LiFE
Lifestyle for Environment

COMPREHENSIVE CHARTER 2.0 FOR WATER CONSERVATION AND POLLUTION PREVENTION BY SUGAR INDUSTRIES

स्वच्छ पर्यावरण के लिए प्रतिबद्ध
IN PURSUIT OF CLEAN ENVIRONMENT
CPCB

CENTRAL POLLUTION CONTROL BOARD

JULY, 2024

ABBREVIATIONS AND ACRONYMS

ACF	Activated Carbon Filter
AT	Aeration Tank
IER	Ion Exchange Resin
%	Percentage
@	At the rate of
<	Less than
APCD	Air Pollution Control Device
APH	Air Pre-heater
ASP	Activated Sludge Process
BOD	Biological Oxygen Demand
BMT	Bare Minimum Technologies
CAQM	Commission for Air Quality Management
CGWA	Central Ground Water Authority
CO_2	Carbon Dioxide
COD	Chemical Oxygen Demand
Co-gen	Co-generation
CPCB	Central Pollution Control Board
CPU	Condensate Polishing Unit
CSTR	Continuous Stirred Tank Reactor
CTE	Consent To Establish
CTO	Consent To Operate
DCS	Distributed Control System
DO	Dissolved Oxygen
DSM Screen	Dutch State Mines Screen
DMR	Daily Manufacturing Record
DM Water	Demineralized Water
EBP	Ethanol Blending Policy
ENA	Extra neutral alcohol
EMC	Environmental Management Cell
EPR	Extended producer responsibility
ESP	Electrostatic Precipitator
ETP	Effluent Treatment Plant
G.S.R.	General Statutory Rules
HCL	Hydrochloric Acid
Hon'ble NGT	Honourable National Green Tribunal
hr	Hour
HW	Hazardous Wastes
i.e.	That is
IIT	Indian Institute of Technology
ITI	Industrial Training Institute
IMFL	Indian Made Foreign Liquor
kg/cm^2	Kilogram per square meter
L/T	Litre per ton

Lit	litre
m^2	Square meter
m^3	Cubic meter
Max.	Maximum
MF	Microfiltration
mg/l	Milligram per litre
mg/nm^3	Milligram per newton cubic meter
MGF	Multi Grade Filter
MLSS	Mixed Liquor Suspended Solids
MLVSS	Mixed Liquor Volatile Suspended Solids
MoEF&CC	Ministry of Environment Forest and Climate Change
MoJS	Ministry of Jal Shakti
MT	Metric Tonne
MTD	Metric Tonne Per Day
MVR	Mechanical Vapour Recompression
MW	Megawatt
NCR	National Capital Region
NMCG	National Mission for Clean Ganga
NO_2	Nitrogen Di-oxide
NOCs	No Objection Certificates
NSI	National Sugar Institute
^oC	Degree centigrade
O.A.	Original Application
OCEMS	Online Continuous Effluent System
PCDs	Pollution Control Devices
PCT	Process Cooling Tower
pH	Potential of Hydrogen
PI	Preparatory Index
PPM	Parts Per Million
PPE	Provision of personal protective equipment
PSM	Process Safety Management
RMC	Ready Mix Concrete
RME	Reduced Mill Extraction
RVF	Rotary Vacuum Filter
RBC	Rotary Bagasse Carrier
RO	Reverse Osmosis
SO_2	Sulphur Di-oxide
SOPs	Standard Operating Procedures
SPCB	State Pollution Control Board
SRS	Sulphate Removal System
TCD	Ton Crush per Day
TDS	Total Dissolved Solids
TPAs	Third Party Assessments
TPD	Tonne Per Day
TSDF	Treatment, storage and disposal facility

TSS	Total Suspended Solids
TVR	Thermal Vapour Recompression
UGR	Under Ground Reservoir
UASB	Up-flow Anaerobic Sludge Blanket Reactor
viz.	that is or namely
VSI	Vasantdada Sugar Institute
WTP	Water Treatment Plant
ISMA	Indian Sugar Mills Association
UPSMA	UP Sugar Mills Association

Contents

List of Tables

List of Figures

1. REGULATORY FRAMEWORK AND EVOLUTION OF SUGAR CHARTER

The Government of India vide Gazette Notifications dated January 15th, 2016 G.S.R. 35 (E) in exercise of the powers delegated by section 6 and 25 of the Environment (Protection) Act, 1986, notified the standards for sugar industries for quality of treated effluent. The discharge norms are tabulated below:

Table 1: Notified discharge standards under E(P)Act, 1986 for sugar industries

Industry	**Parameters**	**Standards (*All concentration values are in milligramme per litre except for pH*)**
Sugar Industry	pH	5.5 – 8.5
	Total Suspended Solids (TSS)	100 (for disposal on land) 30 (for disposal in surface waters)
	Biological Oxygen Demand, BOD (3 days at 27°C)	100 (for disposal on land) 30 (for disposal in surface waters)
	Oil & Grease,	10
	Total Dissolved Solids (TDS)	2100
	Final wastewater discharge limit	200 litre per tonne of cane crushed
	(Final treated effluent discharge restricted to 100 litre per tonne of cane crushed and Waste water from spray pond overflow or cooling tower blow down to be restricted to 100 litre per tonne of cane crushed and only single outlet point from unit is allowed.)	
	EMISSIONS	
	The particulate matter emissions from the stack shall be less than 150 milligram per normal cubic metre	

In these standards, the emphasis was only on effluent characteristics and discharge quantity. However, Sugar industry is water surplus industry where the water comes in system from Sugarcane (approx. 70%) which was not focused in notified norms.

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 sugar industries on water quality of river Ganga and its tributaries became a priority agenda before the regulatory agencies. Prior to crushing season 2017-18 most of the sugar industries in river Ganga basin were not having adequate and functional effluent treatment plants (ETPs) and were engaged in the disposal of untreated/partially treated effluent in waterbodies which was ultimately reaching river Ganga & its tributaries. The major reasons for adverse environmental impact of sugar industries on water quality of river Ganga and its tributaries were non-existence of functional & adequate ETPs, lack of process optimisation, intensive use of freshwater (250-350 L/T of cane crushed), lack of awareness and unskilled manpower for proper operation and maintenance of ETP and consequently high discharge of effluent etc. and most importantly lack of technical know-how to adopt desired infrastructure for treating the effluent so as to have control over the quantum and quality of effluent.

To address these issues, CPCB organised series of meeting with sugar industries and other stake holders during 2017-2018. In these meetings it was decided that all the sugar industries situated in the Ganga Basin shall up-grade the effluent treatment facilities at their end and will get Effluent Treatment Plant (ETP) adequacy reports and up-gradation plan prepared from reputed expert institutions. CPCB also constituted an Expert Committee comprising experts from NSI, IIT, VSI, Indian Sugar Mills Association (ISMA), UP Sugar Mills Association (UPSMA) and industry representatives.

The purpose of this initiative was to develop a self- regulatory approach amongst the industries for complying with the set standards, improvement of the quality of the discharged effluent and to minimize the specific freshwater consumption.

Accordingly, the “charter for effluent treatment by Sugar industries situated in river Ganga Basin” was formulated during 2018. The purpose of formulating the charter was to enforce appropriate technologies for effluent treatment in sugar industries in Ganga basin and to motivate them to accomplish desired level of environmental protection and achieve prescribed discharge norms so as to meet objective of clean river Ganga. The

Charter took a holistic approach for pollution prevention by emphasizing on process technology up-gradation, adoption of waste minimisation practices, besides quantum improvement in effluent treatment technologies including reduction in specific fresh water consumption requirement through water recycling and metering. The Charter also suggested Bare Minimum Technologies (BMT) as an indication of the set of desired technologies.

Meetings were organised under the chairmanship of Principal Secretary, Sugar industry and Sugarcane Development Department of Uttar Pradesh & Uttarakhand and Chairman, Bihar State Pollution Control Board with Sugar industries during 2018 to facilitate the industries and their associations for implementation of sugar Charter. Orders dated 17.07.2018, 30.07.2018 and 21.08.2018 were issued by State Sugarcane Development Departments of U.P, Uttarakhand and Bihar State Pollution Control Board, respectively for implementation of the Charter. Before the commencement of crushing season 2018-19, CPCB also issued directions under section 5 of Environment (Protection) Act, 1986 to Sugar Industries for implementation of the action points in line with the Charter recommendations.

In the first phase of the Charter implementation, the sugar industries were required to carry out adequacy assessment of ETPs, identification of the gaps in effluent management and downstream technologies. Accordingly, action plans were to be prepared to upgrade the technologies for ensuring compliance with the discharge norms. Thereafter, in the second phase, Evaluation/ Validation of above work plan was carried out by expert technical institutes in respect of implementation of the suggestions given in the adequacy assessment reports. The major highlights of the Charter are as below:

- Participatory approach to facilitate the industries for pollution control
- Third party involvement for planning, assessment, design and monitoring
- Upgradation of ETP upto tertiary treatment level
- Metering at water abstraction points, water use, waste generation and discharge points
- Adequacy of ETP and Water Audit by technical institutes
- Self-monitoring and reporting

- Maintenance of log books and record keeping
- Installation of Condensate Polishing Unit (CPU) where high pressure boiler (more than 45 kg/cm2 working pressure)
- Recirculation of water employed in SO_2 gas coolers massecuite cooling and elsewhere
- Use of surplus cooled condensate as make up water replacing fresh water
- Use of membrane-based technology to attain brine recovery
- Development of proper infrastructure for operation and maintenance of ETP
- Commissioning of mechanical sludge handling system of adequate capacity
- Preparation of Irrigation Management Plan
- Installation of OCEMS and its connectivity to CPCB and SPCB servers
- Development of Environmental Management Cell (EMC)

Successful implementation of Charter resulted in following:

- Reduction in specific fresh water consumption by 74% as compared to 2016-17. This resulted in saving of approx. 2500 million litres of fresh water in spite of increase in total production in 2022-23 with respect to 2016-17.
- BOD load has also reduced from 8.45TPD to 2.1TPD from 2017 to 2023.
- Sugar industries had prepared irrigation management plan for the utilization of treated effluent in irrigation.
- Augmentation & Updation of effluent treatment plants upto tertiary level.
- Metering at the various recycling points in the sugar process as well as at all water abstraction points along with ETP inlet and outlet point.
- Adequacy of effluent treatment plants by the sugar industries situated in the Ganga basin.
- Proper record keeping
- Installation of condensate polishing unit for the treatment of excess condensate for its further utilization in the sugar process
- Installation of Online Continuous Effluent Monitoring System (OCEMS)

2. CURRENT STATUS OF SUGAR INDUSTRY ON MAIN STEM OF RIVER GANGA AND YAMUNA

On the main stem of river Ganga and Yamuna around 155 nos. of sugar industries are located with crushing capacity range of 2500 to 16000 TCD as per the inventory of year 2024, which constitute about 22% of country's sugar sector. Sugar industries processes sugarcane as raw material to produce either sulphited or refined sugar., These industries are spread over the states of Uttarakhand, Haryana, Uttar Pradesh, Bihar & West Bengal. Out of 149 sugar industries inspected in the crushing season 2022-23, 115 (83 in river Ganga main stem states and 32 in river Yamuna main stem states) were found operational with an average crushing of around 646447.80 MT/day. Category wise number of operational sugar industries is shown in Table 2 below:

Table 2: Category-wise sugar data for the crushing season 2022-23

category / State	Standalone	Sugar with co-generation	Refinery	Refinery with co-generation
Uttarakhand	05	02	01	-
Haryana	02	06	-	01
Uttar Pradesh	34	36	07	19
Bihar	01	-	-	01
West Bengal	-	-	-	-
Total	42	44	8	21

3. CHARTER 2.0

3.1 NEED FOR CHARTER 2.0

Significant achievements have been observed over a period of time (from the year 2017 to 2023) in terms of the reduction in fresh water consumption, effluent discharge, treatment and management of sugar effluent and maintenance of effluent standards as well as energy saving in sugar sector due to the effective implementation of the charter 1.0. However, during various interactions, meetings, seminars held with Sugar industries certain issues pertaining to sugar industries emerged such as groundwater exploitation due to excessive freshwater consumption, high quantum of effluent generation, under capacity of ETP, sludge management, brine reject management, non-compliance w.r.t. stack emissions norms, untrained and inadequate manpower, storage and handling of press mud, handling and disposal of boiler/bottom & fly ash, poor performance of ETP & non-compliance with effluent discharge norms, difference in

treated water reuse opportunity because of factors like different plant configuration, type of molasses diversion, sugarcane variety and varying weather conditions during crushing season (November to April). Due to these issues, increase in number of legal litigation related to sugar industries was noticed. Therefore, it is high time to address these issues and hence, the charter needs to be updated in order to develop a more holistic and comprehensive version.

During recent inspections by CPCB officials 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 emerged:

3.1.1 Groundwater exploitation due to excessive freshwater consumption

The sugar industry is the sector where excess water enters the system from raw material since sugarcane contains 70% water which amounts to approx. 700-750 lit/tonne of cane crushed.

It has been observed that the sugar industries are using significant amount of freshwater, about 100-200 litres per ton of crushed cane from groundwater through bore wells. Sugar industries acquire 'No Objection Certificates (NOCs)' for three to six bore wells from the CGWA/State ground water department. The quality of groundwater in areas next to sugar industries has declined due to overexploitation and intensive irrigation in sugarcane field in the command areas. It has been found through a number of groundwater quality studies that the groundwater around sugar industries is becoming unfit for human consumption due to high levels of conductivity, hardness, alkalinity, sulphate and iron.

Therefore, usage of the large quantity of fresh water resource by sugar and its allied industries is a matter of concern. Hence, sugar industries need to explore the possibilities of optimizing the reuse and recycling of the excess condensate and treated effluent in the process. Groundwater overuse can be reduced with such utilization and initiatives.

The consumption of freshwater in sugar industries depends on various factors such as:

a) **Type of sugar category i.e. standalone, sugar with co-gen etc.**

Depending upon the configuration the range of freshwater consumption in sugar industries varies from 50-150L/ton of cane crushed. In the case of Standalone sugar industry, fresh water consumption is around 50-70 L/T of cane crushed. In the case of sugar sulphitation industry with co-generation, the range of fresh water consumption is approx.100-150 L/T of cane crushed. Similarly, in the case of sugar refinery industry with co-generation, the range of freshwater consumption is 100-150 L/T of cane crushed. Variation in freshwater consumption in different categories of sugar industries is mainly due to the variation in steam requirement and boiler feed water quality.

b) Type of boiler and mode of turbine operation

The choice between a high-pressure and a low-pressure boiler in a sugar industry largely depends on the size of industry, its energy needs, and its operational goals.

High-pressure boilers operate at pressures above 42 Kg/cm^2. The steam generated is at a higher temperature and pressure, making it highly efficient for power generation through turbines. High-pressure boilers are more suited to larger industries with higher energy requirements and a focus on maximizing electricity generation for internal use and revenue generation through power export. Modern sugar industries tend to favour high-pressure boilers due to their energy efficiency and potential to cut costs and generate additional revenue. Moreover, with increasing focus on sustainable practices, the efficient conversion of bagasse into both sugar and energy using high-pressure systems aligns well with environmental goals.

Low-pressure boilers typically operate at pressures below 42 Kg/cm^2. The steam generated is suitable for low power needs and is used primarily for process heating in various applications. They are mostly used in smaller industries where the scale and scope of operations justify a simpler, more cost-effective steam generation system.

In low pressure boilers, fresh water is only required for initiation of boiler operation, which is approx. 50 L/ton of cane crush. Thereafter, process condensate is utilized as a feed for steam generation. Whereas, in case of high pressure boilers freshwater consumption varies between 70-150 L/ton of cane depending upon the turbine operation mode i.e. back pressure mode and condensing mode.

In back pressure turbine mode, the steam exhausts at a higher and fixed pressure which can then be used directly in the sugar manufacturing process or for heating. This mode allows the turbine to generate both power and useful thermal energy (in the form of steam). While the electrical efficiency of back pressure turbines is lower than that of condensing turbines, they are more efficient in terms of overall energy utilization, as they cogenerate heat and electricity. This mode is ideal during the crushing season when there is significant demand for process steam in the mill for heating, evaporation, and other processes.

In condensing turbine mode, the steam is cooled in the condenser, turns back into water and is then returned to the boiler. This mode is designed to produce maximum electricity from the available steam. This mode is highly efficient in terms of electricity generation as it generates more power production per ton of steam. Condensing turbines are generally used when there is a more power generation and less need for process steam such as during non-crushing seasons or in mills where surplus power is sold to the electricity grid.

c) Seasonal variation in terms of evaporation losses

Surplus water available in sugar industries is not a constant parameter as it varies according to atmospheric conditions such as temperature, humidity etc. As observed, in the month of November, December and January the percentage of juice brix is low, water input from cane remains high and hence the fresh water requirement remains on lower side whereas during the months of February, March and April the percentage of juice brix is higher and water input from cane reduces hence the fresh water requirement increases. Due to ambient temperature difference there are variation in evaporation losses, also.

