

Conservation in the printing industry

Organisations, standards, certificates and technologies for sustainable, green production



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The heated debate on global warming and the expansion of the ozone hole above the polar caps have heightened environmental awareness the world over. The members of the European Community and Organisation for Economic Co-operation and Development justifiably see themselves as pioneers in initiating preventative action and

establishing ecological standards. The impact on the print media industry – which consumes a huge volume of forestry products and chemicals while emitting VOCs, dust, noise and heat – is manifold. This supplement examines the challenges facing printers, and the opportunities they offer.

Consumption and emissions

The print media industry's special status

Paper consumption • The fact that printing is not usually possible without paper, and that vast volumes of packaging are printed on other materials, has given the printing and packaging industry a special status. Disposable printed products and packaging are the biggest source of waste by a huge margin. And despite the growth of e-media, our annual consumption of paper is rapidly rising. So the industry has an obligation to adopt sustainable production methods wherever possible. Press manufacturers can make a material contribution by developing new technologies to cut paper waste.

Emissions • Printing presses can be pretty loud – the higher the number of ink-splitting points, the louder the press. Motors, gears, mobilised masses and compressed air all contribute to the general noise. On web presses the folder is an additional source of noise.

The issues of ink mist, paper dust, powder, ozone, volatile organic compounds (VOCs) and heat emissions must also be addressed. The “VOC database for the German printing industry”, published by Ökopol in 1999, ranked the printing industry among the biggest polluters, with emissions of 70,000 tonnes of VOCs per year (7%). Most manufacturers of presses, inks and chemicals have therefore come to consider it their duty to help bring about a substantial reduction in emissions.

Status quo in the production chain

Pre-press • The introduction of digital workflows and direct imaging in offset, gravure and flexo printing has rendered many environmentally critical processes

Ecology

is a branch of biology studying the relationships between living organisms and their environment. Man must view himself as part of this relationship and thus limit his impact on natural resources to a sustainable minimum. Plants and animals must be given sufficient living space so that an ecological balance is maintained which will allow future generations of humans to enjoy an intact environment.

Sustainability

is the term used to describe human activity that will have a neutral or positive long-term impact on the environment. More specifically this refers to the preservation and care of the soil, water, air, habitats and other resources, and the substitution of fossil-based and slow-growing resources with renewable and fast-growing ones.

superfluous. *Ozone-generating copying frames, silver-laden residues* and hazardous waste from film development and platemaking are now a thing of the past in many printing plants. In offset, chemistry-free plates are becoming more popular, the Presstek plates imaged on-press in KBA's 74 Karat and 46 Karat having proven their performance for many years now.

Planographic printing • In wet offset, VOC emissions caused by the evaporation of *isopropyl alcohol (IPA)* from the fount solution are still the biggest process-related issue. This can be addressed by taking on board the technology to

reduce the alcohol content or use an alcohol substitute. Alcohol substitution is one of the benefits afforded by KBA's hybrid presses. But even though it may be recycled many times, fount solution must ultimately be disposed of as hazardous waste. In waterless offset, where KBA's keyless inking units have moved it ahead of the curve, there is no fount solution at all.

Ink mist is non-existent on waterless presses like the KBA Cortina, and has been substantially reduced both on the compact Commander CT and on Compacta commercial web presses by fitting a new type of film

roller. For quality reasons, only tiny quantities of *spray powder* are used on Rapida sheetfed offset presses, and the powder and paper dust are extracted by an ACS air-cleaning system in the delivery. A lot of powder manufacturers have voluntarily undertaken to minimise the proportion of finer grains.

VOCs in the *cleaning agents* for rollers and blankets are increasingly being replaced by high-boiling mineral or vegetable oils, which can be reused following filtration. Sheetfed offset and coldset inks are VOC-free, while some of the binding agents they contain are manufactured from renewable resources (vegetable oils).

Thermally drying aqueous coatings and heatset inks consumes a lot of energy. Heatset oils are recovered when the exhaust emissions from afterburning systems are cleaned and used for heating or hot water. The *ozone* generated when inks and coatings are cured by radiation (UV, EB) can be extracted in full. *Radiation sources* are encapsulated in opaque housings.

Gravure • In the past few years there has been a dramatic drop in *toluene* emissions from printing inks following the adoption of low-toluene inks, encapsulation technology and recovery from the dryer air. So the airborne concentrations of toluene found today at most modern presses are no longer a health hazard. From the environmental perspective, water-based inks are a poor alternative because they can cause fan-out and the drying process consumes a lot of energy. Carcinogenic *nitrobenzene coatings* have been replaced by harmless two-component solvent-based coatings similar to those used in flexo.



Reaping the reward for environmental engagement: Herbert Preissler (l), managing director of Druckhaus Berlin-Mitte, expressing his delight at winning the Druck&Medien award for the most environmentally focused enterprise of the year. Sponsored by KBA, the award was presented by Ralf Sammeck, KBA's executive vice-president for sheetfed sales, following a decision by an independent 20-man jury. Druckhaus Berlin-Mitte, which has a number of Rapida presses, joined the Eco Management and Audit Scheme (EMAS), an initiative designed to improve companies' environmental performance, in 2002 and obtained EN ISO 14001 environmental accreditation that same year

Letterpress • Conventional flexo printing inks emit a number of *alcoholic and aromatic VOCs*. The solvents are burnt off in the exhaust cleaning unit or recycled using catalytic conversion. UV inks and coatings can be used as an alternative for printing on film, aqueous inks on paper and corrugated board. Letterpress inks for packaging and labels are at the same stage of development as offset inks.

