CHARTER FOR WATER RECYCLING & POLLUTION PREVENTION IN PULP & PAPER INDUSTRIES (IN MAIN STEM STATES OF RIVER GANGA & YAMUNA)

(CHARTER 3.0)

CENTRAL POLLUTION CONTROL BOARD
DELHI

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1. REGULATORY FRAMEWORK AND EVOLUTION OF CHARTER

As per the various gazette notifications under Environment Protection Rules, 1986, Pulp & Paper industries were categorized based on the scale of production and it was made mandatory to comply with the notified standards for quality of treated effluent. Category-wise notified discharge norms are mentioned in Table 1 below:

Table 1: Notified discharge norms under E(P) Rules, 1986 for Pulp & Paper industries based on scale of production

Parameters	**Notified standards**	
	Large Pulp & Paper Mills (Capacity above 24000 MT/Annum)	**Small Pulp & Paper Mills (Capacity up to 24000 MT/Annum)**
pH	7.0-8.5	5.5-9.0
TSS (mg/L)	50	100
BOD (mg/L)	30	30 (discharge into inland surface water) 100 (discharge on land)
COD (mg/L)	350	-
AO_x	1 kg/MT of paper produced	2 kg/MT of paper produced (discharge on land)
SAR	-	26 (discharge on land)
Sp. Effluent Discharge	100 kL/MT of paper produced	200 kL/MT of paper produced (agro based) 75 kL/MT of paper produced (wastepaper based)

Framing of above-mentioned standards and categorization were based on scale of production, without any emphasis on type of raw material used and grade of paper produced.

With declaration of river Ganga as National River and constitution of **National Ganga River Basin Authority (NGRBA)** to ensure effective abatement of pollution and conservation of the river Ganga, the issue of minimizing the environmental impact of pulp and paper mills on water quality of river Ganga and its tributaries became a priority agenda before regulatory bodies. Up to year 2011, most of the Pulp & Paper industries in river Ganga basin were facing issues of compliance with stipulated discharge norms. The major reasons for adverse environmental impact of Pulp and Paper industries on water quality of river Ganga and its tributaries were use of obsolete production technology & equipment, discharge of black liquor (effluent generated during cooking/digestion section in

wood/agro residue based Pulp & Paper industries, typically having high solid content around 8 – 12% and COD in the range of 75000 – 125000 mg/L), lack of process optimisation, intensive use of water and consequently high discharge, low performing and inadequate existing effluent treatment plants, lack of awareness and unskilled manpower for proper operation & maintenance of ETP, etc.

Considering the adverse impact of discharge of untreated/partially treated effluent from Pulp & Paper industries on water quality of recipient water bodies (i.e. freshwater streams, rivulets, rivers etc.), the Central Pollution Control Board (CPCB) in year 2010 carried out a study in collaboration with **IIT Kanpur, IIT Delhi, IIT Roorkee and Central Pulp and Paper Research Institute (CPPRI), Saharanpur** and submitted a report on **"Techno-economic feasibility for setting up of Common Chemical Recovery Plant & Common Effluent Treatment Plant for Pulp & Paper Industries operating under identified cluster in Uttar Pradesh & Uttarakhand". The major highlights of the reports are as follows:**

1. Installation of stand-alone or Common Chemical Recovery Plants (CRPs) by wood/agro-based Pulp & paper industries for black liquor management was made as a mandatory requirement for continuing their manufacturing operations.
2. Industries to be categorized as per the raw material and grade of paper produced for setting up benchmarks for specific freshwater consumption and wastewater discharge.
3. Process optimization and adoption of cleaner production technology for minimizing water use and effluent generation.
4. The setting up of CETP was found to be techno-economic unfeasible.
5. Upgradation of ETP by individual paper mills.

The follow-up of the above study led to the formulation of the **"Charter for Water Recycling & Pollution Prevention in Pulp and Paper Industries located in river Ganga basin"** by CPCB in consultation with leading technical institutes like **IIT Roorkee, IIT Kanpur, IIT Delhi & CPPRI, SPCBs, representatives from industry & industry associations, and other stakeholders** with an objective to reduce the specific freshwater consumption & effluent discharge, improvement in quality of treated effluent to ensure improvement in water quality of the recipient water bodies/ streams/tributaries and river Ganga. The basic premise of the Charter was majorly based on:

(a) participatory approach

(b) process technology augmentation, standardization, and adoption of cleaner production options for waste minimization

(c) retrofitting in existing infrastructure and upgradation/augmentation of ETPs to promote recycling and reuse of various effluent streams without and with treatment (partial or full treatment) for different end-point uses i.e. cascade management of water utilization and wastewater management

(d) effective and continuous self and third-party monitoring program.

The first version of Charter (i.e. Charter 1.0) was implemented in the year 2012 in five clusters of Pulp & Paper industries, namely Kashipur & Roorkee in Uttarakhand, Moradabad, Meerut (Vill. -Saini, Meerut-Mawana road) & Muzaffarnagar in Uttar Pradesh. The implementation of Charter 1.0 proved to be a turning point, as the wood/agro-based mills and wastepaper-based mills were able to achieve freshwater consumption levels up to 40 – 60 kL/MT of paper and 15 – 20 kL/MT of paper respectively. The successful implementation of the existing Charter in the states of Uttarakhand & Uttar Pradesh led to the framing of an improved/revised version of the Charter (i.e. Charter 2.0) by CPCB in consultation with leading technical institutes like IITs, CPPRI, SPCBs, representatives from industry & industry associations, and other stakeholders during 2014 – 2015.

The major highlights of the Charter were categorization based on the type of raw material & grade of paper produced, category-wise benchmarking for specific freshwater consumption & effluent discharge, formulation of discharge norms for all categories of industries i.e., Chemical Pulp Mills (Wood & Agro- Bleached & Unbleached) and Waste Paper/RCF based Mills (Bleached & Unbleached), and initiation of concept for bare minimum technologies for various unit operations. Categorization and benchmark values for specific freshwater consumption and specific effluent discharge as per Charter 2.0 are mentioned in Table 2 below:

Table 2: Categorization of Pulp & Paper industries, benchmark for specific freshwater consumption & specific effluent discharge in Charter 2.0

Type of Industry	**Category**	**Benchmark values (kL/MT of product)**	
		Specific Freshwater consumption	**Specific Effluent discharge**
Wood Based Pulp & Paper Mills producing bleached grades of chemical pulps, papers,	A1	50	40

paperboards & newsprint			
Wood Based Pulp & Paper Mills producing unbleached grades of papers and paperboards	A2	25	20
Agro Based Pulp & Paper Mills producing bleached grades of chemical pulps, papers, paperboards & newsprint	B1	50	40
Agro Based Pulp & Paper Mills producing unbleached grades of papers and paperboards	B2	25	20
RCF and Market Pulp Based Paper Mills producing bleached grades of papers, paperboards & newsprint	C1	15	10
RCF and Market Pulp Based Paper Mills producing unbleached grades of papers and Paperboards	C2	10	6
RCF and Market Pulp Based Specialty Paper Mills	D	50	40

Targeted norms for treated effluent quality as recommended in Charter 2.0 are mentioned in Table 3 below:

Table 3: Targeted norms for treated effluent quality as recommended in Charter 2.0

Parameters	**Integrated Pulp & Paper Mills Producing Chemical Pulp**	**RCF based Mills**
pH	6.5-8.5	6.5-8.5
TSS (in mg/l)	< 30	< 30
TDS (in mg/l)	< 1800	< 1600
COD (in mg/l)	< 200	< 150
BOD (in mg/l)	< 20	< 20
Colour, PCU	< 250	< 150
AOx (in mg/l)	< 8	-
SAR	< 10	< 8

The bare minimum technologies recommended in Charter 2.0 are mentioned in Annexure 1.

Charter 2.0 was implemented in the year 2015 in nine states of the river Ganga and Yamuna basin viz. Uttarakhand, Haryana, Delhi, Uttar Pradesh, Bihar, Jharkhand, Madhya Pradesh, Chhattisgarh and West Bengal.

