SOLARA
Active Pharma Sciences

Communication Address :
Solara Active Pharma Sciences Limited
R.S.No. 33 & 34,
Mathur Road, Periyakalapet
Puducherry - 605 014. India
Tel: +91 413 2654100.

30/06/2023

To

The Director,
The Ministry of Environment and Forest & Climate Change,
Integrated Regional Office,
1st Floor, Additional Office Block for GPOA,
Shastri Bhawan, Haddows Road,
Nungambakkam, Chennai – 600 006

Sub: Submission of **six-monthly Environmental Clearance Compliance statement for June 2023** of "M/s Solara Active Pharma Science Limited – "Change in product mix without increase in total production capacity" at Periyakalapet, Mathur Road, Puducherry - 605014.

Ref: Environmental Clearance obtained from SEIAA, Puducherry and its F. No. 247066/SEIAA/PY/EE/2022 dated: 27.04.2022

Dear Sir / Madam,

We submit herewith the six monthly Environmental Clearance Compliance statement for June 2023 for "Change in product mix without increase in total production capacity" at M/s Solara Active Pharma Science Limited - R.S. Nos. 30/4pt, 32/1A, 32/2, 32/3, 33/1, 33/10, 33/11, 33/13, 33/2, 33/3, 33/4,33/5, 33/6, 33/9, 34/1, 34/2, 34/3, 34/4, 34/5, 34/6, 34/7, 34/8, 35/4, 35/5, 35/6, 35/7, 36/5, Mathur Road, Periyakalapet, Puducherry - 605014 for June 2023 (for the period from October 2022 March 2023) along with the supporting documents for your perusal.

Thanking you

Yours faithfully,

M. [signature]

Authorized Signatory

Solara Active Pharma Sciences Limited
Puducherry
605 014
Periyakalapet

Enclosed: EC Compliance Report along with Annexure.

SIX-MONTHLY ENVIRONMENTAL CLEARANCE COMPLIANCE REPORT

For (Period of October 2022 - March 2023)

"Change in product mix without increase in total production capacity"

EC OBTAINED Vide F.No 247066/SEIAA/PY/EE/2022 dated: 27.04.2022

At

R.S. Nos. 30/4pt, 32/1A, 32/2, 32/3, 33/1, 33/10, 33/11, 33/13, 33/2, 33/3, 33/4, 33/5, 33/6, 33/9, 34/1, 34/2, 34/3, 34/4, 34/5, 34/6, 34/7, 34/8, 35/4, 35/5, 35/6, 35/7, 36/5, Periyakalapet, Mathur Road, Puducherry.

Submitted By

SOLARA
Active Pharma Sciences

M/s Solara Active Pharma Science Limited
Periyakalapet, Mathur Road,
Puducherry.

Prepared by

NABET HECS

ENVIRONMENTAL CONSULTANT
HUBERT ENVIRO CARE SYSTEMS (P) LTD
CHENNAI

June 2023

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1.0 Project Details

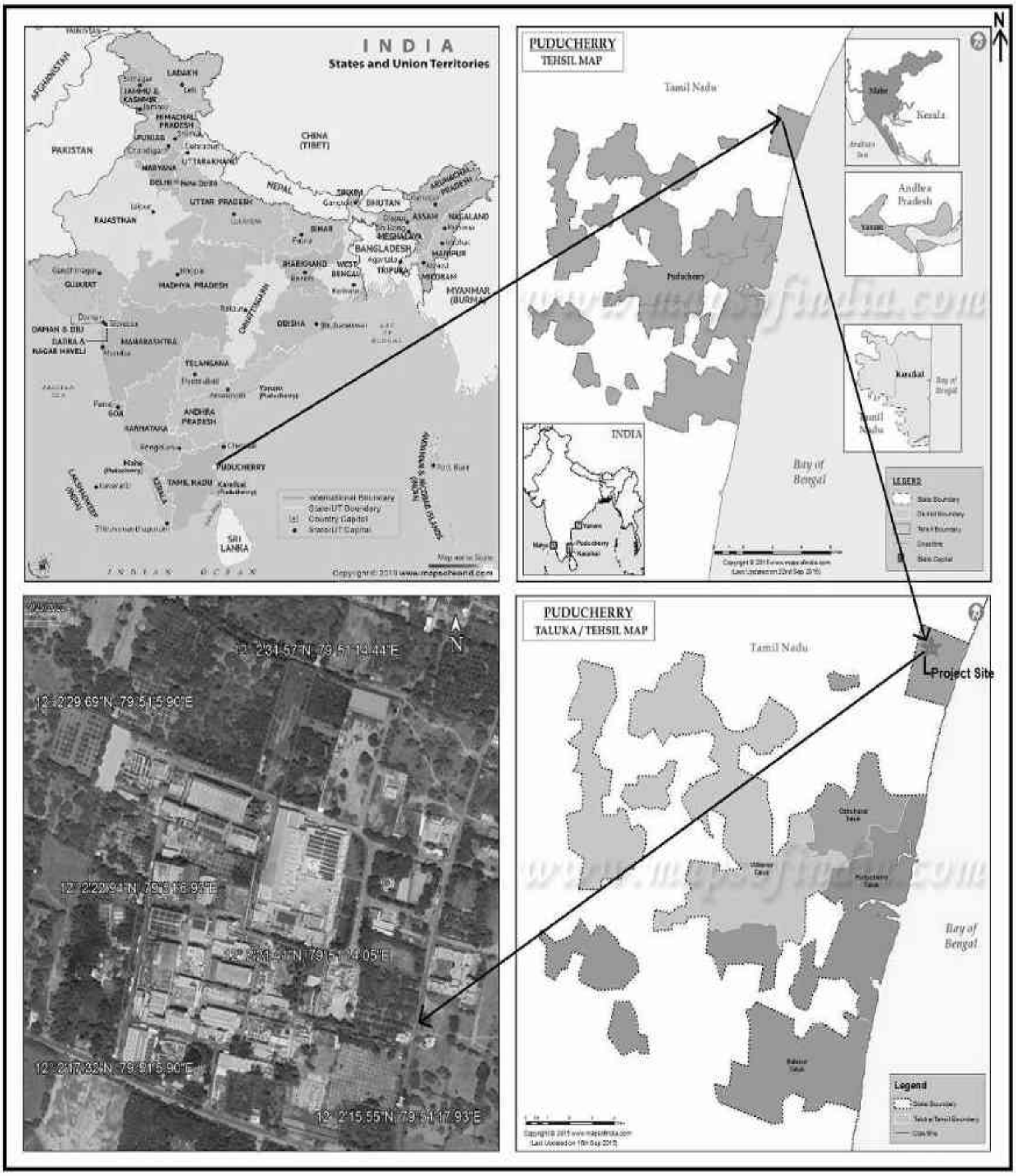
M/s. Solara Active Pharma Science Limited

Name of the Project	"Change in product mix without increase in total production capacity"
Project Proponent	M/s. Solara Active Pharma Science Limited
Location	R.S. Nos. 30/4pt, 32/1A, 32/2, 32/3, 33/1, 33/10, 33/11, 33/13, 33/2, 33/3, 33/4, 33/5, 33/6, 33/9, 34/1, 34/2, 34/3, 34/4, 34/5, 34/6, 34/7, 34/8, 35/4, 35/5, 35/6, 35/7, 36/5, Periyakalapet, Mathur Road, Puducherry.
EC. No	F. No. 247066/SEIAA/PY/EE/2022 dated: 27.04.2022. EC copy is enclosed as **Annexure - 1.**
Total Land Area	24.30 Acres (98338.93 Sq.m.)
Green Built Area	8.42 Acres (34.65%)
Manpower	789 no's

Project Description product & Capacity	**Product Name**	**Existing Quantity**	**Proposed Quantity**	**Total after change in product mix**
	Ibuprofen	4308	-312	3996
	Ibuprofen DC	240	0	240
	Ibuprofen Lysinate	120	0	120
	Ibuprofen Sodium	20	0	20
	S+ Ibuprofen	100	0	100
	Pilot Scale R&D Operations	12	0	12
	Carisoprodol	12	-12	0
	Ammonium lactate	0	120	120
	Celecoxib	0	144	144
	Rebamipide	0	60	60

	Total (TPA)	**4812**	**0**	**4812**
Water Requirements	Total Water Requirement- 762 KLD Total Fresh Water Requirement-110 KLD Recycled Water - 652 KLD Source from Bore well and Treated sewage water from PWD STP			
Power Requirements	Puducherry Electricity Department -3860 KVA DG Sets - 2 × 1500 and 2 × 1010 KVA			
Hazardous Waste Management	The total hazard waste quantity generated per Annum is 29079 TPA.			
Estimated Project Cost	Rs.211.3307 Crores (existing)			

2.0 Location Map



3.0 Site Photographs

4.0 SIX MONTHLY ENVIRONMENTAL CLEARANCE COMPLIANCE STATEMENT

Specific Conditions:

S.No	Conditions	Status of Compliance
i.	This clearance is issued under the provisions of the EIA Notification, 2016. All other statutory clearances as applicable to the project shall be obtained by the project proponent from the concerned competent authority including the Consent to Establish and Operate for change in product mix from the Puducherry Pollution Control Committee (PPCC).	Condition accepted and noted. The CTE application has been applied to PPCC for the new EC. The proof for the CTE application is attached as **Annexure -2.** The CTO renewal application is also under process with PPCC. The proof of CTO renewal application submitted to PPCC is attached as **Annexure – 2.**
ii.	The pollution and control measures with regard to waste water treatment and disposal, air and noise pollution control measures, hazardous waste and solid waste management and all risk mitigation measures shall be strictly implemented as per the Environmental Management Plan submitted by the project proponent and in consonance with existing rules and regulations.	Condition accepted and noted. As per Environment management plan submitted, all risk mitigation measures were strictly implemented. The photograph of ZLD system, and scrubber photograph is attached as **Annexure- 3**.
iii.	There shall be no additional water requirement or waste water generation from the process.	Condition noted. There will be no additional water requirement or no increase in waste water from process.
iv.	No additional land shall be used / acquired for any activity of the project without obtaining Proper permission.	Condition accepted and noted. No additional land will be used for the project activity without proper permission.
v.	Environment and Safety Audit shall be carried out in different operating zones of the plant at least once in a year and the adequacy of environmental safeguards and plant / occupational safety shall be reviewed and necessary corrective measures shall be taken	Condition being complied. Environment and Safety Audit has been carried out in different operating zones of the plant. The safety audit report is attached as **Annexure – 4.**

S.No	Conditions	Status of Compliance
vi.	The proponent shall continuously monitor ambient VOC levels around the plant and implement necessary VOC control measures.	Condition being complied. The VOC sensors have installed around the plant. The photograph of same is attached as **Annexure-30.**
vii.	Fugitive emissions shall be controlled at 99.98% with effective chillers. VOCs shall be controlled at 99.997% with effective chillers / modern technology. The unit shall ensure Zero Liquid Discharge from the plant.	Condition noted. Primary, secondary and tertiary condensers were used to recover and reuse of solvents by which the fugitive emissions will controlled. The online VOC monitoring report is enclosed as **Annexure- 29.** The condensers photograph is enclosed as **Annexure- 17 b.** The ZLD system photograph is enclosed as **Annexure-3.**
viii.	All the ETP Tanks shall be above the ground level to avoid any ground water contamination. Waste water shall not be stored in underground sumps / tanks.	Condition accepted and noted. The ETP tanks were provided above the ground level to avoid ground water contamination. The ETP photograph is attached as **Annexure -3.**
ix.	The project proponent shall carry out regular monitoring of the ground water level and quality in and around the industry by establishing network of monitoring wells. Quarterly monitoring of water quality and water level shall be carried out through NABL accredited laboratory covering all seasons and reports shall be submitted to PPCC.	Condition complied. The ground water quality report are attached as **Annexure -5.**
x.	Organic Waste Convertor shall be installed for converting organic waste into manure and the manure shall be used for gardening.	Condition will be complied. Installation work of Organic waste convertor inside the site is under process. The installation work will be completed in 3 months time.
xi.	The industry shall carry out energy audit through accredited agencies and take appropriate actions for energy conservation.	Condition being complied. The industry has been carried out energy audit through accredited agencies The energy audit report is attached as **Annexure- 6.**

S.No	Conditions	Status of Compliance
xii.	The project proponent has allocated 8.42 acres of land (34.65%) for green belt development. This area shall not be diverted for other use. Stratified green belt with tall trees and shrubs beneath should be developed and maintained properly to serve as effective sink for air pollutants.	Condition accepted and noted. The entire plant is covered with greenbelt area of 8.62 Acres which is 34.65 % of the total area of 24.30 acres. The green belt photograph and plant species detail is attached as **Annexure – 7.**
xiii.	A separate Environment Management Cell (having qualified persons with Environmental Science / Engineering / Management specializations) equipped with full-fledged laboratory facilities shall be set up to carry out the Environmental Management and Monitoring functions.	Condition accepted and noted. A separate environment Management cell having qualified persons has been set up to carry out Environment management and Monitoring functions. The EMC organogram is attached as **Annexure – 8.**
xiv.	As per the MoEF CC OM dated 30.09.2020 superseding the OM dated 01.05.2018 regarding the Corporate Environmental Responsibility, the project proponent shall allocate an amount of Rs. 1.58 Crores towards environment conservation and community welfare activities, which shall be utilized over a period of three years. The said amount shall be utilized for activities like infrastructure creation for drinking water supply, sanitation, health, education, skill development, roads, cross drains, electrification including solar power, solid waste management facilities, scientific support and awareness to local farmers to increase yield of crop and fodder, rain water harvesting, soil moisture conservation works, avenue plantation, plantation in community areas, etc. within the project area. The Project Proponent shall prepare a separate project report on the proposed environment conservation and community welfare activities in consultation with the District Collector and copy of the report shall be submitted to the District Collector, SEIAA, PPCC and Regional Office of MoEF CC.	Condition accepted and noted. The CER plan detail is attached as **Annexure- 9.**

S.No	Conditions	Status of Compliance
	The activities shall be implemented in a time bound manner in consultation with the District Collector. The project progress report shall be submitted to the SEIAA, PPCC and Regional Office of MoEF CC as a part of the half yearly compliance report. The above fund allocated towards environment conservation support activities is to be in addition to the cost envisaged under the CSR budget of the company which will be allocated as per the rules prescribed by the Government of India / Companies Act 2013.	

GENERAL CONDITIONS:

I. Statutory compliance

S.No	Conditions	Status of Compliance
1.	The project proponent shall obtain Consent to Establish / Operate under the provisions of the Air (Prevention & Control of Pollution) Act, 1981 and the Water (Prevention & Control of Pollution) Act, 1974 from the PPCC before commencement of production of the new products and shall submit copy of the same to SEIAA, Puducherry.	Condition accepted and noted. The CTE and CTO renewal application is under process. The application proof submitted to PPCC is attached as **Annexure -2.**
2.	The project proponent shall obtain authorization under the Hazardous and other Waste Management Rules, 2016 as amended from time to time from PPCC.	Condition accepted and noted. The HWA renewal copy is attached as **Annexure- 32.**
3.	The Company shall strictly comply with the rules and guidelines under Manufacture, Storage and Import of Hazardous Chemicals (MSIHC) Rules, 1989 as amended time to time. All transportation of Hazardous Chemicals shall be as per the Motor Vehicle Act (MVA), 1989.	Condition accepted and noted.

II. Air quality monitoring and preservation

S.No	Conditions	Status of Compliance
1.	The project proponent shall install 24x7 continuous emission monitoring system at process stacks to monitor stack emission with respect to standards prescribed in Environment (Protection) Rules, 1986 and the data to be transmitted to PPCC and CPCB online servers. This system shall be calibrated from time to time according to equipment supplier specification through labs recognized under Environment (Protection) Act, 1986 or NABL accredited laboratories.	Condition accepted and noted. The online monitoring report is attached as **Annexure -5.**
2.	The project proponent shall monitor fugitive emissions in the plant premises at least once in every quarter through labs recognized under Environment (Protection) Act, 1986.	Condition accepted and noted. The fugitive emission monitoring report is attached as **Annexure- 5.**
3.	The project proponent shall install system to carryout Ambient Air Quality Monitoring for common/criterion parameters relevant to the main pollutants released (e.g. PM_{10} and $PM_{2.5}$ in reference to PM emission, and SO_2 and NO_2 in reference to SO_2 and NO_x emissions) within and outside the plant area at least at four locations (one within and three outside the plant area at an angle of 120° each), covering upwind and downwind directions.	Condition noted. Online monitoring systems were used to monitor the given emission. The online monitoring report is attached as **Annexure – 5.**
4.	To control source and the fugitive emissions, suitable pollution control devices shall be installed to meet the prescribed norms and / or the NAAQS. The gaseous emissions shall be dispersed through stack of adequate height as per CPCB/PPCC guidelines.	Condition being complied. To control source and the fugitive emissions scrubbers has been installed. The photograph of scrubber is attached as **Annexure-3.**
5.	Storage of raw materials shall be either stored in silos or in covered areas to prevent dust pollution and other fugitive emissions.	Condition being complied. The raw material has been stored in a closed storage area The photograph of Raw material storage area is attached as **Annexure- 10.**
6.	The DG sets shall be equipped with suitable pollution control devices and adequate stack height so that the emissions are in conformity	Condition accepted and noted. The acoustic enclosed DG set photograph is Attached as

S.No	Conditions	Status of Compliance
	with the extant regulations and the guidelines in this regard.	**Annexure -11.**
7.	National Emission Standards for Organic Chemicals Manufacturing Industry issued by the Ministry vide G.S.R. 608(E) dated 21st July, 2010 and amended from time to time shall be followed.	Agreed to comply.
8.	The National Ambient Air Quality Emission Standards issued by the Ministry vide G.S.R. No. 826(E) dated 16th November, 2009 and amendment from time to time shall be complied with.	Condition accepted and noted. The ambient air quality report is attached as **Annexure – 5.**

III. Water quality monitoring and preservation

S.No	Conditions	Status of Compliance
1.	The project proponent shall provide online continuous monitoring for treated effluent. The unit shall install web camera with night vision capability and flow meters in the channel/drain/pipelines carrying effluent within the premises.	Condition accepted and noted. The unit has installed web camera with night vision and low meters in the channel/drain/pipeline. The photograph of the same is attached as **Annexure – 12.**
2.	As already committed by the project proponent, Zero Liquid Discharge shall be ensured and no waste/treated water shall be discharged outside the premises.	Condition accepted and noted. The ZLD photos are attached as **Annexure – 3.**
3.	The effluent discharge shall conform to the standards prescribed under the Environment (Protection) Rules, 1986 or as specified by the Puducherry Pollution Control Committee while granting Consent under the Air/Water Act, whichever is more stringent	Condition accepted and noted. The ETP water quality report is attached as **Annexure -5.**
4.	Total fresh water requirement shall not exceed the proposed quantity or as specified by the Committee. Prior permission shall be obtained from the concerned regulatory authority/CGWA in	Agreed to comply. The fresh water requirement is 110 KLD which is met through Bore well. The remaining 652 KLD of

S.No	Conditions	Status of Compliance
	this regard.	water will be met through PWD STP. The ground water permission from Puducherry ground water authority is attached as **Annexure -13.**
5.	Process effluent/any wastewater shall not be allowed to mix with storm water. The storm water from the premises shall be collected and discharged through a separate conveyance system.	Condition accepted and noted. As ZLD system is followed, the process effluent water will not mix with the storm water. The storm water drain photograph is attached as **Annexure- 31.**
6.	The Company shall harvest rainwater from the roof tops of the buildings and storm water drains to recharge the ground water and utilize the same for different industrial operations within the plant.	Agreed to comply. The Rain water system photograph is attached as **Annexure -14.**

IV. Noise monitoring and prevention

S.No	Conditions	Status of Compliance
1.	Acoustic enclosure shall be provided to DG set for controlling the noise pollution.	Condition noted. DGs are provided with inbuilt acoustic enclosures. The photograph of same is attached as **Annexure- 11.**
2.	The overall noise levels in and around the plant area shall be kept well within the standards by providing noise control measures including acoustic hoods, silencers, enclosures etc. on all sources of noise generation.	Condition agreed to comply.
3.	The ambient noise levels should conform to the standards prescribed under Environment (Protection) Rules, 1986 viz., 75 dB (A) during day time and 70 dB(A) during night time.	Condition accepted and noted. The ambient noise monitoring report is attached as **Annexure – 5.**

V. Energy Conservation measures

S.No	Conditions	Status of Compliance
1.	The energy sources for lighting purposes shall preferably be LED based or advanced energy efficient lighting systems.	Condition accepted and noted. The LED street lights have been installed in the plant premises and the photograph of LED is attached as **Annexure- 15.**

VI. Waste management

S.No	Conditions	Status of Compliance
1.	Hazardous chemicals shall be stored in tanks, tank farms, drums, carboys etc. Flame arresters shall be provided on tank farm and the solvent transfer through pumps.	Condition being complied. Hazardous chemicals were stored in closed tanks, bags and drums in separate storage area. Flame arrestors have been provided. The photograph of hazardous chemicals storage area and flame arrestors is attached as **Annexure- 16.**
2.	Hazardous wastes like waste dichromate solution, ETP Sludge, waste oil, spent solvent, distillation residue, process residue, spent catalyst / carbon, off specification products, date expired / discarded off specification drugs, spent organic solvents, Sludge from Treatment of Wastewater arising out of cleaning / disposal of Barrels / containers, Discarded Containers / Barrels / Liners, Contaminated with Hazardous waste Chemicals, Chemical Sludge from Wastewater treatment, Oil and Grease Skimming Residues and spent acid shall be disposed off to the cement plants for co-processing, reprocessing units or TSDFs after obtaining necessary Hazardous Waste Authorization from PPCC.	Condition accepted and noted. The HWA application is under process with PPCC. The proof of submitted application to PPCC is attached as **Annexure-32.**
3.	The company shall undertake waste minimization measures as below:-	a) Condition agreed to comply.

S.No	Conditions	Status of Compliance
	a) Metering and control of quantities of active ingredients to minimize waste. b) Reuse of by-products from the process as raw materials or as raw material substitutes in other processes. c) Use of automated filling to minimize spillage. d) Use of Close Feed system into batch reactors. e) Venting equipment through vapour recovery system. f) Use of high-pressure hoses for equipment cleaning to reduce waste water generation.	b) Condition accepted and noted. c) Condition agreed. The automated filling system photograph is attached as **Annexure- 17a.** d) Condition accepted. The closed feed system photograph is attached as **Annexure- 17 b.** e) Condition noted. f) Condition noted.

VII. Green Belt

S.No	Conditions	Status of Compliance
1.	The green belt of 5-10 m width shall be developed in more than 33% of the total project area, mainly along the plant periphery, in downward wind direction, and along road sides etc. Selection of plant species shall be as per the CPCB guidelines in consultation with the Forest Department	Condition accepted and noted. The entire plant is covered with greenbelt area of 8.62 Acres which is 34.65 % of the total area of 24.30 acres. The green belt photograph is attached as **Annexure -7**

VIII. Safety and Human health issues

S.No	Conditions	Status of Compliance
1.	Emergency preparedness plan based on the Hazard Identification and Risk Assessment (HIRA) and Disaster Management Plan shall be implemented.	Agreed to comply.
2.	The unit shall make the arrangement for	Condition noted.

S.No	Conditions	Status of Compliance
	protection of possible fire hazards during manufacturing process and material handling. Firefighting system shall be as per the norms.	To protect the unit from fire hazards during manufacturing and material handling a firefighting system has been implemented in the plant. The fire fighting system photograph has been attached as **Annexure -18.**
3.	The Project Proponent shall provide Personal Protection Equipment (PPE) as per the norms of Factory Act.	Condition accepted and noted. Personal protective equipment has been provided to the workers as per factory act. The PPE photograph is attached as **Annexure – 19.**
4.	Training shall be imparted to all employees on safety and health aspects of chemicals handling. Pre-employment and routine periodical medical examinations for all employees shall be undertaken on regular basis.	Condition being complied. Mock drill training were conducted with regular period of time for the employees. The safety training photograph is attached as **Annexure – 20.**
5.	Occupational health surveillance of the workers shall be done on a regular basis and records maintained as per the Factories Act.	Condition noted. Occupational health surveillance report for the workers is attached as **Annexure – 21.**
6.	There shall be adequate space inside the plant premises earmarked for parking of vehicles for raw materials and finished products, and no parking to be allowed outside on public places.	Condition accepted and noted. An adequate space has been provided for parking of vehicles for unloading the raw materials and loading the finished products. The photograph of the same is attached as **Annexure-22.**

IX. Corporate Environment Responsibility

S.No	Conditions	Status of Compliance
1.	The company shall have a well laid down environmental policy duly approved by the Board of Directors. The environmental policy should	Condition accepted and noted. The company has well laid down environment policy which approved

S.No	Conditions	Status of Compliance
	prescribe standard operating procedures to have proper checks and balances and to bring into focus any infringements / deviation / violation of the environment / forest / wildlife norms / conditions. The company shall have defined system of reporting infringements / deviation / violation of the environmental / forest / wildlife norms / conditions and / or shareholders / stake holders. The copy of the board resolution in this regard shall be submitted as a part of half yearly compliance report.	by the board of directors. The company environment policy is attached as **Annexure – 23.**
2.	A separate Environmental Cell both at the project and company head quarter level, with qualified personnel shall be set up under the control of senior Executive, who will directly report to the head of the organization.	Condition accepted and noted. A dedicated qualified person has been set under the control of senior Executive, who is directly report to the head of the organization. The EMC organogram is attached as **Annexure – 8.**
3.	Action plan for implementing EMP and environmental conditions along with responsibility matrix of the company shall be prepared and shall be duly approved by competent authority. The year wise funds earmarked for environmental protection measures shall be kept in separate account and not to be diverted for any other purpose. Year wise progress of implementation of action plan shall be reported to the SEIAA, PPCC and Regional Office of MoEFCC along with the Six-Monthly Compliance Report.	Agreed to comply. The EMP budget plan is attached as **Annexure -24.**
4.	Self-environmental audit shall be conducted annually. Every three years third party environmental audit shall be carried out.	Agreed to comply.

X. Miscellaneous

S.No	Conditions	Status of Compliance
i.	The project proponent shall make public the environmental clearance granted for their project along with the environmental conditions and safeguards at their cost by prominently advertising it at least in two local newspapers of the District, of which one shall be in the vernacular language within seven days and in addition this shall also be displayed in the project proponent's website permanently.	Condition complied. The Newspaper advertisement was published in both English and local vernacular language. The newspaper advertisement copy is attached as **Annexure-25**.
ii.	The copies of the environmental clearance shall be submitted by the project proponents to the Heads of local bodies, Panchayats and Municipal Bodies in addition to the relevant offices of the Government (Industries Department and PPCC) who in turn has to display the same for 30 days from the date of receipt.	Condition complied. The copy of same is attached as **Annexure- 26.**
iii.	No further expansion or modifications in the plant shall be carried out without prior Environmental Clearance from SEIAA / MoEFCC, as applicable. In case of any deviation or alterations in the project proposal from those submitted to the SEIAA for clearance, a fresh reference shall be made to the SEIAA / MoEFCC, as applicable, to assess the adequacy of the conditions imposed and to add additional environmental protection measures required, if any.	Condition accepted and noted. There is no expansion or modification in the project.
iv.	The project proponent shall upload the status of compliance of the stipulated environment clearance conditions, including results of monitored data on their website and update the same on half-yearly basis.	Condition being complied. The compliance report with monitored data has been uploaded in the company website on half – yearly basis. The screenshot of the same is attached as **Annexure – 33.**
v.	The project proponent shall monitor the criteria pollutants level viz., PM10, SO2, NOx (ambient levels as well as stack emissions) or critical sectoral parameters, indicated for the projects and display the same at a convenient location for disclosure to the public and put on the website of the company.	Condition accepted and noted. The ambient air quality monitoring report is attached as **Annexure –5.** The display board photograph is attached as **Annexure –27.**

S.No	Conditions	Status of Compliance
vi.	The project proponent shall submit six-monthly compliance report on the status of the compliance of the stipulated environmental conditions including results of monitored data in hard and soft copies on 1st June and 1st December of each calendar year in respect of the conditions stipulated in the Environmental Clearance issued to SEIAA, PPCC and Regional Office of CPCB and MoEFCC.	Condition being complied The six monthly compliance report along with monitoring data is being submitted to the PPCC, MoEF and CPCB. The acknowledgement copy of the same is attached as **Annexure -34.**
vii.	The project proponent shall submit six-monthly reports on the status of the compliance of the stipulated environmental conditions on the website of the Ministry of Environment, Forest and Climate Change at environment clearance portal.	Condition being complied.
viii.	The project proponent shall submit the Environmental Statement for each financial year in Form-V to the Puducherry Pollution Control Committee as prescribed under the Environment (Protection) Rules, 1986, as amended subsequently and put on the website of the company.	Condition being complied. The Form -V submission acknowledgement copy is attached as **Annexure – 28.**
ix.	The project proponent shall inform the Regional Office as well as the Ministry, the date of financial closure and final approval of the project by the concerned authorities and start of production operation by the project.	Condition accepted and noted
x.	The project authorities must strictly adhere to the stipulations made by the Puducherry Pollution Control Committee and the U.T. Government.	Condition noted.
xi.	Concealing factual data or submission of false/fabricated data may result in revocation of this environmental clearance and attract action under the provisions of Environment (Protection) Act, 1986.	Condition agreed to comply.
xii.	The SEIAA may revoke or suspend the clearance, if implementation of any of the above conditions is not satisfactory.	Condition agreed.
xiii.	The SEIAA reserves the right to stipulate additional conditions if found necessary. The Company in a time bound manner shall	Condition accepted and noted.

S.No	Conditions	Status of Compliance
	implement these conditions.	
xiv.	The Puducherry Pollution Control Committee and Regional Office of MoEFCC shall monitor compliance of the stipulated conditions. The project authorities should extend full cooperation to the Officer (s) of the PPCC / Regional Office of MoEFCC by furnishing the requisite data / information / monitoring reports whenever requested.	Condition agreed. Full co –operation will be given to the officers during inspection.
xv.	The above conditions shall be enforced, inter-alia under the provisions of the Water (Prevention & Control of Pollution) Act, 1974, the Air (Prevention & Control of Pollution) Act, 1981, the Environment (Protection) Act, 1986, Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 and the Public Liability Insurance Act, 1991 along with their amendments and Rules and any other orders passed by the Hon'ble Supreme Court of India / High Courts and any other Court of Law relating to the subject matter.	Condition accepted and noted.
xvi.	Any appeal against this EC shall lie with the National Green Tribunal, if preferred, within a period of 30 days as prescribed under Section 16 of the National Green Tribunal Act,2010	Condition agreed.

XI. VALIDITY:

S.No	Conditions	Status of Compliance
1.	The validity of this Environmental Clearance is for Ten years from the date of issue of EC.	Condition accepted and noted.

5.0 ENVIRONMENTAL MONITORING DETAILS

It is mandatory to submit six-monthly compliance report to MoEF Regional Office by the proponent. For submitting six-month compliance, Environmental monitoring was carried out at site during the period of October 2022 – March 2023.

5.1 Ambient air quality monitoring

The ambient air quality parameters such as Particulate matter <10µ (PM10), Particulate matter <2.5 µ (PM 2.5), Sulphur dioxide, Oxides of Nitrogen (NO_x) and Carbon monoxide were monitored. The test report of ambient air quality recorded for the Period of October 2022 – March 2023 is enclosed in **Annexure -5**.

5.2 Ambient Noise level monitoring

Noise level is being monitored and the test report of ambient noise recorded during the Period of October 2022 – March 2023 is enclosed in **Annexure -5.**

5.3 Ground water quality monitoring

Ground water was tested for various water quality parameters during the period of October 2022 - March - 2023.The test report of bore well water collected and analyzed is enclosed as **Annexure- 5.**

5.4 Stack Emission monitoring

The existing Boiler and DG stack emission quality parameters such as Particulate matter, Sulphur dioxide, Oxides of Nitrogen (NOx), Acid mist and Flue gas temperature were monitored. The test report of stack emission quality recorded during the period of October 2022 – March 2023 is enclosed in **Annexure -5.**

6.0 CONCLUSION

1. The environmental monitoring was carried out at site during the period October 2022 – March 2023 for the EC obtained vide F. No.247066/SEIAA/PY/EE/2022 dated: 27.04.2022

2. All the conditions stipulated in Environmental clearance will be implemented.

For

M/s Solara Active Pharma Science Limited

Solara Active Pharma Sciences Limited
Puducherry
605 014
Periyakalapet

Authorized Signatory

ANNEXURE

Annexure - 1

ENVIRONMENTAL CLEARANCE

PARIVESH

(Pro-Active and Responsive Facilitation by Interactive, and Virtuous Environmental Single-Window Hub)

Government of India
Ministry of Environment, Forest and Climate Change
(Issued by the State Environment Impact Assessment Authority(SEIAA), Puducherry)

To,

The VP
MS. SOLARA ACTIVE PHARMA SCIENCES LIMITED
Mathur Road, Periakalapet Puducherry -605014

Subject: Grant of Environmental Clearance (EC) to the proposed Project Activity under the provision of EIA Notification 2006-regarding

Sir/Madam,

This is in reference to your application for Environmental Clearance (EC) in respect of project submitted to the SEIAA vide proposal number SIA/PY/IND3/247066/2021 dated 29 Dec 2021. The particulars of the environmental clearance granted to the project are as below.

1.	**EC Identification No.**	**EC22B058PY151130**
2.	**File No.**	247066/SEIAA/PY/EE/2022
3.	**Project Type**	New
4.	**Category**	B2
5.	**Project/Activity including Schedule No.**	5(f)-API
6.	**Name of Project**	Proposed Change In Product Mix Without Increase In Total Production Capacity (4812 TPA)
7.	**Name of Company/Organization**	MS. SOLARA ACTIVE PHARMA SCIENCES LIMITED
8.	**Location of Project**	Puducherry
9.	**TOR Date**	N/A

The project details along with terms and conditions are appended herewith from page no 2 onwards.

Date: 27/04/2022

(e-signed)
Smt. SMITHA. R, I.A.S
Member Secretary
SEIAA - (Puducherry)

Note: A valid environmental clearance shall be one that has EC identification number & E-Sign generated from PARIVESH.Please quote identification number in all future correspondence.

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GOVERNMENT OF PUDUCHERRY
DEPARTMENT OF SCIENCE, TECHNOLOGY AND ENVIRONMENT
STATE LEVEL ENVIRONMENT IMPACT ASSESSMENT AUTHORITY
3rd FLOOR, PHB BUILDING, ANNA NAGAR, PUDUCHERRY – 605 005.
Telephone: (0413) 2201256 TeleFax: (0413) 2203494.
Email: seiaapuducherry@gmail.com

……………………………………………………………………………………………………

Director (DSTE) /
Member Secretary (SEIAA)

No. SEIAA/PY/EE/247066/2021

Sir,

Sub: DSTE/SEIAA, U.T of Puducherry Proposal for Environmental Clearance submitted by M/s. Solara Active Pharma Sciences Limited, Puducherry for proposed change in Product Mix without increase in Total Production Capacity (4812 TPA) – Issued.

Ref: (i) Your Online Application No. SIA/PY/IND3/247066/2021 dated 29.12.2021 in Parivesh Portal.
(ii) Minutes of the 29th SEAC Meeting held on 15.03.2022 and 16.03.2022.
(iii) Minutes of the 24th SEIAA Meeting held on 20.04.2022.

* * *

This has reference to your application cited (i) above submitted to the State level Environment Impact Assessment Authority (SEIAA), Government of Puducherry seeking Environmental Clearance under the Environment Impact Assessment Notification, 2006 and its subsequent amendments. The proposal has been appraised by the State Level Expert Appraisal Committee (SEAC) in its 29th SEAC Meeting held on 15.03.2022 and 16.03.2022 as per the prescribed procedure in the light of provisions under the EIA Notification, 2006 on the basis of the mandatory documents enclosed with the application *viz.,* Form-I, Form-IA, Conceptual Plans and the additional clarifications furnished by the proponent.

It is noted that the project proposal involves proposed change in Product Mix without increase in total production capacity (4812 TPA). Project details are as under:

<table>
<tr><td>Name of the Project</td><td>Change in product mix without increase in total production capacity (4812 TPA) by M/s. Solara Active Pharma Sciences Limited, Puducherry.</td></tr>
<tr><td>Project Location</td><td>R.S. Nos. 30/4pt, 32/1A, 32/2, 32/3, 33/1, 33/10, 33/11, 33/13, 33/2, 33/3, 33/4, 33/5, 33/6, 33/9, 34/1, 34/2, 34/3, 34/4, 34/5, 34/6, 34/7, 34/8, 35/4, 35/5, 35/6, 35/7, 36/5, Periyakalapet, Mathur Road, Puducherry.</td></tr>
<tr><td>Project Description – Product & Capacity</td><td>
<table>
<tr><th>Product Name</th><th>Existing Quantity</th><th>Proposed Quantity</th><th>Total after change in product mix</th></tr>
<tr><td>Ibuprofen</td><td>4308</td><td>-312</td><td>3996</td></tr>
<tr><td>Ibuprofen DC</td><td>240</td><td>0</td><td>240</td></tr>
<tr><td>Ibuprofen Lysinate</td><td>120</td><td>0</td><td>120</td></tr>
<tr><td>Ibuprofen Sodium</td><td>20</td><td>0</td><td>20</td></tr>
<tr><td>S+ Ibuprofen</td><td>100</td><td>0</td><td>100</td></tr>
<tr><td>Pilot Scale R&D Operations</td><td>12</td><td>0</td><td>12</td></tr>
<tr><td>Carisoprodol</td><td>12</td><td>-12</td><td>0</td></tr>
<tr><td>Ammonium lactate</td><td>0</td><td>120</td><td>120</td></tr>
<tr><td>Celecoxib</td><td>0</td><td>144</td><td>144</td></tr>
<tr><td>Rebamipide</td><td>0</td><td>60</td><td>60</td></tr>
<tr><td>Total (TPA)</td><td>4812</td><td>0</td><td>4812</td></tr>
</table>
</td></tr>
<tr><td>Total land area</td><td>24.30 Acres (98338.93 Sq.m.)</td></tr>
<tr><td>Green belt area</td><td>8.42 Acres (34.65%)</td></tr>
<tr><td>Manpower</td><td>789 (Existing - 789 & Proposed - Nil)</td></tr>
<tr><td>Power requirement</td><td>3860 KVA (Existing - 3860 & Proposed - Nil)</td></tr>
<tr><td>Source of power</td><td>Puducherry Electricity Department</td></tr>
<tr><td>Power backup</td><td>Existing - 2 x 1500 and 2 x 1010 KVA DG Sets
Proposed - Nil</td></tr>
<tr><td>Water Source</td><td>Bore well and Treated Sewage water from PWD STP.</td></tr>
</table>

Water requirement

Total Water Requirement:

S. No.	Description	Existing	Proposed	After Change in product mix
1	Freshwater requirement (A)	110	No Change	110
2	Recycled water (B)	652	No Change	652
3	Treated sewage from PWD (C)*	566	No Change	566
Total (A+B)		**762**	**-**	**762**

*Note: Recycled water includes treated sewage water consumed from PWD STP: Approved treated sewage quantity by PWD is 590 KLD as per Water Consent.