Screen printing • Here the choice of inks ranges from VOC-rich to VOC-free (water-based or UV curing), depending on the substrate concerned. *Removing the stencil* from the screen entails more waste than cleaning the inking units.

Digital printing • Electrophotographic processes that entail dry toner emit *particulate matter*, though nowadays this is well below the permitted thresholds. More critical is the emission of *benzene, azo dyes and heavy metals* from uncertified toners. Most of the *ozone* emitted when the photoconductor drum is charged is filtered out. Inkjet inks, even UV-curing ones, are not VOC-free. They are based in part on particularly dangerous solvents such as *ethyl acetate and butyl acetate*. For inkjet printing, water-based inks are the VOC-free alternative.

Offline finishing • Alongside non-hazardous aqueous special-effect coatings and UV coatings, laminating film is often used to coat surfaces. Dry lamination, during which VOCs are emitted, is increasingly being replaced by wet, thermal (pre-coating) and granular (spray-on) lamination, which is VOC-free. The VOC emissions threshold for the application of

adhesives is 5 tonnes per year.

Conversion • The *vapours* emitted by aqueous dispersion, hotmelt and PUR adhesives must be extracted. Only unhardened adhesive waste is classified as hazardous waste.

Environmental responsibility and liability

Legal situation

International law • The resolutions passed by the Environment Directorate of the *Organisation for Economic Co-operation and Development* (OECD), of which the world's 30 leading industrial nations are members, are binding under international law.

European law • The environmental directives issued by the *European Community* (EC) are also legally binding, and in the course of European harmonisation must be reflected in the laws and statutory regulations of the member states. Their legal foundation is liability for hazards relating to plant and equipment, which includes liability under laws on the protection of air, water and soil, pollutant thresholds (technical directives on contamination, noise, vibration) and the handling of chemicals and dangerous goods.



Costly IPA in fount solutions is the biggest VOC issue in the printing industry and controlling or reducing the level of IPA can deliver substantial cost savings. The alcohol substitutes used in IPA-free print production cost no more than IPA, and the higher initial cost of IPA controls (photo), modified water circuits or inking-unit temperature control is recouped in the long term. If the right procedures are followed, then dispensing with alcohol does not impair quality

Photo: Technotrans

National law • In the USA personal freedom and inviolability have the highest priority, which is why warnings are more often issued in place of prohibitions, even in matters relating to environmental protection; some states, however, have draconic laws. In *Switzerland* alcohol- and VOC-rich cleaning agents are taxed progressively (VOC incentive tax) according to the volume consumed (in litres). In *Denmark* and *Sweden*, waterless offset has been adopted more extensively than elsewhere as a result of draconic VOC emissions thresholds and a ban on chlorofluorocarbons (CFCs) as coolants in fount solutions. The superior quality that waterless offset can deliver is evidenced by the numerous KBA Rapida presses and, more recently, the Cortina heatset newspaper press in operation there.

Liability risks and hierarchy • Print providers' liability in respect of environmental issues is defined in *civil law* (which includes commercial and labour laws) and *criminal law* – and encompasses all corporate positions from partners and associates down to humble employees. So to minimise liability risks it is wise to make environmental management an integral part of modern corporate management. At company level a *liability insurance against environmental damage and related personal injury* is compulsory. In the EU the maximum indemnity limit for personal injury and material damage is €85 million, in the USA there is no upper limit.

Impact on the European printing industry

Pollution • Pollution laws in Europe have been harmonised since EC directive 96/61/EC *Integrated Pollution Prevention and Control* (IPPC Directive) was passed six years ago. For existing systems the new law came into force in autumn 2007. It also brought changes in the licensing procedures for printing plants. The calculation of *VOC threshold volumes* has been expanded to include not just solvents from inks but *all solvents* (IPA, washes, thinners, from laminators etc). And annual threshold volumes have now been calculated in addi-

Estimated volumes of ink consumption at which printing presses must comply with directive 99/13/EC on the limitation of VOC emissions (EC VOC-RL) Source: Ökopoll 1999

Press line	Critical ink volume	Total VOC emission*
Publication rotogravure	> 15 tonnes/year	> 25 tonnes/year
Heatset web offset	> 30 tonnes/year	> 15 tonnes/year
Packaging gravure, solvent-based	> 10 tonnes/year	> 15 tonnes/year
Packaging gravure, water-based	> 60 tonnes/year	> 15 tonnes/year
Packaging flexo, solvent-based	> 10 tonnes/year	> 15 tonnes/year
Packaging flexo, water-based	> 60 tonnes/year	> 15 tonnes/year

* of which diffuse emissions: < 25% at 15 t/a, < 20% at 25 t/a

Example of a VOC audit scheme

Volume of high-VOC materials purchased	Process-related VOC emissions
Ink, coatings	printing, finishing
IPA	exhaust purification
Other dampening additives	ink residue, rags, chemical waste
Cleaning agents	cleaning (% emitted less % chemically destroyed)
Total VOC input	Total VOC output

VOC input less VOC output = "diffuse emissions" (cf thresholds!)