The implementation of the Charter through a systematic and time-bound action plan led to resource conservation, water conservation, reduction in energy consumption, and improved quality of treated effluent, reduction in discharge due to reuse/recycling of treated/partially treated effluent.

The noteworthy achievement of Charter 2.0 was zero black liquor discharge (through the dismantling of 100 chemical pulping digesters from 33 pulp & paper mills & commissioning of 7 Chemical Recovery Plants catering to 10 Wood/agro-based Pulp & Paper mills). Additionally, Charter 2.0 created a continual awareness among the industries regarding environmental conservation and sustainable development.

The successful implementation of Charter 2.0 in the pulp and paper industries operating in river Ganga & Yamuna main stem states has been monitored and reported by various agencies including the Center for Ganga River Basin Management and Studies (cGanga) in its report titled "Strategy for Improving the Condition of Water Bodies in the Vicinity of Pulp & Paper Industries in Ganga River Basin", NMCG, SPCBs, and reputed technical institutes.

Key achievements of Charters implementation are mentioned below:

a. reduction in average specific freshwater consumption i.e. 51.34 kL/MT of product (before Charter), 16.91 kL/MT of product (year 2017) to 8.37 kL/MT of product (year 2023)
b. reduction in average specific effluent discharge i.e. 33.75 kL/MT of product (before Charter), 11.47 kL/MT of product (year 2017) to 5.10 kL/MT of product (year 2023)
c. reduction in organic pollution load i.e. 12.83 kg/MT of product (before Charter), 1.44 kg/MT of product (year 2017) to 0.13 kg/MT of product (year 2023)
d. increase in yield, due to installation of fibre recovery systems such as Sedicell, Krofta, DAF, Hill screen, etc.
e. estimated saving of groundwater around 484 million liters per day
f. annual conservation of energy (around 860 MW) and estimated reduction in carbon footprint by 782.5 Ton/CO_2e
g. zero black liquor discharge

2. CURRENT STATUS OF PULP & PAPER INDUSTRY IN MAIN STEM STATES OF RIVER GANGA AND YAMUNA

Pulp & Paper industries located in the main stem States of rivers Ganga and Yamuna use diverse fibrous raw materials (Wood, Agro residues, Wastepaper (Indigenous & Imported) /Recycled Fiber (RCF) and Ready-made pulp), to produce various grades of paper (bleached & unbleached grades paper and paper board, and specialty grade papers), and having significant variation in scale of production.

As per the inventory (year 2023) available with CPCB, there are around 161 nos. of Pulp & Paper industries situated in the main stem states of river Ganga & Yamuna which constitute about 17–18% of the total Pulp & Paper industries in the country. These industries are spread over the states of Uttarakhand, Haryana, Uttar Pradesh, Bihar & West Bengal. Out of 161 nos. of Pulp & Paper industries, 130 (78 in river Ganga main stem states and 52 in river Yamuna main stem states) were found operational during inspections in the year 2023 having an overall total average production of around 18552 MT/day. Category-wise number of operational Pulp & Paper industries and corresponding production is shown in Table 4 below:

Table 4: Category-wise number of Pulp & Paper Industries found operational during 2022 – 2023 with actual production in river Ganga & Yamuna main stem states

Category	**No. of operational Pulp & Paper industries situated in the main stem states of rivers Ganga & Yamuna**	**Total avg. daily production (MT/day)**
A1	04	1710
A2	No industry in this category	
B1	04	766
B2	04	639
C1	46	5600
C2	68	9691
D	04	146
Total	**130**	**18552**

As indicated above, recycled fiber/ wastepaper-based Pulp & Paper industries constitute about 87% of the Pulp & Paper industries operating in river Ganga and Yamuna basin main stem states and contribute to about 82% of the total paper production. Category-wise specific freshwater consumption and effluent discharge values monitored during the year 2023 are shown in Table 5 below:

Table 5: Category-wise specific freshwater consumption and effluent discharge values found during year 2023

Type of Industry	Particulars	Specific freshwater consumption (kL/MT of product)	Specific Effluent Discharge (kL/MT of product)
Wood & Agro based – bleached category	Existing Charter Norm	**50**	**40**
	Best	17-23	7-15
	Average	23- 35	15-25
	Below average	35-59	25-28
Wastepaper based – bleached category	Existing Charter Norm	**15**	**10**
	Best	2-5	0-3
	Average	5- 8	3- 5
	Below average	8-20	5-12
Wastepaper based – unbleached category	Existing Charter Norm	**10**	**6**
	Best	1.5-2	0-1
	Average	2- 3	1-2
	Below average	3-6	2-4

State-wise distribution of pulp & paper industries, specific freshwater consumption, and effluent discharge values during the year 2023 are shown in Table 6 below:

Table 6: State-wise distribution of pulp & paper industries, specific freshwater consumption, and effluent discharge values during the year 2022 – 2023

State	No. of operational industries	Total actual production (MT/day)	Total Freshwater Consumption (KLD)	Total Effluent Discharge (KLD)	Specific Freshwater consumption (kL/MT of product)	Specific Effluent Discharge (kL/MT of product)
Uttarakhand	27	4621	63995	44933	13.84	9.72
Haryana	3	357	1632	704	4.57	1.97
Uttar Pradesh	81	11986	78608	42424	6.56	3.54
Bihar	6	191	614	412	13.85	9.72
West Bengal	13	1396	10348	6509	7.41	4.66
Total	**130**	**18552**	**155196**	**94570**	**8.37**	**5.10**

3. CHARTER 3.0

3.1. NEED FOR CHARTER 3.0

In order to achieve benchmark for specific freshwater consumption specified in Charter 2.0, industries took measures to close the water loop and achieved a significant reduction in specific freshwater consumption, however, it has resulted in new environmental challenges. At the same time production from wastepaper/ recycled fibre has increased significantly as the existing industries have gone through capacity expansion and many industries in other categories have switched to wastepaper-based production. The number of wastepaper-based industries operating on Zero Liquid Discharge (ZLD) has increased significantly by complete reuse/recycling of untreated/partially treated effluent into the process. Around 48 wastepaper-based pulp & paper industries located in main stem states in the river Ganga & Yamuna basin were reported to be operating on ZLD in the year 2023. Charter 2.0 did not have any set of guidelines on ZLD which now requires immediate attention.

During recent inspections by officials of CPCB under 'Environmental Surveillance of 17 categories of highly polluting industries and common facilities, based on OCEMS data', Public complaints, court/NGT matters, and annual inspections by CPCB authorized Third Party Technical Institutes, the following issues have been observed:

a. Increase in the concentration of pollutants in raw effluent

Implementation of Charter 2.0 in the year 2015, resulted in a reduction in specific freshwater consumption and discharge over a period due to increased recycling of untreated/partially treated/ treated effluent, however as a consequence, the concentration of pollutants has increased significantly. Typical characteristics of raw effluent observed at ETP inlet in different categories of Pulp & Paper industries operating in the main stem states of rivers Ganga & Yamuna are shown in Table 7 below:

Table 7: Typical characteristics of effluent observed at ETP inlet in different categories of Pulp & Paper industries operating in main stem states in river Ganga & Yamuna basin

Category	Avg. Inlet BOD (mg/l)	Avg. Inlet COD (mg/l)	Avg. Inlet TSS (mg/l)	Avg. Inlet TDS (mg/l)
A1	322	867	178	1524

A2	No industry in this category			
B1 having discharge	848	2028	2524	4676
B2 having discharge	3775	11312	1963	6240
C1 having discharge	1766	4634	3715	3519
C2 having discharge	2668	6563	2104	6610
C1 on ZLD	3780	8292	762	12536
C2 on ZLD	9926	24602	7075	21726

b. Issues in RCF (Waste paper) based Pulp & Paper industries operating on ZLD

- **Non-uniformity in trade effluent closing loop:**

  No uniformity has been observed in the trade effluent closing loop by pulp & paper industries operating on ZLD. A large number of industries are recycling trade effluent after two-stage fiber recovery systems in long circulation loops. Few industries also employ conventional effluent treatment systems and recycle effluent back to the process after primary, secondary/tertiary treatment. Current practices of ZLD adopted by these type of industries is illustrated in Figure 1, and Figure 2:

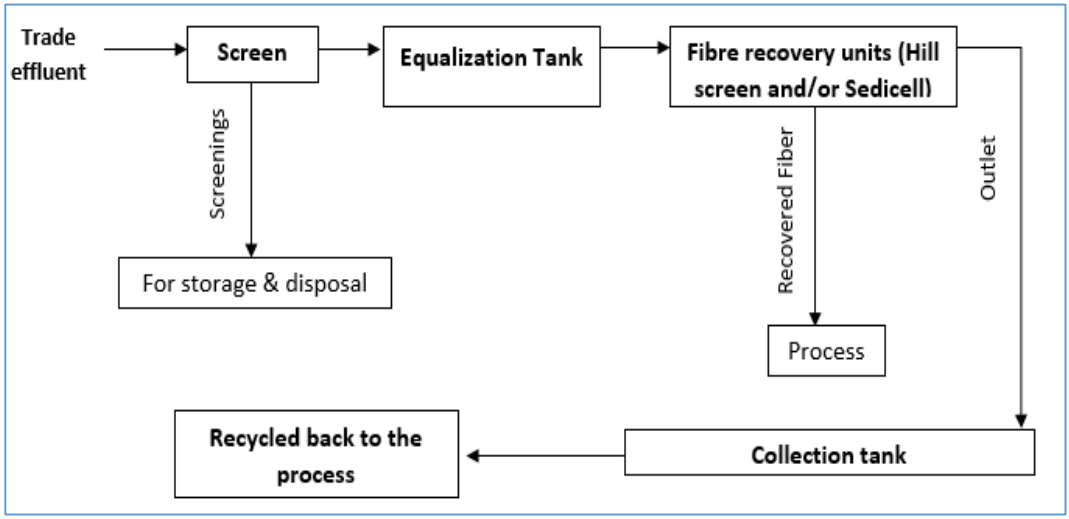


Figure 1: Effluent management scheme in wastepaper based industries operating on ZLD (recycling effluent after Fibre recovery system)

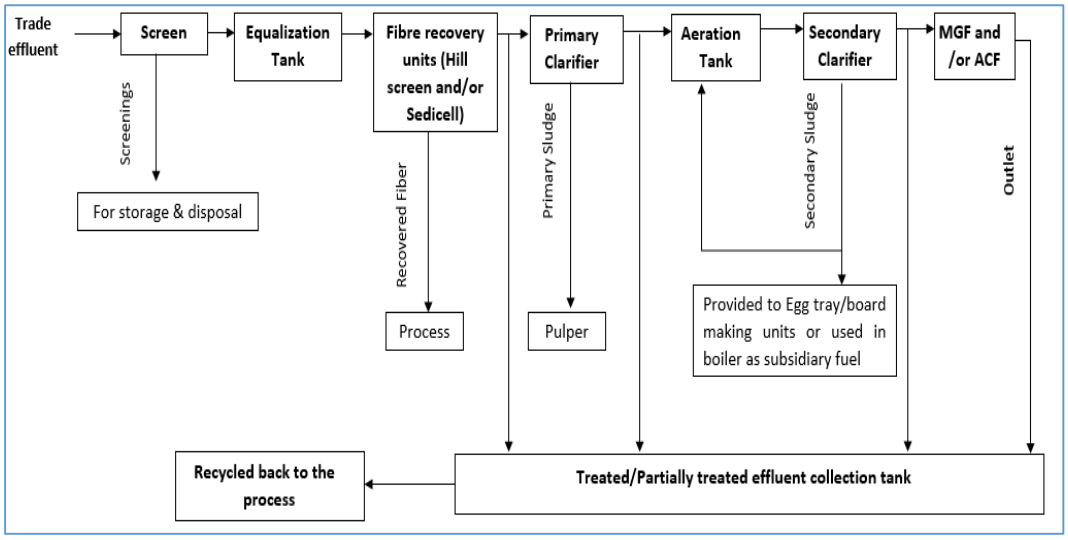


Figure 2: Effluent management scheme in wastepaper based industries operating on ZLD having ETP upto tertiary level (recycling effluent after different stages)

It has been observed that ETP in wastepaper-based operating on ZLD has negligible reduction in effluent parameters such as BOD & TSS (3 – 13 %) due to high concentration of BOD, COD & TSS in raw effluent. It was also observed that none of these industries have TDS reduction units.

- **<u>Purging of effluent</u>:**

  Continuous recycling of process water/trade effluent in a closed loop causes a build-up of pollutants (majorly TDS ≥ 20,000 mg/l, low-molecular fatty acids, and other organics) thereby leading to a significant decrease in the oxygen content of the process water, and approaching anaerobic conditions resulting in scaling, aggressive corrosion of pipelines & equipment, intensified growth of microorganisms and a higher demand for fungicides, and poor product quality.

  Hence to avoid the above issues, periodical purging of some quantity of effluent into recipient water body/drains (maybe on a fortnightly/ weekly basis) by industries operating on ZLD cannot be ruled out as evident from the physical conditions and water quality of recipient drains.

c. <u>Issues in RCF (Waste paper) based Pulp & Paper industries having discharge</u>

- **<u>Non-uniformity in existing effluent treatment scheme</u>:**

  No uniformity has been observed in the effluent treatment scheme adopted by these types of industries. Typical effluent management schemes adopted by these

industries are as under:

- partial recycling of effluent back to the process after treating it through preliminary & primary treatment units (i.e., screen, equalization tank & Sedicell) and remaining treated through secondary biological treatment followed by tertiary treatment units (i.e. DMF/PSF/MGF /ACF) for discharge.

OR

- partial recycling of effluent back to the process after secondary biological treatment & tertiary treatment units and the remaining quantity is discharged

Schematic diagrams of current effluent treatment/management practices adopted by these types of industries is shown in Figure 3 below:

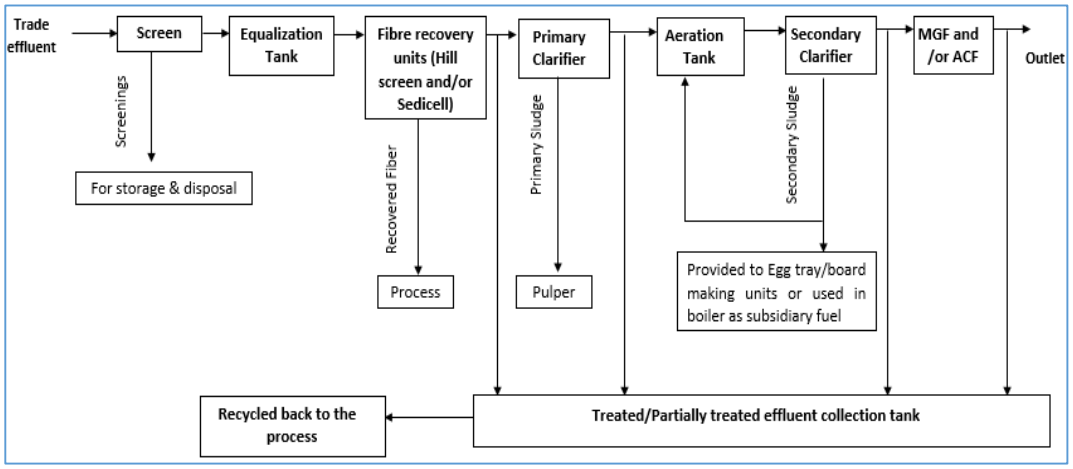


Figure 3: Effluent management scheme in wastepaper based industries having discharge

The continuous recycling of partially treated effluent results in a significant increase in the concentration of pollutants in raw effluent (i.e. high contents of organics, suspended solids, chlorides, sulphates, and organic acids). Hence, existing ETPs have now become less efficient (i.e. efficiency of around 80% against the designed efficiency of around 95%) and are unable to achieve the desired final effluent quality. In many cases, intensive closure of the trade effluent loop has made existing ETP units overcapacity leading to high retention time in primary treatment units, consequently leading to septic conditions.

d. Unscientific management and disposal of Non – paper Solid waste (i.e. Plastic waste, Boiler ash, and ETP sludge)

Wastepaper/ Recycle fibre-based pulp & paper industries typically generate non-

paper solid waste @ 10% of raw material. Presently, most industries have not adopted scientific management and disposal practices for non-paper solid waste. These industries do not have a proper record of generation and disposal of non-paper solid waste. The major non-paper solid wastes that require immediate attention are Plastic waste, Boiler ash & ETP sludge.

