAT-AELs are specified in different ways and because BAT-AELs for lime kilns and TRS burners do not occur within sulphite pulp production.

The opinion of the Swedish EPA is instead that, for a mill with cross recovery, the BAT-AELs that are specified in Chapter 1.2 of the BAT conclusions for kraft pulp production should be applied to recovery boilers, lime kilns and TRS burners. For those BAT-AELs that are specified as production-related amounts (kg/ADt), the total production of kraft pulp and NSSC pulp should form the basis for the calculation of the emission value. The BAT-AELs that are specified as concentration apply in the same way as at mills that only produce kraft pulp.

In respect of the technical BAT that relate to emissions to air, it is our interpretation that only BAT 34 is applicable in the event of cross recovery. Other technical BAT (BAT 35, 36, 37) relate to the design and operation of a sulphite pulp recovery boiler. As recovery takes place in a kraft pulp recovery boiler in the event of cross recovery, these BAT are not applicable. However, the technical BAT in Chapter 1.2 for kraft pulp production apply to the recovery boilers, lime kilns and TRS burners that serve the combined production of kraft and NSSC pulp.

20.4.3 Energy consumption and efficiency

(chapter 1.3.3, BAT pages 103-104; BREF page 804)

Regarding energy consumption and energy efficiency, there are technical BAT for sulphite pulp production in BAT 38 and 39. For kraft pulp production, corresponding technical BAT can be found in BAT 31 and 32. Some technical BAT refer to the actual production of pulp, while others refer to the operation of the recovery boiler, i.e. kraft pulp recovery boilers or sulphite pulp recovery boilers.

In the event of cross recovery, the technical BAT that refer to the kraft pulp recovery boiler will apply due to the kraft pulp production, regardless of the fact that the boiler also recovers spent liquor from NSSC production. Otherwise, a separate assessment must be carried out regarding which technical BAT are applicable.

Background information to the BAT techniques in BAT 38 and 39, as well as examples of consumption levels, can be found in the BREF document in Chapters

- 4.1.4 Chemical and energy recovery system
- 4.2.2.3 Energy consumption
- 4.3.24 Reduction of energy consumption (energy efficiency)

21 Mechanical pulp and paper as well as CTMP pulp

(Chapter 1.4, BAT pages 109-111; BREF pages 805-806)

21.1 Mechanical pulp and paper – emissions to water

For mills with integrated production of mechanical pulp and paper, a number of BAT conclusions without emission levels that can be found in Chapter 1.6 on paper production also apply, in addition to Chapter 1.4. These BAT conclusions are listed in the introduction to Chapter 1.4 and are BAT 49, 51, 52c and 53.

21.1.1 Differences in the production process

For mechanical pulp, there are a number of factors that mean that there can be large differences between the processes at different mechanical mills, despite the fact that the same BAT-AEL applies.

21.1.1.1 THE PRODUCTION OF MARKET PULP AND INTEGRATED PRODUCTION OF PULP AND PAPER

The BAT conclusions for mechanical pulp that are specified in BAT 40, Table 16, apply both to

- mills that only produce market pulp
and to
- mills with integrated production of pulp and paper.

BAT-AELs in Table 16 are specified in the unit “kg/t” as a result of the table being applied to the finished paper product. For mills that produce market pulp, the corresponding unit is “kg/ADt”.

The same BAT-AEL consequently applies to the production of market pulp as to integrated production of mechanical pulp and paper. This may seem illogical, as the emissions reasonably ought to be less when only producing market pulp compared to mills where paper is also being produced from the pulp. The reason is that the majority of mills with mechanical pulp production are integrated mills with paper production. There are only a handful of mills that produce mechanical market pulp and the supporting data has therefore been deemed to be insufficient to specify particular BAT-AELs for the production of market pulp alone.

21.1.1.2 BLEACHED AND UNBLEACHED PULP

The bleaching of pulp is a process that is extremely important as regards the amount of water pollution that is generated during production. As opposed to the production of kraft pulp, however, BAT-AELs for mechanical pulp and paper do not draw any distinction between mills that produce bleached or unbleached pulp.

21.1.1.3 ADDITIVES

At some mills, the finished paper is made up to a significant extent of additives such as filler and coating agents. These additives are mainly inorganic and only contribute to a small extent to the emissions of organic substances from the mill. As BAT-AELs are calculated on the finished paper, this means that it will be easier for such mills to comply with BAT-AEL for COD than those that use a small amount of additives.

21.1.2 Purchased pulp

Some mills with integrated production of mechanical pulp and paper buy in other pulp, for example kraft pulp to give the paper better strength properties. During its production, the purchased pulp has not contributed to any emissions at the mill that buys in the pulp. However, the purchased pulp will give rise to emissions during paper production. BAT-AELs for mechanical pulp and paper differ from BAT-AELs for non-integrated paper production primarily in relation to COD. The upper value for mechanical pulp and paper is 4.5 kg/tonne of paper (BAT 40, Table 16), whereas the upper value for non-integrated paper production is 1.5 kg/tonne of paper (BAT 50, Table 20). The question then is how BAT-AELs should be calculated for purchased pulp.

According to the heading for Table 16, it covers:

“BAT-associated emission levels for the direct waste water discharge to receiving waters from the integrated production of paper and board from mechanical pulps produced on site” (Swedish EPA’s underlining)

As the purchased pulp is not produced on site, the conclusion can be drawn that purchased pulp is not covered by the BAT-AELs that are specified in Table 16.

As regards paper production, the introduction to Chapter 1.6 “BAT conclusions for papermaking and related process” states:

“The BAT conclusions in this section apply to all non-integrated paper mills and board mills and to the paper and board making part of integrated kraft, sulphite, CTMP and CMP mills.”

As mechanical pulp is not mentioned among the listed production types, this can be interpreted as meaning that this also does not include emissions from the paper production deriving from purchased pulp at integrated mechanical pulp mills.

The conclusion of this is that, if the text in the BAT conclusions document is read literally, there is no BAT-AEL for paper that is produced from purchased pulp at integrated mechanical pulp mills. In other words, these emissions would be unregulated, which cannot be the objective. It would also mean that the mill needs to demonstrate that emissions from that part of pulp and paper production that is actually covered by Table 16 remains within the BAT-AELs that are specified. As the waste water streams are shared, this would be difficult to distinguish.

The supporting data for mechanical pulp includes mills that also buy in pulp, and this could lead to the conclusion that the intention has been that purchased pulp should also be covered by BAT-AELs in Table 16.

Due to this lack of clarity, it is also possible to apply the BAT conclusions so that BAT-AELs for mechanical pulp and paper (Table 16) apply to the share of the paper that derives from pulp produced in-house, whereas BAT-AELs for paper production (Table 20) apply to the share of the paper that derives from purchased pulp. This is the most reasonable application from a technical and environmental perspective, in the opinion of the Swedish EPA.

21.1.3 COD

(BAT 40, Table 16, BAT page 110; BREF page 805)

21.1.3.1 HIGHLY BLEACHED OR NOT HIGHLY BLEACHED PULP

According to Table 16, the following applies as BAT-AEL for COD:

Yearly average: 0.9–4.5 kg/t

Footnote 1 to Table 16 also states:

“In the case of highly bleached mechanical pulp (70–100% of fibre in final paper), emission levels of up to 8 kg/t may occur.”