Ranking atmospherically relevant gas emissions

Global warming (greenhouse effect):

1. CO₂ (carbon dioxide); 2. CH₄ (methane); 3. NO_x (nitrogen oxide); 4. H₂O, density < 0.6 kg/m³ (water vapour); 5. SF₆ (sulphur hexafluoride)

Impact on the ozone layer:

1. CFCs (chlorofluorocarbons): destruction; 2. HC (hydrocarbons) plus NO_x (nitrogen oxide): compression/enrichment, "summer smog"

VOC emissions generated in the Germany printing industry, by printing process Source: Ökopoll 1999

Process	Proportion*
Sheetfed offset	29%
Packaging gravure	23%
Commercial web offset (heatset)	17%
Publication rotogravure	15%
Packaging flexo	7%
Screen printing	5%
Newspaper web offset (coldset)	2%
Continuous and letterpress	2%

* Industry emissions: calculated 53,293 t, estimated 70,000 t = 7% of total annual emissions in Germany

KBA pioneers green printing

KBA established a name for itself some years ago as a pioneer of greener press technology. Evidence of this is the “Emission tested” environmental certificates that have been issued by the Berufsgenossenschaft Druck und Papierverarbeitung (BGDP) for the entire Rapida series since Drupa 2000 – including the latest high-speed generation, hybrid and UV versions and large-format presses. The emission thresholds tested by the BGDP (the German equivalent of the H&SE in the UK and OSHA in the US) are shown in the table below. The forerunner of the 18,000sph Rapida 105 was the first sheetfed offset press on the world market to be awarded this BGDP certificate, whereby the dampening unit, with reduced alcohol emissions, played a major role. The dampeners fitted on commercial web offset presses have also been modified to allow low-alcohol or alcohol-free printing. There are large numbers of KBA sheetfed and web customers printing with **reduced or no alcohol**. Naturally, the surface of the rollers and cylinders must also be compatible with **vegetable-based cleaning agents**.

KBA's commitment to environmentally friendly **waterless offset** is unique in the marketplace. The presses concerned have also passed the BGDP accreditation procedure with flying colours. This applies not only to keyless sheetfed technology (Genius 52UV, 74 Karat, Rapida 74G) and newspaper technology (Cortina) but also to presses with conventional temperature-controlled inking units (Rapida 74 to 162, 46 Karat). Environmental regulations are particularly strict in Scandinavia. Printing plants and presses there must carry more certificates than anywhere else. As a consequence, the proportion of waterless or alcohol-free Rapidas is exceptionally high.

Although safety regulations stipulate that **radiation protection** must be in place at the end-of-press dryer to prevent UV emissions, there are still a lot of older presses in



KBA president and CEO Albrecht Bolza-Schünemann affixing an “Emission tested” seal of approval on a hybrid Rapida 105 at Drupa 2000. The two-coater 105's emissions were well below the permitted thresholds



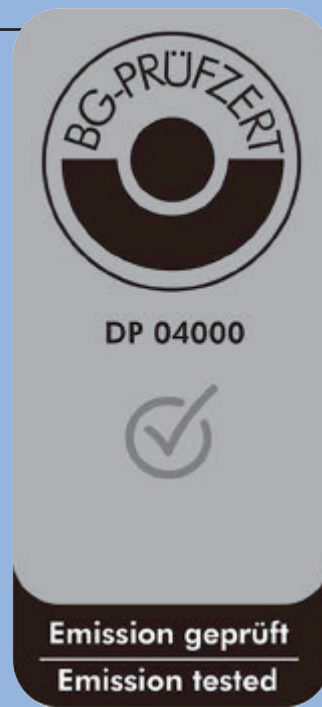
KBA sheetfed marketing manager Jürgen Veil accepting an “Emission tested” certificate from Albrecht H Glöckle at the second hybrid user forum in April 2005. This certifies that the new-generation, 18,000sph KBA Rapida 105 complies with the BGDP's rigorous thresholds and thus also those of the pertinent EC directives

Emissions tested at offset presses for BGDP accreditation

Emission source	Agent, process	Threshold
Fount solution in dampeners and water circuits	VOC isopropanol	500 mg/m ³
Inks, coatings and cleaning agents in inking and coating units	VOCs with hydrocarbons	500 mg/m ³
Inks on high-speed inking rollers	ink aerosols (ink mist)	under discussion
UV lamps in dryers	ozone	0.2 mg/m ³
UV lamps in dryers	UV radiation	0 (as per prEN 1010-2)
Powder sprayer in the delivery	powder	6 mg/m ³ (1.5 mg/m ³ under discussion)
Entire press line	noise	84 dB(A)

operation where no protection is provided for personnel against carcinogenic UV radiation. KBA has long since made opaque radiation screens a standard feature of all

its UV and hybrid presses. An **extractor** is used to remove the **ozone** (O₃) that is produced when shortwave UV photons collide with the oxygen (O₂) in the air. As an



