

EXECUTIVE SUMMARY

Of

ENVIRONMENTAL IMPACT ASSESSMENT REPORT

FOR

PUBLIC HEARING

OF

PROPOSED 26 MW BAGASSE BASED CO-GENERATION POWER PLANT

By

**“M/s. Sahakar Maharshi Shivajirao Narayanrao
Nagawade Sahakari Sakhar Karkhana Ltd.”**

Limpangaon, Tal- Shrigonda, Dist- Ahmadnagar

SUBMITTED TO

MAHARSHTRA POLLUTION CONTROL BOARD

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EXECUTIVE SUMMARY

1. INTRODUCTION

M/s Sahakar Maharshi Shivajirao Narayanrao Nagawade Sahakari Sakhar Karkhana (SMSNNSSKL) is registered under co-operative societies act, 1960 dated 3rd August 1965 to venture agro-based industrial and related activities. SMSNNSSKL is an agro based sugar complex unit established in 1973-74 by founder Chairman Hon'ble late Shri. Shivajirao Nagawade. This plant is working in good condition since then & has been performing well. The sugar unit generates large quantities byproducts viz. bagasse, molasses and press mud. To be economically and environmentally sustainable, it is necessary for the sugar industries to convert these by-products into high value products. Hence, the company has proposed to establish a new 26 MW bagasse based co-gen unit. SMSNNSSKL is proposing to establish this proposed unit at the existing sugar complex.

As per the EIA notification 2006 & its subsequent amendments existing project does not require Environmental Clearance. Existing industry have obtained consent to operate from Maharashtra Pollution Control Board (MPCB) & is complying with all the norms of CPCB & MPCB.

This Industry has existing 3500 TCD sugar unit & have obtained consent to establish for total 4800 TCD. Industry has already taken steps towards increasing crushing capacity upto 4800 TCD & has obtained Consent to Establish for the same. Industry has also applied for consent to operate for 4800 TCD & expecting to get the same soon. In season 2018-19, industry will crush sugarcane at the rate of 4800 TCD. Industry generates Bagasse @ 28 % of total cane crushed per day. So the Bagasse produced at existing capacity of 3500 TCD is 980 TPD & that of proposed capacity of 4800 TCD is 1344 TCD. To run proposed co-gen power plant Bagasse is required @ 1306.36 TPD. Proposed co-generation plant will be operated 180 days in season. Hence, the entire bagasse requirement will be fulfilled from existing sugar unit only.

2. TYPE OF PROJECT

As per EIA Notification dated 14th Sept., 2006, and its subsequent amendments; the project falls under Category "B", Project or Activity 1(d).

- The proposal was considered by SEAC-I in its 150th meeting dated 3rd May 2018 & MoM were published on 21st May 2018. As per the ToR finalized by SEAC, EIA (this) prepared, rechecked & now ready for submission to SPCB for public hearing.

3. NEED OF THE PROJECT

- Sufficient steam is generated to meet the sugar plant requirements as well as generation of power with the available potential.
- Power generated is utilized for in plant requirements and also exported to the grid at reasonable tariff rate.
- Handling & storage of bagasse is considerably reduced (Since directly used in co-gen project) and thus reducing expenses.
- Power is generated on lower cost and fed to sugar plant almost on no cost basis.
- Development of adjoining rural area.

4. SITE SELECTION & JUSTIFICATION THEREOF

Proposed bagasse based 26 MW co-gen project will be done on available open land within the existing sugar plant premises. As adequate land is available within existing sugar factory premises, no additional land will be acquired. Hence, no other alternative sites are examined. The site for the existing sugar plant was finalized considering the ideal location for the industries. The proposed co-gen plant location is considered based on availability of bagasse, steam, power and water from existing sugar unit and hence it is the best option as far as location is considered.

