EXECUTIVE SUMMARY

Molasses Based 30KLPD Distillery of

Shree Rameshwar Sahakari Sakhar Karkhana Limited

At Raosahebnagar, Post Sipora Bazar, Taluka Bhokardan,
District Jalana, Maharashtra

Prepared By

VASANTDADA SUGAR INSTITUTE*
Manjari (Bk), Pune, Maharashtra 412 307
Telephone: (020) 26902100, 26902343/7/6 Fax (020) 26902244
Web Site: www.vsisugar.com

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EXECUTIVE SUMMARY

1.0 INTRODUCTION

M/s. Shree Rameshwar Sahakari Sakhar Karkhana Limited (SRSSKL) is one of the progressive cooperative sugar factories from north Maharashtra. It is registered under the Government of Maharashtra Co-operative Societies Act 1960 and register no JLA/JBD/PRG/(A)/S-54/1994 dated 18-4-1994. The initial installed crushing capacity of the sugar factory was 2500 T.C.D. Its first crushing season was in the year of 2001-02. The management of the sugar factory has plan to install a molasses based distillery unit of 30KLPD.

The factory is always exploring different avenues to generate more revenue, for the benefit and development of its shareholder farmers and the society

2.0 PROJECT AND SITE INFORMATION

Nature of the Project: New molasses based distillery

Size of the Project: 30 kilo litres per day (30KLPD)

Location of the Project: Within existing sugar factory at Raosaheb nagar,

Post Sipora Bazar, Taluka -Bhokardan, District -Jalna, Maharashtra

Geographical Location	75^0 51'12.00'' E and 20^0 15'18.68" N. Altitude 581 m above MSL
Nearest City/Town	Bhokardan town 9 Km
Road	Bhokardan -Jaffarabad state highway No.178 just a 0.9km
Railway Station	Jalna 45 km
Air Port	Aurangabad 80 km

3.0 PROJECT HIGHLIGHTS

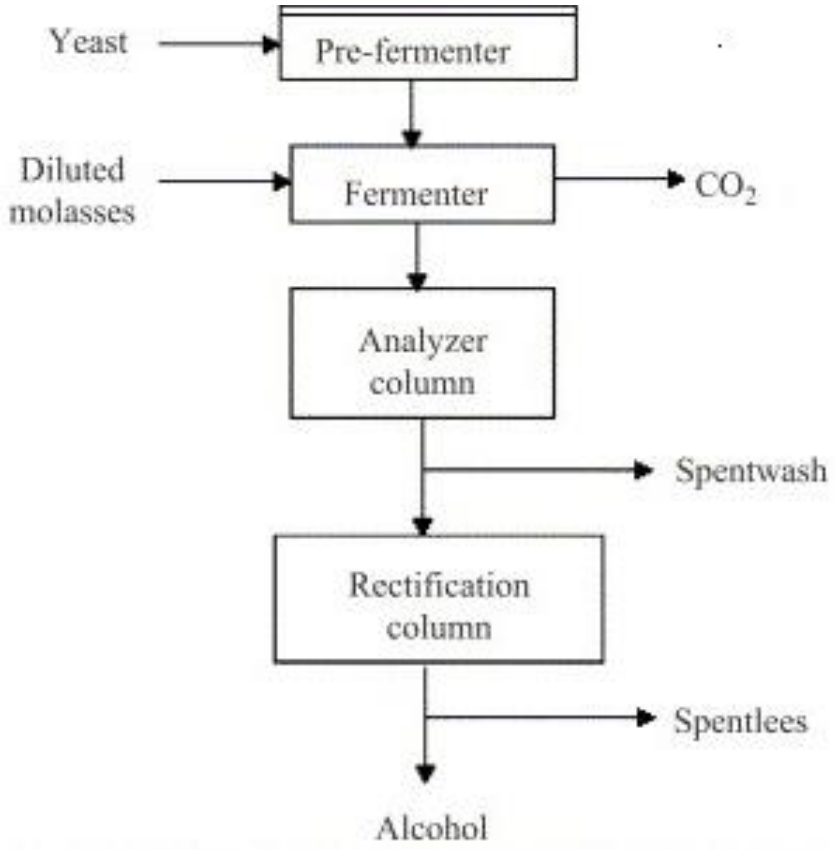
Table 1: Project details in brief

Project	**New Molasses Based Distillery Unit of 30 KLPD**
Proponent	Co-operative Industry
Project Concept	
a) Qualitative Standards of Product	• Rectified Spirit (RS) ISI Grade-I, 323 (1959) • Extra Neutral Alcohol (ENA) ISI Grade-I,

