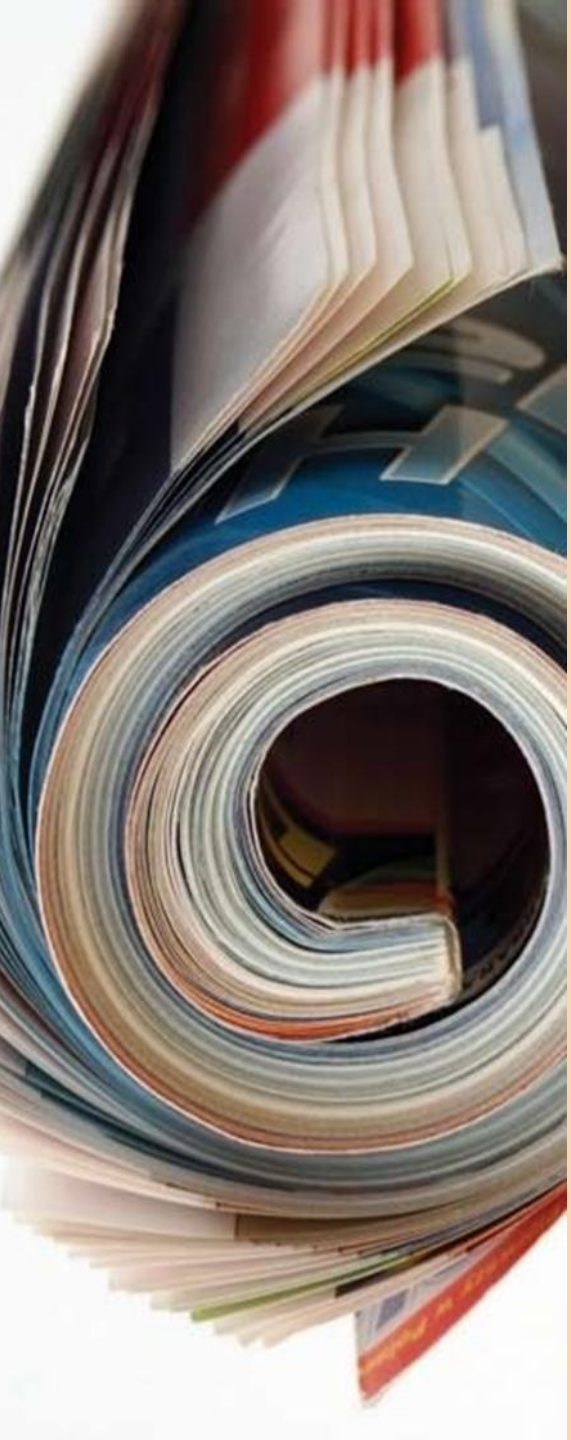

Pulp and Paper Industry

REGULATORY OVERVIEW

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Fact file…

- Paper manufacturing is a highly capital, energy and water intensive industry.
- In India, around 905.8 million m^3 of water is consumed and around 695.7 million m^3 of wastewater is discharged annually by this sector.
- The global best specific water consumption is 28.66 m^3/tonne for large scale wood based pulp and paper mill far better than India's average fresh water consumption in pulp and paper sector, which is ~60-70 m^3/tonne of product.

Major categories of the paper mills in India

- -- The major categories of the mills for which norms have been set up are
- - Wood based mills producing
  - - Bleached varieties
  - - Unbleached varieties
  - - Newsprint
  - - Rayon grade pulp
- - Agricultural residue based mill producing
  - - Bleached varieties with & without recovery system
  - - Unbleached varieties without recovery system
- - Recycled fiber and Market Pulp based mills producing
  - - Writing & Printing varieties with & without deinking
  - - Newsprint with & without deinking
  - - Unbleached Kraft
  - - Board

REGULATORY PROVISIONS

- 'Environment' is defined as the sum total of water, air and land and the inter relationships which exists among and between water, air and land, and human beings, other living creatures, plants, micro-organisms and property.
- Any solid, liquid or gaseous substance present in such concentration as may be or tend to be injurious to environment is called an environmental pollutant [EP, Act, 1986]
- India, being a signatory to the United Nations Conference on the human Environment held in Stockholm in 1972 and other subsequent Conferences aimed at arresting the degradation of environment and conserving it, is committed to take appropriate and adequate steps for the preservation of natural resources of the earth and for the protection and improvement of human environment.

