

**REPORT  
ON  
ECOLOGICAL & ENVIRONMENTAL FACTORS  
IN PAPER INDUSTRY**

**VOLUME-IV**

**NATIONAL AND INTERNATIONAL REGULATORY  
STANDARDS FOR WATER & AIR QUALITY  
MONITORING**

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**PREPARED**

**FOR**

**INDIAN PAPER MANUFACTURER'S ASSOCIATION**

**BY**

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## **VOLUME-IV**

### **NATIONAL & INTERNATIONAL REGULATORY STANDARDS FOR WATER & AIR QUALITY MONITORING**

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## **REGULATORY STANDARDS FOR WATER & AIR IN INDIAN PULP & PAPER INDUSTRY & COMPARATIVE REVIEW OF STANDARDS WITH OTHER COUNTRIES**

### **I. Introduction:**

The quantity and the quality of pollutants released in air, water and soil from different units varies considerably and are dependent on size of the plants, complexity and quality of the products, raw materials and process technology used, age of the plants, general maintenance and house keeping standards in the factory.

During recent years, sustaining and assimilating capacity of the biosphere has started showing signs of stress primarily because of the **impact of human on environment and warrants for optimum utilisation of resources and minimisation of adverse impact on the environment**. Sound environmental management has become major issue during recent years for survival of mankind and sustainable development. India is the first country which has made provision for the protection and improvement of environment in its constitution. Environmental impact assessment (EIA) which identifies and predicts the impact on various environmental components and has been a significant development in environmental management during recent years.

EIA has been made mandatory for getting the environmental clearance for the new projects listed in Schedule I of EIA notification of 1994 issued by Ministry of Environment and Forest, Govt. of India, expansion and modernisation of any activity, if pollution load is to increase in existing one or new projects encompassing all developmental infrastructural and chemical projects.

Some of the environmental implications of pulp and paper mill manufacture activities are

- large scale deforestation.-Use of huge natural resources like water coal, lime stone etc
- discharge of colored and toxic pollutants in water stream,- emission of malodorous sulfur compounds,- discharge of huge quantity of solid wastes like lime sludge, fly ash and bottom ash, chipper house dust, forest residues, screening and cyclone rejects; & noise pollution.

The various aspects of EIA, Environmental Protection Acts, Environmental apprehensions due to pulp and paper manufacture and their impact on environmental components, scope of EIA for pulp and paper plants and environmental management plan for sustainable development are discussed.

**II. ENVIRONMENTAL PROTECTION ACTS, RULES AND STANDARDS IN INDIA:**

In response to United Nations Conference held at Stockholm in June, 1972 for the preservation of natural resources of earth and protection and improvement of human environment, several acts, rules, regulations, conventions, practices and standards has been enforced in India. Table-1 show the EP acts, rules various amendments and now it is constitutional obligation of all the citizen of India to protect and improve natural environment including forest, lakes, rivers and wild life and to have compassion for living creatures. Some of these rules includes Water (Prevention and Control of pollution) Act 1974. Air (Prevention and Control of Pollution) Act 1981. Environmental (Protection) Act, 1986 and various amendments. Emission and effluent standards prescribed for pulp and paper industry and caustic chlorine plant which is integral part of many large units is given in following tables. The Central Pollution Board has also set ambient air quality standards which must be met by the industries.

**TABLE-1****ENVIRONMENTAL PROTECTION ACTS, RULES AND VARIOUS AMENDMENTS**

The Water (Prevention and Control Of Pollution) Act, 1974 and its Amendment Up To 1988.  
The Water (Prevention and Control Of Pollution) Rules, 1975  
The Water (Prevention and Control Of Pollution) (Procedures For Transaction Of Business) Rules, 1975  
The Water (Prevention and Control Of Pollution) Cess Act, 1977 As Amended By Amendment Act, 1991.  
The Water (Prevention and Control Of Pollution) Cess Act 1977 As Amended By Amendment Act, 1991.  
The Water (Prevention and Control Of Pollution) Rule, 1978  
The Air (Prevention and Control Of Pollution) Act, 1981, As Amended By Amendment Act, 1987.  
The Air (Prevention and Control Of Pollution) (Union Territories) Rules, 1983.  
The Air (Protection ) Act, 1986.  
The Environmental Protection Rules, 1986.  
Environmental Impact Assessment Of Development Projects  
Hazardous Wastes (Management And Handling) Rules, 1989.  
Manufacture storage And import Of Hazardous Chemical Rules, 1989.  
Manufacture, Use, Import, Export And Storage Of Hazardous Chemical Rules, 1989.  
Manufacture, Use, Import, Export And Storage Of Hazardous Micro-Organism Genetically Engineered Organisms Or Cells Rules, 1989.  
Scheme Of Labelling Of Environment Friendly Products (ECO-MARKS)  
The Public Liability Insurance Act, 1991.  
The public liability insurance Rules, 1991.