The Berufsgenossenschaft Druck und Papierverarbeitung (BGDP) is the competent authority on emissions accreditation for German press manufacturers such as KBA, and fulfils the same functions as the UK's Health & Safety Executive. Its “Emission tested” certificate confirms compliance with industry thresholds. These are the same as, and sometimes even lower than, the threshold values laid down in EU directives. The BG seal is thus recognised outside Germany. Nonetheless, KBA has also had some of its presses certified by the European safety executive (CEFIC)

tion to the hourly consumption limits. If emissions exceed 200 tonnes per year then the emitter must apply for a licence. Heatsset presses are no longer classified by their threshold volumes, and must now be certified in the same way as flexo and gravure presses under the *VOC Solvents Directive on the limitation of emissions of volatile organic compounds due to the use of organic solvents in certain activities and installations* (1999/13/EC, see table on page 3). Solvent audits

(see schematic on page 3) and reduction schedules must be drawn up for such presses. The same applies to ink and coating manufacturers' production and filling lines.

Cross-industry threshold lists are adjusted every year and expanded to include new hazardous substances. Printing plants must also study these *values for maximum workplace and ambient concentrations*. Selected thresholds are shown in the table on page 6. **No outdated technologies** • In accor-

dance with the IPPC Directive, licensing procedures in EU member states specify that installations must be on a par with the *best available techniques* (BAT), ie ones that have a smaller environmental impact or entail greener processes than earlier technologies. The licensing institutions must comply with BAT reference documents (BREF) issued by the Institute for Prospective Technological Studies (IPTS) in Seville. The reference documents are drawn up by experts from public

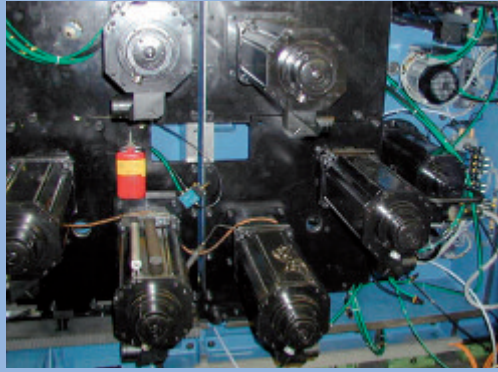
optional extra for the delivery KBA also offers an ACS air cleaning system to **extract the powder, paper dust and any residual ozone** that may be carried on the sheet sur-

authorities and from industry, including KBA. Waterless offset is an exception to the BAT rule. Although it should, in all honesty, be considered a BAT for offset printing, wet offset presses are still assessed with no reference to fount-free technology. The BAT used as a benchmark in wet offset – beside the technology to remain below emission thresholds – is the potential for alcohol reduction.

Handling waste • In the printing and packaging industry, the non-



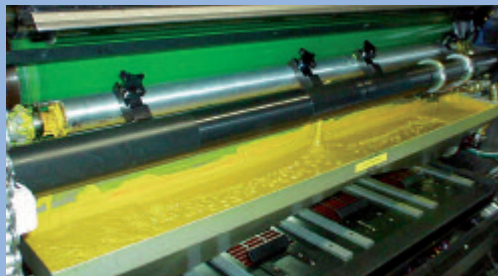
A lot of paper dust and powder is deposited on grippers and lamp housings at the end-of-press dryer and sheet delivery (above). To protect press operators from exposure to dust and powder and to prevent contamination of the console and pressroom equipment KBA can install an Air Cleaning System (ACS, below) in the delivery of its Rapida presses. On UV and hybrid presses ACS also extracts ozone residue



Its waterless coldset offset technology, which dispenses with fountain solution and thus with alcohol, is not the only reason why the KBA Cortina compact newspaper press is environmentally friendly. Its dedicated drives eliminate the need for lubricating oil in the printing units (above), while keyless inking units eliminate ink mist (below)



David Gask, managing director of the Polar Print Group, Leicester, invested a cool £3 million in a project seeking to make two KBA Rapida 105 presses alcohol free and carbon-neutral



Sandler in Marbach an der Donau (Austria) inaugurated the world's first environmentally accredited twelve-unit sheetfed press, a Rapida 105, in 2002. Eight printing units are connected to Technotrans water-circulating systems (one for four units) that allow alcohol-free CMYK perfecting. Each of the two remaining pairs of printing units is connected to an additional circulating system that allows metallic inks to be printed with the necessary alcohol content of 3% or less. The vegetable-based inks are pumped automatically to the ink ducts either from a vat (process colours, coatings) or from cartridges (special colours)

face or on the air disturbed by the grippers. More and more environmentally focused printers are acknowledging KBA's pole position in green press technology. One current example is the UK's Polar Print Group based in Leicester, which has teamed up with KBA to forge a broad coalition of like-minded manufacturers in the paper, ink and consumables industries. Polar invested in two KBA Rapida 105 presses to implement its trademarked "Printing Responsibility" project, a corporate philosophy promoting compliance with ethical printing standards through sustainable emissions reduction and carbon-neutral production. After conducting detailed comparative studies of other makes of press it went for a six-colour hybrid version, which was commissioned in November 2007, and a ten-colour perfecter,

which will be installed in 2008. Since Polar has ISO 12647-2 accreditation, the Rapida 105's quality assurance systems were another reason for choosing KBA. When the first press was installed, its CO₂ emissions were calculated by an independent expert and will be offset by emissions trading. Both presses are equipped for alcohol-free production. Polar's objective is to increase turnover from £4.5m to around £6.5m without increasing its carbon footprint. The Printing Responsibility project is supported by environmental organisations such as Greenpeace, Friends of the Earth and Comic Relief. Polar is considered a leading light in the UK print media industry on issues relating to conservation. In addition to ISO 12647-2 it boasts ISO 14001, Forest Stewardship Council (FSC) and OHSAS 18001 (health and work safety) accreditation.