Water Requirement Break-up:

Water requirement	Existing (KLD)	Proposed (KLD)	After change in product mix (KLD)	Total Break-up	
				Fresh water	Treated Water
Process	80	Nil	80	80	-
Non-Process (DM Plant)	16	Nil	16	16	-
Process cooling tower	323	Nil	323	-	323
Cooling tower (ZLD)	150	Nil	150	-	150
Boiler Feed	154	Nil	154	-	154
Domestic	29	Nil	29	4	25
Green belt	10	Nil	10	10	-
Total	**762**	Nil	**762**	**110**	**652**

Waste Water Generation:

Description	Existing (KLD)	Proposed (KLD)	After Change in product mix (KLD)	Treatment Units	Final Disposal Points
HTDS (from process)	**50**	**No change**	**50**	MEE and ATFD	ZLD facility
Domestic	25	No change	25		

Treated sewage water from PWD	566	No change	566	Biological ETP followed by RO.	Reused for Non process application
Effluent from, Non process, Boiler, coiling tower blowdown	11	No change	11		
Process effluent from Strides pharma sciences Ltd – Formulation division (non-EC category)	43	No change	43		
Total LTDS effluent	**645**	**No change**	**645**		
Total (HTDS + LTDS effluent)	**695**	No change	**695**		

Air Emissions

Details	Air Pollution Source			No. of Stacks			APC Measures
	Existing	**Proposed**	**After change in product mix**	**Existing**	**Proposed**	**After change in product mix**	
Stack Process	IBU	IBU + Celecoxib	IBU + Celecoxib	1	0	1	Existing Wet Scrubber/ Bag Filter
	S-IBU	S-IBU + Reba-Pimide	S-IBU + Reba-Pimide	0	0	0	Bag Filter
	IBU Lysine	IPCA + Ammonium lactate	IPCA + Ammonium lactate	0	0	0	Bag Filter
	IBU Sodium	IBU Lysine	IBU Lysine	0	0	0	Bag Filter
	DC-90	IBU Sodium	IBU Sodium	0	0	0	Bag Filter
	IPCA	DC-90	DC-90	0	0	0	Bag Filter
Stack – Non Process (DG)	2 x 1500 KVA 2 x 1010 KVA	No change	2 x 1500 KVA 2 x 1010 KVA	4	0	4	Chimney 18 m height, AGL

Boiler – Bio Mass Briquette	2 x 16TPH boiler (1 in standby boiler) 1 X 12 Lac Kcal/hr Thermic Fluid Heater 1 X 10 Lac Kcal/hr Thermic Fluid Heater (Standby TFH)	No change	2 x 16TPH boiler (1 in standby boiler) 1 X 12 Lac Kcal/hr Thermic Fluid Heater 1 X 10 Lac Kcal/hr Thermic Fluid Heater (Standby TFH)	2	0	2	Multi cyclone Dust Collector going in for Bag Filter and then to Stack, 30 m AGL
Total No of Stacks				**7**	**0**	**7**	

Solid Waste

Description	Quantity (Kg/day)			Method of Collection	Method of Disposal
	Existing	Proposed	After change in product mix		
Organic	210.3	Nil	210.3	Collection in bins Manual	Existing: Composting and used as manure for gardening. Proposed: Compost in Organic waste convertor & will be used as manure for gardening.
Inorganic	142.02	Nil	142.02	Collection in bins Manual	Authorized recyclers.
Boiler ash (TPD) (from Bio-briquettes boiler)	5	Nil	5	Manual	Distributed to the local villagers for agricultural purposes, transport through trucks with water sprinkling & covered by tarpaulin.

Hazardous Waste

Name of the Hazardous Waste	Existing KLA/TPA	Proposed Quantity KLA/TPA	After Change in product mix Quantity KLA/TPA	Method of Stage / Disposal
Waste Sodium Dichromate Solution	22000	Nil	22000	Dispose to Authorized Vendor.
34.1ETP Sludge	3	Nil	3	Sent to Co-processing in Cement Industries
5.1 Spent Lubricating Oil	4	Nil	4	Dispose to PPCC Authorized Vendor.
5.2 Waste / Residue containing Oil	150	Nil	150	Dispose to PPCC Authorized Vendor.
20.2 Spent Solvent	900	Nil	900	Dispose to PPCC Authorized Vendor.
20.3 Distillation Residue	48	Nil	48	Dispose to PPCC Authorized Vendor.
28.1 Process Residue / Waste	720	Nil	720	Dispose to PPCC Authorized Vendor.
28.2 Spent Catalyst / Spent Carbon	54	Nil	54	Dispose to PPCC Authorized Vendor
28.3 Off Specification Product	1	Nil	1	Dispose to PPCC Authorized Vendor.
28.4 Date Expired / Discarded Off Specification drugs / Medicines	1	Nil	1	Dispose to PPCC Authorized Vendor.
28.5 Spent Organic Solvent	36	Nil	36	Dispose to PPCC Authorized Vendor.
33.2 Sludge from Treatment of Wastewater arising out of cleaning / disposal of Barrels / containers	20	Nil	20	Dispose to PPCC Authorized Vendor.
33.3 Discarded Containers / Barrels / Liners, Contaminated with Hazardous waste Chemicals	250	Nil	250	Dispose to PPCC Authorized Vendor.
35.1 Chemical Sludge from Wastewater treatment	4800	Nil	4800	ATFD salts are collected directly dispose to nearby TSDF sites / Co processor.
34.4 Oil and Grease Skimming Residues	1	Nil	1	Dispose to PPCC Authorized Vendor.
35.2 Spent Catalyst	1	Nil	1	
35.3 Spent Carbon	90	Nil	90	
Spent Acid	0	Nil	0	
Total	**29079**	**-**	**29079**	

Project Cost	Rs. 211.3307 Crores (existing); No additional project cost for proposed change in product mix.
EMP Cost	Total Capital Cost - Rs. 40 Crores. Recurring Cost / Month - Rs. 1.5 Crores. No additional EMP cost for proposed change in product mix.

The project is covered under 5(f) Synthetic Organic Chemicals Industry in the Schedule to EIA Notification, 2006 and falls under B2 Category (as per amendment dated 27.03.2020, 15.10.2020 & 16.07.2021).

The proposal was appraised by SEAC in the 29th SEAC meeting held on 15 and 16th February 2022 and SEAC has recommended the case for issue of Environmental Clearance stipulating the specific conditions along with standard EC conditions prescribed by MoEFCC for Pharmaceutical / Chemical Industry sector. The proposal was examined by the SEIAA in its 24th Meeting held on 20.04.2022 and the Authority accepted the recommendations of SEAC. Based on the recommendations of SEAC, the SEIAA hereby accords Environmental Clearance to the above project under the provisions of EIA Notification dated 14th September 2006 and subsequent amendments subject to strict compliance of the following Specific and General conditions.

SPECIFIC CONDITIONS

i) This clearance is issued under the provisions of the EIA Notification, 2016. All other statutory clearances as applicable to the project shall be obtained by the project proponent from the concerned competent authority including the Consent to Establish and Operate for change in product mix from the Puducherry Pollution Control Committee (PPCC).

ii) The pollution and control measures with regard to waste water treatment and disposal, air and noise pollution control measures, hazardous waste and solid waste management and all risk mitigation measures shall be strictly implemented as per the Environmental Management Plan submitted by the project proponent and in consonance with existing rules and regulations.

iii) There shall be no additional water requirement or waste water generation from the process.

iv) No additional land shall be used / acquired for any activity of the project without obtaining proper permission.

v) Environment and Safety Audit shall be carried out in different operating zones of the plant at least once in a year and the adequacy of environmental safeguards and plant / occupational safety shall be reviewed and necessary corrective measures shall be taken.

vi) The proponent shall continuously monitor ambient VOC levels around the plant and implement necessary VOC control measures.

vii) Fugitive emissions shall be controlled at 99.98% with effective chillers. VOCs shall be controlled at 99.997% with effective chillers / modern technology. The unit shall ensure Zero Liquid Discharge from the plant.

viii) All the ETP Tanks shall be above the ground level to avoid any ground water contamination. Waste water shall not be stored in underground sumps / tanks.

ix) The project proponent shall carry out regular monitoring of the ground water level and quality in and around the industry by establishing network of monitoring wells. Quarterly monitoring of water quality and water level shall be carried out through NABL accredited laboratory covering all seasons and reports shall be submitted to PPCC.

x) Organic Waste Convertor shall be installed for converting organic waste into manure and the manure shall be used for gardening.

xi) The industry shall carry out energy audit through accredited agencies and take appropriate actions for energy conservation.

xii) The project proponent has allocated 8.42 acres of land (34.65%) for green belt development. This area shall not be diverted for other use. Stratified green belt with tall trees and shrubs beneath should be developed and maintained properly to serve as effective sink for air pollutants.

xiii) A separate Environment Management Cell (having qualified persons with Environmental Science / Engineering / Management specializations) equipped with full-fledged laboratory facilities shall be set up to carry out the Environmental Management and Monitoring functions.

xiv) As per the MoEFCC OM dated 30.09.2020 superseding the OM dated 01.05.2018 regarding the Corporate Environmental Responsibility, the project proponent shall allocate an amount of Rs. 1.58 Crores towards environment conservation and community welfare activities, which shall be utilized over a period of three years. The said amount shall be utilized for activities like infrastructure creation for drinking water supply, sanitation, health, education, skill development, roads, cross drains, electrification including solar power, solid waste management facilities, scientific support and awareness to local farmers to increase yield of crop and fodder, rain water harvesting, soil moisture conservation works, avenue plantation, plantation in community areas, etc. within the project area. The

Project Proponent shall prepare a separate project report on the proposed environment conservation and community welfare activities in consultation with the District Collector and copy of the report shall be submitted to the District Collector, SEIAA, PPCC and Regional Office of MoEFCC. The activities shall be implemented in a time bound manner in consultation with the District Collector. The project progress report shall be submitted to the SEIAA, PPCC and Regional Office of MoEFCC as a part of the half yearly compliance report. The above fund allocated towards environment conservation support activities is to be in addition to the cost envisaged under the CSR budget of the company which will be allocated as per the rules prescribed by the Government of India / Companies Act 2013.

GENERAL CONDITIONS

I. Statutory compliance

i) The project proponent shall obtain Consent to Establish / Operate under the provisions of the Air (Prevention & Control of Pollution) Act, 1981 and the Water (Prevention & Control of Pollution) Act, 1974 from the PPCC before commencement of production of the new products and shall submit copy of the same to SEIAA, Puducherry.

ii) The project proponent shall obtain authorization under the Hazardous and other Waste Management Rules, 2016 as amended from time to time from PPCC.

iii) The Company shall strictly comply with the rules and guidelines under Manufacture, Storage and Import of Hazardous Chemicals (MSIHC) Rules, 1989 as amended time to time. All transportation of Hazardous Chemicals shall be as per the Motor Vehicle Act (MVA), 1989.

II. Air quality monitoring and preservation

i) The project proponent shall install 24x7 continuous emission monitoring system at process stacks to monitor stack emission with respect to standards prescribed in Environment (Protection) Rules, 1986 and the data to be transmitted to PPCC and CPCB online servers. This system shall be calibrated from time to time according to equipment supplier specification through labs recognized under Environment (Protection) Act, 1986 or NABL accredited laboratories.

ii) The project proponent shall monitor fugitive emissions in the plant premises at least once in every quarter through labs recognized under Environment (Protection) Act, 1986.

iii) The project proponent shall install system to carryout Ambient Air Quality Monitoring for common/criterion parameters relevant to the main pollutants released (e.g. PM_{10} and $PM_{2.5}$ in reference to PM emission, and SO_2 and NO_2 in reference to SO_2 and NO_x emissions) within and outside the plant area at least at four locations (one within and three outside the plant area at an angle of 120° each), covering upwind and downwind directions.

iv) To control source and the fugitive emissions, suitable pollution control devices shall be installed to meet the prescribed norms and / or the NAAQS. The gaseous emissions shall be dispersed through stack of adequate height as per CPCB/PPCC guidelines.

v) Storage of raw materials shall be either stored in silos or in covered areas to prevent dust pollution and other fugitive emissions.

vi) The DG sets shall be equipped with suitable pollution control devices and adequate stack height so that the emissions are in conformity with the extant regulations and the guidelines in this regard.

vii) National Emission Standards for Organic Chemicals Manufacturing Industry issued by the Ministry vide G.S.R. 608(E) dated 21st July, 2010 and amended from time to time shall be followed.

viii) The National Ambient Air Quality Emission Standards issued by the Ministry vide G.S.R. No. 826(E) dated 16th November, 2009 and amendment from time to time shall be complied with.

III. Water quality monitoring and preservation

i) The project proponent shall provide online continuous monitoring for treated effluent. The unit shall install web camera with night vision capability and flow meters in the channel/drain/pipelines carrying effluent within the premises.

ii) As already committed by the project proponent, Zero Liquid Discharge shall be ensured and no waste/treated water shall be discharged outside the premises.

iii) The effluent discharge shall conform to the standards prescribed under the Environment (Protection) Rules, 1986 or as specified by the Puducherry Pollution Control Committee while granting Consent under the Air/Water Act, whichever is more stringent.

iv) Total fresh water requirement shall not exceed the proposed quantity or as specified by the Committee. Prior permission shall be obtained from the concerned regulatory authority/CGWA in this regard.

v) Process effluent/any wastewater shall not be allowed to mix with storm water. The storm water from the premises shall be collected and discharged through a separate conveyance system.

vi) The Company shall harvest rainwater from the roof tops of the buildings and storm water drains to recharge the ground water and utilize the same for different industrial operations within the plant.

IV. Noise monitoring and prevention

i) Acoustic enclosure shall be provided to DG set for controlling the noise pollution.

ii) The overall noise levels in and around the plant area shall be kept well within the standards by providing noise control measures including acoustic hoods, silencers, enclosures etc. on all sources of noise generation.

iii) The ambient noise levels should conform to the standards prescribed under Environment (Protection) Rules, 1986 viz., 75 dB(A) during day time and 70 dB(A) during night time.

V. Energy Conservation measures

i) The energy sources for lighting purposes shall preferably be LED based or advanced energy efficient lighting systems.

VI. Waste management

i) Hazardous chemicals shall be stored in tanks, tank farms, drums, carboys etc. Flame arresters shall be provided on tank farm and the solvent transfer through pumps.

ii) Hazardous wastes like waste dichromate solution, ETP Sludge, waste oil, spent solvent, distillation residue, process residue, spent catalyst / carbon, off specification products, date expired / discarded off specification drugs, spent organic solvents, Sludge from Treatment of Wastewater arising out of cleaning / disposal of Barrels / containers, Discarded Containers / Barrels / Liners, Contaminated with Hazardous waste Chemicals, Chemical Sludge from Wastewater treatment, Oil and Grease Skimming Residues and spent acid shall be disposed off to the cement plants for co-processing, reprocessing units or TSDFs after obtaining necessary Hazardous Waste Authorization from PPCC.

iii) The company shall undertake waste minimization measures as below:-

a) Metering and control of quantities of active ingredients to minimize waste.
b) Reuse of by-products from the process as raw materials or as raw material substitutes in other processes.
c) Use of automated filling to minimize spillage.
d) Use of Close Feed system into batch reactors.
e) Venting equipment through vapour recovery system.
f) Use of high-pressure hoses for equipment cleaning to reduce waste water generation.

VII. Green Belt

The green belt of 5-10 m width shall be developed in more than 33% of the total project area, mainly along the plant periphery, in downward wind direction, and along road sides etc. Selection of plant species shall be as per the CPCB guidelines in consultation with the Forest Department.

VIII. Safety and Human health issues

i) Emergency preparedness plan based on the Hazard Identification and Risk Assessment (HIRA) and Disaster Management Plan shall be implemented.

ii) The unit shall make the arrangement for protection of possible fire hazards during manufacturing process and material handling. Firefighting system shall be as per the norms.

iii) The Project Proponent shall provide Personal Protection Equipment (PPE) as per the norms of Factory Act.

iv) Training shall be imparted to all employees on safety and health aspects of chemicals handling. Pre-employment and routine periodical medical examinations for all employees shall be undertaken on regular basis.

v) Occupational health surveillance of the workers shall be done on a regular basis and records maintained as per the Factories Act.

vi) There shall be adequate space inside the plant premises earmarked for parking of vehicles for raw materials and finished products, and no parking to be allowed outside on public places.

IX. Corporate Environment Responsibility

i) The company shall have a well laid down environmental policy duly approved by the Board of Directors. The environmental policy should prescribe standard operating procedures to have proper checks and balances and to bring into focus any infringements / deviation / violation of the environment / forest / wildlife norms / conditions. The company shall have defined system of reporting infringements / deviation / violation of the environmental / forest / wildlife norms / conditions and / or shareholders / stake holders. The copy of the board resolution in this regard shall be submitted as a part of half yearly compliance report.

ii) A separate Environmental Cell both at the project and company head quarter level, with qualified personnel shall be set up under the control of senior Executive, who will directly report to the head of the organization.

iii) Action plan for implementing EMP and environmental conditions along with responsibility matrix of the company shall be prepared and shall be duly approved by competent authority. The year wise funds earmarked for environmental protection measures shall be kept in separate account and not to be diverted for any other purpose. Year wise progress of implementation of action plan shall be reported to the SEIAA, PPCC and Regional Office of MoEFCC along with the Six-Monthly Compliance Report.

iv) Self-environmental audit shall be conducted annually. Every three years third party environmental audit shall be carried out.

X. Miscellaneous

i) The project proponent shall make public the environmental clearance granted for their project along with the environmental conditions and safeguards at their cost by prominently advertising it at least in two local newspapers of the District, of which one shall be in the vernacular language within seven days and in addition this shall also be displayed in the project proponent's website permanently.

ii) The copies of the environmental clearance shall be submitted by the project proponents to the Heads of local bodies, Panchayats and Municipal Bodies in addition to the relevant offices of the Government (Industries Department and PPCC) who in turn has to display the same for 30 days from the date of receipt.

iii) No further expansion or modifications in the plant shall be carried out without prior Environmental Clearance from SEIAA / MoEFCC, as applicable. In case of any deviation or alterations in the project proposal from those submitted to the SEIAA for clearance, a fresh reference shall be made to the SEIAA / MoEFCC, as applicable, to assess the adequacy of the conditions imposed and to add additional environmental protection measures required, if any.

iv) The project proponent shall upload the status of compliance of the stipulated environment clearance conditions, including results of monitored data on their website and update the same on half-yearly basis.

v) The project proponent shall monitor the criteria pollutants level viz., PM_{10}, SO_2, NO_x (ambient levels as well as stack emissions) or critical sectoral parameters, indicated for the projects and display the same at a convenient location for disclosure to the public and put on the website of the company.

vi) The project proponent shall submit six-monthly compliance report on the status of the compliance of the stipulated environmental conditions including results of monitored data in hard and soft copies on 1st June and 1st December of each calendar year in respect of the conditions stipulated in the Environmental Clearance issued to SEIAA, PPCC and Regional Office of CPCB and MoEFCC.

vii) The project proponent shall submit six-monthly reports on the status of the compliance of the stipulated environmental conditions on the website of the Ministry of Environment, Forest and Climate Change at environment clearance portal.

viii) The project proponent shall submit the Environmental Statement for each financial year in Form-V to the Puducherry Pollution Control Committee as prescribed under the Environment (Protection) Rules, 1986, as amended subsequently and put on the website of the company.

ix) The project proponent shall inform the Regional Office as well as the Ministry, the date of financial closure and final approval of the project by the concerned authorities and start of production operation by the project.

x) The project authorities must strictly adhere to the stipulations made by the Puducherry Pollution Control Committee and the U.T. Government.

xi) Concealing factual data or submission of false/fabricated data may result in revocation of this environmental clearance and attract action under the provisions of Environment (Protection) Act, 1986.

xii) The SEIAA may revoke or suspend the clearance, if implementation of any of the above conditions is not satisfactory.

xiii) The SEIAA reserves the right to stipulate additional conditions if found necessary. The Company in a time bound manner shall implement these conditions.

xiv) The Puducherry Pollution Control Committee and Regional Office of MoEFCC shall monitor compliance of the stipulated conditions. The project authorities should extend full cooperation to the Officer (s) of the PPCC / Regional Office of MoEFCC by furnishing the requisite data / information / monitoring reports whenever requested.

xv) The above conditions shall be enforced, inter-alia under the provisions of the Water (Prevention & Control of Pollution) Act, 1974, the Air (Prevention & Control of Pollution) Act, 1981, the Environment (Protection) Act, 1986, Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 and the Public Liability Insurance Act, 1991 along with their amendments and Rules and any other orders passed by the Hon'ble Supreme Court of India / High Courts and any other Court of Law relating to the subject matter.

xvi) Any appeal against this EC shall lie with the National Green Tribunal, if preferred, within a period of 30 days as prescribed under Section 16 of the National Green Tribunal Act, 2010.

XI. VALIDITY:

The validity of this Environmental Clearance is for **Ten years** from the date of issue of EC.

Copy to:-

1. The Secretary to Government (Environment), Chief Secretariat, Puducherry. 605 001.
2. The Chairman, Central Pollution Control Board, Parivesh Bhavan, CBD-cum-Office Complex, East Arjun Nagar, New Delhi 110032.
3. The Member Secretary, Puducherry Pollution Control Committee, 3rd Floor, PHB Building, Anna Nagar, Puducherry – 605 005.
4. Regional Office, Ministry of Environment & Forest (SZ), Kendriya Sadan, IV floor, E&F wings, 17th Main Road, Koramangala II Block, Bangalore - 560034.
5. Monitoring Cell, IA Division, Ministry of Environment & Forests, Paryavaran Bhavan, CGO Complex, New Delhi – 110 003.
6. Standing Guard File.

* * *

Annexure - 2

SOLARA
Active Pharma Sciences

Communication Address:
Solara Active Pharma Sciences Limited
R.S.No. 33 & 34
Mathur Road, Periyakalapet
Puducherry - 605 014. India
Tel: +91 413 2654100, Fax: +91 413 2655154

To

Date: 03.01.2023

The Member Secretary,
Puducherry Pollution Control Committee,
3 rd. Floor, PHB Building, Anna Nagar,
Pudhucherry-605005.

Dear sir,

Sub: Requesting for Air & Water Consent order – Renewal.

Ref:

1. **Air Consent order No: - 7528/PPCC/CTO(A)/OMK/PDY/JE/2021/1111 valid up to 31.01.2023 dated on 24.09.2021.**
2. **Water Consent order No: - 7528/PPCC/CTO(W)/OMK/PDY/JE/2021/1111A valid up to 31.01.2023 dated on 24.09.2021.**

With reference to the above subject (1) (2)., We would like to inform you that we submitted online application of Air & Water Consent order for renewal on 31.12.2022. Herewith we are enclosing the online application form and Demand/Banker's Draft No. 504194 ICICI BANK (Name of Bank), dated 18.11.2022 for Rs. 78,200 (Rupees seventy-eight Thousand two hundred only) in favour of The Member Secretary PPCC (Puducherry Pollution Control Committee), Puducherry as fees payable under section 25 and 21 of the Act. Kindly issue the renewal of CTO.

Thanking you,

Yours faithfully,

For **Solara Active Pharma Sciences Limited,**

M. Mohan
Chief Operations Officer

DEPARTMENT OF SCIENCE TECHNOLOGY AND ENVIRONMENT
RECEIVED
DATE 4/01/2023

Enclosed: -

- The copy of online application for CTO Renewal.

- The original Demand Draft No: - 504194 dated 18.11.2022.

- The copy of ZLD PFD, Ibuprofen &Ibuprofen derivatives PFD, Water balance, List of Raw materials, Borewell license, Environmental Clearance, Form – V and Form – IV.

SOLARA
Active Pharma Sciences

Communication Address :
Solara Active Pharma Sciences Limited
R.S.No. 33 & 34,
Mathur Road, Periyakalapet
Puducherry - 605 014. India
Tel: +91 413 2654100, Fax: +91 413 2655154

21/06/2022

To

Member Secretary
Pudhucherry Pollution Control Committee,
3 rd Floor, PHB Building,
Anna Nagar, Pudhucherry -605005.

Dear Sir,

Sub: APPLICATION FOR CONSENT TO ESTABLISH / OPERATE / RENEWAL UNDER SECTION 25 OF WATER (PREVENTION & CONTROL OF POLLUTION) ACT 1974 / SECTION 21 OF AIR (PREVENTION & CONTROL OF POLLUTION) ACT, 1981

With reference to the above cited, we would like to inform that we applied online application for Consent To Establish (CTE) on 17.06.2022. we are enclosed the online filed application, necessary documents, and DD for CTE fees amount paid Rs. 71200 in the name of "The Member secretary PPCC" payable at Puducherry.

Kindly review our application and issue the CTE.

For Solara Active Pharma Science limited

M. Mohan
Chief Operations Officer

Enclosure:

1. Copy of online application for consent to establish / operate / renewal of water (prevention & control of pollution) act 1974 / Air (prevention & control of pollution) act, 1981.
2. DD NO: 506342 dated 03.06.2022 Rs.71200/- ICICI Bank
3. Copy of Form – I, Prefeasibility report, Environmental Management Plan, Process description & process Flowchart of Ibuprofen, Process description & process Flowchart of ZLD system, Reactor & storage tank details, Air & water consent condition compliance report, List of raw materials, Hazardous waste disposal vendor details, EC, compliance report, Noise level monitoring reports, AAQ monitoring reports, DG & stack emission reports, Test bore well reports, Ground water analysis reports and Raw materials MSDS.

DEPARTMENT OF SCIENCE TECHNOLOGY AND ENVIRONMENT
RECEIVED
DATE: 21/6/2022

Annexure - 3

ZLD system Photograph

ETP plant Photograph

Ro System Photograph

Scrubber Photograph

Annexure - 3

SOLARA ACTIVE PHARMA SCEINCES LTD

SAFETY AUDIT REPORT

By

GLOBAL SAFETY STUDIES
Safety Training & Consulting

Introduction

SOLARA Active Pharma Sciences, Located in Periayakalapet, Pondicherry PINCODE-605 502.

In order to comply with the provisions of the **Factories Act and Pondicherry Factories Rules,** the organization engaged the services of M/ s Global Safety Studies (safety Training and Consulting Organization) Pondicherry to conduct a comprehensive Occupational Health and Safety Audit as per Guidelines of IS 14489.

The safety audit was conducted on 09.12.2022 by the following team:

AUDIT TEAM

K.Vengatesan B.Tech, MBA, I Dip Nebosh, PGDHSE, Grad IOSH –UK

Balasubramanium, DME, DIS

D.Buvanesh, DPT, MBA, PGDHSE,CPSM

Due considerations were given for the existing safe guards in the plant.

The consultants wish to place on record their sincere thanks to the management and staff of The Solara Pharma for their excellent cooperation and participation in the study.

Date: 12.12.2022 K.VENGATESAN

Executive Summary:

The detailed EHS Evaluation was conducted on with the participation of SOLARA PHARMA

MANAGEMENT and Plant personnel on 09.12.2022. The team kicked off with initial evaluation of Management System and documentation. All activities were evaluated on different places of the plant, office facilities, Occupational Health Centre, material store areas. All the deviations and gapes in the management system were discussed in detail with the representatives and improvement measures were agreed both in management system requirements and implementation at plant. The evaluation was concluded with closeout meeting with SOLARA PHARMA Team and highlighted the issues.

Major Improvements:

1. Safety Policy displayed in different locations of plant.
2. Firefighting training conducted with practical.
3. Segregation of Vehicle and pedestrian marking maintained well.
4. Occupational health Centre facilities checked and found in order & Ambulance van PY 05 B 1990 was checked and found in order.

Major areas for improvement:

Following are some of the major areas for improvement.

1. **Emergency exits are provided with breakable glasses and a hammer to break in case of emergency**. This may not be adequate for a proper rescue or escape. This provision shall be reviewed and replaced the door with easy accessible door.
2. **Any hot work in areas where highly flammable substances are handled shall be avoided and alternate methods thought of**. This was explained in detail during the audit. **BELZONA Epoxy Composites coating can be used to arrest the leakage** in the process equipment during emergency situation to avoid hot work.
3. **Fire blankets with standard quality needs to be procured with test certificates and used for hot work activities**. Separate storage area needs to be allocated for placing the fire blankets and the fire extinguishers.
4. **Competent welder** need to be used for hot work and competent supervisor need to be present during work activity.
5. **Fire watcher/Fire Marshal Roles should be clearly defined and effective training** to be done. Need to provide additional fire watcher based on work activity.
6. **Maintenance activity to be carried out under the supervision of respective department personnel**.

7. **Last minute risk assessment (LMRA)** to be carried out before executing the job.
8. Contractors equipment(**welding machine, gas cutting set, drilling and grinding machines, pneumatic/ electrical hammers, other power tools, hand tools** etc. shall be periodically examined in detail by competent person from company side and certified before use
9. Display of the properties as excerpts from **MSDS is suggested. Particularly, physical and chemical properties, handling and storage(including PPE), firefighting measures, spill handling** measures and first aid measures

Conclusion:

By being evident of general EHS compliance at plant, Management need to take appropriate action to prevent workplace accidents and improve health of employees, Management need to improve safety culture of organizations and concentrate on safety Documentations, Lessons learnt to be developed for all incidents so that accident will be prevented.
We appreciate the efforts of SOLARA MANAGEMENT team for their contribution to this evaluation and their transparent explanation of issues. The evaluation team has reflected outcome of the exercise for further enhancement of current EHS practices at the plant. The details of the each finding were discussed thoroughly and corrective actions were explained to theparticipants.

Safety Audit Goals

Audits are normally designed to achieve one or more of the following goals

1. To provide the auditee with an opportunity to assess its own OS & H system against standards and identify areas for improvement.
2. To determine the conformity of the implemented OS & H systems with specified requirements and identify areas for improvement.
3. To meet regulatory requirements.

Audit Objectives

Occupational Safety and Health (OS & H) audits are conducted

1. To carry out a systematic critical appraisal of all potential hazards involving personnel, plant, services and operational methods.
2. To ensure that OS & H system fully satisfy the legal requirements and those of company's written safety policies, objectives and progress.

Audit Methodology

1. Appraisal of Audit procedures to the concerned executives.
2. Familiarization visit to various sections of the unit.
3. Visit to various sections for in- depth study of hazard potential.
4. Study of the maintenance system of process vessels, machines, pipes, equipments, buildings etc.,
5. Interaction with various levels of employees.
6. Perusal of documents relating to OS & H.
7. Appraisal of major observations to the functional heads who are decision makers to improve SHE system.

Methodology

Following Methodologies were followed to complete Safety Audit and IS 14489 Referred.

Document review

All applicable documents which includes Work permit system, Standard Operating Procedures, MSDS(Material Safety Data sheet),Health monitoring report, Standard operating procedures, Emergency plan, Mock drill report, Safety Committee meetings, Equipment inspections, Accident report , Training records, Firefighting equipment inspection records, Contractor selection procedures,

Consulting with Employees

Interviews were conducted with range of employees which included senior management,HR Managers, Safety Manager and Engineers, Production Manager, Maintenance team, Plant personnel, QC, Fire marshal and workers, the purpose of the interviews was to identify the effectiveness of the existing control measures and safety awareness among the workforce.

Observations/Plant inspection

The purpose of the observations was to physically verify the implementation of safetymeasures and to establish if the workforce level of safety awareness, Inspection of various locations includes

production Vessel No PO 8SSR093 and the surrounding areas inspected, Process line valves, Occupational health Centre facilities, Ambulance, canteen and office areas.

Areas covered under audit

01. Safety policy

02. Organization Setup

03. Safety Education and Training

04. Employees participation in OS & H

05. Safety Manual & Rules

06. Compliance with Statutory Requirements

07. New Equipment Inspection

08. Risk assessment including hazard identification

09. Plant safety inspections

10. Health and safety improvements plans / targets

11. First aid facilities – Occupational Health Centre

12. Personal protective equipment

13. House keeping

14. Machine and general area guarding

15. Electrical and personal safe guarding

16. Ventilation, illumination and noise

17. Work environment monitoring system

18. Occupational Health

19. Safe operating procedures

20. Work permit system

21. Fire prevention, protection and fighting system

22. Emergency preparedness plan

23. Process / plant modification procedures

24. Hazardous waste storage and disposal

25. Safety in storage and warehousing

26. Contractor safety system

27. Utilities

Documents Perused

The following records are pursued during the audit.

01. OS & H Policy.
02. Safety Department's organization chart
03. Contractor selection procedure.
04. Safety promotional & motivational measures.
05. Training records on safety & Fire safety Practical session.
06. Record of Electrical inspections. 07. Accident investigation reports
10. Safe operating procedures.
11. Record of work permits (Hot work permit)
12. Record of Safety Campaigns.
13. Maintenance and testing records of the firefighting Equipment. 15. Occupational Health Centre/First Aid Details
16. Medical records of employees.
17. Records of industrial hygiene surveys.
18. Material safety data sheets
19. On-site emergency plan and record of Mock Drills
20. Communication Systems adopted in the unit

Plant Observations:

1. Vessel No PO 8SSR093 and the surrounding areas inspected.
2. Emergency stop switches were near the vessels
3. Flameproof fittings are ensured and found in order
4. Pipeline color code is displayed as per IS 2379:1990
5. Ambulance van PY 05 B 1990 was checked and found in order
6. Occupational health centre facilities checked and found in order
7. Four emergency internal numbers are available
8. Contractors' selection screening process is in place. Need to check competency of contractor personnel.
9. Document CWI-SASD-022 for hot work permit is available

10. Emergency preparedness and response plan is available
11. Permit to work no 703/ 30-11-2022 reviewed and all columns found filled
12. Fire exits and fire hydrant points were blocked and noticed that Pharma bagged material kept without identification in 1st floor of production unit.
13. Incompetent welder observed need to be replaced.
14. Substandard fire blankets used (Tarpaulin) for hot work.
15. Poor stargaze of fire safety materials observed it lead to contaminations.
16. MSDS of Hexane not displayed in plant. Few employees unaware of Chemical properties.
17. Restricted entry system need to be implemented in critical production unit.
18. Fire extinguisher kept in ground in production unit.

SUMMARY OF RECOMMENDATIONS:

The recommendations have been embedded in the previous section (Observations & Discussions) along with the observations and the discussions. The summary of the important recommendations are once again being presented hear for the sake of convenience. For complete justification, the previous section, "Observations & Discussions" may be referred.

Safety Policy

1. The safety policy available and displayed in entrance and other locations of plant.
2. The safety policy should also Communicated to all employees including contractors. Safety Policy should be communicated to visitors through visitor induction trainings.

Safety & Health Organization

3. Plant safety department is headed by Safety-In-charge having 25 years' experience in the plant. Safety head reports to Factory Manager. Fire services and OHS are under him.
4. Management need to conduct regular safety inspection and management walkthrough.

Safety Committee

5. The safety committee meetings conducted on regular basis, and document maintained. Need to conduct meeting with contractor for improve health and Safety Performance.

Fire Safety:

6. Hot work permit system need to be implemented effectively and all control measures need to be followed and shift change procedures need to be included in permit.
7. Only competent Welder only allowed for hot work in process unit.
8. Appropriate PPE including Fire resistant Suit need to be provided.
9. SMP (Standard Maintenance procedure for hot work) need to be developed and implemented.(NO SOP Available for Process plant welding activity)
10. Standard quality fire blankets need to be purchased (Never use Tarpaulin for Hot work).
11. Continuous air monitoring need to be carried out for hot work in process unit.
12. Competent fire watcher need to be appointed for hot work.
13. Pre use inspection of hot work equipment including welding machine and Tools.
14. Separate storage area needs to be allocated for placing the fire blankets and the fire extinguishers.
15. It should be ensured that effectiveness emergency Plan & Need to conduct fire mock drill. The company should enforce the No smoking policy across its sites to prevent/reduce any fire risks.
16. Fire hydrant system to be monitored.
17. Fire alarm system installed and communicate to all employees.

Chemical Safety

18. MSDS for HEXANE to be posted in the process area
19. Chemical Safety Training to be provided.
20. Personal Hygiene procedures and techniques to be followed.

Housekeeping & Material arrangement.

21. Barricading of the areas where maintenance work is carried out should be done.
22. Segregation of material and proper identification labels to be placed and fire pints shall not be blocked.
23. All the walk ways should be free from obstructions.
24. The floors should be kept free of spillages and slippery materials.

Hazard Identification and Control

25. Tool box talks should be provided for the workforce by the supervisor.
26. Pre task checklist for hot work need to be developed and followed.
27. It should be ensured that all the risk controls will be implemented.

Safe Operating Procedures

28. SOP need to be developed for all the Contractors activities.
29. List of standard operating procedure for all operations should be displayed in the respective areas.
30. It may be ensured that the details of all the SOPs are strictly followed.

Work Permit System

31. Training on Work permit system to be conducted for all work activities.(General work, Hot work, Height work and Confined space entry)
32. Strict actions should be taken when persons are found to breach the permit to work system.
33. Safety department should have a check over the permit to work system to ensure that all the hazards of the hazardous jobs have been well identified.

Personal Protective Equipment

34. Need to provide standard quality PPE to all employees including contractors.
35. It may be ensured that all the workers entering the high speed machines do not wear loose clothing & Long hair.
36. The adequate protective devices should be kept handy whenever the maintenance work is carried out in hazardous areas.
37. Strict vigilance should be kept about the use of PPE by the contractors' workers.
38. PPE matrix need to be followed.

Mobile equipment and vehicular traffic & Material Handling

39. All the vehicles should be provided with reversing horns and visual signals, which should be used by the drivers.
40. Blind spot mirror to be provided to maintain safe vehicle movement.

Machine Guarding & Maintenance

41. Machinery inspection to be carried out and all the safety devices to be installed.

42. Machine guard provided to all moving machinery & Machine guards of all the pumps should be checked regularly.
43. Maintenance for the Equipment's in (AMC) should be actively monitored by the in-house staffs.
44. Behavior based safety training program to be conducted for developing the safety culture.
45. Contractor equipment's to be thoroughly inspected and labelled by competent person.

Building & Design

46. Stability certificate to be carried out by competent person. Suggested to review periodically as there are buildings with concrete sealing are damaged.
47. Fire exit door and Fire exit stair cases need to be checked for safe access during emergency.

