

# Reducing Environmental Footprint Through Holistic Approach - A Case Study Of Pulp & Paper Mills In Kashipur Cluster

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## ABSTRACT

With creation of state of Uttarakhand in 2000, and subsequently increased focus on promoting industrialisation through providing tax concessions / exemptions, cheap power etc, Kashipur became one of the most important industrial hub in the state specially in context of pulp and paper mills. Today Kashipur is a major pulp and paper industrial cluster in Uttarakhand comprising of over 24 pulp and paper mills. Among these 25% are agro based mills while 75% are waste paper based mills. From product point of view around 17 pulp and paper mills i.e. 70% are packaging pulp and paper mills producing packaging grade i.e. both kraft paper and duplex grade etc. The industrial growth in Kashipur gradually resulted in environmental implications specially in context of pollution of river Ramganga a tributary of River Ganga as Kashipur is situated in Ganga river basin. The discharge from partially treated or untreated effluent / black liquor from pulp and paper mills of Kashipur was identified as one of the major reason of pollution of river Ganga a downstream and with increased regulatory pressure the survival of most of the mills was under cloud. It was in this perspective a proactive approach or initiative by pulp and paper mills in Kashipur Cluster was undertaken under guidance / technical support from CPCB & CPPRI to implement strategies and measures for technological, process and ETP upgradation as well as strategies to reduce water consumption under Charter for Water Recycling & Pollution Prevention in Pulp & Paper Industries. The improvement in environmental compliance can be judged from the fact that unlike previous years when the mills in Kashipur had to shut down their operation under direction from regulatory authorities to clean river Ganga & its tributaries during festival down stream, since 2013 the mills in Kashipur are operating without any interruption or shut down. The paper highlights the journey and achievements of the pulp and paper mills of Kashipur to achieve environmental sustainability.

## INTRODUCTION - BRIEF PROFILE OF PULP & PAPER INDUSTRIAL CLUSTER IN KASHIPUR

In last one decade or so Kashipur in Uttarakhand has emerged an important pulp and paper mill cluster. The mushroom growth of pulp and paper mills in this cluster

has been attributed towards the state's focus on providing favourable climate for industrial growth and investment through incentives like tax concessions, regular power at cheaper rate etc. In addition to favourable industrial policy of the state, Kashipur's strategic location in context of transport, Connectivity, manpower availability, ground water / river water availability etc also contributed in the growth of the pulp and paper sector in Kashipur cluster. At present there are over 24 pulp and paper mills based on

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agro residues and waste paper and producing a variety of grades of paper like writing and printing, newsprint, packaging (kraft and duplex board) and other specialty grades of paper. Among these mills over 17 mills are producing only packaging grade of paper mainly from waste paper in view of ever increasing demand and market for packaging paper. The pulp and paper mills in this cluster are of varying production capacity ranging from 50 – 250 tpd. Among these mills around 70 % of the mills produce packaging grade of paper like kraft paper and duplex board. One of the major reason in domination of packaging paper mills is the evergreen market / better margin in packaging grade of paper compared to writing and printing grade/newsprint.

The growth of Kashipur as pulp and paper industrial cluster resulted in increased employment opportunities (direct and indirect) as well as the economic growth of the region. However this industrial / economic growth came with a price. Being located in River Ganga Basin the discharge of untreated / partially treated industrial effluent (90 % of which was reported to be from Pulp & Paper mills) into the local rivulets namely Dhela, Bahela Kosi and which ultimately meet river Ramganga and finally River Ganga downstream led to significant environmental impact on river water quality as well as aquatic life. Being located in Ganga River Basin and the fact the major waste water discharge into river Ramganga is from pulp and paper mills of this cluster leading to significant impact on River Ganga, the Kashipur's pulp and paper mills are under constant environmental scrutiny by regulatory authorities, NGOs and other stake holders specially after River Ganga was declared as National river in 2008 and setting up of National Ganga River Basin Authority (NGRBA) to plan finance, monitor and coordinate activities related to rejuvenation of River Ganga. NGRBA has resolved under Mission Clean Ganga that no untreated effluent /municipal sewage will be allowed to be discharged under River Ganga by 2020.