	6613 (1972) • Head Spirit ISI-Grade - II, 323 (1959)	
b) Products and Estimated Production		
Rectified Spirit Impure Spirit OR	28.5 KLPD 1.5 KLPD	
Extra Neutral Alcohol (ENA) Impure spirit OR	28.2 KLPD 1.8 KLPD	
Anhydrous Alcohol Impure Spirit	27.05 KLPD 1.5 KLPD	
c) Effluent Treatment System	Biogas (biomethanation) followed by Bio-composting	
d) Annual Operational Days	270	
e) Spent wash generation /annum (@300m^3/day)	81,000 m^3	
f) Annual Press mud requirement	32,400MT(Consumption ratio 1:2.5 (Pressmud to Spentwash) and 45 day cycle	
Infrastructure prostitute		
a) Raw Material	Molasses 30,000MT per annum	
b) Steam requirement	Max. 110MT/day	
c) Bagasse (Fuel)	Max. 48 MT/day	
d) Water requirement	460m^3/day (Joe medium scale irrigation project, permission for the same has been given by the Jalna Small Scale irrigation division Jalna)	
e) Electricity	Max. 725KW/h	
f) Land	165 acres of land available with sugar factory of which 18.6 acres will be used for distillery and ancillary units as well as greenbelt Distillery unit – 4.6acres	
	For distillery, Bio-methanation, storage lagoon	4 acres
	Bio-composting unit	10 acres
	For green belt development	4.6 acres

g) Employment opportunities for	95 persons
Financial Aspect	
Total Project Cost	Rs 3852.5 lakhs
Capital Expenses on Environment Management	Rs 963.00 Lakhs

Figure 2: Schematic of manufacturing process of alcohol



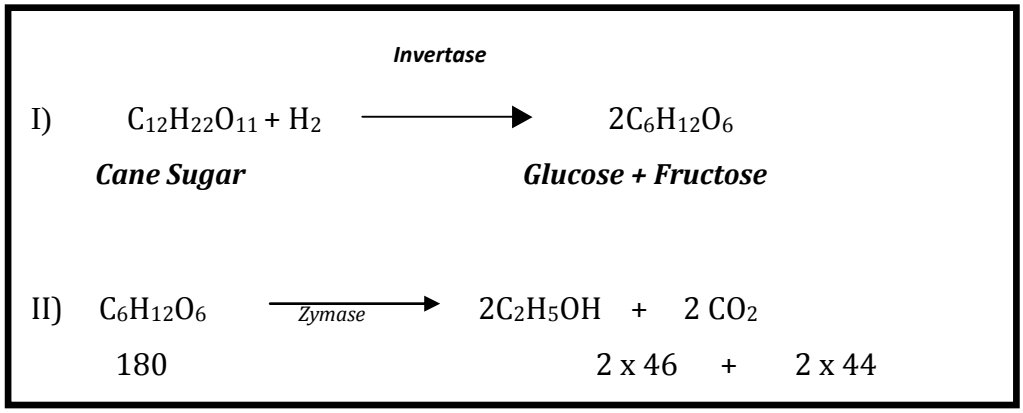
4.0 TECHNOLOGY AND PROCESS DESCRIPTION

4.1 Continuous Process

In this process fermentation and distillation is coupled to get a continuous supply of fermented beer for the distillation column. Yeast is recycled. The advantage of the process is highly active yeast cells initiates the fermentation rapidly and the alcohol yield is also much higher compared to the batch process.

Molasses is the chief raw material used for production of alcohol. Molasses contains about 50% total sugars, of which 30 to 33% are cane sugar and the rest are reducing sugar. During the fermentation, yeast strains of the species *Saccharomyces Cerevisiae*, a

microorganism belonging to class fungi converts sugar present in the molasses such as sucrose or glucose into alcohol. Chemically this transformation for sucrose to alcohol can be approximated by the equation.



Molasses, diluted with water to a desired concentration is supplied continuously to the fermenter. Additives like urea and de-foaming oil are also introduced in the fermenter as required. There is an automatic foam level sensing and dosing system for de-foaming oil. Every kilogram of alcohol generates, about 290 kilocalories of heat. This excess heat is removed by continuous circulation of fermented wash through an external plate heat exchanger called the fermenter cooler. The fermenter temperature is always maintained between 32-34^{o}C, the range optimum for efficient fermentation. The yeast for the fermentation is initially developed in the propagation section. Once propagated, yeast recycling and continuous aeration of the fermenter maintain a viable cell population of about 350 to 500 million cells/ml. Fluctuations in the yeast count of +/- 20% have little effect on the overall fermenter productivity

4.2 Propagation

The propagation section is a feeder unit to the Fermenter. Yeast, either *Saccharomyees cereviseae or Schizosaccharomyees pombe* (the choice being determined by other process parameters, mainly the downstream effluent treatment system) is grown in three stages. The first two stages are designed for aseptic growth. Propagation vessel III develops the inoculums using pasteurized molasses solution as the medium. This vessel has a dual function. During propagation, it serves for inoculums build-up. When the fermenter enters the continuous production mode, propagation vessel III is used as an intermediate wash tank. Propagation is carried out only to start up the process initially or after very long shutdowns during which the fermenter is emptied.

