

BLUE ANGEL

The German Ecolabel



Thermal Paper

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Basic Award Criteria
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The Environmental Label is supported by the following four institutions:



Federal Ministry
for the Environment, Nature Conservation,
Nuclear Safety and Consumer Protection

The Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection is the owner of the label. It regularly provides information on the decisions taken by the Environmental Label Jury.



The German Environmental Agency with its specialist department for "Ecodesign, Eco-Labeling and Environmentally friendly Procurement" acts as office of the Environmental Label Jury and develops the technical criteria of the Basic Criteria for Award of the Blue Angel.



The Environmental Label Jury is the independent, decision-making body for the Blue Angel and includes representatives from environmental and consumer associations, trade unions, industry, the trade, crafts, local authorities, academia, the media, churches, young people and the German federal states.



The RAL gGmbH is the awarding body for the Environmental Label. It organises the process for developing the relevant award criteria in independent expert hearings – which involve all relevant interest groups.

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This document is a translation of a German original. In case of dispute, the original document should be taken as authoritative.

1 Introduction

1.1 Preface

In cooperation with the Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection, the German Environmental Agency and considering the results of the expert hearings conducted by RAL gGmbH, the Environmental Label Jury has set up these Basic Criteria for the Award of the Environmental Label. RAL gGmbH has been tasked with awarding the Environmental Label.

Upon application to RAL gGmbH and on the basis of a Contract on the Use of the Environmental Label to be concluded with RAL gGmbH, the permission to use the Environmental Label may be granted to all products, provided that they comply with the requirements as specified hereinafter.

The product must comply with all the legal requirements in the country in which it is to be marketed. The applicant shall declare that the product meets this requirement.

1.2 Background

Thermal paper is a special type of paper that is used in direct thermal printing systems installed in cash registers, ticket counters, parking meters or printers for receipts, address stickers or bank receipts. The text is not printed but activated in the paper due to a chemical reaction. As a result, this process does not require printer cartridges that need to be regularly replaced. To enable this process, many types of thermal paper contain chemical colour developers (approx. 0.5 % to 3 % by mass) that activate the black colour in the paper due to a chemical reaction when heat is applied. Bisphenol A and bisphenol S have been the main colour developers used up to now.

Bisphenol A (BPA) is now classified EU-wide as a substance of very high concern (SVHC) under the European Chemicals Regulation REACH¹, both with respect to human health and the environment. BPA has an endocrine effect on humans and the environment.² This means that the substance can be harmful to health if it enters the hormone system. BPA is also classified as a reprotoxic substance – which means that it can have a negative effect on the sexual function of both males and females. There have been limits on the use of BPA for a long time and the latest restriction on its use in thermal paper came into force on 2 January 2020. Since then, thermal paper containing BPA with a concentration equal to or greater than 0.02 % by mass can no longer be placed onto the market in the EU and thus cannot be sold³.

No conclusive evaluations are currently available for alternative colour developers such as bisphenol S (BPS), although there are already activities related to these substances under REACH. BPS is also suspected of being an endocrine disrupter for humans and the environment. A total of 104,000 tonnes of thermal paper containing BPS were placed onto the market in 2018, which represented an increase of 15 percent in comparison to the previous year. Another alternative

¹ REACH stands for the "Registration, Evaluation, Authorization and Restriction of Chemicals"; EU Regulation No. 1907/2006 of the European Parliament and of the Council of 18 December 2006

² edlists.org\\the-ed-lists\\list-i-substances-identified-as-endocrine-disruptors-by-the-eu?page=0

³ REACH Annex 17 Add link

is bisphenol B (BPB), which was included on the SVHC list from the ECHA in July 2021⁴. Bisphenols, analogues and so-called "phenol-free" colour developers are primarily used at the moment for price and availability reasons. The latter group includes thermal papers called "bisphenol A-free", "BPA-free", "BPS-free" or "phenol-free". Systematic laboratory tests have shown which chemicals were used in the thermal paper available on the German market between 2015 and 2019. Alongside bisphenol A, these tests revealed that bisphenol S and ®Pergafast 201 are now also used as the main components of colour developers^{5,6}.

Since 2019, the ECHA has intensified its systematic examination of the toxicity of bisphenols and derivatives of this family of substances. It is now generally suspected that all members of this substance family are reprotoxic or endocrine disrupters. In the next few years, research institutes in the EU will be investigating the long-term stability, ecotoxicity and/or human toxicity of the above-mentioned non-phenolic developer substances⁷. Pergafast 201 from the group of urea derivatives is now also the subject of numerous scientific studies and this substance has been shown to be critically ecotoxic^{8,9}. It is expected that the SVHC list of candidates and the regulatory limits under REACH will be expanded to include the currently known substitutes for BPA.

Due to their problematic properties, it is not possible to dispose of any thermal paper containing colour developers that is currently available on the market as recovered paper because the colour developer would still be present in the recycled paper as an impurity.

However, thermal paper that does not contain any colour developers is also available on the market. Coated paper has been available as a developer-free alternative since approx. 2017. It consists of adjacent opaque, i.e. not very transparent, and non-transparent layers. In direct thermal printing, the top layer is physically altered to reveal the underlying coated paper containing the pigment. This system is still being constantly improved to this day and has a broad range of potential applications.¹⁰ The coatings used on the paper contain chemicals that are also found in other paper applications as coatings or binders. The use of these systems based on the current state of technology is thus preferable and will be prioritized in the Blue Angel environmental label.

The Blue Angel generally restricts the addition of critical production aids and paper refining agents in its criteria for paper in order to, on the one hand, minimise the waste water load and, on the other hand, reduce the pollutant load in the paper product and thus in the recovered paper in the future. For example, the use of optical brighteners, mineral oil-based additives,

⁴ www.reach-clp-biozid-helpdesk.de/SharedDocs/Meldungen/DE/REACH/2021-07-08-Neue-SVHC-2021.html

⁵ www.sciencedirect.com/science/article/pii/S0045653517312602 ; M. Eckardt, T.J. Simat, Bisphenol A and alternatives in thermal paper receipts - A German market analysis from 2015 to 2017, Chemosphere 186 (2017) 1016-1025

⁶ www.sciencedirect.com/science/article/pii/S0021967319308222; M. Eckardt, M. Kubicova, D. Tong, T.J. Simat, Determination of color developers replacing bisphenol A in thermal paper receipts using diode array and Corona charged aerosol detection—A German market analysis 2018/2019, J. Chromatogr. A 1609 (2020) 460437

⁷ edlists.org/the-ed-lists/list-ii-substances-under-eu-investigation-endocrine-disruption?page=1

⁸ echa.europa.eu/documents/10162/04fa6267-654d-9d2e-cfec-8a3c775be68d

⁹ pubchem.ncbi.nlm.nih.gov/compound/22035425

¹⁰ www.dow.com/en-us/product-technology/pt-additives-modifiers/pg-additives-hollow-sphere-pigments.html

critical substances and perfluorinated and polyfluorinated substances is prohibited in these criteria. The criteria continue to support the recyclability of paper products certified with the Blue Angel by requiring that colourants are deinkbar and adhesives can be removed during the preparation of the recovered paper.