5. BRIEF DESCRIPTION OF NATURE, SIZE, LOCATION OF THE PROJECT AND ITS IMPORTANCE TO THE COUNTRY, REGION

Table 1: Summary of proposed bagasse based co-gen project

1	Type of project	26 MW bagasse based co-generation power plant			
2	Area of the project	Total Factory Plot Area- 331800 Sq.m Green Belt Area- 109494 Sq.m. (33 % of Total Plot Area)			
3	Latitude & Longitude	Latitude 18°35'19.94" N Longitude 74°37'11.52" E.			
4	Products & By-products	26 MW Bagasse based co-generation power plant			
5	Operational days	180			
6	Raw Materials	Bagasse - 228786.75 MTA			
7	Capacity of Boiler	140 TPH			
8	Fuel Requirement	Bagasse - 228786.75 MTA HSD for DG set- 400 lit/hr (for full load).			
10	DG Set as power backup	2 x 900 KVA			
11	Stack Details	Sr. No.	Stack Attached to	Stack Height	Air Pollution Control Equipment
		1	Boiler (140 TPH)	70 m	Electrostatic precipitator
		4	DG Sets - 2 x 900 KVA	2.5 m above roof top	Adequate stack height
12	Total water Requirement	938.4 CMD Source - Ghod Canal			
13	Total Waste Water Generation	53 CMD			
14	Total Power Requirement	7 MW for Sugar Unit, Distillery Unit, Boiler & Utilities.			
	Total Power export to MSEDCL grid	16.83 MW			
15	Steam Requirement	NA			
16	Manpower	15 Nos.			
17	Hazardous Waste	NA. Proposed project will not generate any kind of hazardous waste.			

6. MAJOR REQUIREMENT FOR THE PROPOSED COGEN PROJECT

6.1 RAW MATERIALS REQUIREMENT

Table 2: List of raw materials required and their source along with mode of transportation

Material	Quantity	Source	Transportation
(A) Major Raw Material			
Bagasse for 180 operational days	228786.75 MT	Own Sugar Factory	Direct use of bagasse generated from sugar factory for co-generation. Internal Transportation by RBC.
(B) Other chemicals and materials required			
No Other Chemicals are required			

6.2 STEAM REQUIREMENT

Steam requirement for proposed co-gen unit is of 127.38 TPH which will be met from proposed co-gen unit bagasse based boiler.

6.3 POWER REQUIREMENT

- For Sugar Unit – 5.98 MW
- For Condensation - 0.50 MW
- For Distillery Unit – 0.25 MW
- For Misce.Use - 0.30 MW

- Total Power requirement – 7.03 MW

- Total Power for Export – 16.83 MW

6.4 MANPOWER REQUIREMENT

Additional manpower needed to operate the proposed cogen plant will be 15. More than 85 % of the manpower requirement will be fulfilled by employing the local people. Man power requirement for construction work i.e. on contract basis will be about 20. Construction workers will reside in nearby villages. Residential facility will not be required for the construction personnel.

Residential quarters

Residential facilities to the essential employees are already available at site. Most of the workers will be from nearby villages.

6.5 WATER REQUIREMENT

Total water input = 5111.6 m³/day

Recycling & Utilization streams = 4120.2 m³/day

Make up fresh water requirement = 938.4 m³/day

80% of water will be recycled. Only 20 % of fresh water will be required.

Effluent sober in nature sent to ETP- 53 CuM/day

Existing sugar unit ETP of 1000 CMD will accommodate effluent from proposed co-gen unit also.

6.5.1 Status of Approval for water

Industry has already obtained water permission from Ghod Canal. The proposed water requirement will get fulfilled within the quantity approved by the Authority.

6.6 LANDREQUIREMENT

Total land available with SMSNNSKL is 331800 Sq.m. About 33% of the total land i.e. 109494 Sq.m. will be developed as green belt.

Sufficient land is available within existing sugar factory premises to accommodate proposed co-gen project.