4.3 CO_2 Scrubber and Recovery

The carbon dioxide produced during fermentation is scrubbed with water in packed-bed scrubber, to recover alcohol. The water from the scrubber is returned to the fermenter. In some industries, carbon-di-oxide is captured by, scrubbing the fermenter off gas. A part of the wash is drawn into a separate vessel and is aerated there. This external aeration allows the recovery of CO_2 un-contaminated with air.

4.4 Yeast Recycling

The yeast in the fermenter wash is removed as 45 to 55% v/v slurry, and is returned to the fermenter. This feature ensures that a high yeast cell concentration is achieved and maintained in the fermenter. Mature active yeast will be recycled so as to reduce the excess consumption of sugar by growing yeast. Thus, it make available for ethanol production and ensuring high process efficiency.

4.5 Fermentation Parameters (Typical)

The pH of the fermenter is maintained within 4.0 to 4.8 usually by addition of any acid. The alcohol concentration is maintained between 7.0 to 8.5 % v/v, unless a highly concentrate effluent is to be produced.

Conversion of sugar to ethanol is instantaneous and the residual sugar concentration is maintained below 0.2% w/w as glucose. This usually corresponds to a residual reducing substances concentration of 2.0 to 2.5 % w/w in wash.

Weak Wash /Spent wash Recycling (Optional - depends upon yeast strain)

Recycling of weak wash helps to maintain the desired level of dissolved solids in the fermenter, so that an adequately high osmotic pressure is achieved. Osmotic pressure and the concentration of alcohol in the fermenter, together keep off infections and minimize sugar losses. Weak wash recycling also reduces the quantity of effluent spent wash and reduces the process water requirement of the plant.

4.6 Pressure Vacuum Distillation

Vacuum distillation system consists of three to four distillation columns namely –

- Analyzer column – Operated under vacuum.
- Pre rectifier column – Operated under Vacuum
- Rectifier cum Exhaust Column – Operated under pressure

Fusel oil concentration column may be added to improve quality of alcohol further.

Fermented wash is preheated in fermented wash pre-heater and fed at the top of the Analyzer column, Analyzer column is fitted with thermosyphon reboiler. Top vapors of

analyzer column are sent to pre-rectifier column. Rest of the fermented wash flows down and is taken as spent wash from analyzer column bottom. Pre-rectifier bottom liquid is preheated with spent-lees and fed to rectifier cum exhaust column. Low boiling impurities are concentrated in the pre-rectifier column. A top draw is taken out as impure alcohol from the pre-rectifier column. The bottom of pre-rectifier column is sent to rectifier feed tank. Rectifier exhaust is operated under pressure and heats analyzer column through reboiler. Alcohol is enriched towards the top and is drawn out as Rectified spirit (RS). Fusel oil build-up is avoided in the Rectifier column by withdrawing outside streams of fuel oil. These are sent to fuel oil concentration column from where the fuel oil is sent to decanter for further separation. The fuel oil wash water is recycled back to the column. A top draw is taken out as impure alcohol from the top of fuel oil column & pre-rectifier column.

5. RAW MATERIAL

Table 2 : Raw material details

Sr. No.	Particulars	Consumption/ Production (per days)	Remarks
A.	**Raw Materials, Consumption**		
1.	Molasses, MT	111MT	Basis 47% of F.S. Source: Attached Sugar Factory
B.	**Chemicals, Consumption**		
1.	Nutrients (N,P)	15 kg	Stored in Fermentation House Source: Local Market at Sipora bazar/ Bhokardan /Sillod
2.	**Turkey Red Oil (TRO)**)	27kg	Source: Local Market Local market at Bhokardan /Sillod/ Jalna
C.	**Utilities, Consumption**		
1.	Fuel: Bagasse	Max. 48MT	Source: Attached Sugar Factory
2.	Water	460m^3	Source: Joe medium scale reservoir with permission from Irrigation Dept; Govt of Maharashtra

Sr. No.	Particulars	Consumption/ Production (per days)	Remarks
3.	Steam, MT	2.2 to 3.5 MT/hr Max. 96 MT/day	Source: Attached Sugar Factory (during season)
4.	Power	Max. 725KW/hr	Source: Attached Sugar Factory