Specific requirements are also placed on the waste water emissions in the production of the paper and pulp. These requirements are based on the European Regulation 2010/75/EU on industrial emissions. The associated Commission Implementing Decision 2014/687/EU²⁰¹³, the so-called BAT conclusions (Best Available Techniques Reference (BREF)), was published in 2014. In the case of waste water emissions, these limit values can be found on a German level in the "Ordinance on Requirements for the Discharge of Waste Water into Waters" (Waste Water Ordinance - AbwV), which was revised for the paper-producing sector in 2018 and 2020. The Appendix places specific requirements on the production of paper and cardboard. It also requires the introduction of emission limits and the monitoring of defined waste water parameters. The requirements placed on the production of pulp are taken from the above-mentioned BAT conclusions in combination with Appendix 19 of the AbwV, as well as Appendix 28 of the AbwV for paper production.¹¹

The Blue Angel also places requirements on the origin of the paper fibres. Whenever technically possible, recycled paper should be used because the use of recovered paper contributes to the conservation of resources, especially the preservation of ecosystems such as forests, and thus helps to protect species and the climate. However, it is necessary to use pulp from virgin fibres in the production of thermal paper because the paper is very thin and it must have a high tensile strength or tear resistance. As it is produced in rolls for use in e.g. cash registers, it has to have the lowest possible grammage. The printed layer must also have a high level of optical homogeneity so that barcodes, QR codes and rows of text or numbers can be clearly read. Raw materials extracted from recovered paper would not fulfil these quality requirements. Therefore, the Blue Angel ensures that the virgin pulp fibres have at least been sourced from sustainably managed pulp production and forestry.

Harvesting timber from forests that are particularly worthy of protection e.g. tropical or boreal forests is not acceptable. In Germany, three forest certification systems have become established. The "Programme for the Endorsement of Forest Certification Schemes" (PEFC) is the system with the largest certified area, covering around 7.35 million hectares out of a total of 11.4 million hectares of forests in Germany. The system operated by the "Forest Stewardship Council®" (FSC) currently certifies an area of around 1.1 million hectares, while around 54,000 hectares are certified according to the criteria for ecological forest management from Naturland. The latter are also FSC certified. Compliance with the PEFC criteria largely corresponds to the minimum requirements found in the applicable legal regulations in Germany or the Helsinki and Vienna criteria from FOREST EUROPE. By certifying their forests in accordance with especially demanding certification systems such as the FSC or Naturland, forest owners indicate their willingness to comply with requirements for sustainability and nature and species protection that

¹¹ www.gesetze-im-internet.de/abwv/BJNR056610997.html

go far beyond the legally prescribed standards¹². All three systems are recognised by the Blue Angel for certifying the proportion of virgin fibres.

1.3 Objectives of the Environmental Label

The requirements in these Basic Award Criteria are intended, in particular, to prevent the use of substances that are not required for technical reasons, as well as colour developers and their auxiliary materials that are classified as being toxic to humans and the environment, during the production of the thermal paper. The production of thermal paper that does not create problems in the recovered paper cycle makes an important contribution to the conservation of resources.

It also reduces the amount of waste, especially when using recovered paper from household and commercial collections for the production of the base paper or cardboard. The environmental pollution directly associated with the cellulose and pulp production is avoided but the same performance characteristics are achieved in the final product. In a comparison of their impact on ecological systems, those paper products made from recovered paper perform better than paper products made from virgin fibres that use wood as a source of fibrous raw materials.

If virgin pulp fibres are required for technical reasons, these fibres should always be sourced from sustainably managed pulp production and forestry.

Therefore, following benefits for the environment and health are stated in the explanatory box:



1.4 Definitions

Colour developers are chemically active substances that are required to activate or initiate a colour reaction. In thermal paper, they can be a constituent component of a heat-sensitive layer that also contains the colour former and special melting point regulators.

Constituent components are substances added to the product as such or as part of a mixture in order to achieve or influence certain product properties and those required as chemical cleavage products for achieving the product properties. This does not include, for example, residual monomers that have been reduced to a minimum and unavoidable impurities. If necessary, these substances are covered by their own requirements.

¹² UBA forest paper can be found electronically at https://www.umweltbundesamt.de/sites/default/files/medien/376/publikationen/umweltschutz_wald_und_nachhaltige_holznutzung_in_deutschland_web.pdf

Direct thermal printing: A printing process in which the colouring layer is located in the thermal paper and activated by heat from the electrical printhead.

Thermal printing: The umbrella term for direct thermal printing and thermal transfer printing.

Thermal paper: A special type of paper for thermal printing processes. It is usually single-sided with a temperature and pressure-sensitive layer that changes its colour (in paper containing colour developers) or also just its transparency (in paper without colour developers) in direct contact with the electrical printhead at temperatures of between 70 and 120°C. Information can also be printed on the back of the paper using a different printing process.

Thermal transfer printing: The colour former on a separate film is transferred to the surface of the paper using heat and pressure. This creates waste in the form of the plastic film that contains a readable, reverse image of the printed information. This printing technique is not covered by these Basic Award Criteria.

2 Scope

These Basic Award Criteria apply to

- a) Thermal paper and
- b) Finished products made of thermal paper, such as cash register receipts, sales receipts, travel tickets, entrance tickets and other receipts.

Labels are excluded from the scope of these Basic Award Criteria.

3 Requirements

3.1 Type of paper and structure of the thermal paper

The base paper must be paper with the sort key 01 60 30 05 "coating base paper, for SD paper, thermo paper, special office paper" based on the grade statistics from the German Pulp and Paper Association (Verband Deutscher Papierfabriken e.V. – VDP).

The rolls of thermal paper can have different grammages, surfaces and colours. This ranges from single mat white paper through to coloured paper or special multi-layer composite material. The structure of the paper and its composition are dependent on its intended use and specific application.

The manufacturer must declare the multi-layer structure of the product and its composition based on the proportion of the total weight accounted for by these layers.

Compliance verification

The applicant shall declare compliance with the requirement in Annex 1. The applicant shall state the number of layers of paper and their proportions of the total weight of the product in a substance list in Annex 7.