7. PROCESS DESCRIPTION ALONG WITH MAJOR EQUIPMENTS AND MACHINERIES, PROCESS FLOW SHEET (QUANTATIVE) FROM RAW MATERIAL TO PRODUCTS

The objective of the cogen plant is to ensure that the energy generated by firing bagasse can be utilized in generating high pressure and high temperature steam, which can be efficiently in extracting cum condensing STG set. During this process, steam is extracted from two extraction points in the turbine to meet the process steam requirements. The flow through the condenser has been kept at a minimum during the crushing season. To improve the efficiency of the power cycle one HP heater and a feedwater pre-heater is added to the power cycle. The boiler of the power cycle will be having traveling gate type, which is used to fire wet mill bagasse, other biomass and coal.

The cogen plant has to be sized for meeting the steam and energy requirements during the peak crushing of 4800 TCD. The moisture of the wet mill bagasse which is available for the cogen plant has been considered as 50%. The efficiency of the boiler, when firing bagasse as fuel is considered as 70%.

The major factor in deciding the cogen plant scheme is the Maharashtra Electricity Regulatory Commission's (MERC) criteria for 'Selection of a plant as cogeneration power plant'. The selection of a plant as cogeneration plant will result in the plant being able to achieve a tariff of Rs. 3.05 for the first year of operation; with an escalation of 2% per annum in the tariff for the subsequent years. The criteria for selection stipulates that "Topping cycle mode of cogeneration: For the cogeneration facility to qualify under topping cycle mode, the sum of useful power output and one half the useful thermal output be greater than 45 % of the facility's energy consumption.

Co-generation Plant process in Brief –

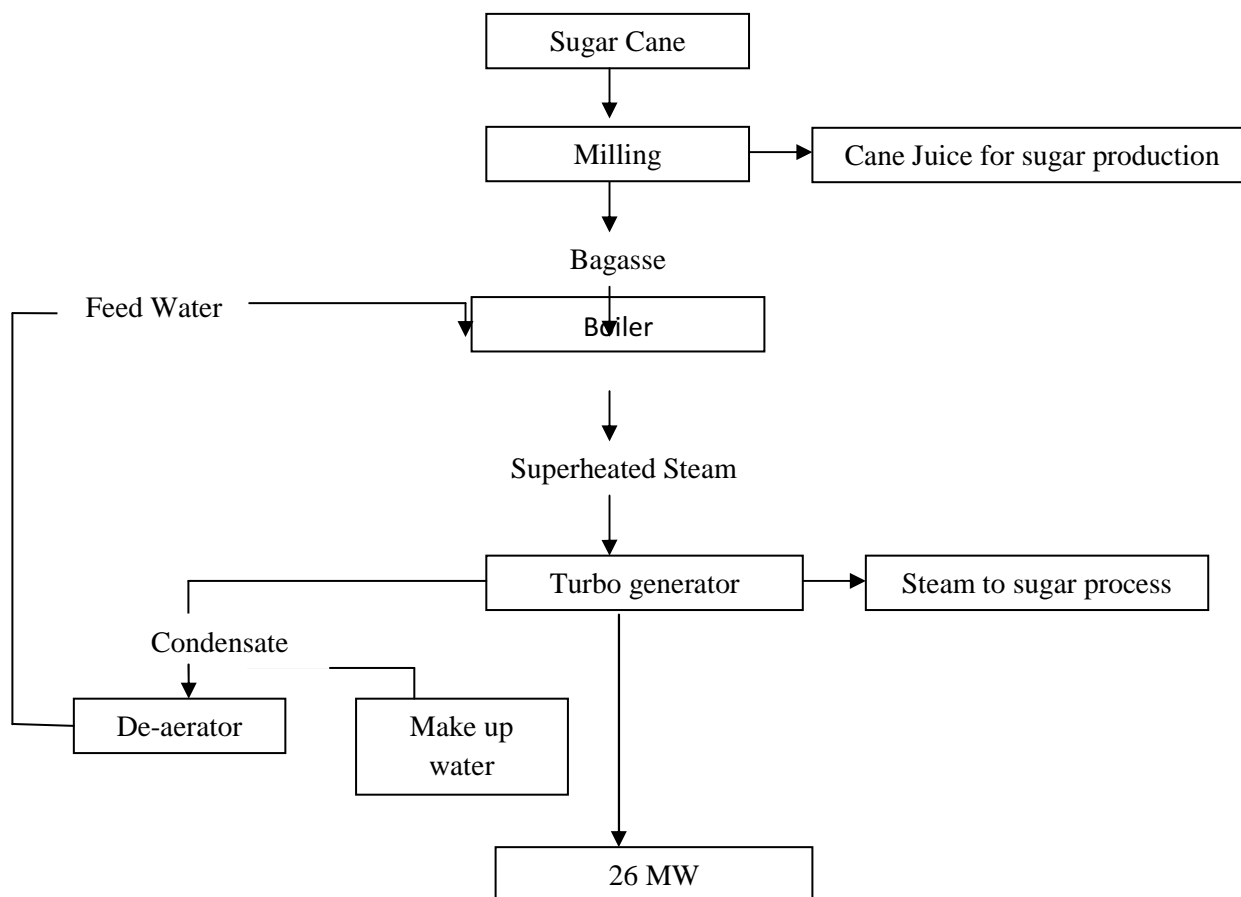
Cogeneration denotes generation of surplus power mainly with a view to supplying power to the grid. The process of manufacturing of crystal sugar requires steam. However by producing steam at higher pressure and higher temperature, electricity can be generated in addition to the main manufactured product. i.e. Sugar, is known as Cogeneration.