As has been pointed out above, the same BAT-AEL applies to COD regardless of whether the mill is producing bleached pulp or unbleached pulp. As a significant portion of the organic substance that is added to the waste water derives from bleaching, this means that mills that wholly or partially produce unbleached pulp have a reasonable opportunity to achieve lower emission levels than those that principally produce bleached pulp.

Through footnote 1, a separate level has been introduced for those mills that produce “highly bleached pulp”. According to the footnote, however, this higher COD value may only be applied if at least 70% of the fibre in the final paper is highly bleached. However, what is meant by “highly bleached” pulp is not defined in the BAT conclusion.

The bleaching chemicals that normally occur during mechanical pulp production are sodium dithionite and hydrogen peroxide, either one or other of these or both in combination. Using hydrogen peroxide, the pulp can be bleached to a higher brightness than when only sodium dithionite is used.

In the opinion of the Swedish EPA, “highly bleached mechanical pulp” should be defined neutrally from a technique perspective based on the bleaching results, i.e. the brightness of the bleached pulp specified as % ISO units.

There is not much guidance in the BREF document regarding what level of brightness should be viewed as “highly bleached” when producing mechanical pulp. Chapter 5.1.7 “Bleaching of mechanical pulps” states (page 496) that with dithionite bleaching, and a minimum of wood loss, the brightness can be increased by up to 12 percentage points, from an initial brightness of 58-70% ISO to around 70-76% ISO. Chapter 6 of the BREF document addresses paper production, with Chapter 6.3 giving examples of treatment techniques for emissions to water. Chapter 6.3.9 “Combined ozonation and filtration” describes a combination of ozone treatment and filtration, with examples from a German paper mill. The evaluation of the treatment concept states that a larger

amount of COD is generated when producing paper grades with a higher brightness, 73-80% ISO, than for standard grades with a brightness of 67-68% ISO.

Mechanical pulp and paper that is produced at Swedish mills lies between 65 and 75% ISO in the case of dithionite bleaching and between 70 and 83% ISO with hydrogen peroxide bleaching. The highest brightnesses are achieved with groundwood pulp. During the consultation with the sector regarding this guidance, it has been suggested that the limit for “highly bleached pulp” should be set at 70% ISO.

Bleaching using sodium dithionite is considered to have a lower impact and produce a lower release of organic substances than bleaching with hydrogen peroxide. During the consultation, the sector has presented information which it considers demonstrates that the release of organic substance during bleaching increases linearly with increasing final brightness, and that the release at a certain brightness is the same irrespective of whether dithionite or hydrogen peroxide is used. According to this conclusion, the measured lower emissions with dithionite bleaching would be due to the fact that the mill is bleaching to a lower brightness, not due to dithionite in itself producing a lower release of organic substance. However, the Swedish EPA considers that the information which has been presented does not contain much data relating to dithionite bleaching. It is consequently difficult to draw the conclusion, with any degree of certainty, that dithionite bleaching produces the same release of organic substance as hydrogen peroxide when bleaching to the same brightness. However, there is also no data that demonstrates the opposite.

In addition to the bleaching chemical that is used, the brightness that is achieved also depends on the initial brightness of the unbleached pulp, which in turn is dependent on the type of wood and the wood quality.

The final release to the receiving water body is also dependent on the degree of treatment in the waste water treatment plant. According to the information gathered by the Swedish EPA, the degree of treatment stands at 86-92% at those mills that produce TMP pulp. Two of the mills produce pulp in the range 75-78% ISO. Thanks to a high degree of treatment, 92%, one of these mills (in 2016) is largely achieving the level for “non-highly bleached pulp”, i.e. 4.5 kg COD/tonne of paper. If the same degree of treatment were to exist at the other mill, that mill would also have achieved the level of 4.5 kg COD/tonne of paper.

The Swedish EPA observes that the BREF document contains insufficient information to determine what should be viewed as “highly bleached pulp”. The sector has presented further supporting data, but despite this it is not clear where the limit should be drawn. The Swedish EPA’s opinion is that the limit of 70% ISO proposed by the sector is on the low side. In order to specify unambiguously a limit at which the legally binding BAT-AEL should be raised from 4.5 to 8 kg COD/tonne of paper, more knowledge would be required, in particular data regarding the release of organic substance when bleaching with sodium dithionite to brightnesses higher than 70% ISO.

During the licensing process, “consideration” must be given to BAT-AEL in order to assess the requirement for best possible techniques (Chapter 1 Section 10 of the

Ordinance on Industrial Emissions). In order to prescribe emissions terms in respect of organic substances, the above factors should consequently be taken into account, i.e. the brightness of unbleached pulp, the brightness to which bleaching is taking place, which bleaching chemical is being used and the potential to achieve a high degree of treatment in the waste water treatment plant.

21.1.3.2 CALCULATION OF PERMITTED COD EMISSIONS TAKING INTO ACCOUNT THE PROPORTION OF HIGHLY BLEACHED PULP

As set out above, 4.5 kg/tonne of paper or 8 kg/tonne of paper can apply as BAT-AEL for emissions of COD, depending on whether the pulp is considered to be highly bleached or not. The requirement for using the higher value is that at least 70% of the fibre in the paper is made up of highly bleached pulp. As stated in Section 21.1.2, our opinion is that this applies to pulp produced in-house, i.e. at least 70% of the fibre produced in-house that is included in the paper should be deemed to be highly bleached.

A number of paper products with different brightnesses are normally produced. We can therefore see two alternative ways of determining which BAT-AEL is to be used for paper production.

- a) The various fibre grades that are made are classified as either “highly bleached” or “not highly bleached”, and are added together in each category. If the totalled proportion of “highly bleached” is 70% or higher, the higher COD value (8 kg/tonne of paper) may be used for the entire paper production that is based on in-house pulp. If the totalled proportion of “highly bleached” is lower than 70%, the lower COD value (4.5 kg/tonne of paper) must be used for the entire paper production based on in-house pulp.
- b) The proportion of the fibre produced in-house that is classified as highly bleached or not highly bleached is calculated for each paper grade. If the proportion of highly bleached fibre in each paper grade is 70% or higher, the higher value (8 kg/tonne of paper) may be used. If the proportion is lower than 70%, the lower value (4.5 kg/tonne of paper) must be used.

Alternative a) is a simpler way of determining which BAT-AEL is to be applied. However, alternative b) entails a more flexible calculation method that is better adapted to the production in question, and therefore produces a fairer result.

Examples of how calculations are to be performed regarding which emissions are included within BAT-AELs can be found in Appendix 1 “Calculations of permitted emission amounts within the framework of BAT-AEL”. The examples E1-E4 relate to mechanical pulp. Example E4 illustrates in particular the two methods, a and b, for calculating the proportion of the produced paper that is to be classified as “highly bleached”.

21.1.4 Nitrogen

(BAT 40, Table 16, BAT page 110; BREF page 805)

BAT-AEL for total nitrogen, Table 16:

yearly average:	0.03–0.1 kg/t
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Footnote 2 to Table 16 states:

“When biodegradable or eliminable chelating agents cannot be used due to pulp quality requirements (e.g. high brightness), the emissions of total nitrogen might be higher than this BAT-AEL and should be assessed on a case-by-case basis.”