3.2 Requirements for the origin of the wood for the pulp

Due to the high technical requirements of thermal paper, it has only been possible to produce it using virgin fibres – and not recycled fibres – up to now. The fibrous raw materials used to produce the base paper must be sourced 100 % from certified fibres. The wood must be sourced from forests that can verify that they are managed in an ecological and socially responsible manner. Wood sourced from regional forestry businesses that remain close to nature also helps to avoid long transport routes, which have a negative ecological impact.

- Verification of the pulp used in the product must be provided in the form of one of the following certificates:
 - ♦ Forest Stewardship Council (FSC¹³): FSC Mix Credit or FSC 100%,
 - ♦ Program for the Endorsement of Forest Certification Schemes (PEFC)¹⁴: 100% PEFC certified,
- or by submitting a comparable certificate whose scope and requirement standards are equivalent to one of the named certification systems¹⁵. The equivalence of the certification system must be confirmed by an independent environmental verifier.
- Alternatively, individual verifications in accordance with the criteria and verification requirements of one of the named certification systems may be presented if an equivalent level of protection can be achieved. The equivalence of the individual verifications must be confirmed by an independent environmental verifier.

For the wood used in the production of the pulp, the tree species including their scientific names (e.g. *Pinus elliottii* for pine) and the geographical location of the forest (country) must be stated.

The following information must be provided about the pulp used for manufacturing the base paper:

- The trading name of the pulp
- The technical data sheet
- The certification system used to verify the origin of the wood

Compliance verification

The applicant shall declare compliance with the requirement in Annex 1 to the contract.

The following information shall be entered in Annex 1:

- *the name of the wood used for the production of the pulp, the geographical location of the forest and the trading names of the pulp*
- *The name of the certification system used for the pulp and the sales documents (usually the invoice or delivery note) verifying delivery of legitimately certified raw materials.*

¹³ <https://info.fsc.org/index.php?lang=GER>

¹⁴ <https://pefc.org/find-certified>

¹⁵ <https://naturland.de>

Verification is based on two data points:

- *A valid certification number and an appropriate scope of certification (e.g. tested via the FSC certificate database) or PEFC or Naturland and*
- *A certification statement on the material.*

FSC, PEFC or systems whose equivalence has been proven will be accepted as verification.

3.3 Requirements for the production of the pulp

3.3.1 Auditor for examining the criteria

To verify compliance with the criteria on the production of the pulp, the applicant must submit a report completed by an auditor from

- a certification body for ISO 14001 accredited by the German Accreditation Body (DAkkS) or an international accreditation body for the scope of paper manufacturers (NACE 17.12) or
- an environmental verifier approved for this scope (NACE 17.12) by the German Society for the Accreditation and Registration of Environmental Verifiers (DAU) in accordance with the Environmental Audit Act

The evaluation of compliance with the criteria will be carried out in each case based on the stated verifications.

Compliance verification

The applicant shall declare compliance with all of the criteria in Paragraph 3.3 in Annex 1 to the contract. To verify compliance with the criteria in Paragraph 3.3, a report shall be submitted to RAL gGmbH as Annex 6 to the contract that confirms compliance with the criteria based on the stated verifications in each case.

3.3.2 Emissions to waste water in the production of the pulp

Strict requirements apply to the emissions to waste water during the production of the pulp used in the thermal paper. Pulp plants usually have their own waste water treatment plants and are thus direct dischargers. The applicant must determine the levels of the following chemical substances in the emissions to waste water at the pulp plant (measurement specifications, see Appendix C "Measurement of emissions to waste water"):

- Chemical oxygen demand (COD) in kg O¹⁶ per air dry tonne¹⁷
Proportion of chemically oxidising organic compounds in the waste water (usually based on analyses using dichromate oxidation) given as O
- Total nitrogen content in kg N per air dry tonne
Total-N (Total nitrogen, Tot-N), given as N. This includes organic nitrogen, free ammonia and ammonium (NH₄⁺-N), nitrites (NO₂⁻-N) and nitrates (NO₃⁻-N).
- Total phosphorous content in kg P per air dry tonne
Total-P (Tot-P), given as P. This includes both dissolved phosphorous and also undissolved phosphorous which enters the waste water in the form of precipitates or microorganisms.

¹⁶ O stands for oxygen

¹⁷ air dry: air dried pulp

The following reference values apply to the named substances:

Chemical oxygen demand: COD_{reference} = 18.00 kg O/air dry tonne
Total nitrogen content: N_{reference} = 0.25 kg N/air dry tonne
Total phosphorous content: P_{reference} = 0.03 kg P/air dry tonne

Based on the measurement values, the applicant must calculate so-called emission points (P) for each of the measured substances as a ratio between the measurement value and the reference value as follows:

$$P_{COD} = \frac{COD_{measurement\ value}}{COD_{reference\ value}}$$

$$P_N = \frac{N_{measurement\ value}}{N_{reference\ value}}$$

$$P_P = \frac{P_{measurement\ value}}{P_{reference\ value}}$$

The following requirements apply:

For each of the emission points P_{COD}, P_N and P_P, a value of 1.5 must not be exceeded in each case and the sum of the emission points for the emissions to waste water (P_{COD}, P_N, and P_P) must not exceed a value of 3.0.

In addition, the AOX value in the waste water must also be determined. See Paragraph 3.3.4 for more details.

Compliance verification

The applicant shall declare compliance with the requirement in Annex 1 to the contract, provide details on the auditor (according to 3.3.1) and enclose Annex 8 (emission values) completed by the producers of the pulp, as well as the test reports and the required supplementary documentation to the contract. The supplementary documentation comprises calculations of the emission points verifying compliance with this requirement.

The test reports must comply with the requirements in the measurement specifications in Appendix C "Measurement of emissions to waste water". The submitted test reports must be produced by a testing laboratory accredited according to DIN EN ISO/IEC 17025 (general requirements for the competence of testing and calibration laboratories) or with official accreditation as a GLP laboratory¹⁸. In-house laboratories are recognised as being of an equivalent standard when they have been accredited by an independent body as an SMT laboratory (supervised manufacturer testing laboratory).