**1. Liquid Discharge Standards:**

Standards for liquid discharges are based on how the discharges are disposed. There are however separate standards promulgated by Central Pollution Control Board for discharge of liquid effluents. There are separate standards for disposal on land, inland surface water, marine coastal land and public sewers. Table-2 represents the standards for liquid effluent discharge in pulp and paper mills.

In order to encourage water conservation, a water (prevention and Control of Pollution) Cess Act 1977 is passed and a cess is levied on industries based on quantity water consumed. This act has been revised in December 1991 and is brought into force in January, 1991.

**TABLE-2**  
**LIQUID EFFLUENTS DISCHARGE STANDARDS**  
**IN PULP AND PAPER MILLS**

Parameter	Large Mills Above 24000 T/year	Small Mills Upto 24000 T/Year	
		Agro based	Waste Paper based
Volume, m <sup>3</sup> /T	175 pulp & paper mills (150 rayon grade/ news print)	200 (150)	75 (50)
pH	7.0 - 8.5	5.5-9.0	5.5-9.0
BOD <sub>5</sub> at 20°C mg/l	30	30	30
COD mg/l	350	---	---
SS mg/l	50	100	50
TOC paper *kg/T	2	---	---

Figures in bracket are for new mills set up after 1992

\* From January 1992

Some of the mills particularly in small sectors, after primary and secondary clarifications have been claiming the use of treated effluents for and some mills have arrangements with academic institutions to study the quality of sub soil after use of treated effluents over a period of time. The principle behind the use of effluents for irrigational purposes is:

- Use of soil as a treatment system
- Supplementary source for irrigation.
- Lowering of effluent treatment cost.

However, the effluent from agro based mills in particular, carries significant amounts of sodium. Although on a short term basis, the use of effluents for irrigation purpose may prove beneficial, but the salinity and SAR of the soil over a period of time needs to be critically evaluated. Number of guidelines and specifications are available to decide whether a particular effluent can be used for irrigation or not. Table-3 shows the standard limits for industrial effluent to various recipient streams.

**TABLE-3**

**STANDARD DISCHARGE LIMITS FOR INDUSTRIAL EFFLUENTS\***

Particulars	In to Inland surface water	On Land	Marine Coastal Area	Public Sewer
PH	5.5 – 9.0	5.5 – 9.0	5.5 – 9.0	5.5 – 9.0
BOD 20°C, mg/l	30	100	100	350
COD, mg/l	250	-	250	-
Suspended solids, mg/l	100	200	100	600
% Sodium	-	60	-	60

\* BIS : 2490 (Part I).

Table – 4 shows the limits for effluent for irrigation discharge.

**TABLE-4**

**STANDARD LIMITS OF FINAL EFFLUENTS FOR IRRIGATION PURPOSES\***

BOD load	225 kg/hectare/d
pH value	6.5 – 9.0
Sodium Absorption Ratio	8 on permeable soils
Color	Investigation required
Land requirement	4.3 – 5.3 hectares / 1000 m <sup>3</sup> effluent/d

\* BIS : 5061 (Part – I) 1978.

**TABLE –5**

**STANDARDS FOR CAUSTIC CHLORINE PLANT**

Parameter	Concentration
pH	5.5-9.0
Mercury in the final Effluent, mg l <sup>-1</sup>	0.01
Mercury bearing waste water generation	10 kilo lit/Tonne of caustic produced
<b>EPA Emission Standards</b>	<b>Maximum permissible limit</b>
Mercury from hydrogen gas holder	0.2 mg/Nm <sup>3</sup>
Chlorine from Hypo tower	15 mg/Nm <sup>3</sup>
HCl vapour and mist from HCl Plant	35 mg/Nm <sup>3</sup>

**2. Air Emissions:**

The standards for emission from stacks for air polluting standards from heavy & moderate polluting industries are shown in Table-6 & 7 and further there are specific standards for emission from large pulp & paper mills Table –8 and lime kilns Table – 9.