### TECHNOLOGICAL & ENVIRONMENTAL STATUS OF PULP & PAPER MILLS IN KASHIPUR

Prior to 2012, though Kashipur got established as an important pulp and paper mill cluster however the technological and environmental status of most of the mills was very poor. As almost all the mills were set up by local private players with limited capital and thus mostly second hand imported or locally fabricated equipments and technologies were preferred from economics point of view while compromising with resource and energy efficiency and environmental compliance as compared to modern fiberline technologies. Consequently the mills in this cluster were on same page in terms of high level of fresh water

and consequently high volume of waste water discharged as well as generated high pollution load. Apart from just 2-3 mills producing writing and printing grade of paper which had conventional / modified chemical recovery process, all the packaging grade agro based mills were discharging black liquor with partial treatment or without treatment. Though most of the mills were having ETP facilities but majority of them were inadequate to handle and treat the effluent to comply discharge norms. An estimated pollution load generated from Pulp and Paper Mills in Kashipur Cluster is indicated in Fig 1. In all, most of the mills (except a few exceptions) were having serious issues / crisis in terms technological competitiveness and frequent environmental non-compliance. Being located in sensitive Ganga River basin, these mills were under high regulatory pressure and surveillance and their sustainability was at stake.

### CHARTER FOR WATER RECYCLING & POLLUTION PREVENTION IN PULP & PAPER INDUSTRIES OF GANGA RIVER BASIN

It was in this critical circumstances where the sustainability of pulp and paper industries was at stake a **Charter for Water Recycling & Pollution Prevention in Pulp & Paper Industries of Ganga River Basin** was formulated by CPCB in consultation with CPPRI, IITs, SPCBs of Uttarakhand and Uttar Pradesh and Industry Associations, for over 80 Pulp & Paper Mills operating in five identified clusters including Kashipur. The Charter involved an integrated multi-disciplinary approach for achieving sustainability and environmental in Pulp & Paper industries by focusing on

- **Revision of norms which were stringent than existing national norms**
- **Process optimisation**
- **Adoption of best practices**
- **Technology up-gradation**
- **ETP upgradation including tertiary treatment.**

### SALIENT FEATURES OF CHARTER

Charter outlined a time bound road map / action plan with specific and clearly demarcated responsibilities to the major stake holders viz mill association, CPPRI, State & Central Pollution Control Board. While the mills were required to achieve charter compliance related to different

requirements as indicated above technological and process up gradation, fresh water conservation and ETP up gradation within fixed time frame of 15 days to 8 months, CPPRI (as third party) and respective state pollution control boards were assigned the initiative to regular monitor the progress of charter compliance / implementation status by each mill. CPCB / SPCB and CPPRI along with Paper Unit Chapter of Kumaon Garhwal Chamber of Commerce & Industry (KGCCI), worked synergistically to monitor the Charter progress as well as providing necessary guidance on various issues related to timely compliance of Charter requirements. CPPRI also provided training on basics of ETP operations, waste water analysis to mill personnel recruited for ETP monitoring. As indicated above the step wise multi disciplinary approach adopted in Charter included:

**(I) Formulation of Fresh water & Discharge norms (based on Best Available Technology and Best Achieved Level in the Paper)**

The Charter took a bold step in formulating the fresh water consumption norms along with revising the waste water discharge norms which were more stringent than the existing national norms. Further another unique feature of the Charter was notification of separate discharge norms including colour for mills producing chemical pulp and RCF based mills. The Charter norms are indicated in Table 1 & 2

**Table 1 : Fresh Water Consumption & Waste Water Discharge Norms**

Category	Fresh Water Consumption Norms	Waste Water Discharge Norms
<b>A1: Agro Based</b> Writing & Printing Paper mills	60	50
<b>A2: Agro Based</b> Kraft paper mills	40	30
<b>B1: RCF Based</b> Writing & Printing Paper, Duplex board, newsprint	20	15
<b>B1: RCF Based</b> Kraft paper mills	15	10