¹⁸ <https://www.oecd.org/chemicalsafety/testing/oecdseriesonprinciplesofgoodlaboratorypracticeglpandcompliancemonitoring.htm>

3.3.3 Emissions to air in the production of the pulp

Strict requirements apply to the emissions to air during the production of the pulp used in the thermal paper. The emissions to air include those from the recovery boiler, lime kiln, steam boiler and incinerator for strong smelling gases. Diffuse emissions must also be taken into account. The applicant must determine the levels of the following chemical substances in the emissions to air at the pulp plant (measurement specifications, see Appendix D "Measurement of emissions to air"):

- Gaseous sulphur compounds (sulphur) in kg S per air dry tonne
Total reduced sulphur (TRS): Sum of the following reduced bad-smelling sulphur compounds released during the production of the pulp: hydrogen sulphide, methyl mercaptan, dimethyl sulphide and dimethyl disulfide, given as S, plus sulphur dioxide (SO₂), given as S
- Nitrogen oxide (NO_x) in Kg NO_x per air dry tonne
Sum of nitrogen oxide (NO) and nitrogen dioxide (NO₂), given as NO₂
- Dust emissions (dust) in kg dust per air dry tonne
Sum of the dust emissions at the recovery boiler and lime kiln, given as dust Solid particles of any form, structure or thickness that are dispersed during the gas phase and remain upstream of a defined filter after drying under specified conditions. According to DIN EN 13284 - 1

The following reference values apply to the named substances:

- Gaseous sulphur compounds: Sulphur_{Reference} = 0.6 kg S/air dry tonne
- Nitrogen oxide: NO_{xReference} = 1.5 kg NO/air dry tonne

Based on the measurement values, the applicant must calculate so-called emission points (P) for each of the measured substances as a ratio between the measurement value and the reference value as follows:

$$P_{Sulphur} = \frac{Sulphur_{measurement\ value}}{Sulphur_{reference\ value}}$$

$$P_{NOx} = \frac{NOx_{measurement\ value}}{NOx_{reference\ value}}$$

The following requirements apply:

For each of the emission points P_{Sulphur} and P_{NOx}, a value of 1.5 must not be exceeded in each case and the sum of the emission points for the emissions to air (P_{Sulphur} and P_{NOx}) must not exceed a value of 2.0.

Dust emissions must not exceed the limit value of 0.33 kg dust/air dry tonne.

Compliance verification

The applicant shall declare compliance with the requirement in Annex 1 to the contract, provide details on the auditor (according to 3.3.1) and enclose Annex 8 (emission values) completed by the pulp producer, as well as the test reports and the required supplementary documentation to

the contract. The supplementary documentation comprises calculations of the emission points verifying compliance with this requirement.

The test reports must comply with the requirements in the measurement specifications in Appendix D "Measurement of emissions to air". The submitted test reports must be produced by a testing laboratory accredited according to DIN EN ISO/IEC 17025 (general requirements for the competence of testing and calibration laboratories) or with official accreditation as a GLP laboratory¹⁹. In-house laboratories are recognised as being of an equivalent standard when they have been accredited by an independent body as an SMT laboratory (supervised manufacturer testing laboratory).

3.3.4 Bleaching process used in the production of the pulp

In the production of the pulp, the following requirements apply to the bleaching process:

- The pulp must not be bleached using elementary chlorine.
- The specific amounts of poorly biodegradable complexing agents (ethylenediaminetetraacetic acid (EDTA) and diethylenetriaminepentaacetic acid (DTPA)) must be stated in kg per air dry tonne, expressed as an annual average.
- A total chlorine free (TCF) process is preferred for the bleaching process, although an elemental chlorine free (ECF) process is permitted. In this case, the specific amount of bleaching agent consumed, expressed as an annual average, must be stated in kilograms of ClO₂ per air dry tonne. The adsorbable organically combined halogens (AOX) must be measured in the waste water. The annual average for the measured AOX emissions to waste water must not exceed a value of 0.12 kg AOX per air dry tonne.

Compliance verification

The applicant shall declare compliance with the requirement in Annex 1 to the contract, provide details on the auditor (according to 3.3.1) and submit a declaration from the pulp producer in Annex 8 stating the bleaching process and verifying that no elemental chlorine is used in the bleaching process.

Based on the test reports, the applicant shall submit information on the specific amounts of EDTA and DTPA consumed, as well as the bleaching agent, to RAL gGmbH in Annex 6.

If chlorine compounds (e.g. ClO₂) are added to the bleach for the pulp, the applicant shall submit a test report for the AOX emissions to waste water as an Annex. One of the test methods ISO 9562, EN1485, DIN 38409 Part 14 or the equivalent EPA 1650C must be used for measuring the AOX emissions. The measurements shall be carried out over a production period of 12 months, with measurements taken on at least a monthly basis.

The submitted test reports must be produced by a testing laboratory accredited according to DIN EN ISO/IEC 17025 (general requirements for the competence of testing and calibration laboratories) or with official accreditation as a GLP laboratory²⁰. In-house laboratories are recognised as being of an equivalent standard when they have been accredited by an independent body as an SMT laboratory (supervised manufacturer testing laboratory).

¹⁹ See footnote 17

²⁰ See footnote 17

3.3.5 Energy consumption in the production of the pulp

The specific energy consumption in the production of the pulp must not exceed the following limit values:

- Electrical energy: $\leq 1,125$ kWh/air dry tonne
- Heating energy: $\leq 7,500$ kWh/air dry tonne

a) Electrical energy (electricity):

The electricity consumed in the production of the pulp must be measured over a period of 12 months and stated in relation to the pulp produced (air dry tonnes) during this period.

The electricity consumption is calculated as follows:

Electricity consumption = electricity generated at the plant
plus the electricity purchased from outside of the plant
less the electricity sold outside of the plant
less the electricity consumed at the treatment plant
less the electricity consumed for processes not related to the pulp production at the plant

b) Heating energy (fuel):

The heating energy consumed in the production of the pulp must be measured over a period of 12 months and stated in relation to the pulp produced (air dry tonnes) during this period. Heating energy can be in the form of gaseous, liquid or solid fuels (e.g. natural gas, heating oil, biomass) or in the form of heat transfer media (e.g. water, steam). For the energy content of the fuel, the lower heating value (LHV) for the relevant fuel is used. In the case of damp fuels (e.g. wood, biomass), the effective calorific value (after subtracting the evaporation energy of the enclosed water) is used, while the effective energy content is used for heat transfer media.

The heating energy consumption is calculated as follows:

Heating energy consumption = fuel produced at the plant
plus the purchased heating energy or fuel
less the heating energy or fuel sold
less 1.25 x the electricity generated at the plant
less heating energy consumed for processes not related to the pulp production at the plant

Note:

The heating energy includes all fuels used (their lower heat value) and the heating energy recovered from the incineration of pulping liquors and waste at the production site (e.g. waste wood, sawdust, pulping liquor, waste paper, rejected paper), as well as the heating energy recovered from the plant's own electricity generation. The applicant must present the calculation for the energy consumption for the production of the pulp in the form of an energy statement together with the calculation parameters used. If the applicant does not have their own heating values for the fuels used, the heating values documented in the Nordic ecolabel for paper products ²¹ may be used.