Variation in fresh water consumption in different categories of sugar industries is tabulated in table no. 3 below:

Table 3. Different scenarios of effluent generation and freshwater consumption in different categories of sugar industries

S.No.	Category	Sub-category	Type of turbine	Category code	Type of molasses	Fresh water consumption	Final Discharge (including spray pond overflow)
1	Standalone (S)	Sugar mill Sulphitation and low pressure boiler	Back pressure turbine	S1	C heavy	70 Ltrs/MT of cane	230-260 Ltrs/MT of cane
2					B heavy	70 Ltrs/MT of cane	250-280 Ltrs/MT of cane
3					Syrup and B-heavy	70 Ltrs/MT of cane	235-260 Ltrs/MT of cane
4		Sugar mill Sulphitation and high pressure boiler	Condensing mode turbine	S2A	C heavy	120 -150 Ltrs/MT of cane	190-220 Ltr/MT of Cane
5					B heavy	120 -150 Ltrs/MT of cane	210-240 Ltrs/MT of cane
6					Syrup and B-heavy	120 -150 Ltrs/MT of cane	190-220 Ltrs/MT of cane
7			Back pressure turbine	S2B	C heavy	60-70 Ltrs/MT of cane	230-260 Ltr/MT of Cane
8					B heavy	60-70 Ltrs/MT of cane	250-280 Ltrs/MT of cane
9					Syrup and B-heavy	60-70 Ltrs/MT of cane	240-270 Ltrs/MT of cane
10		Sugar backend refinery with low pressure boiler	Back pressure turbine	R1	C heavy	70-80 Ltrs/MT of cane	220-250 Ltrs/MT of cane
11					B heavy	70-80 Ltrs/MT of cane	240-270 Ltrs/MT of cane
12					Syrup and B-heavy	70-80 Ltrs/MT of cane	220-250 Ltrs/MT of cane
13		Sugar backend refinery with high pressure boiler	Condensing mode turbine	R2A	C heavy	120 -150 Ltrs/MT of cane	180-210 Ltr/MT of Cane
14					B heavy	120 -150 Ltrs/MT of cane	190-220 Ltrs/MT of cane
15					Syrup and B-heavy	120 -150 Ltrs/MT of cane	185-215 Ltrs/MT of cane
16			Back pressure turbine	R2B	C heavy	70-80 Ltrs/MT of cane	220-250 Ltrs/MT of cane
17					B heavy	70-80 Ltrs/MT of cane	240-270 Ltrs/MT of cane
18					Syrup and B-heavy	70-80 Ltrs/MT of cane	220-250 Ltrs/MT of cane
19	Integrated Sugar mills with	Sugar mill Sulphitation	Back pressure turbine	I1	C heavy	60-70 Ltrs/MT of cane	170-200 Ltrs/MT of cane

S.No.	Category	Sub-category	Type of turbine	Category code	Type of molasses	Fresh water consumption	Final Discharge (including spray pond overflow)
20	Distillery units	with low pressure boiler integrated with distillery			B heavy	60-70 Ltrs/MT of cane	190- 220 Ltrs/MT of cane
21					Syrup and B-heavy	60-70 Ltrs/MT of cane	175-200 Ltrs/MT of cane
22		Sugar mill Sulphitation with high pressure boiler units with co-generation and integrated with distillery	Back pressure turbine	I2A	C heavy	60-70 Ltrs/MT of cane	170-200 Ltrs/MT of cane
23					B heavy	60-70 Ltrs/MT of cane	190- 220 Ltrs/MT of cane
24					Syrup and B-heavy	60-70 Ltrs/MT of cane	175-200 Ltrs/MT of cane
25			Condensing mode turbine	I2B	C heavy	120 -150 Ltrs/MT of cane	120-150 Ltr/MT of Cane
26					B heavy	120 -150 Ltrs/MT of cane	130-160 Ltrs/MT of cane
27					Syrup and B-heavy	120 -150 Ltrs/MT of cane	125-155 Ltrs/MT of cane

3.1.2 High quantum of effluent generation

Sugar industry is a water surplus industry as sugarcane contains 70% of water. As tabulated in Table 3 above after considering losses total wastewater discharge including balance excess condensate, cold water effluent and spray pond overflow amounts to 170-280 lit/ton (in case of low pressure boiler) and 120-270 lit/ton (in case of high pressure boiler). The detailed water balance is given in Appendix 8.4. Therefore, it produces high quantum of effluent which can be treated and reused in various unit operations. Additionally, cleaning operations viz. washing of mill house floor, various division of boiling house like clarifications, evaporators, vacuum pans, centrifugation etc. generate huge volume of waste water. Periodical cleaning of heat exchangers, evaporators & regeneration of IER column with NaOH, NaCl, HCl, Sulphamic acid etc. to remove the scale from the tube surfaces and regenerate the resin in their original form which contributes organic and inorganic pollutant loading to waste water treatment plants. Leakages from pumps, pipelines, centrifugal section also contribute to waste

water produced. Effluent is also produced from boiler blow down, spray pond overflow and from condenser cooling water which is discharged as waste water when it gets contaminated with cane juice or molasses.

As per the notified discharge norms for Sugar industry, final wastewater discharge limit is notified as 200 litre per tonne of cane crushed (final treated effluent discharge restricted to 100 litre per tonne of cane crushed and waste water from spray pond overflow or cooling tower blow down to be restricted to 100 litre per tonne of cane crushed).

In sugar industries quantity of effluent generation is not uniform. Variation in final effluent discharge quantity in different categories of sugar industries is tabulated in above table 3.

The following factors affects the effluent discharge quantity:

a) Difference in treated water reuse opportunity because of different plant configuration

i. **Standalone with low pressure boiler:**

- After initial fill no fresh water is required. The treated condensate is used for auxiliary cooling towers, boiler feed and process cold water UGR makeup. No fresh water for cooling tower makeup and boiler feed is needed.
- Even after that, the final effluent discharge could be in the range of 230-280 L/T of cane crushed.

ii. Sugar with cogeneration having high pressure boiler operating on condensing mode turbine:

- High-pressure boilers are more suitable to larger industries with higher energy requirements and a focus on maximizing electricity generation for internal use and revenue generation through power export.
- In case of high pressure boiler with operating on condensing mode turbine, sugar industries need additional fresh water as makeup water for cooling tower because of increased cogeneration capacity. Hence, the reuse capacity of treated condensate is increased. However, final effluent discharge comes in the range of 210-240 L/T of cane crushed with the utilization of treated condensate.

- In the other case where the high pressure boilers are operated with back pressure turbines, there is no cooling tower for power plant and hence the reuse opportunity decreases and in that case the effluent discharge comes in range of 240-280 Ltr/MT of cane.

iii. Presence of cooling tower or

iv. Integrated sugar industries with distilleries:

- With any of the previous two case, if there is a distillery installed, there will always be an opportunity for use of treated condensate in distillery cooling towers /fermenters.
- Due to increase in reuse opportunity, as about 60 lit/tonne of treated effluent being recycled in case of integrated sugar industries the final effluent discharge quantity is less in comparison to standalone sugar industries and sugar refineries. For instance, integrated sugar industries having low pressure boiler is in the range of 170-220 L/T of cane crushed. However, in case of integrated sugar mills where high pressure boilers are operated on condensing mode turbine the final discharge quantity falls in the range of 120-160 L/T of cane crushed.

b) Type of molasses diversion:

Molasses, the residual syrup after sugar crystallization, is a valuable by-product which is used by distillery for production of ethanol, ENA, IMFL and country liquor. Two type of molasses generates as by-products from the process i.e. C –Heavy (final molasses) and B- Heavy. On the basis of basic consideration of the production of C Heavy molasses ranges between 4 - 5% on cane and B Heavy ranges from 6-7 % on cane. With the introduction of sugar syrup for ethanol production in Ethanol Blending Policy (EBP) by Government of India, there is rising trend in sugar industries diverting upto 30% sugar syrup to distilleries.

With B-Heavy diversion the vapour load at condensing system reduces resulting lesser heat

load at cooling tower hence lesser water loss. In standalone sugar industries operating with low pressure boiler, the variation in excess condensate generation increases to 20% on cane in case of B-Heavy molasses diversion, however, the same is about 14% on cane in case of C-Heavy diversion. Whereas, in the sugar industries operating with high pressure boiler, the excess condensate generation is in the range of 12% to 14.5% on cane depending of the type of molasses diversion.

c) **Sugarcane variety and varying weather conditions during crushing season (November to April)**

- Percent fibre of the early varieties (viz. CoLk 11203, CoLk 9709, Co 0238 etc.) was 12.5% to 14.91 % on cane (dry basis) from October to April and it increased by an average of 2.44 units till April in all the varieties. In late maturing varieties (CoLk 11206, CoLk 9204, Co Pant 12226 etc.) the percentage fibre was 12.8% to 15.29% on cane (dry basis) from October to April and increased by 2.47 units till April [*Reference- Priyanka Singh, M.M. Singh, Jyotsendra Singh (2021). "Suitable Sugarcane Varieties For Sustainable Sugar Recovery in Conditions of Subtropical India" (published in E-proceedings of 79th annual convention of STAI: 70-76)*]
- Seasonal variation in effluent discharge quantity with different reuse opportunities is tabulated in table 4 & 5 below:

Table 4. Indicative trend of Effluent generation (With Zero fresh water consumption for process) in the case where reuse opportunity is least

Months	**Treated Effluent Generation (L /T of cane)**	**Comments**
November, December & January	240-260	Period of lower juice brix, higher water input and lesser loss of water in bagasse because of low bagasse % cane.
February	200-210	Period of improved juice brix, comparatively lower water input and higher loss of water in bagasse.
March and April	160-170	Period of higher juice brix lower water input and higher loss of water in bagasse & at spray pond / cooling tower due to higher ambient temp.
Season Average	200-210	

Table 5. Indicative trend of Effluent generation (With Zero fresh water consumption for process) in the case where there is opportunity of reuse in the cooling tower of power plants

Months	**Treated Effluent Generation (L/T of cane)**	**Comments**

November, December & January	200-220	Period of lower juice brix, higher water input and lesser loss of water in bagasse because of low bagasse % cane.
February	160-170	Period of improved juice brix, comparatively lower water input and higher loss of water in bagasse.
March and April	120-130	Period of higher juice brix lower water input and higher loss of water in bagasse & at spray pond / cooling tower due to higher ambient temp.
Season Average	160-175	

d) Cooling Towers Vs Spray Pond

Cooling towers and spray ponds are both cooling mechanisms used in industrial processes to dissipate heat from various sources. They consume water through evaporation and may emit plumes of water vapour and hence the drift loss of water from cooling tower is slightly higher as compared to spray pond. Spray ponds can have less loss of water as they do not consume water for cooling as significantly as cooling towers. Cooling towers are slightly more efficient for cooling applications however with capacity and good quality of nozzles spray ponds are also serving the purpose. Spray pond require large area approximately 25-50 times the area of cooling tower. In terms of excess condensate reuse, cooling tower has more opportunity than spray due to requirement of makeup water. However, cooling tower carry over losses which are 0.2-0.6 % of water flow, causes corrosion of blades, forms the fog around tower with increase in carry over losses make up water required is also increased.

In different categories of sugar industries with high or low pressure boiler having different mode of turbine operation, the range of cooling tower blow down estimated as 72 L/T to 130 L/T of cane crushed and spray pond overflow generation is up to 500 L/T of cane crushed. Both cooling tower blow down and spray pond overflow contributes in total effluent generation quantity in sugar industries.

Spray Pond Cooling System

The spray pond cooling is the one of the simplest method of cooling the condenser water. In spray pond warm water is broken up into a spray by means of nozzles.

Advantages: a) Pumping cost is low b) Head required is less c) Lesser wastage of water d) Low drift losses e) Least choking f) Easy to maintain g) High Durability and long life

Disadvantages: a) Large area is required. Approximately 25-50 times the area of cooling tower b) Spray losses due to evaporation and windage losses c) There is no control over the temperature of cooled water e) Cooling efficiency is low f) Cooling effect reduces with reduced wind velocity g) When load on the plant increases it does not respond to change

Cooling Tower

The cooling tower are desired when positive control on the temperature of water is required, the space occupied by the cooling system is considerable factor and the plant is situated near the load centre.

Higher the surface area, more time of exposure, lower relative humidity, and higher difference between WBT of air and water inlet temperature and cross flow gives effective cooling and reduced the tower size

The cooling tower are mainly divided into two groups as Natural draft or Atmospheric cooling tower and Mechanical draft tower as per the air flow through the tower

Advantages: a) Less floor space area required b) Induced draft design with fan motor c) More efficient compare to spray ponds

Disadvantages: a) The carry over losses which are 0.2-0.6 % of water flow, causes corrosion of blades forms the fog around tower with increase in carry over losses make up water required is also increased b) The drift droplets have the same chemical impurities as the circulating water and the deposition of these chemicals on object causes potential environmental concern c) Cooling tower where sewage effluent is uses for making up is highly conductive for growth of algae d) More maintenance

Conclusion:

The choice between a cooling tower and a spray pond depends on factors such as space availability, efficiency requirements, and operational preferences. Cooling towers are generally slightly more efficient for cooling applications however with capacity and good quality of nozzles spray ponds are also serving the purpose.

3.1.3 Poor performance of ETP and non-compliance with effluent discharge norms

It has been observed that many units have provided adequate retention time of around 24 hr. in the aeration tank however the reduction in the organic load in terms of BOD/COD are very less (60-80%) than the desirable (BOD reduction 85-95%) in secondary biological treatment despite maintaining the satisfactory MLSS level in aeration tank. The probable main reason behind this issue is the shallow depth (2.5-3.5 m) of aeration tank (initially designed for surface aeration) against the desirable depth of minimum 4.5 meter which is required to achieve Standard O_2 Transfer Efficiency up to 20 % requisite in case of diffused aeration system. Most of the sugar industries has been shifted to the diffused aeration system over surface aerator to maintain requisite DO level in aeration basin. As the depth (submergence) of aeration system decreased oxygen transfer efficiency of aeration system also decrease proportionally. Thus, such types of aeration system shall be upgraded as per requirement.

Central Pollution Control Board authorized Third Party Technical Institute i.e. VSI, Pune and NSI, Kanpur carried out inspections of the sugar industries annually to verify the compliance status of the sugar industries. During the inspection, it was observed that instead of treating the effluent in ETP some sugar industries were found bypassing the ETP and directly discharging untreated effluent into the drain/surface water bodies which is a potential hazard to the environment.

CPCB has inspected total 77 sugar industries during 2023-24 in Uttar Pradesh to verify the compliance status, wherein 67 industries were found operational.

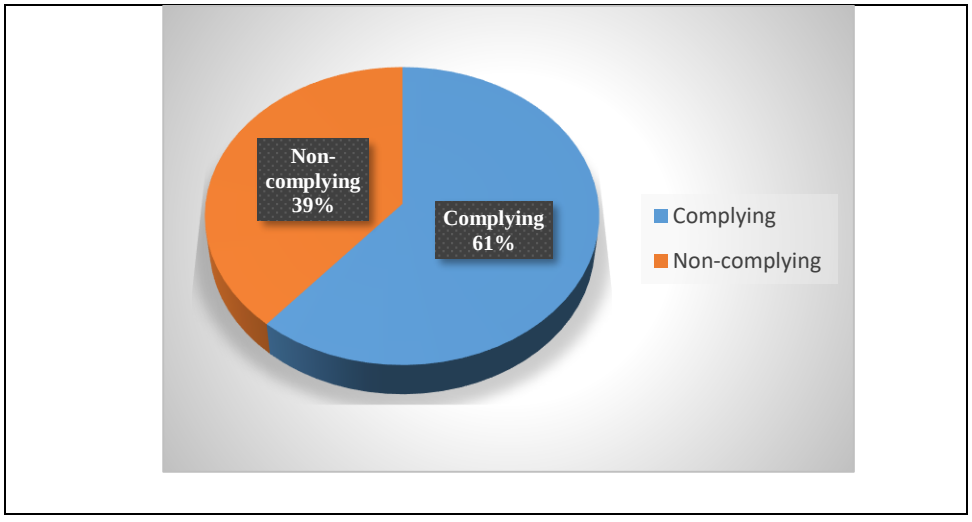


Figure 1. Compliance status of 77 sugar industries in crushing season 2023-24

Out of 67 sugar industries, 41 were found complying and 26 were found non-complying w.r.t. the pH, BOD, COD, TSS, TDS and Oil & Grease and also suspected dilution. The range of exceedance for various parameters is as follows:

Table 6. Range of exceedance of chemical parameters

S. No.	Parameter	Exceedance Range
1.	BOD	35 mg/l to 107 mg/l
2.	COD	263 mg/l to 874 mg/l
3.	TSS	31.3 mg/l to 207 mg/l
4.	TDS	2176 mg/l to 3004 mg/l
5.	O&G	39 mg/l
Out of 26 non-complying units, 06 were non-complying w.r.t. the suspected dilution in the effluent.		

Therefore, there is need for augmentation of ETP to ensure better and consistent compliance with notified discharge norms.

3.1.4 ETP under capacity

Successful implementation of Charter 1.0 has led to upgradation of ETPs up to tertiary treatment level to achieve the notified discharge norms. During 2018-19, sugar industries carried out adequacy of effluent treatment plants by technical institutes. It has been observed that the adequacy was done by taking effluent discharge as 200 L/T of cane crushed (notified norms) rather than carrying out the adequacy on actual effluent discharge quantity. As described in above paras, actual discharge quantity depends on various factors and it may exceed 200 L/T of cane crushed depending upon the plant configuration. Therefore, there is need to carry out augmentation/upgradation of the ETPs of sugar industries located in Ganga basin based on actual effluent discharge quantity.

3.1.5 ETP Sludge management

Now-a-days, almost all sugar industries have installed ETP based on the physico-chemical treatment followed by secondary biological treatment with the objective to treat all types of generated effluent, collectively. Primary treatment usually produces sludge which contains chemicals that are used during coagulation/flocculation/pH correction and need to be disposed off separately after proper dewatering of sludge. ETP sludge (biological) generation rate is about 20% of the COD load in effluent at

ETP inlet. However, it is observed that estimated sludge generation usually not found in-line with the logbook record maintained by industries. So, there is a need of proper record keeping and disposal system to ensure environmentally safe disposal of ETP sludge.

3.1.6 Brine reject Management

For de-colorization of the sugar melt, use of Ion Exchange Resins is made. Desorption of the colorants from the exhausted resins is achieved using alkaline sodium chloride solution. Periodical cleaning of heat exchangers, evaporators & regeneration of IER column with NaOH, NaCl, HCl, Sulphamic acid etc. to remove the scale from the tube surfaces and regenerate the resin in their original form results in organic and inorganic pollutant loading to waste water treatment plants. Considerable amount of effluent is generated during the back wash and re-charging of the Ion Exchange Column. The regeneration waste poses a disposal problem, due to its high salinity and BOD. In the sugar refineries having Ion Exchange process for de-colorization of the sugar melt, the brine recovery system holds great significance. The process of brine recovery system is based on single or double stage nano-filtration for recovery of the brine and to reuse it to regenerate ion-exchange resin and it is envisaged that such system can recover brine to the extent of 85%. The brine reject generates @ 1-2% of cane crushed. Disposal of brine reject from Brine Recovery System is an issue.