The sugarcane stalk consists of around 73 % water and 27% solids. Solids in turn comprise soluble solids mainly sucrose and fiber. The woody fiber of the cane is known as Bagasse and is about 28 % of the weight of the sugarcane. Sugar plant of 3500 TCD provided with two boiler of 22 & 35 tones with 21 kg/sq.cm. Pressure and suitable turbo-alternator set etc. the sugar units of the capacity consume of about 35 % of steam for processing.

The factory crushing at 295 tons per hour by adopting the new special methods can reduce the process steam consumption from 32% to 35% and also by increasing the boiler pressure at 87 kg/sq. cm. at 510 degree C would enable generation power of 18 mw. That is to say it would be possible to export 10.5 MW of surplus power after considering a captive consumption of 7.5 MW.

Co-generation for the sugar factory has been a very attractive option in view of the potential for improving the financial health. On the other hand it helps in reducing ecological damage, by promoting the use of renewable fuels like Bagasse. Bagasse based cogeneration of power for export to the grid is a technology used in many countries; this is very beneficial to both the Sugar unit and to the Government. This concept is born out of the fact the sugar plant cogeneration holds the promise of narrowing the ever widening gap between the power supply and demand at low incremental cost. The present potential are estimated for the surplus exportable power to the grid from the sugar factories is around 5000 MW in the country.

The fuel for the boilers of the cane sugar industry is Bagasse; however the storage of large quantity of combustible Bagasse in the premise of the sugar factory is problematic. Most of the boilers of sugar factory are designed in such a way as to use the entire quantity of Bagasse in cane as it is crushed daily. There is thus inbuilt energy inefficiency in the factory using all the Bagasse produced as fuel for the low pressure boilers, which could be otherwise used in a more efficient manner by making alteration in the specifications of boiler and producing high pressure steam which can be utilized for generation of Power. Thus there is no any need of additional raw material for running this plant only need is to increase the efficiency of the existing procedure and plant and machinery.

Figure 1: Manufacturing Process for Co-Generation Power Plant

8 DESCRIPTION OF ENVIRONMENT

Baseline study was conducted for a period of three months during 1st March 2018 to 31st May 2018. An area, covering 10 km radial distance around the project site is considered as the study area for conducting baseline studies. For the present study, an area covered in 10 Km radius from the project location has been considered and marked as per the guidelines.