**TABLE-6**

**HEAVY POLLUTING INDUSTRIES STACK EMISSIONS  
(Permissible Concentrations)**

Parameter	Industrial area	Residential/ Rural area	Sensitive area
SPM mg/m <sup>3</sup>	500	200	100
Dust metal mg/m <sup>3</sup> (Fe, Zn, Cu etc.)	50	30	15
SO <sub>3</sub> H <sub>2</sub> SO <sub>4</sub> mist mg/m <sup>3</sup>	100	50	20
SO <sub>2</sub> ppm	500	200	100
CO ppm	100	50	30
HC ppm	50	30	15
NH <sub>3</sub> ppm	100	50	20
F ppm	50	30	15
Mercaptan	10	10	10



**TABLE-7**

**MODERATE POLLUTING INDUSTRIES STACK EMISSION  
(Permissible Concentration)**

Parameter	Industrial area	Residential/ Rural area	Sensitive area
SPM, mg/m <sup>3</sup>	2000	1000	500
Iron Dust, mg/m <sup>3</sup>	1000	500	250
SO <sub>2</sub> , ppm	5000	2000	1000

**TABLE – 8**

**EMISSIONS FROM LARGE PULP AND PAPER MILLS**

Particulate matter	250 mg/Nm <sup>3</sup> *
H <sub>2</sub> S	10 mg/Nm <sup>3</sup>

**TABLE – 9**

**EMISSIONS FROM LIME KILNS**

Capacity of Kiln	Parameter	Standard
Upto 5 t/day	Particulate matter	A hood should be provided with a stack of 30 m height from ground level (including Kiln height)
5-40/day	Particulate matter	500 mg/Nm <sup>3</sup>
Over 40 t/day	Particulate matter	150 mg/Nm <sup>3</sup>

**TABLE – 10**

**NATIONAL AMBIENT AIR QUALITY STANDARDS**

<b>POLLUTION</b>	<b>Time Weighted average</b>	<b>Concentration in ambient air</b>		
		<b>Industrial area</b>	<b>Residential, rural &amp; mixed use area</b>	<b>Sensitive area</b>
<b>Sulphur dioxide (SO<sub>2</sub>)</b>	Annual Average*	80	60	15
	24 hours	120	80	30
<b>Oxides of Nitrogen (as NO<sub>2</sub>)</b>	Annual Average*	80	60	15
	24 Hours	120	80	30
<b>Suspended particulate matter</b>	Annual Average*	360	140	70
	24 Hours	500	200	100
<b>Lead (Pb)</b>	Annual Average*	1.0	0.75	0.50
	24 Hours	1.5	1.00	0.75
<b>Carbon Monoxide (CO)</b>	8 Hours**	5.0	2.0	1.00
	1 Hour	10.5	4.0	2.00

Ambient air noise standard is also prescribed and given in table 11.

**TABLE – 11**

**NOISE STANDARDS**

Area Code	Category of area	Limits in dB (A) Leg	
		Day time	Night time
A.	Industrial Area	75	70
B.	Commercial Area	65	55
C.	Residential Area	55	45
D.	Silence Zone	50	40

Inserted as Schedule – III to the Environment (Protection) Rules, 1986 vide Notification No. GSR 1063 (E) dated 26.12.1989 in the Gazette of India.

Exposure Time Hrs/day	Limit dB(A) Leg
8	90
4	93
2	96
1	99
½	102
¼	105
1/8	108
1/16	111
1/32 (2 min. or less)	114

### III. ENVIRONMENTAL PROTECTION ACTS & REGULATORY NORMS PRACTICED IN DEVELOPED COUNTRIES FOR EFFLUENT & AIR EMISSIONS.

United States Environmental Protection Agency (US-EPA) has laid daily & monthly average standards for BOD<sub>5</sub>, COD, TSS, Color, AOX and TCDD, TCDF & CHCl<sub>3</sub> – since, the pulp & paper industry is thought to have a big impact on the Environment. Therefore, some of the new environmental regulations have been notified during the last few years. Tables-12 shows the current environmental legislation's in pulp & paper industry for European countries, USA & Australia and China.

**TABLE-12**

#### DISCHARGE STANDARDS FOR ALL MILLS IN CHINA

Pulp	Discharge vol. (m <sup>3</sup> /t)	Class I			Class II			Class		
		BOD mg/l	COD mg/l	S.S. Mg/l	BOD mg/l	COD mg/l	S.S. Mg/l	BOD mg/l	COD mg/l	S.S. Mg/l
Unbleached wood	150	30	100	70	100	350	200	500	800	400
Bleached wood	240	30	100	70	120	350	200	500	800	400
Unbleached non-wood	190	30	100	70	150	450	200	600	900	400
Bleached non-wood	290	30	100	70	150	450	200	600	900	400
Paper & Board	60	30	100	70	60	150	100	400	500	400

Source: Paper maker Vol. 8 No. I (Jan) 1998.

1. Class I is for water used for water supplies, fishing area & other scenic areas.
2. Class II is for rivers etc. that supply water for agriculture, and for parts & exploration areas
3. Class III is for discharge areas that proceed to further treatment by authorities.