Typically, characteristics of Brine reject are as tabulated below:

Table 7. BRS characteristics

S. No.	Parameters	Observed Values
1.	pH	8.0-9.0
2.	BOD (mg/l)	3500-4000
3.	COD (mg/l)	15000-25000
4.	TSS (mg/l)	2000-3000
5.	TDS (mg/l)	35000-40000
6.	Salt	20000-25000

3.1.7 Non-compliance w.r.t. stack emission norms

A sugar industry can potentially generate significant amount of air pollution. The emission mainly consists of fine particulate matter and smoke due to incomplete combustion of fuel along with NOx and SOx as potential pollutants. Besides, juice clarification, evaporation and sugar dust in drier house are other emission sources that

causes air pollution. Non-compliances w.r.t. the emission norms were observed by the sugar industries during inspections carried out under the Hon'ble NGT orders. As per the notified norms, the prescribed value of particulate matter emissions from the stack shall be less than 150 mg/Nm^3 (As per MoEFCC notification G.S.R. 373(E) dated 16 May 2023 PM emission std. 250 mg/Nm^3 for agro based fuel used in boilers > 10 TPH). Also, the sugar industries located in districts viz. Meerut, Muzaffarnagar, Moradabad, Ghaziabad, Hapur, Sonepat, Panipat, Karnal etc. covered under National Capital Region (NCR), has to ensure emission parameters as per Commission for Air Quality Management i.e. 80 mg/nm^3 in NCR and adjoining areas. Twenty-eight sugar industries are located in NCR, therefore installation and proper operation of adequate Air Pollution Control Device (APCD) is of utmost importance in order to achieve the stringent emission norms.

3.1.8 Untrained and inadequate Manpower

During inspections of sugar industries, it has been observed that the ETP operations are managed by one or two untrained persons, who are not well versed with the technical aspects of various treatment units of ETP. The working of the Effluent Treatment Plant and Water Management System should be monitored by trained and qualified personnel (having manager level position), assisted by the skilled staff with operation & maintenance of ETP and analytical chemists to carry out the daily analysis of ETP inlet & outlet parameters including performance of each ETP units for the efficient working of the ETP unit operations.

3.1.9 Storage and handling of press mud

Press mud, also known as filter cake or press cake, is a residual by product in the sugar industry. Sugar industries generate press mud @4 % of cane crushed. Press mud contains all solid impurities from converting sugarcane juice to raw sugar under elevated temperature, including residual soil, phosphate precipitates, calcium oxalate/aconitate, sucrose and fibre. At present, there is no regulations or SOP for the proper handling and storage of the press mud. The press mud has the potential to be used as a biofuel, microbial carrier, soil conditioner, bioremediation of heavy metals, animal feed, wax production, and concrete formation.

3.1.10 Handling and disposal of boiler ash and fly ash

In sugar industries bagasse is used as fuel for boiler for steam generation. Bagasse generation is approx. 28-32% of cane crushed. Steam requirement varies with the

configuration of the industry. Steam consumption in case of C-heavy molasses diversion is in the range of 32-52% on cane, in case of B-heavy molasses it is in the range of 30-50% on cane and with 25% syrup and B-heavy diversion it is in the range of 30-45%. Daily fuel requirement is estimated based on steam generation @ 2.2-2.4MT steam/MT of bagasse. Boiler ash generated @1.8% to 2%.

Regarding handling and disposal of ash, public complaints and court matters are regularly being reported as the general practice of the ash disposal adopted by the sugar industries are not scientific. Mostly, it has been observed that, hot ash is disposed in open area without prior cooling and accidental burning incidents are also being reported. Also, there is no record keeping regarding the ash generation and disposal quantity. A significant gap has been observed in estimated and actual ash generation. There is no SOP available for the safe & scientific disposal and utilization of ash generated from Sugar industries.

4. STAKEHOLDER CONSULTATION FOR FORMULATION OF CHARTER 2.0

To address the above-mentioned issues and to endorse the culture of consistent betterment, consultative meetings on "emerging issues in the sugar industry and to discuss the charter 2.0", which were held on 01.06.2023, 29.03.2024, 11.05.2024, 03.06.24 and 13.06.24 with different stakeholders like VSI, NSI, experts from industry and technology providers for setting up of new benchmarks and technological intervention for overall improvement in environmental status and to ensure better and consistent compliance of norms by sugar industries. Experts/participants advocated for revision of the existing Charter with more focus on resource conservation in terms of reduction in specific freshwater consumption rather than focusing on ensuring compliance to effluent discharge volume as the achievability of discharge norms of 200 L/T of cane crushed is not feasible during entire crushing season. Effluent discharge quantity is affected by various factors viz. difference in treated water reuse opportunity because of different plant configuration i.e. standalone with low pressure boiler, sugar with co-generation having high pressure boiler operating on condensing mode turbine, high pressure boilers with back pressure turbines integrated sugar industries with distilleries, type of molasses diversion, sugarcane variety and varying weather conditions during crushing season (November to April). The detailed explanation is given in para 3.1.2. As evident in Table 3 effluent discharge quantity varies between 180-350 L/T of cane crushed depending upon the type of boiler and turbine mode operation after considering losses total wastewater generation including balance excess condensate,

cold water effluent and spray pond overflow. Also, due to current policy of Government regarding rates for power export to sugar industries, it has been observed that most of the industries has stopped co-generation for surplus power production thus, affecting the condensate generation quantity.

Therefore, achieving the notified discharge norm of 200 L/T of cane during entire crushing season in all type of sugar industries is not feasible.

Therefore, the charter needs to be updated in order to develop a more holistic and comprehensive version.

5. CHARTER 2.0- SUGGESTIVE NORMS, GUIDELINES & ACTION POINTS

5.1 Basic estimates in sugar manufacturing process

Table 8. Typical range of particulars in sugar manufacturing process

S. No.	Particulars	Typical Range
1.	Capacity of Sugar plant (TCD)	2500 - 20000
2.	Recovery (Sugar)	9 – 13%
3.	Bagasse % cane	28 - 32%
4.	Moisture % Bagasse	48 - 52%
5.	Filter cake % cane	4 - 5%
6.	Moisture % Filter cake	70 -72%
7.	B Heavy molasses % cane	6 - 7%
8.	C Heavy molasses % cane (Final Molasses)	4 - 5%
9.	Steam Consumption % Cane (C Molasses)	32 - 52%
10.	Steam Consumption % Cane (B Molasses)	30- 50%
11.	Steam Consumption % Cane (25% Syrup + B H Molasses)	30 - 45%
12.	Water in cane in the month of Nov. To Feb.	Around 72%
13.	Water in cane in the month of March. To Mayonwards.	Around 68%
14.	Hot excess condensate generation (% on cane)	10 - 20%

15.	Imbibition % cane	28 – 50 %
16.	Mixed juice % cane	100 - 120%
17.	Spray pond overflow generation (Including excesscondensate left after miscellaneous usage)	60 – 100 lit/Ton of cane
18.	Plant Effluent	100 – 120 L/T of Cane
19.	Total waste water generation including balance excess condensate, cold water effluent & spray pond overflow.	• 180 – 280 L/T of cane (In case- Low Pressure Boiler) • 300- 350 L/T ofcane (In case- High Pressure Boiler)

- ETP sludge (biological, on dry basis) generation rate as 20% of the COD load in raw effluent at ETP inlet.
- Ash generation rate as 1.8% - 2% on bagasse consumption
- Daily fuel requirement is estimated based on steam generation @ 2.2-2.4 MT steam/MT of bagasse.
- Brine reject generates @ 1-2% of cane crushed.

5.2 Rationale for setting up of specific freshwater consumption targets

During the meeting held under the chairmanship of Hon'ble Minister of Environment, Forest and Climate Change (MoEF&CC) and Hon'ble Minister Jal Shakti (MoJS) on 9th July, 2020; CPCB and CGWB were directed to verify the consumption of groundwater by industries and accordingly the permission should be granted for abstraction. Further, during the meeting taken by Secretary, MoEF&CC and Secretary, MoJS on 30th November, 2022 it was decided to cap groundwater withdrawal based on charter norms/average specific freshwater consumption by grossly polluting industries (GPIs). Thereafter, during meeting held on 16th December, 2023 in CPCB with technical institutes, NMCG and SPCBs it was decided to develop a SOP for integrated sugar and distillery units for freshwater conservation and in sugar mills instead of effluent discharge norms, freshwater consumption norms shall be enforced for water conservation.

As already explained, in sugar industries there is water input from cane which is approx. 690-710 L/T of cane, out of this water only 150-180 L/T of cane water is

consumed in the sugar manufacturing process. During the sugar manufacturing process, approx. 180-260 L/T of cane water evaporates from cooling towers, which depends upon the process (sulphitation or refinery) as well as molasses diversion route (C heavy /B heavy/ Syrup diversion), Weather condition (Ambient Temp and Humidity). The total quantum of water loss during the process falls in the range of 330-440 L/T of cane. Consequently, the balance water from cane remains in the range of 270-360 L/T of cane which primarily comes out from three routes:

- Plant Effluent
- Spray Pond /Cooling Tower overflow
- Excess condensate (Balance after possible reuse /recycle)

The detailed explanation regarding the actual requirement of freshwater in sugar industries is mentioned in para 3.1.1 and factors affecting final effluent discharge quantity is mentioned in para 3.1.2. It is evident from table 3 where freshwater consumption and final effluent discharge quantity in different categories of sugar industries is tabulated that the final effluent discharge is in the range 120-280 L/T of cane crushed and vis a vis freshwater consumption is only 60-150 L/T of cane crushed. This scenario clearly indicates that there is a need to focus on setting norms for specific freshwater consumption rather than effluent discharge as sugar industry is a water surplus industry where the water is coming in the system from raw material. Fixing the norms for freshwater will result in resource conservation by saving groundwater/surface water and benefit the ambient environment whereas, fixing the specific effluent discharge norms will be of no help to ambient environment in any manner.

5.3 Targets for specific freshwater consumption for different categories of sugar industries

CPCB considered all the above mentioned factors affecting effluent discharge and suggestions emerged during discussions held with stakeholders regarding the fresh water consumption in different categories of sugar industries, and accordingly, with the focus on conservation of freshwater new targets for the specific fresh water consumption are given in Table 9 below:

Table 9. New norms for fresh water consumption in different categories of sugar

industries

S. No.	Category	Sub-category	Type of Turbine	Category Code	New Norms for Specific Fresh Water Consumption (L/T)	
					Short Term (before crushing season 2025-26)	Long term (before crushing season 2028-29)
1.	Standalone (S)	Sugar mill Sulphitation and low pressure boiler	Back pressure turbine	S1	50	30
		Sugar mill Sulphitation and high pressure boiler	Condensing mode turbine	S2A	100*	60
			Back pressure turbine	S2B	75	50
2.	Sugar backend refinery (R)	Sugar backend with low pressure boiler	Back pressure	R1	50	30
		Sugar backend refinery with high pressure boiler	Condensing mode turbine	R2A	100*	60
			Back pressure turbine	R2B	75	5
3.	Integrated Sugar mills with Distillery units	Sugar mill Sulphitation with low pressure boiler integrated with distillery	Back pressure turbine	I1	50	30
		Sugar mill Sulphitation with high pressure boiler units with co-generation and integrated	Condensing mode turbine	I2A	100*	60
			Back pressure turbine	I2B	75	50

		with distillery				

***Note-**

-In case of sugar industries with cogeneration, it is presumed that power export is only upto 50% of home load.

- For every 25% increase in power export, additional 25% specific fresh water consumption shall be permitted.

(For example, if any industry is generating 20MW of power and home load is 10MW. Then, upto 5MW power export new norm of specific fresh water consumption i.e. 100 L/T of cane crushed shall be applicable. However, since industry is exporting 10MW of power which is 100% of home load, therefore considering additional 25% specific fresh water consumption for every 25% increase in power export, the additional specific freshwater consumption of 50 L/T of cane crushed shall be allowed i.e. specific freshwater consumption permissible will be 100+50=150L/T of cane crushed).

SOP for assessment of specific fresh water consumption:

Objective: To establish a systematic procedure for monitoring and recording fresh water consumption in the sugar mill, ensuring efficient use of water resources and compliance with regulatory requirements.

Scope: This SOP applies to all personnel involved in water management and operations within the sugar mill premises.

Responsibilities:

Water Management Team:

a. Track daily water usage of fresh water and keep precise records of the data.
b. Investigate and report any abnormalities in water consumption
c. Adhere to the conditions issued by the respective authorities regarding freshwater usage

Procedure:

1. **Installation of Flow meters**
   a. Borewell(s)/ Tubewell(s) to be provided as per the No Objection Certificate (NOC) issued by the concerned authority (Central Ground Water Authority/ State Ground Water Department). Type of well, depth of the well, type of the pump, H.P. of the pump, rate of withdrawal (m^3/hr) and maximum allowable running hours per day etc. to be as per the NOC issued in the matter.
   b. Sugar factories to provide digital electromagnetic type flow meter(s) (conforming to BIS/ IS standards) of adequate capacity having rate of

extraction and totalizer facility at each Borewell/ Tubewell as per CGWA notification in Appendix 8.8). The link for the CGWA notification is: **https://cgwa-noc.gov.in/landingpage/UserAssistance/Final%20Specification%20of%20Digital%20Water%20Flow%20meter%20with%20Telemetry%20System.pdf.**

The telemetry flow meter installed in the industry shall ensure compliance with the ISO 4064. The link for this document is: **https://cdn.standards.iteh.ai/samples/55371/c05284af86c24671b477bbef77a85842/ISO-4064-1-2014.pdf.**. The factories shall provide separate flow meter(s) with check measurement facility at each Borewell/ Tubewell.

c. Construction of piezometer(s) and installation of digital water level recorders with telemetry shall be mandatory for sugar factories as per the guidelines issued in the matter.

d. Permanent display board(s) should be installed at Piezometer/Tubewell(s) site for providing the location, piezometer/ tubewell number, depth and zone tapped of piezometer/ tubewell for standard referencing and identification.

2. Daily Monitoring:

a. Responsible personnel will record the starting water meter reading for the day.

b. Calculate and record total water consumption periodically (e.g., every 8 hours).

3. Recording Data:

a. Proper recording keeping of water abstraction to be made in the logbooks on day to day basis by the sugar industries (Format for logbook for daily water consumption is provided in Appendix section 8.6).

b. All the flow meters to be connected with on-line Real Time Monitoring System (RTMS) to transmit the data (rate of extraction and totalizer reading) to concerned Ground Water Authority, Central Pollution Control Board (CPCB)/ State Pollution Control Board (SPCB).

4. Investigating Discrepancies:

a. Compare current consumption with historical data and production levels.

b. Investigate any significant deviations from expected water usage.

c. Identify and address potential leaks, overuse, or inefficiencies promptly.

d. Under the normal circumstances, no underground water pipelines shall be used for the purpose.
e. The samples of ground water for different parameters of each Borewell/ Tubewell shall be analyzed twice in a year during pre-monsoon (May/June) and post-monsoon (October/November) periods from any NABL accredited laboratory authorized by Central/ Sate Government and a record of the same shall be kept.

5. Reporting:

a. Compile daily water consumption data into a weekly/monthly report.
b. Highlight trends, anomalies, or areas for improvement.
c. Submit reports to the designated manager or water management team.
d. The sugar units shall submit every month a consolidated statement about quantity of sugarcane crushed, quantity of fresh water withdrawal, specific fresh water consumption (litre per tonne of cane) etc. to concerned Ground Water Authority, Central Pollution Control Board (CPCB)/ State Pollution Control Board (SPCB) through the prescribed proforma on web portal.

6. Maintenance and Calibration:

a. Regularly inspect and maintain water consumption meters to ensure accuracy.
b. Calibrate meters as per manufacturer's recommendations or regulatory requirements.
c. All the flow meters to be calibrated and sealed by **Department of Legal Metrology** (Weights and Measures) before start of every sugar crushing season.

7. Water Conservation Measures and tanning:

a. Implement water-saving initiatives and best practices (e.g., reuse of condensate, optimizing process water usage and maintain separate record for the same).
b. Train personnel on efficient water management practices

8. Compliance:

a. Ensure compliance with local environmental regulations and permits regarding water usage
b. Maintain records as required by regulatory authorities.

9. Emergency Procedures:

a. In case of a water leak or spill, notify the water management team immediately take necessary steps to contain the leak and minimize water loss

10. Documentation:

a. Keep all records of water meter readings, consumption reports, and maintenance logs organized and accessible for audits or reviews

5.4 Discharge norms

Sugar industries generate high quantum of effluent, even after considering losses total wastewater generation including balance excess condensate, cold water effluent and spray pond overflow amounts to 230-260 lit/ton (in case of low pressure boiler) and 300-350 lit/ton (in case of high pressure boiler). Effluent is having high BOD 700-1200 mg/l, COD 1500-2500 mg/l, which after treatment in ETP is being discharged either in surface water bodies or on land for irrigation purpose. It is pertinent to mention here that need for stringent norms has also been highlighted. During the meeting taken by Secretary, MoEF&CC and Secretary, MoJS on 30th November, 2022 it was directed that standards for industrial effluents to be made more stringent similar to what is being proposed for STPs. Also, during the meeting held on 16th December, 2023 in CPCB with technical institutes, NMCG and SPCBs it was emphasized to undertake studies for consistent compliance of industries on the basis of stringent discharge norms so that their operations do not affect mass bathing during special occasions like Magh Mela and Kumbh Mela.