Transportation by Road

48. The management should ensure that the all requirements of Central Motor Vehicle Rules are met with before loading or unloading the materials. & High level of dust observed in site, it should be controlled.
49. Need to Conduct Health monitoring and eye test for driver on regular basis (All lifting vehicles and other vehicles).

Training

50. Provide induction training for all the contactors and visitors.
51. Refresher training should be given for all the employees by considering the skill matrix training record.
52. Behavior based safety training program to be conducted for developing the safety culture.
53. Job specific training should be given for the in-house employees and the contractors.
54. Contractor workers competency should be verified by the concerned department heads.
55. Hazardous area classification awareness to be given.

SAFETY DOCUMENTATION

The following Documents to be maintained and Updated Regular basis.

1. **Plant organization chart (Workplace Safety & Health)**
2. **Workplace Safety & Health policy statement**
3. **Management System Manual (Safety Manual)**
4. **Duties & responsibilities / job descriptions**
5. **Risk Assessment Records**
6. **Record of Safe Work Procedure**
7. **List of main and subcontractors' details & qualified personnel with certificate**
8. **Records/Evidence of safety training 9. Safety committee meetings reports.**
10. **Accident investigation reports / records**
11. **Permit-to-work system**
12. **Personal protective equipment issue records**
13. **Safety inspection checklists, registers and other records of inspections carried out.**
14. **Statutory test certificates of site machinery and equipment**
15. **Machinery preventive maintenance records**
16. **Certificate of competency and authorization of machinery operators**
17. **Standard testing Procedures.**
18. **Safety Data Sheet (SDS)**
19. **Emergency Plan & Mock drill reports**
20. **Occupational Health Programmes & records**
21. **Previous Safety Audit Reports and Action Plans**
22. **Medical reports**
23. **Internal and External communication reports**
24. **Employees competency records**
25. **Skill matrix and training matrix**

(All the documents shall be Maintained and updated)

List of documents need to be prepared

ADDITIONAL INFORMATIONS

n-Hexane

dipropyl; Gettysolve-B; hexyl hydride; Skellysolve-B

DANGER! FLAMMABLE! IRRITANT

Emergency Overview:
Colorless, volatile liquid; sweet/gasoline odor. Irritating to eyes/skin/respiratory tract. Also causes: dizziness, fatigue, muscle weakness, hallucinations. Chronic: peripheral neuropathy (muscle weakness, motor loss, sensory disturbances). Flammable.

Precautionary Measures: Avoid exposure to skin. Wear protective clothing: Goggles, Gloves, Apron.

First Aid Procedures: Inhalation: Remove to fresh air and support breathing as needed. Eyes/Skin: Remove contaminated clothing. Flush with plenty of water for at least 15 minutes. Ingestion: Do not induce vomiting! Consult physician.

Fire Procedures: Flammable. Can form explosive mixtures in the air. Use water as fog, dry chemical, carbon dioxide, or foam. Water spray may be ineffective.

Spill Procedures: Notify safety personnel; isolate and ventilate area, deny entry, stay upwind. Shut off heat and ignition sources. Take up with inert material such as sand or vermiculite. Cleanup personnel should protect against exposure.

CAS No. 110-54-3

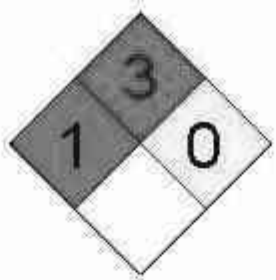
Chemical Information

Hexane (n-hexane)

CAS 110-54-3
UN 1208
GUIDE 128 - Flammable liquids (non-polar / water-immiscible)

Colorless liquid; gasoline-like odor

NFPA Information



Health (Blue): 1 Slightly Hazardous
Fire (Red): 3 Flash Point < 100°F
Instability (Yellow): 0 Stable

n-Hexane

Colorless, volatile liquid; sweet/gasoline odor. Irritating to eyes/skin/respiratory tract. Also causes: dizziness, fatigue, muscle weakness, hallucinations. Chronic: peripheral neuropathy (muscle weakness, motor loss, sensory disturbances). Flammable.

CAS No. 110-54-3

IS 15381: Fire Blanket BS

EN 1869


Approved Personal
Protective Equipment
must be worn


DANGER
NO ENTRY
AUTHORISED
PERSONNEL ONLY


Fire
escape door
keep clear of
obstruction
at all times


FIRE
EXIT

FI

For Global Safety Studies,,

Kumar
HEAD OF INSTITUTION

K.Vengatesan B.Tech, MBA, I Dip Nebosh, DIS, PDRSM, Grad IOSH -UK
Director and Safety Consultant
Global Safety studies
(An ISO 9001-2015 Certified Safety Training and Consulting Organization)
CITY PLAZA, 209/5A, BALAJI NAGAR, NH 45A, VILLIANUR MAIN ROAD, OULGARET, MORE SUPERMART UPSTAIRS, Puducherry, 605010.
Contact: 0413-2913500, +91-9043445500 & +91-8525017060

Annexure - 5

E-mail : test@mettexlab.com
Web : www.mettexlab.com

Phone : 044-22323163, 22311024
42179490, 42179491

CHENNAI METTEX LAB PRIVATE LIMITED®

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.

TC-5589

TEST REPORT

ISSUED TO : M/s. Solara Active Pharma Sciences Ltd,
Periyakalapet,
Puducherry – 605014.

T.C Date : 09.11.2022

T.C No : CML/22-23/52086

Party's Ref : SRF Date:30.10.2022

Date of Receipt: 30.10.2022

Lab No : 2357070

Test Completed on: 07.11.2022

Sample Description: AAQ Monitoring – Location: Near ETP Area
(as stated by customer)

Date of Sampling: 29.10.2022– 10.30 am to 30.10.2022– 10.30 am

Ambient Temperature: Min. 26 °C & Max. 32 °C

Relative Humidity: Min. 62 % & Max. 93 %

Discipline / Group: Chemical / Atmospheric Pollution

S.No.	Test Parameters	Protocol	Results	CPCB Standards	Unit
01.	Sulphur dioxide as SO_2	IS: 5182 Part 2:2001 (Reaff.2017)	13.7	80	µg/m³
02.	Nitrogen Dioxide as NO_2	IS: 5182 Part 6:2006 (Reaff.2017)	15.1	80	µg/m³
03.	Particulate Matter (PM_{10}) (Size Less than 10 µm)	IS: 5182 Part 23:2006 (Reaff.2017)	65.8	100	µg/m³
04.	Particulate Matter ($PM_{2.5}$) (Size Less than 2.5 µm)	CML/AIR/SOP/22	30.4	60	µg/m³
05.	Ozone as O_3	IS: 5182 Part IX:1974 (Reaff.2019)	25.8	180	µg/m³
06.	Lead as Pb	USEPA Compendium Method IO-3.4;1999	BDL(DL:0.1)	1.0	µg/m³
07.	Carbon Monoxide as CO	IS: 5182 Part 10:1999 (Reaff.2019)	BDL(DL:1.0)	4.0	mg/m³
08.	Ammonia as NH_3	CML/AIR/SOP/07	29.1	400	µg/m³
09.	Benzene	IS: 5182 Part 11:2006 (Reaff.2017)	BDL (DL:1.0)	5.0	µg/m³
10.	Benzo (α) Pyrene	IS: 5182 Part 12:2004 (Reaff.2019)	BDL (DL:0.1)	1.0	ng/m³
11.	Arsenic as As	USEPA Compendium Method IO-3.4;1999	BDL (DL:1.0)	6.0	ng/m³
12.	Nickel as Ni		BDL (DL:1.0)	20	ng/m³

Instrument No: CML/ENV/RDS- 03, CML/ENV/FDS- 02; BDL: Below Detection Limit. DL: Detection Limit.

End of Report

For Chennai Mettex Lab Private Limited,

Reviewed & Authorized By

P. KAVITHA
Technical

E-mail : test@mettexlab.com
Web : www.mettexlab.com

Phone : 044-22323163, 22311034
42179490, 42179491

CHENNAI METTEX LAB PRIVATE LIMITED®

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.

TC-5589

TEST REPORT

ISSUED TO : M/s. Solara Active Pharma Sciences Ltd,
Periyakalapet,
Puducherry – 605 014.

T.C Date : 09.11.2022

T.C No : CML/22-23/52087

Party's Ref : SRF Date: 30.10.2022

Date of Receipt: 30.10.2022

Lab No : 2357071

Test Completed on: 07.11.2022

Sample Description: AAQ Monitoring – Location: In-front of IPU Plant Area
(as stated by customer)

Date of Sampling: 29.10.2022– 10.45 am to 30.10.2022– 10.45 am

Ambient Temperature: Min. 26 °C & Max. 32 °C

Relative Humidity: Min. 62 % & Max. 93 %

Discipline / Group: Chemical / Atmospheric Pollution

S.No.	Test Parameters	Protocol	Results	CPCB Standards	Unit
01.	Sulphur dioxide as SO_2	IS: 5182 Part 2:2001 (Reaff.2017)	13.1	80	µg/m³
02.	Nitrogen Dioxide as NO_2	IS: 5182 Part 6:2006 (Reaff.2017)	14.9	80	µg/m³
03.	Particulate Matter (PM_{10}) (Size Less than 10 µm)	IS: 5182 Part 23:2006 (Reaff.2017)	61.7	100	µg/m³
04.	Particulate Matter ($PM_{2.5}$) (Size Less than 2.5 µm)	CML/AIR/SOP/22	24.3	60	µg/m³
05.	Ozone as O_3	IS: 5182 Part IX:1974 (Reaff.2019)	22.6	180	µg/m³
06.	Lead as Pb	USEPA Compendium Method IO-3.4;1999	BDL(DL:0.1)	1.0	µg/m³
07.	Carbon Monoxide as CO	IS: 5182 Part 10:1999 (Reaff.2019)	BDL(DL:1.0)	4.0	mg/m³
08.	Ammonia as NH_3	CML/AIR/SOP/07	28.5	400	µg/m³
09.	Benzene	IS: 5182 Part 11:2006 (Reaff.2017)	BDL (D:1.0)	5.0	µg/m³
10.	Benzo (α) Pyrene	IS: 5182 Part 12:2004 (Reaff.2019)	BDL (DL:0.1)	1.0	ng/m³
11.	Arsenic as As	USEPA Compendium Method IO-3.4;1999	BDL (DL:1.0)	6.0	ng/m³
12.	Nickel as Ni		BDL (DL:1.0)	20	ng/m³

Instrument No: CML/ENV/RDS- 25, CML/ENV/FDS- 06; BDL: Below Detection Limit. DL: Detection Limit.

End of Report

For Chennai Mettex Lab Private Limited,

Reviewed & Authorized By

P. KAVITHA
Technical Manager
Authorised Signatory

E-mail : test@mettexlab.com
Web : www.mettexlab.com

Phone : 044-22323163, 22311034
42179490, 42179491

CHENNAI METTEX LAB PRIVATE LIMITED®

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.

TC-5589

TEST REPORT

ISSUED TO : M/s. Solara Active Pharma Sciences Ltd,
Periyakalapet,
Puducherry – 605 014.

T.C Date : 09.11.2022

T.C No : CML/22-23/52088

Party's Ref : SRF Date:30.10.2022

Date of Receipt: 30.10.2022

Lab No : 2357072

Test Completed on: 07.11.2022

Sample Description: AAQ Monitoring – Location: Near Aldehyde Plant
(as stated by customer)

Date of Sampling: 29.10.2022– 11.00 am to 30.10.2022– 11.00 am

Ambient Temperature: Min. 26 °C & Max. 32 °C **Relative Humidity:** Min. 62 % & Max. 93 %

Discipline / Group: Chemical / Atmospheric Pollution

S.No.	Test Parameters	Protocol	Results	CPCB Standards	Unit
01.	Sulphur dioxide as SO_2	IS: 5182 Part 2:2001 (Reaff.2017)	13.4	80	µg/m³
02.	Nitrogen Dioxide as NO_2	IS: 5182 Part 6:2006 (Reaff.2017)	15.2	80	µg/m³
03.	Particulate Matter (PM_{10}) (Size Less than 10 µm)	IS: 5182 Part 23:2006 (Reaff.2017)	67.1	100	µg/m³
04.	Particulate Matter ($PM_{2.5}$) (Size Less than 2.5 µm)	CML/AIR/SOP/22	28.3	60	µg/m³
05.	Ozone as O_3	IS: 5182 Part IX:1974 (Reaff.2019)	23.5	180	µg/m³
06.	Lead as Pb	USEPA Compendium Method IO-3.4;1999	BDL(DL:0.1)	1.0	µg/m³
07.	Carbon Monoxide as CO	IS: 5182 Part 10:1999 (Reaff.2019)	BDL (DL:1.0)	4.0	mg/m³
08.	Ammonia as NH_3	CML/AIR/SOP/07	26.8	400	µg/m³
09.	Benzene	IS: 5182 Part 11:2006 (Reaff.2017)	BDL (DL:1.0)	5.0	µg/m³
10.	Benzo (α) Pyrene	IS: 5182 Part 12:2004 (Reaff.2019)	BDL (DL:0.1)	1.0	ng/m³
11.	Arsenic as As	USEPA Compendium Method IO-3.4;1999	BDL (DL:1.0)	6.0	ng/m³
12.	Nickel as Ni		BDL (DL:1.0)	20	ng/m³

Instrument No: CML/ENV/RDS- 15, CML/ENV/FDS- 04; BDL: Below Detection Limit. DL: Detection Limit.

End of Report

For Chennai Mettex Lab Private Limited,

Reviewed & Authorized By

P. KAVITHA
Technical Manager
Authorised Signatory

E-mail : test@mettexlab.com
Web : www.mettexlab.com

Phone : 044-22323163, 22311034
42179490, 42179491

CHENNAI METTEX LAB PRIVATE LIMITED®

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.

TC-5589

TEST REPORT

ISSUED TO : M/s. Solara Active Pharma Sciences Ltd,
Periyakalapet,
Puducherry – 605 014.

T.C Date : 09.11.2022

T.C No : CML/22-23/52089

Party's Ref : SRF Date: 30.10.2022

Date of Receipt: 30.10.2022

Lab No : 2357073

Test Completed on: 07.11.2022

Sample Description: Stack Emission – Boiler- 16 Ton (Load- 8500 kg/h)
(as stated by customer)

Date of Sampling: 29.10.2022

Sampling Plan & Procedure: CML/STACK/SOP/08 **Discipline / Group:** Chemical / Atmospheric Pollution

Sl. No.	Stack Details	
01	Diameter	1.5 m
02	Temperature	138 °C
03	Velocity	6.8 m/sec
04	Volume of Gas Discharged	31252 Nm^3/hr

Sl. No.	Test Parameters	Test Method	Results	Unit
01	Particulate Matter	IS 11255 Part 1-1985 (RA:2019)	128.1	mg/Nm^3
02	Sulphur-di-oxide (SO_2)	USEPA Method - 6C - 1996	29	mg/Nm^3
03	Oxides of Nitrogen (NOx)	USEPA Method - 7E -1990	115	mg/Nm^3
05	Carbon Monoxide as CO	USEPA Method - 10 - 1996	143	mg/Nm^3
06	Carbon dioxide as CO_2	USEPA Method - 3A - 1989	6.9	%
07	Oxygen as O_2	USEPA Method - 3A - 1989	13.6	%

Note: Instrument ID.No: CML/ENV/SMK/07
As per CPCB Norms Concentration of Particulate matter Standards are

Steam generation capacity (ton/hour)	Maximum Limits (mg/Nm^3)
less than 2	1200
2 to less than 10	800
10 to less than 15	600
15 and above	150

End of Report

For Chennai Mettex Lab Private Limited,

Reviewed & Authorized By
P. KAVITHA
Technical Manager
Authorised Signatory

E-mail : test@mettexlab.com
Web : www.mettexlab.com

Phone : 044-22323163, 22311034
42179490, 42179491

CHENNAI METTEX LAB PRIVATE LIMITED®

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.

TC-5589

TEST REPORT

ISSUED TO : M/s. Solara Active Pharma Sciences Ltd,
Periyakalapet,
Puducherry – 605 014.

T.C Date : 09.11.2022

T.C No :CML/22-23/52090

Party's Ref : SRF Date: 30.10.2022

Date of Receipt:30.10.2022

Lab No : 2357074

Test Completed on: 07.11.2022

Sample Description: Stack Emission – D.G- 1010 KVA Caterpillar
(as stated by customer)

Date of Sampling: 29.10.2022

Sampling Plan & Procedure: CML/STACK/SOP/08 **Discipline / Group:** Chemical / Atmospheric Pollution

Sl. No.	Stack Details		Unit
01	Stack Diameter	25	cm
02	Temperature	327	°C
03	Velocity	28.4	m/sec
04	Volume of Gas Discharged	2494	Nm^3/hr

Sl. No.	Test Parameters	Test Method	Results	CPCB Norms	Unit
01	Particulate Matter	IS 11255 Part 1-1985 (RA:2019)	65.1	75	mg/Nm^3
02	Sulphur-di-oxide (SO_2)	USEPA Method - 6C - 1996	BDL (DL: 3.0)	--	ppmv
03	Oxides of Nitrogen (NOx)	USEPA Method - 7E -1990	331	710	ppmv
04	Non-Methane Hydrocarbon	CML/STACK/SOP/06	87	100	mg/Nm^3
05	Carbon Monoxide as CO	USEPA Method - 10 - 1996	139	150	mg/Nm^3
06	Carbon dioxide as CO_2	USEPA Method - 3A - 1989	7.3	--	%
07	Oxygen as O_2	USEPA Method - 3A - 1989	11.6	--	%

Note: Instrument ID.No: CML/ENV/SMK/07

End of Report

For Chennai Mettex Lab Private Limited,

Reviewed & Authorized By

P. KAVITHA
Technical Manager
Authorised Signatory

E-mail : test@mettexlab.com
Web : www.mettexlab.com

Phone : 044-22323163, 22311034
42179490, 42179491

CHENNAI METTEX LAB PRIVATE LIMITED®

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.

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TEST REPORT

ISSUED TO : M/s. Solara Active Pharma Sciences Ltd,
Periyakalapet,
Puducherry – 605 014.

T.C Date : 09.11.2022

T.C No : CML/22-23/52091

Party's Ref : SRF Date: 30.11.2022

Date of Receipt: 30.10.2022

Lab No : 2357075

Test Completed on: 07.11.2022

Sample Description: Stack Emission – D.G- 1500 KVA Caterpillar
(as stated by customer)

Date of Sampling: 29.10.2022

Sampling Plan & Procedure: CML/STACK/SOP/08 **Discipline / Group:** Chemical / Atmospheric Pollution

Sl. No.	Stack Details	Chimney-1	Chimney-2	Unit
01	Stack Diameter	25	25	cm
02	Temperature	**378**	**378**	°C
03	Velocity	**29.0**	**29.0**	m/sec
04	Volume of Gas Discharged	**2348**	**2348**	Nm^3/hr

Sl. No.	Test Parameters	Test Method	Results	CPCB Norms	Unit
01	Particulate Matter	IS 11255 Part 1-1985 (RA:2019)	68.6	75	mg/Nm^3
02	Sulphur-di-oxide (SO_2)	USEPA Method - 6C - 1996	BDL (DL: 3.0)	--	ppmv
03	Oxides of Nitrogen (NOx)	USEPA Method - 7E -1990	405	710	ppmv
04	Non-Methane Hydrocarbon	CML/STACK/SOP/06	81	100	mg/Nm^3
05	Carbon Monoxide as CO	USEPA Method - 10 - 1996	142	150	mg/Nm^3
06	Carbon dioxide as CO_2	USEPA Method - 3A - 1989	7.9	--	%
07	Oxygen as O_2	USEPA Method - 3A - 1989	10.8	--	%

Note: Instrument ID.No: CML/ENV/SMK/07

End of Report

For Chennai Mettex Lab Private Limited,

Reviewed & Authorized By

P. KAVITHA
Technical Manager
Authorised Signatory

E-mail : test@mettexlab.com
Web : www.mettexlab.com

Phone : 044-22323163, 22311034
42179490, 42179491

CHENNAI METTEX LAB PRIVATE LIMITED®

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.

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TEST REPORT

ISSUED TO : M/s. Solara Active Pharma Sciences Ltd,
Periyakalapet,
Puducherry – 605 014.

T.C Date :09.11.2022

T.C No :CML/22-23/52092

Party's Ref : SRF Date:30.10.2022

Date of Receipt: 30.10.2022

Lab No :2357076

Test Completed on: 07.11.20222

Sample Description: Stack Emission – D.G- 1010 KVA Cummins
(as stated by customer)

Date of Sampling: 29.10.2022

Sampling Plan & Procedure: CML/STACK/SOP/08 **Discipline / Group:** Chemical / Atmospheric Pollution

Sl. No.	Stack Details	Chimney-1	Chimney-2	Unit
01	Stack Diameter	25	25	cm
02	Temperature	286	286	°C
03	Velocity	23.2	23.4	m/sec
04	Volume of Gas Discharged	2188	2202	Nm^3/hr

Sl. No.	Test Parameters	Test Method	Results	CPCB Norms	Unit
01	Particulate Matter	IS 11255 Part 1-1985 (RA:2019)	49.7	75	mg/Nm^3
02	Sulphur-di-oxide (SO_2)	USEPA Method - 6C - 1996	BDL (DL: 3.0)	--	ppmv
03	Oxides of Nitrogen (NOx)	USEPA Method - 7E -1990	320	710	ppmv
04	Non-Methane Hydrocarbon	CML/STACK/SOP/06	59	100	mg/Nm^3
05	Carbon Monoxide as CO	USEPA Method - 10 - 1996	134	150	mg/Nm^3
06	Carbon dioxide as CO_2	USEPA Method - 3A - 1989	7.5	--	%
07	Oxygen as O_2	USEPA Method - 3A - 1989	11.3	--	%

Note: Instrument ID.No: CML/ENV/SMK/07

End of Report

For Chennai Mettex Lab Private Limited,

Reviewed & Authorized By
P. KAVITHA
Technical Manager
Authorised Signatory

E-mail : test@mettexlab.com
Web : www.mettexlab.com

Phone : 044-22323163, 22311034
42179490, 42179491

CHENNAI METTEX LAB PRIVATE LIMITED®

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.

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TEST REPORT

ISSUED TO : M/s. Solara Active Pharma Sciences Ltd,
Periyakalapet,
Puducherry – 605 014.

T.C Date :09.11.2022

T.C No :CML/22-23/52093

Party's Ref :SRF Date :30.10.2022

Date of Receipt:30.10.2022

Lab No :2357077

Test Completed on:07.11.2022

Sample Description: Stack Emission – D.G- 1500 KVA Cummins
(as stated by customer)

Date of Sampling: 29.10.2022

Sampling Plan & Procedure: CML/STACK/SOP/08 **Discipline / Group:** Chemical / Atmospheric Pollution

Sl. No.	Stack Details	Chimney-1	Chimney-2	Unit
01	Stack Diameter	25	25	cm
02	Temperature	356	356	°C
03	Velocity	27.4	26.8	m/sec
04	Volume of Gas Discharged	2293	2244	Nm^3/hr

Sl. No.	Test Parameters	Test Method	Results	CPCB Norms	Unit
01	Particulate Matter	IS 11255 Part 1-1985 (RA:2019)	58.6	75	mg/Nm^3
02	Sulphur-di-oxide (SO_2)	USEPA Method - 6C - 1996	BDL (DL: 3.0)	--	ppmv
03	Oxides of Nitrogen (NOx)	USEPA Method - 7E -1990	358	710	ppmv
04	Non-Methane Hydrocarbon	CML/STACK/SOP/06	64	100	mg/Nm^3
05	Carbon Monoxide as CO	USEPA Method - 10 - 1996	135	150	mg/Nm^3
06	Carbon dioxide as CO_2	USEPA Method - 3A - 1989	8.2	--	%
07	Oxygen as O_2	USEPA Method - 3A - 1989	10.2	--	%

Note: Instrument ID.No: CML/ENV/SMK/07

------------------------ *End of Report* ------------------------

For Chennai Mettex Lab Private Limited,

Reviewed & Authorized By

P. KAVITHA
Technical Manager
Authorised Signatory

E-mail : test@mettexlab.com
Web : www.mettexlab.com

Phone : 044-22323163, 22311034
42179490, 42179491

CHENNAI METTEX LAB PRIVATE LIMITED®

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.

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TEST REPORT

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Periyakalapet,
Puducherry – 605 014.

T.C Date :09.11.2022

T.C No :CML/22-23/52094

Party's Ref : SRF Date :30.10.2022

Date of Receipt: 30.10.2022

Lab No :2357078

Test Completed on: 07.11.2022

Sample Description: Stack Emission – IBU Proffer Dryer Exhaust
(as stated by customer)

Date of Sampling: 29.10.2022

Sampling Plan & Procedure: CML/STACK/SOP/08 **Discipline / Group:** Chemical / Atmospheric Pollution

Sl. No.	Stack Details		Unit
01	Stack Diameter	0.30	cm
02	Temperature	46	°C
03	Velocity	6.5	m/sec
04	Volume of Gas Discharged	1543	Nm^3/hr

Sl. No.	Test Parameters	Test Method	Results	CPCB Norms	Unit
01	Particulate Matter	IS 11255 Part 1-1985 (RA:2019)	26.3	150	mg/Nm^3

Note : Instrument ID.No: CML/ENV/SMK/07

End of Report

For Chennai Mettex Lab Private Limited,

Reviewed & Authorized By

P. KAVITHA
Technical Manager
Authorised Signatory

E-mail:test@mettexlab.com
Web :www.mettexlab.com

Phone : 044-22323163, 22311034
42179490, 42179491

CHENNAI METTEX LAB PRIVATE LIMITED®

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.

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TEST REPORT

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Periyakalapet,
Puducherry – 605 014.

T.C Date : 09.11.2022

T.C No :CML/22-23/52095

Party's Ref : SRF Date :30.10.2022

Date of Receipt: 30.10.2022

Lab No : 2357079

Test Completed on:07.11.2022

Sample Description: Stack Emission – IPCA Plant Exhaust
(as stated by customer

Date of Sampling: 29.10.2022

Sampling Plan & Procedure: CML/STACK/SOP/08 **Discipline / Group:** Chemical / Atmospheric Pollution

Sl. No.	Stack Details		Unit
01	Stack Diameter	0.25	cm
02	Temperature	29	°C
03	Velocity	8.1	m/sec
04	Volume of Gas Discharged	1412	Nm^3/hr

Sl. No.	Test Parameters	Test Method	Results	CPCB Norms	Unit
01	Acid Mist	Titration Method	4.5	35	mg/Nm^3
Note : Instrument ID.No: CML/ENV/SMK/07					

End of Report

For Chennai Mettex Lab Private Limited,

Reviewed & Authorized By

P. KAVITHA
Technical Manager
Authorised Signatory

E-mail : test@mettexlab.com
Web : www.mettexlab.com

Phone : 044-22323163, 22311034
42179490, 42179491

CHENNAI METTEX LAB PRIVATE LIMITED®

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.

TC-5589

TEST REPORT

ISSUED TO : M/s. Solara Active Pharma Sciences Ltd,
Periyakalapet,
Puducherry – 605 014.

T.C Date : 09.11.2022

T.C No : CML/22-23/52096

Party's Ref : SRF Date:30.10.2022

Date of Receipt: 30.10.2022

Lab No : 2357080

Test Completed on: 30.10.2022

Test: Ambient Noise Level Monitoring
(as stated by customer)

Work Commenced on: 29.10.2022

Test Method: IS: 9989 – 1981 (Reaff.2020)

Discipline / Group: Atmospheric Pollution

S. No.	Location	Result in Leq dB(A)	
		Day Time	Night Time
1	Near Main Gate	64.1	53.7
2	Near Boiler Area	62.8	53.8
3	Near Old ETP Area	59.5	52.1
4	Near IPCA Plant	62.5	53.9

Note: As per Ministry of Environment and Forests vide gazette notification dated 14th February 2000 and as amended in January 2010 standards for Day time and Night time Noise level is 65 and 55 dB (A).

Noise Meter Make: LT Lutron; Model: SL- 4035SD; Serial No: Q637005;

End of Report

For Chennai Mettex Lab Private Limited,

Reviewed & Authorized By

P. KAVITHA
Technical Manager
Authorised Signatory

E-mail:test@mettexlab.com
Web :www.mettexlab.com

Phone : 044-22323163, 22311034
42179490, 42179491

CHENNAI METTEX LAB PRIVATE LIMITED®

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.

(Approved/Recognized by APEDA, AGMARK, GAFTA, EIC, FSSAI, BIS & MoEF)

TEST REPORT

ISSUED TO : M/s. Solara Active Pharma Sciences Ltd,
Periyakalapet, Puduchery - 605 014.

T.C Date : 06.10.2022

T.C No : CML/22-23/44071

Date of Receipt : 26.09.2022

Commenced on : 27.09.2022

Completed on : 01.10.2022

Cust. Ref : SRF Dated : 26.09.2022

Lab No : 2348622

Sample Description : Test Bore Well- 1
(as stated by customer)

TEST	PROTOCOL	RESULTS
Discipline: Chemical		**Group : Water**
pH at 25°C	IS: 3025 Part: 11-1983 (Reaff: 2017)	7.19
Conductivity @ 25°C	IS 3025 Part 14:2013 (Reaff: 2019)	1945 µmhos/cm
Colour	IS: 3025 Part: 4 -1983 (Reaff: 2017)	Above 500 Hazen
Silica as SiO_2	IS: 3025 Part: 35 -1988 (Reaff: 2014)	64.3 mg/l
Total Alkalinity as $CaCO_3$	IS 3025 Part 23:1986 (Reaff: 2019)	224.4 mg/l
Chloride as Cl	IS 3025 Part 32:1988 (Reaff:2019)	612.2 mg/l
Residual Free Chlorine	IS: 3025 Part 26-1986 (Reaff: 2019)	BDL(DL : 0.1 mg/l)
Magnesium as Mg	IS: 3025 Part 46:1994 (Reaff: 2019)	24.3 mg/l
Total Dissolved Solids	IS: 3025 Part 16-1984 (Reaff: 2017)	1767 mg/l
Sulphate as SO_4	IS: 3025 Part 24-1986 (Reaff: 2019)	105 mg/l
Fluoride as F	APHA 23rd Edn.2017-4500-F-D	0.12 mg/l
Hexavalent Chromium as Cr^{6+}	IS:3025 Part 52:2003 (Reaff:2019)	BDL (DL:0.03 mg/l)
Sodium as Na	IS: 3025 Part 45:1993 (Reaff: 2019)	399.2 mg/l
Potassium as K	IS: 3025 Part 45:1993 (Reaff: 2019)	42.2 mg/l

...*Contd....2*

P. KAVITHA
Technical Manager

E-mail:test@mettexlab.com
Web :www.mettexlab.com

Phone : 044-22323163, 22311034
42179490, 42179491

CHENNAI METTEX LAB PRIVATE LIMITED®

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.

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Lab No: 2348622 T.C No: CML/22-23/44071 Dated : 06.10.2022

TEST	PROTOCOL	RESULTS
BOD @ 27°C for 3 days	IS:3025 Part 44:1993 (Reaff:2019)	BDL (DL:2.0 mg/l)
Chemical Oxygen Demand	IS:3025 Part 58:2006 (Reaff:2017)	11 mg/l
Calcium as Ca	IS: 3025 Part 40:1991 (Reaff: 2019)	140.2 mg/l
Zinc as Zn	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.05 mg/l)
Total Chromium as Cr	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.02 mg/l)
Copper as Cu	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.02 mg/l)
Cadmium as Cd	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.001 mg/l)
Lead as Pb	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)
Selenium as Se	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)
Total Arsenic as As	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)
Mercury as Hg	USEPA 200.8	BDL (DL:0.0005 mg/l)
Nickel as Ni	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)
Manganese as Mn	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.02 mg/l)
Molybdenum as Mo	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.02 mg/l)
Barium as Ba	IS: 3025 Part 65:2014 (Reaff:2019)	BDL(DL:0.05 mg/l)
Antimony as Sb	IS: 3025 Part 65:2014 (Reaff:2019)	BDL(DL:0.003 mg/l)
Silver as Ag	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)
Hexane	Instrument Used by GCMS - Method	Not Detected
Acetone		Not Detected
Methanol		Not Detected

Note : BDL – Below Detection Limit, DL – Detection Limit, APHA – American Public Health Association.

End of Report

For Chennai Mettex Lab Privat Limited

Reviewed & Authorized By

P. KAVITHA
Technical Manager

E-mail:test@mettexlab.com
Web :www.mettexlab.com
Phone : 044-22323163, 22311034
42179490, 42179491

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Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.

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TEST REPORT

ISSUED TO : M/s. Solara Active Pharma Sciences Ltd,
Periyakalapet, Puduchery - 605 014.

T.C Date : 06.10.2022

T.C No : CML/22-23/44072

Date of Receipt : 26.09.2022

Cust. Ref : SRF Dated : 26.09.2022

Commenced on : 27.09.2022

Lab No : 2348623

Completed on : 01.10.2022

Sample Description (as stated by customer) : **Test Bore Well- 2**

TEST	PROTOCOL	RESULTS
Discipline: Chemical	**Group : Water**	
pH at 25°C	IS: 3025 Part: 11-1983 (Reaff: 2017)	7.21
Conductivity @ 25°C	IS 3025 Part 14:2013 (Reaff: 2019)	2015 µmhos/cm
Colour	IS: 3025 Part: 4 -1983 (Reaff: 2017)	Above 500 Hazen
Silica as SiO_2	IS: 3025 Part: 35 -1988 (Reaff: 2014)	64.9 mg/l
Total Alkalinity as $CaCO_3$	IS 3025 Part 23:1986 (Reaff: 2019)	224.4 mg/l
Chloride as Cl	IS 3025 Part 32:1988 (Reaff:2019)	607.4 mg/l
Residual Free Chlorine	IS: 3025 Part 26-1986 (Reaff. 2019)	BDL(DL : 0.1 mg/l)
Magnesium as Mg	IS: 3025 Part 46:1994 (Reaff: 2019)	24.3 mg/l
Total Dissolved Solids	IS: 3025 Part 16-1984 (Reaff. 2017)	1749 mg/l
Sulphate as SO_4	IS: 3025 Part 24-1986 (Reaff: 2019)	91.5 mg/l
Fluoride as F	APHA 23rd Edn.2017-4500-F-D	0.10 mg/l
Hexavalent Chromium as Cr^{6+}	IS:3025 Part 52:2003 (Reaff:2019)	BDL (DL:0.03 mg/l)
Sodium as Na	IS: 3025 Part 45:1993 (Reaff: 2019)	373.6 mg/l
Potassium as K	IS: 3025 Part 45:1993 (Reaff: 2019)	14.2 mg/l

...**Contd....2**

E-mail:test@mettexlab.com
Web :www.mettexlab.com

Phone : 044-22323163, 22311034
42179490, 42179491

CHENNAI METTEX LAB PRIVATE LIMITED ®

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.

(Approved/Recognized by APEDA, AGMARK, GAFTA, EIC, FSSAI, BIS & MoEF)

Lab No: 2348623 **T.C No: CML/22-23/44072** **Dated : 06.10.2022**

TEST	PROTOCOL	RESULTS
BOD @ 27°C for 3 days	IS:3025 Part 44:1993 (Reaff:2019)	4 mg/l
Chemical Oxygen Demand	IS:3025 Part 58:2006 (Reaff:2017)	22 mg/l
Calcium as Ca	IS: 3025 Part 40:1991 (Reaff: 2019)	120.2 mg/l
Zinc as Zn	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.05 mg/l)
Total Chromium as Cr	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.02 mg/l)
Copper as Cu	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.02 mg/l)
Cadmium as Cd	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.001 mg/l)
Lead as Pb	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)
Selenium as Se	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)
Total Arsenic as As	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)
Mercury as Hg	USEPA 200.8	BDL (DL:0.0005 mg/l)
Nickel as Ni	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)
Manganese as Mn	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.02 mg/l)
Molybdenum as Mo	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.02 mg/l)
Barium as Ba	IS: 3025 Part 65:2014 (Reaff:2019)	BDL(DL:0.05 mg/l)
Antimony as Sb	IS: 3025 Part 65:2014 (Reaff:2019)	BDL(DL:0.003 mg/l)
Silver as Ag	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)
Hexane	Instrument Used by GCMS - Method	Not Detected
Acetone		Not Detected
Methanol		Not Detected

Note : BDL – Below Detection Limit, DL – Detection Limit, APHA – American Public Health Association.

End of Report

For Chennai Mettex Lab Privat Limited

Reviewed & Authorized By
P. KAVITHA
Technical Manager

E-mail:test@mettexlab.com
Web :www.mettexlab.com

Phone : 044-22323163, 22311034
42179490, 42179491

CHENNAI METTEX LAB PRIVATE LIMITED®

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.

(Approved/Recognized by APEDA, AGMARK, GAFTA, EIC, FSSAI, BIS & MoEF)

TEST REPORT

ISSUED TO : M/s. Solara Active Pharma Sciences Ltd,
Periyakalapet, Puduchery - 605 014.

T.C Date : 06.10.2022

T.C No : CML/22-23/44073

Date of Receipt : 26.09.2022

Commenced on : 27.09.2022

Completed on : 01.10.2022

Cust. Ref : SRF Dated : 26.09.2022

Lab No : 2348624

Sample Description : **Test Bore Well- 3**
(as stated by customer)

TEST	PROTOCOL	RESULTS
Discipline: Chemical	**Group : Water**	
pH at 25°C	IS: 3025 Part: 11-1983 (Reaff: 2017)	7.26
Conductivity @ 25°C	IS 3025 Part 14:2013 (Reaff: 2019)	2232 µmhos/cm
Colour	IS: 3025 Part: 4 -1983 (Reaff: 2017)	Above 500 Hazen
Silica as SiO_2	IS: 3025 Part: 35 -1988 (Reaff: 2014)	60 mg/l
Total Alkalinity as $CaCO_3$	IS 3025 Part 23:1986 (Reaff: 2019)	244.8 mg/l
Chloride as Cl	IS 3025 Part 32:1988 (Reaff:2019)	617.1 mg/l
Residual Free Chlorine	IS: 3025 Part 26-1986 (Reaff. 2019)	BDL(DL : 0.1 mg/l)
Magnesium as Mg	IS: 3025 Part 46:1994 (Reaff: 2019)	24.3 mg/l
Total Dissolved Solids	IS: 3025 Part 16-1984 (Reaff. 2017)	1759 mg/l
Sulphate as SO_4	IS: 3025 Part 24-1986 (Reaff. 2019)	98 mg/l
Fluoride as F	APHA 23rd Edn.2017-4500-F-D	0.15 mg/l
Hexavalent Chromium as Cr^{6+}	IS:3025 Part 52:2003 (Reaff:2019)	BDL (DL:0.03 mg/l)
Sodium as Na	IS: 3025 Part 45:1993 (Reaff: 2019)	384.2 mg/l
Potassium as K	IS: 3025 Part 45:1993 (Reaff: 2019)	19.2 mg/l

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E-mail:test@mettexlab.com
Web :www.mettexlab.com

Phone : 044-22323163, 22311034
42179490, 42179491

CHENNAI METTEX LAB PRIVATE LIMITED®

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.