woven materials and cleaning rags used in the printing process, and all returnable containers, are classic examples of cleanable, reusable waste. Paper and packaging waste, however, can only be recycled, and it is mainly paper that is returned to the original materials cycle; most synthetic and composite waste is taken to incinerators. So packaging printers have an ethical duty to develop recyclable, non-polluting, combustible or biodegradable packaging. On top of this,

packaging should fulfil its purpose with the minimum possible input of material. In the EU, national measures relating to the *management of packaging and packaging waste* have been harmonised since 1998 in accordance with directive 94/62/EC.

Handling dangerous substances • Since June 2007, laws governing chemicals have also been harmonised throughout the EU in accordance with regulation 1907/2006/EC on the *Registration, Evaluation, Authorisation*

and Restriction of Chemicals (REACH). It encompasses access to databases on dangerous substances and goods such as poisons, flammable and explosive liquids, softeners, heavy metals etc, and safety data sheets relating to their transport, storage, processing and disposal. While dangerous substances are still classified, packaged and labelled in accordance with directive 67/548/EEC, under the new chemicals law the burden of proof is reversed and now corre-

sponds more closely to the American model. It is no longer the injured party but the emitter, in this case the printing plant, that must provide complete documentation on the composition of printed matter or packaging. REACH also applies to dangerous substances in printed products manufactured outside the EU, eg in China, but destined for the European market. In recent years this has resulted in toys and children's books being recalled for safety reasons. It goes without

saying that environmentally friendly production encompasses the substitution of hazardous substances with harmless ones.

Product accountability

Integrated product policy • Ethical production policies are summarised in a number of publications, among them the EU's green book on *Integrated Product Policy (IPP) 2001*, which advocates making manufacturers accountable for the entire life cycle of their products. This is of particular relevance for packaging printers, whose products must be environmentally friendly, reusable or recyclable. KBA acknowledges a duty to develop presses that are manufactured in environmentally friendly conditions and to guarantee that their emission levels will not exceed the original, certified levels for the duration of their service life. KBA has established a formidable standing as a pioneer of waterless and keyless offset technology, enabling users to minimise waste levels by eliminating water and alcohol substitutes.

Choosing green materials • The *Product Design for Environment (DfE)* initiative has a similar thrust, though its main focus is to promote the use of environmentally friendly materials, including printed products and packaging. Biodegradability and standardised, reusable composite materials (eg Tetrapak) are two of the issues treated. KBA supports DfE by eliminating pollutants. The direct cylinder drives in the Cortina and Commander CT, for example, allow the printing units to be operated with no lubricating oil. In the print media industry, *Product Design for Recycling (DfR)* refers to de-inkability, say, or 100% recyclability. DfE and DfR are a must for any eco-management system.

Standards and certificates

Selected models

Accountability • Nowadays companies with environmental ambitions are expected to seize the initiative, and in view of an emerging demand among customers for greener products, this has become a key image and differentiation factor. More specifi-

Key ISO 14000 norms relating to environmental management and contamination control

ISO	Type	Content
14001	Specification	Environmental management systems – Specification with guidance for use
14004	Directive	Environmental management systems – General guidelines on principles, systems and supporting techniques
14010 (EN)*	Directive	Guidelines for environmental auditing – General principles
14011 (EN)*	Directive	Guidelines for environmental auditing – Audit procedures
14012 (EN)*	Directive	Qualification criteria for environmental auditors
14024 (EN)	Specification	Environmental labels and declarations
14031 (EN)	Directive	Environmental management – Environmental performance evaluation
14040 (EN)	Specification	Environmental management – Life cycle assessment – Principles and framework
14041 (EN)	Specification	Environmental management – Life cycle assessment – Goal and scope definition and inventory analysis

*superseded by 19011 *Guidelines for quality and environmental management systems auditing*