Considering the fact that, since 2015 as per charter for Pulp & Paper industries the existing norms for BOD <20 mg/l, COD – 150 mg/l and TDS- 1600 mg/l, respectively. Also, in reference to the norms prescribed by Hon'ble NGT in the order dated April 30, 2019, concerning OA no. 1069/2018, stringent norms are applied for compliance verification of effluent discharged from STPs. These standards specify BOD less than 10 mg/l, TSS less than 20 mg/l and COD less than 50 mg/l for compliance when discharging into ponds and lakes. Similarly, vide notification dated 10.09.2021 stringent BOD norms of 20 mg/l was prescribed for tannery industries.

Annual inspections data reflects that most of the sugar industries are already achieving the BOD concentration <30 mg/l. The performance assessment of sugar industries w.r.t BOD concentration is tabulated in table 10 below

Table 10. Performance assessment w.r.t. BOD

Type of Sugar Industry	BOD Range (mg/l)	Performance	No. of Units
Standalone	<20	Best	7
	20 to 30	Average	22
	>30	Below average	2
Sugar with cogeneration	<20	Best	5
	20 to 30	Average	31
	>30	Below average	1
Sugar refinery	<20	Best	2
	20 to 30	Average	6
	>30	Below average	-
Refiner with cogeneration	<20	Best	7
	20 to 30	Average	12
	>30	Below average	-

Considering the above facts, since most of the mills in all categories are already discharging treated effluent with BOD < 20 mg/l. Hence, it is suggested that efforts should be made to achieve more stringent discharge norms as compared to notified norms. It is even more substantial considering that the treated effluent from sugar industries is intensively being used for agricultural purpose by method of flood irrigation or discharged into surface water bodies where availability of water for dilution is limited. Since in other sectors stringent norms are being applied therefore to ensure better and consistent compliance stringent norm for BOD <30 mg/l is desirable. It is pertinent to highlight that designing of the ETP could only be made for single outlet parameter only therefore norms of 100 mg/l at ETP outlet does not hold any significance. However, new target for treated effluent discharge quality is given as under:

Table 11. New target for treated effluent discharge quality.

Industry	Parameters	Standards (*All concentration values are in milligramme per litre except for pH*)
Sugar Industry	pH	5.5 – 8.5
	Total Suspended Solids (TSS)	30
	Biological Oxygen Demand, BOD (3 days at 27°C)	30
	Oil & Grease,	10

	Total Dissolved Solids (TDS)	2100

5.5 Upgradation / Augmentation of effluent management systems

It has been observed that mostly sugar industries have installed conventional ETP system consisting of pH correction tank, primary clarifier, secondary biological treatment followed by tertiary filtration system (MGF & ACF) for treatment of effluent generated in mill house and spray pond overflow. Treated effluent is being either used for irrigation purposes or discharged outside.

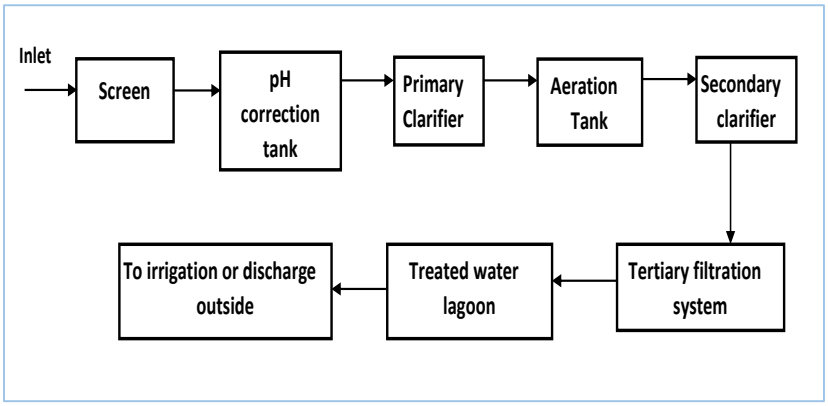


Figure 2. Existing typical Effluent treatment plants scheme

As explained above in Para 3.1.3 & 3.1.4, existing ETPs installed in some of the sugar industries are not complying with notified norms and their design adequacy was carried out considering effluent discharge quantity as 200L/T of cane crushed. However, with above mentioned details in Para 3.1.1 & 3.1.2 achievability of effluent discharge norm of 200L/T during entire crushing season with different plant configurations seems difficult. Therefore, it is necessary for carrying out fresh adequacy and performance assessment of ETPs based on actual final effluent discharge quantity.

Existing capacity of ETPs installed in sugar industries would not be sufficient to treat the actual effluent generation quantity, hence to treat the high quantum of effluent generation sugar industries need to go for capacity expansion to ensure the treatment of effluent up to the prescribed discharge norms. Capacity expansion will also lead to augmentation and upgradation of ETPs for ensuring consistent and better compliance.

In this charter, norms for specific freshwater consumption are being prescribed. Therefore, in order to achieve the specific fresh water consumption norms, the sugar

industries have to improve their water use efficiency. Hence, sugar industries shall optimize reuse and recycle of treated effluent and excess condensate in the process, cooling tower makeup, boiler feed, integrated distilleries etc. after treating it up to the desired extent by installing Condensate Polishing Units. Desirable quality for recycling treated condensate after CPU and for reuse of ETP treated water for various purposes are tabulated in Table 12 and 13, respectively.

Table 12. Standard parameters for recycling treated condensate after CPU

S.No.	Parameter	CPU Outlet parameters
1	pH	7.0 – 8.5
2	Temperature (^{0}C)	25 - 30
3	COD (mg/l)	<100
4	BOD (mg/l)	<30
5	TDS (mg/l)	<150

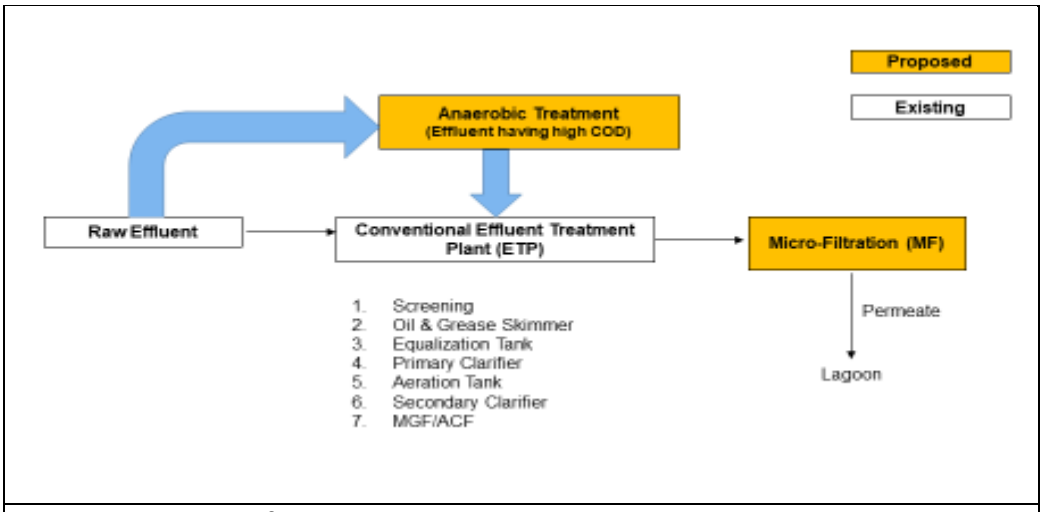
Table 13. Standard parameters for recycling of ETP treated water for various purposes

S.No.	Parameters	Sugar factory (in process)	Co-generation Cooling tower make-up	WTP feed
1	pH	6.5-7.5	6.5-7.5	6.5-7.5
2	COD	<250	<250	< 100
3	BOD	<30	<20	<5
4	SS	<30	<20	<5
5	TDS	<500	<150	<100

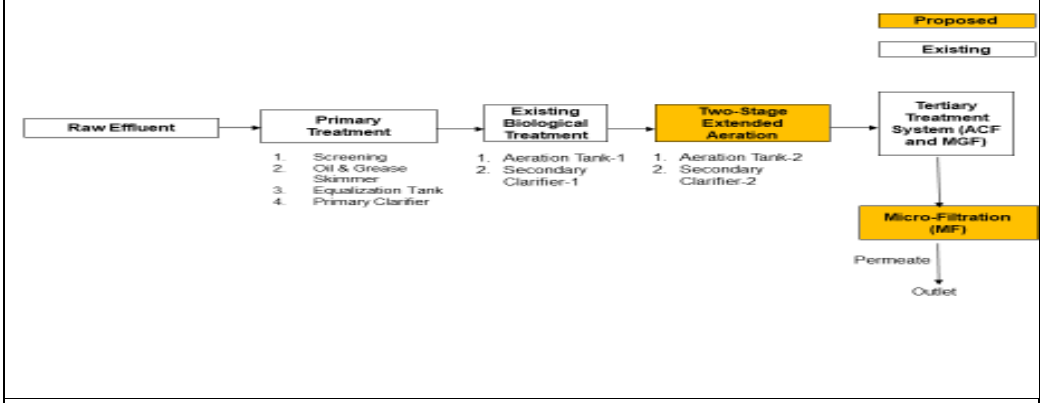
To achieve the desirable quality for recycling treated condensate and ETP treated water for various purposes the following augmentations and upgradation are suggested in ETPs which will further improve water reuse efficiency resulting in reduction of specific freshwater consumption and compliance with notified discharge norms:

i. Installation of mechanical oil & grease skimmer with adequate retention time according to the technology.
ii. Upgradation/augmentation of existing ETPs by installing two stage Secondary biological treatment (anaerobic-aerobic or two stage extended aeration system in series) and tertiary treatment upto microfiltration.
iii. Installation of Condensate Polishing Units (CPU)
iv. Fresh adequacy of ETP based on actual final effluent discharge quantity
v. Installation of separate brine recovery system (BRS) towards recovery and reuse of brine solution and to minimize the reject brine quantity. Ensure proper

disposal of Brine reject i.e. spraying on bagasse/ burning in incineration boiler /gradual discharge to ETP for treatment etc.



Case 1: Anaerobic followed by aerobic



Case 2: Extended aeration

Figure 3: Proposed Effluent treatment plants scheme

5.5.1 SOP for ETP operations during pre and post crushing season:

Since the sugar industries are the seasonal in nature, therefore there is requirement to establish standard operating procedures for the safe and efficient ETP operations as well as stopping of the Effluent Treatment Plant (ETP) to ensure compliance with environmental regulations and operational efficiency. In order to streamline ETP operations during pre and post crushing season a SOP has been developed and same is provided in Appendix section 8.5.

5.6 Treated effluent utilization and irrigation management plan

Sugar industries have different configuration and the range of specific effluent discharge, as tabulated in table 3 varies from 120 to 280 L/T of cane crushed.

After complying with the notified discharge norms, as the treated effluent have inherited properties of the parameters that are required for growth of sugarcane in lower concentration (Nitrate- 36.7 mg/l, Phosphate- 14mg/l, Sulphate- 107 mg/l, Copper-3.12 mg/l, Lead-1.46 mg/l. Cadmium- 2.37 mg/l, Zinc-14.11 mg/l, Mangnese-5.03 mg/l) *[Reference- Usha Damodharan, M. Vikram Reddy (2012) " Impact of Sugar Industrial Treated Effluent on the Growth Factor in Sugarcane-Cuddalore, India", Journal of Sustainable Bioenergy System (Volume-02, pg-43-48)]* and no hazardous chemical is used in the treatment process therefore it is suitable for utilization in irrigation. This will also result in water conservation by reduction in abstraction of fresh water by farmers for irrigation purposes.

To ensure that treated effluent is used in irrigation upto the maximum extent, following measures are recommended:

i. An impermeable/ impervious lagoon shall require to be constructed for storage of treated effluent during no demand period of irrigation, the treated effluent to be stored in a seepage proof lined lagoon having 15 days holding capacity only. However, sugar industries have to maintain the quality of stored treated effluent as tabulated below:

Table 14. Standards for land disposal

Parameters	**Standards (*All concentration values are in milligramme per litre except for pH*)**
pH	5.5 – 8.5
Total Suspended Solids (TSS)	100
Biological Oxygen Demand, BOD (3 days at 27°C)	100
Oil & Grease	10
Total Dissolved Solids (TDS)	2100

ii. The monitoring of treated effluent quality and periodic cleaning of lagoon may be ensured by the sugar industries to avoid algae/algal bloom formation during storage.

iii. Installation of flow meter at lagoon to record the quantity of treated effluent being utilized for irrigation purpose i.e. in-house and agricultural fields.

iv. To utilize the treated effluent in agriculture, the unit shall have the irrigation management plan depending on the irrigation requirement of the crop and soil duly vetted by agricultural universities.

v. Best practices for water and soil management in Sugarcane crop:

To improve water use efficiency, strategies should include advanced micro-irrigation systems like drip and sprinkler irrigation. Specifically, drip irrigation can save up to 50% of water use while increasing productivity by 25-30%, compared to conventional flood/furrow irrigation. Drip systems also improve fertilizer efficiency, reducing application rates by 30-40%. Maintaining proper soil moisture and aeration, reducing weed growth and preventing land degradation are key benefits of drip irrigation for sugarcane. These integrated soil and water management practices can boost sugarcane yields in a sustainable manner by conserving resources and improving soil health.

By adopting advanced irrigation, nutrient management, and soil conservation practices, farmers can optimize resource use, maintain soil fertility, and improve economic and environmental outcomes.

vi. For sugarcane-growing farmers under their command area emphasis on adoption of drip irrigation/sprinkler instead of flood irrigation method may be done. Time bound action plan in this regard may be formulated by sugar industries.

5.7 Management & disposal of solid waste

Suggestive measures for effective handling, disposal, and monitoring solid waste (i.e. boiler ash and ETP sludge) generated by sugar industries:

a. SPCBs to facilitate sugar industries to adopt manifesto system for managing solid waste (i.e. boiler ash and ETP sludge) either through industry association or joint forum with industry association & SPCB.

b. All sugar industries have to ensure collective responsibility and participation in waste management efforts. Details of action plan for effective handling, disposal, and monitoring of solid waste (boiler ash and ETP sludge) are presented in subsequent sections below:

5.7.1 ETP sludge management

i. Mechanical sludge handling system shall be installed viz. filter press/ screw press/ decanter/ rotary belt filter etc.
ii. Proper record keeping of sludge generation quantity and disposal.
iii. Establishment of a manifest system for environmentally safe collection, storage, handling, transfer and disposal of ETP sludge shall be ensured.

5.7.2 Ash handling and management

i. The sugar industries ensure the installation of air pollution control device viz. electrostatic precipitator/bag filters alone or in combination with other APCD to minimize the air pollutants of boiler.
ii. Boiler ash should be managed scientifically as per CPCB guidelines titled "Guidelines for disposal/utilisation of Fly Ash for reclamation of Low Lying Area and in stowing of Abandoned mines/Quarries", March 2019.
iii. Boiler ash if disposed through landfilling (i.e. stowing of mines or reclamation of low lying area), the site should be:
   (a) properly demarcated and fenced to restrict human and animal intrusion
   (b) properly capped with top soil (with minimum 30 cm cover to promote vegetation growth) after exhaustion of the capacity of filling site
   (c) properly lined and made impermeable to avoid any possibility of contamination of surface water & ground water
iv. Approval from SPCB should be obtained for site selection, safe operation and for development of vegetation cover after exhaustion of the capacity of filling site.
v. **Ash disposal & utilization:**

The waste generated from the combustion process is the bagasse ash in form of furnace ash and fly ash. The quantity of furnace ash is about 25% (by weight) of the total bagasse ash produced and is rich in silica (70-80%), whereas the left over is fly ash which is rich in carbon (40-50%). In general, bagasse ash is mostly disposed of as a filler in landfill sites. On the other hand, fly ash may be effectively utilized in farming by mixing with the filter cake, if the carbon content is found to be of inorganic type.

Fly ash and furnace ash can be utilized as mentioned below:

Fly ash utilization

a. **Soil Amendment**: The ash can be used as a soil amendment due to its high content of potassium, calcium, and other nutrients that are beneficial for plant growth. It improves soil structure and fertility, especially in acidic soils.

b. **Fertilizer**: It can be processed into a fertilizer by mixing it with press mud for use in cane farms.

Furnace ash utilization

Since, furnace ash contains high silica, therefore, the furnace ash may be a good alternative of cement replacing material in concrete production.

a. **Construction Material and low land fill**: Boiler ash can be used as a construction material, particularly in road construction and embankments. It improves stability and reduces the risk of settlement. It can be used for filling lowlands also.

b. **Brick Making**: It can be used in brick-making processes, where it acts as a binding agent and filler material.

c. **Environmental Remediation**: It can be used in environmental remediation projects, such as land reclamation and stabilization.

vi. Scattered/ haphazard disposal of boiler ash should be completely stopped.

vii. Proper record keeping should be ensured regarding generation, storage and disposal of boiler ash.

viii. The sugar industries shall establish a manifest system for environmentally safe collection, storage, handling, transfer and disposal of boiler ash. The manifesto shall be submitted to SPCBs for record purpose.

Table 15. Solid waste generation and its treatment/disposal

S.No.	Waste	Quantity, TPD	Treatment	Disposal	Remark
1	Sugar ETP and CPU sludge	Around 1.5 % on effluent quantity going to ETP	Drying/Dewatering	As per manifest system	Organic
2	Ash	1.8 - 2 % on bagasse consumption	Ash quenching and mechanical handling	As per manifest system	Organic

a. Manifest System Facilitation:

- SPCBs should facilitate the sugar industries for establishment of a manifest system for environmentally safe collection, storage, handling, transfer and

disposal of boiler ash and ETP sludge. Manifest shall be prepared by the generator of the solid waste. The generator has primary responsibility for the ultimate disposal of the waste and must give the manifest, along with the waste itself, to a licensed solid waste transporter. A copy of the manifest must be delivered by the transporter to the authorized recyclers/ waste to energy plants/co-processing plants, having registration on EPR portal. Each time the waste changes hands, a copy of the manifest must be signed. Copies of the manifest to be kept by each party involved, and additional copies to be sent to appropriate environmental agencies/SPCBs.

i. Individual industries must maintain a logbook that records waste quantities, types, and disposal methods. This logbook will serve as a crucial reference for waste management audits and assessments.