The International discharge standards are given in Table 13a. Besides, the regulations for discharge of chlorinated organic compounds measured as AOX (kg/tonne pulp) from bleaching of chemical pulps for different countries is given in Table 13b.

**TABLE-13A**

**INTERNATIONAL DISCHARGE STANDARDS**

Countries	Kg/Adt			
	BOD <sub>5</sub>	COD	TSS	AOX
Canada	5.5-30	-	9.5-14.5	None
U.S.A.	5.5-8.0	-	9.5-16.4	-
USA EPA proposed	1.7-2.7	30-45	-	0.2-0
Finland	6.8-34	65	5-15	-
Norway		90	5	
Sweden	7.5-17	30-107	0.3-5.8	-
Australia	2	70	2	
Belgium	2.3-5.4	22-63	7-14.4	
Germany	n.a	n.a	n.a.	
France	3.3-30	48-95	6.5-10	
Indonesia*	8.5	29.75	8.5	1.5
India, mg/l	30	350	50	2kg/tp

\* Effective as of year 2000

**TABLE-13B**

**THE REGULATIONS FOR DISCHARGE OF CHLORINATED ORGANIC COMPOUNDS FOR DIFFERENT COUNTRIES**

Country	1994	1995-2000	2000-2005
Australia	1.0 <sup>(1)</sup>		
Austria	0.75-1.5	0.5-1.0	
Belgium	1.5		
Canada			
Alberta	0.29 (1)/1.5		
British Columbia	1.5	0	0
Ontario		1.5	0.8
Quebec <sup>(2)</sup>	1.5(H.W.)	1.0-2.0	
Finland <sup>(2)</sup>		1.0-2.0	
Germany <sup>(2)</sup>	1.0		
India		2.0	
Japan <sup>(3)</sup>	1.5		
Norway <sup>(2)</sup>	1.0-2.0		
Sweden	1.2-1.5	0.3-1.0	0.3-0.5
USA <sup>(4)</sup>		0.156	

- (1) Limits for new mills- Lower limits for hardwood pulps  
 (2) Guidelines of Japan Pulp, Paper and Paperboard Association  
 (3) Proposed regulation of "Cluster Rules" by EPA  
 All figures in Kg/t of pulp.

#### **IV. THE CLUSTER RULE:**

**The U.S. Environmental Protection Agency's cluster rule** controls both effluent discharges and air emissions from pulp, paper, and paper board sources. Phase I of the Cluster Rule was scheduled for publication in the Federal Register in January 1998. The details of **Phase I of the Cluster Rule** includes new effluent limitations guidelines and standards for **two subcategories of pulp mills: bleached paper-grade kraft and soda mills, and paper-grade sulfite mills**. The Phase I directives regarding the new national emission standards for hazardous air pollutants (**HAP**) at all chemical pulping and bleaching facilities in the country is also review. Phase II and III, which will specify effluent limitations for other subcategories, are to follow in the next year or two.

##### **1. Effluent Limitations Guidelines:**

Key features for the "Water side" of the regulations include:

- Implementation through the **National Pollutant Discharge Elimination System (NPDES)** for state permitting, with a minimum three-year compliance time frame from the date of publication of the regulation in the Federal Register
- Bleach-plant effluent limitations for dioxin, furan, chlorinated phenolics, and chloroform
- Final effluent limitations for **AOX (adsorbable organic halide)**
- **BMP (best management practices)** implementation for control of spills of spent pulping liquor, turpentine, and soap
- A voluntary advanced-technology incentives program as an alternative approach to meeting the regulation, resulting in greater permitting flexibility
- Postponement of regulation of COD (chemical oxygen demand) until implementation of Phase II
- No changes to existing limitations of BOD<sub>5</sub> (five-day) biochemical oxygen demand) or TSS (total suspended solids)
- No limitations on color, acetone, methylene chloride, or methyl ethyl ketone.

##### **Bleached Paper-grade Kraft and Soda:**

In the **BPK (bleached paper-grade kraft and soda)** subcategory, the EPA considered two options for regulating toxic and nonconventional pollutants from existing mills through **BAT (best available technology economically achievable)**

Option A was selected as the basis for regulation of existing sources. Option A is based on the following:

- ☆ Adequate control of chip thickness
- ☆ Closed screening
- ☆ Use of dioxin-and furan-precursor-free defoamers

- ☆ Effective brownstock washing, with a target of less than 10 Kg Na<sub>2</sub>SO<sub>4</sub> carryover to bleaching per air-dry (a.d.) metric ton of pulp
- ☆ Elimination of hypochlorite
- ☆ 100% ClO<sub>2</sub> substitution.
- ☆ Oxygen-and peroxide-enhanced extraction
- ☆ Strategies for minimizing kappa factor and dioxin and furan precursors in brown stock pulp
- ☆ High-shear mixing during bleaching
- ☆ Efficient biological wastewater treatment.