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Lab No: 2348624 **T.C No: CML/22-23/44073** **Dated : 06.10.2022**

TEST	PROTOCOL	RESULTS
BOD @ 27°C for 3 days	IS:3025 Part 44:1993 (Reaff:2019)	BDL (DL:2.0 mg/l)
Chemical Oxygen Demand	IS:3025 Part 58:2006 (Reaff:2017)	11 mg/l
Calcium as Ca	IS: 3025 Part 40:1991 (Reaff: 2019)	140.2 mg/l
Zinc as Zn	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.05 mg/l)
Total Chromium as Cr	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.02 mg/l)
Copper as Cu	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.02 mg/l)
Cadmium as Cd	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.001 mg/l)
Lead as Pb	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)
Selenium as Se	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)
Total Arsenic as As	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)
Mercury as Hg	USEPA 200.8	BDL (DL:0.0005 mg/l)
Nickel as Ni	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)
Manganese as Mn	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.02 mg/l)
Molybdenum as Mo	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.02 mg/l)
Barium as Ba	IS: 3025 Part 65:2014 (Reaff:2019)	BDL(DL:0.05 mg/l)
Antimony as Sb	IS: 3025 Part 65:2014 (Reaff:2019)	BDL(DL:0.003 mg/l)
Silver as Ag	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)
Hexane	Instrument Used by GCMS - Method	Not Detected
Acetone		Not Detected
Methanol		Not Detected

Note : BDL – Below Detection Limit, DL – Detection Limit, APHA – American Public Health Association.

End

For Chennai Mettex Lab Privat Limited

Reviewed & Authorized By

P. KAVITHA
Technical Manager

E-mail:test@mettexlab.com
Web :www.mettexlab.com

Phone : 044-22323163, 22311034
42179490, 42179491

CHENNAI METTEX LAB PRIVATE LIMITED®

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.

(Approved/Recognized by APEDA, AGMARK, GAFTA, EIC, FSSAI, BIS & MoEF)

TEST REPORT

ISSUED TO : M/s. Solara Active Pharma Sciences Ltd,
Periyakalapet, Puduchery - 605 014.

T.C Date : 06.10.2022

T.C No : CML/22-23/44074

Date of Receipt : 26.09.2022

Commenced on : 27.09.2022

Completed on : 01.10.2022

Cust. Ref : SRF Dated : 26.09.2022

Lab No : 2348625

Sample Description : **Test Bore Well- 4**
(as stated by customer)

TEST	PROTOCOL	RESULTS
Discipline: Chemical	**Group : Water**	
pH at 25°C	IS: 3025 Part: 11-1983 (Reaff: 2017)	7.16
Conductivity @ 25°C	IS 3025 Part 14:2013 (Reaff: 2019)	2151 μmhos/cm
Colour	IS: 3025 Part: 4 -1983 (Reaff: 2017)	Above 500 Hazen
Silica as SiO_2	IS: 3025 Part: 35 -1988 (Reaff: 2014)	67 mg/l
Total Alkalinity as $CaCO_3$	IS 3025 Part 23:1986 (Reaff: 2019)	234.6 mg/l
Chloride as Cl	IS 3025 Part 32:1988 (Reaff:2019)	621.9 mg/l
Residual Free Chlorine	IS: 3025 Part 26-1986 (Reaff. 2019)	BDL(DL : 0.1 mg/l)
Magnesium as Mg	IS: 3025 Part 46:1994 (Reaff: 2019)	21.8 mg/l
Total Dissolved Solids	IS: 3025 Part 16-1984 (Reaff. 2017)	1770 mg/l
Sulphate as SO_4	IS: 3025 Part 24-1986 (Reaff: 2019)	101 mg/l
Fluoride as F	APHA 23rd Edn.2017-4500-F-D	0.14 mg/l
Hexavalent Chromium as Cr^{6+}	IS:3025 Part 52:2003 (Reaff:2019)	BDL (DL:0.03 mg/l)
Sodium as Na	IS: 3025 Part 45:1993 (Reaff: 2019)	381 mg/l
Potassium as K	IS: 3025 Part 45:1993 (Reaff: 2019)	22.3 mg/l

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E-mail:test@mettexlab.com
Web :www.mettexlab.com

Phone : 044-22323163, 22311034
42179490, 42179491

CHENNAI METTEX LAB PRIVATE LIMITED®

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.

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Lab No: 2348625 **T.C No: CML/22-23/44074** **Dated : 06.10.2022**

TEST	PROTOCOL	RESULTS
BOD @ 27°C for 3 days	IS:3025 Part 44:1993 (Reaff:2019)	BDL (DL:2.0 mg/l)
Chemical Oxygen Demand	IS:3025 Part 58:2006 (Reaff:2017)	12 mg/l
Calcium as Ca	IS: 3025 Part 40:1991 (Reaff: 2019)	148.2 mg/l
Zinc as Zn	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.05 mg/l)
Total Chromium as Cr	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.02 mg/l)
Copper as Cu	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.02 mg/l)
Cadmium as Cd	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.001 mg/l)
Lead as Pb	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)
Selenium as Se	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)
Total Arsenic as As	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)
Mercury as Hg	USEPA 200.8	BDL (DL:0.0005 mg/l)
Nickel as Ni	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)
Manganese as Mn	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.02 mg/l)
Molybdenum as Mo	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.02 mg/l)
Barium as Ba	IS: 3025 Part 65:2014 (Reaff:2019)	BDL(DL:0.05 mg/l)
Antimony as Sb	IS: 3025 Part 65:2014 (Reaff:2019)	BDL(DL:0.003 mg/l)
Silver as Ag	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)
Hexane	Instrument Used by GCMS - Method	Not Detected
Acetone		Not Detected
Methanol		Not Detected

Note : BDL – Below Detection Limit, DL – Detection Limit, APHA – American Public Health Association.

End of Report

For Chennai Mettex Lab Privat Limited

Reviewed & Authorized By

P. KAVITHA
Technical Manager

E-mail:test@mettexlab.com
Web :www.mettexlab.com

Phone : 044-22323163, 22311034
42179490, 42179491

CHENNAI METTEX LAB PRIVATE LIMITED®

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.

(Approved/Recognized by APEDA, AGMARK, GAFTA, EIC, FSSAI, BIS & MoEF)

TEST REPORT

ISSUED TO : M/s. Solara Active Pharma Sciences Ltd,
Periyakalapet, Puduchery - 605 014.

T.C Date : 06.10.2022

T.C No : CML/22-23/44075

Date of Receipt : 26.09.2022

Commenced on : 27.09.2022

Completed on : 01.10.2022

Cust. Ref : SRF Dated : 26.09.2022

Lab No : 2348626

Sample Description : **Test Bore Well- 5**
(as stated by customer)

TEST	PROTOCOL	RESULTS
Discipline: Chemical	**Group : Water**	
pH at 25°C	IS: 3025 Part: 11-1983 (Reaff: 2017)	7.28
Conductivity @ 25°C	IS 3025 Part 14:2013 (Reaff: 2019)	2036 µmhos/cm
Colour	IS: 3025 Part: 4 -1983 (Reaff: 2017)	Above 500 Hazen
Silica as SiO_2	IS: 3025 Part: 35 -1988 (Reaff: 2014)	68 mg/l
Total Alkalinity as $CaCO_3$	IS 3025 Part 23:1986 (Reaff: 2019)	214.2 mg/l
Chloride as Cl	IS 3025 Part 32:1988 (Reaff:2019)	617.1 mg/l
Residual Free Chlorine	IS: 3025 Part 26-1986 (Reaff. 2019)	BDL(DL : 0.1 mg/l)
Magnesium as Mg	IS: 3025 Part 46:1994 (Reaff: 2019)	31.5 mg/l
Total Dissolved Solids	IS: 3025 Part 16-1984 (Reaff. 2017)	1761 mg/l
Sulphate as SO_4	IS: 3025 Part 24-1986 (Reaff: 2019)	98 mg/l
Fluoride as F	APHA 23rd Edn.2017-4500-F-D	0.15 mg/l
Hexavalent Chromium as Cr^{6+}	IS:3025 Part 52:2003 (Reaff:2019)	BDL (DL:0.03 mg/l)
Sodium as Na	IS: 3025 Part 45:1993 (Reaff: 2019)	382.4 mg/l
Potassium as K	IS: 3025 Part 45:1993 (Reaff: 2019)	31.3 mg/l

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E-mail:test@mettexlab.com
Web :www.mettexlab.com

Phone : 044-22323163, 22311034
42179490, 42179491

CHENNAI METTEX LAB PRIVATE LIMITED®

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.

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Lab No: 2348626 T.C No: CML/22-23/44075 Dated : 06.10.2022

TEST	PROTOCOL	RESULTS
BOD @ 27°C for 3 days	IS:3025 Part 44:1993 (Reaff:2019)	BDL (DL:2.0 mg/l)
Chemical Oxygen Demand	IS:3025 Part 58:2006 (Reaff:2017)	12 mg/l
Calcium as Ca	IS: 3025 Part 40:1991 (Reaff: 2019)	136.2 mg/l
Zinc as Zn	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.05 mg/l)
Total Chromium as Cr	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.02 mg/l)
Copper as Cu	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.02 mg/l)
Cadmium as Cd	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.001 mg/l)
Lead as Pb	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)
Selenium as Se	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)
Total Arsenic as As	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)
Mercury as Hg	USEPA 200.8	BDL (DL:0.0005 mg/l)
Nickel as Ni	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)
Manganese as Mn	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.02 mg/l)
Molybdenum as Mo	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.02 mg/l)
Barium as Ba	IS: 3025 Part 65:2014 (Reaff:2019)	BDL(DL:0.05 mg/l)
Antimony as Sb	IS: 3025 Part 65:2014 (Reaff:2019)	BDL(DL:0.003 mg/l)
Silver as Ag	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)
Hexane	Instrument Used by GCMS - Method	Not Detected
Acetone		Not Detected
Methanol		Not Detected

Note : BDL – Below Detection Limit, DL – Detection Limit, APHA – American Public Health Association.

End of Report

For Chennai Mettex Lab Privat Limited

Reviewed & Authorized By

P. KAVITHA
Technical Manager

E-mail:test@mettexlab.com
Web :www.mettexlab.com

Phone : 044-22323163, 22311034
42179490, 42179491

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Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.

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TEST REPORT

ISSUED TO : M/s. Solara Active Pharma Sciences Ltd,
Periyakalapet, Puduchery - 605 014.

T.C Date : 06.10.2022

T.C No : CML/22-23/44076

Date of Receipt : 26.09.2022

Commenced on : 27.09.2022

Completed on : 01.10.2022

Cust. Ref : SRF Dated : 26.09.2022

Lab No : 2348627

Sample Description : **Test Bore Well- 6**
(as stated by customer)

TEST	PROTOCOL	RESULTS
Discipline: Chemical	**Group : Water**	
pH at 25°C	IS: 3025 Part: 11-1983 (Reaff: 2017)	7.24
Conductivity @ 25°C	IS 3025 Part 14:2013 (Reaff: 2019)	2028 µmhos/cm
Colour	IS: 3025 Part: 4 -1983 (Reaff: 2017)	Above 500 Hazen
Silica as SiO_2	IS: 3025 Part: 35 -1988 (Reaff: 2014)	59 mg/l
Total Alkalinity as $CaCO_3$	IS 3025 Part 23:1986 (Reaff: 2019)	244.8 mg/l
Chloride as Cl	IS 3025 Part 32:1988 (Reaff:2019)	621.9 mg/l
Residual Free Chlorine	IS: 3025 Part 26-1986 (Reaff. 2019)	BDL(DL : 0.1 mg/l)
Magnesium as Mg	IS: 3025 Part 46:1994 (Reaff: 2019)	29.1 mg/l
Total Dissolved Solids	IS: 3025 Part 16-1984 (Reaff. 2017)	1756 mg/l
Sulphate as SO_4	IS: 3025 Part 24-1986 (Reaff: 2019)	108 mg/l
Fluoride as F	APHA 23rd Edn.2017-4500-F-D	0.18 mg/l
Hexavalent Chromium as Cr^{6+}	IS:3025 Part 52:2003 (Reaff:2019)	BDL (DL:0.03 mg/l)
Sodium as Na	IS: 3025 Part 45:1993 (Reaff: 2019)	374.2 mg/l
Potassium as K	IS: 3025 Part 45:1993 (Reaff: 2019)	37.1 mg/l

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E-mail:test@mettexlab.com
Web :www.mettexlab.com
Phone : 044-22323163, 22311034
42179490, 42179491

CHENNAI METTEX LAB PRIVATE LIMITED®

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.

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Lab No: 2348627 **T.C No: CML/22-23/44076** **Dated : 06.10.2022**

TEST	PROTOCOL	RESULTS
BOD @ 27°C for 3 days	IS:3025 Part 44:1993 (Reaff:2019)	3 mg/l
Chemical Oxygen Demand	IS:3025 Part 58:2006 (Reaff:2017)	18 mg/l
Calcium as Ca	IS: 3025 Part 40:1991 (Reaff: 2019)	136.2 mg/l
Zinc as Zn	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.05 mg/l)
Total Chromium as Cr	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.02 mg/l)
Copper as Cu	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.02 mg/l)
Cadmium as Cd	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.001 mg/l)
Lead as Pb	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)
Selenium as Se	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)
Total Arsenic as As	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)
Mercury as Hg	USEPA 200.8	BDL (DL:0.0005 mg/l)
Nickel as Ni	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)
Manganese as Mn	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.02 mg/l)
Molybdenum as Mo	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.02 mg/l)
Barium as Ba	IS: 3025 Part 65:2014 (Reaff:2019)	BDL(DL:0.05 mg/l)
Antimony as Sb	IS: 3025 Part 65:2014 (Reaff:2019)	BDL(DL:0.003 mg/l)
Silver as Ag	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)
Hexane	Instrument Used by GCMS - Method	Not Detected
Acetone		Not Detected
Methanol		Not Detected
Note : BDL – Below Detection Limit, DL – Detection Limit, APHA – American Public Health Association.		

End of Report

For Chennai Mettex Lab Privat Limited

Reviewed & Authorized By

P. KAVITHA
Technical Manager

E-mail:test@mettexlab.com
Web :www.mettexlab.com

Phone : 044-22323163, 22311034
42179490, 42179491

CHENNAI METTEX LAB PRIVATE LIMITED®

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.

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TEST REPORT

ISSUED TO : M/s. Solara Active Pharma Sciences Ltd,
Periyakalapet, Puduchery - 605 014.

T.C Date : 06.10.2022

T.C No : CML/22-23/44331

Cust. Ref : SRF Dated : 26.09.2022

Date Of Receipt : 26.09.2022

Lab No : 2348628

Analysis Commenced On : 27.09.2022

Sample Description : **Soil – SLF - I**
(as stated by customer)

Analysis Completed On : 06.10.2022

S. No	Test Parameters	Protocols	Results
1	pH @ 25°C	IS 2720 Part 26 - 1987 (Reaff:2016)	8.04
2	Conductivity @ 25°C	IS 14767 - 2000 (Reaff : 2016)	254 μmhos/cm
3	Cation Exchange Capacity	USEPA 9080 – 1986	49.22 meq/100g of soil
4	Moisture Content	IS 2720 Part 2 - 1973 (Reaff: 2015)	0.99 %
5	Organic Matter	IS 2720 Part 22-1972 (Reaff:2015)	1.54 %
6	Total Nitrogen as N	IS 14684 : 1999 (Reaff:2019)	2023 mg/l
7	Total Phosphorus as P	IS 10158 : 1982 (Reaff: 2019)	317 mg/kg
8	Potassium as K	USEPA 3050 B – 1996 & USEPA 6010 C - 2000	556 mg/kg
9	Calcium as Ca		6432 mg/kg
10	Magnesium as Mg		1384 mg/kg
11	Cadmium as Cd		BDL(DL: 1.0 mg/kg)
12	Organic Content	IS 2720 Part 22-1987 (Reaff:2020)	0.897 %
Note : BDL – Below Detection Limit, DL – Detection Limit.			

End of Report

For Chennai Mettex Lab Privat Limited

Reviewed & Authorized By

P. KAVITHA
Technical Manager

E-mail:test@mettexlab.com
Web :www.mettexlab.com

Phone : 044-22323163, 22311034
42179490, 42179491

CHENNAI METTEX LAB PRIVATE LIMITED®

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.

(Approved/Recognized by APEDA, AGMARK, GAFTA, EIC, FSSAI, BIS & MoEF)

TEST REPORT

ISSUED TO : M/s. Solara Active Pharma Sciences Ltd,
Periyakalapet, Puduchery - 605 014.

T.C Date : 06.10.2022

T.C No : CML/22-23/44332

Date of Receipt : 26.09.2022

Analysis Commenced On : 27.09.2022

Analysis Completed On : 06.10.2022

Cust. Ref : SRF Dated : 26.09.2022

Lab No : 2348629

Sample Description : Soil – SLF-II
(as stated by customer)

Characteristics Test	Test Method	Results
pH @ 25°C	IS 2720 Part 26 - 1987 (Reaff:2016)	8.09
Conductivity @ 25°C	IS 14767 - 2000 (Reaff : 2016)	118 µmhos/cm
Cation Exchange Capacity	USEPA 9080 – 1986	19.17 meq/100g of soil
Moisture Content	IS 2720 Part 2 - 1973 (Reaff: 2015)	0.77%
Organic Matter	IS 2720 Part 22-1972 (Reaff:2015)	0.85%
Total Nitrogen as N	IS 14684 : 1999 (Reaff:2019)	2545 mg/kg
Total Phosphorus as P	IS 10158 : 1982 (Reaff: 2019)	186 mg/kg
Potassium as K	USEPA 3050 B – 1996 & USEPA 6010 C - 2000	309 mg/kg
Calcium as Ca		2014 mg/kg
Magnesium as Mg		669 mg/kg
Cadmium as Cd		BDL(Dl:1.0 mg/kg)
Organic Content	IS 2720 Part 22-1987 (Reaff:2020)	0.49 %
Note : BDL – Below Detection Limit, DL – Detection Limit.		

End of Report

For Chennai Mettex Lab Privat Limited

Reviewed & Authorized By

P. KAVITHA
Technical Manager

E-mail : test@mettexlab.com
Web : www.mettexlab.com

Phone : 044-22323163, 22311034
42179490, 42179491

CHENNAI METTEX LAB PRIVATE LIMITED®

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.

TC-5589

TEST REPORT

ISSUED TO : M/s. Solara Active Pharma Sciences Ltd,
Periyakalapet,
Puducherry – 605014.

T.C Date : 24.11.2022

T.C No : CML/22-23/55817

Party's Ref : SRF Date: 19.11.2022

Date of Receipt: 19.11.2022

Lab No : 2362501

Test Completed on: 24.11.2022

Sample Description: AAQ Monitoring – Location: Near ETP Area
(as stated by customer)

Date of Sampling: 18.11.2022– 10.15 am to 19.11.2022– 10.15 am

Ambient Temperature: Min. 25 °C & Max. 32 °C

Relative Humidity: Min. 62 % & Max. 92 %

Discipline / Group: Chemical / Atmospheric Pollution

S.No.	Test Parameters	Protocol	Results	CPCB Standards	Unit
01.	Sulphur dioxide as SO_2	IS: 5182 Part 2- 2001(Reaff.2017)	12.7	80	µg/m³
02.	Nitrogen Dioxide as NO_2	IS: 5182 Part 6-2006(Reaff.2017)	14.9	80	µg/m³
03.	Particulate Matter (PM_{10}) (Size Less than 10 µm)	IS: 5182 Part 23-2006(Reaff.2017)	62.5	100	µg/m³
04.	Particulate Matter ($PM_{2.5}$) (Size Less than 2.5 µm)	IS: 5182 Part 24-2019	31.4	60	µg/m³
05.	Ozone as O_3	IS: 5182 Part 9 :1974 (Reaff.2019)	27.1	180	µg/m³
06.	Lead as Pb	USEPA Compendium Method IO-3.4;1999	BDL(DL:0.1)	1.0	µg/m³
07.	Carbon Monoxide as CO	CML/AIR/SOP/05	BDL(DL:1.0)	4.0	mg/m³
08.	Ammonia as NH_3	IS: 5182 Part 25 :2018	31.5	400	µg/m³
09.	Benzene	IS: 5182 Part 11-2006 (Reaff.2017)	BDL (DL:1.0)	5.0	µg/m³
10.	Benzo (α) Pyrene	IS: 5182 Part 12 -2004 (Reaff.2019)	BDL (DL:0.1)	1.0	ng/m³
11.	Arsenic as As	USEPA Compendium Method IO-3.4;1999	BDL (DL:1.0)	6.0	ng/m³
12.	Nickel as Ni		BDL (DL:1.0)	20	ng/m³

Instrument No: CML/ENV/RDS- 25, CML/ENV/FDS- 06; BDL: Below Detection Limit. DL: Detection Limit.

End of Report

For Chennai Mettex Lab Private Limited,

Reviewed & Authorized By

P. KAVITHA
Technical Manager
Authorised Signatory

E-mail : test@mettexlab.com
Web : www.mettexlab.com

Phone : 044-22323163, 22311034
42179490, 42179491

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TC-5589

TEST REPORT

ISSUED TO : M/s. Solara Active Pharma Sciences Ltd,
Periyakalapet,
Puducherry – 605 014.

T.C Date : 24.11.2022

T.C No :CML/22-23/55818

Party's Ref : SRF Date: 19.11.2022

Date of Receipt: 19.11.2022

Lab No : 2362502

Test Completed on:24.11.2022

Sample Description: AAQ Monitoring – Location: In-front of IPU Plant Area
(as stated by customer)

Date of Sampling: 18.11.2022– 10.30 am to 19.11.2022– 10.30 am

Ambient Temperature: Min. 25 °C & Max. 32 °C

Relative Humidity: Min. 62 % & Max. 92 %

Discipline / Group: Chemical / Atmospheric Pollution

S.No.	Test Parameters	Protocol	Results	CPCB Standards	Unit
01.	Sulphur dioxide as SO_2	IS: 5182 Part 2- 2001(Reaff.2017)	13.4	80	µg/m³
02.	Nitrogen Dioxide as NO_2	IS: 5182 Part 6-2006(Reaff.2017)	15.3	80	µg/m³
03.	Particulate Matter (PM_{10}) (Size Less than 10 µm)	IS: 5182 Part 23-2006(Reaff.2017)	81.6	100	µg/m³
04.	Particulate Matter ($PM_{2.5}$) (Size Less than 2.5 µm)	IS: 5182 Part 24-2019	34.7	60	µg/m³
05.	Ozone as O_3	IS: 5182 Part 9 :1974 (Reaff.2019)	25.1	180	µg/m³
06.	Lead as Pb	USEPA Compendium Method IO-3.4;1999	BDL(DL:0.1)	1.0	µg/m³
07.	Carbon Monoxide as CO	CML/AIR/SOP/05	BDL(DL:1.0)	4.0	mg/m³
08.	Ammonia as NH_3	IS: 5182 Part 25 :2018	30.8	400	µg/m³
09.	Benzene	IS: 5182 Part 11-2006 (Reaff.2017)	BDL (D:1.0)	5.0	µg/m³
10.	Benzo (α) Pyrene	IS: 5182 Part 12 -2004 (Reaff.2019)	BDL (DL:0.1)	1.0	ng/m³
11.	Arsenic as As	USEPA Compendium Method IO-3.4;1999	BDL (DL:1.0)	6.0	ng/m³
12.	Nickel as Ni		BDL (DL:1.0)	20	ng/m³

Instrument No: CML/ENV/RDS- 03, CML/ENV/FDS- 02; BDL: Below Detection Limit. DL: Detection Limit.

-------- End of Report --------

For Chennai Mettex Lab Private Limited,

Reviewed & Authorized By
P. KAVITHA
Technical Manager
Authorised Signatory

E-mail : test@mettexlab.com
Web : www.mettexlab.com

Phone : 044-22323163, 22311034
42179490, 42179491

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TEST REPORT

ISSUED TO : M/s. Solara Active Pharma Sciences Ltd,
Periyakalapet,
Puducherry – 605 014.

T.C Date : 24.11.2022

T.C No : CML/22-23/55819

Party's Ref : SRF Date:19.11.2022

Date of Receipt: 19.11.2022

Lab No : 2362503

Test Completed on: 24.11.2022

Sample Description: AAQ Monitoring – Location: Near Aldehyde Plant
(as stated by customer)

Date of Sampling: 18.11.2022– 10.45 am to 19.11.2022– 10.45 am

Ambient Temperature: Min. 25 °C & Max. 32 °C

Relative Humidity: Min. 62 % & Max. 92 %

Discipline / Group: Chemical / Atmospheric Pollution

S.No.	Test Parameters	Protocol	Results	CPCB Standards	Unit
01.	Sulphur dioxide as SO_2	IS: 5182 Part 2- 2001(Reaff.2017)	13.1	80	µg/m³
02.	Nitrogen Dioxide as NO_2	IS: 5182 Part 6-2006(Reaff.2017)	15.2	80	µg/m³
03.	Particulate Matter (PM_{10}) (Size Less than 10 µm)	IS: 5182 Part 23-2006(Reaff.2017)	76.9	100	µg/m³
04.	Particulate Matter ($PM_{2.5}$) (Size Less than 2.5 µm)	IS: 5182 Part 24-2019	32.5	60	µg/m³
05.	Ozone as O_3	IS: 5182 Part 9 :1974 (Reaff.2019)	25.4	180	µg/m³
06.	Lead as Pb	USEPA Compendium Method IO-3.4;1999	BDL(DL:0.1)	1.0	µg/m³
07.	Carbon Monoxide as CO	CML/AIR/SOP/05	BDL (DL:1.0)	4.0	mg/m³
08.	Ammonia as NH_3	IS: 5182 Part 25 :2018	28.6	400	µg/m³
09.	Benzene	IS: 5182 Part 11-2006 (Reaff.2017)	BDL (DL:1.0)	5.0	µg/m³
10.	Benzo (α) Pyrene	IS: 5182 Part 12 -2004 (Reaff.2019)	BDL (DL:0.1)	1.0	ng/m³
11.	Arsenic as As	USEPA Compendium Method IO-3.4;1999	BDL (DL:1.0)	6.0	ng/m³
12.	Nickel as Ni		BDL (DL:1.0)	20	ng/m³
Instrument No: CML/ENV/RDS- 15, CML/ENV/FDS- 04; BDL: Below Detection Limit. DL: Detection Limit.					

End of Report

For Chennai Mettex Lab Private Limited,

Reviewed & Authorized By
P. KAVITHA
Technical Manager
Authorised Signatory

E-mail : test@mettexlab.com
Web : www.mettexlab.com

Phone : 044-22323163, 22311034
42179490, 42179491

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TEST REPORT

ISSUED TO : M/s. Solara Active Pharma Sciences Ltd,
Periyakalapet,
Puducherry – 605 014.

T.C. Date : 24.11.2022

T.C. No : CML/22-23/55820

Party's Ref : SRF Date: 19.11.2022

Date of Receipt: 19.11.2022

Lab No :2362507

Test Completed on: 24.11.2022

Sample Description: Stack Emission – Boiler- 16 Ton (Load- 12000 kg/h)
(as stated by customer)

Date of Sampling: 18.11.2022

Sampling Plan & Procedure: CML/STACK/SOP/08 **Discipline / Group:** Chemical / Atmospheric Pollution

Sl. No.	Stack Details		
01	Diameter	1.5 m	
02	Temperature	129 °C	
03	Velocity	6.5 m/sec	
04	Volume of Gas Discharged	30873 Nm^3/hr	

Sl. No.	Test Parameters	Test Method	Results	Unit
01	Particulate Matter	IS 11255 Part 1-1985 (RA:2019)	117.8	mg/Nm^3
02	Sulphur-di-oxide (SO_2)	USEPA Method - 6C - 1996	16	mg/Nm^3
03	Oxides of Nitrogen (NOx)	USEPA Method - 7E - 1990	78	mg/Nm^3
04	Carbon Monoxide as CO	CML/STACK/SOP/05	106	mg/Nm^3
05	Carbon dioxide as CO_2		4.6	%
06	Oxygen as O_2		15.9	%

Note: Instrument ID.No: CML/ENV/SMK/07
As per CPCB Norms Concentration of Particulate matter Standards are

Steam generation capacity (ton/hour)	Maximum Limits (mg/Nm^3)
less than 2	1200
2 to less than 10	800
10 to less than 15	600
15 and above	150

End of Report

For Chennai Mettex Lab Private Limited,

Reviewed & Authorized By
P. KAVITHA
Technical Manager
Authorised Signatory

E-mail : test@mettexlab.com
Web : www.mettexlab.com

Phone : 044-22323163, 22311034
42179490, 42179491

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Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.

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TEST REPORT

ISSUED TO : M/s. Solara Active Pharma Sciences Ltd,
Periyakalapet,
Puducherry – 605 014.

T.C Date : 24.11.2022

T.C No : CML/22-23/55821

Party's Ref : SRF Date: 19.11.2022

Date of Receipt: 19.11.2022

Lab No : 2362508

Test Completed on: 24.11.2022

Sample Description: Stack Emission – D.G- 1010 KVA Caterpillar
(as stated by customer)

Date of Sampling: 18.11.2022

Sampling Plan & Procedure: CML/STACK/SOP/08 **Discipline / Group:** Chemical / Atmospheric Pollution

Sl. No.	Stack Details		Unit
01	Stack Diameter	25	cm
02	Temperature	314	°C
03	Velocity	27.4	m/sec
04	Volume of Gas Discharged	2461	Nm^3/hr

Sl. No.	Test Parameters	Test Method	Results	CPCB Norms	Unit
01	Particulate Matter	IS 11255 Part 1-1985 (RA:2019)	61.5	75	mg/Nm^3
02	Sulphur-di-oxide (SO_2)	USEPA Method - 6C - 1996	BDL (DL: 3.0)	--	ppmv
03	Oxides of Nitrogen (NOx)	USEPA Method - 7E -1990	316	710	ppmv
04	Non-Methane Hydrocarbon	CML/STACK/SOP/06	73	100	mg/Nm^3
05	Carbon Monoxide as CO	CML/STACK/SOP/05	134	150	mg/Nm^3
06	Carbon dioxide as CO_2		6.9	--	%
07	Oxygen as O_2		12.0	--	%

Note: Instrument ID.No: CML/ENV/SMK/07

End of Report

For Chennai Mettex Lab Private Limited,

Reviewed & Authorized By

P. KAVITHA
Technical Manager
Authorised Signatory

E-mail : test@mettexlab.com
Web : www.mettexlab.com

Phone : 044-22323163, 22311034
42179490, 42179491

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Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.

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TEST REPORT

ISSUED TO : M/s. Solara Active Pharma Sciences Ltd,
Periyakalapet,
Puducherry – 605 014.

T.C Date : 24.11.2022

T.C No : CML/22-23/55822

Party's Ref : SRF Date: 19.11.2022

Date of Receipt: 19.11.2022

Lab No : 2362509

Test Completed on: 24.11.2022

Sample Description: Stack Emission – D.G- 1500 KVA Caterpillar
(as stated by customer)

Date of Sampling: 18.11.2022

Sampling Plan & Procedure: CML/STACK/SOP/08 **Discipline / Group:** Chemical / Atmospheric Pollution

Sl. No.	Stack Details	Chimney-1	Chimney-2	Unit
01	Stack Diameter	25	25	cm
02	Temperature	347	347	°C
03	Velocity	26.5	25.6	m/sec
04	Volume of Gas Discharged	2248	2171	Nm^3/hr

Sl. No.	Test Parameters	Test Method	Results	CPCB Norms	Unit
01	Particulate Matter	IS 11255 Part 1-1985 (RA:2019)	63.6	75	mg/Nm^3
02	Sulphur-di-oxide (SO_2)	USEPA Method - 6C - 1996	BDL (DL: 3.0)	--	ppmv
03	Oxides of Nitrogen (NOx)	USEPA Method - 7E -1990	364	710	ppmv
04	Non-Methane Hydrocarbon	CML/STACK/SOP/06	79	100	mg/Nm^3
05	Carbon Monoxide as CO	USEPA Method - 10 - 1996	139	150	mg/Nm^3
06	Carbon dioxide as CO_2	USEPA Method - 3A - 1989	7.3	--	%
07	Oxygen as O_2	USEPA Method - 3A - 1989	10.8	--	%

Note: Instrument ID.No: CML/ENV/SMK/07

------------------------------ *End of Report* ------------------------------

For Chennai Mettex Lab Private Limited,

Reviewed & Authorized By

P. KAVITHA
Technical Manager
Authorised Signatory

E-mail : test@mettexlab.com
Web : www.mettexlab.com

Phone : 044-22323163, 22311034
42179490, 42179491

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TC-5589

TEST REPORT

ISSUED TO : M/s. Solara Active Pharma Sciences Ltd,
Periyakalapet,
Puducherry – 605 014

T.C Date : 24.11.2022

T.C No : CML/22-23/55823

Party's Ref : SRF Date: 19.11.2022

Date of Receipt: 19.11.2022

Lab No : 2362510

Test Completed on: 24.11.2022

Sample Description: Stack Emission – D.G- 1010 KVA Cummins
(as stated by customer)

Date of Sampling: 18.11.2022

Sampling Plan & Procedure: CML/STACK/SOP/08 **Discipline / Group:** Chemical / Atmospheric Pollution

Sl. No.	Stack Details	Chimney-1	Chimney-2	Unit
01	Stack Diameter	25	25	cm
02	Temperature	281	281	°C
03	Velocity	23.4	23.6	m/sec
04	Volume of Gas Discharged	2226	2240	Nm^3/hr

Sl. No.	Test Parameters	Test Method	Results	CPCB Norms	Unit
01	Particulate Matter	IS 11255 Part 1-1985 (RA:2019)	51.4	75	mg/Nm^3
02	Sulphur-di-oxide (SO_2)	USEPA Method - 6C - 1996	BDL (DL: 3.0)	--	ppmv
03	Oxides of Nitrogen (NOx)	USEPA Method - 7E -1990	286	710	ppmv
04	Non-Methane Hydrocarbon	CML/STACK/SOP/06	57	100	mg/Nm^3
05	Carbon Monoxide as CO	USEPA Method - 10 - 1996	132	150	mg/Nm^3
06	Carbon dioxide as CO_2	USEPA Method - 3A - 1989	7.7	--	%
07	Oxygen as O_2	USEPA Method - 3A - 1989	11.3	--	%

Note: Instrument ID.No: CML/ENV/SMK/07

End of Report

For Chennai Mettex Lab Private Limited,

Reviewed & Authorized By

P. KAVITHA
Technical Manager
Authorised Signatory

E-mail : test@mettexlab.com
Web : www.mettexlab.com

Phone : 044-22323163, 22311034
42179490, 42179491

CHENNAI METTEX LAB PRIVATE LIMITED®

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TC-5589

TEST REPORT

ISSUED TO : M/s. Solara Active Pharma Sciences Ltd,
Periyakalapet,
Puducherry – 605 014.

T.C Date : 24.11.2022

T.C No : CML/22-23/55824

Party's Ref : SRF Date :19.11.2022

Date of Receipt: 19.11.2022

Lab No : 2362511

Test Completed on: 24.11.2022

Sample Description: Stack Emission – D.G- 1500 KVA Cummins
(as stated by customer)

Date of Sampling: 18.11.2022

Sampling Plan & Procedure: CML/STACK/SOP/08 **Discipline / Group:** Chemical / Atmospheric Pollution

Sl. No.	Stack Details		Chimney-1	Chimney-2	Unit
01	Stack Diameter		25	25	cm
02	Temperature		328	328	°C
03	Velocity		26.2	25.8	m/sec
04	Volume of Gas Discharged		2296	2257	Nm^3/hr
Sl. No.	**Test Parameters**	**Test Method**	**Results**	**CPCB Norms**	**Unit**
01	Particulate Matter	IS 11255 Part 1-1985 (RA:2019)	56.1	75	mg/Nm^3
02	Sulphur-di-oxide (SO_2)	USEPA Method - 6C - 1996	BDL (DL: 3.0)	--	ppmv
03	Oxides of Nitrogen (NOx)	USEPA Method - 7E -1990	326	710	ppmv
04	Non-Methane Hydrocarbon	CML/STACK/SOP/06	68	100	mg/Nm^3
05	Carbon Monoxide as CO	USEPA Method - 10 - 1996	133	150	mg/Nm^3
06	Carbon dioxide as CO_2	USEPA Method - 3A - 1989	7.9	--	%
07	Oxygen as O_2	USEPA Method - 3A - 1989	10.6	--	%
Note: Instrument ID.No: CML/ENV/SMK/07					

End of Report

For Chennai Mettex Lab Private Limited,

Reviewed & Authorized By
P. KAVITHA
Technical Manager
Authorised Signatory

E-mail : test@mettexlab.com
Web : www.mettexlab.com

Phone : 044-22323163, 22311034
42179490, 42179491

CHENNAI METTEX LAB PRIVATE LIMITED®

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.

TC-5589

TEST REPORT

ISSUED TO : M/s. Solara Active Pharma Sciences Ltd,
Periyakalapet,
Puducherry – 605014.