- **Plastic waste:**

  The wastepaper/ Recycle fibre-based pulp & paper industry receives plastic majorly in the form of lamination and packaging (estimated as 03 % in Indigenous wastepaper and 04 % in imported wastepaper). Plastic waste is generated and collected mainly in the pulping section and screens at the ETP inlet. These are stored separately in heaps in open areas or under sheds for 3 – 5 days for drying. A significant gap has been observed in estimated and actual plastic waste generation.

- **Boiler ash:**

  Different types of fuels such as biomass (i.e. bagasse, rice husk, wood barks, leaves), coal, plastic and Refuse Derived Fuel (RDF) are being used in the boilers installed in the industries. Most of the generated ash is being disposed off for landfilling in low-lying areas within and outside the premises. A significant gap has been observed in estimated and actual boiler ash generation.

  For the estimation of boiler ash generation, the following rationale is to be used:

  - *Daily steam requirement estimated as 2 MT steam/MT of paper (for the wastepaper-based unit) and 8 MT/MT of paper (for the wood /agro-based unit)*
  - *Daily fuel requirement is estimated based on steam generation @ 3 MT steam/MT of Indian Coal, 4 MT steam/MT of Imported Coal, 2.5 MT steam/MT of Bagasse, and 3 MT steam/MT of Rice Husk*
  - *Fuel-wise wise boiler ash generation rate is estimated as 2.5% for bagasse, 30-35% for coal, 5% for plastic, and 17% in the case of rice husk & RDF*

- **ETP Sludge:**

  Sludge generated from primary clarifier majorly consists of pulp fiber, which is recycled back to pulpers without measurement as a standard practice in all industries to improve product yield. Sludge generated from the secondary clarifier is being used by the board industries for making egg trays/boards and some are

utilizing it as subsidiary fuel in boiler after mechanical dewatering. A significant gap has been observed in estimated and actual ETP sludge generation quantity. *The typical rate of secondary sludge (biological) generation is assumed as 20% of the COD load in raw effluent at the ETP inlet*.

e. Quality of recipient drains/ water bodies still reported to be unsatisfactory

The analysis results of samples collected from recipient drains indicated high pollution load during monitoring in different industrial clusters.

f. Poor metering

Flow meters with totalizer have not been installed at different freshwater consumption points, effluent generation points, ETP Inlet, ETP outlet and effluent recycle lines, thus a proper water audit cannot be performed.

g. High electrical energy & steam consumption w.r.t. global average

Category-wise specific electrical energy & steam consumption in Indian Pulp & Paper industries in comparison to global figures is shown in Table 8 below:

Table 8: Category-wise specific electrical energy & steam consumption in Indian Pulp & Paper industries in comparison to global figures

Type of Industry	Particulars	Units	Global Avg.	Indian Avg.	Indian best practices
Wood-based Industries	Sp. Electrical Energy Consumption	kWh/MT of paper	1000 – 1100	1400 – 1500	1200
	Sp. Steam Consumption	MT of steam/ MT of product	7.0 – 9.0	12.0 – 13.0	9.0
Agro based Industries	Sp. Electrical Energy Consumption	kWh/MT of paper	-	1200 – 1400	1000
	Sp. Steam Consumption	MT of steam/ MT of product	-	12.0 – 14.0	10.0
Wastepaper based – bleached category	Sp. Electrical Energy Consumption	kWh/MT of paper	600 – 650	680 – 800	570
	Sp. Steam Consumption	MT of steam/ MT of product	4.0 – 4.5	6.0 – 7.0	5.0
Wastepaper-based – unbleached category	Sp. Electrical Energy Consumption	kWh/MT of paper	500	450 – 550	400
	Sp. Steam	MT of steam/	2.5	4.0 – 5.0	3.5

	Consumption	MT of product			

Source: Report titled "Improving Energy Efficiency in Pulp & Paper Sector (Achievements and Way Forward), Bureau of Energy Efficiency, September 2018

h. Process safety management

It has been perceived that industries have the least focus on Process safety management. During interaction with industry representatives, it has been observed that most of the incidents happening in the industry are majorly due to the following:

- *Bad maintenance of machineries/equipments*
- *Poor technical competency*
- *Blind cost-cutting*
- *Not following procedures or ignoring safe practices*
- *Poor emergency response*
- *Failing to learn from incidents*
- *Lack of availability of Safety manual and SOP for safe operation of machines/equipments*
- *Lack of awareness among workers regarding safety*

To address above-mentioned issues, and to promote the culture of continuous betterment, consultative meetings were held on 12.03.2024, 12.04.2024, 17.05.2024 & 01.06.2024 with different stakeholders like IITs, CPPRI, experts from industry & technology providers, and representatives from industry associations for setting up of new benchmarks, discharge norms, and technological intervention for overall improvement in environmental status of pulp and paper industries and ambient environment. Experts/participants advocated for revision of the existing Charter (i.e. Charter 2.0).

3.2. FRESHWATER CONSUMPTION & EFFLUENT DISCHARGE TARGETS UNDER CHARTER 3.0

After the successful implementation of Charter 2.0, specific freshwater consumption & effluent discharge levels have reduced significantly. The current status of specific freshwater consumption & effluent discharge in different categories is shown in Table 5. The targets for specific freshwater consumption and effluent discharge have been revised as shown in Table 9 below:

Table 9: Category-wise targets for Specific Freshwater Consumption & Effluent Discharge under Charter 3.0

Category	Specific Freshwater Consumption (kL/MT of product)	Specific Effluent discharge (kL/MT of product)
A1	**35**	**25**
A2	**20**	**14**
B1	**35**	**25**
B2	**20**	**14**
C1	**12**	**8**
C2	**6**	**4**
D	**35**	**25**

*Note: The industries are required to submit an Action Plan to achieve the proposed targets of specific freshwater consumption & effluent discharge within a period of **6 months** from date of implementation of Charter 3.0*

3.3. DISCHARGE NORMS UNDER CHARTER 3.0

The discharge norms for Wood & Agro Based Pulp & Paper Mills producing Chemical Pulp and RCF based Pulp & Paper industries are shown in **Table 10** below:

Table 10: Norms for Treated Effluent Quality under Charter 3.0

Parameters	Integrated Pulp & Paper Industries Producing Chemical Pulp	Waste Paper/RCF & Market Pulp Based Pulp & Paper Industries
pH	6.5 – 8.5	6.5 – 8.5
TSS (in mg/l)	30	30
BOD (in mg/l)	20	20
COD (in mg/l)	200	150
TDS (in mg/l)	2100	1600
Color (PCU)	250	150
AOx (in mg/l)	8	-
SAR	10	8

*Note: (a) Above effluent discharge norms or as prescribed by concerned SPCBs, whichever are stringent, will be applicable. The industries are required to submit an Action Plan to achieve the proposed discharge norms within a period of **6 months** from date of implementation of Charter 3.0.*

(b) During the implementation phase of Charter 3.0, the industries are required to submit their monthly logbook of analysis of treated effluent to respective State Pollution Control Boards.