Some international threshold values in the printing industry

Material	Max. airborne concentration
Acetone (in cleaning agents)	20 ml/m ³ = 83 mg/m ³
Aluminium oxide (on roughened offset plates)	1.5 mg/m ³
Benzene (in solvents and cleaning agents)	1 mg/m ³ (2.5 g/h)
Butyl acetate (solvent in certain inkjet inks)	5 ml/m ³ (USA), 20 ml/m ³ (EU)
Isopropyl alcohol (in offset fountain solution)	200 ml/m ³ = 500 mg/m ³
Carbon atoms (in exhaust fumes and air)	
- afterburning	20 mg/m ³
- adsorption cleaning	50 mg/m ³
- biofiltration	90 mg/m ³
Copper (in electrolytic vats)	0.1 mg/m ³
Methylene diphenyl diisocyanate (in PUR adhesives)	0.05 mg/m ³
Ozone (in UV and corona devices)	120 mg/m ³ (up to 8 hours)
Dust (paper/fillers, powder)*	
- alveolar particulate matter < 10 µm	3 mg/m ³
- respirable dust > 10 µm	10 mg/m ³
- paper particulate matter < 0.5 mm (in coldset)	30 g/m ³ (lower explosion threshold)
- dust deposits on surfaces	350 mg/m ²
Toluene solvent (in gravure inks)	190 ml/m ³ = 50 mg/m ³
Xylene solvent (in gravure inks and coatings)	440 ml/m ³

*Manufacturers' voluntary controls: the minimum particle size of fine printing powder may deviate from the mean (80% frequency) by no more than 20 µm

Noise exposure limits as laid down in EU directive 2003/10/EC

Daily level	Peak sound pressure	Noise controls
from 80 dB(A) to 135 dB(C)		voluntary hearing protection and hearing test
from 85 dB(A) to 137 dB(C)		obligatory labelling, obligatory hearing protection, right to hearing test
from 87 dB(A) to over 137 dB(C)		plus machine encapsulation

cally it entails adopting an environmental management system and/or providing proof of sustainable technologies and materials procurement. An added bonus is that implementing an environmental management system will reveal cost-saving potential, so certification is always well worth the input.

ISO 14000 • The ISO 14000 series of international standards (*see table at the top of this page*) regulates the *implementation of an environmental management system* within an enterprise. Most of the norms in this series are based on an EU norm (EN) and are therefore found in many national norms. The most important steps are described in ISO 14001, for which companies can obtain accreditation. The focus of an environmental management system

is the *environment programme* that an enterprise is obliged to implement. ISO 14040 describes how to draw up an *eco-audit*.

EMAS • The *Eco Management and Audit Scheme (EMAS)* was initially established by European Regulation 1836/93, though this has since been superseded by Council Regulation 761/01. It is a voluntary initiative designed to improve companies' environmental performance. Among the EU member states EMAS is as widespread as ISO 14000, but goes still further by requiring participating organisations to publish regular *statements on their environmental performance*. These statements must include goals and procedures relating to environmental policy, an eco-audit (consumption of resources and materials, with the resulting emis-

sions) and the environmental management system. The statements must be verified by an independent expert before the company can be registered by the competent national organisation as having a valid environmental management system.

Sustainability report • This is good for marketing purposes and the corporate image, and is issued by many companies alongside their business reports. Among print media enterprises, the public limited company (UK) or stock corporation (US) is a common form for globally active groups and media houses, and for smaller operations, particularly in Switzerland. But regardless of its listing, legal form or size, any print provider can publish its environmental programme on the internet. A sustainability report is only compulsory if the company is listed in one of the *Dow Jones Sustainability Indices (DJSI World, DJSI STOXX Europe)*. In autumn 2007 the Austrian paper and packaging producer Mondi was listed in both indices following a management assessment that will be repeated every year.

The sustainability report evolved from earlier annual environmental reports and the three-yearly location-specific environmental statement, but includes more of what are known as G3 indicator categories in accordance with *Global Reporting Initiative (GRI)* guidelines. Alongside environmental performance (30 points) the main indicators are governance, commitments, engagement (17), working practices and employment (14), report parameters (13), corporate profile (10) and product responsibility (9).

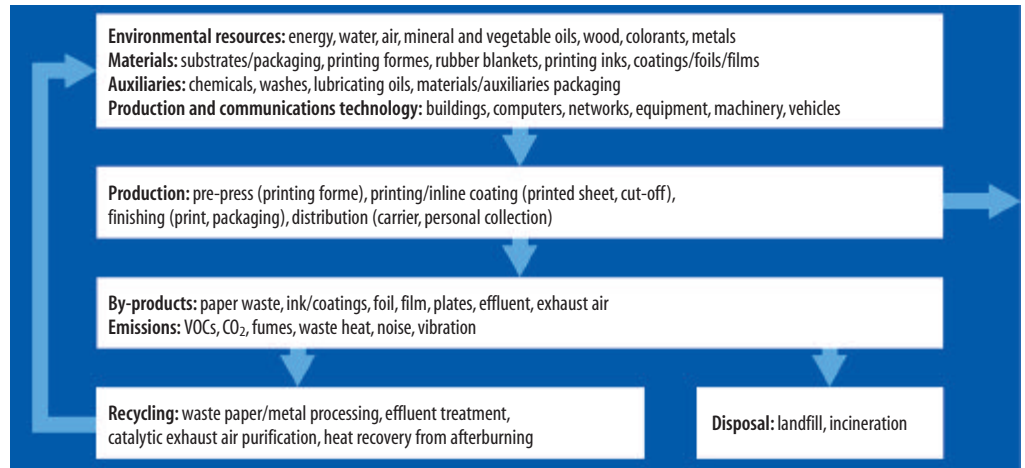
Sustainable Green Printing Partnership • This initiative was established in

September 2007 in the USA by the Printing Industries of America/Graphic Arts Technical Foundation (PIA/GATF), the Specialty Graphic Imaging Association (SGIA) and the Flexographic Technical Association (FTA). More than 90% of its member companies are persuaded that, in future, print customers will go for environmentally printed products.