Ambient Air Quality Monitoring reveals that the concentrations of PM₁₀ and PM_{2.5} for all the 9 AAQM stations were found between 58.5 to 74.5 µg/m³ and 18.6 to 33.1 µg/m³. The concentrations of SO₂ and NO_x were found to be in range of 6.32 to 9.32 µg/m³ and 12.03 to 23.45 µg/m³ respectively. The concentrations of CO are in range of 0.125 to 0.347 mg/m³. The concentration of NH₃ in the range of 15.85 to 26.54 µg/m³ respectively. The resultant concentration of the parameters is well within the prescribed limits of CPCB & NAAQS.

Prediction of impacts on air environment has been carried out by employing a mathematical model. In the present case, **Industrial Source Complex Short-Term (ISCST3)** dispersion model based on steady state Gaussian plume dispersion, designed for multiple point sources for short term has been used for predicting the ground level concentrations.

The computations deal with major pollutants like Sulphur dioxide and Suspended Particulate Matter and Oxides of Nitrogen.

Results of mathematical modelling reveals that the maximum incremental short term 24 hourly ground level concentrations for PM₁₀, SO₂ and NO_x likely to be encountered during pre-monsoon season are 2.38 µg/m³, **10.18 µg/m³** and **25.42 µg/m³** respectively.

Ambient noise levels were measured at 9 locations around the plant site. Noise level varies from 40 to 54 Leq dB (A) during day time and from 34 to 44 Leq dB (A) during night time. From the above study, it can be concluded that the resultant noise levels in the study area are within the limits as prescribed by the Noise Pollution (Regulation and Control) Rules, 2000. Noise level at site is found to be at higher side due to industrial activities & vehicular movement in the area.

SMSNNSSKL is going to achieve Zero liquid discharge in surface water for the proposed Co generation project & hence there is no effect on the river water quality due to this industry.

A review of the above chemical analysis reveals that there is not much variation in chemical composition of water tapped from hand pumps and tube wells. Analysis results of ground water reveal the following: -

- pH varies from 7.14 to 8.23
- Total hardness varies from 195 to 412.69 mg/l
- Total dissolved solids vary from 413 to 1623 mg/l.

Soil samples collected from 9 identified locations indicate pH value ranges from 6.23 to 7.65, which shows that the soil is having near neutral pH. Total Kjeldahl Nitrogen is found to be in good amount as it ranges from 1356.40 gm/cm³ to 2262 gm/cm³ and Phosphorous i.e. from 645 mg/kg to 780.23 mg/kg, whereas the Potassium is found to be ranging from 155.30 mg/kg to 486.24 mg/kg. Soil of the area is found to be suitable for agricultural activities.

For studying ecology & biodiversity, a primary field survey was carried out within 10 km radius impact zone in and around the project area to study the floral and faunal diversity of the terrestrial and aquatic environment of the study area. Detailed field survey for flora & fauna species was conducted to identify the common plant & animal species and also to identify presence of any threatened, medicinal, endangered and rare plant species in the study area.

Some of the information was collected from the local habitants. All the collected data were classified to interpret the impact of pollution on the flora and fauna of that region. Survey of the wild plants as well as agriculture crop plants was done and all the available information was recorded. The investigation included field observations, discussions with local people, forest officials etc.

There are no National Parks or Wildlife Sanctuaries in the 25 Km. radius from the proposed plant site. There are no reports with the forest department of endangered species or notified protected species. Wildlife species, common almost all over rural India such are hare, jackals, monkeys, pigs, several species of birds and reptiles are present.

9 ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

Anticipated environmental impacts due to the proposed project along with mitigation measures are given in Table below.

Table 3: Environmental impacts Mitigation Measures in Brief

Sr.No.	Facets of Environment	Mitigation & Impact Thereafter
(A) Construction Phase		
1.	Air	<ol style="list-style-type: none"> 1. The approach roads will be paved or asphalted and regular sprinkling of water on roads and construction site will be undertaken. 2. Regular PUC check will be undertaken. 3. All vehicles and construction equipment with internal combustion engines being used will be maintained for effective combustion to reduce vehicular emissions. 4. Vehicles and all internal combustion engines will meet the prescribed emission standards of CPCB. 5. Unleaded petrol blended with fuel ethanol will be used for vehicles in use. 6. Recycled water will be sprayed through high pressure water hoses during dust generating construction activities e.g. excavation, crushing, concrete mixing, material handling etc. for dust