3.4. GUIDELINE FOR INDUSTRIES OPERATING ON ZERO LIQUID DISCHARGE

Under Charter 3.0, a guideline is proposed to be followed by pulp and paper industries operating on ZLD to justify their ZLD status. These include:

a) Flow meter installation:
Install flow meters with totalizers at all freshwater intake sources, freshwater consumption points, effluent generation points, ETP inlet, ETP outlet and treated effluent reuse points and maintain logbooks for the same on a daily basis.

b) Upgradation/augmentation of existing ETPs:
- ETP installed in Kraft paper industry based on wastepaper shall have the following:
  - Fibre recovery unit → Primary clarifier → Anaerobic-Aerobic biological treatment → Tertiary treatment (Sand Filter, Carbon Filter, Dual Media filter, etc.) → Micro-filtration

OR

  - Fibre recovery unit → Primary clarifier → Two-stage aerobic biological treatment (extended aeration system) → Tertiary treatment (Sand Filter, Carbon Filter, Dual Media filter, etc.) → Micro-filtration

c) Minimum performance of effluent treatment system and recycling protocol:
- Recycling of treated effluent allowed only after secondary biological treatment/ tertiary treatment stage.
- Ensure at least 80 % reduction in BOD & TSS after the secondary biological/ tertiary treatment stage.
- Ensure that characteristics of recycled water used in the process (in a closed loop) shall meet BOD <2000 mg/l; COD < 4000 mg/l and TSS < 400 mg/l.

d) Average daily freshwater consumption:
- ≤ 2.5 kL/MT of paper for wastepaper-based industries not having power turbines, and
- ≤ 3.0 kL/MT of paper for wastepaper-based industries having power turbine

e) Water balance along with short and long recirculation loops to be provided by the industry
f) Material balance to be provided by the industry
g) Daily record of TDS & COD level in the backwater
h) Provision of PTZ web camera at identified sites like recycling flow meters / dry drains if existing
i) The monthly environmental compliance report to be prepared by industries and sent to CPCB/SPCBs, should include TDS & daily freshwater consumption values.
j) Land application of treated effluent will not be considered as ZLD. In such cases, the mill is required to treat the effluent as per consent norms.

3.5. OPERATION & MAINTENANCE OF ETP

To achieve the designed performance from ETP and to meet the environmental discharge standards, it is necessary to operate it under optimum conditions. It is also desired that regular maintenance of ETP takes place and analysis of performance parameters is regularly carried out. For proper and optimum operation of ETPs, the industries shall ensure:

a) Operation of ETP at optimum operating conditions as per the designed specifications
b) Design of equalization tank (equipped with aeration system to avoid septic condition) to be made in such a way as to reduce the shockload to biomass & the system as a whole
c) Ensure proper addition of nutrients
d) Maintain the required level of MLSS/MLVSS concentration during biological treatment
e) Maintain the desired level of DO in the aeration tank (1-2 mg/l). The mills may install jet aerators to ensure optimum DO level
f) The mills should ensure regular removal of sludge in clarifiers and avoid septic conditions
g) The final discharge outlet shall be visible and exposed, it should not be discharged through closed pipes.

3.6. DOCUMENTATION UNDER CHARTER 3.0

Maintain logbooks/records for the following:

a) Raw material consumption
b) Production with no. of operational days
c) Freshwater abstraction from Borewells
d) Consumption of freshwater in different sections,
e) Effluent generation from different points
f) Quantity of effluent fed into ETP
g) Quantity of treated effluent recycled from ETP into the process
h) Quantity of treated effluent consumed in the process
i) Quantity of treated effluent discharged
j) Chemical consumption in ETP
k) Nutrient consumption in aeration tank
l) Power consumption in ETP

m) Fuel consumption in Boiler

n) Plastic waste generation and disposal

o) Boiler ash generation and disposal

p) Quantity of ETP sludge generation & disposal

q) Hazardous waste generation & disposal (also maintain Form-IV, Form-X, agreement with TSDF facility)

r) Inventory of chemicals used in the production process (including MSDS) and maintain consumption records on daily/weekly/monthly basis

Note: In the log book related to freshwater consumption, effluent discharge, recycled backwater, and power consumption in ETP, the daily production should also be mentioned and remarks/reasons should be provided for any deviation from the general trend.

3.7. BARE MINIMUM TECHNOLOGY (BMT)

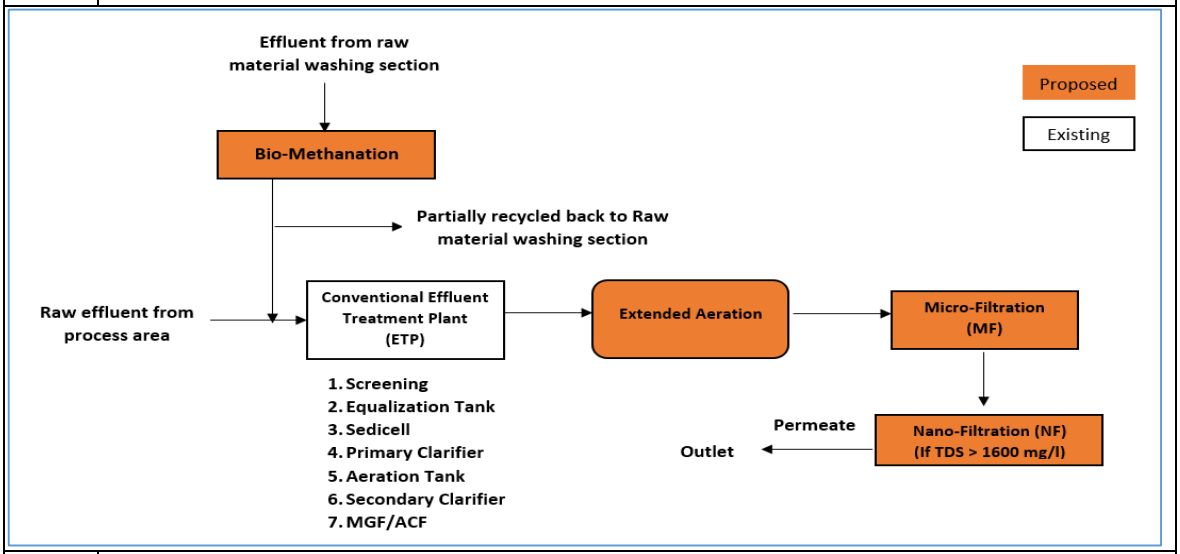
BMT is indicative of the systems, equipment, processes, and practices that are considered essential for achieving the objectives of this Charter. The technology required, or implemented, by individual mills to achieve the same documented level of environmental protection, may differ on account of their unique set of circumstances such as the scale of operations, existing equipment & system configuration, product portfolio, raw material mix, etc.

During discussions/ deliberations with technical experts from IITs, CPPRI, Pulp & Paper industries, and representatives from Paper Mill Associations, experts were of the view that in addition to measures listed in Charter 2.0, there is a need for technological intervention for further environmental improvement of pulp & paper industries. Suggested Bare Minimum Technologies in addition to those already mentioned in Charter 2.0 are mentioned in Table 11 below:

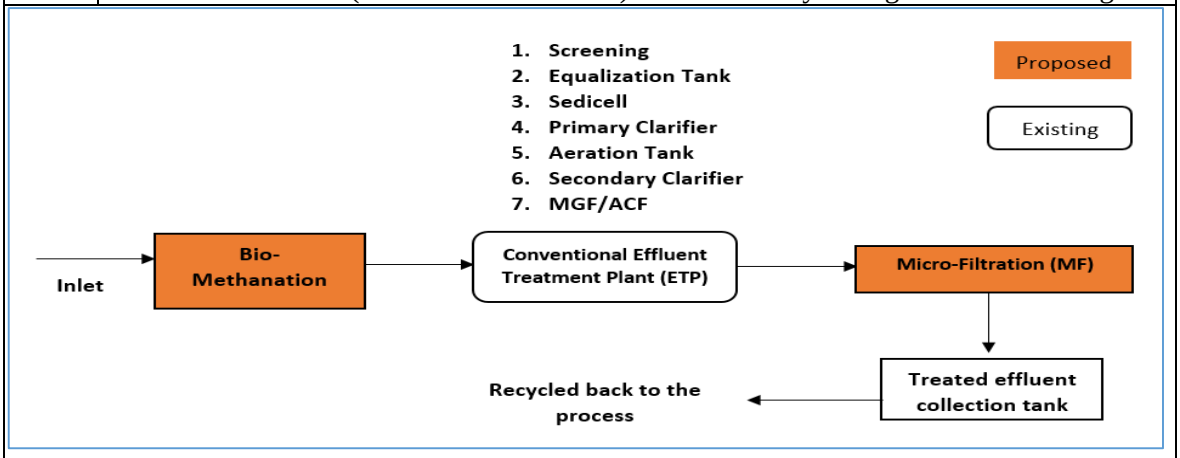
Table 11: Bare Minimum Technologies (Mandatory) in addition to those already mentioned in Charter 2.0