²¹ https://www.nordic-ecolabel.org/globalassets/ai001_3.0_basic_module_cd.pdf

Compliance verification

The applicant shall state the specific energy consumption (Annex 6) and declare compliance with the requirement in Annex 1 to the contract. In addition, the applicant shall provide details on the auditor (according to 3.3.1) and submit an energy statement, which documents the energy consumption over a period of 12 months, the heating values for the relevant fuels used, the annual production volumes of pulp and the calculation of the specific energy consumption values.

3.4 Requirements for waste water from the paper manufacturing process

The following requirements apply with respect to waste water:

3.4.1 Direct discharge

In the production of thermal paper, the emission limits for the waste water load that are listed by the EU Commission in the "Best Available Techniques (BAT) Reference Document for the Production of Pulp, Paper and Board PP BREF" must be complied with by direct dischargers. These limits have been implemented in Germany in Appendix 28 of the German Waste Water Ordinance. The limits listed in Table 1 go above and beyond the statutory requirements in some cases so that the environmental label can only be used to certify paper that is produced in a particularly environmentally friendly way. Therefore, the emission limits for the waste water load that are listed by the EU Commission in the "Best Available Techniques (BAT) Reference Document for the Production of Pulp, Paper and Board" must be complied with by **direct dischargers**. These limits are listed in Table 1 below:

Table 1: Maximum limits for the average annual emission parameters (waste water) in the paper production process

Parameter	Maximum limit for the waste water emissions (average annual value as a load or concentration) ²²
Volumetric flow rate of waste water	15 m ³ /Adt
COD	3 kg/Adt
BSB5	0.15 kg/Adt or 25 mg/l
Total N (inorganic + organic N) (TN _b)	0.07 kg/Adt or 15 mg/l
Total P	0.008 kg/Adt or 1.2 mg/l

Adt = air dried ton

TN_b = total nitrogen bound. This parameter defines the total pollution of water by nitrogen compounds, which can appear in the form of e.g. ammonia, nitrites, nitrates or organic nitrogen compounds. A suitable method for determining this parameter is DIN EN 12260.

3.4.2 Indirect discharge

Indirect dischargers must declare compliance with the emission limits for the parameters stated in Table 1 after treatment.

²² BREF (Best Available Techniques Reference Document) full version and BAT conclusions in German and English at <https://www.umweltbundesamt.de/themen/wirtschaft-konsum/beste-verfuegbare-techniken/sevilla-prozess/bvt-merkblaetter-durchfuhrungsbeschluesse>

Compliance verification

*If the manufacturer of the recycled paper is a **direct discharger**, he/she shall declare compliance with the emission limits according to Table 1 in Annex 1 to the contract and state the measured emission values in Annex 4 to the contract.*

*If the manufacturer is an **indirect discharger**, he/she shall declare compliance with the limit values in Annex 1. The volumetric flow rate of waste water and the AOX value at the mixing location must be stated in Annex 2.*

The manufacturer shall submit a confirmation from the operator of the waste water treatment plant that provided the emission values for the other parameters in the downstream waste water treatment plant as Annex 5 to the contract (mixed values for all dischargers).

*The correctness of the data on the waste water provided in **Annexes 2 and 4** to the contract shall be verified for both direct dischargers and indirect dischargers at the time of application and then once a year in accordance with **Annex 6** (or 6a) to the Basic Award Criteria by:*

- *a certification body for ISO 14001 accredited by the German Accreditation Body (DAkkS) for the scope of paper manufacturers (NACE 17.12) or*
- *an environmental verifier approved for this scope (NACE 17.12) by the German Society for the Accreditation and Registration of Environmental Verifiers (DAU) in accordance with the Environmental Audit Act or*
- *an accredited FSC/PEFC certifier or*
- *an expert recognised by the UBA in the areas of fibrous raw materials, grades of recovered paper, the recycling of recovered paper and waste water treatment.*

3.5 Requirements for energy consumption and the origin of the electricity for the paper production process

The paper industry is one of the most energy-intensive industries in Germany, which is why it is important to further reduce the consumption of heat and electricity at the production sites and switch to environmentally friendly/friendlier energy sources.

For the production of thermal paper, the following limits for the consumption of electricity and process heat must not be exceeded as an annual average:

- Electrical power: $\leq 1,000$ kWh/t paper
- Process heat: $\leq 1,700$ kWh/t paper

These limits were derived from the data collected for the BAT reference document for the paper and pulp industry (PP BREF²³, here Section 7.3.15, Table 7.30, 7.31).

The sum of the process heat and electrical power is permitted to exceed the limit by a total of 10 %.

In addition, the applicant must state the energy mix used at the plant based on the type and origin of the energy. The consumed electricity should be sourced from renewable energies.

²³ See footnote 21

Compliance verification

The manufacturer of the thermal paper shall declare compliance with the required energy consumption values in Annex 1 to the contract and state the measured energy consumption values and the measurement period used in Annex 2. In addition, the manufacturer shall state all of the energy sources used, their proportions and origins (own generation/third-part generation) and the proportion of green electricity in the electricity consumed (notifications from the energy supply company) and, if relevant, the proportion of self-generated green electricity.

3.6 General exclusion of substances with certain properties

No substances may be added as colourants (incl, printing inks, toners, dyes), coating materials, production aids and paper refining agents that contain constituent components with the following properties:

- a) It is prohibited to add substances of very high concern (SVHC) that have been identified as being particularly alarming in accordance with Article 57, Paragraph 1 of Regulation (EC) No 1907/2006 (REACH) and added to the so-called "candidate list" according to Article 59, Paragraph 1 of the same regulation²⁴.
- b) No substances may be added to the product that
 - ♦ according to the criteria of Regulation (EC) No 1272/2008 are classified with the following H Phrases named in Table 2 or which meet the criteria for such classification.
 - ♦ or which are classified as carcinogenic, mutagenic or reprotoxic substances in the currently valid version of TRGS 905²⁵.

Table 2: H Phrases according to the CLP Regulation

H Phrases according to the CLP Regulation	Wording
H340	May cause genetic defects.
H341	Suspected of causing genetic defects.
H350	May cause cancer.
H350i	May cause cancer if inhaled.
H351 ²⁶	Suspected of causing cancer.
H360F	May damage fertility.
H360D	May damage the unborn child.
H360FD	May damage fertility. May damage the unborn child.
H360Fd	May damage fertility. Suspected of damaging the unborn child.
H360Df	May damage the unborn child. Suspected of damaging fertility.
H361f	Suspected of damaging fertility.
H361d	Suspected of damaging the unborn child.
H361fd	Suspected of damaging fertility. Suspected of damaging the unborn child.

²⁴ https://www.reach-clp-biozid-helpdesk.de/SiteGlobals/Forms/Suche/DE/Kandidatenlistesuche_Formular.html?nn=8790910

²⁵ <https://www.baua.de/DE/Angebote/Rechtstexte-und-Technische-Regeln/Regelwerk/TRGS/pdf/TRGS-905.pdf>

²⁶ An exception is made for titanium dioxide because its classification is only based on the respirable dust.