It is unclear how this footnote should be interpreted. At present, EDTA or DTPA are used more or less exclusively as chelating agents. These have similar properties. The degradability can vary considerably depending on the conditions in the biological treatment plant. The footnote uses the term “biodegradable”. There is no detailed definition of this in the BAT conclusions document. On the basis of BAT 3b (page 85), it is possible to draw the conclusion that “biodegradable” refers to breaking down to at least 70%. In most biological treatment plants, the level of decomposition is less than this, which is why EDTA and DTPA are not classified as “biodegradable”.

EDTA and DTPA contain nitrogen and therefore produce higher nitrogen emissions. The nitrogen in the chelating agents is difficult to access, is not considered capable of being absorbed as a nutrient during biological treatment, and therefore cannot replace the nitrogen additive in the biological treatment plant. It either remains in the agent or is separated and quickly converted to nitrate. The micro-organisms in the biological treatment plants require nitrogen as ammonia. The Swedish EPA interprets this as meaning that, when using EDTA or DTPA, there may be reason to accept higher a BAT-AEL for nitrogen.

The instruction in the footnote that the emission level “should be assessed on a case-by-case basis” means that the operator needs to apply for and be granted derogation in order for a higher emission limit value to apply. That which is stated in the footnote can then constitute supporting data when assessing the derogation. See also comments regarding footnotes in Section 18.1 above.

21.2 CTMP and CMP – emissions to water

For the production of CTMP (and CMP, although such production does not currently occur in Sweden), the chapter only applies to the actual pulp production.

For CTMP mills that have integrated pulp and paper production, the BAT conclusions for paper production in Chapter 1.6 also apply. The BAT-AEL values for CTMP pulp in Chapter 1.4 shall be added together with the BAT-AEL values for paper production in Chapter 1.6.

21.2.1 Nitrogen

(Table 17, BAT page 110; BREF page 806)

According to Table 17, the following apply for CTMP as BAT-AEL for total nitrogen:

yearly average	0.15–0.18 kg/ADt
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Footnote 1 to Table 17 states however:

“When biodegradable or eliminable chelating agents cannot be used due to pulp quality requirements (e.g. high brightness), the emissions of total nitrogen might be higher than this BAT-AEL and should be assessed on a case-by-case basis.”

The same footnote can be found in Table 16 for mechanical pulp and paper. See also the comments on this footnote under Section 21.1.4 above.

21.3 Energy consumption and efficiency

(Chapter 1.4.2, BAT pages 110-111; BREF page 806)

Background information to the BAT techniques in BAT 41 as well as examples of consumption levels can be found in the following chapters in the BREF document

- 5.2.2.7 Energy use
- 5.3.9 Extensive recovery of secondary heat from TMP and CTMP refiners and reuse of recovered steam in paper and pulp drying
- 5.3.10 Emission-optimised incineration of solid waste and energy recovering
- 5.4.1 New energy-efficient TMP processes
- 5.4.2. New energy-efficient bleached CTMP processes

BAT 41 a in respect of energy-efficient refineries is covered specifically in Chapter 5.4.1. BAT 41 b in respect of recovery of fumes from refineries is covered specifically in Chapter 5.3.9.

22 Recycled fibres (RCF)

(Chapter 1.5, BAT pages 111-114; BREF pages 807-809)

Chapter 1.5 addresses pulp and paper production based on recycled fibres (RCF).

Note that for paper production in mills with integrated production of pulp and paper based on recycled fibres, a number of BAT conclusions without emission levels also apply, which can be found in Chapter 1.6 on paper production. These BAT conclusions are listed in the introduction to Chapter 1.5 and are BAT 49, 51, 52c and 53.

22.1 Materials management

Chapter 1.5.1, BAT page 111; BREF page 807)

For RCF, Chapter 1.5.1, BAT 42 a-e, contains a number of specific BAT without emission levels for materials management, i.e. the handling of the recycled material that constitutes raw material for RCF production.

Supporting data for these BAT can be found in the BREF document, Chapter

- 6.3.1 Good housekeeping in handling and storage of paper for recycling.

22.2 Emissions to water

(Chapter 1.5.2, BAT pages 112-113; BREF pages 807-809)

BAT-AELs apply both to mills with

- production of market pulp alone, and
- integrated production of pulp and paper.

BAT-AELs in Tables 18 and 19 are specified in the unit “kg/t”. For mills that produce market pulp, the unit “kg/ADt” is used. Table 18 applies to production without deinking, Table 19 to production with deinking.

The same BAT-AEL consequently applies to the production of market pulp as to integrated production of pulp and paper based on recycled fibres. The reason for this is the absence of any separate data for pulp production. Swedish mills also do not produce recycled fibre pulp for sale.

22.2.1 RCF without deinking

It can be noted that for COD, TSS, nitrogen and phosphorus, the upper limit in BAT-AEL for “RCF without deinking” is lower than for “non-integrated paper production” (BAT 50, Table 20). As BAT-AEL for RCF includes both pulp production and paper production, it is open to question whether this is reasonable. The question has arisen of whether a mill that produces paper from recycled fibres can use BAT-AEL for paper production instead of BAT-AEL for RCF. In our interpretation, for the type of pulp and the type of paper that are produced from recycled fibres without deinking, the

supporting data shows that the emission levels specified in BAT 45 (Table 18) for RCF without deinking can be achieved. In our opinion, BAT-AEL solely for paper production should consequently not be applied to RCF.

22.2.1.1 TSS

(BAT 45, Table 18, BAT page 113; BREF page 808)

For the production of paper from recycled fibres, the following is specified as BAT-AEL for TSS:

Yearly average	0.02–0.2 kg/t
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Footnote 2 to Table 18 states however:

“For existing plants, levels up to 0.45 kg/t may occur, due to the continuous decline in the quality of paper for recycling and the difficulty of continuously upgrading the effluent plant.”

What is meant by “decline in the quality of paper” has not been defined in greater detail, although the sector has specified that the amount of fibres that are difficult to remove has increased, e.g. due to size and surface charging. The operator should demonstrate to the supervisory authority both that it is difficult to achieve the lower BAT-AEL value, and that the probable reason for this is the quality of the raw material.

The footnote specifies a high value (0.45 kg/t) for “existing plants”. According to the definitions on page 81 in the BAT conclusions document (page 779 in the BREF document), an “existing plant” is a plant that has received its permit prior to the publication of the BAT conclusions, i.e. before 30 September 2014. If a plant is replacing an existing plant within an installation, however, it is viewed as a “new plant” even if this takes place with no new licensing process. This means that if one of several production lines is being replaced within a mill that produces paper from recycled fibres, that line is to be viewed as “new”. Different BAT-AELs may then apply to each production line. A proportional calculation may then be carried out to arrive at a total BAT-AEL value for the entire RCF production.

22.2.1.2 PHOSPHORUS

(BAT 45, Table 18, BAT page 113; BREF page 808)

Table 18 specifies the following as BAT-AEL for phosphorus:

yearly average	0.001–0.005 kg/ADt
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Footnote 3 to Table 18 states however:

“For mills with a waste water flow between 5 and 10 m³/t, the upper end of the range is 0.008 kg/t.