   (a) SPCBs to supervise waste management practices of sugar industries. This includes overseeing waste handling, transportation, disposal and verification through logbook & manifest system slip.
   (b) SPCBs to verify the accuracy and completeness of the records, which ensures transparency and accountability in boiler ash and ETP sludge management practices.
   (c) Solid waste material to be provided only to 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) & Consent to Operate (CTO) issued by SPCBs.

- The State Pollution Control Boards (SPCBs) should facilitate the establishment of forums.
  i. The forum should be specifically dedicated for management of solid wastes (Boiler Ash and ETP sludge) generated by industrial units.
  ii. Sugar industries should ensure their responsibility and participation in waste management efforts.
  iii. Member industries of forum to maintain a logbook that records waste quantities, types, and disposal methods. This logbook will serve as a crucial reference for waste management audits and assessments.
  iv. The SPCBs should supervise waste management practices within member

industries of forum. This includes overseeing waste handling, transportation, disposal and verification through logbook & manifest system slip

v. Member units to bear the cost associated with waste management, including transportation, treatment, and final disposal.

vi. The forum will play a crucial role in ensuring compliance with regulations governing the transportation of hazardous industrial waste.

- The forum should facilitate the proper use of the six-copy manifest system.
- This includes ensuring generators and transporters understand the color-coded copies and their designated actions:
    - White Copy: Forwarded to the State Pollution Control Board (SPCB) by the generator.
    - Light Yellow Copy: Signed and returned to the generator by the transporter.
    - Pink Copy: Retained by the disposal facility operator.
    - Orange Copy: Returned to the transporter by the facility after accepting waste.
    - Green Copy: Forwarded to the SPCB by the facility after disposal.
    - Blue Copy: Returned to the generator by the facility after disposal.

5.8 Setting up of Environmental Management Cell (EMC), environmental laboratory and trained & adequate manpower for ETP operations

a. Every sugar industry will set up an EMC to effectively monitor the environmental compliance. The EMC may constitute of following:

i. Executive Director/Vice President/Managing Director/General Manager

ii. ETP in-charge/ Environmental Engineer/ Environmental Manager/EHS Manager/Environmental Officer

iii. Process Head (CC/CE)

iv. Environmental/Chief Chemist

v. ETP Supervisors/Operators & Helper

b. Duties of Environmental Management Cell

i. The EMC shall review the status of water consumption, measures taken and identify the areas for water conservation, resource recovery and pollution reduction every week.

ii. Detailed minutes of the decisions taken will be recorded and circulated to all members of Environmental Cell and follow up of the decisions will be monitored by the Unit Head & ETP in-Charge.

iii. Review to be made in case of non-compliance by any statutory department.

iv. Internal Audit to be done by the EMC on quarterly basis.

v. External Environmental audit on annual basis.

c. Sugar industries will set up an internal lab of ETP with minimum analysis facilities for basic tests and should have below mentioned instruments:

i. pH Meter/pH pen

ii. Water distillation unit

iii. TSS meter

iv. TDS meter

v. DO meter

v. BOD testing kits with incubator

vi. COD testing kits with digester

vii. Oven

viii. Digital weighing balance with 0.1mg accuracy & 10gms accuracy

ix. Necessary Glassware

x. Chemical reagents

xi Digital thermometer/thermometer

A particular time schedule should be followed for measuring various pollution parameters. The frequency of such measurements is listed in Table 16.

Table 16. Frequency of Wastewater Analysis

Parameters	Frequency of Testing
pH	Once in a shift of 8 Hours
TSS	Once in a Shift of 8 hours
TDS	Once in a Shift of 8 Hours
Dissolved Oxygen	Once in a shift of 8 hours

Color visual	Once in a shift of 8 Hours
MLVSS/MLSS	Once in a shift of 8 Hours
COD	Once in a day
BOD	Once in a week

d. Engagement of scientific officials and technical staff for smooth operations of ETP

Details of such staff with their cadre and qualifications are given in Table 17.

Table 17 . Scientific and Technical Staff for ETP and Laboratory

Minimum strength in ETP		
Post	**Education / Experience**	**No of employees**
Environmental Manager/Officer/Head	Masters in Env. Sci/ Engineering	01
Shift Supervisor cum Lab Technician	Graduate/Master in Science/Engineering	0 1 (1 per shift)
Fitters cum operators	ITI pass	0 3 (1 per shift)
Helpers	Adult workers	06 (2 per shift)
Necessary strength of relievers to be maintained for working on 7 days a week (Continuous process)		

e. Training of the Staff

It is essential to provide necessary training to each employee with minimum 5 man days per employee in year by professional trainers from reputed organizations.

5.9 Press mud handling & management

- The press mud has the potential to be used as a biofuel, microbial carrier, soil conditioner, bioremediation of heavy metals, wax production, and concrete formation.
- Designated storage area.
- Record keeping of press mud generation and disposal.

5.10 Compliance of stack emission norms

- The sugar industries located in National Capital Region (NCR), has to ensure emission parameters as per CAQM order which is 80 mg/Nm3.
- Air pollution control device as notified under E(P)Rules,1986 shall be installed to achieve the prescribed emission norms under E(P)Rules, 1986/CAQM/SPCB, whichever is stringent.

- Installation and proper operation of adequate Air Pollution Control Device (APCD) is mandatory.

5.11 Installation of Sewage Treatment Plant (STP)

- It is mandatory to install the sewage treatment plant to treat the sewage generated from the residential colony of sugar industries and ensure compliance with the notified discharge norms.
- Flow meters to be installed at the inlet and outlet of the STP and logbook should be maintained.

5.12 Process Safety Management (PSM)

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 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 and lack of awareness among workers regarding safety. Therefore, to minimize the accidents sugar industries should consider following points to achieve the goals of process safety management:

- Sugar industries shall make arrangements of firefighting system
- Sugar industries shall conduct program for process safety management with the employees on regular basis
- Occupational health surveillance program for all employees should exercise on regular basis
- **In cane loading area**:
    - Sugar industries shall engage skilled, experienced and trained cane operator
    - No person shall be allowed to stand or work below the cane unloader
    - Sufficient lighting in the area
    - Maintenance of crane safety limit switches, break & mechanical stopper
    - Ensuring safe access and egress for vehicles carrying sugar cane to avoid risk of major injury due to inadvertent movement of vehicle/ bullock carts.

- **Feeder, Leveller & Chopper:**
    - All machines should be covered with guards
    - No person shall be allowed to stand or work on feeder conveyor
    - Installation of emergency switches at strategic locations should be mandatory
- **Juice Extraction- Mill**
    - Good housekeeping practice shall be followed to avoid slips and trips while working in the area
    - Installation of guard in all running nip points of devices and mill roles
    - Tapes shall be provided for eye wash /body wash in nearby area
    - Suitable ear protection shall be provided while working in mill area
- **Return bagasse carrier (RBC)**
    - Barricading shall be provided for the opening of RBC carrier to avoid the fall of worker
    - All machines shall be covered with guards
    - Work permits shall be issued for all repair/adjustment on RBC to ensure safe isolation through lock out/tag out.
- **Boiler**
    - At the time of starting of factory, hydraulic pressure testing shall be done at boiler to prevent any type of accident during operation
    - All drives shall be fitted with suitable guards
    - Dust and ash handling system should be installed
    - After getting report of steam leakages, correction should be made immediately.
    - Proper monitoring of Safety Valve should be maintained.
    - Personal protective equipment shall be provided
- **Bagasse storage and handling**

  In order to reduce the fugitive emission in bagasse storage and handling area following measures may be taken: -
    - Proper housekeeping
    - Covered conveyors and transfer points
    - Local exhaust ventilation
    - Provision of personal protective equipment (PPE)
    - Training and supervision

- Provision of proper fire hydrant system with water monitors
- Provision of secured fencing to all rotary parts and conveyor nip points with suitable and safe access for working near conveyor
- Maintenance of pull cord interlock system on both sides of conveyor.

- **Clarification /Evaporation**
  - All heating vessels proper tested to take into operation. Main holes and other opening provided with secured fitting. Avoid working near or below such joints.
  - All process and cleaning chemicals handled safely with protective equipments while handling chemicals.
  - Provided mechanical handling system of sulphur and lime to minimize exposure.
  - Steam pressure and temperature of juice heaters and evaporator bodies maintained properly.
  - Provided safety valve in steam lines and auto vacuum releasing valve in last body of Evaporator.
  - Employees provided with necessary protective measures i.e. safety shoes, hand gloves, respiratory mask, safety helmets, and safety belts etc.
  - Provided proper railing on all open tanks to avoid falling in the tanks.
  - The leakages of SO_2 gas through the burner and pipe lines attend immediately to avoid any mis-happening.
  - Work permit systems i.e. entry into the vessels (bodies, tanks) strictly followed.
- **Rotary vacuum filter& press mud conveyor**
  - All the rotating parts of the rotary vacuum filter guarded properly.
  - Avoid working near rotary parts. Use incidental tool to clean the roller.
- **Pan Section**
  - At the time of starting of the sugar factory, hydraulic pressure testing done all the Pans.
  - Auto vacuum releasing valve installed in all Pans.
  - Work permit system i.e. entry into the vessels strictly followed.
- **Centrifugal Machines**
  - Provided and maintained door /lid interlock of centrifugal machines.

- Provided guards to all drives.

- **Sugar storage and packing**
  - Use mechanized cleaning of floor.
  - All drives fitted with suitable guards.
  - We have maintained ventilation and dust collection system.
  - Elimination of other sources of ignition such as hot work, smoking and naked flames strictly followed.
  - We follow safe practices to avoid risks associated with sugar bag handling and stacking.
  - Temporary electrical supply given through ELCB/RCCB protected panels as per requirement.
  - All hoppers top is covered with GI Sheets.

6. Action Plan

<table>
<tr><th>S. No.</th><th>Action Points</th></tr>
<tr><td>1.</td><td>Implementation of new norms for specific fresh water consumption as tabulated in above Table 9.
<table>
<tr><th rowspan="2">S. No.</th><th rowspan="2">Category</th><th rowspan="2">Sub- category</th><th rowspan="2">Type of Turbine</th><th rowspan="2">Category Code</th><th colspan="2">New Norms for Specific Fresh Water Consumption (L/T)</th></tr>
<tr><th>Short Term (before crushing season 2025-26)</th><th>Long term (before crushing season 2028-29)</th></tr>
<tr><td rowspan="3">1.</td><td rowspan="3">Standalone (S)</td><td>Sugar mill Sulphitation and low pressure boiler</td><td>Back pressure turbine</td><td>S1</td><td>50</td><td>30</td></tr>
<tr><td rowspan="2">Sugar mill Sulphitation and high pressure boiler</td><td>Condensing mode turbine</td><td>S2A</td><td>100*</td><td>60</td></tr>
<tr><td>Back pressure turbine</td><td>S2B</td><td>75</td><td>50</td></tr>
<tr><td rowspan="3">2.</td><td rowspan="3">Sugar backend refinery (R)</td><td>Sugar backend with low pressure boiler</td><td>Back pressure</td><td>R1</td><td>50</td><td>30</td></tr>
<tr><td rowspan="2">Sugar backend refinery with high pressure boiler</td><td>Condensing mode turbine</td><td>R2A</td><td>100*</td><td>60</td></tr>
<tr><td>Back pressure turbine</td><td>R2B</td><td>75</td><td>5</td></tr>
</table></td></tr>
</table>

	3.	Integrated Sugar mills with Distillery units	Sugar mill Sulphitation with low pressure boiler integrated with distillery	Back pressure turbine	I1	50	30
			Sugar mill Sulphitation with high pressure boiler units with co-generation and integrated with distillery	Condensing mode turbine	I2A	100*	60
				Back pressure turbine	I2B	75	50

*In case of Sugar Industry with cogeneration, it is presumed that power export is only up to 50 % of home load for every 25% increase in power export, additional 25% specific fresh water consumption shall be permitted. Example mentioned in the NOTE of Table 9. New norms for fresh water consumption in different categories of sugar industries.

2. Implementation of stringent discharge norms (**Timeline**: before crushing season 2028-29)

i. In other sectors stringent norms are being applied therefore to ensure better and consistent compliance in sugar industries, stringent norm for BOD as 20 mg/l is desirable by 2028-29. Till then for compliance verification the notified norms are applicable.

ii. New target for treated effluent discharge quality is given as under:

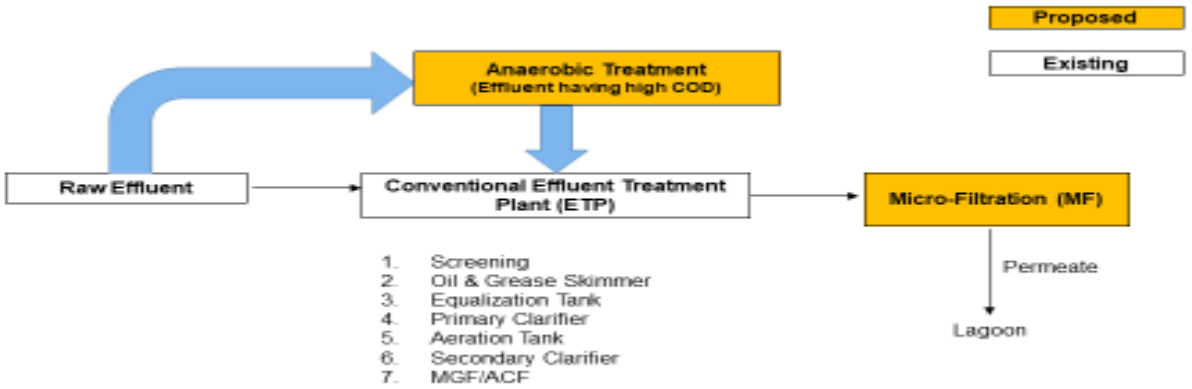
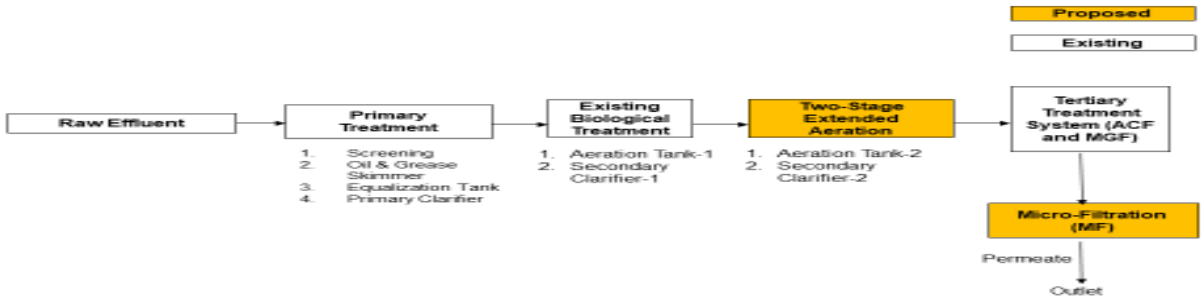
Table: Notified surface water discharge standards under E(P)Act, 1986 for sugar industries

Industry	**Parameters**	**Standards (*All concentration values are in milligramme per litre except for pH*)**
Sugar Industry	pH	5.5 – 8.5
	Total Suspended Solids (TSS)	30
	Biological Oxygen Demand, BOD (3 days at 27°C)	30
	Oil & Grease,	10
	Total Dissolved Solids (TDS)	2100

3. Upgradation/Augmentation of effluent management systems (**Timeline**: before crushing season 2025-26)

i. Installation of mechanical oil & grease skimmer with adequate retention time according to the technology.

ii. Upgradation/augmentation of existing ETPs by installing two stage Secondary biological treatment [anaerobic (anaerobic filter/digester) aerobic or two stage extended aeration system) and tertiary treatment up to microfiltration.

	iii. For effective settling, flow by gravity of effluent from aeration tank to secondary clarifier to be ensured instead of conveyance arrangement for flow. iv. Installation of Condensate Polishing Units (CPU) v. Fresh adequacy of ETP based on actual final effluent discharge quantity vi. Installation of separate brine recovery system (BRS) towards recovery and reuse of brine solution and to minimize the reject brine quantity. Ensure proper disposal of Brine reject i.e. spraying on bagasse/ burning in incineration boiler /gradual discharge to ETP for treatment etc.
	Proposed treatment scheme
	Case 1: Anaerobic followed by aerobic 
	Case 2: Two-stage Extended aeration 
4.	Sludge Management (**Timeline**: before crushing season 2025-26) i. Mechanical sludge handling system shall be installed viz. filter press/ screw press/ decanter/ rotary belt filter etc. i. Proper record keeping of sludge generation and disposal quantity and method (agriculture field/in-house gardening)

<table>
<tr><td></td><td>ii. Establishment of a manifest system for environmentally safe collection, storage, handling, transfer and disposal of ETP sludge shall be ensured.</td></tr>
<tr><td>5.</td><td>Treated effluent utilization and irrigation management plan (Timeline: before crushing season 2025-26)
i. An impermeable/ impervious lagoon shall require to be constructed for storage of treated effluent during no demand period of irrigation, the treated effluent to be stored in a seepage proof lined lagoon having 15 days holding capacity only.
ii. The monitoring of treated effluent quality in lagoon may be ensured by the sugar industries to avoid algae/algal bloom formation during storage.
iii. Installation of flow meter at to record the quantity of treated effluent being utilized for irrigation purpose i.e. in-house and agricultural fields.
iv. To utilize the treated effluent in agriculture, the unit shall have the irrigation management plan depending on the different soil texture duly vetted by agricultural universities.
v. For sugarcane-growing farmers under their command area emphasis to adopt drip irrigation instead of flood irrigation method by setting annual target of covering 10% land for groundwater conservation before crushing season 2025-26. Irrigation of all the command area by using drip irrigation method before crushing season 2028-29.
Table: New standards for land disposal
<table><tr><th>Parameters</th><th>Standards (All concentration values are in milligramme per litre except for pH)</th></tr><tr><td>pH</td><td>5.5 – 8.5</td></tr><tr><td>Total Suspended Solids (TSS)</td><td>100</td></tr><tr><td>Biological Oxygen Demand, BOD (3 days at 27°C)</td><td>100</td></tr><tr><td>Oil & Grease,</td><td>10</td></tr><tr><td>Total Dissolved Solids (TDS)</td><td>2100</td></tr></table></td></tr>
<tr><td>6.</td><td>Ash handling and management (Timeline: before crushing season 2025-26)
i. Air pollution control device as notified under E(P)Rules,1986 shall be installed to achieve the prescribed emission norms under E(P)Rules, 1986/CAQM/SPCB, whichever is stringent.
ii. For disposal of boiler ash into agricultural fields, sugar industries shall make agreement/record of disposed ash quantity.</td></tr>
</table>

	iii. The sugar industries shall ensure the controlled application of ash on agricultural land after mixing with press mud. iv. Provide designated and fenced area with caution display at hot boiler ash storage site to avoid accidents. v. Boiler ash shall be used for land filling at low lying areas after attaining ambient temperature. vi. The sugar industries shall establish a manifest system for environmentally safe collection, storage, handling, transfer and disposal of boiler ash. The manifesto shall be submitted to SPCBs for record purpose. vii. Boiler ash should be transport in covered vehicle
7.	Setting up of environmental management cell (EMC), environmental laboratory and trained & adequate manpower for ETP operations (**Timeline:** before crushing season 2025-26) i. Setting up of an Environmental Management Cell (EMC) to effectively monitor the environmental compliance. ii. Setting up of an internal lab of ETP with minimum analysis facilities for basic tests. iii. Appointment of scientific officials and technical staff for smooth operations of ETP. iv. Training to ETP staff
8.	Installation of sewage treatment plant for treatment of sewage generated from the residential colonies of sugar industries. (**Timeline:** before crushing season 2025-26)

7. FACILITATION TO INDUSTRIES BY SPCBS FOR IMPLEMENTATION OF SUGGESTIVE MEASURES:

SPCBs/ PCCs shall ensure proper implementation of the Charter by the individual sugar industry. They shall be responsible for monitoring and surveillance activities to ensure environmental compliance. In case of any violation of the environmental norms, concerned SPCBs will take appropriate actions, including issuance of closure directions, under the Water/ Air Acts/ E (P) Act.

i. Industries to prepare time bound action plan for implementation of the suggestive measures as mentioned above, including upgradation/augmentation of existing ETPs installed in sugar industries having permission to discharge.
ii. Solid wastes and boiler ash to be provided only to authorized agencies.
iii. Adoption and implementation of manifest system for environmentally safe collection, storage, handling, transfer and disposal of solid waste (boiler ash and ETP sludge).

iv. All individual industry to ensure collective responsibility and participation in waste management efforts.
v. Ensure proper record keeping regarding generation, storage and disposal of solid waste (boiler ash and ETP sludge).