**Table 2: Treated Effluent Quality Norms**

Parameters	Agro Based Mills	RCF based Mills
pH	6.5-8.5	6.5-8.5
TSS, mg/l	<75	<75
COD, mg/l	<250	<225
BOD, mg/l	<30	<30
Colour, PCU	<500	<250

To achieve the new fresh water and discharge norms, the mills were required to undertake a systematic and methodical approach involving:

- **Reduction in Fresh Water Consumption & Improve Water Conservation**
- **Process Upgradation &**
- **ETP Upgradation**

The various strategies / approach adopted in the above areas to assist the mills in achieving the charter norms are summarised as under:

In addition other important feature of the charter were mandatory requirement of maintaining log books for daily recording of Fresh Water Consumption, Waste Water Discharge, Energy Consumption in ETP, Chemical Consumption in ETP, Waste Water Analysis with an aim to help both the mills as well as regulatory authorities in monitoring the operation and performance of ETP on regular basis. Focus on creation of ETP lab facility with trained manpower for monitoring of ETP was an important step towards helping these mills in achieving optimum performance efficiency of ETP.

**CASE STUDY : IMPACT OF CHARTER IMPLEMENTATION IN KASHIPUR CLUSTER**

Implementation of Charter proved to be a blessing in disguise as the implementation of the Charter not only helped the pulp and paper mills of this cluster in achieving environmental compliance and sustainability but also provided direct and indirect savings through improvement in resource conservation, process efficiency, water and energy conservation as well as improvement in product

Strategies / Mandatory Requirement Under Charter		
Fresh Water Conservation	Process Up gradation	ETP Upgradation
<ul style="list-style-type: none"> <li>• Calibrated flow meter device at bore well and distribution pipe lines ,</li> <li>• Availability of fresh water reservoir</li> <li>• Installation of flow meter at ETP discharge or availability of calibrated V notch</li> <li>• Replacement of existing fresh water showers with new efficient showers of specified diameter</li> <li>• Increased reuse / recycle of back water / treated effluent</li> <li>• Installation of fiber recovery units like Krofta / Sedi Cell/ Poly disc filter.</li> </ul>	<ul style="list-style-type: none"> <li>• Wet Washing System ,</li> <li>• Screw press / belt press/ vacuum , pressure or diffuser washer for black liquor extraction ,</li> <li>• Oxygen Delignification + with Elemental Chlorine bleaching (conventional bleaching) or</li> <li>• ECF bleaching for agro based mills producing bleached grade of paper,</li> <li>• Chemical Recovery Plant or Common Chemical Recovery plant.</li> </ul>	<ul style="list-style-type: none"> <li>• Mandatory ETP Adequacy assessment,</li> <li>• Provision of equalisation tank,</li> <li>• Construction / Up gradation of Primary Clarifier to achieve SS level &lt; 200 mg/l ,</li> <li>• Availability of adequate aeration in aeration tank through surface / diffused aeration</li> <li>• Development of MLSS level ( 2000-3000 mg/l)</li> <li>• Installation of tertiary treatment system (Pressure Sand Filter/ Dual Media Filter/ Activated Carbon Filter/ Micron Filter / Spray Filter etc ) for RCF based mills</li> <li>• Physico- chemical treatment + Pressure Sand Filter/ Dual Media Filter/ Activated Carbon Filter for agro based mills</li> <li>• Provision of separate electricity meter at ETP</li> <li>• Availability of ETP lab facility with trained manpower and equipments</li> <li>• Creation of Environment Management Cell (EMC).</li> </ul>

quality which are summarised as under. **Table 3** and **Figures 1-3** reflects the complete change over in the technological and environmental status of pulp and paper mills of Kashipur due to Charter implementation.