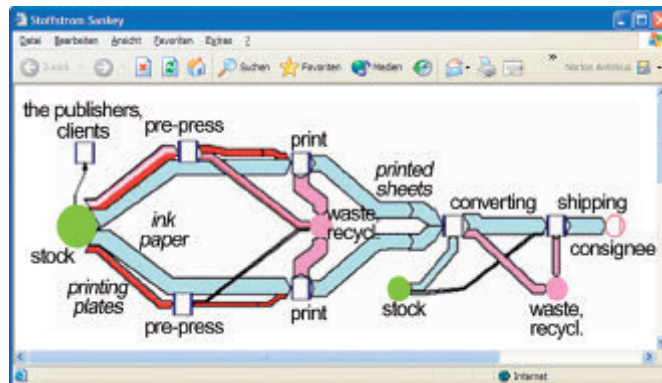
Sustainable forest stewardship • Two initiatives have evolved for certifying the wood-processing industry: the *Programme for Endorsement of Forest Certification Schemes* (PEFC) and the Forest Stewardship Council (FSC). Both are international, non-profit ENGOs (environmental non-governmental organisations) founded to support environmentally appropriate, socially beneficial and economically viable management of the world's forests through independent forest management certification and marketplace labelling of certified forest products. This encompasses reforestation, the promotion of biodiversity and sustainability, and the protection of forest habitats. Both ENGOs offer *chain-of-custody certification* from the forest to the sawmill to the retailer, which includes paper mills and printing plants.

PEFC and FSC have been repeatedly accused by environmental activists of pandering to the logging industry, but renouncing any form of logging would merely drive up demand for non-renewable resources and destroy jobs in structurally weak regions. An alternative to wood-based papermaking is the focus of research by Japanese printer manufacturer Oki and Dalian Polytechnic in China. Before the end of the year they are aiming to launch on the market office printing paper whose fibres are derived from annual crops, not trees. Such projects notwithstanding, forest management is likely to retain its present significance in the long term.

Paper profiles • Even without PEFC or FSC certification, many paper-makers have adopted greater transparency and responsibility in the chain of custody. Since they usually have ISO 14000 accreditation, they are already docu-



Materials flow at a full-service print provider. A detailed schematic should be an integral part of the materials flow management concept embedded in every corporate environmental management system and furnish the basis for calculating job-specific CO₂ emissions



In Sankey diagrams depicting a materials flow management system, the volume and cost are visualised by the thickness of the arrow
Source: Synergetic Freiburg (Meyer)

menting recycling percentages, eco-audits, resource cycles, volume-for-volume grammage reductions and greener, more social standards for paper production and utilisation. At the initiative of nine paper manufacturers and dealers (Holmen, Klippan, M-real, Myllykoski, Norske Skog, Sappi Fine Paper Europe, Stora Enso, Trebruk and UPM-Kymmene), each type of paper has been given a *profile* revealing details of the supply chain, environmental management and the chemicals used.

Advice and promotion • The introduction and certification of environmental management systems has been accompanied by industry bodies and authorities which are fully conversant with national and EU development programmes. There are also a number of consultancies specialising in the analysis, organisation and permanent computer-aided evaluation of materials flow management, order-specific CO₂ emissions and the like. These include CP California and CP UK.

Conservation tools

Environmental controlling: a signature issue • Conservation brings rewards as well as risks. Far-sighted environmental protection can safeguard the *long-term future of a company and its location*. Furthermore, adopting an environmental management system can reveal *wasteful consumption of materials and resources* and thus *potential for process optimisation*. Conservation becomes an integral part of corporate philosophy because management must define its *environmental policy* in writing as a basis for environmental management. This in turn creates the need for *staff motivation and training* in environmental issues. *Monitoring* the optimised materials flow (for example with the aid of current VOC audits), implementing concrete environmental projects and promoting staff discipline in environmental issues represent new management tools for company heads. Successful implementation, which should undoubtedly be certified,

can make environmental engagement a highly effective *marketing instrument*.

Environmental management systems • The purpose and responsibilities of an environmental management system are defined in the company's *environmental policy*. The practical section begins with a comprehensive analysis of all pertinent processes (*cf materials flow management below*) and a breakdown of environmental risks. From this it is possible to formulate an *environmental programme* that defines the company's *environmental performance*. This performance must not only be maintained consistently but continually enhanced through careful planning and control. Specific instruments include recycling instead of disposal, the use of green consumables (eg inks and washes) instead of fossil-based ones, and process optimisation. Keeping a record of action taken and targets achieved allows the company to track progress via regular eco-audits.

An environmental programme incorporates all the directives, laws and regulations that are pertinent to environmental accountability in the relevant industry. At the same time staff competences should be defined with regard to the compliance or optimisation of specific processes. A commendable consequence is the integration of environmental parameters in the *management information system* (MIS, dedicated software), for example to show calculated consumption and times in a *job-specific VOC audit*.