Table 3: Water consumption details

Particulars	Intake	Consumption And Losses	Generated Effluent	Recycle and Reuse	Daily Net requirement
Industrial Process	330	00	300	30	**300**
Cooling tower	300	150	150	150	**150**
Boiler feed	115	00	05	110	**05**
Domestic	05	01	04	00	**05**
Other	00	00	00	00	**00**
Total	750	151	459	290	**460**

6.0 BASELINE ENVIRONMENTAL SETTINGS

Table 4: Summary of Environmental setting in 10km radius area

Facet	In brief
Character	Semi arid
Rainfall	Average 650 mm
Precipitation	Mainly in July-Sep
Temperature	Summer temp (Max) upto 41^{0}C. Sometimes + 41 ^{0}C. Min 24 ^{0}C Winter temp (Min) upto 14^{0}C rarely <10^{0}C
Humidity	High in Monsoon 85 %, In summer it decreases up to 25-30 %
Wind	Calm 44.2%, Predominant direction East, North and south-east
Air Quality	Within National Ambient Air Quality standard Limits at all monitored locations
Noise	Within Standard limits for day as well as night time at all monitored locations

Facet	**In brief**
Water	Satisfactory for domestic use except hardness at few places
Soil	Brown (Various tings), Texture clay to loam
Within 10km Area	There is no tropical forest, biosphere reserve, national park or wildlife sanctuary There is no historically important sites, recreational sites or defense installations

7.0 ENVIRONMENT IMPACT ASSESSMENT

Table 5: Summary of pollution sources and types

Environment	**Process/Source**	**Potential Form of Pollutant**
Air	Bagasse as fuel	Mainly particulate matter (fly ash as SPM)
	Ash and bagasse handling	Minor fugitive dust
Water	Effluent	Spentwash : 300 m3/day Spent lees 30 m^3/day Floor washing 4-5 m^3/day Cooling tower blow down 150m^3
Land	Boiler ash	Ash (Max) 960Kg/day, Non-toxic; non-hazardous, rich in potash
	Hazardous waste	Scrap oil from DG set- very minor since DG will be used only in case of captive power failure
Noise	Bagasse & Ash handballing, Power house and boiling house etc.	Localized and no high noise generating activities involved in the project, hence noise levels are anticipated to remain <75dB(A) at ambient level

7.1 Air Environment

Major source of air pollution from the proposed activity could be the SPM (fly ash). For the control of particulate matter concentration emitted through wet scrubber will be provided as air pollution control equipment.

Sulfur is practically absent in bagasse, however, SOx is likely to get produce due to use of biogas as a fuel (@1000m3/hr). Maximum 2.0% of H_2S is observed in biogas, generated from distillery spent wash. Thus, the SOx generation in case of bagasse presumed to be minor, compared to fossil fuel. Hence, the criterion for fixing stack

height is based on SPM emissions. Accordingly, the stack height of 60m is provided. The temperature encountered in the steam generated while burning high moisture bagasse and biomass is low enough to minimize the nitrogen-dioxide production.

7.1.1 Air Dispersion Modeling

In the present case, Industrial Source Complex-Short Term [ISCST3] 1993 dispersion model based on steady state Gaussian plume dispersion, designed for multiple point sources for short term and developed by United States Environmental Protection Agency [USEPA] has been used for simulations from point sources.

Table: 6 Model Input Data

Parameters	Unit	Stack Attached to Boiler
Stack height	m	60
Stack diameter at exit/top	m	4.0
Stack exit gas velocity	Nm3/hr	12,000
Stack gas temperature at exit	Deg. C	150
Bagasse requirement	MT/day	48
Use of Fuel	Bagasse	
Emission rate for SPM	g/s	0.09*
Emission rate for SO2	g/s	4.93#

* Ash content 2% and Wet scrubber efficiency 98%

\# Sulphur content 0.05%

7.1.2 Prediction:

The maximum incremental load of 0.06μg/m^3 for SPM and 0.35μg/m^3 for SOx is anticipated at 2.5KM towards downwind of the site i.e. WSW. There is no residential area (except small housing colony of the factory) in 2.5km towards wsw of the site where dispersion could be maximum.

7.1.3 Observation: The resultant Ground Level Concentration (GLC) values indicate that, the incremental concentrations of pollutants (SPM and SOx), will be within the prescribed National Ambient Air Quality Standards (NAAQS) for residential & rural areas. Minor negative impact on air environment due to pollutants emitted from flue gases and fugitive dust.