As indicated above, the impact of charter implementation in Kashipur Cluster both on technological front as well as from environmental compliance point of view has been significant and very encouraging. The reduction achieved in

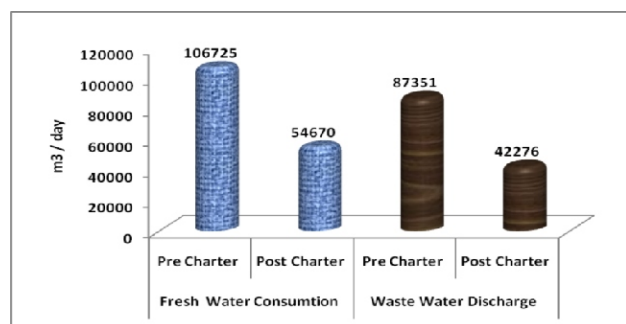
over all pollution load through Charter implementation is summarised in **Fig 4**.

**KEY RIDERS IN ACHIEVING OF ENVIRONMENTAL SUSTAINABILITY OF KASHIPUR CLUSTER THROUGH CHARTER IMPLEMENTATION**

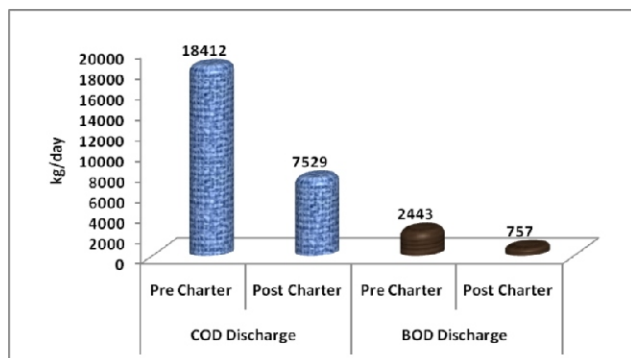
The major factors / riders for above success achieved by Kashipur Pulp & Paper are summarised as under :

**Table 3 : Comparative Technological & Environmental Status of Kashipur Cluster - Before & After Charter Implementation**

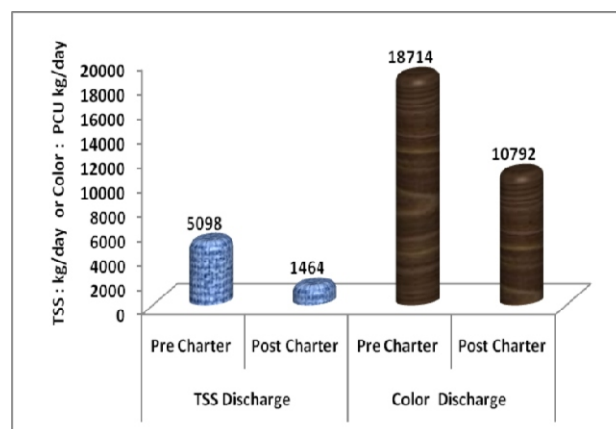
Particulars	Number of Mills : 25	
	Before Charter	After Charter
Availability of Fiber Recovery System	9	All
Satisfactory ETP Operation with adequate MLSS	5	All
Availability of Tertiary Treatment System	Nil	All
Availability of V notch at ETP outlet	4	All
ETP lab facility , trained Manpower	3	All
Fresh Water Consumption , m <sup>3</sup> /day	106725	54670
Waste Water Discharge , m <sup>3</sup> /day	87351	42276
TSS , kg/ day	5098	1464
COD ,kg/ day	18412	7529
BOD ,kg/ day	2443	757
Colour, kg/day	18714	10792



**Fig 1. Reduction in Freshwater Consumption & Waste Water Discharge due to Charter Implementation**



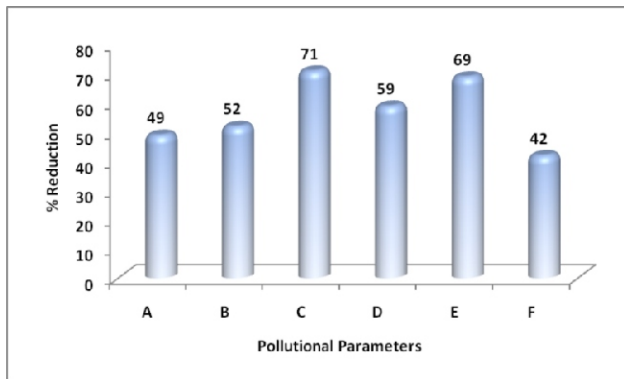
**Fig 2. Reduction in COD & BOD Discharge due to Charter Implementation**