In BAT 5 (page 86), the waste water flow for RCF paper mills without deinking is given as 1.5–10 m³/t (BAT without emission value). The reason for a higher value for those mills included in the upper part of the range for water consumption is not set out. However, the footnote means that a higher BAT-AEL is granted for these mills.

22.2.2 RCF with deinking

As regards TSS and phosphorus, the upper limit for BAT-AEL for “RCF with deinking” is lower than for “non-integrated paper production” (BAT 50, Table 20). In the opinion of Swedish EPA, for the type of pulp and the type of paper that are produced from recycled fibres with deinking, the supporting data has shown that the emission levels specified in BAT 45 (Table 18) for RCF without deinking can be achieved. In our opinion, BAT-AEL solely for paper production should consequently not be applied to RCF.

22.2.2.1 TSS

(BAT 45, Table 19, BAT page 113; BREF page 809)

Table 19 specifies the following as BAT-AEL for TSS:

yearly average	basic value	0.08–0.3 kg/t
yearly average	particular value for tissue paper	0.1–0.4 kg/t

Table 19 does not contain a footnote regarding the deterioration in the quality of the paper, corresponding to the one found in Table 18 for production without deinking. The reason for this difference is not set out.

22.3 Energy consumption and efficiency

(Chapter 1.5.3, BAT page 114; BREF page 809)

Background information to the BAT techniques in BAT 46 as well as examples of consumption levels can be found in the following chapters in the BREF document

6.2.2.4 Energy demand

6.3.10 Examples of energy-saving techniques

6.3.14 Environmentally sound residue and energy recovery

The BAT conclusions are addressed more specifically in the following chapters.
(Headings and BAT conclusions are presented in summary)

BAT	Technique	BREF chap.	BREF page
46	<i>To reduce electrical energy consumption</i>		
a	High consistency pulping for disintegrating paper for recycling	6.3.10.1	627-628
b	Efficient coarse and fine screening by optimising rotor design, screens and screen operation.	6.3.10.2	628-629
c	Energy saving stock preparation concepts extracting impurities as early as possible in the re-pulping process, using fewer and optimised machine components.	6.3.10.3	630-635

23 Papermaking

(Chapter 1.6, BAT pages 114-118; BREF pages 810-813)

23.1 Production amount

BAT-AEL for emissions to water is specified for papermaking as a production-related value in the unit “kg/t”, i.e. “kg per tonne of paper”. It is therefore important how the amount of product, “tonne of paper”, is determined. “Net production” is defined under the heading “Definitions” (page 82; page 780). It can be seen there that this relates to the unpacked, saleable production after the last slitter winder, i.e. before converting.

If broke (discarded paper production) is returned to stock preparation and subsequently back into production as fibrous raw material, this means that the broke never leaves the mill. The broke constitutes part of the paper machine’s “gross production”, but does not constitute saleable production, i.e. “net production”.

If the broke does not go back to the in-house process, but has a financial value and is sold to another operator, it is possible to arrive at different interpretations of what should be included in “net production”. If the broke is sold as “paper”, “board” or equivalent, it is reasonable to view it as a “saleable product” and for it thereby to be included in the paper mill’s production volume. However, if the broke is sold in another form (“fibre pulp” or similar), it is doubtful whether it should be included in the paper mill’s production volume. If the broke does not have any financial value at all that makes it a saleable product, and it is handled in another way, it should not be included in the paper mill’s production volume either.

Discarded material that arises during conversion should be included in the net production, as stated in the definition.

23.2 Waste water and emissions to water

(Chapter 1.6.1, BAT pages 114-116; BREF pages 810-812)

23.2.1 Non-integrated paper mill (apart from for speciality paper)

23.2.1.1 COD

(BAT 50, Table 20, BAT page 116; BREF page 811)

According to Table 20, the following apply as BAT-AEL for COD for the production of paper at a non-integrated paper mill (apart from for speciality paper):

yearly average	0.15–1.5 kg/t
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Footnote 1 to Table 20 states:

“For graphic paper mills, the upper end of the range refers to mills producing paper that use starch for the coating process.”

The footnote does not affect which BAT-AEL applies, as it does not state that the emissions would be permitted to lie above the upper, binding value. The footnote can have some significance, as the BAT conclusions are used as reference during the

licensing process, in order to assess conditions according to the Environmental Code's rules of consideration. The footnote gives an indication that, for the specified production, it can be difficult to get down to the emission levels in the lower part of the range.

23.2.1.2 AOX

(BAT 50, Table 20, BAT page 116, BREF page 811)

In Table 20, BAT-AEL for AOX is specified as the yearly average at 0.05 kg/t for decor paper and wet strength paper.

As opposed to other BAT-AELs, no range is specified here, only a specific value. It should therefore be clarified that the value 0.05 kg/t constitutes the upper emission value that must not be exceeded.

23.2.2 Speciality paper

(BAT 50, Table 21, BAT page 116; BREF page 812)

Table 21 contains BAT-AELs for mills that produce "speciality paper". These values are significantly higher than the values specified in Table 20 for other paper mills. It will consequently be extremely important whether a particular papermaking process is classified as "speciality paper" or not.

Page 82 of the BAT conclusions document defines a "Speciality paper mill" as follows:

"A mill producing numerous paper and board grades for special purposes (industrial and/or non-industrial) that are characterised by particular properties, relatively small end use market or niche applications that are often especially designed for a particular customer or end-user group. Examples of speciality papers include cigarette papers, filter papers, metallised paper, thermal paper, self-copy paper, sticking labels, cast coated paper, as well as gypsum liners and special papers for waxing, insulating, roofing, asphaltting, and other specific applications or treatments. All of these grades fall outside of the standard paper categories."

"Speciality paper" can be viewed as a type of exemption from "normal paper". As can be seen, there are a large number of paper types that could be classified as "speciality paper". In the opinion of the Swedish EPA, "speciality paper" should not be given too broad an interpretation, as only a small proportion of total paper production in the sector can be deemed to constitute "speciality paper". "Speciality paper" can consequently not be considered typical.

In the first instance, the Swedish EPA considers that the motive for this particular BAT-AEL for "speciality paper" is that certain paper grades have particular requirements as regards properties, e.g. purity, or contain particular additives, with the result that the emissions may be greater. The definition states that it should relate to mills with "numerous paper and board grades for special purposes". This can be understood as meaning that changes between special grades, which each have particular requirements regarding purity or some other property, can make it necessary to empty the paper

machine's white water system and that broke cannot be returned to production, which then increases emissions to water.

Chapter 7.1.11.4 of the BREF document contains additional data regarding the conditions that can cause higher emissions, as well as why certain paper types can be counted as "speciality paper".

In the case of paper mills with several paper machines, the Swedish EPA is of the opinion that an assessment should be carried out regarding which paper machines are to be considered machines for "speciality paper" and which are not. A weighted BAT-AEL should then be calculated based on Tables 20 and 21 in relation to production in each paper machine.