**TABLE-14**

**BAT LIMITATIONS FOR EXISTING BLEACHED PAPER-GRADE KRAFT AND SODA MILLS**

PARAMETER	DAILY MAXIMUM	MONTHLY AVERAGE
2,3,7,8-TCDD, Pg/L	<ML*	n.a.
2,3,7,8-TCDD, Pg/L	31.9	n.a.
Chlorinated phenolics, ph/L <sup>c</sup>	<ML	n.a.
Chloroform, g/KKg <sup>d</sup>	6.92	4.14
COD, Kg/kkg	Reserved	Reserved
AOX, kg/kkg	0.951	0.623
A ML (minimum level) = the level at which the analytical system gives recognizable signals and an acceptable calibration point b n.a. =Not applicable c Listed in Table H d kkg = 1 metric ton		

**TABLE-15**

**NEW-SOURCE PERFORMANCE STANDARS FOR BLEACHED PAPER-GRADE KRAFT AND SODA MILLS:**

PARAMETER	DAILY MAXIMUM	MONTHLY AVERAGE
2,3,7,8-TCDD, Pg/L	<ML*	n.a. <sup>b</sup>
2,3,7,8-TCDD, Pg/L	31.9	n.a.
Chlorinated phenolics, ph/L <sup>c</sup>	<ML	n.a.
Chloroform, g/KKg <sup>d</sup>	6.92	4.14
COD, Kg/kkg	Reserved	Reserved
AOX, kg/kkg	0.476	0.272
BOD <sub>5</sub> , KG/KKG	4.52	2.41
TSS, KG/KKG	8.47	3.86
Notations as in Table - 14		

Option B is based on the previous items plus a form of prebleaching extended delignification (oxygen delignification or extended cooking). New-source performance standards (NSPS) were developed based on option B.

Regulated chlorinated phenolics are listed in Table-16.

In "reserving" COD from limitation at this time, EPA has indicated its plan to promulgate COD final effluent limitations in phase II of the Cluster Rule. Phase III is to consist of effluent limitations for mills in the dissolving kraft and dissolving sulfite subcategories.

NSPS limitations are listed in Table III, including limitations for BOD<sub>5</sub> AND TSS. New sources for direct dischargers are defined as those starting construction 60 days or more after the regulations are published in the *Federal Register*. New sources for indirect dischargers are defined as those starting construction after December 17, 1993.

**TABLE-16**  
**REGULATED CHLORINATED PHENOLICS**

Trichlorosyringol	2.5
2,4,5-trichlorophenol	2.5
2,4,6- trichlorophenol	2.5
3,4,5- trichlorophenol	5.0
3,4,5- trichlorophenol	2.5
3,4,6- trichlorophenol	5.0
3,4,6- trichloroguaiacol	2.5
4,5,6- trichloroguaiacol	2.5
3,4,5,6-tetrachlorocatechol	5.0
3,4,5,6- tetrachloroguaiacol	5.0
2,3,4,6- tetrachlorophenol	2.5
Pentachlorophenol	5.0

For indirect dischargers, the bases for pretreatment standards for existing sources (PSES) and for pretreatment standards for new sources (PSNS) are equivalent to those for BAT and NSPS, respectively, with identical bleach-plant effluent limitations, but with a monthly AAOX limit of 1.41 kg/kkg (1kkg=1 metric tonne) and a daily limit of 2.64 kg/kkg prior to effluent treatment. Limitation for BOD<sub>5</sub> or TSS were not promulgated for indirect dischargers.

For noncontinuous dischargers (i.e., mills that hold their effluent from discharge for a portion of the year), an AOX limitation of 0.512 kg/kkg must be attained as an annual average.



## **ECOLOGICAL & ENVIRONMENTAL FACTORS IN PAPER INDUSTRY**

An alternative to meeting the requirements of BAT, mills in the BPK subcategory have the option of selecting one of two voluntary programs with separate requirements and permitting and monitoring incentives:

1. Voluntary adoption of TCF bleaching, with the requirement that AOX will be <ML kg/kg at the mill's final effluent or
2. Commitment to the voluntary advanced-technology incentives program.