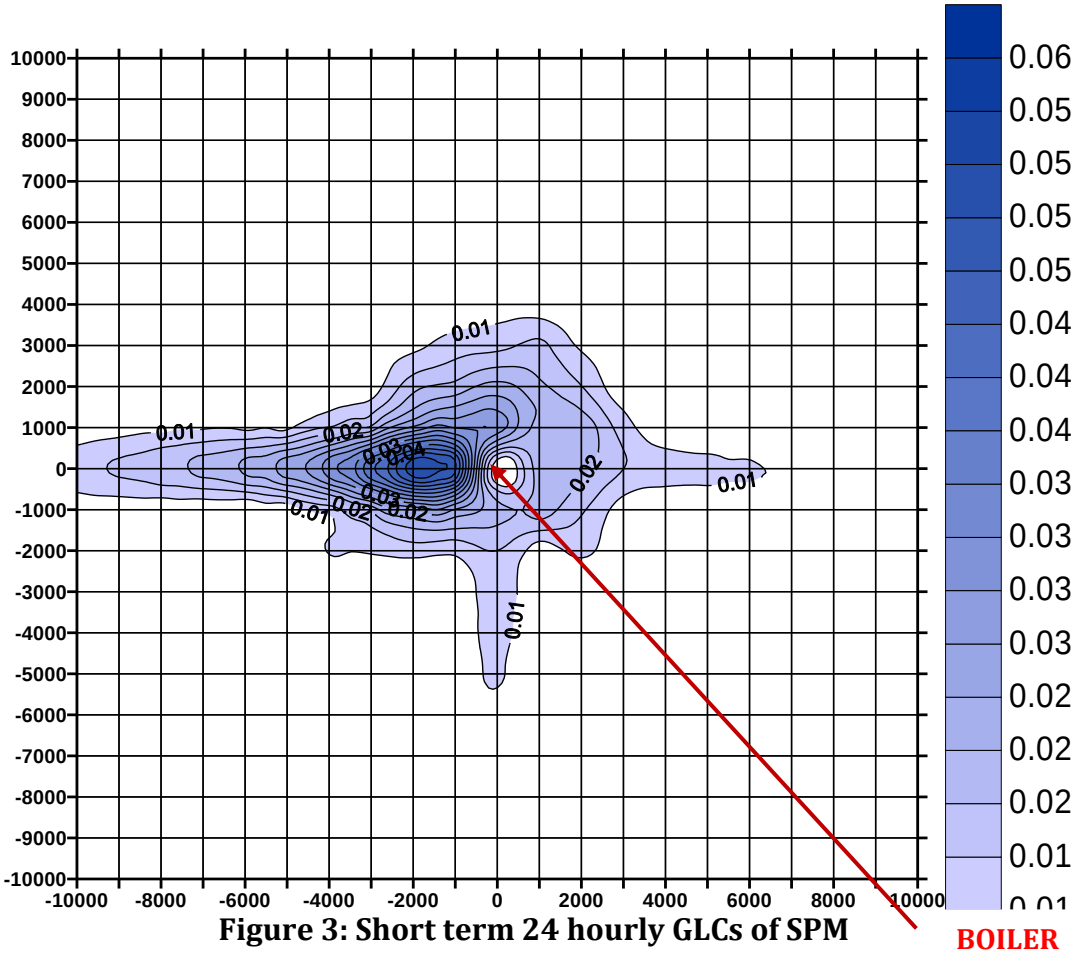


Figure 3: Short term 24 hourly GLCs of SPM

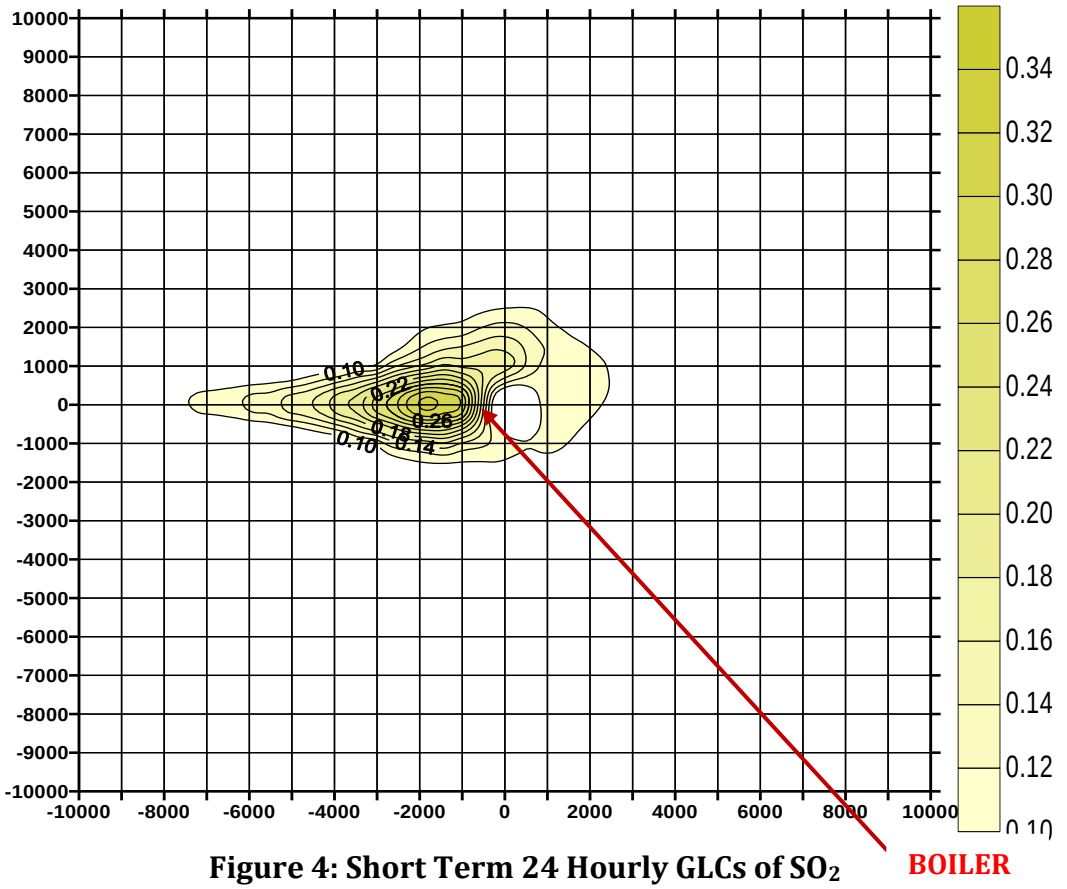


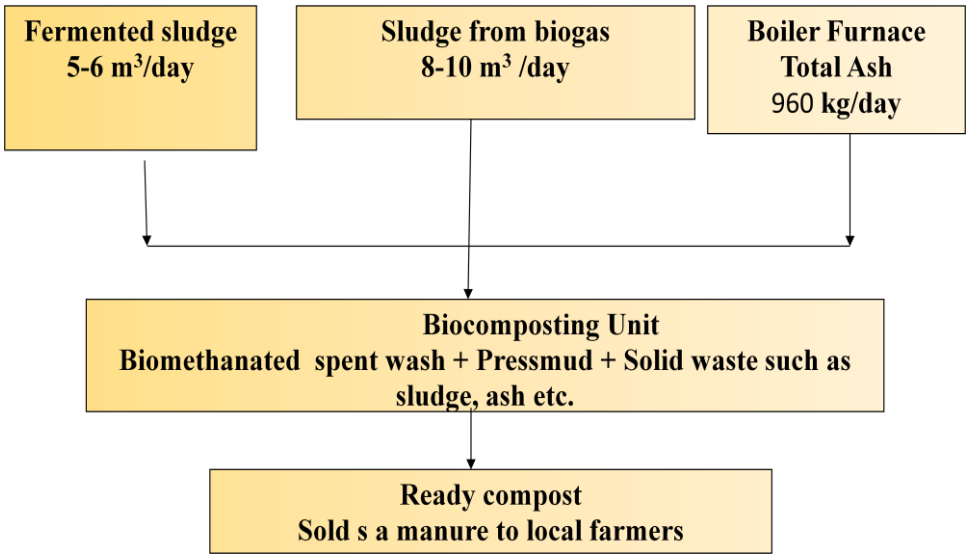
Figure 4: Short Term 24 Hourly GLCs of SO_2

Table: 7: Resultant concentrations due to incremental GLC's

Scenario	Incremental Concentration, μg/m³	Baseline Concentration* μg/m³	Resultant Concentration** μg/m³	CPCB Limit for Residential & Rural Areas, μg/m³
SPM	0.06	61	61.06	100
SO_2	0.35	11.9	12.25	80

*Nearest Downwind site village Babhulgaon 2.5 km- towards WSW direction
**Baseline Concentration – average - at village Babhulgaon
Resultant Concentration at nearest down wind direction

7.2 Solid waste



- The third alternative could be to sell the ash to the local bricks manufacturing unit.
- No negative impact on soil environment, since ash is non hazardous, non toxic and potash rich. Minor negative impact on air environment due to dust

7.3 Water Environment

The main effluent source will be the spent wash effluent. Spentwash generation is estimated to be around 300m3/day and spent lees generation estimates to around 30m³/day. Following treatment system adopted for effluent management.