- Among the seventeen most polluting industries identified by Ministry of Environment & Forests (MoEF), **paper industry is one amongst them**.
- In order to conserve and maintain the environmental quality, the Govt. of India, (Ministry of Environmental & Forests and Central Pollution Control Board) have formulated and notified discharge quality standards for wastewater and waste gases and also the total quantity permitted to be discharged depending upon, the raw materials used, the technology adopted and the year of establishment of the industry. For the **paper and pulp mills, the minimal national standards (MINAS) for wastewater and waste gases are given**.

Sr. No.	Industry	Parameter	Standards
1	2	3	4
14.	**SMALL PULP AND PAPER INDUSTRY**		Concentration not be exceed mg/l (except for pH and sodium absorption ratio)
	*Discharge into inland surface water	pH	5.5 – 9.0
		Suspended Solids	100
		BOD	30
	Disposal on land	pH	5.5 – 9.0
		Suspended Solids	100
		BOD	100
		Sodium Absorption Ratio	26
		[1][Absorbable Organic Halogens (AOX) in effluent discharge	3.00 kg/ton of paper produced with effect from the date of publication of this notification. 2.00 kg/ton of paper produced with effect from the 1st day of March, 2006.

Explanation.- These standards shall apply to all small scale Pulp and Paper Mills having capacity below 24,000 MT per annum]

53.	**LARGE PULP & PAPER NEWS PRINT/ RAYON GRADE PLANTS OF [1][CAPACITY ABOVE 24000 MT PER ANNUM]**	**EFFLUENTS**	Concentration in mg/l except pH and TOCL
		pH	7.0 – 8.5
		BOD[2][3 days at 27°C]	30
		COD	350
		Suspended Solids	500
		[3][Absorbable Organic Halogens (AOX) in effluent discharge	1.5 kg/ton of product with effect from the date of publication of this notification.1.0 kg/ton of product with effect from the 1st day of March,2008.]

29.	**LARGE PULP AND PAPER**	**EMISSIONS**	Concentration in mg/m^3 (normal)
		Particulate matter	250**
		H_2S	10

WASTE WATER GENERATION STANDARDS - PART-B

Pulp & Paper Industries		
(a)	Larger pulp & paper	
	(i) Pulp & Paper	175 m^3/tonne of paper produced
	(ii)Viscose Staple Fibre	150 m^3/tonne of product
	(iii)Viscose Filament Yarn	500 m^3/tonne of product
(b)	Small Pulp & Paper :	
	(i) Agro residue based	150 m^3/tonne of paper produced
	(ii) Waste paper based	50 m^3/tonne of paper produced

Typical Emissions from Pulp & Paper Industry

Water Pollution

The set of indicators measure pollutants released to a paper mill's receiving waters—typically, rivers or streams. The resulting environmental impact depends on local factors such as the volume and composition of pollutants released, and the volume and flow of the receiving waters. These indicators are

- **Effluent Flow**
- **Biochemical Oxygen Demand (BOD)**
- **Chemical Oxygen demand (COD)**
- **Color**
- **Total suspended solids (TSS)**
- **Dioxins and dioxin-like compounds**
- **AOX**
- **EOX**

Source Points of liquid Effluent

Fundamental process	Effluent generated	Pollution load
Raw Material preparation	Barker bearing cooling water	TSS
Pulping	Spent liquor, Leakages from pipelines, pump glands and over flows of storage chests, blow pit spill over, black liquor from small agricultural residue based mills without chemical recovery	High BOD, COD, Color, TDS, TSS and Toxicity
Screening	Weak liquor	Low BOD, COD, TSS
Washing & Cleaning	Wash water	Low BOD, COD, color and even toxicity, Low level of metal ions, Fiber fines which pass through filter cloth in washing units, Sand and clay particularly in bamboo and straws, Fiber fines