### **2. Best Management Practices:**

BMP has been promulgated for both subcategories of mills. The goal is to prevent and control intentional or unintentional diversions of spent pulping liquor, turpentine, and soap and to (a) recovery the material to the extent practicable or (b) meter it to effluent treatment. Spent pulping liquor is essentially defined as cooking liquor once it has contacted the incoming fiber at any point in the pulping and recovery processes. EPA has obtained the BMPs as:

- ◆ Equipment to enable the detection, containment, and recovery (or metered treatment) or spills or leaks of spent pulping liquor, turpentine, and soap.
- ◆ A program of regular visual inspection and repair of leaking equipment.
- ◆ A preventive maintenance system and standard operating procedures.
- ◆ Continuous, automatic monitoring systems to detect and control leaks, spills, and diversions
- ◆ Annual training for personnel involved with operating, maintaining, or supervising operation of equipment in spent pulping liquor, turpentine, or soap service
- ◆ Preparation of a report evaluating spill events not contained in the immediate process area
- ◆ A program to review any planned facility modifications and construction activities in these areas
- ◆ Secondary containment for spent pulping liquor bulk storage tanks or an annual tank-integrity testing program coupled with diversion structures.
- ◆ Secondary containment for turpentine bulk storage tanks
- ◆ Wastewater treatment influent monitoring for organic content (parameter selection at mill's discretion).

### **3. Voluntary Advanced-Technology Incentives:**

As an alternative to meeting BAT requirements, BPK mills may choose to meet one of the following three "tiers" of voluntary advanced-technology incentives:

- ✦ **Tier I** – extended delignification (to kappa no. 20 (softwood) or kappa no. 13 (hardwood); 100%  $\text{ClO}_2$  substitution; recycling of fiber-line effluent prior to bleaching (AOX) long-term average  $<0.26 \text{ Kg/kkg}$ ). Compliance must be within six years of publication of the regulations in the *Federal Register*
- ✦ **Tier II** – Tier I, with further use of water conservation, reuse, and some bleach-filtrate recycle (AOX long-term average  $< 0.10 \text{ kg/kkg}$  and plant effluent<sup>2</sup>  $<10 \text{ m}^3/\text{kkg}$ ). Compliance must be within 11 years of publication of the regulations in the *Federal Register*.
- ✦ **Tier III** – Tier II, with full recycle and reuse of condensates and bleach-filtrate recycle (AOX) long-term average  $<0.05 \text{ kg/kkg}$  and plant effluent<sup>2</sup>  $<5 \text{ m}^3/\text{kkg}$ ). Compliance must be within 16 years of publication of the regulation in the *Federal Register*.

All tiers include efficient wastewater treatment and require attaining BAT limitations for dioxin, furan, chloroform, and the 12 chlorinated phenolics (Table II).

After a tier is achieved, the mill will receive incentives, including greater permitting certainty, reduced effluent monitoring and inspections, public recognition, and reduced penalties.

### **4. National Emission Standards For Hazardous Air Pollutants:**

The following air regulations are based on maximum achievable control technology (MACT) as defined by the EPA:

- ✦ **MACT I final regulations** covering pulping, bleaching and wastewater sources for chemical pulp mills, including kraft, stand-alone semichemical, and sulfite pulping.
- ✦ **MACT II proposed regulations** for kraft, soda, semichemical, and sulfite mill combustion sources, including recovery units, smelt-dissolving tanks, and lime kilns
- ✦ **MACT III final regulations** covering air emissions from paper machines, mechanical pulping, and pulping of secondary fiber and nonwood fiber.

## **ECOLOGICAL & ENVIRONMENTAL FACTORS IN PAPER INDUSTRY**

### **MACT I rule are:**

- ✦ An eight-year compliance schedule is allowed for high-volume, low-concentration (HVLC) gas-collection and-treatment systems for existing sources in kraft mills.
- ✦ HVLC systems are allowed 4% downtime in addition to startup, shutdown, and malfunctions.
- ✦ Low-volume, high-concentration (LVHC) gas-collection and – treatment systems are allowed 1% downtime in addition to startup, shutdown, and malfunctions.
- ✦ Combined LVHC and HVLC emission treatment systems are allowed 4% downtime in addition to startup, shutdown, and malfunctions.
- ✦ Condensate strippers are allowed 10% downtime, including startup, shutdown, and malfunctions.

### **MACT I**

**Pulping Sources:** Sources of air emissions in the pulping process that must be collected and treated for each production subcategory are listed in **Table- 17**.