Upgradation/Augmentation of ETP in different categories of Pulp & Paper industries – implementation within 01 - 1.5 years	
1.	***Wood/Agro residue based (A1,A2, B1 & B2 category) industries***
1.1.	Augmentation/upgradation of secondary biological treatment system by installing either anaerobic followed by aerobic treatment or two stage extended aeration system in series followed by tertiary treatment units consisting of filtration system (i.e. Pressure Sand Filter, Activated Carbon Filter followed by Micro-filtration/Ultrafiltration). If treated effluent has TDS concentration above 1600 mg/l consistently, then unit shall install Nano-

	filtration system after the micro-filtration system to keep the concentration within the stipulated discharge norms. Reject from Nano-filtration system may be utilized in ash quenching, floor washing, makeup water in wet scrubbers, spraying in coal yard, etc.
1.2.	Installation of anaerobic unit for treatment of wet washing effluent



2.	***Waste paper/recycle fibre based industries (C1 & C2 category) operating at ZLD***
2.1.	Installation of secondary biological treatment (anaerobic-aerobic) and ensure minimum 80 % reduction in BOD (w.r.t. inlet BOD value) after secondary biological treatment stage



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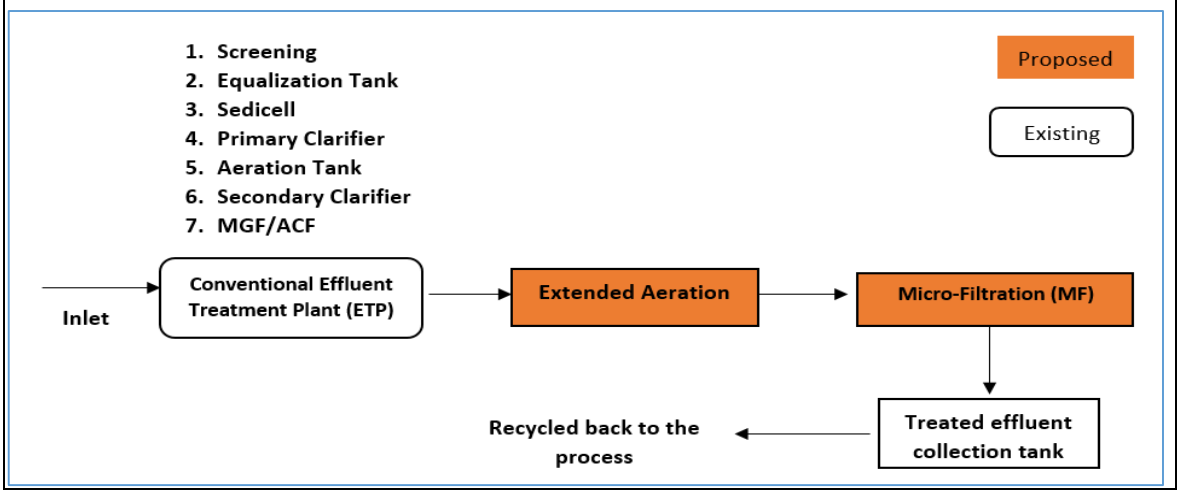
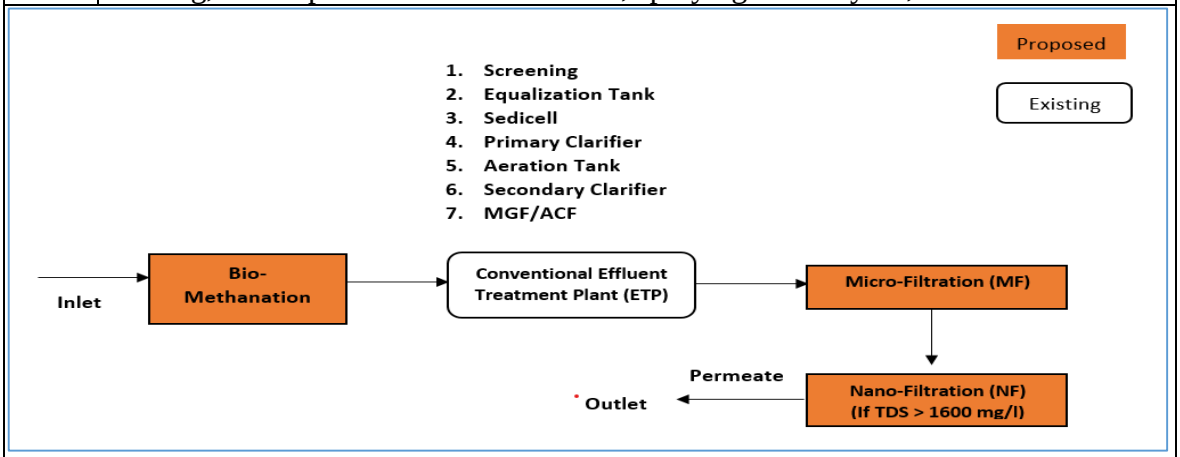


2.2.	Ensure characteristics of recycled water used in process (in closed loop) meets BOD <2000 mg/l; COD < 4000 mg/l and TSS < 400 mg/l.
2.3.	Ensure specific freshwater consumption: • ≤ 2.5 KL/MT of product, for industries not having power turbine, and • ≤ 3.0 KL/MT of product, for industries having power turbine
2.4.	Installation of disinfection system such as dosing of ClO_2, UV, Ozonation for disinfection of treated effluent
2.5.	Explore other advance technologies available like advance oxidation, membrane filtration, electro-oxidation etc. for complete reuse/recycling to ensure ZLD (Optional)
2.6.	Install on-line TDS/Turbidity meter at inlet and all recycling lines and linked to CPCB/SPCB servers
3.	***Waste paper/recycle fiber based industries (C1 & C2 category) discharging treated effluent***
3.1.	Upgradation / augmentation of existing ETPs by installation & commissioning of physico-chemical treatment, secondary biological treatment (either anaerobic followed by aerobic treatment or two stage extended aeration system in series) followed by tertiary treatment units consisting of filtration system (i.e. Pressure Sand Filter, Activated Carbon Filter followed by Micro-filtration/Ultrafiltration). If treated effluent has TDS concentration above 1600 mg/l consistently, then unit shall install Nano-filtration system after the micro-filtration system to keep the concentration within the stipulated discharge norms. Reject from Nano-filtration system may be utilized in ash quenching, floor washing, makeup water in wet scrubbers, spraying in coal yard, etc.