Fundamental process	Effluent generated	Pollution load
Bleaching	Bleach plant wash water	High BOD, COD, Dioxins(formed in C stage and removed from the pulp in E-stage filtrate),Toxicity, even mutagenic and carcinogenic character, Most of effluent color , About 65% of total color from bleaching section of hard wood based mill, About 95% of total color from bleaching section of soft wood based mill, Entire AOX from bleaching section
Stock preparation	Clean up wastewater	Low BOD, COD, color
Paper machine	White water	Fiber fines and filler particles from waste water from paper machine area, BOD, COD from paper additives and color from dyes present in paper machine wastewater, Metal ion impurities in chemicals and additives and corrosion products, Slimicides and biocides used for slime control
Finishing	Cleanup wastewater	Low BOD, COD, color

Characteristics of waste water from different sections of paper mills

Parameter	Chipper house	Digester House	Pulp washing	Pulp Bleaching	Paper Machine	Chemical Recovery
Volume (m^3/t paper)	20-60	5-10	20-40	140-180	40-90	-
Color	Muddy	Dark brown	Dark brown	Brown	Whitish	Light brown
pH	6.4-8.0	9.0-10.0	8.5-9.6	6.0-9.6	5.3-8.1	7.0-9.0
Total solids (mg/l)	540-900	1000-2500	1400-2500	2100-2700	850-1250	1270-2800
Suspended solids (mg/l)	240-520	140-190	350-1000	140-220	490-900	400-760
BOD (mg/l)	30-50	300-360	230-480	125-155	100-160	90-180
COD (mg/l)	175-450	1850-2200	900-1700	550-700	520-780	320-610

Pollution loads from combined Waste waters in Indian Paper Mills

Parameter	Large paper mills	Small paper mills based on	
		Agro-residue	Wastepaper
Flow, m^3/t paper	100-200	150-200	50–100
pH	6-9	6 – 8.5	6 - 8.5
Suspended solids, kg/t	100-150	90-240	50 -80
BOD kg/t	35 - 50	85- 370	10 - 40
COD, kg/t	150	500 - 1100	50 - 90

Air Pollution

- For gaseous emissions, the particulate matter and hydrogen sulfide are the most important parameters. Since some pulp and paper mills use lime-kilns and all the mills operate boilers for steam generation for meeting their process heat and power requirements, they burn coal/fuel & furnace oil/agricultural wastes or a combination of them (i.e. multifuel boilers), and emit SO_2, PM, HC and CO into the atmosphere.
- Integrated mills emit fine particulates, which escape their electrostatic precipitators via their recovery furnace stacks and boiler stacks.
- Respirable particulate fraction has two sub categories-

  (i) Coarse particulate fraction (size 10 <dp <2.5 micrometer) and (ii) fine particulate fraction (dp < 2.5 micrometer).
- Since the emission standards are to be accepted only when the ambient air standards are met, a very heavy responsibility rests with the occupiers of paper mills to meet the fines standards

Air Pollution

Greenhouse gas emissions

The pulp and paper industry is the fourth largest emitter of greenhouse gases among manufacturing industries, and contributes 9 percent of total manufacturing carbon dioxide emissions (U.S. Energy Information Administration 2002; Martin et al.).

Nitrogen oxides

Nitrogen oxides (NOx, which include NO and NO_2) are products of the combustion of fuels in boilers.

Volatile organic compounds

Volatile organic compounds (VOCs) are a broad class of organic compounds that are gases at room temperature, such as vapors from solvents. VOCs react with nitrogen oxides (NOx) to form ground-level ozone, the major component of smog and a severe lung irritant. The pulp and paper industry is the fourth highest contributor of VOC emissions to the atmosphere by industry sector (U.S. EPA 2002).

Total reduced sulfur

Total reduced sulfur compounds cause the distinct odor associated with kraft pulp mills.

Air Emissions from the Pulp and Paper Industry

Pollutant	Effects	Source
Carbon dioxide	greenhouse gas	fuel combustion
Hydrogen sulphide	rotten egg smell	Kraft process
Sulphur dioxide	acid rain	fuel combustion and pulping process. (Kraft 1-3 kg SO_2/tonne) , sulphite 5kg SO_2/tonne)
Volatile organics	some toxic effects and precursors to the formation of ozone	various
Chloroform	toxic, possible carcinogen	chlorine bleaching
Other organo-chlorines	some highly toxic	chlorine bleaching