8. APPENDIX

8.1 BARE MINIMUM TECHNOLOGY (BMT)

BMT is indicative of the systems, equipment, processes and practices that are generally considered essential to achievement of the objectives of this Charter. Technology actually required, or implemented, by individual sugar industries to achieve the same documented level of environmental protection, may differ on account of their unique set of circumstances like scale of operations, equipment and system configuration, product portfolio, raw material etc.

Bare Minimum Technologies (BMT)			
Sl. No	**Functional Area**	**Facility Required**	
		BMT/Optional	**Type of facility**
1	**Cane preparation and juice extraction**		
1.1	Cane unloading	BMT	Cane carrier of suitable width & length with variable speed drive
		BMT	Hydraulic grabs with cross and longitudinal travel trolleys/ sling bar for cane unloading
			Truck /trolley tippler
1.2	Cane Preparation		System to ensure Preparatory Index (PI) of 85+ by installation of :
		Optional	Cane kicker
		BMT	cane leveller/cane chopper, cane cutter and swing hammer fibrizer/cane shredder
		BMT	Rake elevator below fibrizer/ shredder with variable drive
		BMT	Interlocking system in cane preparatory devices with cane carrier
		BMT	Closed loop water circulation for cooling of bearings of preparatory devices
1.3	Cane Milling	BMT	To attain a Reduced Mill Extraction (RME) of 96+ , a milling tandem comprised of 4 three rollers mills with toothed UFR and Donnelly chute with rake carriers between the mills or any other combination using 2/3 rollers mills with UFR/TRF/GRPF/TRPF
		BMT	Each mill driven by a variable speed DC drive with speed reduction through enclosed reduction gear box/ planetary gear

		BMT	Interlocking of all Rake elevator & rake carriers with mills
		BMT	Hydraulic loading and hot water Compound Imbibition using hot water of 85ºC @ 250-300% on fibre or as required. Flow measurement & control system to be installed
		BMT	Closed loop water circulation for cooling of mill bearings & mill drives
1.4	Spillage Monitoring & Control	BMT	Spill pits/tanks, and drainage system for containment/recovery, dry cleaning of floors with bagasse.
2.0	**Steam Generation**		
		BMT for < 42 kg/cm^2 pressure boiler	Bi-drum boiler with tube bank, front, roof, rear and sides water walls. Super heater, economiser, air pre-heater with ID, FD SA fans etc. Air pollution control device as notified under E(P)Rules,1986 shall be installed to achieve the prescribed emission norms under E(P)Rules, 1986/CAQM/SPCB, whichever is stringent.
		BMT for > 42 kg/cm^2 pressure boiler	Bi-drum boiler with tube bank, front, roof, rear and sides water walls. Primary & secondary Super heaters, atemperator, economiser, air pre- heater, de-aerator, ID, FD, SA fans etc. Electrostatic Precipitator (ESP) for arresting ash and particulate matters (PM)
2.1	Instrumentation & control	BMT	Instrumentation , automation & control through DCS
2.2	Waste water re-cycling	BMT	Closed loop re-circulation of waste water generated from RO/DM reject and boiler blow down after treatment in ETP
2.3	Ash disposal	BMT	Supply to cement plant//brick manufacturing unit (coal based ash) filling of low lying land/ bio-composting/land application
3.0	**Power Generation**		
3.1	With/ without Incidental co-generation	BMT for boiler pressure up to 42 kg/cm2	Back pressure/ Bleed cum back pressure steam turbine coupled with an alternator to generate electricity at 11 KV
3.2	With incidental co-generation	BMT for boiler pressure	Back pressure/ Bleed cum back pressure/ Extraction cum condensing steam turbine coupled with an alternator to generate electricity at 11 KV

3.3	With incidental and off season co-generation	above 42 kg/cm2	Ex+++traction cum condensing (EC) steam turbine coupled with an alternator
			Water cooled condenser, cooling towers of suitable capacity for EC turbine
			Closed loop cooling water circulation at power generation with cooling tower of suitable capacity
			Suitable switch yard for power export to grid
4.0	**Handling of Discharges**		
4.1	**Waste water Discharges**		
4.1.1	Effluent Treatment Plant (ETP) design	MBT	As per achieving prescribed norm
4.1.2	Treated wastewater disposal		As per norms of CPCB/SPCB/charter recommendations
4.1.3	Condensate Polishing Unit	BMT for surplus condensate for factories having boiler > 42 kg/cm2 steam pressure	Reverse Osmosis (RO) followed by MGF and ACF or any other proven technology. Treated condensate may be used for various purposes e.g. power plant cooling tower make-up.
4.2	**Atmospheric Discharges**		
	Stacks		Air pollution control device as notified under E(P)Rules,1986 shall be installed to achieve the prescribed emission norms under E(P)Rules, 1986/CAQM/SPCB, whichever is stringent.
5.0	**General Pollution Abatement Measures**		
5.1	Resource Management		Optimum use of all material resources through input-output analysis and establishment of moving targets for specific consumption of inputs. Cost audits to be moderated by environmental considerations.
5.2	Good house keeping		Containment and management of material spillages to prevent contamination of soil, ambient air and ground water, besides increasing pollution loads and vitiating workplace environment.

5.3	Chemical cleaning of heat exchangers		Trial & use of hydroject cleaning in place conventional chemical + mechanical cleaning to the extent possible. Construction of " Hazardous Tank" to collect washings of chemical cleaning & for adding gradually in main ETP
5.4	Monitoring & control		Factory –wide fresh water distribution networks be colour coded (as per BIS) to identify process, utility and domestic supplies.
6.0	**Environmental Management Systems**		
6.1	Environmental Control Laboratory		Establishment of testing facilities, manned by trained and dedicated staff, for routine monitoring of effluent generation and performance measurement of pollution control systems, equipment and devices. The staff will also be responsible for maintaining proper records and initiating non-compliance warnings.
6.2	Environmental Audits/ Third party inspection		Half Yearly Comprehensive Audit/ third party inspection
			Performance audit/inspection by third party during season
7.0	**Compliance Monitoring**		
7.1	Off-line routine monitoring		Routine analysis of pH, TSS, COD, TDS, DO, Colour, MLSS etc. and weekly analysis of BOD,for waste water (effluent) and treated effluent from ETP
			Routine analysis of PM, SO_2, NOx , CO_2, O_2 for stacks
			pH, TSS, COD, TDS, MLSS, colour daily. Air quality measurements as prescribed by SPCB
7.2	Flow measurement		Magnetic flow meter with remote mounted transmitter and totalizer feature with connectivity to a remote PC through an RTU
7.3	Online Continuous Monitoring for wastewater		Online monitoring for flow, pH, TSS, BOD, TDS of treated water as required by SPCB
7.4	Online Continuous Monitoring for air emission		Particulate Matter (PM) emission from stacks as required by SPCB
8.0	**Manufacturing of Plantation White Sugar**		

8.1	Juice weighment	BMT	Mass flowmeter of suitable capacity with arrangement for check weighment. System to have auto juice flow control system to have stabilized flow to process.
8.2	Juice heating	BMT	Heating the raw juice and sulphited juice to 68-70 ^{0}C and 103-104^{0}C in tubular/DCH/PTHE/Condensate heaters of suitable heating surfaces in multiple stages. Similarly heating the clear juice in Tubular/PTHE/DCH to desired temperature. Condensates to be utilized for various purposes in mill and boiling house.
8.3	Clarification	BMT	Clarifying the heated raw juice by addition of milk of lime @ 1.2-1.8%, v/v and SO_2 gas in a juice Sulphiter preferably having auto pH control system.
8.4	Milk of lime preparation	BMT	Slacking quick lime with condensate and screening it through hydro cyclone/vibro screen/Koran classifier.
8.5	SO_2 generation	BMT	Generation of sulphur di-oxide in film type sulphur furnace having combustion control and molten sulphur feed control system with efficient cooling of gas to 70-72^{0}C. Re-circulation of cooling water through fanless cooling towers to minimize fresh water usage.
8.6	Settling	BMT	Use of efficient Rapi Dorr 444 type or equivalent clarifier with retention time not exceeding 2 ½ hours.
8.7	Filtration	BMT	Filtration of underflow/muddy juice from clarifier to recover juice in RVF. Hot condensate of about 70^{0}C to be used for cake wash. Alternatively use of Decanters. Quantity of wash water to be monitored by installing flow meters.
8.8	Evaporation	BMT	Concentration of juice so as to convert it in to syrup using Multiple Effect Evaporators, Quadruple or Quintuple with extensive vapour bleeding system to have heat recovery arrangement through installation of condensate cigar & condensate Heaters. Exhaust steam condensate to be used as boiler feed water, whereas condensate from other bodies to be used for meeting requirements of mill & boiling house. For boilers up to 45 kg/cm^2 g pressure, IInd body condensate to be used partially as boiler feed water make up, whereas, for higher boiler pressure, it is to be used after treatment though CPU.
8.9	Syrup Sulphitation	BMT for	Bleaching the syrup obtained from Evaporators to a pH 5.2-5.4 using SO_2 gas.
9.0	Crystallisation	BMT	**a.** Further concentration of sulphited syrup in vacuum pans (single effect evaporators) to carryout crystallization of sugar. Low head batch pans/ low head batch pans with

			mechanical circulator/continuous vacuum pans to be used. Level of boiling mass in pan and fluctuation in vacuum to be avoided to inhibit entrainment. Tell tail bottles to be provided to periodically check any entrainment. Use of hot water during pan boiling to be measured by installing flow meter & efforts to be made to keep it as low as possible. Condensates to be utilized in a closed loop for meeting mill & boiling house requirements. **b.** Cooling & conditioning of massecuite boiled in vacuum pans in air/water cooled batch/ continuous crystallizers. A – massecuite to be hot cured, B- massecuite cooled to about 52-54°C & C massecuite to be cooled to 40-42°C & then reheated to 52-54°C. Proper cooling arrangement to be provided for re-circulating cooling waters.
9.1	Centrifugation	BMT	Separation of sugar crystals from mother liquor by centrifuging in fully automatic recycling type batch centrifugal in case of A- Massecuite and in continuous machines in case of other massecuite. Quantity of wash water to be monitored & controlled by installing flow meters.
9.2	Cooling & Condensing		Installation of single/multi entry stainless steel jet condensers. The difference between injection water inlet and tail pipe temperature to be 8-15 ^{0}C. For spray ponds, minimum drop of 13^{0}C or within 7^{0}C of wet bulb temperature, whichever is less, to be achieved. For cooling towers, minimum drop of 20^{0}C or within 5^{0}C of wet bulb temperature, whichever is less, to be achieved.
9.2	Sugar Dryer	BMT	Drying of sugar on grass hoppers or fluidized bed dryers to the extent that level of moisture should not be more than 0.06 % w/w.
10.0	**Additional steps for production of Refined Sugar**		
10.1	Raw sugar melting	BMT	Raw sugar melting in sweet water generated from IER and hot condensate.
10.2	Filtration	BMT	Filtration of raw sugar melts through vibro screen / stationary screen of about 0.75 mm opening.
10.3	Remelt liquor heating	BMT for phosphatation process.	Remelt filtered liquor heating in DCH or PTHE up to 85^{0}C of suitable heating surfaces.

10.4	Clarification	BMT	Clarifying the heated remelt liquor by addition of colour precipitant of about 100-150 ppm & about 400-500 ppm P_2O_5 on solid and milk of lime of 2-2 ½ ^{0}Be. Retention time in reaction tank to be about 8 minutes and in floatation clarifier to be about 30-40 minutes.
10.5	Filtration	BMT	One or two stage filtration of underflow using MBF/ candle / leaf filters of suitable filtering area & filtration rate of about 0.45-0.50 $m^3/m^2/hr$.
10.6	Decolourization	BMT for ion exchange resin	Decolourization of clarified liquor in two stage IER columns used in series or in parallel using Acrylic & Styrenic type resins. Two stage brine recovery system to be provided for facilitating 80% recovery.
10.7	Melt Concentration	BMT	Evaporation in Double / Triple Effect Evaporator to convert it in to concentrated liquor of about 74-75^{0}Bx. Condensates to be utilized for various purposes of melting etc.

8.2 BEST PRACTICES FOR SUGAR INDUSTRY

A. Best practices and strategies for reduction of fuel consumption and achieving maximum steam efficiency

- In order to decrease the fuel consumption, it is necessary to improve boiler and steam efficiency. To attain the maximum steam efficiency by limited usage of fuel, installation of a high-pressure boiler the following key points shall be considered:
- DE-aerator charging system utilizing exhaust steam.
- High-pressure heater to preheat boiler feed water to a temperature of at least 165°C.
- Passage of excess air required for fuel combustion through an air preheater (APH) to preheat air, aiding in proper fuel combustion.
- Proper maintenance of boiler furnace panels and piping insulation to prevent radiation losses.
- Designing the boiler with all necessary control devices and loops and ensuring it operates in auto mode through a DCS system.
- Maintaining bagasse moisture below 50% for effective fuel combustion.
- Optimization of boiler blows down to reduce fresh water consumption through regular parameter analysis of feed water.
- Reduction of steam losses by installing steam traps to maximize condensate

recycling

B. Best practices to reduce steam consumption in sugar process

Reducing steam consumption in sugar manufacturing is crucial for enhancing energy efficiency, cutting costs, and minimizing environmental impacts. The sugar industry traditionally relies heavily on steam for various processes such as juice heating, evaporation, crystallization, and curing. Here are some best practices to reduce steam consumption in sugar manufacturing:

C. Optimize Juice Extraction

- Maximize extraction of juice from sugarcane.
- Use energy-efficient milling or diffusion systems to extract juice.

D. Enhance Heat Exchange Systems

- Implement efficient heat exchangers to recover and reuse heat from hot process streams, such as condensate from evaporators and vapors from pans.
- Utilize multi-effect evaporation systems that use the vapor from one effect as the heating medium for the next, significantly cutting down the steam requirement.

E. Adopt Vapour Recompression

- Mechanical or thermal vapor recompression (MVR or TVR) can be used to compress and reuse low-pressure steam, increasing its temperature and pressure for reuse in the process, thereby reducing fresh steam demand.

F. Improve Process Control and Automation

- Use advanced control systems for precise control over steam flow, temperature, and pressure, ensuring optimal steam usage.
- Automate steam traps and condensate return systems to prevent steam loss and improve condensate recovery.

G. Regular Maintenance

- Regularly maintain steam pipes, valves, and fittings to prevent leaks and losses of steam.
- Ensure that insulation on steam pipes and vessels is intact and effective to reduce heat loss.

H. Condensate Recovery

- Efficiently collect and return condensate to the boiler for reuse. This not only saves water but also the energy needed to heat fresh water.
- High-quality condensate can reduce the boiler's fuel consumption and chemical treatment requirements.

I. Batch Pan Crystallization Improvements

- Optimize seeding and massecuite cooling techniques to minimize the steam used in the crystallization phase.
- Explore continuous pan systems that can use vapor bleeding techniques for more efficient steam usage.

J. Best practices for reduction in fresh water consumption

Providing micro-irrigation (drip irrigation) system for sugarcane crop will be reduce significant groundwater extraction at field.

Efficient water management holds paramount importance in sugar manufacturing for mitigating environmental impact and operational costs.