T.C Date :21.12.2022

T.C No :CML/22-23/62312

Party's Ref : SRF Date: 18.12.2022

Date of Receipt: 19.12.2022

Lab No : 2372105

Test Completed on: 21.12.2022

Sample Description: AAQ Monitoring – Location: Near ETP Area
(as stated by customer)

Date of Sampling: 17.12.2022– 09.30 am to 18.12.2022– 09.30 am

Ambient Temperature: Min. 24 °C & Max. 30 °C

Relative Humidity: Min. 67 % & Max. 93 %

Discipline / Group: Chemical / Atmospheric Pollution

S.No.	Test Parameters	Protocol	Results	CPCB Standards	Unit
01.	Sulphur dioxide as SO_2	IS: 5182 Part 2:2001 (Reaff.2017)	11.9	80	µg/m³
02.	Nitrogen Dioxide as NO_2	IS: 5182 Part 6:2006 (Reaff.2017)	13.5	80	µg/m³
03.	Particulate Matter (PM_{10}) (Size Less than 10 µm)	IS: 5182 Part 23:2006 (Reaff.2017)	51.7	100	µg/m³
04.	Particulate Matter ($PM_{2.5}$) (Size Less than 2.5 µm)	IS: 5182 Part 24 : 2019	24.8	60	µg/m³
05.	Ozone as O_3	IS: 5182 Part IX:1974 (Reaff.2019)	26.1	180	µg/m³
06.	Lead as Pb	USEPA Compendium Method IO-3.4;1999	BDL(DL:0.1)	1.0	µg/m³
07.	Carbon Monoxide as CO	CML/AIR/SOP/005	BDL(DL:1.0)	4.0	mg/m³
08.	Ammonia as NH_3	IS: 5182 Part 25 : 2018	25.4	400	µg/m³
09.	Benzene	IS: 5182 Part 11:2006 (Reaff.2017)	BDL (DL:1.0)	5.0	µg/m³
10.	Benzo (α) Pyrene	IS: 5182 Part 12:2004 (Reaff.2019)	BDL (DL:0.1)	1.0	ng/m³
11.	Arsenic as As	USEPA Compendium Method IO-3.4;1999	BDL (DL:1.0)	6.0	ng/m³
12.	Nickel as Ni	USEPA Compendium Method IO-3.4;1999	BDL (DL:1.0)	20	ng/m³

Instrument No: CML/ENV/RDS- 07, CML/ENV/FDS- 02; BDL: Below Detection Limit. DL: Detection Limit.

End of Report

For Chennai Mettex Lab Rrivate Limited,

Reviewed & Authorized By

P. KA[illegible]
Technic[illegible]
Authorise[illegible]

E-mail : test@mettexlab.com
Web : www.mettexlab.com

Phone : 044-22323163, 22311034
42179490, 42179491

CHENNAI METTEX LAB PRIVATE LIMITED®

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.

TC-5589

TEST REPORT

ISSUED TO : M/s. Solara Active Pharma Sciences Ltd,
Periyakalapet,
Puducherry – 605 014.

T.C Date :21.12.2022

T.C No :CML/22-23/62313

Party's Ref : SRF Date:18.12.2022

Date of Receipt: 19.12.2022

Lab No : 2372106

Test Completed on:21.12.2022

Sample Description: AAQ Monitoring – Location: In-front of IPU Plant Area
(as stated by customer)

Date of Sampling: 17.12.2022– 10.00 am to 18.12.2022– 10.00 am

Ambient Temperature: Min. 24 °C & Max. 30 °C **Relative Humidity:** Min. 67 % & Max. 93 %

Discipline / Group: Chemical / Atmospheric Pollution

S.No.	Test Parameters	Protocol	Results	CPCB Standards	Unit
01.	Sulphur dioxide as SO_2	IS: 5182 Part 2:2001 (Reaff.2017)	12.2	80	µg/m³
02.	Nitrogen Dioxide as NO_2	IS: 5182 Part 6:2006 (Reaff.2017)	13.7	80	µg/m³
03.	Particulate Matter (PM_{10}) (Size Less than 10 µm)	IS: 5182 Part 23:2006 (Reaff.2017)	58.3	100	µg/m³
04.	Particulate Matter ($PM_{2.5}$) (Size Less than 2.5 µm)	IS: 5182 Part 24 : 2019	27.4	60	µg/m³
05.	Ozone as O_3	IS: 5182 Part IX:1974 (Reaff.2019)	23.8	180	µg/m³
06.	Lead as Pb	USEPA Compendium Method IO-3.4;1999	BDL(DL:0.1)	1.0	µg/m³
07.	Carbon Monoxide as CO	CML/AIR/SOP/005	BDL(DL:1.0)	4.0	mg/m³
08.	Ammonia as NH_3	IS: 5182 Part 25 : 2018	28.4	400	µg/m³
09.	Benzene	IS: 5182 Part 11:2006 (Reaff.2017)	BDL (D:1.0)	5.0	µg/m³
10.	Benzo (α) Pyrene	IS: 5182 Part 12:2004 (Reaff.2019)	BDL (DL:0.1)	1.0	ng/m³
11.	Arsenic as As	USEPA Compendium Method IO-3.4;1999	BDL (DL:1.0)	6.0	ng/m³
12.	Nickel as Ni		BDL (DL:1.0)	20	ng/m³

Instrument No: CML/ENV/RDS- 15, CML/ENV/FDS- 04; BDL: Below Detection Limit. DL: Detection Limit.

End of Report

For Chennai Mettex Lab Private Limited,

Reviewed & Authorized By

P. KAVITHA
Technical Manager
Authorised Signatory

E-mail : test@mettexlab.com
Web : www.mettexlab.com

Phone : 044-22323163, 22311034
42179490, 42179491

CHENNAI METTEX LAB PRIVATE LIMITED®

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.

TC-5589

TEST REPORT

ISSUED TO : M/s. Solara Active Pharma Sciences Ltd,
Periyakalapet,
Puducherry – 605 014.

T.C Date : 21.12.2022

T.C No : CML/22-23/62314

Party's Ref : SRF Date: 18.12.2022

Date of Receipt: 19.12.2022

Lab No : 2372107

Test Completed on: 21.12.2022

Sample Description: AAQ Monitoring – Location: Near Aldehyde Plant
(as stated by customer)

Date of Sampling: 17.12.2022– 10.15 am to 18.12.2022– 10.15 am

Ambient Temperature: Min. 24 °C & Max. 30 °C **Relative Humidity:** Min. 67 % & Max. 93 %

Discipline / Group: Chemical / Atmospheric Pollution

S.No.	Test Parameters	Protocol	Results	CPCB Standards	Unit
01.	Sulphur dioxide as SO_2	IS: 5182 Part 2:2001 (Reaff.2017)	12.0	80	μg/m³
02.	Nitrogen Dioxide as NO_2	IS: 5182 Part 6:2006 (Reaff.2017)	13.7	80	μg/m³
03.	Particulate Matter (PM_{10}) (Size Less than 10 μm)	IS: 5182 Part 23:2006 (Reaff.2017)	60.1	100	μg/m³
04.	Particulate Matter ($PM_{2.5}$) (Size Less than 2.5 μm)	IS: 5182 Part 24 : 2019	27.3	60	μg/m³
05.	Ozone as O_3	IS: 5182 Part IX:1974 (Reaff.2019)	22.9	180	μg/m³
06.	Lead as Pb	USEPA Compendium Method IO-3.4;1999	BDL(DL:0.1)	1.0	μg/m³
07.	Carbon Monoxide as CO	CML/AIR/SOP/005	BDL (DL:1.0)	4.0	mg/m³
08.	Ammonia as NH_3	IS: 5182 Part 25 : 2018	25.7	400	μg/m³
09.	Benzene	IS: 5182 Part 11:2006 (Reaff.2017)	BDL (DL:1.0)	5.0	μg/m³
10.	Benzo (α) Pyrene	IS: 5182 Part 12:2004 (Reaff.2019)	BDL (DL:0.1)	1.0	ng/m³
11.	Arsenic as As	USEPA Compendium Method IO-3.4;1999	BDL (DL:1.0)	6.0	ng/m³
12.	Nickel as Ni		BDL (DL:1.0)	20	ng/m³

Instrument No: CML/ENV/RDS- 24, CML/ENV/FDS- 05; BDL: Below Detection Limit. DL: Detection Limit.

End of Report

For Chennai Mettex Lab Private Limited,

Reviewed & Authorized By

P. KAVITHA
Technical Manager
Authorised Signatory

E-mail : test@mettexlab.com
Web : www.mettexlab.com
Phone : 044-22323163, 22311034
42179490, 42179491

CHENNAI METTEX LAB PRIVATE LIMITED®

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.

TC-5589

TEST REPORT

ISSUED TO : M/s. Solara Active Pharma Sciences Ltd,
Periyakalapet,
Puducherry – 605 014.

T.C Date : 21.12.2022

T.C No : CML/22-23/62315

Party's Ref : SRF Date: 18.12.2022

Date of Receipt: 19.12.2022

Lab No : 2372108

Test Completed on: 21.12.2022

Sample Description: Stack Emission – Boiler- 16 Ton (Load- 14000 kg/h)
(as stated by customer)

Date of Sampling: 17.12.2022

Sampling Plan & Procedure: CML/STACK/SOP/08 **Discipline / Group:** Chemical / Atmospheric Pollution

Sl. No.	Stack Details	
01	Diameter	1.5 m
02	Temperature	125 °C
03	Velocity	7.8 m/sec
04	Volume of Gas Discharged	37240 Nm^3/hr

Sl. No.	Test Parameters	Test Method	Results	Unit
01	Particulate Matter	IS 11255 Part 1-1985 (RA:2019)	137.7	mg/Nm^3
02	Sulphur-di-oxide (SO_2)	USEPA Method - 6C - 1996	5	mg/Nm^3
03	Oxides of Nitrogen (NOx)	USEPA Method - 7E -1990	186	mg/Nm^3
05	Carbon Monoxide as CO	USEPA Method - 10 - 1996	92	mg/Nm^3
06	Carbon dioxide as CO_2	USEPA Method - 3A - 1989	7.5	%
07	Oxygen as O_2	USEPA Method - 3A - 1989	12.0	%

Note: Instrument ID.No: CML/ENV/SMK/07
As per CPCB Norms Concentration of Particulate matter Standards are

Steam generation capacity (ton/hour)	Maximum Limits (mg/Nm^3)
less than 2	1200
2 to less than 10	800
10 to less than 15	600
15 and above	150

End of Report

For Chennai Mettex Lab Private Limited,

Reviewed & Authorized By

KAVITHA
Technical Manager
Authorised Signatory

E-mail : test@mettexlab.com
Web : www.mettexlab.com

Phone : 044-22323163, 22311034
42179490, 42179491

CHENNAI METTEX LAB PRIVATE LIMITED®

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.

TC-5589

TEST REPORT

ISSUED TO : M/s. Solara Active Pharma Sciences Ltd,
Periyakalapet,
Puducherry – 605 014.

T.C Date : 21.12.2022

T.C No : CML/22-23/62316

Party's Ref : SRF Date: 18.12.2022

Date of Receipt: 19.12.2022

Lab No : 2372109

Test Completed on: 21.12.2022

Sample Description: Stack Emission – D.G- 1010 KVA Caterpillar
(as stated by customer)

Date of Sampling: 17.12.2022

Sampling Plan & Procedure: CML/STACK/SOP/08 **Discipline / Group:** Chemical / Atmospheric Pollution

Sl. No.	Stack Details		Unit
01	Stack Diameter	25	cm
02	Temperature	305	°C
03	Velocity	26.4	m/sec
04	Volume of Gas Discharged	2405	Nm^3/hr

Sl. No.	Test Parameters	Test Method	Results	CPCB Norms	Unit
01	Particulate Matter	IS 11255 Part 1-1985 (RA:2019)	58.4	75	mg/Nm^3
02	Sulphur-di-oxide (SO_2)	USEPA Method - 6C - 1996	BDL (DL: 3.0)	--	ppmv
03	Oxides of Nitrogen (NOx)	USEPA Method - 7E -1990	289	710	ppmv
04	Non-Methane Hydrocarbon	CML/STACK/SOP/06	87	100	mg/Nm^3
05	Carbon Monoxide as CO	USEPA Method - 10 - 1996	142	150	mg/Nm^3
06	Carbon dioxide as CO_2	USEPA Method - 3A - 1989	6.7	--	%
07	Oxygen as O_2	USEPA Method - 3A - 1989	12.6	--	%
Note: Instrument ID.No: CML/ENV/SMK/07					

End of Report

For Chennai Mettex Lab Private Limited,

Reviewed & Authorized By

P. KAVITHA
Technical Manager
Authorised Signatory

E-mail : test@mettexlab.com
Web : www.mettexlab.com

Phone : 044-22323163, 22311034
42179490, 42179491

CHENNAI METTEX LAB PRIVATE LIMITED®

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.

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TEST REPORT

ISSUED TO : M/s. Solara Active Pharma Sciences Ltd,
Periyakalapet,
Puducherry – 605 014.

T.C Date :21.12.2022

T.C No :CML/22-23/62317

Party's Ref : SRF Date:

Date of Receipt: 19.12.2022

Lab No : 2372110

Test Completed on:21.12.2022

Sample Description: Stack Emission – D.G- 1500 KVA Caterpillar
(as stated by customer)

Date of Sampling: 17.12.2022

Sampling Plan & Procedure: CML/STACK/SOP/08 **Discipline / Group:** Chemical / Atmospheric Pollution

Sl. No.	Stack Details		Chimney-1	Chimney-2	Unit
01	Stack Diameter		25	25	cm
02	Temperature		315	315	°C
03	Velocity		25.1	24.6	m/sec
04	Volume of Gas Discharged		2242	2202	Nm^3/hr
Sl. No.	**Test Parameters**	**Test Method**	**Results**	**CPCB Norms**	**Unit**
01	Particulate Matter	IS 11255 Part 1-1985 (RA:2019)	66.5	75	mg/Nm^3
02	Sulphur-di-oxide (SO_2)	USEPA Method - 6C - 1996	BDL (DL: 3.0)	--	ppmv
03	Oxides of Nitrogen (NOx)	USEPA Method - 7E -1990	336	710	ppmv
04	Non-Methane Hydrocarbon	CML/STACK/SOP/06	86	100	mg/Nm^3
05	Carbon Monoxide as CO	USEPA Method - 10 - 1996	142	150	mg/Nm^3
06	Carbon dioxide as CO_2	USEPA Method - 3A - 1989	7.1	--	%
07	Oxygen as O_2	USEPA Method - 3A - 1989	10.8	--	%
Note: Instrument ID.No: CML/ENV/SMK/07					

End of Report

For Chennai Mettex Lab Private Limited,

Reviewed & Authorized By

P. KAVITHA
Technical Manager
Authorised Signatory

E-mail : test@mettexlab.com
Web : www.mettexlab.com

Phone : 044-22323163, 22311034
42179490, 42179491

CHENNAI METTEX LAB PRIVATE LIMITED®

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.

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TEST REPORT

ISSUED TO : M/s. Solara Active Pharma Sciences Ltd,
Periyakalapet,
Puducherry – 605 014.

T.C Date :21.12.2022

T.C No :CML/22-23/62318

Party's Ref : SRF Date:18.12.2022

Date of Receipt:19.12.2022

Lab No : 2372111

Test Completed on:21.12.2022

Sample Description: Stack Emission – D.G- 1010 KVA Cummins
(as stated by customer)

Date of Sampling: 17.12.2022

Sampling Plan & Procedure: CML/STACK/SOP/08 **Discipline / Group:** Chemical / Atmospheric Pollution

Sl. No.	Stack Details	Chimney-1	Chimney-2	Unit
01	Stack Diameter	25	25	cm
02	Temperature	289	289	°C
03	Velocity	23.1	23.4	m/sec
04	Volume of Gas Discharged	2167	2196	Nm^3/hr

Sl. No.	Test Parameters	Test Method	Results	CPCB Norms	Unit
01	Particulate Matter	IS 11255 Part 1-1985 (RA:2019)	53.3	75	mg/Nm^3
02	Sulphur-di-oxide (SO_2)	USEPA Method - 6C - 1996	BDL (DL: 3.0)	--	ppmv
03	Oxides of Nitrogen (NOx)	USEPA Method - 7E -1990	270	710	ppmv
04	Non-Methane Hydrocarbon	CML/STACK/SOP/06	61	100	mg/Nm^3
05	Carbon Monoxide as CO	USEPA Method - 10 - 1996	135	150	mg/Nm^3
06	Carbon dioxide as CO_2	USEPA Method - 3A - 1989	7.3	--	%
07	Oxygen as O_2	USEPA Method - 3A - 1989	11.3	--	%

Note: Instrument ID.No: CML/ENV/SMK/07

End of Report

For Chennai Mettex Lab Private Limited,

Reviewed & Authorized By
P. KAVITHA
Technical Manager
Authorized Signatory

E-mail : test@mettexlab.com
Web : www.mettexlab.com

Phone : 044-22323163, 22311034
42179490, 42179491

CHENNAI METTEX LAB PRIVATE LIMITED®

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.

TC-5589

TEST REPORT

ISSUED TO : M/s. Solara Active Pharma Sciences Ltd,
Periyakalapet,
Puducherry – 605 014.

T.C Date :21.12.2022

T.C No : CML/22-23/62319

Party's Ref : SRF Date: 18.12.2022

Date of Receipt: 19.12.2022

Lab No : 2372112

Test Completed on: 21.12.2022

Sample Description: Stack Emission – D.G- 1500 KVA Cummins
(as stated by customer)

Date of Sampling: 17.12.2022

Sampling Plan & Procedure: CML/STACK/SOP/08 **Discipline / Group:** Chemical / Atmospheric Pollution

Sl. No.	Stack Details		Chimney-1	Chimney-2	Unit
01	Stack Diameter		25	25	cm
02	Temperature		302	302	°C
03	Velocity		24.8	25.1	m/sec
04	Volume of Gas Discharged		2268	2294	Nm^3/hr
Sl. No.	**Test Parameters**	**Test Method**	**Results**	**CPCB Norms**	**Unit**
01	Particulate Matter	IS 11255 Part 1-1985 (RA:2019)	60.8	75	mg/Nm^3
02	Sulphur-di-oxide (SO_2)	USEPA Method - 6C - 1996	BDL (DL: 3.0)	--	ppmv
03	Oxides of Nitrogen (NOx)	USEPA Method - 7E -1990	311	710	ppmv
04	Non-Methane Hydrocarbon	CML/STACK/SOP/06	71	100	mg/Nm^3
05	Carbon Monoxide as CO	USEPA Method - 10 - 1996	134	150	mg/Nm^3
06	Carbon dioxide as CO_2	USEPA Method - 3A - 1989	7.6	--	%
07	Oxygen as O_2	USEPA Method - 3A - 1989	11.0	--	%
Note: Instrument ID.No: CML/ENV/SMK/07					

End of Report

For Chennai Mettex Lab Private Limited,

Reviewed & Authorized By

P. KAVITHA
Technical Manager
Authorised Signatory

E-mail : test@mettexlab.com
Web : www.mettexlab.com

Phone : 044-22323163, 22311034
42179490, 42179491

CHENNAI METTEX LAB PRIVATE LIMITED®

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.

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TEST REPORT

ISSUED TO : M/s. Solara Active Pharma Sciences Ltd,
Periyakalapet,
Puducherry – 605014.

T.C Date :04.02.2023

T.C No :CML/22-23/74460

Party's Ref : SRF Date: 26.01.2023

Date of Receipt: 28.01.2023

Lab No : 2383047

Test Completed on: 04.02.2023

Sample Description: AAQ Monitoring – Location: Near ETP Area
(as stated by customer)

Date of Sampling: 24.01.2023– 10.00 am to 25.01.2023– 10.00 am

Ambient Temperature: Min. 26 °C & Max. 31 °C **Relative Humidity:** Min. 56 % & Max. 92 %

Discipline / Group: Chemical / Atmospheric Pollution

S.No.	Test Parameters	Protocol	Results	CPCB Standards	Unit
01.	Sulphur dioxide as SO_2	IS: 5182 Part 2:2001 (Reaff.2017)	11.4	80	µg/m³
02.	Nitrogen Dioxide as NO_2	IS: 5182 Part 6:2006 (Reaff.2017)	14.7	80	µg/m³
03.	Particulate Matter (PM_{10}) (Size Less than 10 µm)	IS: 5182 Part 23:2006 (Reaff.2017)	55.2	100	µg/m³
04.	Particulate Matter ($PM_{2.5}$) (Size Less than 2.5 µm)	IS: 5182 Part 24 : 2019	28.4	60	µg/m³
05.	Ozone as O_3	IS: 5182 Part IX:1974 (Reaff.2019)	28.1	180	µg/m³
06.	Lead as Pb	USEPA Compendium Method IO-3.4;1999	BDL(DL:0.1)	1.0	µg/m³
07.	Carbon Monoxide as CO	CML/AIR/SOP/005	BDL(DL:1.0)	4.0	mg/m³
08.	Ammonia as NH_3	IS: 5182 Part 25 : 2018	27.3	400	µg/m³
09.	Benzene	IS: 5182 Part 11:2006 (Reaff.2017)	BDL (DL:1.0)	5.0	µg/m³
10.	Benzo (α) Pyrene	IS: 5182 Part 12:2004 (Reaff.2019)	BDL (DL:0.1)	1.0	ng/m³
11.	Arsenic as As	USEPA Compendium Method IO-3.4;1999	BDL (DL:1.0)	6.0	ng/m³
12.	Nickel as Ni		BDL (DL:1.0)	20	ng/m³

Instrument No: CML/ENV/RDS- 05, CML/ENV/FDS- 01; BDL: Below Detection Limit. DL: Detection Limit.

End of Report

For Chennai Mettex Lab Private Limited,

Reviewed & Authorized By:
P. KAVITHA
Technical Manager
Authorised Signatory

E-mail : test@mettexlab.com
Web : www.mettexlab.com

Phone : 044-22323163, 22311034
42179490, 42179491

CHENNAI METTEX LAB PRIVATE LIMITED®

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.

TC-5589

TEST REPORT

ISSUED TO : M/s. Solara Active Pharma Sciences Ltd,
Periyakalapet,
Puducherry – 605 014.

T.C Date : 04.02.2023

T.C No : CML/22-23/74461

Party's Ref : SRF Date: 26.01.2023

Date of Receipt: 28.01.2023

Lab No : 2383048

Test Completed on: 04.02.2023

Sample Description: AAQ Monitoring – Location: In-front of IPU Plant Area
(as stated by customer)

Date of Sampling: 24.01.2023– 10.15 am to 25.01.2023– 10.15 am

Ambient Temperature: Min. 26 °C & Max. 31 °C **Relative Humidity:** Min. 56 % & Max. 92 %

Discipline / Group: Chemical / Atmospheric Pollution

S.No.	Test Parameters	Protocol	Results	CPCB Standards	Unit
01.	Sulphur dioxide as SO_2	IS: 5182 Part 2:2001 (Reaff.2017)	11.9	80	µg/m³
02.	Nitrogen Dioxide as NO_2	IS: 5182 Part 6:2006 (Reaff.2017)	14.8	80	µg/m³
03.	Particulate Matter (PM_{10}) (Size Less than 10 µm)	IS: 5182 Part 23:2006 (Reaff.2017)	61.3	100	µg/m³
04.	Particulate Matter ($PM_{2.5}$) (Size Less than 2.5 µm)	IS: 5182 Part 24 : 2019	29.7	60	µg/m³
05.	Ozone as O_3	IS: 5182 Part IX:1974 (Reaff.2019)	25.4	180	µg/m³
06.	Lead as Pb	USEPA Compendium Method IO-3.4;1999	BDL(DL:0.1)	1.0	µg/m³
07.	Carbon Monoxide as CO	CML/AIR/SOP/005	BDL(DL:1.0)	4.0	mg/m³
08.	Ammonia as NH_3	IS: 5182 Part 25 : 2018	31.6	400	µg/m³
09.	Benzene	IS: 5182 Part 11:2006 (Reaff.2017)	BDL (D:1.0)	5.0	µg/m³
10.	Benzo (α) Pyrene	IS: 5182 Part 12:2004 (Reaff.2019)	BDL (DL:0.1)	1.0	ng/m³
11.	Arsenic as As	USEPA Compendium Method IO-3.4;1999	BDL (DL:1.0)	6.0	ng/m³
12.	Nickel as Ni		BDL (DL:1.0)	20	ng/m³

Instrument No: CML/ENV/RDS- 16, CML/ENV/FDS- 02; BDL: Below Detection Limit. DL: Detection Limit.

End of Report

For Chennai Mettex Lab Private Limited,

Reviewed & Authorized By

P. KAVITHA
Technical Manager
Authorised Signatory

E-mail : test@mettexlab.com
Web : www.mettexlab.com

Phone : 044-22323163, 22311034
42179490, 42179491

CHENNAI METTEX LAB PRIVATE LIMITED®

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.

TC-5589

TEST REPORT

ISSUED TO : M/s. Solara Active Pharma Sciences Ltd,
Periyakalapet,
Puducherry – 605 014.

T.C Date : 04.02.2023

T.C No : CML/22-23/74462

Party's Ref : SRF Date: 26.01.2023

Date of Receipt: 28.01.2023

Lab No : 2383049

Test Completed on: 04.02.2023

Sample Description: AAQ Monitoring – Location: Near Aldehyde Plant
(as stated by customer)

Date of Sampling: 24.01.2023– 10.30 am to 25.01.2023– 10.30 am

Ambient Temperature: Min. 26 °C & Max. 31 °C **Relative Humidity:** Min. 56 % & Max. 92 %

Discipline / Group: Chemical / Atmospheric Pollution

S.No.	Test Parameters	Protocol	Results	CPCB Standards	Unit
01.	Sulphur dioxide as SO_2	IS: 5182 Part 2:2001 (Reaff.2017)	11.6	80	µg/m³
02.	Nitrogen Dioxide as NO_2	IS: 5182 Part 6:2006 (Reaff.2017)	13.9	80	µg/m³
03.	Particulate Matter (PM_{10}) (Size Less than 10 µm)	IS: 5182 Part 23:2006 (Reaff.2017)	65.7	100	µg/m³
04.	Particulate Matter ($PM_{2.5}$) (Size Less than 2.5 µm)	IS: 5182 Part 24 : 2019	30.2	60	µg/m³
05.	Ozone as O_3	IS: 5182 Part IX:1974 (Reaff.2019)	24.6	180	µg/m³
06.	Lead as Pb	USEPA Compendium Method IO-3.4;1999	BDL(DL:0.1)	1.0	µg/m³
07.	Carbon Monoxide as CO	CML/AIR/SOP/005	BDL (DL:1.0)	4.0	mg/m³
08.	Ammonia as NH_3	IS: 5182 Part 25 : 2018	28.4	400	µg/m³
09.	Benzene	IS: 5182 Part 11:2006 (Reaff.2017)	BDL (DL:1.0)	5.0	µg/m³
10.	Benzo (α) Pyrene	IS: 5182 Part 12:2004 (Reaff.2019)	BDL (DL:0.1)	1.0	ng/m³
11.	Arsenic as As	USEPA Compendium Method IO-3.4;1999	BDL (DL:1.0)	6.0	ng/m³
12.	Nickel as Ni		BDL (DL:1.0)	20	ng/m³

Instrument No: CML/ENV/RDS- 25, CML/ENV/FDS- 05; BDL: Below Detection Limit. DL: Detection Limit.

End of Report

For Chennai Mettex Lab Private Limited,

Reviewed & Authorized By
P. KAVITHA
Technical Manager
Authorised Signatory

E-mail : test@mettexlab.com
Web : www.mettexlab.com

Phone : 044-22323163, 22311034
42179490, 42179491

CHENNAI METTEX LAB PRIVATE LIMITED®

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.

TC-5589

TEST REPORT

ISSUED TO : M/s. Solara Active Pharma Sciences Ltd,
Periyakalapet,
Puducherry – 605 014.

T.C Date :04.02.2023

T.C No :CML/22-23/74463

Party's Ref : SRF Date: 26.01.2023

Date of Receipt: 28.01.2023

Lab No : 2383050

Test Completed on: 04.02.2023

Sample Description: Stack Emission – Boiler- 16 Ton (Load- 10500 kg/h)
(as stated by customer)

Date of Sampling: 24.01.2023

Sampling Plan & Procedure: CML/STACK/SOP/08 **Discipline / Group:** Chemical / Atmospheric Pollution

Sl. No.	Stack Details			
01	Diameter		1.5 m	
02	Temperature		112 °C	
03	Velocity		7.1 m/sec	
04	Volume of Gas Discharged		34934 Nm^3/hr	
Sl. No.	**Test Parameters**	**Test Method**	**Results**	**Unit**
01	Particulate Matter	IS 11255 Part 1-1985 (RA:2019)	118.6	mg/Nm^3
02	Sulphur-di-oxide (SO_2)	CML/STACK/SOP/05	BDL (DL: 3.0)	mg/Nm^3
03	Oxides of Nitrogen (NOx)		162	mg/Nm^3
05	Carbon Monoxide as CO		76	mg/Nm^3
06	Carbon dioxide as CO_2		7.2	%
07	Oxygen as O_2		11.9	%

Note: Instrument ID.No: CML/ENV/SMK/07
As per CPCB Norms Concentration of Particulate matter Standards are

Steam generation capacity (ton/hour)	Maximum Limits (mg/Nm^3)
less than 2	1200
2 to less than 10	800
10 to less than 15	600
15 and above	150

End of Report

For Chennai Mettex Lab Private Limited,

Reviewed & Authorized By

P. KAVITHA
Technical Manager
Authorised Signatory

E-mail : test@mettexlab.com
Web : www.mettexlab.com

Phone : 044-22323163, 22311034
42179490, 42179491

CHENNAI METTEX LAB PRIVATE LIMITED®

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.

TC-5589

TEST REPORT

ISSUED TO : M/s. Solara Active Pharma Sciences Ltd,
Periyakalapet,
Puducherry – 605 014.

T.C Date :04.02.2023

T.C No :CML/22-23/74464

Party's Ref : SRF Date: 26.01.2023

Date of Receipt: 28.01.2023

Lab No :2383051

Test Completed on: 04.02.2023

Sample Description: Stack Emission – D.G- 1010 KVA Caterpillar
(as stated by customer)

Date of Sampling: 24.01.2023

Sampling Plan & Procedure: CML/STACK/SOP/08 **Discipline / Group:** Chemical / Atmospheric Pollution

Sl. No.	Stack Details		Unit
01	Stack Diameter	25	cm
02	Temperature	318	°C
03	Velocity	27.9	m/sec
04	Volume of Gas Discharged	2489	Nm^3/hr

Sl. No.	Test Parameters	Test Method	Results	CPCB Norms	Unit
01	Particulate Matter	IS 11255 Part 1-1985 (RA:2019)	60.1	75	mg/Nm^3
02	Sulphur-di-oxide (SO_2)	CML/STACK/SOP/05	BDL (DL: 3.0)	--	ppmv
03	Oxides of Nitrogen (NOx)		325	710	ppmv
04	Non-Methane Hydrocarbon	CML/STACK/SOP/06	84	100	mg/Nm^3
05	Carbon Monoxide as CO	CML/STACK/SOP/05	145	150	mg/Nm^3
06	Carbon dioxide as CO_2		7.1	--	%
07	Oxygen as O_2		11.6	--	%

Note: Instrument ID.No: CML/ENV/SMK/07

End of Report

For Chennai Mettex Lab Private Limited,

Reviewed & Authorized By

P. KAVITHA
Technical Manager
Authorised Signatory

E-mail : test@mettexlab.com
Web : www.mettexlab.com

Phone : 044-22323163, 22311034
42179490, 42179491

CHENNAI METTEX LAB PRIVATE LIMITED

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.

TC-5589

TEST REPORT

ISSUED TO : M/s. Solara Active Pharma Sciences Ltd,
Periyakalapet,
Puducherry – 605 014.

T.C Date : 04.02.2023

T.C No : CML/22-23/74465

Party's Ref : SRF Date: 26.01.2023

Date of Receipt: 28.01.2023

Lab No : 2383052

Test Completed on: 04.02.2023

Sample Description: Stack Emission – D.G- 1500 KVA Caterpillar
(as stated by customer)

Date of Sampling: 25.01.2023

Sampling Plan & Procedure: CML/STACK/SOP/08 **Discipline / Group:** Chemical / Atmospheric Pollution

Sl. No.	Stack Details	Chimney-1	Chimney-2	Unit
01	Stack Diameter	25	25	cm
02	Temperature	342	342	°C
03	Velocity	24.5	24.0	m/sec
04	Volume of Gas Discharged	2099	2058	Nm^3/hr

Sl. No.	Test Parameters	Test Method	Results	CPCB Norms	Unit
01	Particulate Matter	IS 11255 Part 1-1985 (RA:2019)	61.5	75	mg/Nm^3
02	Sulphur-di-oxide (SO_2)	CML/STACK/SOP/05	BDL (DL: 3.0)	--	ppmv
03	Oxides of Nitrogen (NOx)		363	710	ppmv
04	Non-Methane Hydrocarbon	CML/STACK/SOP/06	91	100	mg/Nm^3
05	Carbon Monoxide as CO	CML/STACK/SOP/05	147	150	mg/Nm^3
06	Carbon dioxide as CO_2		7.4	--	%
07	Oxygen as O_2		10.8	--	%

Note: Instrument ID.No: CML/ENV/SMK/07

End of Report

For Chennai Mettex Lab Private Limited,

Reviewed & Authorized By
P. KAVITHA
Technical Manager
Authorised Signatory

E-mail : test@mettexlab.com
Web : www.mettexlab.com

Phone : 044-22323163, 22311034
42179490, 42179491

CHENNAI METTEX LAB PRIVATE LIMITED®

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.

TC-5569

TEST REPORT

ISSUED TO : M/s. Solara Active Pharma Sciences Ltd,
Periyakalapet,
Puducherry – 605 014.

T.C Date : 04.02.2023

T.C No : CML/22-23/74466

Party's Ref : SRF Date: 26.01.2023

Date of Receipt: 28.01.2023

Lab No : 2383053

Test Completed on: 04.02.2023

Sample Description: Stack Emission – D.G- 1010 KVA Cummins
(as stated by customer)

Date of Sampling: 25.01.2023

Sampling Plan & Procedure: CML/STACK/SOP/08 **Discipline / Group:** Chemical / Atmospheric Pollution

Sl. No.	Stack Details	Chimney-1	Chimney-2	Unit
01	Stack Diameter	25	25	cm
02	Temperature	317	317	°C
03	Velocity	24.0	24.2	m/sec
04	Volume of Gas Discharged	2143	2157	Nm^3/hr

Sl. No.	Test Parameters	Test Method	Results	CPCB Norms	Unit
01	Particulate Matter	IS 11255 Part 1-1985 (RA:2019)	50.4	75	mg/Nm^3
02	Sulphur-di-oxide (SO_2)	CML/STACK/SOP/05	BDL (DL: 3.0)	--	ppmv
03	Oxides of Nitrogen (NOx)		285	710	ppmv
04	Non-Methane Hydrocarbon	CML/STACK/SOP/06	69	100	mg/Nm^3
05	Carbon Monoxide as CO	CML/STACK/SOP/05	136	150	mg/Nm^3
06	Carbon dioxide as CO_2		7.8	--	%
07	Oxygen as O_2		11.3	--	%

Note: Instrument ID.No: CML/ENV/SMK/07

---------- *End of Report* ----------

For Chennai Mettex Lab Private Limited,

Reviewed & Authorized By
P. KAVITHA
Technical Manager
Authorised Signatory

E-mail : test@mettexlab.com
Web : www.mettexlab.com

Phone : 044-22323163, 22311034
42179490, 42179491

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Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.

TC-5589

TEST REPORT

ISSUED TO : M/s. Solara Active Pharma Sciences Ltd,
Periyakalapet,
Puducherry – 605 014.

T.C Date : 04.02.2023

T.C No : CML/22-23/74467

Party's Ref : Letter Date

Date of Receipt: 28.01.2023

Lab No : 2383054

Test Completed on: 04.02.2023

Sample Description: Stack Emission – D.G- 1500 KVA Cummins
(as stated by customer)

Date of Sampling: 25.01.2023

Sampling Plan & Procedure: CML/STACK/SOP/08 **Discipline / Group:** Chemical / Atmospheric Pollution

Sl. No.	Stack Details		Chimney-1	Chimney-2	Unit
01	Stack Diameter		25	25	cm
02	Temperature		337	337	°C
03	Velocity		26.0	26.1	m/sec
04	Volume of Gas Discharged		2241	2253	Nm^3/hr
Sl. No.	**Test Parameters**	**Test Method**	**Results**	**CPCB Norms**	**Unit**
01	Particulate Matter	IS 11255 Part 1-1985 (RA:2019)	65.8	75	mg/Nm^3
02	Sulphur-di-oxide (SO_2)	CML/STACK/SOP/05	BDL (DL: 3.0)	–	ppmv
03	Oxides of Nitrogen (NOx)		347	710	ppmv
04	Non-Methane Hydrocarbon	CML/STACK/SOP/06	82	100	mg/Nm^3
05	Carbon Monoxide as CO	CML/STACK/SOP/05	142	150	mg/Nm^3
06	Carbon dioxide as CO_2		8.1	--	%
07	Oxygen as O_2		9.8	--	%

Note: Instrument ID.No: CML/ENV/SMK/07

End of Report

For Chennai Mettex Lab Private Limited,

Reviewed & Authorized By

P. KAVITHA
Technical Manager
Authorised Signatory

E-mail : test@mettexlab.com
Web : www.mettexlab.com
Phone : 044-22323163, 22311034
42179490, 42179491

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TEST REPORT

ISSUED TO : M/s. Solara Active Pharma Sciences Ltd,
Periyakalapet,
Puducherry – 605014.

T.C Date : 07.03.2023

T.C No : CML/22-23/83321

Party's Ref : SRF Date: 26.02.2023

Date of Receipt: 26.02.2023

Lab No : 2392340

Test Completed on: 04.03.2023

Sample Description: AAQ Monitoring – Location: Near ETP Area
(as stated by customer)

Date of Sampling: 25.02.2023– 10.15 am to 26.02.2023– 10.15 am

Ambient Temperature: Min. 27 °C & Max. 33 °C **Relative Humidity:** Min. 48 % & Max. 89 %

Discipline / Group: Chemical / Atmospheric Pollution

S.No.	Test Parameters	Protocol	Results	CPCB Standards	Unit
01.	Sulphur dioxide as SO_2	IS: 5182 Part 2:2001 (Reaff.2017)	11.8	80	μg/m³
02.	Nitrogen Dioxide as NO_2	IS: 5182 Part 6:2006 (Reaff.2017)	13.9	80	μg/m³
03.	Particulate Matter (PM_{10}) (Size Less than 10 μm)	IS: 5182 Part 23:2006 (Reaff.2017)	49.5	100	μg/m³
04.	Particulate Matter ($PM_{2.5}$) (Size Less than 2.5 μm)	IS: 5182 Part 24 : 2019	22.7	60	μg/m³
05.	Ozone as O_3	IS: 5182 Part IX:1974 (Reaff.2019)	25.8	180	μg/m³
06.	Lead as Pb	USEPA Compendium Method IO-3.4;1999	BDL(DL:0.1)	1.0	μg/m³
07.	Carbon Monoxide as CO	CML/AIR/SOP/005	BDL(DL:1.0)	4.0	mg/m³
08.	Ammonia as NH_3	IS: 5182 Part 25 : 2018	26.8	400	μg/m³
09.	Benzene	IS: 5182 Part 11:2006 (Reaff.2017)	BDL (DL:1.0)	5.0	μg/m³
10.	Benzo (α) Pyrene	IS: 5182 Part 12:2004 (Reaff.2019)	BDL (DL:0.1)	1.0	ng/m³
11.	Arsenic as As	USEPA Compendium Method IO-3.4;1999	BDL (DL:1.0)	6.0	ng/m³
12.	Nickel as Ni		BDL (DL:1.0)	20	ng/m³
Instrument No: CML/ENV/RDS- 07, CML/ENV/FDS- 02; BDL: Below Detection Limit. DL: Detection Limit.					