Main emission of reduced sulphur compounds from sulphate pulping

Emission source	Emission rate kg S/t_{90}			
	H_2S	CH_3SH	CH_3SCH	CH_3SSCH_3
Digester batch	0-0.15	0-1.3	0.05-3.3	0.05-2.0
Digester continuous	0-0.1	0.5-1.0	0.05-0.5	0.05-0.4
Evaporation (indirect)	0-0.	0.05-1.0	0.1-1.0	0.1-0.8
Recovery furnace (with direct contact evaporation)	0.05-1.5	0.05-0.8	0.05-1.0	0.05-1.0
Smelt dissolving tank	0-25	0-2	0-1	0-0.3
Lime kiln	0-1	0.01	0.01	0.01
Settling basin	0-0.5	0-0.2	0.01	0-0.02

Absolute odor threshold values for reduced sulphur compounds from kraft pulping

Compound	Odour threshold (ppb)
Hydrogen sulphide H_2S	0.2-4.7
Methyl mercaptan CH_3SH	0.8-2.1
Dimethyl sulphide CH_3SCH	1.0-3.9
Dimethyl disulphide CH_3SSCH_3	5.6

Solid waste generated in large paper mills

Section	Large paper mills	Small paper mills
Raw material handling/preparation	45 kg/t paper	210 (straws) 550 (bagasse)
Hypo preparation (Grit)	20 kg/t	
Recausticising lime mud	593 kg/t	
Power plant/Boiler ash	656 kg/t	1300
Primary sludge	84 kg/t	116
Secondary sludge	16 kg/t	105
Total	1507 kg/t	1731 (2071)

Environmental concerns…

Some of the current environmental issues faced by Indian paper industry and being addressed under corporate responsibility for environmental protection (CREP) are given below:

- Minimization and elimination of color and AOX in the effluent through innovative non-chlorine bleaching practices.
- The management and disposal of lime sludge from chemical recovery.
- Minimization of fresh water consumption.
- Minimization of emission of odor.
- Maximization of energy efficiency.
- Enhancement in the waste paper recycling as a raw material.
- Establishment of chemical recovery unit in agro-based raw materials from pulp and paper industry.

Charter on CREP in Pulp & Paper Industry

Large Pulp and Paper	Implementation Schedule
Discharge of AOX kg/tonne of paper	AOX 1.5 kg/tonne of paper within 2 years AOX 1.0 kg / tonne of paper in 5 years
Installation of lime kiln	Within 4 years
Wastewater discharge cum / tonne of paper	Less than 140 cum/tonne of paper within 2 years Less than 120 cum / tonne in 4years for units installed before 1992 Less than 100 m^3 / tonne of paper per units installed after 1992.
Odour control by burning the reduced sulfur emissions in the boiler/lime-kiln	Installation of odour control system within 4 years.
Utilization of treated effluent for irrigation	Utilization of treated effluent for irrigation wherever possible
Colour removal from the effluent	Indian Paper Manufacturers Association to take up project with Central Pulp & Paper Research Institute

Small Pulp and Paper	Implementation Schedule
Compliance of standard of BOD, COD & AOX	Recovery of chemicals by installation of Chemical recovery plant or utilization of black liquor with no discharge from pulp mill within 3 years **OR** Shift to waste paper
Upgradation of ETPs so as to meet discharge standards	ETPs to be upgraded within 1 year so as to meet discharge standards.
Waste water discharge/ tonne of paper	Less than 150 cum/tonne of paper within 3 years
Utilization of treated effluent for irrigation	Utilization of treated effluent for irrigation wherever possible
Colour removal from the effluent	Indian Agro and Recycled Paper Manufacturers Association to take up project with CPPRI.
Note: Non-complying units not meeting notified standards under Environment (Protection) Act, 1986 will submit action plan with PERT Chart along with bank guarantee to SPCBs by June 30, 2003.	

ENVIRONMENTAL ISSUES IN PULP AND PAPER INDUSTRY

- Discharge and emission norms for pulp and paper industry has been formulated in early nineties based on the technological and environmental scenario existing then.
- Over these years large scale pulp and paper mills have undergone significant increase in scale of operation as well as change in technological level and environmental status.
- New issues related to Water & Energy Conservation, Control of Absorbable Organic Halides (AOX), Color of Effluents, Non Condensable Gases, Solid Wastes and Product
- Moreover developments like Kyoto Protocol & WTO entry have put further pressure on achievement of environmental protection norms matching global standards.