- **Recycling and Reuse:** Implementing systems to recycle and reuse process water whenever feasible, such as utilizing condensate for various purposes.
- **Optimized Process Design:** Designing processes to minimize water usage, such as employing closed-loop systems and optimizing cleaning procedures to mitigate water wastage. Use of hydro jet cleaning and dry cleaning.
- **Advanced Technologies:** Investing in advanced technologies like membrane filtration and reverse osmosis with polishing unit to treat and reuse excess condensate generated from the sugar process, thus reducing the consumption of fresh water for boilers.
- **Water-Efficient Equipment:** Installing water-efficient equipment and machinery throughout the manufacturing process and water-saving pumps equipped with mechanical seals rather than gland sealing.
- **Regular Maintenance:** Conducting regular maintenance of equipment to prevent leaks and ensure efficient water use**.**
- **Employee Training:** Educating employees about the significance of water conservation and implementing training programs to promote water-saving practices.
- **Optimization of Boiler Blowdown:** Maintaining boiler water quality as per requirements to reduce the frequency of blowdown, thereby minimizing fresh water

intake at RO/DM and reducing effluent generation.

- **Rooftop rainwater harvesting:** Harvesting of rainwater during rainy season and storage for utilization during commencement of crushing season
- **Adaption of dual plumbing system:** Installation of dual plumbing system to reduce freshwater consumption by reusing treated wastewater for flushing in toilets

Laboratory: Made provision of polished permeate line at lab for laboratory purpose, this might be 20 mg/l to 25 mg/l TDS water and good replacement of fresh for laboratory purpose.

K. Best practices to reduce effluent generation

Effluent generation reduction strategies can be effectively implemented through various measures:

- **Centralized Grease Lubrication System:** Installing a centralized grease lubrication system instead of oil lubrication can prevent oil contamination and spillage, especially with bearing cooling water in the mill and process house.
- **Minimization of Juice or Water Leakages:** To reduce effluent generation, efforts should be focused on minimizing leakages of juice or water at the mill house. This canbe achieved by implementing preventive measures to address gland leakages. Collecting any leakages in a pit and subjecting them to physical and chemical treatment to prevent microbial contamination, facilitating recycling. Installing proper arrangements to prevent spitting from both sides of mill rollers.
- **Dry Cleaning and Collection of Leaks:** Keeping the mill house bottom foundation area dry and opting for dry cleaning instead of water washing can help reduce effluent generation. Additionally, collecting all gland leakages and tank spillages in a pit and promptly returning them to the process house for treatment is essential.
- **Cleaning Schedule and Communication:** Establishing a cleaning schedule for mill house and process house equipment and effectively communicating it to the Environment department ensures proper maintenance and minimizes effluent generation.
- **DSM Screen / Static Screen Installation:** Providing DSM screens/rotary screens or static screens for the removal of bagasse and foreign material from effluent generated by the sugar plant not only improves effluent quality but also reduces temperature.

L. For indoor air pollution management

Usually bagasse is used as fuel for boiler in the sugar industries and this process causes emission of pollutants such as SO_2, CO & NO_2. In addition to this milling, sulphitation

process evaporation and sugar dust in packaging house, bagasse and ash handling are other emission sources that causes air pollution. Following steps shall be taken by the sugar industries:

- Factories should have installed APCD to minimize the air pollutants of boiler.
- Adoption of leak proof system to prevent leakages of SO_2.
- Dust collector mechanical device should be installed in sugar drier house to arrest the sugar dust particles.
- Personal protective equipment should be provided to the workmen at their working place.
- Mechanical handling of ash and bagasse

Handling of chemicals and housekeeping

Hazardous chemicals

i. In case of chemical/mechanical cleaning of the heat exchangers is practiced, 'Hazardous Tank' of adequate capacity (so as to facilitate addition @ 5% max. v/v of total effluent) or surge tank at ETP may be provided to collect washings and their addition to ETP gradually so as to avoid shock loads and to reduce the pollution load as well.

ii. The sugar factories shall also require to maintain the disposal records of Hazardous Substances (oil & grease and brine or any hazardous substances etc.) and annual return in Form-4.

iii. It is recommended that covered area should be provided to store the hazardous wastes at hazardous wastes collection site.

iv. Dry cleaning of factory floors etc. using bagasse should be practiced instead of wet cleaning using water.

v. Separate collection of hazardous chemicals generated during lab analysis of physico-chemical parameters of sugar effluent and its proper disposal through TSDF shall be recommended.

vi. Centralized lubrication system with grease may be installed for cooling of mill bearings to reduce the effluent and oil contamination in water.

vii. Minimum use of cleaning chemicals and use of hydro jet machines for evaporator cleaning

viii. Buffer tanks in process house to restrict the shock load in case of any accidental spillage/overflow

ix. Proper engineering control to avoid leakages and spillages in the plants

a. Good housekeeping

i. Good housekeeping must be ensured by preventing spillages, leakages and overflows etc. which otherwise increases the load of pollutants in the waste waters coming out of different sections of the factory.

ii. Proper maintenance of process parameters is necessary to avoid over sulphitation of syrup and also preventing entrainment so as to minimize contamination of the process cooling tower/spray pond water, in particular. External catchalls may also be provided in the last body of the Evaporator and also in the pans.

iii. Likewise, unnecessary blowing of safety valve and loss of exhaust steam/vapors through noxious gas removal system to be minimized. The radiation, condensation and losses due to leakages are also required to be minimized.

iv. Treated effluent use in preparation of chemicals for dosing at ETP is recommended, there should not be any provision of separate freshwater line for the said purpose.

v. Display of ETP layout with capacity and dimensions of each unit at ETP

vi. Greenbelt development in factory premises and around the ETP

vii. Factory should develop and implement comprehensive safety polity in unit

viii. Installation of factory layout at main gate

8.3 DOCUMENTATION UNDER CHARTER 2.0

Proper records in prescribed formats shall be made routine practice and periodically reviewed by the industry, which can be provided to the SPCBs/CPCB as and when required. The sugar industry shall maintain logbooks/records for the following:

1.	Environmental Clearance and compliances uploaded on PARIVESH portal
2.	Air Consent
3.	Water Consent
4.	Hazardous Waste Authorization
5.	Agreement with third party for disposal of Hazardous Wastes
6.	Copy of Form-4 and Form-10 (Manifesto, Annual return etc.)
7.	Valid CGWA NOC/Application copy
8.	Daily Manufacturing Report
9.	Process details- Material Balance
10.	Form RT-8C (current + previous crushing season)
11.	Bore well/Tube well log book
12.	Hot & Cold Water recycling system logbook

13.	Detailed Water Balance diagram
14.	ETP flow diagram along with dimensions of ETP units
15.	ETP Adequacy Report
16.	ETP effluent generation and discharge log book/record
17.	ETP Logbook for parameter analysis
18.	ETP Sludge generation/disposal logbook
19.	Details of Condensate Polishing Unit (CPU) system adopted by the industry (If applicable)
20.	Boiler & fly ash generation/disposal logbook
21.	Boiler & fly ash disposal point (If boiler ash is sent to cement industry then submit agreement with cement industry)
22.	Press mud generation and disposal log book/record
23.	Disposal record of hazardous wastes
24.	Chemical dosing/consumption record (for pH maintenance etc.)
25.	Energy Meter logbook for ETP
26.	Laboratory analysis of ETP carried out by the unit
27.	Laboratory analysis of ETP carried out by third party/external agency
28.	Spray Pond overflow treatment process details
29.	Spray Pond overflow logbook
30.	Irrigation Management Plan and farmers agreement
31.	Record for treated effluent used in irrigation/other purpose
32.	Record for treated effluent used in attached distillery
33.	Dimensions/drawings of: i. Lagoons ii. Hazardous tanks iii. Other Pits (if, any) iv. UGRs (hot & cold)
34.	Piezometer details – locations name with co-ordinates
35.	STP flow diagram and logbook (**if installed/applicable**)
36.	List of flow meters, their locations in sugar mill and logbooks - Fresh water abstraction and use - ETP inlet & outlet and spray pond overflow - Treated effluent for own purpose and farmer's irrigation
37.	Details of OCEMS
38.	Details of Air Pollution Control System and third party stack monitoring results

8.4 CASE STUDY:

A. 5000 TCD STANDALONE SUGAR MILL WITH LOW PRESSURE BOILER

Summary of the water balance for case 1				
S. No.	**Particular**	**C Heavy**	**B Heavy**	**Syrup & B Heavy**
		M^3/Day		

1	Total excess condensate available after use in process	900.00	795.00	764.00
2	Boiler blow down going to ETP	7.00	7.00	7.00
3	Effluent generation from cold water	517.00	517.00	517.00
4	Effluent generation including boiler blow down (i.e. 2 + 3)	524.00 (104.8 Lit/ton of cane)	524.00 (104.8 Lit/ton of cane)	524.00 (104.8 Lit/ton of cane)
5	Cold water loss during circulation	23.00	23.00	23.00
6	Total water requirement after considering water losses in effluent and cooling water (524 + 23.00 = 547.00)	547.00	547.00	547.00
7	Makeup water used from excess condensate after cooling treatment	547.00	547.00	547.00
8	**Balance excess condensate after use as makeup (1- 6)** **C Heavy: 900.00 – 547.00 = 353.00** **B Heavy: 1000.00 – 547.00 = 453.00** **Syrup & B Heavy: 964.00- 547.00 = 417. 00**	**353.00 (70.6 Lit/ton of cane)**	**453.00 (90.60 Lit/ton of cane)**	**417.00 (83.40 Lit/ton of cane)**
9	**Spray pond overflow generation from process**	**500.00 (100 Lit/ton of cane)**	**400.00 (80 Lit/ton of cane)**	**300.00 (60 Lit/ton of cane)**
10	**Total waste water generation including: cold water effluent + balance excess condensate + spray pond overflow (4 + 8 + 9)**	**1377.00 (275.40 Lit/Ton of cane)**	**1372.00 (275.40 Lit/Ton of cane)**	**1241.00 (248.20 Lit/Ton of cane)**
11	****Fresh water requirement for process after use of excess condensate**	**00**	**00**	**00**
12	Fresh water requirement for lab and domestic use	50.00	50.00	50.00
** This is applicable towards the normal operations of the unit but fresh water for initial startup and also during long plant shutdowns/reduced crushing situation at the end of season, the additional fresh water will be required which will be around 50 Lit/ton of cane for the season as a whole but this is occasional.				

B. 5000 TCD SUGAR MILL WITH HIGH PRESSURE BOILER WITH CONDENSING MODE TURBINE

Summary of the water balance for case 2

S. No.	Particular	C Heavy	B Heavy	Syrup & B Heavy
		M^3/Day		
1	Total excess condensate available after use in process	564.00	663.00	611.00
2	Water requirement for cooling tower makeup from excess condensate	72.00	144.00	260.00
3	Loss of cold-water during cooling makeup through excess condensate after cooling	20.00	20.00	20.00
4	**Balance excess condensate after makeup for cooling tower and losses (i.e. 1 – 2 - 3)**	**472.00 (94.4 Lit/ton of cane)**	**499.00 (99.8 Lit/ton of cane)**	**331.00 (66.2 Lit/ton of cane)**
5	Boiler blow down going to ETP	5.00	5.00	5.00
6	RO reject going to ETP	73	67	61
7	Cooling tower blow down going to ETP	72	144	260
8	Effluent generation from cold water	517.00	517.00	517.00
9	**Effluent generation including RO reject and cooling tower blow down (i.e. 5 + 6 + 7+ 8)**	**667.00 (133.4 Lit/Ton)**	**733.00 (146.6 Lit/Ton)**	**843.00 (168.60 Lit/Ton)**
10	**Spray pond overflow generation from process**	**500.00 (100 Lit/Ton)**	**400.00 (80 Lit/Ton)**	**300.00 (60 Lit/Ton)**
11	**Total waste water generation including balance excess condensate, cold water effluent and spray pond overflow (i.e. 4 + 9 +10)**	**1639.00 (327.80 Lit/ Ton of cane)**	**1632.00 (326.40 Lit/Ton of cane)**	**1474.00 (294.80 Lit/ Ton of cane)**
12	**Fresh water requirement for boiler makeup through RO**	**180.00 (36 lit/ton of cane)**	**168.00 (34.00 Li/ton of cane)**	**153.00 (31.00 Lit/ton of cane)**
**13	Fresh water requirement for lab and domestic use	50.00	50.00	50.00

*Note: In these calculations, it is considered that minimum required steam will go to turbine generator (TG) condenser but if unit is having co-generation with the increase of power export, the steam to condenser will increase resulting higher water recirculation in TG cooling towers. Hence higher loss of water and higher opportunity for reuse of excess condensate resulting lesser waste water generation

** This is applicable towards the normal operations of the unit but fresh water for initial startup and also during long plant shutdowns/reduced crushing situation at the end of season, the additional fresh water will be required which will be around 50 Lit/ton of cane for the season as a whole but this is occasional.

C. 5000 TCD SUGAR MILL WITH HIGH PRESSURE BOILER WITH BACKPRESSURE MODE TURBINE

Summary of water balance for case 3				
S. No.	**Particular**	**C Heavy**	**B Heavy**	**Syrup & B Heavy**
		M^3/Day		
1	Total excess condensate available after use in process	562.00	663.00	611.00
2	Fresh water requirement for cooling tower makeup	72.00	72.00	72.00
3	Loss of cold-water during cooling	20.00	20.00	20.00
4	Balance condensate after reuse in makeup water	470.00 (94.4 Lit/Ton of cane)	571.00 (114.2 Lit/ton of cane)	519.00 (104.00 Lit/ton of cane)
5	Boiler blowdown going to ETP	5.00	5.00	5.00
6	RO reject going to ETP	62.00	59.00	53.00
7	Cooling tower blow down going to ETP	72.00	72.00	72.00
8	Effluent generation from cold water	517.00	517.00	517.00
9	**Total effluent generation including boiler blow down, RO reject and cogeneration cooling tower blow down (i.e. 5 + 6 + 7 + 8)**	**656.00 (131.20 Lit/Ton)**	**653.00 (130.60 Lit/Ton)**	**647.00 (129.40 Lit/Ton)**
10	Spray pond overflow generation from process	500.00 (100 Lit/Ton)	400.00 (80 Lit/Ton)	300.00 (60 Lit/Ton)
11	**Total waste water generation including balance excess condensate, effluent and spray pond overflow (4 + 9 + 10)**	**1626.00 (325.20 Lit/Tone of cane)**	**1624.00 (324.80 Lit/Tone of cane)**	**1466.00 (293.20 Lit/Tone of cane)**
12	**Fresh water requirement for boiler makeup through RO**	**154.16 (30.83 Lit/Tone of cane)**	**146.33 (29.26 Lit/Tone of cane)**	**130.33 (26.06 Lit/Tone of cane)**
** 13	Fresh water requirement for lab and domestic use	50.00	50.00	50.00

** This is applicable towards the normal operations of the unit but fresh water for initial startup and also during long plant shutdowns/reduced crushing situation at the end of season, the additional fresh water will be required which will be around 50 Lit/ton of cane for the season as a whole but this is occasional.

D. 5000 TCD BACKEND SUGAR REFINERY, HIGH PRESSURE BOILER WITH CONDENSING MODE TURBINE

Summary of water balance for case 4				
S. No.	**Particular**	**C Heavy**	**B Heavy**	**Syrup & B Heavy**
		M^3/Day		
1	Total excess condensate available after use in process	618.00	715.00	664.00
2	Loss of cold-water during cooling	22.00	22.00	22.00
3	Condensate water requirement for cooling tower makeup	130.00	230.00	331.20 Say 332.00
4	Balance excess condensate after makeup for cooling tower and loss	466.00 (93.2 Lit/ton of cane)	463.00 (92.60 Lit/ton of cane)	310.00 (62.00 Lit/ton of cane)
5	Boiler blow down going to ETP	7.00	7.00	7.00
6	RO reject going to ETP	74.00	70.00	65.00
7	Cooling tower blow down going to ETP	130.00	230.00	332.00
8	Effluent generation	567.00	567.00	567.00
9	Total effluent generation including boiler blow down, RO reject, cooling tower blow down (5+6+7+8)	778.00 (155.60 Lit/Ton)	874.00 (174.80 Lit/Ton)	971.00 (194.20 Lit/Ton)
10	Spray pond overflow generation from process	500 (100.00 Lit/Ton)	400 (80.00 Lit/Ton)	300 (60.00 Lit/Ton)
11	Total waste water generation including balance excess condensate, cold water effluent and spray pond overflow (i.e. 4 + 9 + 10)	1744.00 (348.80 Lit/ton of cane)	1737.00 (347.40 Lit/ton of cane)	1581.00 (316.20 Lit/ton of cane)
12	Fresh water requirement for boiler makeup through RO	184.00 (36.80 Lit/ton of cane)	175.00 (35.00 Lit/ton of cane)	162.00

				(32.40 Lit/ton of cane)
**13	Fresh water requirement for lab and domestic use	50.00	50.00	50.00

*Note: In these calculations, it is considered that minimum required steam will go to turbine generator (TG) condenser but if unit is having co-generation with the increase of power export, the steam to condenser will increase resulting higher water recirculation in TG cooling towers. Hence higher loss of water and higher opportunity for reuse of excess condensate resulting lesser waste water generation

** This is applicable towards the normal operations of the unit but fresh water for initial startup and also during long plant shutdowns/reduced crushing situation at the end of season, the additional fresh water will be required which will be around 50 Lit/ton of cane for the season as a whole but this is occasional.