**Fig 3. Reduction in TSS & Color due to Charter Implementation**

**Reduction in Fresh Water Consumption and Waste Water Discharge**

- Improved monitoring of fresh water consumption due to mandatory installation of flow meters on borewell (which has also resulted in red)
- Installation of Fiber recovery system



A: Fresh Water Consumption B: Waste Water Discharge  
 C: Total Suspended Solids ( TSS)  
 D: Chemical Oxygen Demand ( COD) ,  
 E: Biological Oxygen Demand ( BOD), F: Color

**Fig 4 : Percentage Reduction in Pollution Load in Kashipur Cluster after Charter Implementation**

- Installation of tertiary treatment system after secondary clarifier overflow

**Reduction in Pollution Load**

**Reduction in TSS**

- Installation of system for fiber recovery viz Sedicell, Dissolved air floatation system (DAF), Save all , Poly Disc Filters etc.
- Up gradation of Primary / Secondary Clarifiers

**Reduction in COD & BOD**

- Adoption of Chemical recovery System by agro based mills for black liquor management
- Adoption of Oxygen Delignification and Chlorine Dioxide ( ECF) Bleaching by few agro based mills in Kashipur Cluster.
- Upgradation of existing ETP including installation of aerators ( diffused / surface) and development of required MLSS level
- Installation of tertiary treatment system for increased reuse/ recycle of treated effluent as well as compliance to Charter norms.

- Regular ETP monitoring through creation of ETP lab facilities in individual mills

**Reduction in Color Level**

- Improved control and reduced spillages
- Adoption of oxygen delignification and chemical recovery by agro based mills
- Adoption of Tertiary Treatment system

In addition to achieving environmental sustainability the mills have been directly or indirectly benefitted by

- Saving of ground water (17178150 m<sup>3</sup>/ annum approx)
- Resource conservation through improved fiber recovery efficiency by mandatory installation of fiber recovery system
- Improved operational efficiency in terms of resource conservation , energy and water consumption , waste water discharge and pollution load generated due to process and ETP upgradation , water conservation, optimisation of process operation and efficient ETP monitoring
- Creation /Availability of trained manpower

**FUTURE CHALLENGES**

Though the success of Charter Implementation by Kashipur mills is highly encouraging but there are new challenges to be addressed. These include:

**– Compliance of Further Stringent norm under Phase II**

The Charter has been revised and updated in 2014 and is being extended to over 200 pulp and paper mills operating in Ganga River Basin of 9 states namely, **Uttar Pradesh, Uttarakhand, Haryana, NCT of Delhi, Madhya Pradesh, Chattisgarh, Jharkhand, Bihar and West Bengal.** The major highlights of the new Charter are that the revised version or Charter Phase II has included under its purview /scope **wood based mills and speciality paper mills** also as well as the norms related

## (I) Fresh Water Consumption &amp; Effluent Discharge Norms for Pulp &amp; Paper Mills in Ganga River Basin States

Category	Fresh Water Consumption, m <sup>3</sup> / t paper		Waste Water Discharge, m <sup>3</sup> / t paper	
	Short Term March 2016	Long Term March 2017	Short Term March 2016	Long Term March 2017
A1: Wood Based Pulp & Paper Mills producing bleached grades of chemical pulps, papers, paperboards & newsprint	60	50	50	40
A2: Wood Based Pulp & Paper Mills producing unbleached grades of chemical pulps, papers and paperboards	40	25	30	20
B1: Agro Based Pulp & Paper Mills producing bleached grades of chemical pulps, papers, paperboards & newsprint	60	50	50	40
B2: Agro Based Pulp & Paper Mills producing unbleached grades of papers and paperboards	40	25	30	20
C1: RCF & Market Pulp Based Paper Mills producing bleached grades of papers, paperboards & newsprint	20	15	15	10
C2: RCF & Market Pulp Based Paper Mills producing unbleached grades of papers and paperboards	15	10	10	06
D : RCF & Market Pulp Based Specialty Paper Mills#	60	50	50	40

Note : Effluent "Discharge" means effluent leaving the outlet of final wastewater treatment stage and includes volumes applied on land within the mill or other mill-owned land. Such application on land is not be drawn from any point before the outlet of the final wastewater treatment stage.