End of Report

For Chennai Mettex Lab Private Limited,

Reviewed & Authorized By

P. KAVITHA
Technical Manager
Authorised Signatory

E-mail : test@mettexlab.com
Web : www.mettexlab.com

Phone : 044-22323163, 22311034
42179490, 42179491

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Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.

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TEST REPORT

ISSUED TO : M/s. Solara Active Pharma Sciences Ltd,
Periyakalapet,
Puducherry – 605 014.

T.C Date : 07.03.2023

T.C No : CML/22-23/83322

Party's Ref : SRF Date: 26.02.2023

Date of Receipt: 26.02.2023

Lab No :2392341

Test Completed on: 04.03.2023

Sample Description: AAQ Monitoring – Location: In-front of IPU Plant Area
(as stated by customer)

Date of Sampling: 25.02.2023– 10.45 am to 26.02.2023– 10.45 am

Ambient Temperature: Min. 27 °C & Max. 33 °C **Relative Humidity:** Min. 48 % & Max. 89 %

Discipline / Group: Chemical / Atmospheric Pollution

S.No.	Test Parameters	Protocol	Results	CPCB Standards	Unit
01.	Sulphur dioxide as SO_2	IS: 5182 Part 2:2001 (Reaff.2017)	12.6	80	µg/m³
02.	Nitrogen Dioxide as NO_2	IS: 5182 Part 6:2006 (Reaff.2017)	14.4	80	µg/m³
03.	Particulate Matter (PM_{10}) (Size Less than 10 µm)	IS: 5182 Part 23:2006 (Reaff.2017)	57.3	100	µg/m³
04.	Particulate Matter ($PM_{2.5}$) (Size Less than 2.5 µm)	IS: 5182 Part 24 : 2019	28.4	60	µg/m³
05.	Ozone as O_3	IS: 5182 Part IX:1974 (Reaff.2019)	24.9	180	µg/m³
06.	Lead as Pb	USEPA Compendium Method IO-3.4;1999	BDL(DL:0.1)	1.0	µg/m³
07.	Carbon Monoxide as CO	CML/AIR/SOP/005	BDL(DL:1.0)	4.0	mg/m³
08.	Ammonia as NH_3	IS: 5182 Part 25 : 2018	29.1	400	µg/m³
09.	Benzene	IS: 5182 Part 11:2006 (Reaff.2017)	BDL (D:1.0)	5.0	µg/m³
10.	Benzo (α) Pyrene	IS: 5182 Part 12:2004 (Reaff.2019)	BDL (DL:0.1)	1.0	ng/m³
11.	Arsenic as As	USEPA Compendium Method IO-3.4;1999	BDL (DL:1.0)	6.0	ng/m³
12.	Nickel as Ni		BDL (DL:1.0)	20	ng/m³

Instrument No: CML/ENV/RDS- 09, CML/ENV/FDS- 01; BDL: Below Detection Limit. DL: Detection Limit.

End of Report

For Chennai Mettex Lab Private Limited,

Reviewed & Authorized By

P. KAVITHA
Technical Manager
Authorised Signatory

E-mail : test@mettexlab.com
Web : www.mettexlab.com

Phone : 044-22323163, 22311034
42179490, 42179491

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TEST REPORT

ISSUED TO : M/s. Solara Active Pharma Sciences Ltd,
Periyakalapet,
Puducherry – 605 014.

T.C Date : 07.03.2023

T.C No : CML/22-23/83323

Party's Ref : SRF Date: 26.02.2023

Date of Receipt: 26.02.2023

Lab No :2392342

Test Completed on: 04.03.2023

Sample Description: AAQ Monitoring – Location: Near Aldehyde Plant
(as stated by customer)

Date of Sampling: 25.02.2023– 11.00 am to 26.02.2023– 11.00 am

Ambient Temperature: Min. 27 °C & Max. 33 °C **Relative Humidity:** Min. 48 % & Max. 89 %

Discipline / Group: Chemical / Atmospheric Pollution

S.No.	Test Parameters	Protocol	Results	CPCB Standards	Unit
01.	Sulphur dioxide as SO_2	IS: 5182 Part 2:2001 (Reaff.2017)	12.2	80	µg/m³
02.	Nitrogen Dioxide as NO_2	IS: 5182 Part 6:2006 (Reaff.2017)	14.5	80	µg/m³
03.	Particulate Matter (PM_{10}) (Size Less than 10 µm)	IS: 5182 Part 23:2006 (Reaff.2017)	59.3	100	µg/m³
04.	Particulate Matter ($PM_{2.5}$) (Size Less than 2.5 µm)	IS: 5182 Part 24 : 2019	28.1	60	µg/m³
05.	Ozone as O_3	IS: 5182 Part IX:1974 (Reaff.2019)	24.5	180	µg/m³
06.	Lead as Pb	USEPA Compendium Method IO-3.4;1999	BDL(DL:0.1)	1.0	µg/m³
07.	Carbon Monoxide as CO	CML/AIR/SOP/005	BDL (DL:1.0)	4.0	mg/m³
08.	Ammonia as NH_3	IS: 5182 Part 25 : 2018	27.8	400	µg/m³
09.	Benzene	IS: 5182 Part 11:2006 (Reaff.2017)	BDL (DL:1.0)	5.0	µg/m³
10.	Benzo (α) Pyrene	IS: 5182 Part 12:2004 (Reaff.2019)	BDL (DL:0.1)	1.0	ng/m³
11.	Arsenic as As	USEPA Compendium Method IO-3.4;1999	BDL (DL:1.0)	6.0	ng/m³
12.	Nickel as Ni		BDL (DL:1.0)	20	ng/m³

Instrument No: CML/ENV/RDS- 03, CML/ENV/FDS- 05; BDL: Below Detection Limit. DL: Detection Limit.

End of Report

For Chennai Mettex Lab Private Limited,

Reviewed & Authorized By

P. KAVITHA
Technical Manager
Authorised Signatory

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E-mail : test@mettexlab.com
Web : www.mettexlab.com

Phone : 044-22323163, 22311034
42179490, 42179491

CHENNAI METTEX LAB PRIVATE LIMITED®

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.

TC-5589

TEST REPORT

ISSUED TO : M/s. Solara Active Pharma Sciences Ltd,
Periyakalapet,
Puducherry – 605 014.

T.C Date : 07.03.2023

T.C No : CML/22-23/83324

Party's Ref : SRF Date: 26.02.2023

Date of Receipt: 26.02.2023

Lab No : 2392344

Test Completed on: 04.03.2023

Sample Description: Stack Emission – Boiler- 16 Ton (Load- 10500 kg/h)
(as stated by customer)

Date of Sampling: 25.02.2023

Sampling Plan & Procedure: CML/STACK/SOP/08 **Discipline / Group:** Chemical / Atmospheric Pollution

Sl. No.	Stack Details	
01	Diameter	1.5 m
02	Temperature	135 °C
03	Velocity	9.0 m/sec
04	Volume of Gas Discharged	42049 Nm^3/hr

Sl. No.	Test Parameters	Test Method	Results	Unit
01	Particulate Matter	IS 11255 Part 1-1985 (RA:2019)	135.6	mg/Nm^3
02	Sulphur-di-oxide (SO_2)	CML/STACK/SOP/05	BDL (DL: 3.0)	mg/Nm^3
03	Oxides of Nitrogen (NOx)		218	mg/Nm^3
05	Carbon Monoxide as CO		116	mg/Nm^3
06	Carbon dioxide as CO_2		8.9	%
07	Oxygen as O_2		11.6	%

Note: Instrument ID.No: CML/ENV/SMK/07
As per CPCB Norms Concentration of Particulate matter Standards are

Steam generation capacity (ton/hour)	Maximum Limits (mg/Nm^3)
less than 2	1200
2 to less than 10	800
10 to less than 15	600
15 and above	150

End of Report

For Chennai Mettex Lab Private Limited,

Reviewed & Authorized By

P. KAVITHA
Technical Manager
Authorised Signatory

E-mail : test@mettexlab.com
Web : www.mettexlab.com

Phone : 044-22323163, 22311034
42179490, 42179491

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Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.

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TEST REPORT

ISSUED TO : M/s. Solara Active Pharma Sciences Ltd,
Periyakalapet,
Puducherry – 605 014.

T.C Date : 07.03.2023

T.C No : CML/22-23/83325

Party's Ref : SRF Date: 26.02.2023

Date of Receipt: 26.02.2023

Lab No : 2392345

Test Completed on: 04.03.2023

Sample Description: Stack Emission – D.G- 1010 KVA Caterpillar
(as stated by customer)

Date of Sampling: 25.02.2023

Sampling Plan & Procedure: CML/STACK/SOP/08 **Discipline / Group:** Chemical / Atmospheric Pollution

Sl. No.	Stack Details		Unit
01	Stack Diameter	25	cm
02	Temperature	327	°C
03	Velocity	29.5	m/sec
04	Volume of Gas Discharged	2586	Nm^3/hr

Sl. No.	Test Parameters	Test Method	Results	CPCB Norms	Unit
01	Particulate Matter	IS 11255 Part 1-1985 (RA:2019)	61.4	75	mg/Nm^3
02	Sulphur-di-oxide (SO_2)	CML/STACK/SOP/05	BDL (DL: 3.0)	--	ppmv
03	Oxides of Nitrogen (NOx)		317	710	ppmv
04	Non-Methane Hydrocarbon		73	100	mg/Nm^3
05	Carbon Monoxide as CO		137	150	mg/Nm^3
06	Carbon dioxide as CO_2		7.4	--	%
07	Oxygen as O_2		11.2	--	%

Note: Instrument ID.No: CML/ENV/SMK/07

End of Report

For Chennai Mettex Lab Private Limited,

Reviewed & Authorized By

P. KAVITHA
Technical Manager
Authorised Signatory

E-mail : test@mettexlab.com
Web : www.mettexlab.com

Phone : 044-22323163, 22311034
42179490, 42179491

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Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.

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TEST REPORT

ISSUED TO : M/s. Solara Active Pharma Sciences Ltd,
Periyakalapet,
Puducherry – 605 014.

T.C Date : 07.03.2023

T.C No : CML/22-23/83326

Party's Ref : SRF Date: 26.02.2023

Date of Receipt: 26.02.2023

Lab No :2392346

Test Completed on: 04.03.2023

Sample Description: Stack Emission – D.G- 1500 KVA Caterpillar
(as stated by customer)

Date of Sampling: 25.02.2023

Sampling Plan & Procedure: CML/STACK/SOP/08 **Discipline / Group:** Chemical / Atmospheric Pollution

Sl. No.	Stack Details	Chimney-1	Chimney-2	Unit
01	Stack Diameter	25	25	cm
02	Temperature	357	357	°C
03	Velocity	24.2	23.8	m/sec
04	Volume of Gas Discharged	2020	1992	Nm^3/hr

Sl. No.	Test Parameters	Test Method	Results	CPCB Norms	Unit
01	Particulate Matter	IS 11255 Part 1-1985 (RA:2019)	64.1	75	mg/Nm^3
02	Sulphur-di-oxide (SO_2)	CML/STACK/SOP/05	BDL (DL: 3.0)	--	ppmv
03	Oxides of Nitrogen (NOx)		406	710	ppmv
04	Non-Methane Hydrocarbon		89	100	mg/Nm^3
05	Carbon Monoxide as CO		143	150	mg/Nm^3
06	Carbon dioxide as CO_2		7.9	--	%
07	Oxygen as O_2		10.8	--	%

Note: Instrument ID.No: CML/ENV/SMK/07

------------------------------ *End of Report* ------------------------------

For Chennai Mettex Lab Private Limited,

Reviewed & Authorized By

P. KAVITHA
Technical Manager
Authorised Signatory

E-mail : test@mettexlab.com
Web : www.mettexlab.com

Phone : 044-22323163, 22311034
42179490, 42179491

CHENNAI METTEX LAB PRIVATE LIMITED®

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.

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TEST REPORT

ISSUED TO : M/s. Solara Active Pharma Sciences Ltd,
Periyakalapet,
Puducherry – 605 014.

T.C Date : 07.03.2023

T.C No : CML/22-23/83327

Party's Ref : SRF Date: 26.02.2023

Date of Receipt: 26.02.2023

Lab No : 2392347

Test Completed on: 04.03.2023

Sample Description: Stack Emission – D.G- 1010 KVA Cummins
(as stated by customer)

Date of Sampling: 25.02.2023

Sampling Plan & Procedure: CML/STACK/SOP/08 **Discipline / Group:** Chemical / Atmospheric Pollution

Sl. No.	Stack Details	Chimney-1	Chimney-2	Unit
01	Stack Diameter	25	25	cm
02	Temperature	334	334	°C
03	Velocity	22.9	23.2	m/sec
04	Volume of Gas Discharged	1986	2015	Nm^3/hr

Sl. No.	Test Parameters	Test Method	Results	CPCB Norms	Unit
01	Particulate Matter	IS 11255 Part 1-1985 (RA:2019)	46.3	75	mg/Nm^3
02	Sulphur-di-oxide (SO_2)	CML/STACK/SOP/05	BDL (DL: 3.0)	--	ppmv
03	Oxides of Nitrogen (NOx)		310	710	ppmv
04	Non-Methane Hydrocarbon		76	100	mg/Nm^3
05	Carbon Monoxide as CO		129	150	mg/Nm^3
06	Carbon dioxide as CO_2		7.5	--	%
07	Oxygen as O_2		11.3	--	%

Note: Instrument ID.No: CML/ENV/SMK/07

End of Report

For Chennai Mettex Lab Private Limited,

Reviewed & Authorized By

P. KAVITHA
Technical Manager
Authorised Signatory

E-mail : test@mettexlab.com
Web : www.mettexlab.com

Phone : 044-22323163, 22311034
42179490, 42179491

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Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.

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TEST REPORT

ISSUED TO : M/s. Solara Active Pharma Sciences Ltd,
Periyakalapet,
Puducherry – 605 014.

T.C Date : 07.03.2023

T.C No : CML/22-23/83328

Party's Ref : SRF Date : 26.02.2023

Date of Receipt: 26.02.2023

Lab No :2392348

Test Completed on: 04.03.2023

Sample Description: Stack Emission – D.G- 1500 KVA Cummins
(as stated by customer)

Date of Sampling: 25.02.2023

Sampling Plan & Procedure: CML/STACK/SOP/08 **Discipline / Group:** Chemical / Atmospheric Pollution

Sl. No.	Stack Details	Chimney-1	Chimney-2	Unit
01	Stack Diameter	25	25	cm
02	Temperature	348	348	°C
03	Velocity	27.4	26.9	m/sec
04	Volume of Gas Discharged	2320	2284	Nm^3/hr

Sl. No.	Test Parameters	Test Method	Results	CPCB Norms	Unit
01	Particulate Matter	IS 11255 Part 1-1985 (RA:2019)	59.4	75	mg/Nm^3
02	Sulphur-di-oxide (SO_2)	CML/STACK/SOP/05	BDL (DL: 3.0)	--	ppmv
03	Oxides of Nitrogen (NOx)		339	710	ppmv
04	Non-Methane Hydrocarbon		87	100	mg/Nm^3
05	Carbon Monoxide as CO		139	150	mg/Nm^3
06	Carbon dioxide as CO_2		7.9	--	%
07	Oxygen as O_2		10.6	--	%

Note: Instrument ID.No: CML/ENV/SMK/07

End of Report

For Chennai Mettex Lab Private Limited,

Reviewed & Authorized By

P. KAVITHA
Technical Manager
Authorised Signatory

E-mail : test@mettexlab.com
Web : www.mettexlab.com

Phone : 044-22323163, 22311034
42179490, 42179491

CHENNAI METTEX LAB PRIVATE LIMITED®

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.

TC-5589

TEST REPORT

ISSUED TO : M/s. Solara Active Pharma Sciences Ltd,
Periyakalapet,
Puducherry – 605014.

T.C Date :22.03.2023

T.C No :CML/22-23/87824

Party's Ref : SRF Date:17.03.2023

Date of Receipt: 17.03.2023

Lab No : 2398724

Test Completed on:22.03.2023

Sample Description: Ambient Air Quality Monitoring – Location: Near ETP Area
(as stated by customer)

Date of Sampling: 16.03.2023– 10.30 am to 17.03.2023– 10.30 am

Ambient Temperature: Min. 28 °C & Max. 34 °C **Relative Humidity:** Min. 46 % & Max. 85 %

Discipline / Group: Chemical / Atmospheric Pollution

S.No.	Test Parameters	Protocol	Results	CPCB Standards	Unit
01.	Sulphur dioxide as SO_2	IS: 5182 Part 2:2001 (Reaff.2017)	12.5	80	µg/m³
02.	Nitrogen Dioxide as NO_2	IS: 5182 Part 6:2006 (Reaff.2017)	14.3	80	µg/m³
03.	Particulate Matter (PM_{10}) (Size Less than 10 µm)	IS: 5182 Part 23:2006 (Reaff.2017)	52.8	100	µg/m³
04.	Particulate Matter ($PM_{2.5}$) (Size Less than 2.5 µm)	IS: 5182 Part 24 : 2019	24.6	60	µg/m³
05.	Ozone as O_3	IS: 5182 Part IX:1974 (Reaff.2019)	24.3	180	µg/m³
06.	Lead as Pb	USEPA Compendium Method IO-3.4;1999	BDL(DL:0.1)	1.0	µg/m³
07.	Carbon Monoxide as CO	CML/AIR/SOP/005	BDL(DL:1.0)	4.0	mg/m³
08.	Ammonia as NH_3	IS: 5182 Part 25 : 2018	28.4	400	µg/m³
09.	Benzene	IS: 5182 Part 11:2006 (Reaff.2017)	BDL (DL:1.0)	5.0	µg/m³
10.	Benzo (α) Pyrene	IS: 5182 Part 12:2004 (Reaff.2019)	BDL (DL:0.1)	1.0	ng/m³
11.	Arsenic as As	USEPA Compendium Method IO-3.4;1999	BDL (DL:1.0)	6.0	ng/m³
12.	Nickel as Ni		BDL (DL:1.0)	20	ng/m³
Instrument No: CML/ENV/RDS- 06, CML/ENV/FDS- 01; BDL: Below Detection Limit. DL: Detection Limit.					

End of Report

For Chennai Mettex Lab Private Limited,

Reviewed & Authorized By
P. KAVITHA
Technical Manager
Authorised Signatory

E-mail : test@mettexlab.com
Web : www.mettexlab.com

Phone : 044-22323163, 22311034
42179490, 42179491

CHENNAI METTEX LAB PRIVATE LIMITED®

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.

TC-5589

TEST REPORT

ISSUED TO : M/s. Solara Active Pharma Sciences Ltd,
Periyakalapet,
Puducherry – 605 014.

T.C Date :22.03.2023

T.C No :CML/22-23/87825

Party's Ref : SRF Date:17.03.2023

Date of Receipt: 17.03.2023

Lab No :2398725

Test Completed on:22.03.2023

Sample Description: Ambient Air Quality Monitoring – Location: In-front of IPU Plant Area
(as stated by customer)

Date of Sampling: 16.03.2023– 11.00 am to 17.03.2023– 11.00 am

Ambient Temperature: Min. 28 °C & Max. 34 °C **Relative Humidity:** Min. 46 % & Max. 85 %

Discipline / Group: Chemical / Atmospheric Pollution

S.No.	Test Parameters	Protocol	Results	CPCB Standards	Unit
01.	Sulphur dioxide as SO_2	IS: 5182 Part 2:2001 (Reaff.2017)	13.1	80	μg/m³
02.	Nitrogen Dioxide as NO_2	IS: 5182 Part 6:2006 (Reaff.2017)	15.3	80	μg/m³
03.	Particulate Matter (PM_{10}) (Size Less than 10 μm)	IS: 5182 Part 23:2006 (Reaff.2017)	61.7	100	μg/m³
04.	Particulate Matter ($PM_{2.5}$) (Size Less than 2.5 μm)	IS: 5182 Part 24 : 2019	29.3	60	μg/m³
05.	Ozone as O_3	IS: 5182 Part IX:1974 (Reaff.2019)	25.2	180	μg/m³
06.	Lead as Pb	USEPA Compendium Method IO-3.4;1999	BDL(DL:0.1)	1.0	μg/m³
07.	Carbon Monoxide as CO	CML/AIR/SOP/005	BDL(DL:1.0)	4.0	mg/m³
08.	Ammonia as NH_3	IS: 5182 Part 25 : 2018	31.6	400	μg/m³
09.	Benzene	IS: 5182 Part 11:2006 (Reaff.2017)	BDL (D:1.0)	5.0	μg/m³
10.	Benzo (α) Pyrene	IS: 5182 Part 12:2004 (Reaff.2019)	BDL (DL:0.1)	1.0	ng/m³
11.	Arsenic as As	USEPA Compendium Method IO-3.4;1999	BDL (DL:1.0)	6.0	ng/m³
12.	Nickel as Ni		BDL (DL:1.0)	20	ng/m³
Instrument No: CML/ENV/RDS- 07, CML/ENV/FDS- 05; BDL: Below Detection Limit. DL: Detection Limit.					

-End of Report-

For Chennai Mettex Lab Private Limited,

Reviewed & Authorized By
P. KAVITHA
Technical Manager
Authorised Signatory

E-mail : test@mettexlab.com
Web : www.mettexlab.com

Phone : 044-22323163, 22311034
42179490, 42179491

CHENNAI METTEX LAB PRIVATE LIMITED®

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.

TC-5589

TEST REPORT

ISSUED TO : M/s. Solara Active Pharma Sciences Ltd,
Periyakalapet,
Puducherry – 605 014.

T.C Date :22.03.2023

T.C No :CML/22-23/87826

Party's Ref : SRF Date:17.03.2023

Date of Receipt: 17.03.2023

Lab No : 2398726

Test Completed on:22.03.2023

Sample Description: Ambient Air Quality Monitoring – Location: Near Aldehyde Plant
(as stated by customer)

Date of Sampling: 16.03.2023– 11.15 am to 17.03.2023– 11.15 am

Ambient Temperature: Min. 28 °C & Max. 34 °C **Relative Humidity:** Min. 46 % & Max. 85 %

Discipline / Group: Chemical / Atmospheric Pollution

S.No.	Test Parameters	Protocol	Results	CPCB Standards	Unit
01.	Sulphur dioxide as SO_2	IS: 5182 Part 2:2001 (Reaff.2017)	12.9	80	µg/m³
02.	Nitrogen Dioxide as NO_2	IS: 5182 Part 6:2006 (Reaff.2017)	15.1	80	µg/m³
03.	Particulate Matter (PM_{10}) (Size Less than 10 µm)	IS: 5182 Part 23:2006 (Reaff.2017)	60.5	100	µg/m³
04.	Particulate Matter ($PM_{2.5}$) (Size Less than 2.5 µm)	IS: 5182 Part 24 : 2019	27.4	60	µg/m³
05.	Ozone as O_3	IS: 5182 Part IX:1974 (Reaff.2019)	24.6	180	µg/m³
06.	Lead as Pb	USEPA Compendium Method IO-3.4;1999	BDL(DL:0.1)	1.0	µg/m³
07.	Carbon Monoxide as CO	CML/AIR/SOP/005	BDL (DL:1.0)	4.0	mg/m³
08.	Ammonia as NH_3	IS: 5182 Part 25 : 2018	29.1	400	µg/m³
09.	Benzene	IS: 5182 Part 11:2006 (Reaff.2017)	BDL (DL:1.0)	5.0	µg/m³
10.	Benzo (α) Pyrene	IS: 5182 Part 12:2004 (Reaff.2019)	BDL (DL:0.1)	1.0	ng/m³
11.	Arsenic as As	USEPA Compendium Method IO-3.4;1999	BDL (DL:1.0)	6.0	ng/m³
12.	Nickel as Ni		BDL (DL:1.0)	20	ng/m³
Instrument No: CML/ENV/RDS- 02, CML/ENV/FDS- 10; BDL: Below Detection Limit. DL: Detection Limit.					

End of Report

For Chennai Mettex Lab Private Limited,

Reviewed & Authorized By
P. KAVITHA
Technical Manager
Authorised Signatory

E-mail : test@mettexlab.com
Web : www.mettexlab.com

Phone : 044-22323163, 22311034
42179490, 42179491

CHENNAI METTEX LAB PRIVATE LIMITED®

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.

TC-5589

TEST REPORT

ISSUED TO : M/s. Solara Active Pharma Sciences Ltd,
Periyakalapet,
Puducherry – 605 014.

T.C Date :22.03.2023

T.C No :CML/22-23/87827

Party's Ref : SRF Date:17.03.2023

Date of Receipt: 17.03.2023

Lab No : 2398727

Test Completed on:22.03.2023

Sample Description: Stack Emission – Boiler- 16 Ton (Load- 9500 kg/h)
(as stated by customer)

Date of Sampling: 16.03.2023 **Sampling Plan & Procedure:** CML/STACK/SOP/08

Discipline / Group: Chemical / Atmospheric Pollution

Sl. No.	Stack Details	
01	Diameter	1.5 m
02	Temperature	130 °C
03	Velocity	9.5 m/sec
04	Volume of Gas Discharged	44207 Nm^3/hr

Sl. No.	Test Parameters	Test Method	Results	Unit
01	Particulate Matter	IS 11255 Part 1-1985 (RA:2019)	138.7	mg/Nm^3
02	Sulphur-di-oxide (SO_2)	CML/STACK/SOP/06	BDL (DL: 3.0)	mg/Nm^3
03	Oxides of Nitrogen (NOx)		286	mg/Nm^3
05	Carbon Monoxide as CO		123	mg/Nm^3
06	Carbon dioxide as CO_2		7.8	%
07	Oxygen as O_2		12.3	%

Note: Instrument ID.No: CML/ENV/SMK/07
As per CPCB Norms Concentration of Particulate matter Standards are

Steam generation capacity (ton/hour)	Maximum Limits (mg/Nm^3)
less than 2	1200
2 to less than 10	800
10 to less than 15	600
15 and above	150

End of Report

For Chennai Mettex Lab Private Limited,

Reviewed & Authorized By
P. KAVITHA
Technical Manager
Authorised Signatory

E-mail : test@mettexlab.com
Web : www.mettexlab.com

Phone : 044-22323163, 22311034
42179490, 42179491

CHENNAI METTEX LAB PRIVATE LIMITED®

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.

TC-5589

TEST REPORT

ISSUED TO : M/s. Solara Active Pharma Sciences Ltd,
Periyakalapet,
Puducherry – 605 014.

T.C Date :22.03.2023

T.C No :CML/22-23/87828

Party's Ref : SRF Date:17.03.2023

Date of Receipt: 17.03.2023

Lab No : 2398728

Test Completed on:22.03.2023

Sample Description: Stack Emission – D.G- 1010 KVA Caterpillar
(as stated by customer)

Date of Sampling: 16.03.2023

Sampling Plan & Procedure: CML/STACK/SOP/08 **Discipline / Group:** Chemical / Atmospheric Pollution

Sl. No.	Stack Details		Unit
01	Stack Diameter	25	cm
02	Temperature	318	°C
03	Velocity	30.9	m/sec
04	Volume of Gas Discharged	2736	Nm^3/hr

Sl. No.	Test Parameters	Test Method	Results	CPCB Norms	Unit
01	Particulate Matter	IS 11255 Part 1-1985 (RA:2019)	56.3	75	mg/Nm^3
02	Sulphur-di-oxide (SO_2)	CML/STACK/SOP/06	BDL (DL: 3.0)	--	ppmv
03	Oxides of Nitrogen (NOx)		368	710	ppmv
04	Non-Methane Hydrocarbon		59	100	mg/Nm^3
05	Carbon Monoxide as CO		113	150	mg/Nm^3
06	Carbon dioxide as CO_2		7	--	%
07	Oxygen as O_2		11.5	--	%

Note: Instrument ID.No: CML/ENV/SMK/07

End of Report

For Chennai Mettex Lab Private Limited,

Reviewed & Authorized By
P. KAVITHA
Technical Manager
Authorised Signatory

E-mail : test@mettexlab.com
Web : www.mettexlab.com

Phone : 044-22323163, 22311034
42179490, 42179491

CHENNAI METTEX LAB PRIVATE LIMITED

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.

TC-5589

TEST REPORT

ISSUED TO : M/s. Solara Active Pharma Sciences Ltd,
Periyakalapet,
Puducherry – 605 014.

T.C Date : 22.03.2023

T.C No : CML/22-23/87829

Party's Ref : SRF Date: 17.03.2023
Lab No : 2398729

Date of Receipt: 17.03.2023
Test Completed on: 22.03.2023

Sample Description: Stack Emission – D.G- 1500 KVA Caterpillar
(as stated by customer)

Date of Sampling: 17.03.2023 **Sampling Plan & Procedure:** CML/STACK/SOP/08

Discipline / Group: Chemical / Atmospheric Pollution

Sl. No.	Stack Details	Chimney-1	Chimney-2	Unit
01	Stack Diameter	25	25	cm
02	Temperature	352	352	°C
03	Velocity	25.1	24.5	m/sec
04	Volume of Gas Discharged	2104	2048	Nm^3/hr

Sl. No.	Test Parameters	Test Method	Results	CPCB Norms	Unit
01	Particulate Matter	IS 11255 Part 1-1985 (RA:2019)	56.9	75	mg/Nm^3
02	Sulphur-di-oxide (SO_2)	CML/STACK/SOP/06	BDL (DL: 3.0)	--	ppmv
03	Oxides of Nitrogen (NOx)		405	710	ppmv
04	Non-Methane Hydrocarbon		92	100	mg/Nm^3
05	Carbon Monoxide as CO		110	150	mg/Nm^3
06	Carbon dioxide as CO_2		8.1	--	%
07	Oxygen as O_2		10.2	--	%

Note: Instrument ID.No: CML/ENV/SMK/07

End of Report

For Chennai Mettex Lab Private Limited,

Reviewed & Authorized By

P. KAVITHA
Technical Manager
Authorised Signatory

E-mail : test@mettexlab.com
Web : www.mettexlab.com
Phone : 044-22323163, 22311034
42179490, 42179491

CHENNAI METTEX LAB PRIVATE LIMITED®

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.

TC-5589

TEST REPORT

ISSUED TO : M/s. Solara Active Pharma Sciences Ltd,
Periyakalapet,
Puducherry – 605 014.

T.C Date :22.03.2023

T.C No :CML/22-23/87830

Party's Ref : SRF Date:17.03.2023

Date of Receipt: 17.03.2023

Lab No :2398730

Test Completed on:22.03.2023

Sample Description: Stack Emission – D.G- 1010 KVA Cummins
(as stated by customer)

Date of Sampling: 17.03.2023 **Sampling Plan & Procedure:** CML/STACK/SOP/08

Discipline / Group: Chemical / Atmospheric Pollution

Sl. No.	Stack Details		Chimney-1	Chimney-2	Unit
01	Stack Diameter		25	25	cm
02	Temperature		307	307	°C
03	Velocity		22.1	22.4	m/sec
04	Volume of Gas Discharged		1993	2024	Nm^3/hr
Sl. No.	**Test Parameters**	**Test Method**	**Results**	**CPCB Norms**	**Unit**
01	Particulate Matter	IS 11255 Part 1-1985(RA:2019)	53.8	75	mg/Nm^3
02	Sulphur-di-oxide (SO_2)	CML/STACK/SOP/06	BDL (DL: 3.0)	--	ppmv
03	Oxides of Nitrogen (NOx)		332	710	ppmv
04	Non-Methane Hydrocarbon		75	100	mg/Nm^3
05	Carbon Monoxide as CO		120	150	mg/Nm^3
06	Carbon dioxide as CO_2		6.9	--	%
07	Oxygen as O_2		11.7	--	%
Note: Instrument ID.No: CML/ENV/SMK/07					

--- *End of Report* ---

For Chennai Mettex Lab Private Limited,

Reviewed & Authorized By

P. KAVITHA
Technical Manager
Authorised Signatory

E-mail : test@mettexlab.com
Web : www.mettexlab.com
Phone : 044-22323163, 22311034
42179490, 42179491

CHENNAI METTEX LAB PRIVATE LIMITED®

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.

TC-5589

TEST REPORT

ISSUED TO : M/s. Solara Active Pharma Sciences Ltd,
Periyakalapet,
Puducherry – 605 014.

T.C Date :22.03.2023

T.C No :CML/22-23/87831

Party's Ref : SRF Date : 17.03.2023

Date of Receipt: 17.03.2023

Lab No : 2398731

Test Completed on:22.03.2023

Sample Description: Stack Emission – D.G- 1500 KVA Cummins
(as stated by customer)

Date of Sampling: 17.03.2023

Sampling Plan & Procedure: CML/STACK/SOP/08

Discipline / Group: Chemical / Atmospheric Pollution

Sl. No.	Stack Details	Chimney-1	Chimney-2	Unit
01	Stack Diameter	25	25	cm
02	Temperature	347	347	°C
03	Velocity	24.7	25.2	m/sec
04	Volume of Gas Discharged	2084	2126	Nm^3/hr

Sl. No.	Test Parameters	Test Method	Results	CPCB Norms	Unit
01	Particulate Matter	IS 11255 Part 1-1985 (RA:2019)	51.9	75	mg/Nm^3
02	Sulphur-di-oxide (SO_2)	CML/STACK/SOP/06	BDL (DL: 3.0)	--	ppmv
03	Oxides of Nitrogen (NOx)		405	710	ppmv
04	Non-Methane Hydrocarbon		90	100	mg/Nm^3
05	Carbon Monoxide as CO		108	150	mg/Nm^3
06	Carbon dioxide as CO_2		8	--	%
07	Oxygen as O_2		10.5	--	%

Note: Instrument ID.No: CML/ENV/SMK/07

End of Report

For Chennai Mettex Lab Private Limited,

Reviewed & Authorized By
P. KAVITHA
Technical Manager
Authorised Signatory

Communication Address :
Solara Active Pharma Sciences Limited
R.S.No. 33 & 34.
Mathur Road, Periyakalapet
Puducherry - 605 014. india
Tel: +91 413 2654100. Fax: +91 413 2655154

Date: 08.11.2022

To

The Member Secretary,
Pondicherry Pollution Control Committee,
Puducherry -605 005

Respected sir,

Sub: Submission of On Line Monitoring Reports – Reg

Please find the enclosed copy of On Line Monitoring reports of **OCTOBER' -2022.**
Please acknowledge the same.

Thanking you,

For Solara active pharma sciences Limited.,

M. Mohan
Chief Operations Officer

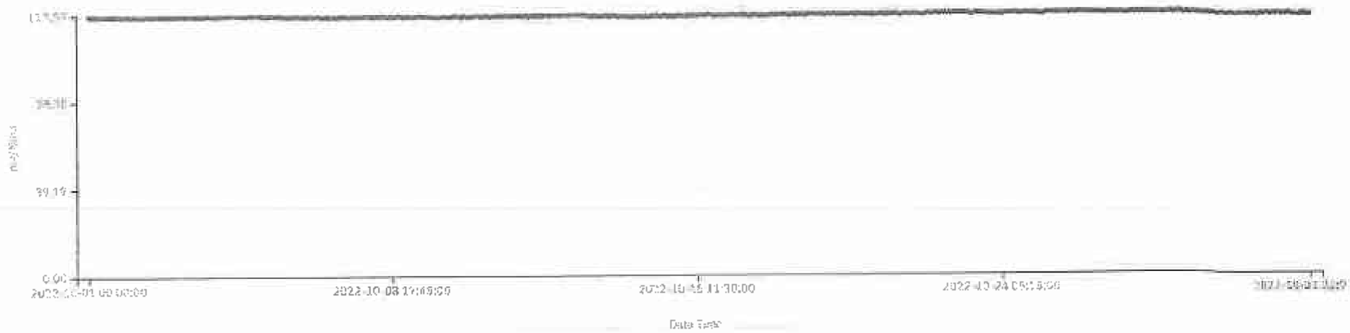
DEPARTMENT OF SCIENCE TECHNOLOGY AND ENVIRONMENT
RECEIVED
DATE

YOKOGAWA
Yokogawa India Ltd.