		<p>suppression.</p> <p>7. Measures will be taken not to use asbestos in the construction work.</p> <p>8. Development of sufficient vegetation will be considered.</p>
2.	Water and Waste Water	<p>1. Fresh water requirement will be minimized by using RMC</p> <p>2. High pressure hoses will be used for cleaning and dust suppression purpose.</p> <p>3. Monsoon season would be avoided for the construction activity, particularly the excavation work.</p> <p>4. Wherever required check dams and dykes will be provided for control of soil erosion.</p> <p>5. Fast growing soil holding/binding vegetation e.g. grass will be grown around the construction site before commencement of construction activity to reduce soil erosion and dust suppression.</p> <p>6. Appropriate sanitation facilities will be provided for the workers to reduce impact on surface water quality.</p> <p>7. Construction wastes will not be discharged to surface or ground water bodies.</p> <p>8. Rain Water Harvesting will be done.</p>
3.	Noise	<p>1. Mandatory use of personal protective equipment like ear plugs shall be ensured to mitigate any significant impact of such equipment on personnel operating the machinery.</p> <p>2. Long exposure to high noise levels shall be avoided by practicing proper shift arrangement for workers. Similarly, shift arrangements shall be made to avoid long exposure to hand-arm vibration and full body vibration.</p> <p>3. Noise making construction activities shall be carried out during day time only.</p> <p>4. Construction equipment generating minimum noise and vibrations will be chosen.</p> <p>5. Vehicles and construction equipment with internal combustion engines will be provided with silencers and mufflers in order to reduce noise levels.</p> <p>Green belt will be developed to attenuate noise impacts and to reduce noise pollution</p>
4.	Soil	<p>Construction wastes will be segregated as much as possible at site itself to increase the feasibility of recycling concrete and masonry as filling material and steel pieces as saleable scrap. Litter disposal and collection points will be established around the work sites. Empty packaging materials, drums, glass, tin, paper, plastic, pet bottles, wood, thermocol and other packaging materials, etc. will be disposed through recyclers. The construction spoils will be temporarily stored at designated dumpsite located inside the plant premises.</p>
(B) Operation Phase		
1.	Air	<p>A stack of 70 m with ESP as APC will be installed to proposed boiler of 140 TPH.</p> <p>Adequate stack height will be provided to proposed DG sets.</p>
2.	Fugitive	<p>Internal roads paved, leveled, no undulations, no sharp curves, slow speed.</p> <p>Tree plantation on surrounding available area.</p>
3.	Water and Waste Water	<p>1. 80% of water will be recycled. Only 20 % of fresh water will be required.</p> <p>2. Rain Water Harvesting will be done.</p> <p>3. Continuous online monitoring system as per CPCB norms has been installed for monitoring waste water.</p>
4.	Solid Waste	<p>100% collection every day. Segregated and treated/ disposed per SPCB</p>

		norms.
5.	Odour	No source of odour.
6.	Noise	Smooth roads. Sturdy foundation. No Vibrations. Acoustic enclosures to existing sugar unit DG Set as per manufacturers' design. Use of DG set as standby only. Trees are planted around. Side cladding. Large No. of tree barriers. Factory placed away from boundary. Acoustic enclosure will be provided to proposed 2 DG sets of 900 KVA for co-gen project.
7.	Socio-economic	Employment generation, Community Skills Development, Improved Standard of Living, Community Organizational Capacity Development Economic Exposure and Development

10 ENVIRONMENTAL MONITORING PROGRAMME

Details of the environmental monitoring schedule / frequency, which will be undertaken for various environmental components, is given in **Table 4**.