In addition, Table 21 contains another exemption from the term "speciality paper", which provides further scope for higher emissions:

Footnote 1: "Mills having special characteristics, such as a high number of grade changes (e.g. of ≥ 5 per day as a yearly average) or producing very light-weight speciality papers (≤ 30 g/m² as yearly average) might have higher emissions than the upper end of the range."

The criteria are clearly defined here. However, nothing is said regarding the maximum emissions that are permitted. As has been set out in section 18.1 above, the Swedish EPA considers that, if a higher emission limit value is to be permitted, this must be determined by the operator applying for derogation from the MPD or in conjunction with the licensing process at the Land and Environment Court. That which is stated in the footnote can then constitute supporting data when assessing the derogation. This should also be compared with Section 19.1.4 regarding nitrogen and phosphorus at kraft pulp mills with compact biological treatment plants.

In summary, in the event it is considered that the paper production should be classified as "speciality paper", the operator should confirm this to the supervisory or licensing authority.

23.2.2.1 AOX

(BAT 50, Table 20, BAT page 116, BREF page 811)

In Table 21, BAT-AEL for AOX is specified as the yearly average at 0.05 kg/t for decor paper and wet strength paper.

As opposed to other BAT-AELs, no range is specified here, only a specific value. It should therefore be clarified that the value 0.05 kg/t constitutes the upper emission value that must not be exceeded.

23.3 Waste generation

(Chapter 1.6.3, BAT page 117; BREF page 812)

BAT 52 a-d contain BAT conclusions without emission levels for waste generation.

Supporting data in the BREF document that relates to the BAT conclusions can be found in Chapters

- 7.2.2.6 Solid waste generation
- 7.3.4 Efficient fibre and filler recovery and broke system
- 7.3.5 Recovery of coating colours/recycling of pigments
- 7.3.10 Installation of an equalization basin and primary treatment of waste water
- 7.3.13 Dewatering and thickening of sludge before final disposal or incineration

23.4 Energy consumption and efficiency

(Chapter 1.6.4, BAT pages 117-118; BREF page 813)

BAT 53 contains BAT conclusions, a-s, for reducing the consumption of thermal and electrical energy. Background information to the BAT techniques in BAT 53 as well as examples of consumption levels at paper mills can be found in the BREF document in Chapters

- 7.2.2.4 Energy demand
- 7.3.15 Energy saving in papermaking
- 7.4.3 Heat recovery with heat pumps

Some of the BAT conclusions are addressed more specifically, which is presented in the table below. (Headings and BAT conclusions are presented in summary)

BAT	Technique	BREF chap.	BREF page
53	<i>In order to reduce the consumption of thermal and electrical energy.</i>		
a	Energy saving screening techniques	7.3.15	752
b	Refining with heat recovery	7.3.15	752
c	Optimised dewatering in the press section of paper machine/wide nip press	7.3.15 7.3.15.1	752 755-757
d	Steam condensate recovery. Efficient exhaust air heat recovery systems.	7.3.15.3	759-762
e	Reduction of use of steam by process integration.		
f	Highly efficient refiners	7.3.15 7.3.15.2	752 758-759
g	Optimisation of the operating mode in refiners (reduction of no load power requirements)		
h	Optimised pumping design, variable speed drive control for pumps, gearless drives		
i	Cutting edge refining technologies		
j	Steam box heating of the paper web	7.3.15	752
k	Optimised vacuum system (e.g. turbo fans instead of water ring pumps)	7.3.15	752
l	Generation optimisation and distribution network maintenance	7.3.15	752
m	Optimisation of heat recovery, air system, insulation	7.3.15	752
n	Highly efficient motors (EFF1)	7.3.15	752

o	Preheating of shower water with a heat exchanger	7.3.15	752
p	Use of waste heat for sludge drying or upgrading of dewatered biomass	7.3.15	752
q	Heat recovery from axial blowers for the supply of air to the drying hood	7.3.15	752
r	Heat recovery of exhaust air from the Yankee hood via a scrubber	7.3.15	752
s	Heat recovery from the infrared exhaust hot air	7.3.15	752

24 Calculation of BAT-AEL for mills with composite production

Mills with integrated production of pulp and paper must interact with BAT regarding both pulp production and paper production. Mills that also produce various types of pulp, such as kraft pulp and CTMP pulp, must comply with BAT for all relevant pulp types.

As regards BAT-AELs for emissions to air, this is no problem as these BAT-AELs are specified for specific processes (equipment) such as recovery boilers, lime kilns and TRS burners.

For emissions to water, the situation is different. Some waste water is processed separately, but for the majority of the waste water it is the case that waste water from different parts of the production process is merged and then treated in a common treatment plant for the mill. It is then not possible, or at any rate extremely difficult and uncertain, to determine the separate emissions to receiving water bodies from each pulp type or from paper production.

Instead, for each production type (kraft pulp, CTMP pulp, paper, etc.), the emission amount (tonnes per year) corresponding to the upper value in the BAT-AEL range should be calculated according to the amount that has been produced during the year in question. These production-related emission amounts are then added together to arrive at a total emission amount, which constitutes the total emissions that may not be exceeded (see the BAT conclusions document, page 80, “General considerations”). In basic cases, this permitted emission amount in “tonnes per year” can be converted to “kg per tonne of product” (pulp or paper).

Note that it is the actual production during the year that is to be used in the calculation, not the permitted production. This means that the operator does not know until the end of the year what total emissions will be the upper limit for BAT-AEL. The emissions and the situation compared to BAT-AEL therefore need to be monitored continuously during the year.

Examples of how calculations are to be performed are presented in Appendix 1 “Calculations of permitted emission amounts within the framework of BAT-AEL”.

25 Normal operating conditions and other than normal operating conditions

For guidance regarding the general principles for the application of “normal operating conditions” and “other than normal operating conditions”, please refer to the Swedish EPA’s general guidance on the IED, report 6702, “Guidance on industrial emissions provisions”³⁹. The issue of normal and other than normal operating conditions is addressed in Chapter 8.3.8 of the guidance, pages 35-36.

Guidance on how “other than normal operating conditions” are to be presented in the environmental report can be found in the Swedish EPA’s “guidance on regulations on environmental reports”. This states that “in the event measurement values during periods with other than normal operating conditions are excluded, it is also necessary to report these time periods and the reason for the other than normal operating conditions” (page 14).

Article 14.1 (f) of the IED gives the following examples of other than normal operating conditions.

- Start-up and shut-down operations
- Leaks
- Malfunctions
- Momentary stoppages
- Definitive cessation of operations

More specific information about what can be viewed as normal or other than normal operating conditions during the production of pulp and paper are given in Chapter 2.2.1.2 of the BREF document, pages 40-41. A distinction is drawn here between emissions to water and emissions to air. For a summary of this, see Sections 25.1 and 25.2 below.

“Malfunctions” can also relate to malfunctions in treatment plants.

There may be a risk that, in the event of raised emissions, “other than normal operating conditions” are cited too lightly. A certain amount of disruptions and operational stoppages may be deemed to be part of normal operating conditions over the course of a whole year. If the operator considers that there are/have been other than normal operating conditions, it is appropriate for this to be notified to the supervisory authority along with a report of the measures that the operator intends to implement. Such a procedure provides the supervisory authority with the potential to assess whether other than normal operating conditions should be considered to exist/to have existed, and if necessary to prescribe measures for preventing a repeat.