E. 5000 TCD BACKEND SUGAR REFINERY, HIGH PRESSURE BOILER WITH BACKPRESSURE MODE TURBINE

Summary of water balance for case 5				
S. No.	**Particular**	**C Heavy**	**B Heavy**	**Syrup & B Heavy**
		M^3/Day		
1	Total excess condensate available after use in process	628.00	715.00	664.00
2	Loss of cold-water during cooling	22.00	22.00	22.00
3	Condensate water requirement for cooling tower makeup	72.00	72.00	72.00
4	**Balance excess condensate after use for makeup [1-(2+3)]**	**534.00 (106.80 Lit/ton of cane)**	**621.00 (124.20 Lit/ton cane)**	**570.00 (114.00 Lit/ton of cane)**
5	Boiler blow down going to ETP	6.00	6.00	6.00
6	RO reject going to ETP	72.40 Say 73	69.00	64.00
7	Cooling tower blow down going to ETP	72.00	72.00	72.00
8	Effluent generation	567.00	567.00	567.00
9	**Total effluent generation including boiler blow down, RO reject, cooling tower blow down (i.e. 5 + 6 + 7 + 8)**	**718.00 (143.6 Lit/Ton)**	**714.00 (142.80 Lit/Ton)**	**709.00 (141.80 Lit/Ton)**
10	Spray pond overflow generation from process	500.00	400.00	300.00

		(100 Lit/Ton)	(80 Lit/Ton)	(60 Lit/Ton)
11	**Total waste water generation including balance excess condensate, cold water effluent and spray pond overflow (i.e. 4 + 9 + 10)**	**1752.00 (350.40 Lit/ton of cane)**	**1735.00 (347.00 Lit/ton of cane)**	**1579.00 (315.80 Lit/ton of cane)**
12	**Fresh water requirement for boiler makeup through RO**	**181.00 (36.20 Lit/ton of cane)**	**172.50 (34.50 Lit/ton of cane)**	**160.00 (32.00 Lit/ton of cane)**
**13	Fresh water requirement for lab and domestic use	50.00	50.00	50.00
** This is applicable towards the normal operations of the unit but fresh water for initial startup and also during long plant shutdowns/reduced crushing situation at the end of season, the additional fresh water will be required which will be around 50 Lit/ton of cane for the season as a whole but this is occasional.				

8.5 Standard Operating Procedure (SOP) for operation and stopping of Effluent Treatment Plant (ETP) during pre and post crushing season

Objective:

To establish procedures for the safe and efficient commissioning and stopping of the Effluent Treatment Plant (ETP), ensuring compliance with environmental regulations and operational efficiency.

Scope:

This SOP applies to all personnel involved in the operation, commissioning, and shutdown procedures of the ETP within the sugar mill premises.

Responsibilities:

1. **ETP Operators:**
    a. Execute commissioning and shutdown procedures as per this SOP.
    b. Monitor process parameters and ensure plant efficiency.
    c. Report any abnormalities or deviations promptly.
2. **Maintenance Team:**
    a. Conduct routine maintenance and checks as per the maintenance schedule.
    b. Ensure all equipment and systems are in working order.
3. **Safety Officer:**
    a. Ensure all safety protocols are followed during commissioning, operation, and shutdown.
    b. Conduct safety briefings and inspections as required.
4. **Commissioning Procedure:**
    1. **Preparation:**
        a. Inform the regional pollution control board about the commissioning of ETP
        b. Check the connection and of the online monitoring system ensure the connection with the server of CPCB and SPCB
        c. Notify all relevant personnel about the upcoming commissioning or starting of the operation of ETP.
        d. Ensure availability of necessary chemicals, equipment, tools and PPE.
    2. **Initial Inspection:**

a. Verify and complete the maintenance of all the equipment's and tanks, including effluent inlet and outlet flowmeters, oil and grease removal mechanism, feed pumps, sludge pumps, screens, oil and grease removal units, equalization tank, neutralization tank, agitator, primary clarifier scrapper arm and gearbox, anaerobic reactor, aerobic reactor and its media, Aerobic tank including air diffusor, air blower, valves, secondary clarifier scrapper arm and gearbox, multi-grade sand filter, and activated carbon filter, are installed aligned properly and operational.
b. Complete the calibration of all the flow meters installed at ETP
c. Check electrical panel board connections and ensure proper grounding. Ensure there is no leakages of electricity and avoid electrocution of the equipment's

3. Start-up Sequence:

a. Start with the screening and oil and grease removal system:
    - Ensure screens are operational and clean.
    - Start oil and grease removal unit according to manufacturer's instructions.
b. Proceed to the equalization tank:
    - Open inlet valves to allow influent flow into the equalization tank.
    - Monitor influent characteristics and adjust flow rates as necessary.
c. Neutralization tank operation:
    - Start mixing and pH adjustment as per the treatment requirements.
    - Monitor pH levels and adjust chemical dosing if required.
d. Primary clarifier operation:
    - Open inlet valves to allow flow into the primary clarifier.
    - Start sludge scraping mechanism and adjust sludge wasting rates.
e. Anaerobic treatment:
    - Open inlet valves to direct flow into the anaerobic reactor.
    - Start anaerobic digestion process.
    - Monitor reduction in COD and BOD, biogas production (In case of UASB or CSTR) and adjust as necessary flow and chemical doses.
f. Aerobic treatment:
    - Transfer effluent from anaerobic reactor to aerobic reactor.
    - Start aeration system by opening the valves of air distribution lines and star air blowers
    - Gradually increase aeration rate to achieve desired dissolved oxygen levels.

- Monitor and adjust pH levels, nutrient dosing, and MLSS (Mixed Liquor Suspended Solids) concentrations.

g. Secondary clarifier:
   - Open inlet valves to allow treated effluent from the aerobic reactor into the secondary clarifier.
   - Start sludge settling and removal mechanisms.
   - Monitor and adjust the rotations of sludge scrapping mechanism for proper sludge removal

h. Filtration systems:
   - Start multigrid sand filter and activated carbon filter units.
   - Monitor filtration efficiency and backwash cycles as required.

4. Process Stabilization:

a. Monitor effluent quality and process parameters (e.g., pH, COD, BOD, TSS, TDS, MLSS etc.)
b. Conduct settling tests in clarifiers and adjust sludge removal rates if necessary.
c. Optimize operational parameters for stable performance.

5. Performance Testing:

a. Perform initial effluent quality testing to ensure compliance with regulatory standards.
b. Record and analyse data to identify any operational adjustments needed.
c. Conduct regular third party monitoring and analysis of the treated and untreated effluent

6. Documentation/data records:

a. Records of daily incoming effluent and treated discharge/recycle
b. Daily logbook of laboratory analysis
c. Daily chemicals and power consumption
d. Data of sludge generation and ultimate disposal
e. Maintain the record of online monitoring system
f. Maintain the record of the third party monitoring and analysis reports of treated and untreated effluent
g. Maintain the calibration record for OCEMS, flowmeters, lab equipment's etc.

7. Stopping Procedure:

1. **Preparation:**
    a. Inform the relevant regulatory authority about the shutdown of the ETP
    b. Notify all relevant personnel in the sugar mill about the impending shutdown.
    c. Ensure there is no effluent coming out of the mill or directly discharge outside the premises without treatment.
2. **Shutdown Sequence:**
    a. Treat the complete available effluent in the inlet/equalization tank and cease influent flow to the ETP by closing inlet valves.
    b. Gradually reduce aeration in the aerobic reactor.
    c. Stop anaerobic reactor operations as per manufacturer's instructions.
    d. Ensure proper drainage and cleaning of all treatment units.
3. **Safety Measures:**
    a. Secure all electrical connections and equipment.
    a. Conduct final safety checks to ensure no hazards exist post-shutdown.
4. **Documentation:**
    a. Record shutdown activities, including final operational readings and any maintenance performed.
    b. Update maintenance logs and equipment status.

8. **Emergency Procedures:**
    a. In case of any malfunction or emergency during commissioning or operation, follow the emergency response plan specified in the ETP SOP.
    b. Notify management and take necessary actions to mitigate risks to personnel and the environment.
9. **Review and Revision:**
    a. This SOP shall be reviewed annually or as needed to incorporate improvements or changes in procedures based on operational feedback or regulatory updates.

8.6 Format for logbook for daily water consumption

a. As per SGWB/CGWA guidelines, it is mandatory to install digital water flow meters at the outlet of borewell/tubewell and to maintains the logbook for daily water consumption. In the logbook, initial and final readings should be mentioned on daily basis following format:

Date and Time	Industrial Borewell/Tubewell -1				Cane Crushed - MT		Specific Water Consumption – L/T of cane crushed		Remarks
	Initial Reading	Final Reading	Water abstraction (For the Day in KL)	Water abstraction (KL) (To date)	For the day - MT	To date – MT	For the day	To date	
Day/Month/ Year AM/PM	A	B	C=B-A	D=C+ Pre Day abstraction	X	Y	C*1000 /X	=D*1000/Y	

b. In case of more than one borewell/tubewell, more columns can be incorporated with one total water abstraction column.

c. During the visit, inspecting authority will take the meter readings of all the borewells physically and match it with the log book to ensure that the data recorded in the logbook is matching with the reading of the flow meters.

d. As per SGWB/CGWA guidelines, the flowmeters should have telemetry arrangement for online data transfer to SGWB/CGWA portal which is yet to be operational.

e. For normal operating days (excluding initial fills or stoppages) the specific water consumption should be within the allowed limit.

f. In the case of initial fills, stoppages and before the starting of crushing season the sugar industry shall maintain the record of freshwater consumption separately to avoid the deviation in monthly average quantum of freshwater consumption.

g. In the case of stoppages, the sugar units shall maintain the fresh water consumption records. However, it is noteworthy that the industry breakdown period should be > 6 hours. The same shall be checked from the Daily Manufacturing Record (DMR) to verify the freshwater consumption quantum for that particular period of time.

h. If some day any industry operates at <70% of its crushing capacity, then the record of freshwater consumption for such occasions shall be maintained separately by the industry.

8.7 Digital Water Flow Meter with Telemetry for Groundwater extraction monitoring as per CGWA notification

Technical specifications

1. Specification of Tamper proof Electronic water meter with telemetry

Metering Technology	Ultrasonic or Electromagnetic
Communication type	LAN (for internet connectivity) or LoRa WAN and/or Cellular (GPRS / 3G / 4G)
Tamper proof:	
a) Power source	The meter shall be battery operated or UPS powered supply with provision of power OFF detection. The telemetry system units shall be battery operated or through external power supply. The metering data should be stored in the meter even if the telemetry system is off due to power failure.
b) Sealing	The meter and telemetry system shall have proper mechanical and electronic sealing (through software) arrangement. Any attempt to open the meter or system enclosure should physically damage the tag.
Compliance	The meter shall preferably be manufactured as per ISO 4064: 2014 Standards and shall have IP 68 ingress protection.
Accuracy	The meter shall be of accuracy better than ± 2% for the operating flow range (from 10 % to 100 % of maximum flow rate).
Test certificate	The meter manufacturer shall submit the latest test/calibration certificate of the meter, from Fluid Control Research Institute (FCRI) / National Physical Laboratory (NPL) or any third party laboratory accredited by National Accreditation Board for Testing and Calibration Laboratories (NABL), for every meter.
Parameters to monitor	The meter (since installation of the requisite water meter) shall transmit the following parameters to a secure cloud

	• Timestamp • Cumulative forward flow volume • Cumulative reverse flow volume • Cumulative Net volume • Cumulative pump working hours • Meter serial number • Device last calibration date • Borewell id (Provided by CGWA)
Cloud	The Communication / telemetry data should be directly captured in a secure cloud. The cloud service provider should be empaneled with The Ministry of Electronics and Information Technology (MeitY).
Transmission frequency	The data shall be transmitted minimum 2 times in a day
Battery life	In case of battery operated meters the battery shall run at least for a period of 3 years with 2 transmissions per day. The battery shall be replaceable without any data loss.
Data acquisition	The meter shall be supplied with complete AMR / AMI system with Data Management software. The Data Management Software must be capable of running on a standard PC. The Data Management Software should be cloud based and should have web portal access so that user can view customer data through browser. In addition to above, Data Management Software will be installed on Server placed in Central Data Base/Control Room, and the software may have option for individual customer to view their meter consumption data through Web portal. Consumer, engineer and manager screens shall be available separately. Data Collection Unit shall be capable of taking data from meter, pump etc. and should be posted in Data Management Software.
Real-time data to CGWA	The un-tampered data from the secure cloud shall be sent to Central Ground Water Authority (CGWA) real-time data management platform once it is ready. Proper cyber security measures shall be taken in the secure cloud.

2. Installation of meter

Location	The meter shall be installed at the bore-well pump discharge line before any branching and preferably as shown in Figure. 1
Bypassing	There shall be no bypassing of pipe prior to the installed flow meter.
Full flow	The installation of the meter shall ensure the pipe shall have full of water at all times. Sufficient upstream and downstream straight length shall be provided for the meter (Refer to Figure 1.)

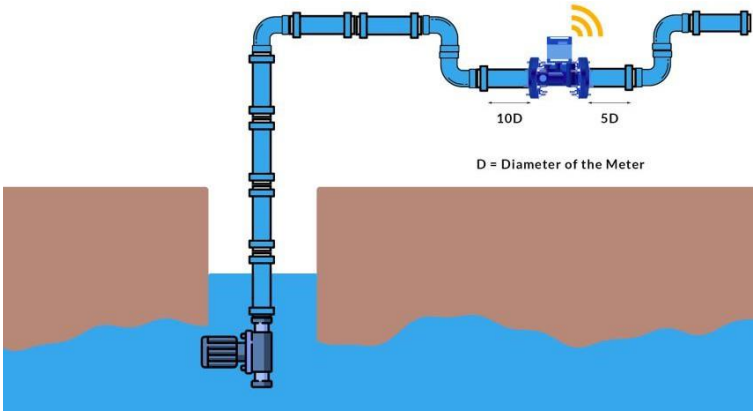


Figure. 1: Installation position of tamper proof flow meter with telemetry at groundwater abstraction structures.

3. Detailed Technical Specifications of Amr / Ami Water Flow Meters

3.1 Specification of flow meter

Flow meters shall meet the following metrological specification:

1. Turndown ratio of 10 or above
2. Accuracy ± 2%
3. Technology: electromagnetic or ultrasonic

3.1.1 Size:

1. DN40 - Flow range: 0.5 lps to 5 lps
2. DN100 - Flow range: 3 to 30 lps
3. DN150 - Flow range: 13 to 130 lps

- Meter performance shall not get affected by external magnetic field, as specified in ISO4064.
- Meters must be able to retain their accuracy, when installed in either horizontal and/or vertical planes.

3.1.2 Material of Construction:

The manufacturer shall provide specific details of materials used for various parts of the meter which must meet the specifications for the material of construction of the individual parts of the meters as per applicable standards (referred above).

- The water meter and accessories shall be manufactured from materials of adequate strength and durability.
- The body of the meter shall be of Brass/Bronze/MS/CI/SS/Engineering Plastic and compact enough to avoid tampering of meter. The manufacturer shall specifically mention in the offer, the material used in manufacturing.
- The materials, which come in contact with the potable water, shall not create a toxic hazard, shall not support microbial growth, and shall not give rise to unpleasant taste, odor or discoloration in the water supply.
- The painting material used should be free from toxic constituents and safe for human uses and should not affect human health (Health Certificate should be attached/provided).
- Each meter should be supplied in separate individual box with its accessories, test/ calibration Certificate (for accuracy parameter) and Guarantee Card for free repair/replacement during the warranty period.

3.1.3 Markings on the Body of the Meter:

- Make/Brand, Size / Nominal Dia.
- Sl. No. / Year of Manufacture, Metrological specifications etc.

3.1.4 Meter indicator

The digital indicator shall be designed in such a way that if the protective glass is broken for a reason or another, the indicator cannot be removed from its place. The protective cover of the indicator shall be made of sturdy glass/PP/PC.

- It shall be of straight reading type.
- No. of digits and verification scale interval shall be as sufficient enough to meet the required accuracy.
- Totalizer shall be made of suitable material required to maintain IP 68 protection class.

3.2 Telemetry System

- The AMR/AMI system should have the facility to detect and communicate any abnormalities, i.e. high consumption, tampering etc. along with necessary alarms.

- The system will communicate in real time for battery and tamper alarms, in order to provide relevant monitoring and management data for operational purposes.
- The battery shall be replaceable without any data loss.
- The meters should report an alarm to the server as and when tampered.
- All Water Meter readings should be time stamped.
- The meter should have the capability to detect and record reverse flow separately.
- The meter should be capable of to detect Leak, Zero (No) Flow, High Flow.
- The AMR/AMI should operate even in electrically noisy environments with electromagnetic interference. The AMR/AMI should function even in the presence of high voltage power lines.
- Battery usage has to be indicated at the server. Provision should be provided to replace batteries if required.
- The communication shall be encrypted to avoid tampering.
- The meter should be configurable either using the DTU or from the server.
- Loss of communication should be indicated in the server within 48 hours.
- The meter should be able to log the daily flow data with a timestamp which is supposed to be sent to the cloud via telemetry for at least 2 years.
- In case the telemetry is non-functional because of power cut or weak cellular signals, the meter should be able to store the data and transmit to the cloud as soon as the telemetry system is live.
- This data shall also be used for retrieval in case of any dispute between meter data and online data.

3.3 Data Management Software

- The web based Data Management Software must be capable of running on a standard PC compatible with minimum Pentium Processor; in addition, the software must run under Windows XP Professional, Windows Vista, Windows 7 and / or latest version of Windows Operating System and HP Unix, Linux, Solaris, etc.
- The Data Management Software should be cloud base and should have web portal access so that user can view customer data through browser. In addition to above, Data Management Software will be installed on Server placed in Central Data Base / Control Room, and the software may have option for individual customer to view their meter consumption data through Web portal.
- The Data Management Software shall provide database backup/restore functions and must have real-time data access. The software should be web-enabled and alerts to be provided through email/SMS to the user.
- The Data Management Software shall post the reading from the communication infrastructure on to appropriate accounts within the Database.

- The Data Management Software should be able to display all kind of data on screen at any time.
- The Data Management Software should have capability to add additional customer information and create customizable data fields.

3.4 Lab Testing / calibration:

Testing or Calibration of meters shall be performed at ISO 17025: 2017 accredited laboratory. The accuracy of meter shall be within ± 2 % in the operating range. The meter shall have valid model approval certificate.

The meter shall have model approval from India or abroad. Every meter should be calibrated/ tested for accuracy in the operating flow range (10% to 100%). At least 4-point calibration at 10%, 40%, 70% and 100% of maximum/rated flow shall be performed.