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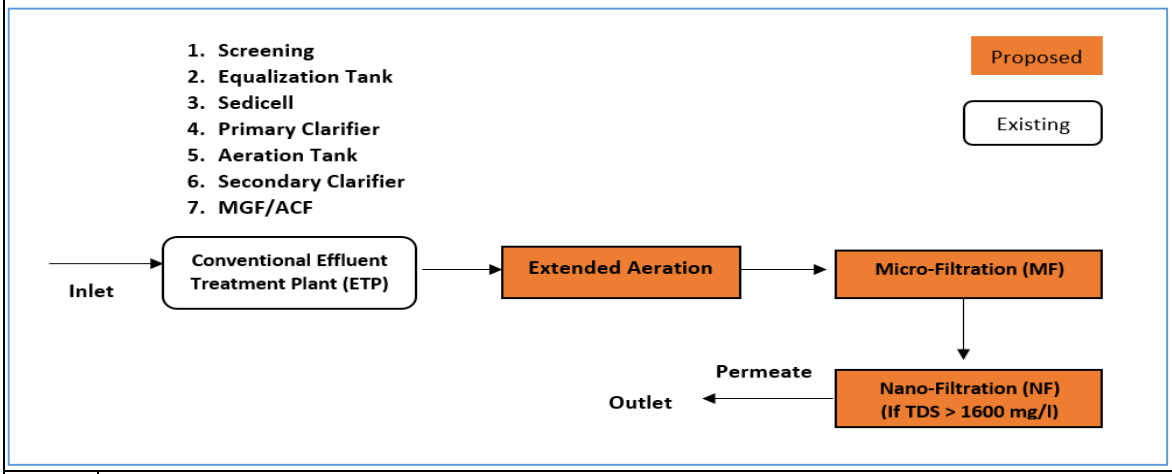

3.2.	Explore other advance technologies available like advance oxidation, membrane filtration, electro-oxidation etc. to ensure consistent compliance with stipulated discharge norms (Optional)

The experts further recommended for general measures to be adopted by Pulp & Paper industries, SPCBs, and industry associations as mentioned below in Table 12 and Table 13:

Table 12: Suggestive general measures to be adopted by Pulp & Paper industries, SPCBs, and industry associations

S. No.	Action Points	Executing agency	Nature (Mandatory/ Optional)	Timeline for execution
General suggestive measures for all Pulp & Paper industries				
1.	Install flow meter with totalizer (electromagnetic, ultrasonic etc.) at ETP Inlet, ETP outlet, effluent recycle line at ETP and effluent reuse point in process, and maintain logbooks for the same on daily basis	All Pulp & Paper industries	Mandatory	03 month
2.	Install separate flow meter with totalizer (electromagnetic, ultrasonic etc.) at all freshwater consumption points such as process area, domestic consumption and boiler, and maintain logbooks for the same on a daily basis	All Pulp & Paper industries	Mandatory	03 month
3.	Installation of fine screen (ex. Rotary drum screen) at ETP inlet for separation of plastics (or other floating materials)	All Pulp & Paper industries	Mandatory	03 months
4.	Installation of Mechanical Sludge Dewatering System	All Pulp & Paper industries	Mandatory	03 months
5.	Creation of an appropriate Hazardous Waste Storage Facility	All Pulp & Paper industries	Mandatory	03 months
6.	Green Belt Development as per consent	All Pulp & Paper industries	Mandatory	12 months
7.	Installation of Piezometer at 3 identified locations in and around the mill site	All Pulp & Paper industries	Mandatory	03 months
8.	ETP lab upgradation	All Pulp & Paper industries	Mandatory	06 months
9.	Improve Operation & Maintenance of ETP (i.e. MLSS > 2000 mg/l, DO – 2 ppm, MLVSS/MLSS ratio – 0.6 to 0.8)	All Pulp & Paper industries	Mandatory	-
10.	Installation of DO sensor (with display) in the aeration tanks to optimize the power consumption of air blowers	All Pulp & Paper industries	Optional	-
11.	Ensure marking and color coding of all ETP lines and dismantle the unnecessary pipelines near the ETP area	All Pulp & Paper industries	Mandatory	03 months
12.	Water Balance & Material Balance	Waste paper/recycled fiber-based industries (C1 & C2) operating on ZLD	Mandatory	Within 6 months after upgradation of ETP
13.	ETP Adequacy Assessment & Performance Evaluation	All Pulp & Paper industries	Mandatory	

S. No.	Action Points	Executing agency	Nature (Mandatory/ Optional)	Timeline for execution
14.	Installation of on-line TDS / Turbidity meter at inlet and all recycling lines and linked to CPCB/SPCB Server	All Pulp & Paper industries operating on ZLD	Mandatory	03 months
General suggestive measures for SPCB and Industry associations				
15.	Installation of real-time ambient air quality monitoring station in industrial clusters and real-time effluent monitoring system in major recipient drains in the cluster	SPCB	Optional	45 days
16.	Stop purging of untreated/partially treated effluent by waste paper based industries operating on ZLD	SPCB and Industry	Mandatory	
17.	Carry out a feasibility study (Effluent characteristics & load, the topography of the industrial area, land availability, etc.) for the requirement of a Common Effluent Treatment Plant (CETP) with advanced technologies in industrial clusters in consensus with the operating industries in the area	SPCB and Industry Association	Optional	06 months
18.	Explore the possibility of setting up of Constructed Wetland System based on the topography and wastewater characteristics of major recipient drains in clusters	SPCB, Industry associations, and expert agencies like CEMDE or others	Optional	3-6 months
Action Plan for scientific management & disposal of non-paper solid waste i.e. Plastic Waste, Boiler Ash, ETP Sludge				
19.	Cluster-based approach in consultation with SPCBs for management of non-paper solid wastes.	SPCB and Industrial Cluster	Mandatory	1 month
20.	Establishment of a manifest system for environmentally safe collection, storage, handling, transfer, and disposal of plastic waste/boiler ash/ETP sludge	SPCB and Industrial Cluster	Mandatory	1 month
21.	Scientific management of boiler ash (generated from the combustion of coal as well as non-coal as fuel) as per CPCB guidelines titled "Guidelines for disposal/utilization of Fly Ash for reclamation of Low Lying Area and in stowing of Abandoned mines/Querries", March 2019	Industrial Cluster	Mandatory	2 months
22.	Action plan for the management of non-paper solid waste namely, Plastic Waste, Boiler Ash, ETP Sludge, and surface drain	Industrial Cluster	Mandatory	2 month
23.	Plastic waste disposal through authorized recyclers/ waste to energy plants/co-processing plants, having registration on EPR portal developed by CPCB, valid EPR certificate issued by CPCB/SPCB and valid Consent to Establish (CTE) &	Industrial Cluster	Mandatory	2 month

S. No.	Action Points	Executing agency	Nature (Mandatory/ Optional)	Timeline for execution
	Consent to Operate (CTO) issued by SPCBs.			
24.	Waste Generation and Record-Keeping	Industrial Cluster	Mandatory	2 months onwards
25.	Verification of end-to-end waste disposal	SPCB	Mandatory	2 months onwards
26.	Data Management and Reporting	Industrial Cluster	Mandatory	2 months onwards
27.	Use of boiler ash for other beneficial purposes such as reuse in: a. manufacturing of building materials such as bricks, blocks, tiles, fibre cement sheets, pipes, boards, panels, ash & geo-polymer based construction material b. manufacturing of cement and Ready Mix Concrete (RMC) c. construction of road and fly over embankment d. agriculture in a controlled manner based on soil testing e. any other eco-friendly purpose as notified time to time	Industrial Cluster	Optional	2 months onwards

Table 13: Suggestive measures for fuel & energy saving, and improvement in process safety (optional)

Sl. No.	Applicable area
1.	**Fuel and Energy consumption saving (Optional)**
1.1.	**Suggestive Techniques for saving:**

S. No.	Technique	Applicability
a.	Use an energy management system that includes all of the following features: Assessment of the mill's overall energy consumption and production Locating, quantifying and optimising the potentials for energy recovery Monitoring and safeguarding the optimised situation for energy consumption	Generally applicable
b.	Recover energy by incinerating those wastes and residues from the production of pulp and paper that have high organic content and calorific value.	Only applicable if the recycling or reuse of wastes and residues from the production of pulp and paper with a high organic content and high calorific value is not possible
c.	Cover the steam and power demand of the production processes as far as possible by the cogeneration of heat and power (CHP)	Applicable for all new plants and for major refurbishments of the energy plant. Applicability in existing plants may be limited due to the mill layout and available space

	d.	Use excess heat for the drying of biomass and sludge, to heat boiler feed water and process water, to heat buildings, etc.	Applicability of this technique may be limited in cases where the heat sources and locations are far apart
	e.	Insulate steam and condensate pipe fittings	Applicable to both new and existing plants for all grades of paper and for coating machines, as long as medium pressure steam is available
	f.	Use energy efficient vacuum systems for dewatering	Generally applicable
	g.	Use high efficiency electrical motors, pumps and agitators	
	h.	Use frequency inverters for fans, compressors and pumps	
	i.	Match steam pressure levels with actual pressure needs	