## (II) Norms for Treated Effluent Quality for Pulp &amp; Paper Mills in Ganga River Basin States

Parameters	Integrated Pulp & Paper Mills manufacturing Chemical Pulp	RCF and Market Pulp Based Pulp & Paper Mills
	Norms	Norms
pH	6.5-8.5	6.5-8.5
TSS, mg/l	30	30
BOD, mg/l	20	20
COD, mg/l	200	150
TDS, mg/l	1800	1600
Colour, PCU	250	150
AOX, mg/l	8	-
SAR	10	8

to fresh water consumption, waste water discharge and pollution load under Charter Phase II are comparatively much stringent than Phase I. The new norms to be complied under the revised Charter are as under :

Note : Effluent "Discharge" means effluent leaving the outlet of final wastewater treatment stage and includes volumes applied on land within the mill or other mill-owned land. Such application on land is not be drawn from any point before the outlet of the final wastewater treatment stage.

**– Zero Liquid Discharge to River**

The revised charter also envisages , zero effluent discharge to recipient river streams through interception, diversion & disposal of treated effluent for irrigation purposes and to meet objectives of the National Mission for Clean Ganga. However zero liquid discharge to the river could be achieved by :

**(a) Utilisation of effluent for irrigation**

However unlike earlier scenario the mills are required to meet the prescribe charter norms before on land application of treated effluent for irrigation . Further utilisation of treated effluent for irrigation have to address issues related to land availability , farmer acceptability, monitoring of impact on ground water , soil quality, disposal issue during lean period when there is no requirement of water for irrigation etc

**(b) Reuse and Recycling of treated effluent / back water**

Removal of color & TDS in treated effluent or back water which is the major bottleneck in complete reuse and recycle of back water leading to zero liquid discharge as envisaged by NMCG . Increased reuse and recycle of back water / treated effluent results in increase of COD & TDS level which may create an adverse impact on process operations, equipments as well as product quality. However the mills particularly producing bleached variety of paper, achieving ZLD requires major technological intervention which include application of membrane filtration systems like ultra , nano, reverse osmosis , photo oxidation , ozonisation etc along with conventional biological & chemical treatment systems so as to recover water of process water quality from treated effluent to facilitate

reuse / recycle of treated effluent and reduce fresh water consumption , waste water discharge , and overall impact on river water quality and ground water . However these kidney technologies itself have inherent environmental related issues which also needs to be addressed . These include :

- Problems of disposal of mother liquor and salts generated in membrane separation technologies for which cost effective solution is yet to be explored nor there are any existing waste management facilities which can receive these high toxic mother liquor and salts for environmentally safe disposal.
- Further , these kidney technologies consume valuable resource like (energy , and chemicals) which itself has cross medium environment impact.

Moreover , the feasibility of these technologies need to be demonstrated in Indian perspective especially in view of the imported origin of most of the technologies , low scale of operation of most of the mills , use of mixed raw materials , volume of effluent generated , capital , operational and maintenance costs

**CONCLUSION**

The Pulp and Paper mills of Kashipur Cluster have set an example in achieving environmental sustainability by successful implementation of Phase I of Charter on Water Recycling and Pollution Prevention in Pulp and Paper Industries in River Ganga Basin in just over 8 months time. The fact the mills are now not required to be closed by regulatory authorities during festive seasons itself indicate the level of improvement in environmental compliance and technological / environmental status of these mills. The mills are again proactively responding to the requirements of the revised Charter or Charter Phase II to achieve the more stringent norms.. There is a need for joint collaborative initiative to study the technical feasibility of the membrane technologies as well as other technologies which have been reported to effective on lab scale but their operational efficiency on mill scale specially in Indian perspective is still to be demonstrated to increase the confidence of the industry related to its potential and success.



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