Table 4: Post project environmental monitoring schedule

Sr. No.	Particulars	Parameters	Location	Frequency
1	Flue gases from proposed co-gen unit stack	PM ₁₀ , PM _{2.5} , SO ₂ and NO _x	Stack monitoring of co-gen unit boilers	Continuous Online Monitoring System will be installed
2	Ambient air quality	PM ₁₀ , PM _{2.5} , SO ₂ and NO _x , CO.	<ul style="list-style-type: none"> Check wind direction Select two point in upwind direction at 120° from site Take one point within site at down wind direction from boiler at about 1 km distance Take one point within site at down wind direction from boiler at about 500 m distance Take two points beyond site in down wind direction about 2 km distance at 120° from site opposite to points taken in upwind direction. 	24 hrs sample, half yearly
3	Water (Ground Water and Surface Water)	As per drinking water standards	<ul style="list-style-type: none"> Take one upstream and downstream sample of surface water. Minimum distance 500 m. For ground water sample- One point upstream at higher elevation from plant site. Also at lower contour point at 3 locations. 	Quarterly
4	Soil	organic & inorganic matter	<ul style="list-style-type: none"> Near bagasse yard Near Sugar mill ETP Outside plant boundary at lower contour 	Pre & post monsoon
8	Noise level, work zone (hourly)	Equivalent noise level- dB (A)	<ul style="list-style-type: none"> One location near turbine house. within 3 m One location in boiler house. 	Quarterly

			<ul style="list-style-type: none"> • One location near I.D. Fan. • Especially monitor noise during soot blowing. • Four locations around plant boundary. 	
9	Greenbelt	Number of plantation (Units), Number of Survived plants/ trees, Number of poor plants/ Trees	Check plant growth and survival of plants	Ongoing-round the year
10	Environmental Audit	As per Direction of ISO 14001	-	Once in a Year
11	Water utilization, m ³ /d	-	For process, domestic, cooling and boiler	Daily
12	Power utilization	-	For air pollution control facility at boilers and for ETP	Daily

11 ADDITIONAL STUDIES

Additional Studies conducted as per ToR granted by SEAC-I, Maharashtra in its 150th meeting dated 3rd May, 2018, are Risk Assessment and Disaster Management Plan. Public Hearing is to be conducted for the project.

RISK ASSESSMENT

An industry with its complex nature of activities involving various plant machineries, raw materials, products, operations, intermediates and environmental discharge has a number of associated hazards. A minor failure can lead to major failure resulting into a disaster causing heavy losses to life, property and environmental. Risk assessment studies are being conducted to ensure safety and reliability of any new plant, through a systematic and scientific methods to identify possible failures and prevent their occurrences before they actually cause disasters and production loss.

Objectives of the risk assessment study

The cogen unit involves storage and handling of large quantity of bagasse which has high calorific value and can be a reason of fire under unfavorable situations. To ensure safe operation of the plant, it is proposed to carry out the Risk Analysis Study with the following objectives,

1. To identify the major hazards relating to fire & explosion due to storage and handling of bagasse.
2. To visualize maximum credible accident scenarios
3. To analyze and quantify primary and secondary effects and damage potentials of the identified maximum credible accident scenarios using standard procedure.
4. To study the nature of exposures, pathways and consequences of maximum credible accident scenarios and characteristics of risk levels.
5. To provide guidelines for disaster management plan.

DISASTER MANAGEMENT PLAN

A major disaster in a work is the one, which has potential to cause serious injury or loss of life. It may cause extensive damage to property and serious disruption both inside and outside the works. A Disaster would normally require the assistance of outside emergency services to handle it effectively. Whatever are the causative factors, like plant failure; human error; earthquake; vehicle crash; sabotage etc, they will normally manifest in three basic forms viz, fire, explosion, and *or* toxic release.

The objectives of disaster management plan include the following-

1. Controlling the disaster, localizing the disaster and eliminating the hazard
2. Welfare of person managing the disaster.
3. Head count and rescue operations.
4. Treatment of injured.