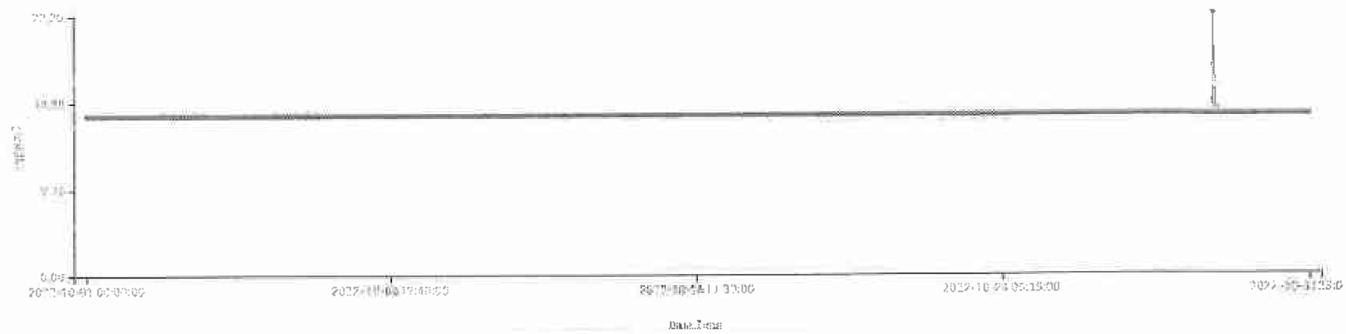
Custom Report

SiteName: M/s Solara Active Pharma Sciences Limited, Formerly Known as M/s Strides Shasun Limited)

Created by: Ssl_API, Created On: 08/11/2022



STACK_3_16_TPH_Briquette_Boiler-PM_Raw



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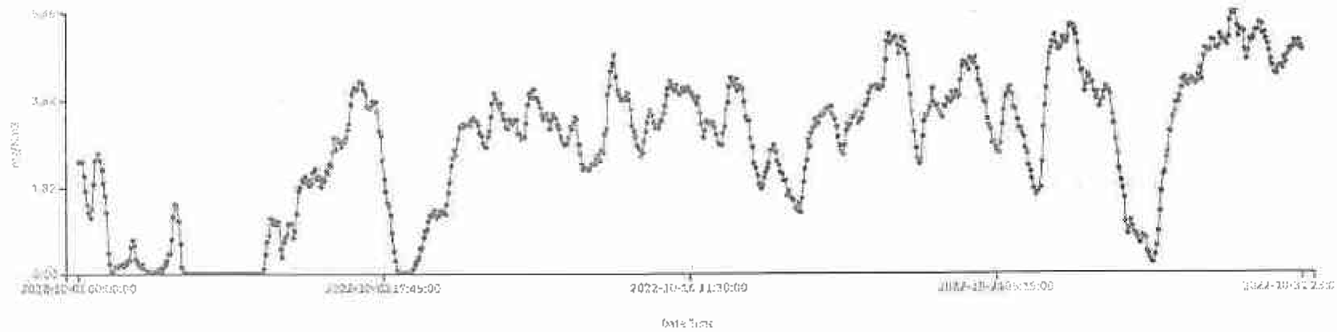

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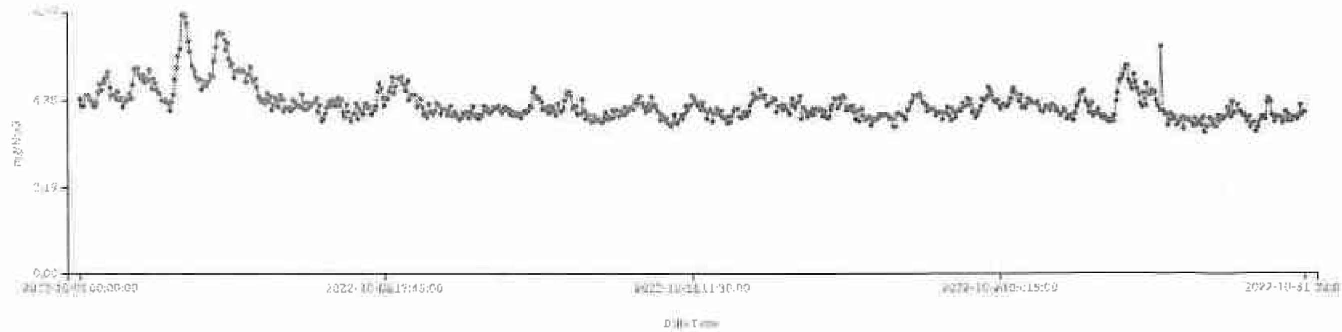

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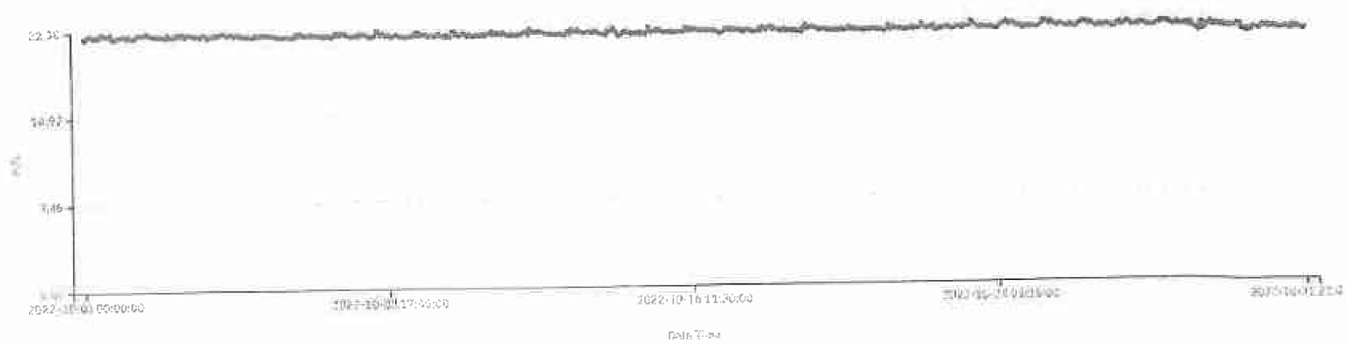


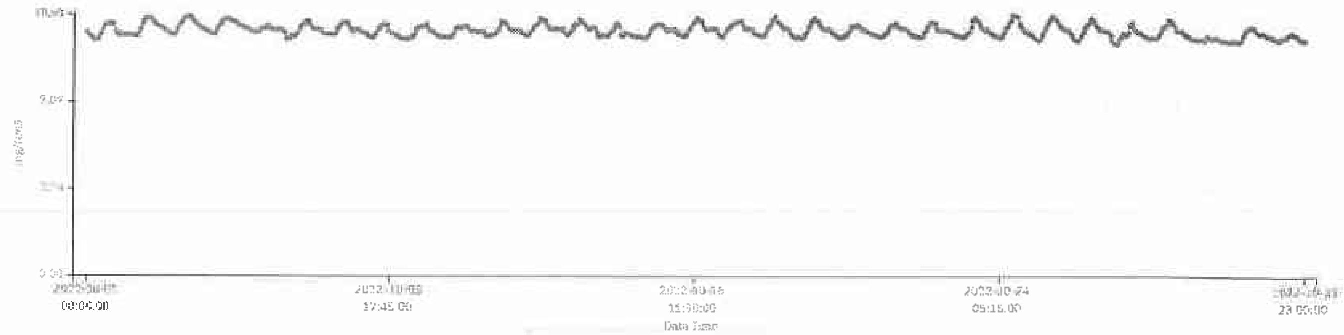
STACK_3_16_TPH_Briquette_Boiler-Velocity_Raw

YOKOGAWA
Yokogawa India Ltd.

Custom Report

SiteName: M/s Solara Active Pharma Sciences Limited, Formerly Known as M/s Strides Shasun Limited)

Created by: Ssl_API, Created On: 08/11/2022



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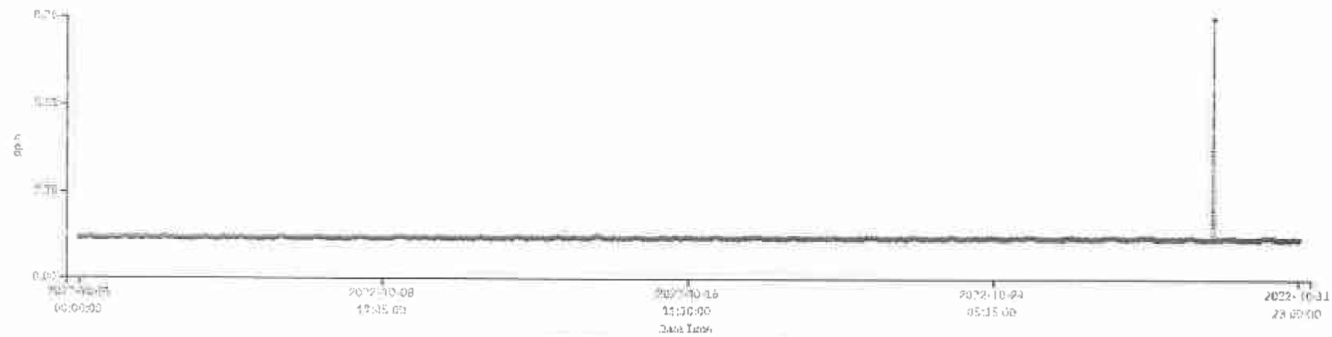
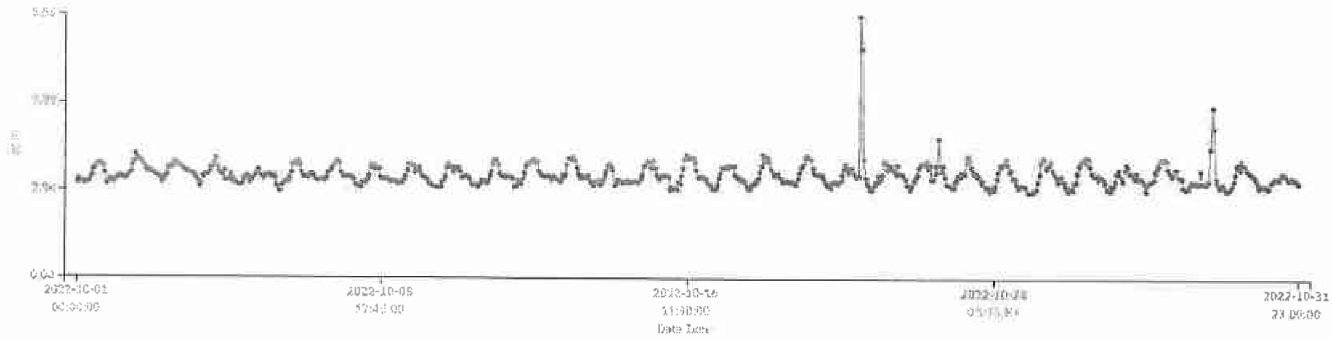
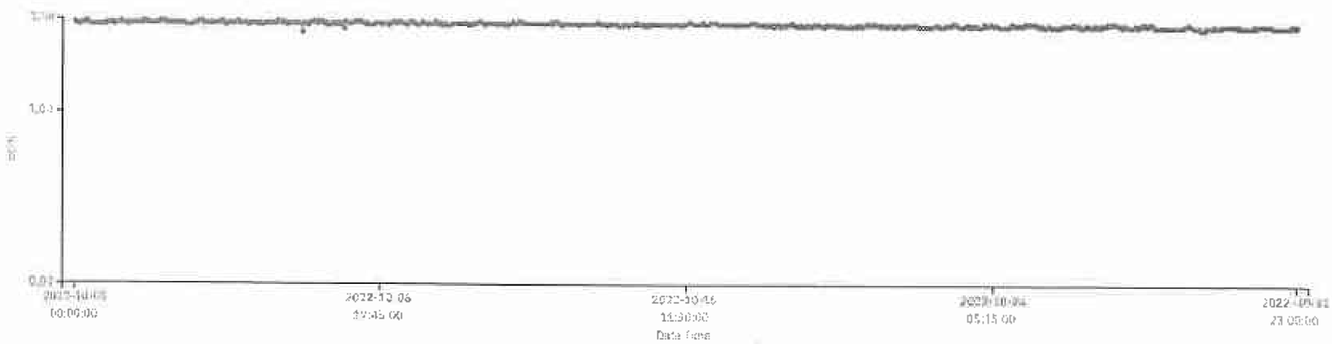


AAQMS1_Fire_Hydrant_VOC1-VOC_Raw



AAQMS2_Power_House_VOC2-VOC_Raw



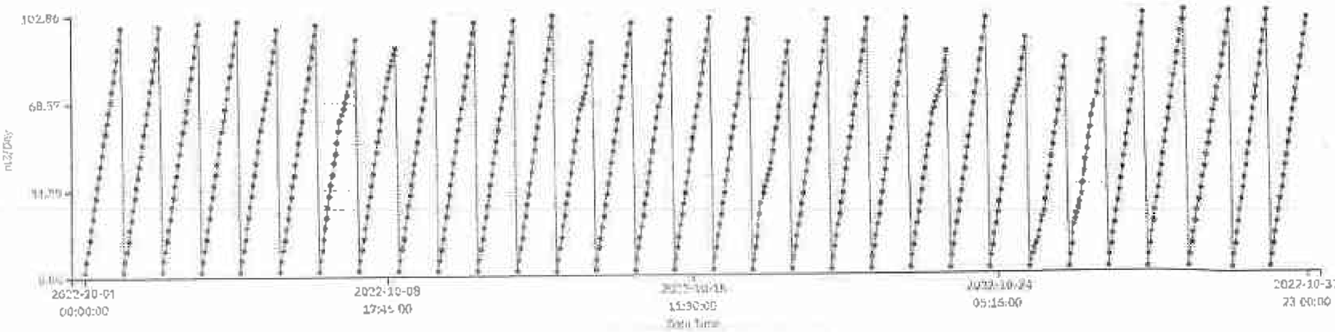
AAQMS3_ZLD_VOC3-VOC_Raw

YOKOGAWA
Yokogawa India Ltd.

Custom Report

SiteName: M/s Solara Active Pharma Sciences Limited, Formerly Known as M/s Strides Shasun Limited)

Created by: Ssl_API, Created On: 08/11/2022



GW_1_BOREWELL_Inlet_flow-Totalizer Flow_Raw

SOLARA
Active Pharma Sciences

Communication Address :
Solara Active Pharma Sciences Limited
R.S.No. 33 & 34,
Mathur Road, Periyakalapet
Puducherry - 605 014. India
Tel: +91 413 2654100.

Date: 09.12.2022

To

The Member Secretary,
Pondicherry Pollution Control Committee,
Puducherry -605 005

Respected sir,

Sub: Submission of On Line Monitoring Reports – Reg

Please find the enclosed copy of On Line Monitoring reports of **NOVEMBER' -2022.**
Please acknowledge the same.

Thanking you,

For Solara active pharma sciences Limited.,

M. Mohan
Chief Operations Officer

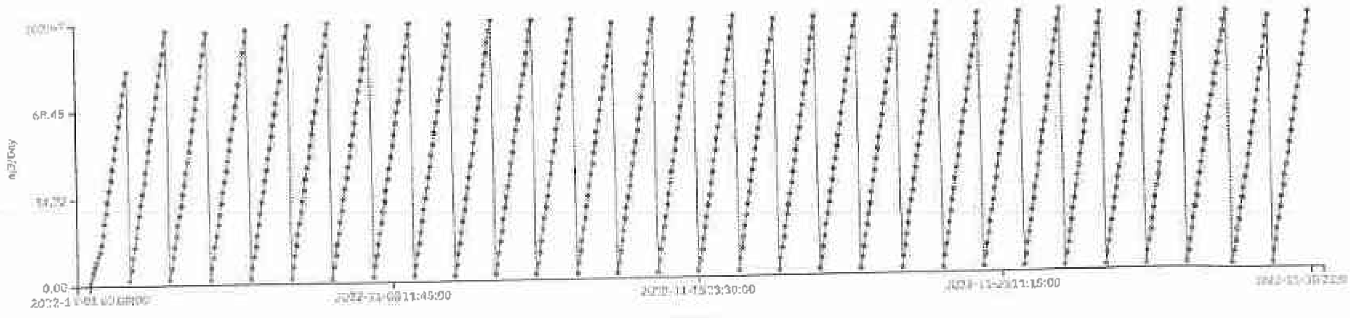
DEPARTMENT OF SCIENCE TECHNOLOGY AND ENVIRONMENT
RECEIVED
DATE:

YOKOGAWA
Yokogawa India Ltd.

Custom Report

SiteName: M/s Solara Active Pharma Sciences Limited, Formerly Known as M/s Strides Shasun Limited)

Created by: Ssl_API, Created On: 01/12/2022

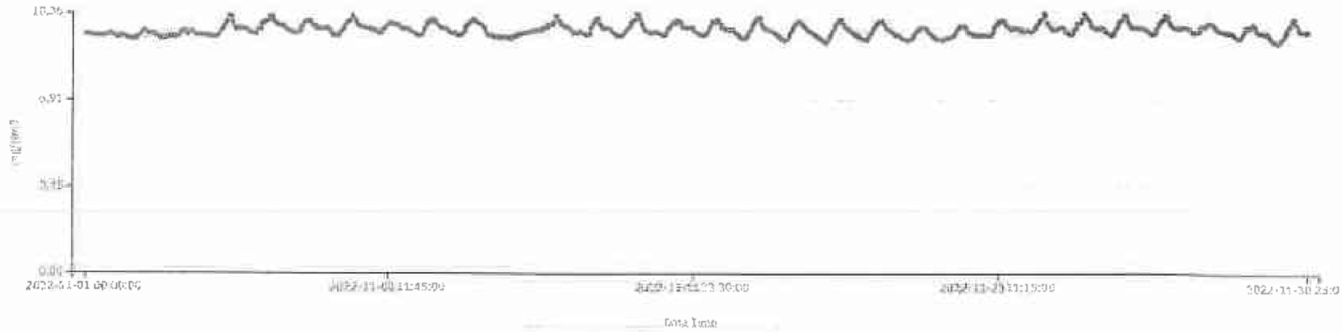


YOKOGAWA
Yokogawa India Ltd.

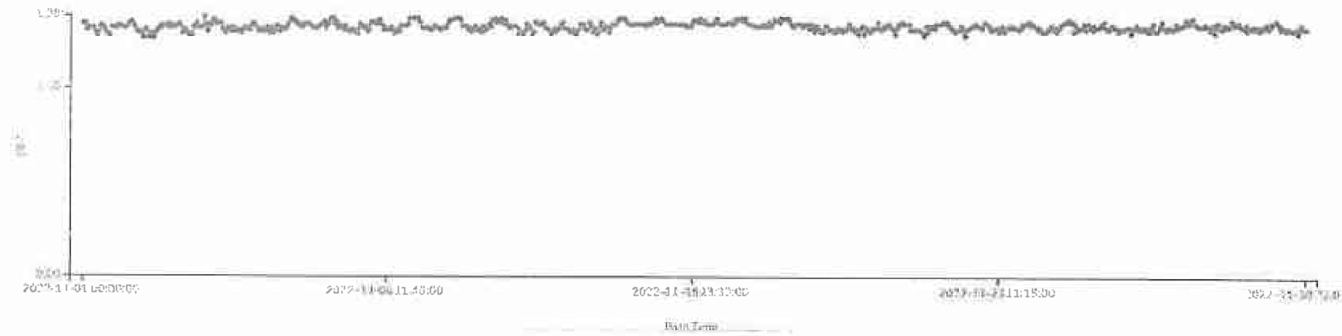
Custom Report

SiteName: M/s Solara Active Pharma Sciences Limited, Formerly Known as M/s Strides Shasun Limited)

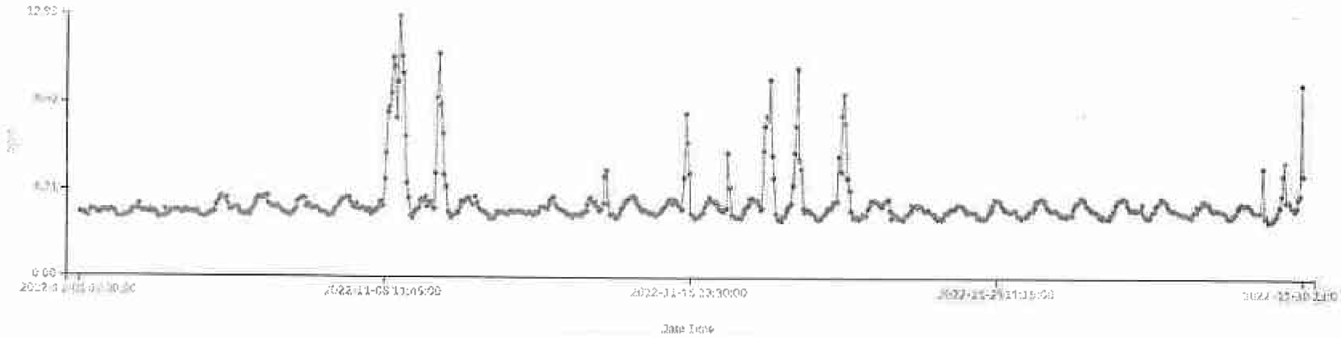
Created by: Ssl_API, Created On: 01/12/2022



Stack_2_HCL_Mist_Vapour-HCL_Raw



AAQMS1_Fire_Hydrant_VOC1-VOC_Raw



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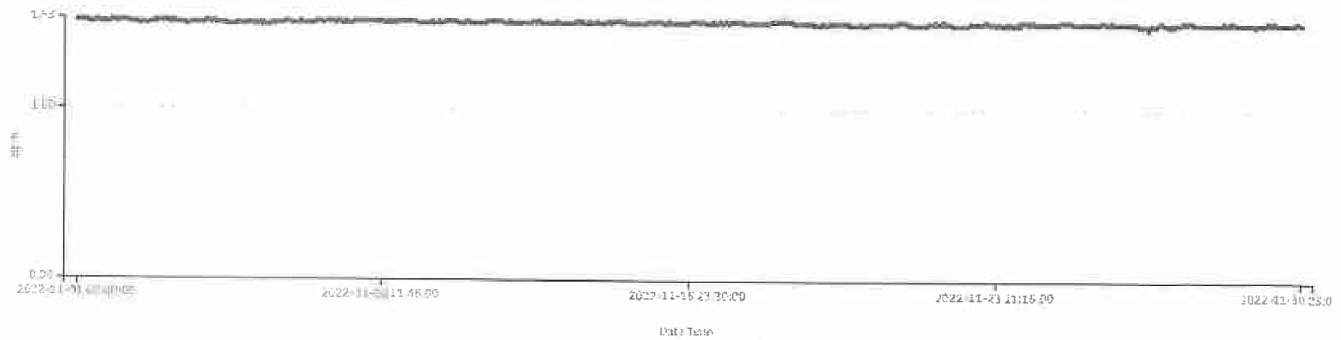

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YOKOGAWA
Yokogawa India Ltd.

Custom Report

SiteName: M/s Solara Active Pharma Sciences Limited, Formerly Known as M/s Strides Shasun Limited)

Created by: Ssl_API, Created On: 01/12/2022

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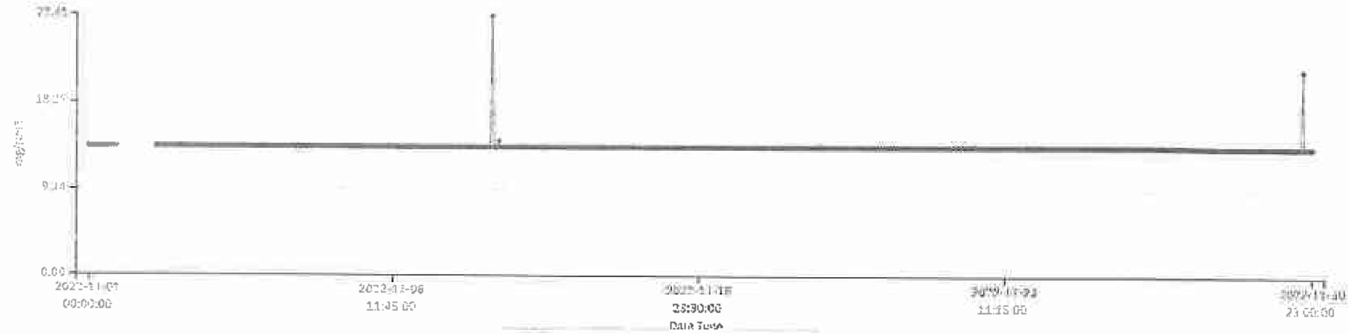

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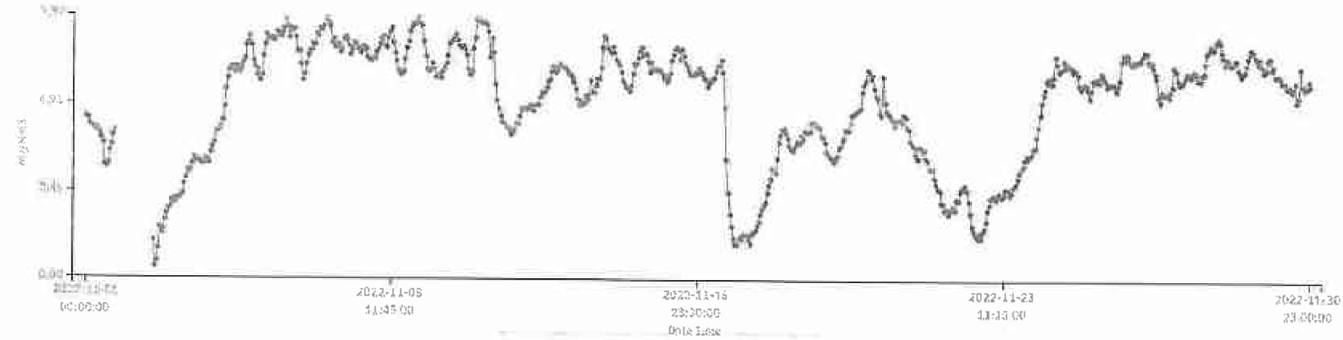

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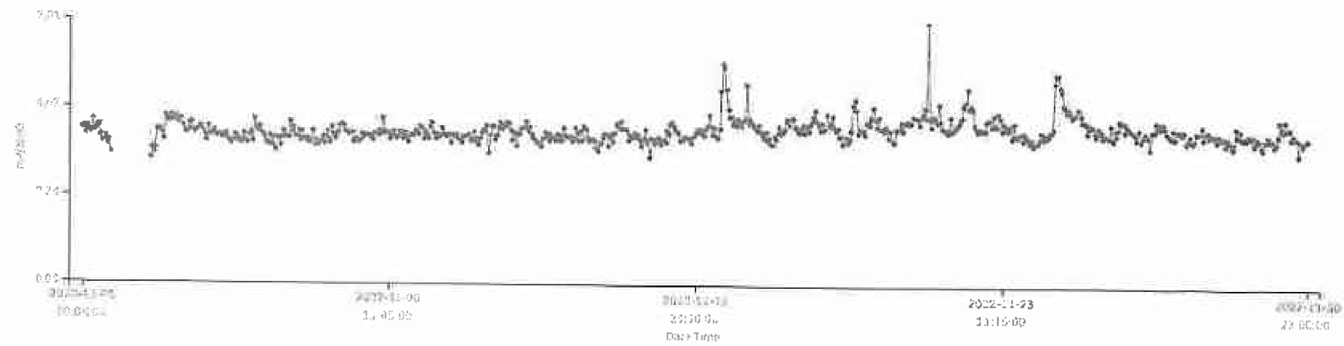

STACK_3_16_TPH_Briquette_Boiler-CO_Raw

Communication Address :
Solara Active Pharma Sciences Limited
R.S.No. 33 & 34,
Mathur Road, Periyakalapet
Puducherry - 605 014, India
Tel: +91 413 2654100.

Date: 05.01.2023

To

The Member Secretary,
Pondicherry Pollution Control Committee,
Puducherry -605 005

Respected sir,

Sub: Submission of On Line Monitoring Reports – Reg

Please find the enclosed copy of On Line Monitoring reports of **DECEMBER' -2022.**
Please acknowledge the same.

Thanking you,

For Solara active pharma sciences Limited.,

M. Mohan
Chief Operations Officer

DEPARTMENT OF SCIENCE TECHNOLOGY AND ENVIRONMENT ★ RECEIVED DATE:..........

YOKOGAWA

Custom Report

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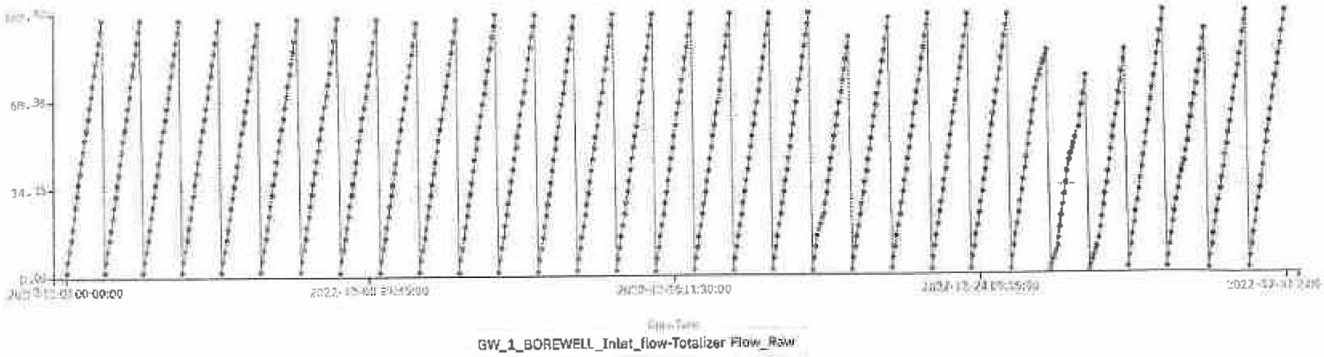

YOKOGAWA
Yokogawa India Ltd

Custom Report

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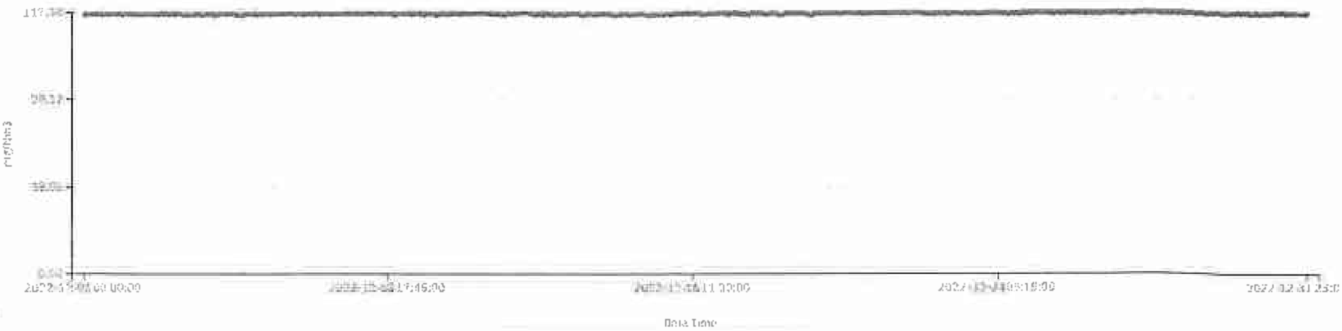

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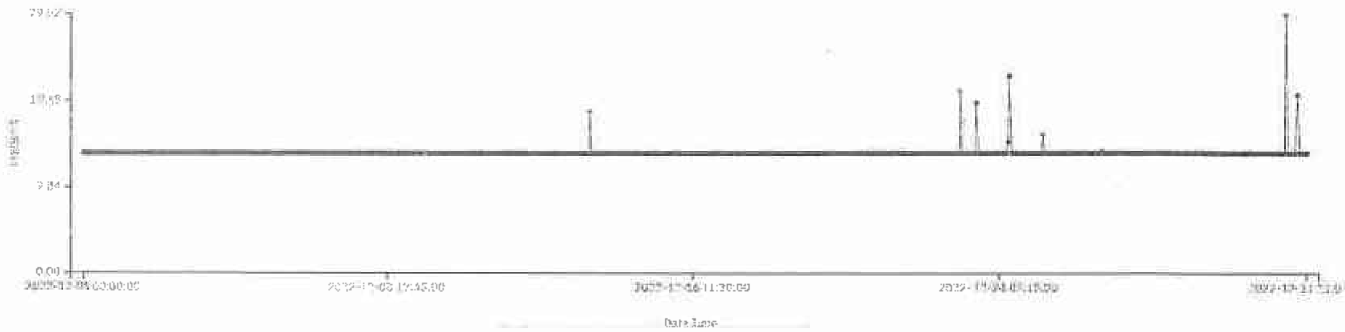

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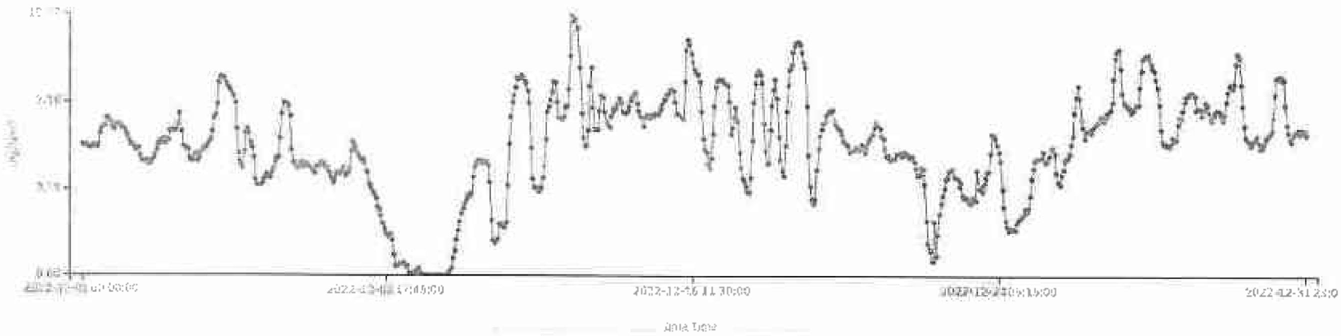

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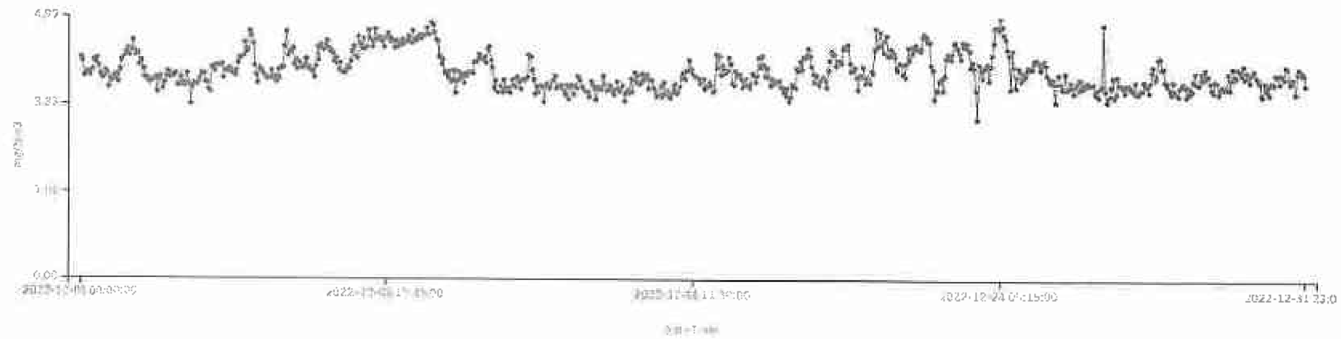


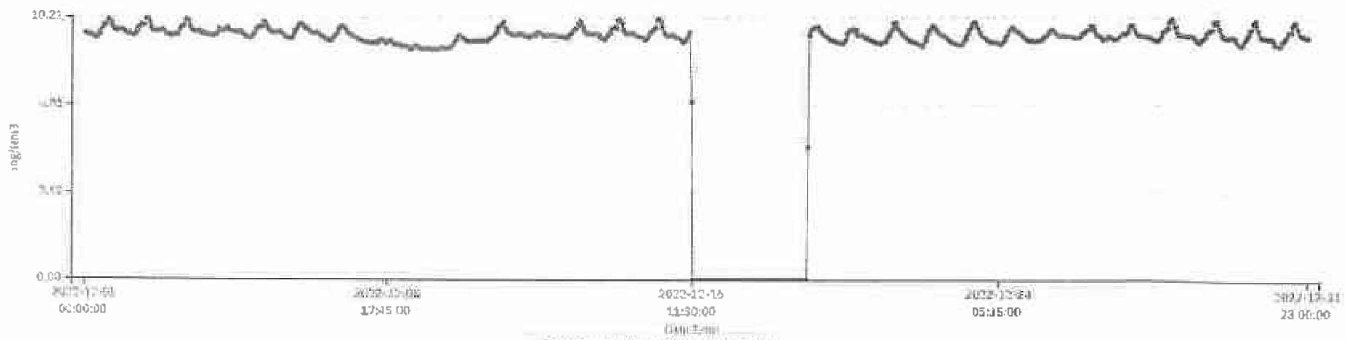
STACK_3_16_TPH_Briquette_Boiler-CO_Raw

YOKOGAWA
Yokogawa India Ltd.

Custom Report

SiteName: M/s Solara Active Pharma Sciences Limited, Formerly Known as M/s Strides Shasun Limited)

Created by: Ssl_API, Created On: 02/01/2023



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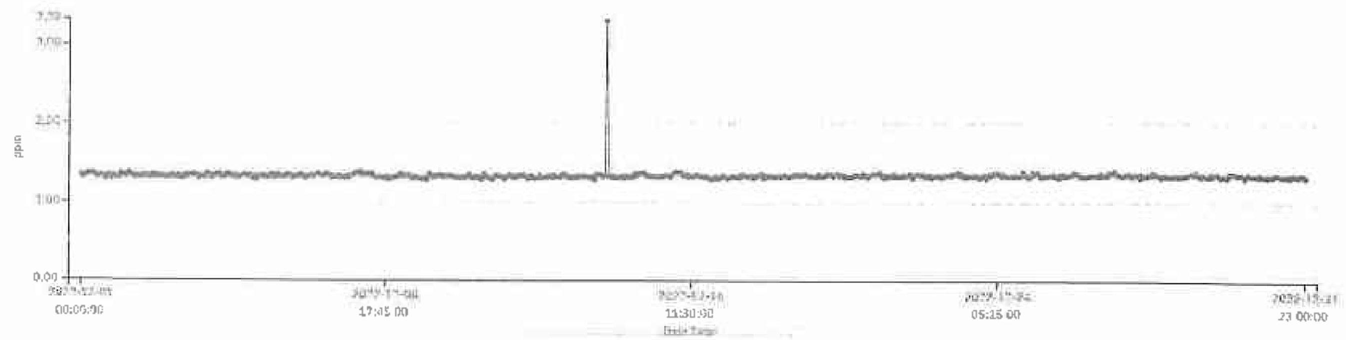
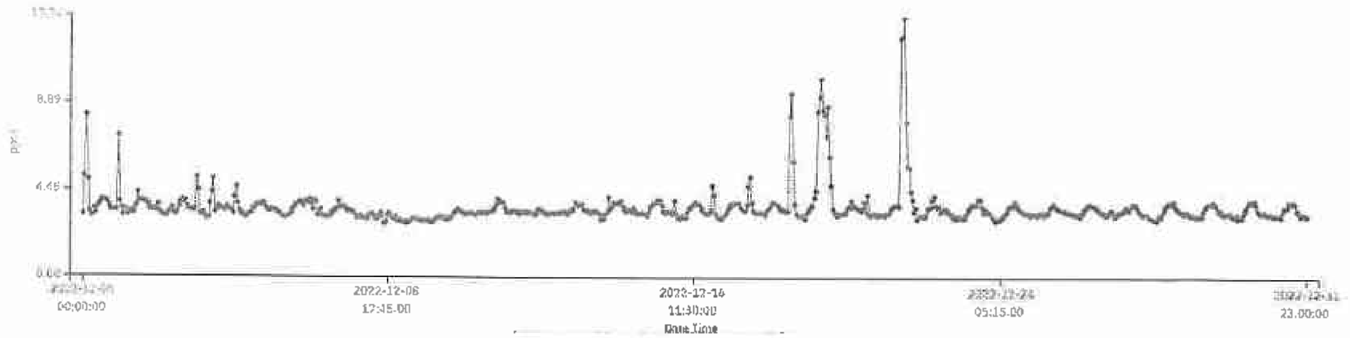


AAQMS1_Fire_Hydrant_VOC1-VOC_Raw



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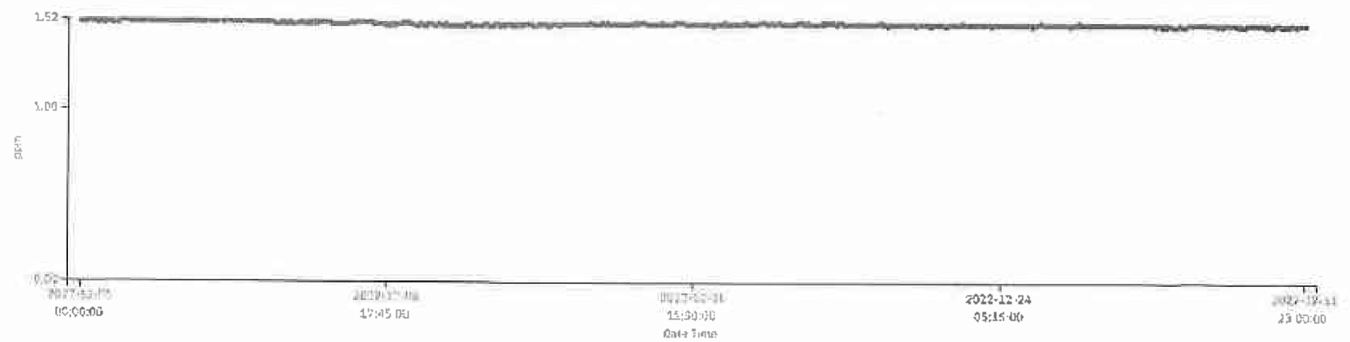

AAQMS3_ZLD_VOC3-VOC_Raw

Annexure - 6

ENERGY AUDIT REPORT

at

SOLARA ACTIVE PHARMA SCIENCES LTD, PONDY

Prepared by

GSH

GSH UTILITIES SERVICES PVT LTD

CHENNAI

JULY 2022

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ACKNOWLEDGEMENT

We wish to place on record our thanks to the management of **Solara Active Pharma Sciences Ltd,** for giving us the opportunity to conduct a **Detailed Energy Audit** (**D E A**) of the utilities at their production facility at Puducherry.