Materials flow management • Cost flow calculations show that the materials and energy consumed in a printing plant account for a bigger proportion of costs than labour. In addition to waste-reducing technologies which can only be acquired through capital investment, it is necessary to exploit any potential for further savings. This includes a better utilisation of paper formats, a reduction in trim waste and the avoidance of all types of waste in general, for example through improved facility management and building automation in both production and administration. This is because the much-cited “dripping tap” often takes the form of faulty, inefficient or non-existent air-conditioning, an absence of heat recovery systems, and decentralised or leaky compressed-air supply systems. Plants with their own delivery department often waste time and money through inefficient route planning.

Environmental purchasing • This tool extends environmental management to materials procurement. For printing plants, this means buying renewable resources in the form of vegetable-based paper, inks and washes.

Emissions trading • The papermaking and printing industries are major emitters of greenhouse

gases, which politicians tend to equate with the biggest emission, CO₂. So proof of an independent carbon audit – in addition to an eco-audit – can be an effective marketing tool when bidding for contracts.

Materials flow management software can be used to carry out this audit and thus quantify a company’s carbon footprint, which along with labour and transport includes the consumption of natural resources, consumables and additives. Emissions from one location can be neutralised by a corresponding reduction in emissions from another anywhere else in the world. The system is co-ordinated via emission trading permits issued under officially recognised international climate protection schemes. Critics describe the certificates issued as “letters of indulgence for a clear conscience”, supporters argue that in the case of a global phenomenon it is immaterial where protective action is taken, the main thing is that it is financed.

The cost of these emission trading certificates is usually passed on to consumers, but should, in principle, have a negligible impact on the price of printed products. In return customers can advertise the fact that print production was carbon-neutral,

and have a certificate issued by the printing plant to prove it. Environmentally conscious customers can thus extend their commitment to embrace print buying, and this may play a major role in their future choice of print provider.

Low-emission technologies • But for the environment it is best to avoid emissions in the first place, by using alcohol substitutes, waterless offset or other low-VOC technologies, eco-accredited presses and direct drives such as KBA’s DriveTronic system, which are not only oil-free but also reduce waste.

Work safety and health protection • Conservation is a contribution towards a cleaner, safer work environment. It minimises the risk of occupational diseases and promotes a more positive work ethic among employees.

Opportunities

To sum up, these are the opportunities afforded by certified environmental management and materials flow scenarios.

- From the business perspective, detecting synergy potential while implementing an environmental management system is always worth the time and effort.

- All internal and inter-company processes are scrutinised and can be optimised.

- Resources and materials are utilised more efficiently. Waste reduction and prevention can lead to substantial cost savings.

- Life cycles and the timing of technology upgrades are examined more thoroughly.

- Environmental discipline is also staff discipline. Environmental controlling becomes a management tool.

- Print providers can differentiate themselves via their environmental programme, eco-accredited production, sustainable paper products, carbon-neutral printing etc, which can be an effective marketing tool.

- Print customers can burnish their own environmental credentials by specifying greener products, which influences their choice of print provider.

Dieter Kleeberg

Dresdener Ring 60
61130 Nidderau, Germany
Tel: (+49) (0) 6187 3153
E-mail: dieter.kleeberg@t-online.de

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Translated by
Christina Degens-Kupp

Koenig & Bauer Aktiengesellschaft Würzburg Facility

97010 Würzburg, Germany
Tel: (+49) 931 909-0
Fax: (+49) 931 909-4101
Web: www.kba-print.com
E-mail: kba-wuerzburg@kba-print.de

Frankenthal Facility

67225 Frankenthal, Germany
Tel: (+49) 6233 873-0
Fax: (+49) 6233 873-3222
Web: www.kba-print.com
E-mail: kba-frankenthal@kba-print.de

Radebeul Facility near Dresden

01439 Radebeul, Germany
Tel: (+49) 351 833-0
Fax: (+49) 351 833-1001
Web: www.kba-print.com
E-mail: office@kba-print.de

KBA-Metronic AG

Benzstrasse 11
97209 Veitshöchheim, Germany
Tel: (+49) 931 9085-0
Fax: (+49) 931 9085-100
Web: www.kba-metronic.com
E-mail: info@kba-metronic.com

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UK	British Printing Industries Federation	www.bpif.org.uk
USA	GATE, PIA, TAGA	www.gain.net
USA	FFTA	www.flexography.org
USA	Gravure Association of America	www.gaa.org
USA	Printers' National Environmental Assistance Center	www.pneac.org
USA	U.S. Environmental Protection Agency	www.epa.gov
EC	European Commission, Environment	ec.europa.eu/environment/index_en.htm
EC	Environmental Technologies Action Plan (ETAP)	ec.europa.eu/environment/etap/index_en.htm
Europe	European Flexographic Technical Association	www.efta.co.uk
Europe	European Rotogravure Association	www.era.eu
Worldwide	INCA-FIEJ Research Association	www.ifra.com
Worldwide	Intergraf	www.intergraf.org
Worldwide	PIRA International	www.pira.co.uk
Worldwide	TAPPI	www.tappi.org
Worldwide	Waterless Printing Association	www.waterless.org

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