³⁹ <http://www.naturvardsverket.se/Om-Naturvardsverket/Publikationer/ISBN/6700/978-91-620-6702-1/>

At most pulp and paper mills, major stoppages in production take place at regular intervals in order to carry out more extensive maintenance and to install new equipment. Whether the stoppage is viewed as “normal operating conditions” or “other than normal operating conditions” depends on your time perspective. From a daily perspective, the days that are covered by a maintenance stoppage cannot be viewed as normal operating conditions. In those cases where BAT-AELs are specified as daily averages, these days can therefore be classified as other than normal operating conditions.

When it comes to BAT-AELs specified as yearly averages, the assessment is not quite as obvious. Planned and regular stoppages that recur each year, or several times a year, could be viewed as a normal part of production, i.e. the emission values during the stoppage should be included when calculating emission values as yearly averages for comparison with BAT-AELs. In recent years, the length of time between maintenance stoppages has been extended to more than a year at some mills. With an increasingly long time between maintenance stoppages, it is becoming more doubtful whether maintenance stoppages should be viewed as part of each year’s normal operating conditions.

It should be noted that, as operations are generally shut down during maintenance stoppages, both the production amount and the emission amount will be small, and will therefore not have much of an impact on the yearly average.

Testing and fine-tuning of new process equipment can constitute other than normal operating conditions. As such activities are planned in advance, it is reasonable to notify the supervisory authority in such circumstances if there is a risk of BAT-AELs being exceeded and if the operator intends to count these as other than normal operating conditions. The length of time such testing may be permitted to continue may be determined by the supervisory authority.

The proportion of operating time that may be permitted to be other than normal operating conditions is not clarified in PP BATC or in the IED. However, it should be pointed out that, in order for an installation to be deemed in compliance with BAT, it is not sufficient for the installation to have low emissions during normal operating conditions. The installation must also be sufficiently robust and operationally reliable so that normal operating conditions with low emissions can be achieved most of the time. An installation with recurring disruptions in operations and a large proportion of other than normal operating conditions cannot be deemed to comply with BAT.

25.1 Emissions to water

Examples of normal operating conditions (BREF document Chapter 2.2.1.2):

- All activities that regularly occur during normal production days.
- For chemical pulp mills, this includes spillages, change of production output, change of wood raw material, change of product quality, regular maintenance and cleaning.
- For mechanical pulp mills, this includes change of refining targets, change of wood raw material, change of product quality, regular maintenance and cleaning.
- For RCF mills, this includes change of quality of the paper for recycling used.

- For paper mills, this includes change of paper grades, paper breaks with subsequent starting and stopping, regular maintenance and cleaning.

The BREF document also states that the difference between “normal operating conditions” and “other than normal operating conditions” is generally less significant for emissions to water, as some equalisation of the pollution takes place in the waste water system.

Examples of other than normal operating conditions:

- Testing new chemical additives, new materials or new process equipment that can have an impact on the function of the waste water treatment system.

25.2 Emissions to air

Examples of normal operating conditions (BREF document Chapter 2.2.1.2):

- All activities that occur during normal production days, including routine maintenance.
- Variations in emissions due to variations of the input or process conditions.
- Change of load conditions for boilers.
- Change of product quality.
- Paper breaks or other interruptions in the process.
- Maintenance and cleaning that takes place regularly on a periodic basis.

It is also stated that special situations can be regulated in the permit. Examples of this include occasions when a treatment plant has to be switched off due to safety reasons. This is not expressly referred to as other than normal operating conditions, but should reasonably be perceived as such.

26 Derogation

Guidance regarding the general principles for derogation is provided in the Swedish EPA's general guidance on the IED, report 6702, "Guidance on industrial emissions provisions". The issue is covered in Chapter 8.5 of the guidance, pages 39-42. The introduction states:

Pursuant to Chapter 1 Section 16(1) of the Ordinance on Industrial Emissions, it can be seen that, in the individual case in question, derogation may be granted from the obligation to comply with a specific emission limit value according to Chapter 1 Section 8 if, due to the installation's geographic location, the installation's technical properties or the local environmental conditions, this would entail disproportionately high costs compared to the environmental benefit of complying with the emission limit value. It is consequently only these three reasons that may be taken into consideration when assessing whether there are grounds for derogation.

In the opinion of the Swedish EPA, the derogation process should also cover establishing emission values in those cases where it has been specified in the BAT conclusion that a higher value may be permitted than that specified as BAT-AEL, but where no specific value has been specified. See also section 18.1. above.

Waste water from the various parts of a mill's production is normally treated jointly. For integrated mills with both pulp production and paper production, and likewise for mills that produce more than one type of pulp, more than one BAT conclusion with BAT-AELs will consequently apply. In such cases, a derogation needs to relate to BAT for all production types, if it is not the case that the operator can distinguish between emission amounts for each production type and demonstrate that one specific production type is causing BAT-AEL to be exceeded.

Otherwise, it is not currently possible to provide specific guidance for BAT PP regarding how derogations allowing for a less strict emission value limit should be assessed.

27 Sources

Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention).

European Commission, JRC Science and Policy Reports. Best Available Techniques (BAT) Reference Document for the Production of Pulp, Paper and Board. 2015

Ordinance on large combustion plants (2013:252)

Ordinance on the incineration of waste (2013:253)

Ordinance on medium combustion plants (SFS 2018:471)

Motive for the ordinance (Fm) 2013:1. Industrial emissions provisions

Ordinance on Industrial Emissions (2013:250)

Commission Implementing Decision of 26 September 2014 establishing the best available techniques (BAT) conclusions, under Directive 2010/75/EU of the European Parliament and of the Council, for the production of pulp, paper and board

Swedish EPA. Guidance on industrial emissions provisions. Report 6702, January 2016

Appendix 1

Calculation of emission amounts corresponding to BAT-AEL

For various types of composite production, examples are shown below regarding how calculations should be performed to ascertain the total emission amount within the framework of BAT-AEL.

Example:

- A. Production of unbleached and bleached kraft pulp as well as CTMP pulp for sale (non-integrated paper mill).
- B. In-house production of pulp and paper. A portion of the in-house pulp production is sold, and a certain amount of pulp of a different type is purchased.
- C. Production of mechanical pulp and RCF pulp as well as paper.
- D. Production of paper, of which a portion is classified as “speciality paper” (non-integrated paper mill).
- E. Production of mechanical pulp and paper with varying degrees of bleaching (E1-E4).

A. Production of unbleached and bleached kraft pulp as well as CTMP pulp for sale (non-integrated paper mill)

During the year in question, mill A has produced 318,000 tonnes of bleached kraft pulp, 80,000 tonnes of unbleached kraft pulp and 156,000 tonnes of CTMP pulp, all for sale.

COD	Pulp In-house Bleached kraft	Pulp In-house Unbleached kraft	Pulp In-house CTMP	Pulp Total
Production, ADt	318,000	80,000	156,000	554,000
BAT-AEL, kg/ADt	7–20	2.5–8	12–20	7.8–18.3
BAT, tonnes	2,226–6,360	200–640	1,872–3,120	4,298–10,120

The maximum permitted emissions are consequently 10,120 tonnes COD, which is equivalent to 18.3 kg COD per tonne of pulp. The lower emission value, which must be taken into consideration during the licensing process, is 4,298 tonnes COD.