Some pollution prevention advances that have been implemented within the pulp and paper industry world wide:

- **Chemical recovery systems**
- **Prevention of chlorinated compounds**
- **Secondary fiber substitution**
- **Extended Delignification**
- **Oxygen Delignification**
- **Ozone Delignification**
- **Anthraquinone Catalysis**
- **Black Liquor Spill Control and Prevention**
- **Enzyme Treatment of Pulp**
- **Improved Brownstock and Bleaching Stage Washing**
- **Improved Chemical Controls and Mixing**

The Ecomark Criteria for Paper:

ECOMARK CRITERIA FOR PAPER

(The Gazette of India, Extraordinary, Part II-Section 3(i), No. 455, Nov. 13, 1992)

GENERAL REQUIREMENTS :

- All the paper manufacturers shall meet relevant Indian Standards of Bureau of Indian Standards (BIS) pertaining to quality and performance.
- The product manufacturers must produce the consent clearance as per the provisions of Water (Prevention and Control of Pollution) Act, 1974 and Air (Prevention and Control of Pollution) Act, 1981, respectively along with the authorisation, if required, under Environment (Protection) Act, 1986 and rules made thereunder to BIS while applying for ECOMARK.
- The product packaging may display in brief the criteria based on which the product has been labelled Environment Friendly.
- The material used for product packaging shall be made from recyclable, reusable or biodegradable material and the parameters evolved for the packaging shall also apply.

The Ecomark Criteria for Paper:

- Eco-labelling of a product is a means to improve the environment.

- This relies on the concept of "from cradle to grave'.

- The BIS, in 1992, has notified the requirements which shall be met by the paper manufacturers while applying for ECOMARK on their products.

- These requirements are product-specific.

- The paper and paper boards manufactured out of pulp containing not less than 60 percent by weight of pulp made from materials other than bamboo, hardwoods, softwoods and Reeds.

- Recycled paper and paper boards must be made from 100% waste paper. The hand made paper is 100% eco-friendly.

- Paper and paper boards used for packaging of food materials shall be manufactured from virgin pulp and shall be free from dioxins.
- Printed surfaces of the paper shall not come into contact with the food and the maximum amounts of contaminants in paper intended to come into contact with food shall not exceed the prescribed limits.

The following BIS standards have been amended incorporating the above Ecomark requirements

1.	IS 1396 : 1960	Blotting paper
2.	IS 1774 : 1986	Paper for permanent records (first revision)
3.	IS 1775 : 1981	Base paper for sensitised paper (first revision)
4.	IS 1848 : 1991	Writing and printing paper (third revision)
5.	IS 2483 : 1986	Ticket board (first revision)
6.	IS 2991 : 1988	Base paper for waxed paper

7.	IS 3064 : 1986	Hand made drawing paper (first revision)
8.	IS 3302 : 1986	Backing sheet for stencil (first revision)
9.	IS 3303 : 1986	Match paper (first revision)
10.	IS 3413 : 1977	Base paper for carbon paper (first revision)
11.	IS 3673 : 1986	Alkali resistant paper (first revision)
12.	IS 4658 : 1988	Coated paper and board (art and chromo) (first revision)
13.	IS 4664 : 1986	Pulp board (first revision)
14.	IS 6956 : 1973	Cover paper
15.	IS 8431 : 1986	Tracing paper (first revision)
16.	IS 8460 : 1977	Wrapping tissue paper
17.	IS 9032 : 1978	Diazo sensitised paper

18.	IS 9033 : 1978	Reproduction tracing paper
19.	IS10405 : 1982	Black centered board
20.	IS11087:1986	Paper for magnetic ink character recognition cheque printing (first revision)
21.	IS 11687 : 1986	Base paper for tracing paper
22.	IS 12765 : 1989	Map printing paper
23.	IS 12766 : 1989	Paper for computer use
24.	IS 12808 : 1989	Base paper for one time carbon paper
25.	IS 14480 : 1997	Plain copier paper-specification
26.	IS 14619 : 1998	Release Base Paper- Specification
27.	IS 14661 : 1999	Toilet paper - Specification


Thank you!