- Biomethanation followed by bio-composting for spentwash
- Spentwash storage and compost yard preparation as per CREP guidelines
- Polishing unit for treatment of spent lees, CIP and blow down water
- Recycling of process condensate
- Recycling of treated water

8.0 ENVIRONMENT MANAGEMENT PLAN (EMP): OPERATION PHASE

Table: 8 Summary of Environment Management Plan: operation phase

Activity	Impact factors	Mitigation Measure	Assessment
Steam Generation thro' boiler (emissions from stack), transportation, process of fermentation	Particulate Matter (SPM) Formation of SO_2, NOx H_2S from Biogas Carbon dioxide due to fermentation process Odour	• Wet scrubber to control ash emission through stack .Stack height 60m • Proper ash and bagasse handling system • Development of greenbelt • Use of biogas as fuel • Installation of CO_2 scrubber • Mechanical handling of bagasse and ash • Bagasse contains traces of S & N, hence generation of SO_X and NO_X anticipated to be limited • Provision of flare unit • Bagasse is a renewable sources of energy & carbon neutral fuel	Minor Negative impact on air quality and ecology of immediate site surrounding
Process and effluent storage, disposal	Effluent from processes, cleaning, blow down water, & condensate Storage of spentwash and its disposal	Zero Liquid discharge (ZLD)will be achieved by • Adopting Biomethanation followed by biocomposting • Treating other effluents in polishing unit and reusing the treated water • Storage of spentwash and construction of compost yard will be strictly as per CREP guidelines • Treated water will be reused for process &/or irrigation • Fresh water requirement will be reduced by recycling of water • Bore well, in downstream	Minor negative impact anticipate mainly due to accidental spillages or leakages and thereby contamination of water, ground water or soil

		area of bio-compost to monitor ground water quality • Use of biogas as fuel • Rain water harvesting	
Generation of ash and solid waste	Ash	Utilized in the process of bio-composting Greenbelt development	Minor negative impact on air quality No negative impact on soil
	Fermented sludge and sludge from Bio-digesters	Utilized in the process of bio-composting	Positive impact on soil
Transportation	Vehicular emissions, emissions & noise due to traffic congestions	• Regular maintenance of factory vehicles • Separate provisions of parking for goods and other vehicles • Leveled, illuminated and well maintained internal roads and proximity of state highway • Safety sign boards at strategic locations • Provision of Adequate personal protective equipments	Transportation requirement is limited, hence it will help to control the gaseous pollutants and maintain ambient air quality Minor increase in noise level particularly at work is anticipated

8.1 Environment Monitoring Programme

In order to maintain the environmental quality within the standards, regular monitoring network to maintain environmental quality will be implemented.

The sugar factory already has a full-fledged laboratory and technical manpower for the pollution matters. The same can be extended to the cogeneration and ETP, since the cogeneration unit is proposed to be within the sugar complex.

Table: 9 Suggested schedule for maintenance of wastewater treatment

Sr. No.	Particulars	Parameter	Frequency#
1	Stack Emissions	SPM, SO_2, NO_x	Monthly
2	Ambient Air Quality	SPM (PM_{10}), RSPM ($PM_{2.5}$), SO_2, NO_x	Monthly
3	Inlet and outlet of polishing unit	pH, BOD, COD, SS, TDS, Oil & Grease etc.	Monthly
4	Bore well /ground water sample nearer to compost yard	pH, COD, BOD, Total solids, Chlorides, Sulphate, Phosphates, and Calcium.	Quarterly /monthly
5	Noise monitoring	Noise Levels measurement at high noise generating places as well as sensitive receptors in the vicinity	Monthly
6	Analysis of ready bio-compost	Moisture, Organic Carbon, and C:N ratio, Nitrogen, Phosphorous, Potassium, etc.	Each batch of compost
7	Occupational health	health and fitness checkup of employees get exposed to various hazards All other staff (except above)	Quarterly Twice a year

Table: 10 Estimated capital & recurring expenses for environmental management program

Sr. No.	Particulars	Amount (Rs. in Lakhs)
1.	Spent wash cooling and holding tank	85.00
2.	Compost yard with PCC top finish	175.00
3.	Leachate management system	15.00
4.	Laboratory shed and its glassware, equipments, etc.	15.00
5.	Polishing units for condensate treatment	100.00
6.	Biomethanation Unit	360.00
7.	Biocomposting machinery, pipeline and other	70.00

Sr. No.	Particulars	Amount (Rs. in Lakhs)
8.	Fire fighting equipments and other	25.00
9.	Tree plantation and bore well for composting	8.00
10.	Wet Scrubber	110.00
	TOTAL	**963.00**
	Recurring Expenses/annum	
1.	Salaries and wages	09.00
2.	Operation and maintenance of all pollution control devices, motors, pumps, pipelines, etc.	3.50
3.	Fuel (composting activity) and Electricity (in case of diesel generator operation)	1.50
4.	Contingency and miscellaneous	1.00
5.	**TOTAL**	15.00

9.0 GREENBELT DEVELOPMENT

There is already a good green belt developed around the complex. The greenery development will be done as per the requirement i.e. type of activity performed at a particular area/block/plot, thus the tree spacing will vary from plot to plot. Therefore, >4,500 plants (including shrubs and trees) are proposed for the greenbelt development.