H Phrases according to the CLP Regulation	Wording
Other potential hazards	
H362	May cause harm to breast fed children.
H370	Causes damage to organs.
H371	May cause damage to organs.
H372	Causes damage to organs through prolonged or repeated exposure.
H373	May cause damage to organs through prolonged or repeated exposure.
H400	Very toxic to aquatic life.
H410	Toxic to aquatic organisms.
H411	Toxic to aquatic organisms with long-lasting effects.

The use of substances or mixtures which upon processing change their properties (e.g. become no longer bioavailable, undergo chemical modification) in a way that the identified hazard no longer applies are exempted from the above requirement.

Compliance verification

The applicant shall declare compliance with the requirement in Annex 1 to the contract.

The applicant shall verify compliance with the requirement by listing the colourants, coating materials, production aids and paper refining agents used and submitting declarations from the suppliers of the colourants, coating materials, production aids and paper refining agents in accordance with Annex 3 to the contract. The applicant shall also enclose the associated safety data sheets. The manufacturer shall provide the necessary information on the purpose of the products and their application.

3.7 Other requirements for production aids and paper refining agents

Only those production aids and paper refining agents that are listed in Recommendation XXXVI from the BfR for "Paper and board for food contact"²⁷ (positive list) in sections B (production aids) and C (special paper refining agents) may be added to the product. The maximum quantities stated in this list must be observed.

Compliance verification

The applicant shall declare compliance with the requirement in Annex 1 to the contract.

The applicant shall also verify compliance with the requirement by listing the dyes, printing inks, surface finishing agents and coating materials used and submitting declarations from the suppliers of the dyes, printing inks, surface finishing agents and coating materials as Annex 3 to the contract. If requested to do so by RAL gGmbH, the applicant shall also submit the relevant safety data sheets.

²⁷ The currently valid version of the BfR recommendation

3.8 Bisphenol A and other colour developers

In the production of thermal paper for direct thermal printing, no chemical colour developing systems may be used that are demonstrably toxic to humans, ecotoxic, very mobile or persistent or are suspected of being so. The use of the following colour developers is strictly prohibited:

CAS 80-05-7 Bisphenol A ²⁸,
CAS 77-40-7 Bisphenol B,
CAS 79-97-0 Bisphenol C,
CAS 620-92-8 Bisphenol F,
CAS 80-09-1 Bisphenol S,
CAS 97042-18-7 Bisphenol S-MAE,
CAS 2167-51-3 Bisphenol P,
CAS 41481-66-7 TGS,
CAS 95235-30-6 D8,
CAS 191680-83-8 D90,
CAS 93589-69-6 DD70,
CAS 232938-43-1 Pergafast 201 ²⁹,
CAS 321860-75-7 UU.

Furthermore, a substance is only considered to be suitable when it complies with all of the following conditions:

- The substance is "readily biodegradable" ($dt_{50} < 40$ d \rightarrow not persistent) or the substance has a high adsorption capacity ($\log K_{oc} \geq 4$ or $WL < 100$ mg/L \rightarrow low mobility in water);
- The substance has a low ecotoxicity ($EC_{50} > 0.1$ mg/L; $NOEC > 0.01$ mg/L; $EC_{50} > WL$);
- The substance has a low human toxicity (no or minor classification as CAT 1A, 1B, 2; STOT RE 1 or 2);
- There are no other comparable reasons for concern (e.g. endocrine disruption in humans and/or the environment according to the WHO/IPCS definition³⁰).

Compliance verification

The applicant shall declare compliance with the requirements in Annex 1 to the contract. The applicant shall declare whether colour developers are used and, if this is the case, name the colour developer and submit the relevant safety data sheets. The suitability criteria described above will be examined by the UBA. The applicant shall submit the required verifications to the UBA.

3.9 Biocides

In the production of the thermal paper, only those slimicides (substances in product type 12) and material preservatives for fibres (substances in product type 9) in the sense of the Biocidal Products Regulation that have been approved in accordance with the Biocidal Products

²⁸ echa.europa.eu/de/registry-of-restriction-intentions/-/dislist/details/0b0236e1853413ea

²⁹ echa.europa.eu/documents/10162/a264b52b-c474-5cad-7ef1-8485245e3d39

³⁰ WHO/IPCS (WHO, International Programme on Chemical Safety) Global Assessment of the State-of-the-Science of Endocrine Disruptors. WHO/PCS/EDC/02.2. 2002: http://www.who.int/ipcs/publications/new_issues/endocrine_disruptors/en/

Regulation (EU) No. 528/2012 (EU list of approved active substances) or are still being examined as a notified existing active substance for the relevant type of biocides as part of the EU work programme for the systematic examination of all existing active substances may be used.

Accordingly, it is only permitted to use those biocidal products classified in product types 9 and 12 that have been explicitly approved for the desired application.

For a transitional period, biocidal products that contain notified existing active substances of product types 9 and 12 that are still being examined as part of the EU examination process can also be used without approval if they have been registered in accordance with the German ordinance on the notification of biocidal products pursuant to the German Chemicals Act (Biocide Notification Ordinance – ChemBiozidMeldeV).

In addition, the biocidal products used in the product must not contain any substances that have been considered as candidates for substitution according to Article 10 of the EU Biocidal Products Regulation 528/2012.

Until the approval requirements for the biocidal products containing notified existing active substances come into force, only those substances that are also listed in Recommendation XXXVI from the BfR are permitted.

It is also possible that production aids and paper refining agents used for the production of the thermal paper contain biocidal products in product type 6 (protection of finished products in containers against microbial deterioration to ensure their shelf life) that have been made available on the market. Residual content of these biocidal products will be accepted.

Compliance verification

The applicant shall declare compliance with the requirement in Annex 1 to the contract and state which biocidal products from which product type have been used with their IUPAC names and CAS numbers, as well as the quantities used per kilogram of dry pulp in Annex 2.

3.10 Optical brighteners

The use of optical brighteners is not permitted.

Compliance verification

The applicant shall verify compliance with the requirement by submitting Annex 3 to the contract.

3.11 Azo dyes and pigments in colourants

No azo dyes or pigments may be added in colourants that can cleave into one of the amines stated in Regulation (EC) No. 1907/2006, Annex XVII, No. 43, Appendix 8 or 9, or in TRGS 614³¹.

Compliance verification

The applicant shall verify compliance with the requirement by submitting Annex 3 to the contract.