5. Safeguarding others by timely evacuation.
6. Minimizing damage to property and environment.
7. Informing and assisting relatives.
 - i. Informing and collaborating with statutory authorities.
 - ii. Informing the news media.
 - iii. Preserving records and organizing investigations.
 - iv. Ensuring safety of the works before personnel re-enters and resumes work.
 - v. Investigating and taking steps to prevent recurrence.
 - vi. Resorting normalcy

12 PROJECT BENEFITS

Implementation of proposed project will result in:

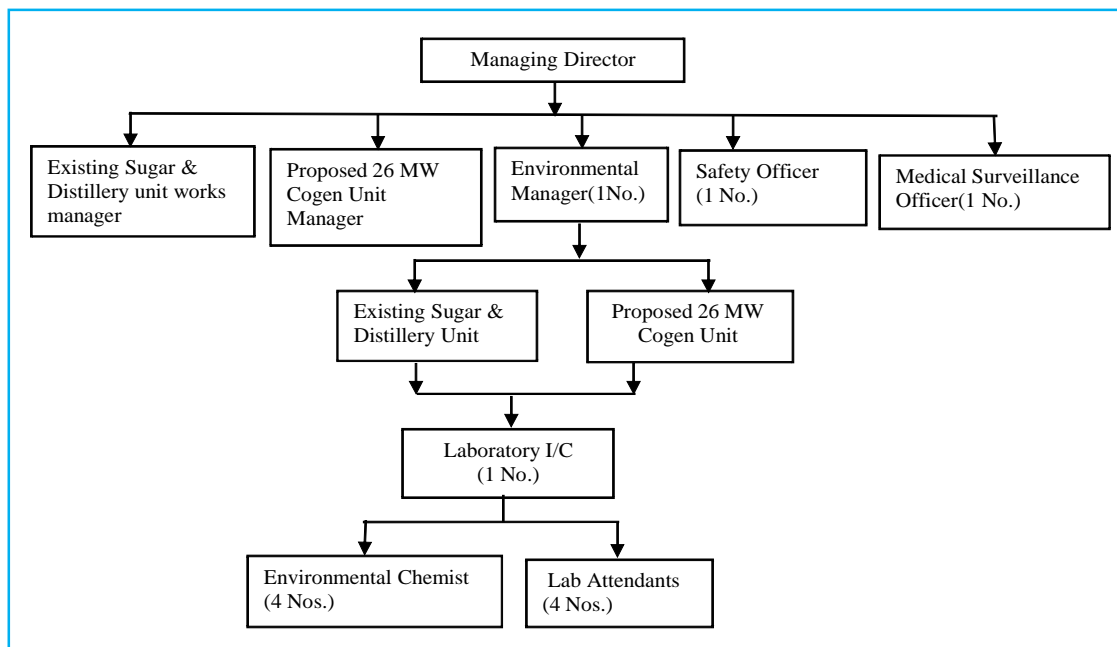
- Huge demand of electricity for industrial sector
- Improvement in the physical infrastructure
- Improvement in the social infrastructure
- Improvement in employment potential
- Improving the economy of farming community

13 ENVIRONMENT MANAGEMENT PLAN

Environmental Management Plan is detailed under the following heads:

- Air Quality Management
- Noise Management
- Waste Water Management
- Solid & Hazardous Waste Management
- Energy Conservation
- Greenbelt Development & Plantation Programme
- Occupational Health & Safety Measures.
- Enterprise social commitment (ESC) - Industry will utilize 0.75% of its project cost for ESC.

Figure 2: Environment Management Cell



Post project environmental monitoring schedule as given in Table No. 4 will be followed strictly.

14. CONCLUSION

The proposed project will prove beneficial to the local people as more infrastructure development, improvement in education and health facilities, roads, availability of drinking water, etc. in near-by villages will be done.

There will be no significant impact on the area, as adequate preventive measures are being/will be adopted to contain the various pollutants within permissible limits. Regular monitoring of all the components of environment is being / will be done. Increased social welfare measures taken by the company will bring development in the near-by villages. Greenbelt development around the area is being /will be also taken up as an effective pollution mitigative technique, as well as to control the pollutants.