**TABLE-17**

**NON-CONDENSIBLE GAS SOURCE MACT-I**

SOURCE	KRAFT MILLS		SODA AND SEMICHEMICAL MILLS		SULFITE MILLS	
	Existing	New	Existing	New	Existing	New
Digester system Digesters, flash tanks, blow tanks, chip steamers not using frest steam, prehydrolysis units (prewashing)	✓	✓	✓	✓	✓	....
Turpentine recovery system Decanters, condensers, storage tanks	✓	✓	✓	✓	....	✓
Evaporator systems Preevaps, evaporators, concentrators, vacuum pumps, hotwells, surface condensers	✓	✓	✓	✓	✓	✓
Steam stripper systems Stripper feed tanks, heat exchangers, strippr columns, condensate storage tanks, condensers	✓	✓	✓	✓	....	....
Washing systems Filtrate tanks, foam tanks, intermediate stock chests, vacuum pump exhaust	✓	✓	....	✓	✓	✓
Oxygen delignification systems Washers, filtrate tanks, blow tanks, intermediate stock chests Knotter and screen systems <sup>a</sup>	✓	✓	...	....	....	....
Knotters with HAPs $\geq 0.1$ lb/ton <sup>b</sup>	✓	✓	....	....	....	....
Knotters with HAPs $\geq 0.1$ lb/ton	....	✓	....	....	....	....
Screens with HAPs $\geq 0.2$ lb/ton	✓	✓	....	....	....	....
Screens with HAPs $> 0.2$ lb/ton	....	✓	....	....	....	....
Combined knotters-screens With HAPs $> 0.3$ lb/ton	....	✓	....	....	....	....
Decker systems Deckers using white water, fresh water, or process water with HAPs $< 400$ ppm	....	✓	....	....	....	....
All other deckers	✓	✓	....	....	....	....
Weak-liquor tanks	....	✓	....	....	....	✓
Strong-liquor tanks	....	....	....	....	....	✓
Acid-condensate storage tanks	...	....	....	....	....	✓

a. Including knot drainer tanks and ancillary tanks

b. Production tonnages are expressed as oven-dry short tons of unbleached pulp.

**MACT I monitoring requirements:**

Table-18 summarizes the monitoring requirements under MACT-1.

**TABLE-18**  
**SOURCES OF AIR EMISSIONS IN PULPING**

Source	Monitoring	Alternates monitoring	Frequency
Thermal oxidizer	Temperature	Methanol outlet conc.	Continuous
Bleach-plant scrubber	pH or redox of scrubber effluent inlet gas flow Scrubber liquid flow rate	Outlet chlorine conc.	Continuous
Bleach plants qualifying for VATIP	Chlorine and hypochlorite (if applicable) addition rates	None	Daily
Steam strippers	Condensate flow rate steam feed rate Condensate feed temperature	Methanol outlet conc.	Continuous
Condensate collection	Site-specific operating parameters to demonstrate at least 65% HAP collection	...	...
Biological treatment	Outlet BOD <sub>5</sub> Mixed-liquor volatile suspended solids Aerator horsepower Inlet liquid flow Liquid temperature	None	Daily composites
Enclosed-vent systems	Visual inspection Leak testing (pressure systems) Vacuum test (vacuum systems)	None None None	Every 30 days Annual Annual

**Bleaching Sources:** The cluster rule requires that vent gases from bleaching stage that use Cl<sub>2</sub> or ClO<sub>2</sub> based compounds should be collected & treated using one of the following methods.

- ✦ Route to a control device capable of achieving a 99% removal of chlorinated HAPs
- ✦ Route to a control device with an outlet concentration of chlorinated HAPs of no more than 10 ppm. (parts per million by volume)
- ✦ Reduce chlorinated HAP emissions to less than 0.002 lb/o.d. ton pulp input to the bleach plant.

**Condensates.** Condensate collection and treatment requirements apply only to kraft pulp mills. Three options are allowed for collection of condensates:

1. Collect digester, turpentine recovery, HVLC, and LVHC condensates plus condensates from the evaporator feed stages.
2. Collect HVLC and HAPs (methanol) in the digester, turpentine, and evaporator condensates.
3. Collect condensate streams totaling at least 7.2 lb

HAAPs per ton for unbleached mills, or 11.1 lb HAPs/ton for bleached mills.

Treatment of condensates is defined as one of the following:

- ✦ Route to a well operated biological treatment system using a submerged inlet
- ✦ Route to a controlled process
- ✦ Route to a control device achieving at least a 92% reduction in methanol
- ✦ Treat to remove at least 6.6 lb/ton HAPs (unbleached mills) or 10.2 lb/ton (bleached mills)
- ✦ Route to a control device with an outlet concentration of no more than 210 ppm (parts per million by weight) for unbleached mills or 330 ppm for bleached mills.

**New-source definition.** New sources for kraft, soda, sulfite, and stand-alone semichemical mills are defined as those starting construction or reconstruction after December 17, 1993. New sources for mechanical, secondary fiber, or nonwood fiber mills are defined as those starting construction or reconstruction after March 8, 1996. New sources must be in compliance upon startup.