³¹ www.baua.de/DE/Angebote/Rechtstexte-und-Technische-Regeln/Regelwerk/TRGS/TRGS-614.html

3.12 Mercury, lead, cadmium or chromium VI compounds in colourants

It is not permitted to add any colourants (pigments or dyes) containing mercury, lead, cadmium or chromium (VI) compounds as constituent ingredients.

Compliance verification

The applicant shall verify compliance with the requirement by submitting a declaration from the colourant supplier in Annex 3 to the contract.

3.13 Requirements for the recyclability of the thermal paper

In order to produce thermal paper, coating colours are applied to a base paper. These coatings produce the text when heat is applied. Unprinted thermal paper does not contain any printing inks. Deinking is a standard process in the preparation of graphic paper or graphic cardboard. Thermal paper should not have a significant negative impact on this process. The recyclability of the paper is verified by testing it in accordance with the defibration and flotation conditions in INGEDE Method 11 (Deinability test, version January 2018).

Unprinted thermal paper must comply with the following criteria:

- ♦ Using a starting mixture of 100 % wood-free, uncoated copy paper printed on both sides with a dry toner and with a surface coverage of 5 % (CEN_TEST Master from EN 12281) on each side, the light absorption coefficient after flotation must only deteriorate by 6 points and filtrate darkening by 3 points when 1 % thermal paper is added to the mixture, in comparison to the floated starting mixture without thermal paper.
- or
- ♦ Using a starting mixture of recovered paper from newspapers/magazines (offset, uncoated) with a 60%/40% ratio, the light absorption coefficient after flotation must only deteriorate by 6 points and filtrate darkening by 3 points when 5 % thermal paper is added to the mixture, in comparison to the floated starting mixture without thermal paper.

Compliance verification

The applicant shall declare compliance with the requirements in Annex 1 to the contract.

In addition, the applicant shall verify compliance with the requirement by submitting test reports from an independent testing institution accredited according to ISO 17025 or a testing institution selected and approved by the UBA. In both of these alternative methods, the measurements must comply with at least one of the two criteria.

The testing must be carried out on the respective thermal paper and must be repeated if there is a significant change to the composition of the product (e.g. change to the type and quantity of printing, i.e. a change to the dye/printing ink, etc.).

3.14 Requirements for finished products made of thermal paper

In the production of finished products made of thermal paper, an additional colour print can, for example, be added to the front or back of the paper or a section of the paper.

Finished products made of thermal paper must comply with all of the requirements in these Basic Award Criteria. If an applicant uses a thermal paper that has already been certified with the Blue Angel to produce the finished products, it is sufficient to verify compliance with the requirements in 3.6, 3.7, 3.11, 3.12 and 3.14.

3.14.1 Use of paper

The applicant for the finished product made of thermal paper according to Paragraph 2 must verify compliance with the requirements in the criteria for the thermal paper. (Paragraphs 3.1 to 3.13).

If an applicant uses a thermal paper that has already been certified with the Blue Angel to produce the finished products, he/she shall name the paper being used.

Compliance verification

The applicant for finished products according to Paragraph 2 shall verify compliance with the requirements by submitting either verifications for Paragraphs 3.1 to 3.13 or a written declaration in Annex 1 to the contract that the finished product is exclusively produced using the thermal paper certified with the environmental label. The applicant shall name the thermal paper and its manufacturer and also state the contract number.

3.14.2 Mineral oils

For printing the finished products, no mineral oil-based additives, colourants or mineral oils that contain aromatic hydrocarbons (with ≥ 10 carbon atoms) as a component may be added. In the case of aliphatic hydrocarbons, only those substances with a chain length of C10 to C20 may be used. Plant-based substitutes for mineral oil should be free of genetic engineering and sourced from sustainable cultivation. The following certification systems are considered suitable for renewable raw materials: RSPO (Roundtable on Sustainable Palmoil), ISCC+, ISCC EU (International Sustainable & Carbon Certification) or RSB (Roundtable on Sustainable Biomaterial), Roundtable Responsible Soy (RTRS) und ProTerra (ProTerra Foundation) or a comparable certification system whose scope and requirement standards are equivalent to one of the named certification systems.

Compliance verification

The applicant shall state the additive, colourant or mineral oils used in the product in Annex 3. The applicant shall declare compliance with the requirement in Annex 1 to the contract and submit Annex 3 to the contract.

If plant-based substitutes have been used, the applicant shall state in Annex 3 which substitutes (which plant-based raw material) are added and where they are sourced.

3.14.3 Perfluorinated or polyfluorinated substances

To avoid the release of persistent substances into the environment, the following requirements must be fulfilled:

No perfluorinated and polyfluoroalkyl substances (PFAS) may be added during production.

Compliance verification

The applicant shall declare compliance with the requirement in Annex 1 to the contract and submit Annex 3 to the contract. The applicant shall state the additive, colourant, etc. used in the product in Annex 3.

3.14.4 Recyclability of finished products made of thermal paper

In accordance with the requirements in Paragraph 3.13, it must be possible to largely remove the colourant from the finished products made of thermal paper in a subsequent recycling process.

Compliance verification

The applicant shall declare compliance with the requirements in Annex 1 to the contract.

In addition, the applicant shall verify compliance with the requirement by submitting test reports from an independent testing institution accredited according to ISO 17025 or a testing institution selected and approved by the UBA.

The testing must be carried out on the respective finished product and must be repeated if there is a significant change to the composition of the product (e.g. change to the type and quantity of printing, i.e. a change to the dye/printing ink, etc.).

3.14.5 Fitness for use

The readability and durability requirements must be guaranteed by the finished products made of thermal paper. The manufacturer must use this information to develop storage recommendations for the user, e.g. for documentation purposes.

Compliance verification

The applicant shall declare compliance with the requirement by submitting a self-declaration (Annex 1).

3.15 Outlook

The following aspects will be added in a future revision of the environmental label:

- Examining and tightening the criteria for the removability of the colour-carrying layer of the paper based on measurement results
- Examining the useability of recovered paper or proportions of recycled paper
- Expanding the criteria to cover labels
- Examining the handling of microplastics

4 Applicants and Parties Involved

Manufacturers (paper mills) of final products according to Paragraph 2 shall be eligible for application.

Parties involved in the award process are:

- RAL gGmbH to award the Blue Angel Environmental Label,
- the federal state being home to the applicant's production site,
- Umweltbundesamt (German Environmental Agency) which after the signing of the contract receives all data and documents submitted in applications for the Blue Angel in order to be able to further develop the Basic Award Criteria.

5 Use of the Environmental Label

The use of the Environmental Label by the applicant is governed by a contract on the use of the Environmental Label concluded with RAL gGmbH.

Within the scope of such contract, the applicant undertakes to comply with the requirements under Paragraph 3 while using the Environmental Label.