The Major objectives of the proposed green belt development will be –

- Mitigate impact due to fugitive emissions
- Create an aesthetic environment
- Enhance the bio-diversity of the vicinity
- Help to restore the ground water table
- Prevent soil erosion and surface run-off

While planning and designing greenbelt, its various functions will be considered: They are-

- Spatio-visual separation of larger parts of the premises
- Entrance and roadside greenery helps in separating the main industrial structures
- Provision of greenery along all interior pedestrian network
- Provision of (smaller) resting areas for the workforce during breaks (park benches, etc,)
- Provision of reserve sites eventually becoming necessary at a later development stage.

Selection of plant species will be based on their following characteristics

- Fast growing
- Thick canopy cover
- Perennial and ever green
- Large leaf area
- Preferably Indigenous
- Resistant to pollutants and should maintain ecological balance for soil and geo-hydrological conditions of the region.

Greenbelt development will be initiated simultaneously or prior to construction phase and it will be implemented in minimum two rainy seasons

10.0 RISK AND DISASTER MANAGEMENT

For the proposed project, risk management and disaster management, (onsite and Off-site Management) programme described separately in Chapter VII and VIII.

11.0 CSR ACTIVITIES OF RAMESHWAR SAHAKARI SAKHAR KARKHANA LTD

RSSKL is a leading and progressive cooperative sugar industry. The factory is committed for holistic development of the region and has implemented many activities towards fulfilling its commitment. To mention a few -

- It is providing good quality seed material, insecticides and fertilizers to member farmers at no loss and no profit basis
- A well equipped and maintained hospital set up is available in the factory premises

12.0 PROJECT BENEFIT

- Generation of direct and indirect employment opportunities to the sun of soils
- Improving the electricity situation in the region and thus reducing the load shedding at least partially
- Economic benefits of the project will be shared with farmers who are the shareholder of this cooperative sugar factory
- Thus, it will boost the local economy

12.1 Social Initiatives by the Industry

The foremost objective of Rameshwar SSKL, is to serve as a centre for all round development of cane growers, peasants and workers in villages of economically backward of district.

In addition to industrial growth in the area, the factory also involved in several socio-economic developmental activities to help member farmers and workers of factory

1. Factory has provided cane seed of improved varieties to cane growers through the agricultural set up at concessional rate.
2. Factory has improved the internal roads in the area of operation.
3. Factory has been supplying bio-compost made from press mud and distillery effluent to farmers at concessional rate.
4. Factory is regularly providing technical guidance for cane development programme at farmer's field.
5. Factory has provided canteen, sports club, reading room, library as welfare activities.
6. Factory has established "Sakhar shala" for children of cane harvesting workers.
7. Factory has provided hospital facility for the employees and cane growers in the area of operation and Karkhana also conducting eye treatment cum operation camp with the help of lion's club of Phaltan.
8. Factory is arranging cultural programs and sports tournaments for employees and cane growers of area of operation.
9. Factory has provided employees credit co- operative society.
10. From last two years, the factory has started providing Rs. 20,000 per acre as loan without interest to the member farmers from Bank to promote cane cultivation in the region. The interest burden on account of the loan is being born by the factory

12.2 Environmental benefit analysis

- Raw material i.e. molasses and bagasse is readily available from the sugar factory
- Hence, saving of raw material transportation cost and fuel,
- Problem of molasses and bagasse disposal of Karkhana will get solved
- Generation of energy (Biogas) from wastewater i.e. spentwash
- Utilization of Biogas and thus saving more bagasse for off-season that will be utilized for cogeneration activity

12.3 Benefits of Wastewater (spentwash) Treatment

Factory has decided to install bio-methanation followed by by Biocomposting treatment System for spentwash treatment that has following advantages:

1. Bio-gas generated from bio-methanation unit could be used for Boiler as a fuel and save bagasse consumption.
2. Production of good quality bio-compost (organic manure)
3. Increase in fertility of soil (Physical and biological).
4. Achieve zero discharge in inland /surface water

13.0 CONCLUSION

Considering all these aspects, the negative impact of the project could be controlled and kept within permissible limit through the proposed Environment Management Plan (EMP). Socio-economic and environmental significance of proposed project is considerable. Thus, the project presumes to maintain the environmental as well as socio-economic sustainability in the long term.