**Significant features of the proposal are:**

- ✦ Existing kraft and soda recovery boilers and smelt tanks will be required to meet the current NSPS particulate levels within three years of promulgation.
- ✦ Existing lime kilns will be required to meet the current NSPS particulate limits that apply to gas-fired kilns.

- ✦ MACT for new combustion sources can be met with modern, efficient electrostatic precipitators.

## **MACT II**

MACT II requirements will apply to all kraft (122), soda (2) sulfite (12) and stand-alone semichemical (13) mills with combustion units for chemical recovery. (The numbers in parentheses are the number of operating mills that are covered in each category). There are three calcium-based sulfite mills and one semichemical mill that do not have chemical recovery and, therefore, are not covered by this regulation.

MACT II regulations cover emissions of particulate matter (PM), particulate hazardous air pollutants (PM HAP), and total gaseous organic (TGO) HAP from chemical pulping combustion sources. The sources covered by this proposal are:

- Kraft and soda recovery boilers
- Smelt dissolving tanks
- Lime kilns
- Sulfite recovery furnaces
- Semichemical combustion units (including fluidized bed reactors, recovery furnaces, smelters, rotary liquor kilns, and pyrolysis reactors).
- MACT FOR new smelt-tank vents can be met with wet scrubbers
- Emissions of hydrochloric acid (HCl) are not being regulated because of lack of sufficient health benefit from their reduction.
- Existing kraft and soda mills may choose a "bubble" limit by grouping combustion sources under one overall limitation.
- Methanol is a surrogate for total gaseous organic HAP for kraft and soda mills.
- Total hydrocarbon (THC) is surrogate for total gaseous organic HAP for semichemical mills.
- On a case-by case basis, projects that qualify as "pollution-control projects" can obtain exemptions from some of the new-source review (NSR) requirements.

## **MACT III**

Air regulations for paper machines, mechanical pulping, secondary fiber (deinked and nondeinked), and non wood mills were proposed on March 8, 1996. These MACT III regulations were signed on November 14, 1997, and are expected to be published in January 1998 along with the MACT I Rule.

MACT III sources that use chlorine or chlorine dioxide for bleaching must collect vent streams and treat to the same level as kraft bleaching: either 99% HAP removal, outlet HAP concentration of 10 ppm or less, or HAP emissions equal to or less than 0.002 lb per o.d. ton. HAPs for these sources are represented by chlorine and do not include chloroform. Bleaching stages using only hypochlorite are not regulated.

### **PSD implications**

The Cluster Rule does not specifically allow exemptions from a PSD (prevention of significant deterioration) review for projects designed to meet Cluster Rule limits.

## **5. Global Focus On Green House Gases:**

**Kyoto Protocol** Marks a first step in global efforts to stabilize atmospheric concentration of greenhouse gases. Major provisions of Kyoto protocol is:

- **Emission limits:** The agreements would establish “differentiated” legally binding GHG limits for the participating countries. The combined reductions would result in a drop equivalent to 5.2% below the 1990 baseline. These emission reductions would be attained and calculated as an average over a five-year period (2008-21012). Emission reductions would vary by country, ranging from a 7% reduction for the United States to stabilization at the baseline for Russia and the Ukraine. It is important to note that the baseline and future emissions are to be determined in “net” terms, taking into account changes in GHG emissions as well as emission sinks.
- **Greenhouse gases covered:** The GHGs covered in the Protocol are CO<sub>2</sub> methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF<sub>6</sub>).

## **6. Greenhouse Gases And Pulp & Paper Industry:**

**International Perspective-**The greenhouse gas of concern to the pulp and paper industry is CO<sub>2</sub>. Principal sources of emissions at mills include power boilers, recovery boilers, and lime kilns. Methane, which is emitted primarily from waste water treatment operations, is of secondary significance.



**List of Technical Trends Used:**

AOX	Adsorbable Organic Halides
BAT	Best Available Technology
BMP	Best Management Practices
BOD	Biochemical Oxygen Demand
COD	Chemical Oxygen Demand
ECF	Elemental Chlorine Free
EIA	Environment Impact Assessment
EPA	Environmental Protection Act
HAPs	Hazardous Air Pollutants
HRT	Hydraulic Retention Time
HVLC	High-volume, low-concentration
LVHC	Low-volume, high-concentration
MACT	Maximum Achievable Control Technology
NPDES	National Pollution Discharge Elimination System
NSPS	New-source Performance Standards
PSNS	Pretreatment Standards for New Sources
PSD	Prevention of Significant Deterioration
S.S.	Suspended Solids
TCF	Total Chlorine Free