B. In-house production of pulp and paper. A portion of the in-house pulp production is sold, and a certain amount of pulp of a different type is purchased.

In this example, during the year in question, mill B has produced 425,000 tonnes of bleached kraft pulp, of which 90,000 tonnes of pulp has been sold as market pulp. At the same time, 50,000 tonnes of pulp of a different type have been purchased. 18,000 tonnes of additives (coating, filler) have been used. From of these input goods, 403,000 tonnes of paper have been produced. For kraft pulp (and for CTMP pulp), BAT-AELs only cover pulp production. For this reason, the permitted emission amount from paper production must be calculated separately and added together with the permitted emission amount for pulp production.

COD	Pulp In-house Bleached kraft	Pulp Sold	Pulp Purchased	Pulp for paper production	Addi- tives Purchased	Paper	Total Entire mill
Production, ADt, tonnes	425,000	90,000	50,000	385,000	18,000	403,000	
BAT-AEL, kg/ADt; kg/t	7–20	-	-	-	-	0.15–1.5	-
BAT, tonnes	2,975– 8,500	-	-	-	-	60–605	3,035– 9,105

The maximum permitted emissions are then 9,105 tonnes COD. The lower emission value, which must be taken into consideration during the licensing process, is 3,035 tonnes COD. This cannot be converted to kg/ADt or kg/tonne of paper in order to compare with BAT-AEL for the relevant production, as the basis for the calculation in one case is “pulp”, while in the other the basis for the calculation is “paper”. As can be seen, however, paper production is of little importance as regards weighted permitted emissions.

C. Production of mechanical pulp and RCF pulp as well as paper

For mechanical pulp and for RCF pulp, emissions from paper production are included in BAT-AEL. For this reason, no emission amount corresponding to BAT-AEL should be calculated separately for paper production. BAT-AELs are different for paper production based on mechanical pulp (0.06–0.45 kg TSS/tonne of paper) and for paper production based on recycled fibre pulp (0.08–0.3 kg TSS/tonne of pulp). In this example, 80% of paper production is based on mechanical pulp and 20% of paper production on RCF pulp with deinking. The paper production also includes additives such as filler and coating.

	In- house Pulp Mech.	In- house Pulp RCF	In- house Pulp Total	Purchased Addi- tives	Prod. Paper	Pulp+ Paper Mech.	Pulp+ Paper RCF	Total
Production, ADt, tonnes	507,000	124,000	631,000	110,000	741,000 ¹⁾	595,384	145,616	
Production, share	80%	20%				80%	20%	
BAT-AEL, kg/ADt			-			0.06–0.45	0.08–0.3	0.06– 0.42
BAT-AEL, tonnes						36–268	12–44	47–312

1) To make it easier to understand how the figures relate to each other, we have ignored fibre losses in the production process in this example. In practice, the amount of produced paper will be slightly less than the sum of the ingoing raw materials.

In example C, the result is that the emissions from the mill during the year in question may not exceed 312 tonnes TSS in order for BAT-AEL to be met. In order to get down

to the levels achieved by the best installations within each production type, the emissions would need to be at 47 tonnes TSS. This corresponds to a weighted BAT-AEL of 0.06–0.42 kg TSS/tonne of paper.

D. Production of paper, of which a portion is classified as “speciality paper” (non-integrated paper mill)

Example D relates to a paper mill with a large paper machine for standard grades, producing 230,000 tonnes, and a small machine for paper that meets the criteria for speciality paper according to the definition on page 80 in the BAT conclusions document. In the small machine, 70,000 tonnes of paper have been produced during the year.

Nitrogen		“Standard paper”	Speciality paper	Total
Production	tonne	230,000	70,000	300,000
BAT-AEL	kg/tonne	0.01–0.1	0.015–0.4	0.011–0.17
BAT-AEL	tonne	2.3–23	1.1–28	3.4–51

Emissions during the year may amount to a maximum of 51 tonnes of nitrogen, which is equivalent to 0.17 kg of nitrogen per tonne of paper. The lower value in the range is calculated at 3.4 tonnes of nitrogen, equivalent to 0.011 kg of nitrogen per tonne of paper.

E. Production of mechanical pulp and paper with varying degrees of bleaching

When producing mechanical pulp and paper, there are a number of factors that influence the calculation of what emissions are permitted within the upper value for BAT-AEL:

- production of pulp (fibres) within the individual activity
- amount of purchased pulp (fibres)
- amount of additives (filler, coating, etc.)
- degree of bleaching

The significance of the various factors is described in section 21.1 above. Different ways of calculating BAT-AEL are indicated in Section 21.1.3.2.

Below are examples of the calculation of permitted emission amounts, where these factors have been taken into consideration.

Example, mill E1

Preconditions

In-house production of mechanical pulp (fibre)	520,000 tonnes
- of which not highly bleached	520,000 tonnes
- of which highly bleached	0 tonnes
Proportion of highly bleached fibre in in-house pulp, calculated	0%
Purchased pulp	0 tonnes

Proportion of in-house pulp, calculated	100%
Additives	40,000 tonnes
Total paper production	560,000 tonnes

BAT-AELs for pulp and paper production are taken from Table 16.

Calculation

COD:	4.5 kg COD/tonne paper	x 560,000 tonnes paper	=	2,520 tonnes COD
TSS:	0.45 kg TSS/tonne paper	x 560,000 tonnes paper	=	252 tonnes TSS
Nitrogen	0.1 kg nitrogen/tonne paper	x 560,000 tonnes paper	=	56 tonnes nitrogen
Phosphorus	0.01 kg phosphorus/tonne paper	x 560,000 tonnes paper	=	5.6 tonnes phosphorus

Example, mill E2

Preconditions

In-house production of mechanical pulp (fibre)	450,000 tonnes
- of which not highly bleached pulp	350,000 tonnes
- of which highly bleached pulp	100,000 tonnes
Proportion of highly bleached, in-house produced pulp, calculated	22%
Purchased pulp	70,000 tonnes
Proportion of in-house pulp, calculated	87%
Additives	40,000 tonnes
Total paper production	560,000 tonnes

For that portion of paper production that derives from in-house produced pulp (87%), BAT-AELs in Table 16 are applied. As the share of highly bleached fibres is below 70%, the basic value in Table 16 is applied for COD, i.e. 4.5 kg COD/tonne of paper. For that portion of paper production that derives from purchased pulp (13%), BAT-AELs for paper production only in Table 20 are applied.