1.2. **Additional measures for energy saving:**

a. High dry solid content of bark, by use of efficient presses or drying
b. High efficiency steam boilers, e.g. low flue-gas temperatures
c. Effective secondary heating systems
d. Closing water systems, including bleach plant
e. High pulp concentration (middle or high consistency technique)
f. High efficiency evaporation plant
g. Recovery of heat from dissolving tanks e.g. by vent scrubbers
h. Recovery and use of the low temperature streams from effluents and other waste heat sources to heat buildings, boiler feed water and process water
i. Appropriate use of secondary heat and secondary condensate
j. Monitoring and control of processes, using advanced control systems
k. Optimize integrated heat exchanger network
l. Heat recovery from the flue-gas from the recovery boiler between the ESP and the fan
m. Ensuring as high pulp consistency as possible in screening and cleaning
n. Use of speed control of various large motors
o. Use of efficient vacuum pumps
p. Proper sizing of pipes, pumps and fans
q. Optimized tank levels

2.	**Process Safety Management**	
2.1.	**Process safety information**	• The unit shall complete a compilation of written process safety information before conducting any process safety hazard analysis • Information/safety instructions shall be placed on each equipment and workplace
2.2.	**Process Hazard Analysis**	• Process Hazard Analysis requires that engineers and maintenance leaders analyze the consequences of safety failures. • Analyses must be conducted in teams, and OSHA requires that each team must include one person who is "knowledgeable in the specific process hazard methodology being used." • MSDS of each hazardous chemical shall be available
2.3.	**Safety training**	• Safety training of all employees/workers shall be carried out regularly
2.4.	**Incident investigation**	• OSHA's state standard calls for investigations for all incidents that result in—or could have resulted in—a catastrophic highly hazardous

		chemical release. Because of that ambiguous wording, cautious companies must keep every potential HHC-related scenario in mind.
2.5.	**Emergency planning and response**	• Even minor chemical releases can lead to major incidents. This element mandates employers to create emergency plans for handling smaller HHC releases
2.6.	**Compliance audits**	• According to the PSM-NEP, "Employers shall certify that they have evaluated compliance with the provisions of this section at least every three years to verify that the procedures and practices developed under the standard are adequate and are being followed." This element also requires employers to retain at least their two most recent audit reports

2.7. Suggestive Checklist for ensuring Process Safety:

S. No.	Points to be implemented related to Safety Provisions
1.	Develop and implement the Safety Policy that ensures the involvement, commitment, and role modeling of Senior Management for Process Safety
2.	Appoint/ Assign a person as a Process Safety Coordinator who will ensure and monitor that the PS-related activities are being performed.
3.	Create and foster a culture that protects the person in reporting unsafe conditions and do the right thing.
4.	Encourage / Ensure compliance with relevant engineering standards while executing projects, procurement, and plant activities like startup and shutdown.
5.	Identify the critical positions responsible for the critical process safety decision and determine the competency required.
6.	Implement the competency build-up program through internal/ external training to comply with the requirement of competency in safety-critical positions.
7.	Implement the Knowledge management program which ensures the availability and accessibility of all process safety information like plant layout, Hazardous chemicals inventories, Chemicals Compatibility, P&ID and PFD, Material and Energy balance, etc.
8.	Develop a plan and conduct the Hazard and Operability (Hazop) study to determine the risk scenarios and develop the emergency response plan against each significant scenario.
9.	Ensure availability of Standard Operating Procedures for all routine activities like Plant Startup, shutdown, emergency shutdown, emergency startup, and equipment handover for maintenance.
10.	Develop and implement the Preventive and Predictive Maintenance program to ensure Asset Integrity.
11.	Implement the Safety Work Permit System for all non-routine activities.
12.	Implement contractor control management to ensure the selection of capable suppliers of materials and services. Inadequate contract management may cause of receipt of inferior quality material or manpower.
13.	Implement a training management system to ensure the identification, imparting, and assessment the performance after imparted training.
14.	Implement Management of the change process to ensure assessing the hazards and implementing adequate measures before implementing any change in process or organization.
15.	Implement the system to carry out the Pre-Startup Safety Review (PSSR) before putting the change in operation or plant startup after normal/ emergency shutdown to ensure that all safety systems are in line and effective.
16.	Encourage the Operational Discipline for plant operation, charge handover, and PS-related activities and implement the consequence management against willful violation.
17.	Develop the emergency response plan considering the failure of all barriers and

		conduct the mock drill to check the preparedness.
	18.	Develop and implement the Process Safety Incident Management System for incident reporting, investigation, and effective action implementation. Am
	19.	Identify the indicators and monitor them regularly to assess the level of Process Safety Management implementation.
	20.	Conduct periodic audits to check the effectiveness of PSM implementation.
	21.	Carry out the periodic review of indicators and audit observations to allocate the required resources based on a risk-based approach.
Note:	Effluent "Discharge" shall mean the effluent leaving the outlet of the final wastewater treatment stage and will include any volumes applied on land within the mill premises or anyother mill-owned lands. Such application on land shall not be drawn from any other point before the outlet of the final wastewater treatment stage.	

3.8. PLAN OF ACTIVITIES

a. Facilitation of Charter

Activities	Action By	Time schedule
Communication of Charter 3.0 to all Pulp & Paper industries operating in main stem states of rivers Ganga & Yamuna	SPCBs	Within 01 month after receiving final version from CPCB
Identification of third party technical institutes, such as IITs, CPPRI, etc., etc. to facilitate the charter implementation and coordination	Industries and industry associations	Within 01 month after receiving communication from SPCB

b. Technological & Process Improvements

Activities	Action By	Time schedule
Self-Assessment: Inventory of existing process technologies & practices, identification of upgradation requirement and preparation of action plan for upgradation with supporting document & pert chart	Industries	45 days
Third Party Evaluation & Validation: Evaluation/ validation of the reports on inventory, upgradation requirements and submission of action plan to SPCB	Industries/Third party	Two months
Implementation of action plan envisaged as submitted to SPCB	Industries	As per schedule
Submission of monthly progress reports to Third Party/ SPCB	Industries	Monthly basis
Regulatory review: Verification of the progress	SPCBs	Monthly basis

c. Water Conservation & Water Recycling

Activities	Action By	Time schedule
Self-Assessment: Preparation of report of existing water consumption- section wise, reuse/ recycle practices; Preparation of work plan to achieve fresh water requirement targets	Industries	One month
Third Party Evaluation & Validation: Evaluation/ validation of the work plan for implementation of water consumption standards	Third party/SPCBs	Two months

Implementation of action plan	Industries	As per schedule
Submission of progress reports to Third Party/ SPCB	Industries	Monthly basis
Regulatory review: Verification of the progress	SPCBs	Monthly basis

d. Assessment, augmentation and upgradation of ETPs as per BMT specified in this Charter

Activities	**Action By**	**Time schedule**
Self-Assessment: Preparation of work plan including design/drawings for upgradation/augmentation of ETP as per BMT specified in this Charter	Industries	One month
Third Party Evaluation & Validation: Evaluation/ validation of adequacy of proposed augmentation/ up-gradation plan, design/ drawings	Third party/SPCBs	Two months
Implementation of work plan	Industries	As per schedule
Submission of progress reports to Third Party/ SPCB	Industries	Monthly basis
Regulatory review: Verification of the progress	SPCBs	Quarterly basis

e. Monitoring & Surveillance of Environmental Compliance

Activities	**Action By**	**Time schedule**
Stop purging of untreated/partially treated effluent by waste paper based industries operating on ZLD	SPCB & industries	45 days
Self-Assessment: ETP performance monitoring by individual Mills and maintenance of Log Book	Industries	Daily basis
Submission of the performance report of individual mill to third party/ SPCBs	Industries	Monthly basis
Review meetings of Mills/ third party & SPCBs to help mills to improve ETP performance & sample analysis quality	Third Party & SPCB	Quarterly basis
Regulatory Monitoring: Surprise inspections	SPCBs	Quarterly basis
Organising training programmes on process technology, best practices, ETP operation & maintenance, Sample analysis etc.	Third Parties/ SPCBs / CPCB	Half yearly basis