Contracts on the Use of the Environmental Label are concluded to fix the terms for the certification of products under Paragraph 2. Such contracts shall run until December 31, 2027.

They shall be extended by periods of one year each, unless terminated in writing by March 31, 2027 or March 31 of the respective year of extension.

After the expiry of the contract, the Environmental Label may neither be used for labelling nor for advertising purposes. This regulation shall not affect products being still in the market.

The applicant (manufacturer) shall be entitled to apply to RAL gGmbH for an extension of the right to use the ecolabel on the product entitled to the label if it is to be marketed under another brand/trade name and/or other marketing organisations.

The Contract on the Use of the Environmental Label shall specify:

- Applicant (manufacturer/distributor)
- Brand/trade name, product description
- Distributor (label user), i.e. the above-mentioned marketing organisations.

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Appendix A Cited legislations and standards, literature

The currently valid versions of the relevant regulations and standards at the time of application apply, unless reference is made to a particular version of the regulation or standard in the criteria.

DIN CEN/TS 13130-13:2005-05 Materials and articles in contact with foodstuffs

DIN EN 643:2014-11 Paper and board - European list of standard grades of paper and board for recycling

DIN EN 645:1994-01 Paper and board intended to come into contact with foodstuffs; preparation of a cold water extract

DIN EN 646:2019-02 Paper and board intended to come into contact with foodstuffs - Determination of colour fastness of dyed paper and board

DIN EN 12260:2003-12 Water quality - Determination of nitrogen – Determination of bound nitrogen (TNb), following oxidation to nitrogen oxides

DIN EN ISO/IEC 17025:2018-03 General requirements for the competence of testing and calibration laboratories

DIN ISO 11475:2019-04 Paper and board – Determination of CIE whiteness, D65/10° (outdoor daylight)

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

German ordinance on the notification of biocidal products pursuant to the German Chemicals Act (Biocide Notification Ordinance – ChemBiozidMeldeV) of 14 June 2011

ISO 2470 Paper, board and pulps – Measurement of diffuse blue reflectance factor

ISO 20494:2017-12 Paper - Requirements for stability for general graphic applications

ISO 21993:2020-01 – Paper and pulp – Deinkability test for printed paper products

Regulation (EU) No. 528/2012 of the European Parliament and of the Council of 22 May 2012 concerning the making available on the market and use of biocidal products

Regulation (EC) 1272/2008 of the European Parliament and of the Council of 16 December 2008 concerning the classification, labelling and packaging of substances and mixtures

Regulation (EC) No. 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH)

TRGS 614 Restrictions on use for azo dyes, which may release aromatic amines classified as carcinogens

TRGS 905 Directory of carcinogenic, mutagenic or teratogenic substances

Appendix B Prohibited dyes and pigments

In accordance with Paragraph 3.11, the azo dyes listed below may not be added.

Azo dyes that may cleave to one of the following aromatic amines (according to Directive (EC) No. 1907/2006, Annex XVII, No. 43)

4-aminobiphenyl	(92-67-1),
benzidine	(92-87-5),
4-chloro-o-toluidine	(95-69-2),
2-naphtylamine	(91-59-8),
o-amino-azotoluene	(97-56-3),
2-Amino-4-nitrotoluene	(99-55-8),
p-chloroaniline	(106-47-8),
2,4-diaminoanisol	(615-05-4),
4,4'-diaminodiphenylmethane	(101-77-9),
3,3'-dichlorobenzidine	(91-94-1),
3,3'-dimethoxybenzidine	(119-90-4),
3,3'-dimethylbenzidine	(119-93-7),
3,3'-dimethyl-4,4'-diaminodiphenylmethane	(838-88-0),
p-cresidine	(120-71-8),
4,4'-methylene-bis-(2-chloro-aniline)	(101-14-4),
4,4'-Oxydianiline	(101-80-4),
4,4'-Thiodianiline	(139-65-1),
o-toluidine	(95-53-4),
2,4-diaminotoluene	(95-80-7),
2,4,5-trimethylaniline	(137-17-7),
4-aminoazobenzene	(60-09-3),
o-anisidine	(90-04-0),
2,4-xylydine	(95-68-1)
2,6-xylydine	(87-62-7)

Appendix C Measurement of emissions to waste water in the production of the paper or pulp

Measurement of emissions to waste water must be carried out on unfiltered and unsettled samples, either after preparation at the production plant or after preparation at an urban waste water treatment plant.

The measurements must be carried out over a production period of 12 months. The frequency of the measurements must be at least monthly (once a month). In the case of new or renovated production plants, the measurements must be based on at least 45 consecutive days of continuous plant operation. The measurements must be representative for the relevant periods.

Accepted test methods include:

- NFT 90101, ASTM D 1252 83, EPA SM 5220D or HACH 8000
- Total N: EN ISO 11732, EN 10304-2, EN ISO 13395, SFS 5505, SS 0280101
- Total P: ISO 6878, SS 028102, SFS 3026, NS 4725, EN 1189:1993, SM4500, APAT IRSA CNR 4110 or Dr Lange LCK 349
- An equivalent test method whose scope and requirement standards is equivalent to one of the named national and international standards. The equivalence of the certification system must be confirmed by an independent environmental verifier.
- Alternatively, individual verifications in accordance with the criteria and verification requirements of one of the named test methods may be presented if an equivalent level of protection can be achieved. The equivalence of the individual verifications must be confirmed by an independent environmental verifier.

Appendix D Measurement of emissions to air in the production of the pulp

The measurements of the emissions to air are carried out over a production period of 12 months. Unless the regulatory requirements at the site of the pulp production prohibit such measurements, measurements of the emissions to air must be completed at least every six months in addition to any measurements stipulated in the regulatory requirements. Written verification must be provided if the production site for the pulp is exempt from this requirement for six monthly measurements. Emissions associated with the generation of electrical energy do not need to be taken into account. The S-emissions associated with the generation of heating energy from oil, coal and other external fuels with known S-contents can be measured or calculated and must be taken into account. In the case of new or renovated production plants, the measurements must be based on at least 45 consecutive days of continuous plant operation. The measurements must be representative for the relevant periods.

Accepted test methods include:

- Gaseous sulphur compounds: NS 4859, SFS 5265, SS 028421, EPA 8, EPA 16A
- NO_x: ISO 11564, ISO 10849, EN 14792, SS 028425, EPA 7E
- Dust: EN 13284-1, SFS 3866
- An equivalent test method whose scope and requirement standards is equivalent to one of the named national and international standards. The equivalence of the certification system must be confirmed by an independent environmental verifier.
- Alternatively, individual verifications in accordance with the criteria and verification requirements of one of the named test methods may be presented if an equivalent level of protection can be achieved. The equivalence of the individual verifications must be confirmed by an independent environmental verifier.