Calculation

Paper from in-house pulp

COD:	4.5 kg COD/tonne paper	x 0.87 x 560,000 tonnes paper	=	2,181 tonnes COD
TSS:	0.45 kg TSS/tonne paper	x 0.87 x 560,000 tonnes paper	=	218 tonnes TSS
Nitrogen	0.1 kg nitrogen/tonne paper	x 0.87 x 560,000 tonnes paper	=	48 tonnes nitrogen
Phosphorus	0.01 kg phosphorus/tonne paper	x 0.87 x 560,000 tonnes paper	=	4.8 tonnes phosphorus

Paper from purchased pulp

COD:	1.5 kg COD/tonne paper	x 0.13 x 560,000 tonnes paper	=	113 tonnes COD
TSS:	0.35 kg TSS/tonne paper	x 0.13 x 560,000 tonnes paper	=	26 tonnes TSS
Nitrogen	0.1 kg nitrogen/tonne paper	x 0.13 x 560,000 tonnes paper	=	7.5 tonnes nitrogen
Phosphorus	0.01 kg phosphorus/tonne paper	x 0.13 x 560,000 tonnes paper	=	0.9 tonnes phosphorus

Total, entire paper production

COD:	2,181 tonnes	+ 113 tonnes	=	2,294 tonnes COD
TSS:	218 tonnes	+ 26 tonnes	=	244 tonnes TSS

Nitrogen:	48 tonnes	+ 7.5 tonnes	=	56 tonnes nitrogen
Phosphorus:	4.8 tonnes	+ 0.9 tonnes	=	5.8 tonnes nitrogen

Comment: Compared to mill E1, the permitted emissions of COD and TSS are lower for mill E2. This is because a portion (13%) of the produced paper derives from purchased pulp, for which lower BAT-AEL values are applied. There is no difference for nitrogen, as the same BAT-AELs apply to “mechanical pulp+paper” as to solely “paper production”. For phosphorus, the permitted emissions are slightly higher for mill E2 due to the fact that BAT-AEL for solely “paper production” is higher than for the production of “mechanical pulp+paper”.

Example, mill E3

Preconditions

In-house production of mechanical pulp (fibre)	450,000 tonnes
- of which not highly bleached pulp	120,000 tonnes
- of which highly bleached pulp	330,000 tonnes
Proportion of highly bleached, in-house produced pulp, calculated	73%
Purchased pulp	70,000 tonnes
Proportion of in-house pulp, calculated	87%
Additives	40,000 tonnes
Total paper production	560,000 tonnes

For that portion of paper production that derives from in-house produced pulp (87%), BAT-AELs in Table 16 are applied. As the share of highly bleached fibres is above 70%, the value specified in footnote 1 in Table 16 is applied for COD, i.e. 8 kg COD/tonne of paper. For that portion of paper production that derives from purchased pulp (13%), BAT-AELs for paper production in Table 20 are applied.

Calculation

The calculation for mill E3 only differs from mill E2 in respect of COD, which is why only the calculation for COD is presented below.

Paper from in-house pulp

$$\text{COD: } 8 \text{ kg COD/tonne paper} \times 0.87 \times 560,000 \text{ tonnes paper} = 3,877 \text{ tonnes COD}$$

Paper from purchased pulp

$$\text{COD: } 1.5 \text{ kg COD/tonne paper} \times 0.13 \times 560,000 \text{ tonnes paper} = 113 \text{ tonnes COD}$$

Total, entire paper production

$$\text{COD: } 3,877 \text{ tonnes} + 113 \text{ tonnes} = 3,990 \text{ tonnes COD}$$

The permitted emissions of COD for mill E3 will be significantly higher than for mill E2 due to the fact that the share of highly bleached pulp from in-house pulp production is above 70%.

Example, mill E4

This example applies the two different methods for calculating the permitted emission amount that are presented in Section 21.1.3.2 above. In this case, calculation method b results in a higher permitted emission amount. With different conditions, the opposite result may be achieved. Both calculation methods are possible.

Common preconditions

In-house production of mechanical pulp (fibre)	450,000 tonnes
- of which not highly bleached pulp	170,000 tonnes
- of which highly bleached pulp	280,000 tonnes
Purchased pulp	70,000 tonnes
Proportion of in-house pulp, calculated	87%
Additives	40,000 tonnes
Total paper production	560,000 tonnes

Preconditions when using calculation method a

Proportion of highly bleached, in-house produced pulp, calculated	62%
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Preconditions when using calculation method b

Paper grade 1	
In-house pulp (fibre)	330,000 tonnes
- of which not highly bleached pulp	80,000 tonnes
- of which highly bleached pulp	250,000 tonnes
Proportion of highly bleached, in-house produced pulp, calculated	76%
Purchased pulp	55,000 tonnes
Proportion of in-house pulp, calculated	86%
Additives	25,000 tonnes
Paper production, grade 1	410,000 tonnes

Paper grade 2	
Own pulp (fibre)	120,000 tonnes
- of which not highly bleached pulp	90,000 tonnes
- of which highly bleached pulp	30,000 tonnes
Proportion of highly bleached, in-house produced pulp, calculated	25%
Purchased pulp	15,000 tonnes
Proportion of in-house pulp, calculated	89%
Additives	15,000 tonnes
Paper production, grade 2	150,000 tonnes

Calculation

The calculation for mill E4 only differs from mills E1-E3 in respect of COD, which is why only the calculation for COD is presented below.

For that portion of paper production that derives from in-house produced pulp, BAT-AELs in Table 16 are applied. For that portion of paper production that derives from purchased pulp, BAT-AELs for paper production in Table 20 are applied.

Calculation method a

If the share of highly bleached pulp is calculated in the same way as in examples E1-E3, i.e. for the entire paper production, the result is that the share of highly bleached pulp will make up 62% of in-house pulp production. This means that the basic value in Table 16 shall be applied for COD, i.e. 4.5 kg COD/tonne of paper.

Paper from in-house pulp

COD: 4.5 kg COD/tonne paper x 0.87 x 560,000 tonnes paper = 2,181 tonnes COD

Paper from purchased pulp

COD: 1.5 kg COD/tonne paper x 0.13 x 560,000 tonnes paper = 113 tonnes COD

Total, entire paper production

COD: 2,181 tonnes + 113 tonnes = 2,294 tonnes COD

Calculation method b

As the mill produces several paper grades, the share of highly bleached pulp and the permitted emission amount can be calculated separately for each paper grade (see Section 21.1.3). The above preconditions result in a 76% share of highly bleached pulp for paper grade 1 and 25% for paper grade 2. As a result, for the in-house pulp in paper grade 1, the *higher* value according to the footnote must be used, 8 kg COD/tonne of paper. For the in-house pulp in paper grade 2, the *lower* basic value in the table must be used, 4.5 kg/tonne of paper.

Paper from in-house pulp

COD: Paper grade 1

8 kg COD/tonne paper x 0.86 x 410,000 tonnes paper = 2,811 tonnes COD

Paper grade 2

4.5 kg COD/tonne paper x 0.89 x 150,000 tonnes paper = 600 tonnes COD

Total: 3,411 + 600 = 4,011 tonnes COD

Paper from purchased pulp

COD: Paper grade 1

1.5 kg COD/tonne paper x 0.14 x 410,000 tonnes paper = 88 tonnes COD

Paper grade 2

1.5 kg COD/tonne paper x 0.11 x 150,000 tonnes paper = 25 tonnes COD

Total: 88 + 25 = 113 tonnes COD

Total, entire paper production

COD: 3,411 tonnes + 113 tonnes = 3,524 tonnes COD

As can be seen, the results of calculation methods 1 and 2 may be entirely different depending on the distribution of highly bleached and not highly bleached pulp between different paper grades.