We extend our wholehearted thanks to

1)	Mr. M. Mohan	:	Chief Operations Officer
2)	Mr. P.V Shankar	:	CAPEX - LEAD
3)	Mr. R. Ramesh	:	GM - EHS
4)	Mr. Jothi Subramaniyam	:	GM - Engg

Our thanks are due to

1)	Mr. S. Raj Kumar	:	AGM : Utilities
2)	Mr. A. Seenuvasan	:	AGM : Tech. Services
3)	Mr. S. Kaliraman	:	Sr. Manager : Utilities
4)	Mr. N. Arunkumar	:	Mgr. Project : Electrical

and other concerned technical personnel including Mr G Rajesh Kumar, Mr. K Aravindan (Sr Executives) . et al for all their support in making this DEA assignment a success

The excellent rapport, unstinted cooperation and clear understanding shown by the concerned personnel are of great help to us in carrying out and completing this study successfully. We are pleased to record our appreciation for the same.

The energy conservation schemes identified and proposed in this report - when implemented - are expected to bring in lasting benefits (savings) in terms of energy as well as cost to the management.

We are privileged to submit this ***"Comprehensive Energy Audit Report"*** to the management of Solara Active Pharma Sciences Ltd, Puducherry and wish them all success in the implementation of ENCON schemes.

Any missing of names in the acknowledgement is purely unintentional.

Plant Address:

Solara Active Pharma Sciences Ltd,

Mathur Road, Periyakalapet,

Puducherry – 605 014

Email : ramesh.ramasamy@solara.co.in

Mobile : 95784 22252

July 2022

Dr R SETHUMADHAVAN

CEA : 4980 AEA : 0315

Energy Audit Team Leader

GSH Utilities Services Pvt Ltd

Gopalapuram, Chennai - 600 086

Phone: 94 44 45 46 25

Email: rsm@gshgroup.com

DISCLAIMER

In line with our methodology for carrying out energy / cost reduction studies, our key findings and recommendations proposed in this report are based on the data made available to us, energy parameters observed on the site and discussions held with the key / relevant personnel at the site.

The observations made in this report are only an indication on the performance of the facility based on our assessment and should not be construed as a comment on the functioning of the facility.

Details presented in this report are based on information collected from the site personnel and observation of energy parameters during the visit and therefore the findings of this report are valid as on the date of visit and period of study at the site.

It is sincerely believed that the observations made by us represent the normal working at site and hence this report stands for its technical content.

We have exercised all reasonable skill, care, and diligence in carrying out the study. This report is not deemed to be of any undertaking, warranty, or certificate.

It should also be noted that - though the equipment / technology of many Indian or foreign manufacturers / suppliers, installed at the site have been analysed in this report - there is no intention on our part to comment positively or adversely on the capabilities of these suppliers or their equipment / technology. The outcome is purely based on the data / parameters recorded at that point of time at the site.

The name of technology or equipment mentioned in this report belongs to the respective suppliers.

It is emphasized here that the economics of the proposals presented in this report are indicative only and intend to provide the user an overview on the likely investment requirement.

Of course, efforts were made to project a reasonable and real time cost only in our proposals. However, this can vary at the time of implementation due to various internal / external factors that may come into play.

Further, it may be noted that the capital costs mentioned in the report - towards evaluation of payback analysis - are budgetary only. No provision has been made for cost involvement towards Detailed Design, Project Management, Site Management, Contract Supervision, Site Commissioning, balancing of any work associated with “bedding in” of plant or equipment or adjustment of settings, levels etc., as they go beyond the scope of the Audit.

Hence, it is advised that the cost of implementation shall be ascertained / confirmed by the internal project team prior to committing the expenditure. This is very much emphasized where capital expenditure involved is substantial.

In short, the management is advised to carry out their own financial analysis / due diligence prior to implementation.

EXECUTIVE SUMMARY

1 BACKGROUND

- Solara Active Pharma Sciences Ltd (Formerly Strides Shasun Ltd) had set up its pharma products manufacturing unit at Puducherry in the year 1986. This facility is one of largest manufacturing facilities of Ibuprofen and its derivatives in India.
- Solara Pharma has 6 API manufacturing facilities in India located at Ambernath (Maharashtra), Cuddalore (T N), Mangaluru (Karnataka), Puducherry (UT), Mysuru (Karnataka) and Vizag (A P).
- As far as the facilities at Puducherry is concerned, there are about 140 reactors in the plant that use various utility sources like Chilled Water, Brine Solution, Process Water , Steam, Compressed Air, Hot Thermic Fluid etc., for production of Ibuprofen

2 ENERGY SOURCING & COST INCURRED

- This Pharma unit is an energy intensive one consuming both electrical and thermal energy in ample quantities.
- Energy sourcing protocol of this plant is as below : (Fig 1)

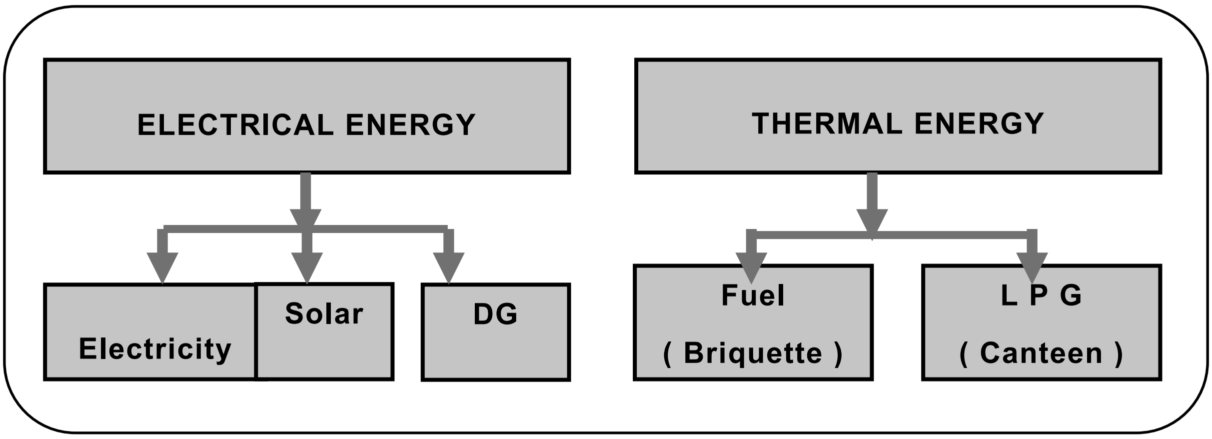
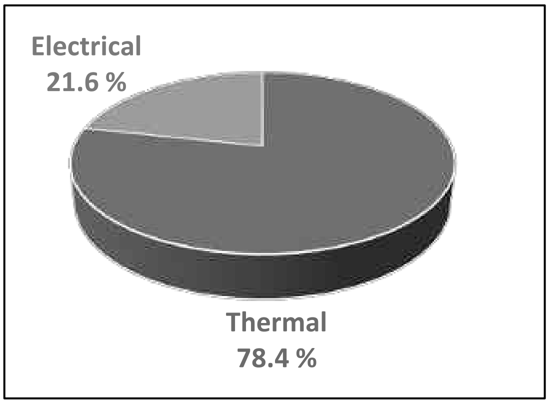


Fig 1 : Energy Sourcing Protocol

- The present energy and cost share pattern of the plant is shown in Fig 2

Energy Share **Cost Share**



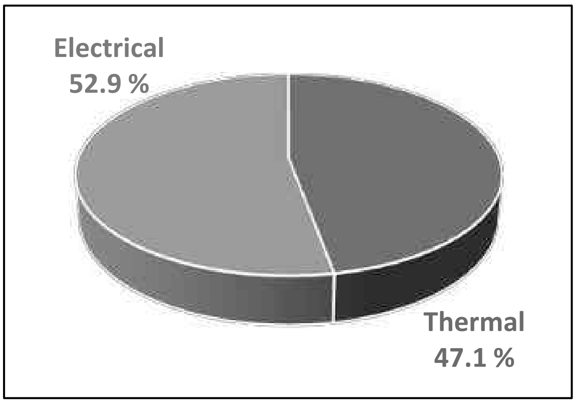


Fig 2 : Energy and Cost Share Diagram : Overall

- On an average, the plant spends **₹ 31 crores / y** on energy sourcing alone and the split up in terms of electrical & thermal is in the ratio 53 : 47

3 ENERGY CONSUMPTION

- The thermal energy is used in the boiler for steam / hot thermic oil generation
- Electricity is used for the operation of all rotaries and non - rotary electrical gadgets.
- The plant wise energy intensiveness is depicted in Fig 3

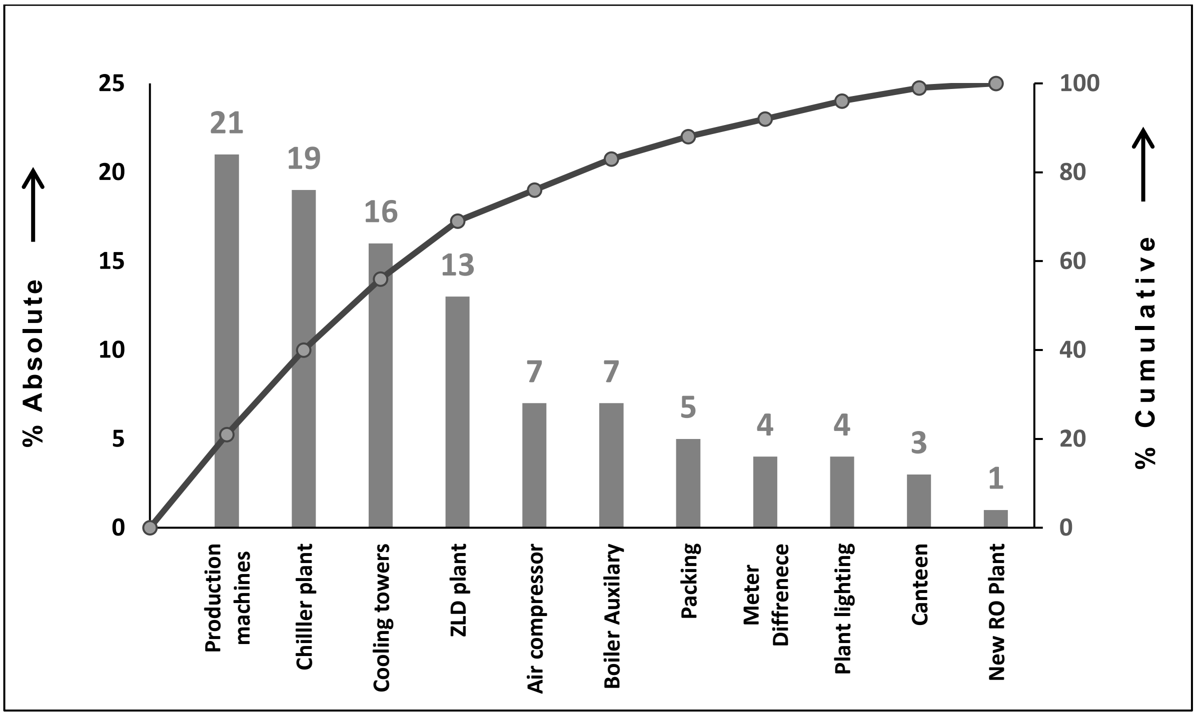


Fig 3 : Energy Usage Pattern : Pareto Chart

4 EMISSIONS RELEASED

- It has been estimated - based on the energy use figures - that this plant had released CO_2 to an extent of **25 000 tons / y** . This is the carbon footprint of this plant

5 SUMMATION OF AUDIT FINDINGS

- A Comprehensive Energy Assessment of all Utilities (both thermal & electrical) - using appropriate and sophisticated instruments - was conducted for a period of 4 days at the site and that had indicated the existence of ample scope for energy conservation in the utilities.
- **Fourteen (14)** proposals have been identified as energy cum cost conservation schemes - based on our study - and are listed below in the form of a Table. These proposals - in addition - are also grouped as per the investment required and presented facilitating the management to take an appropriate techno economic informed decision.
- The overall anticipated savings are indicated in the Table 1

Table 1 : Energy cum Cost Conservation Proposals - Utility wise

ECM No	Energy Conservation Proposals	Cost Savings ₹ / y	Investment ₹	Payback Period Months	Page No
I) THERMAL					
1	Strategic Co - Firing of sized wood (Casuarina) with conventional Agro - Briquettes in the Process Boiler as a measure of cost conservation	58 00 000	Nil	Immediate	154
2	Recovery of condensate from the Steam Traps that are open to ambient and have no collection mechanism	3 16 386	8 00 000	30	157
3	Reducing the **Thermal Energy Loss** by redoing the insulation work afresh in identified locations that have either damaged insulation / peeled off insulation exposing bare surface	25 92 800	20 00 000	9	159

ECM No	Energy Conservation Proposals	Cost Savings ₹ / y	Investment ₹	Payback Period Months	Page No
II) TRANSFORMER + POWERHOUSE					
4	Improvement of power factor by rectifying the non- operational / failed Capacitor Banks in order to save on the energy cost payable to Puducherry Electricity Dept	21 42 800	15 00 000	9	154
5	Construction of additional Powerhouse near the Boiler Plant with a view to i) contain the excessive load experienced by the present Powerhouse ii) reduce the distribution losses occurring in power transmission to ZLD plant	48 79 000	1 50 00 000	36	167
III) CHILLERS					
6	Reducing the **Cooling Energy Loss** by redoing the insulation work afresh in identified locations that have either Damaged Insulation / Peeled Off insulation exposing bare surface	3 00 288	1 50 000	6	169
7	i) Fitment of Variable Frequency Drive to Primary Pumps & ii) Installation of in - line Condenser Water Circulation Pump in the Chiller dedicated for Aldehyde Plant for the sake of Performance Improvement and Energy Usage Optimisation	25 84 000	22 00 000	10	172
8	Energy optimization in the operation of Chiller System dedicated to Pharma Plant by way of adoption of i) VFD operation to the primary brine circulation pump ii) dedicated in - line condenser pump for this chiller	33 18 400	22 00 000	8	177
9	Performance improvement of chiller of IBU plant through adoption of the below - listed measures : i) VFD operation to the primary brine circulation pump ii) dedicated in - line condenser pump for this chiller	27 20 000	22 00 000	10	180

ECM No	Energy Conservation Proposals	Cost Savings	Investment	Payback Period	Page No
		₹ / y	₹	Months	
10	Energy Optimization measures proposed in I P C A Chiller operation	25 84 000	20 00 000	10	183
IV) COOLING TOWER					
11	Installation of new Energy Efficient , Low Approach Cooling Tower replacing the existing 2000 TR Utility Cooling Tower for the sake of Energy Conservation	10 05 312	20 00 000	24	186
V) AIR COMPRESSORS					
12	Pressure drop reduction in Compressor Air generation Location	9 16 300	2 00 000	< 3	188
13	Energy optimization through the use of **IoT monitoring** system in the Compressed Air system Circuit	5 23 600	5 00 000	< 12	190
VI) ILLUMINATION					
14	Replacement of existing conventional luminaires with appropriate energy efficient L ED lamps for the sake of Energy Conservation	2 48 200	2 50 000	12	192
Total		**2 99 31 086**	**3 10 00 000**	**< 13**	

The management - while encouraged to discuss the schemes with the auditors - is requested to take steps to achieve the objective of this assignment viz, the energy and thereby cost conservation.

The overall anticipated savings computed is close to **₹ 3.0 crores / y** with an onetime investment of **₹ 3.1 crores** which shall be paid back in about **13 months**.

The Energy cum Cost Conservation Proposals - sorted in the ascending / increasing order of investment - are provided in the Table below for easy reference.

Table 2 : Energy cum Cost Conservation Proposals : Investment wise

No	ECM No	Energy Conservation Proposals	Cost Savings	Investment	Payback Period
			₹ / y	₹	Months
1	1	Strategic Co - Firing of sized wood (Casuarina) with conventional Agro-Briquettes in the process boiler as a cost conservation measure	58 00 000	Nil	Immediate
2	4	Reducing the cooling energy loss by redoing the insulation work afresh in identified locations that have either Damaged Insulation / Peeled Off insulation exposing bare surface	3 00 288	1 50 000	6
3	12	Pressure drop reduction in Compressor Air generation location	9 16 300	2 00 000	< 3
4	14	Replacement of existing conventional luminaries with appropriate energy efficient LED lamps for the sake of Energy Conservation	2 48 200	2 50 000	12
5	13	Energy optimization through the use of IoT monitoring system in the Compressed Air system circuit	5 23 600	5 00 000	< 12
6	2	Recovery of Condensate from the Steam Traps that are open to ambient and have no collection mechanism	3 16 386	8 00 000	30
7	5	Improvement of power factor by Rectifying the non-operational / failed Capacitor Banks in order to save on the energy cost payable to PED	21 42 800	15 00 000	9
8	3	Reducing the Thermal Energy Loss by redoing the insulation work afresh in identified locations that have either damaged Insulation / Peeled Off insulation exposing bare surface	25 92 800	20 00 000	9
9	10	Energy optimization measures proposed in IPCA chiller operation	25 84 000	20 00 000	10
10	11	Installation of new energy efficient , low approach cooling tower replacing the existing 2000 TR Utility Cooling Tower for the sake of energy conservation	10 05 312	20 00 000	24
11	7	i) Fitment of Variable Frequency Drive to Primary Pumps & ii) Installation of dedicated Condenser Water Circulation Pump in the chiller dedicated for Aldehyde Plant for the sake of performance improvement and energy usage optimisation	25 84 000	22 00 000	10

No	ECM No	Energy Conservation Proposals	Cost Savings	Investment	Payback Period
			₹ / y	₹	Months
12	8	Energy optimization in the operation of chiller system dedicated to Pharma Plant by way of adoption of i) VFD operation to the primary brine circulation pump ii) dedicated in - line Condenser Pump for this chiller	33 18 400	22 00 000	8
13	9	Performance improvement of chiller of IBU plant through adoption of the listed- below measures i) VFD operation to the primary brine circulation pump ii) Dedicated in-line Condenser Pump for this chiller	27 20 000	22 00 000	10
14	6	Construction of additional Powerhouse near the Boiler Plant with a view to i) Contain the excessive load experienced by the present Powerhouse ii) Reduce the distribution losses occurring in power transmission to ZLD plant	48 79 000	1 50 00 000	36
Total			**2 99 31 086**	**3 10 00 000**	**< 13**

Summary of cost savings computed is as below :

Table 3 : Summary of Cost Savings

No	Details	Savings ₹ / y	No of Proposals
A	Savings - without investment	58 00 000	1
B	Savings - with investment	2 41 31 086	13
Total		2 99 31 086	14
C	Investment Required (₹)	**3 10 00 000**	-
D	Payback Period (Months)	**<13**	-

- Further, Three **P**erformance **C**entric **P**roposals **(P C P s)** have also been identified which are presented below :

Table 4 : Performance Centric Proposals

No	Description
1	Installation of 2 Way Valves in place of existing 3 Way Valves in identified Air Handling Units
2	Installation of Water Cooled VRF Condenser Unit for Microbiology Lab DX Unit
3	Replacement of existing Men’s Urinal with Waterless Urinal

- The Performance Centric Proposals too are sure to bring in enhanced productivity and thereby profit.
- The management of Solara - while encouraged to discuss the schemes with the auditors - is requested to take steps to achieve the objective of this assignment viz the energy and thereby cost conservation
- GSH.- USPL can assist SAPSL in the implementation of those schemes by offering complete technical support.

1 PLANT & PRODUCTION PROCESS - A BRIEF

1.1 PREAMBLE

- Solara Active Pharma Sciences Ltd (formerly Strides Shasun Ltd) was established in the year 1976 with the organization name Shasun Pharmaceuticals Ltd at Chennai
- In the year 1986, the firm had set up its plant at Puducherry for manufacturing Ibuprofen and its derivatives (Therapeutic Category: Non – Steroidal Anti - inflammatory drug)
- This facility is one of the largest manufacturers of Ibuprofen and is approved by National & International Regulatory Authorities
- This site has dedicated facilities for the manufacturing of Ibuprofen intermediates, Ibuprofen A P I , Ibuprofen derivatives and a facility for manufacturing new products
- Solara Active Pharma Sciences Ltd is a young, entrepreneurial and customer - oriented API manufacturer and headquartered at Bengaluru
- It is in the business of pharma product manufacturing for the past 30 years and the origin of this can be traced to the API expertise of Strides Shasun Ltd and the technical know - low of human API business to Sequent Scientific Ltd.
- Solara has 6 API manufacturing facilities, and the locations are as below :

(i)	Ambernath	:	Maharashtra
(ii)	Cuddalore	:	Tamilnadu
(iii)	Mangaluru	:	Karnataka
(iv)	Puducherry	:	Union Territory
(v)	Mysuru	:	Karnataka
(vi)	Vizag	:	Andhra Pradesh

- The turn - over of the company is close to **₹ 1600 crores** as of the FY 21 - 22

1.2 SOLARA PLANT AT PUDUCHERRY: A BRIEF

- The major product of this manufacturing facility is "Ibuprofen" - a known and very effective pain killer
- The plant has received "Energy Efficiency Award" in recognition of their continued energy conservation / efficiency related activities.
- The plant has the following International Certifications in EHS
  - ➢ ISO 14001 – 2015 : Environmental Management System
  - ➢ ISO 45001 - 2018 : Occupational Health & Safety Management System

1.3 PROCESS FLOW CHART

- The plant has various process flows starting with IBU derivatives and ending with the final product Ibuprofen
- The simplified process chart is given below :

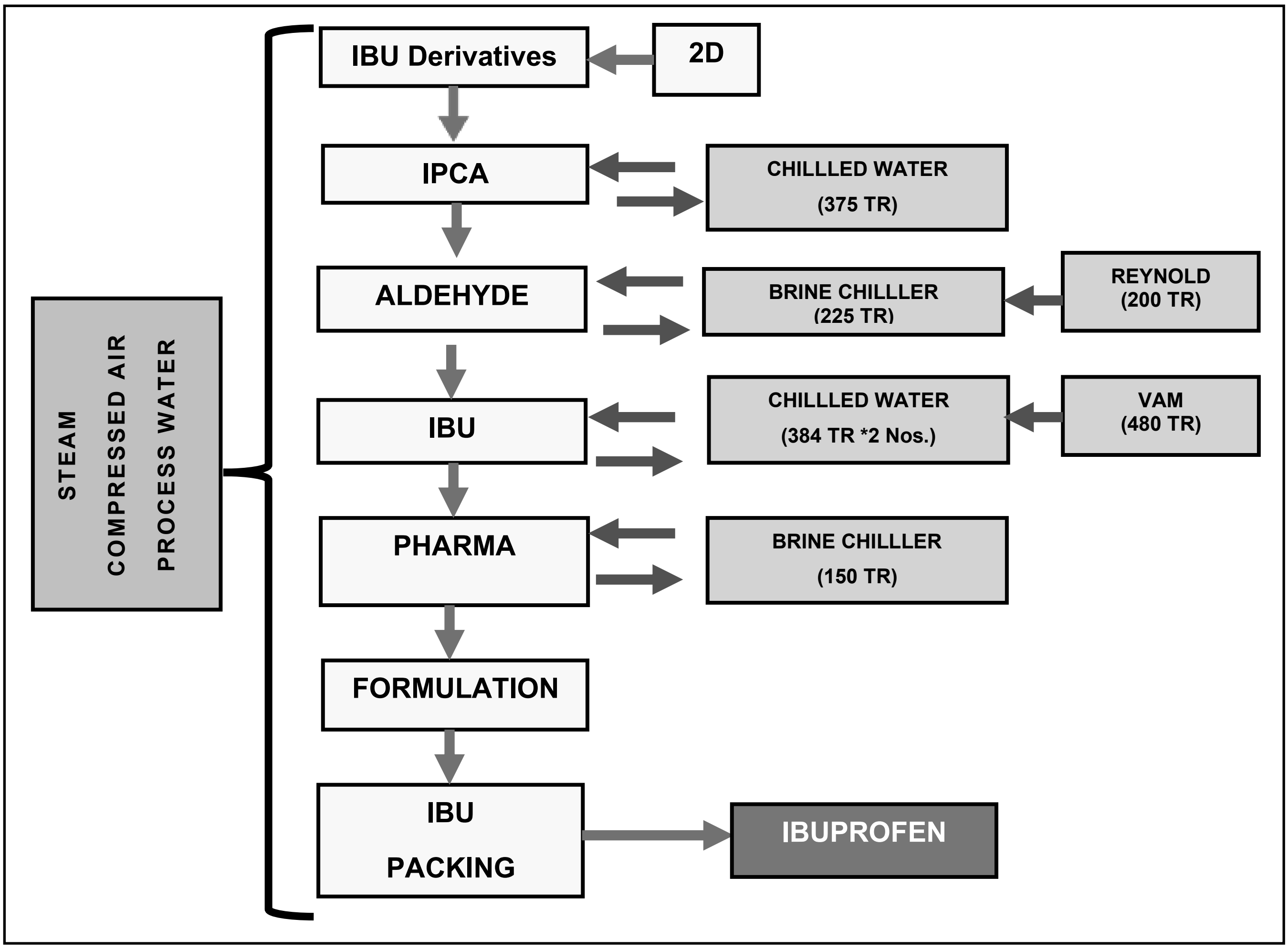


Fig 1.1 : Process Flow Chart : A Simplified Version

There are about 140 reactors in the plant that use various utility sources like chilled water, brine water, process water, steam, compressed air, hot fluid, etc., for the production of ibuprofen

1.4 STUDY ENABLER

SAPSL has been segregated into the below cited zones - for the sake of easy & effective analysis - and thereupon energy auditing was carried out

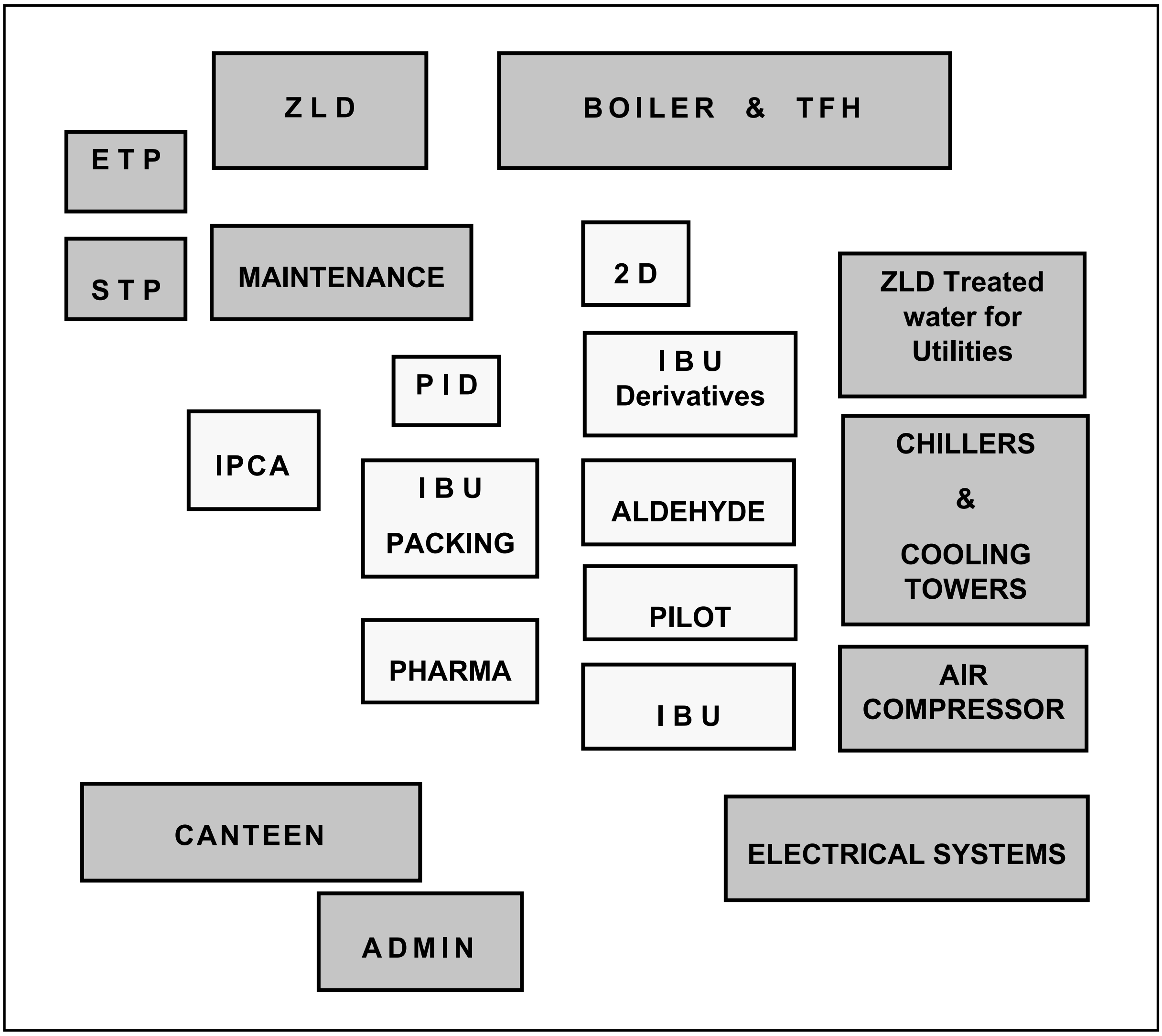


Fig 1.2: Plant Layout with Zone Segregation

The methodology adopted towards carrying out detailed energy audit is outlined in the forthcoming Chapter : 3

2 ENERGY USE PATTERN

2.1 PREAMBLE

- This production facility - being an energy intensive one - consumes both electrical and thermal energy in ample quantities
- Electricity - the energy source for all rotary and non - rotary electrical gadgets - is drawn from PED and to an insignificant extent from in - house solar plant.
- DG Sets supply power during power outage period and is quite limited in quantity.
- The thermal energy demand is met by burning agro - briquettes in processes boilers towards supply of the steam. The agro briquettes - the environment friendly fuel - is procured locally and the major ingredient is saw dust.
- The GCV of the agro briquettes hovered around 4000 kcal / kg
- The energy sourcing protocol is shown below in Fig 2.1 :

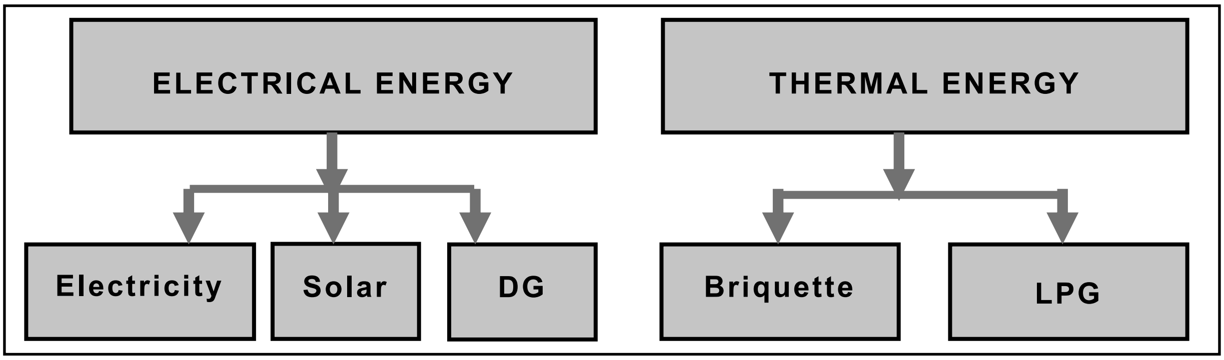


Fig 2.1 : Energy Sourcing Protocol

2.2 CONSUMPTION : OVERALL

- The various energy inputs combined with their annual consumption and contribution in the plant's overall energy basket is summarised below in Table 2.1

Table 2.1 Consolidated Energy Consumption: Apr'21 – Mar'22

No	Energy Source	UoM	Quantity	Energy Equivalent MToE	%
1	Thermal (Agro Briquettes)	tons	21 170	8045	78.7
2	Electricity	kWh	2 41 07 791	2031	19.9
3	HSD	lit	1 38 343	141	1.4

Note : LPG is used in the Canteen for cooking purpose and not considered in the above categorization that goes for production purposes

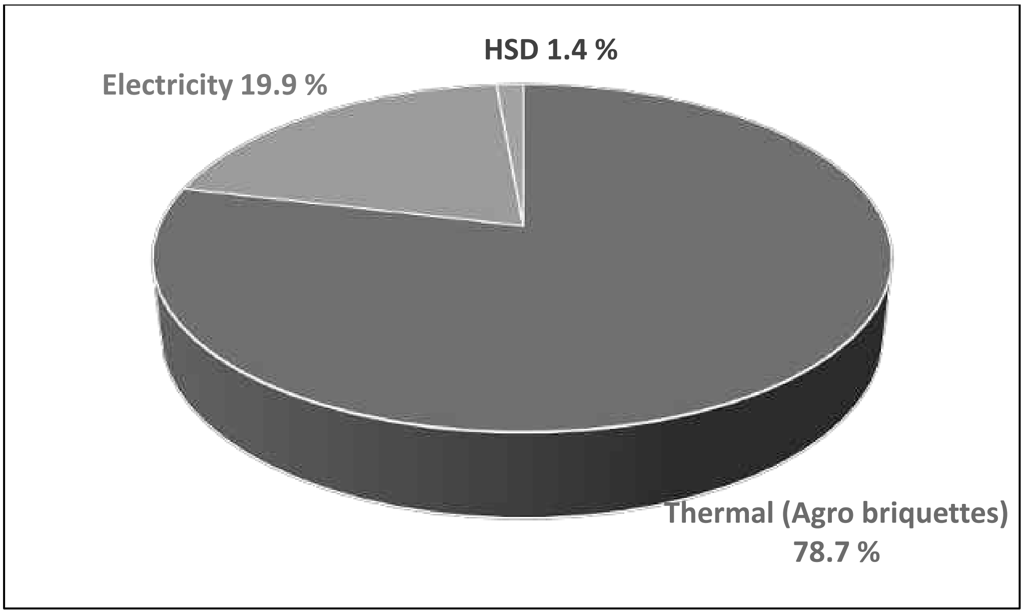


Fig 2.2 Energy Source : Share Diagram

- Steam, Thermic Heat, and Electricity are 3 forms of secondary energy consumed across the process and utility areas

2.3 USAGE PATTERN

- Electricity consumption profile of various Utilities is shown in Fig 2.3 & Fig 2.4 through pie chart & Pareto chart respectively

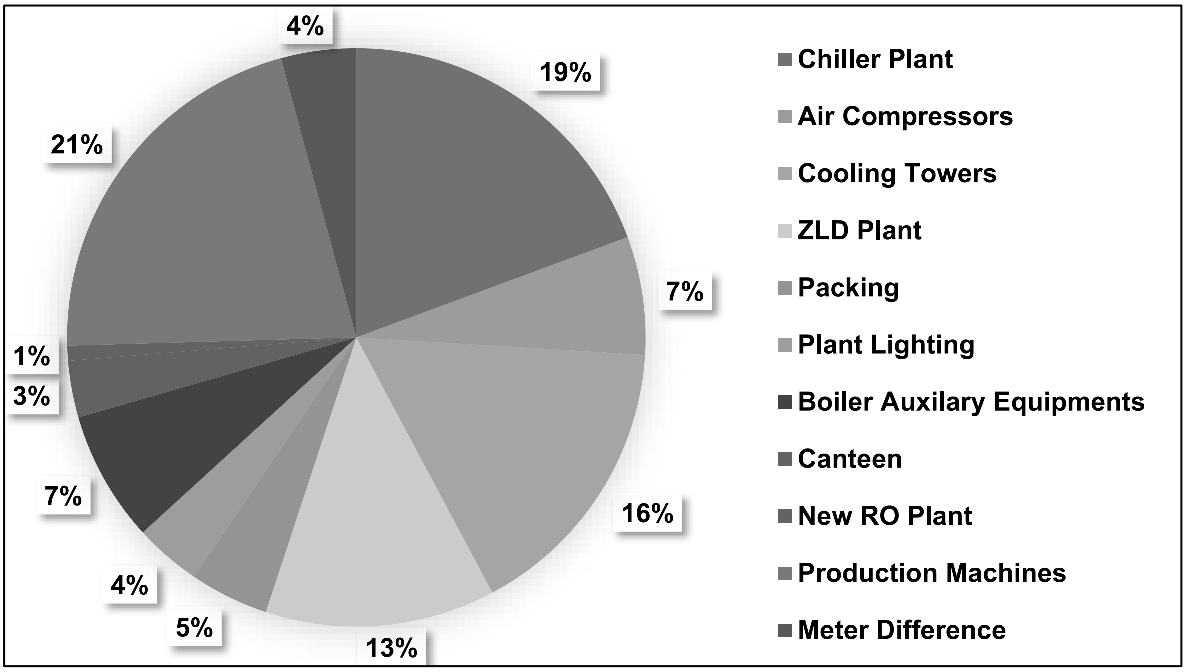


Fig 2.3 : Energy Usage Pattern : Pie Chart

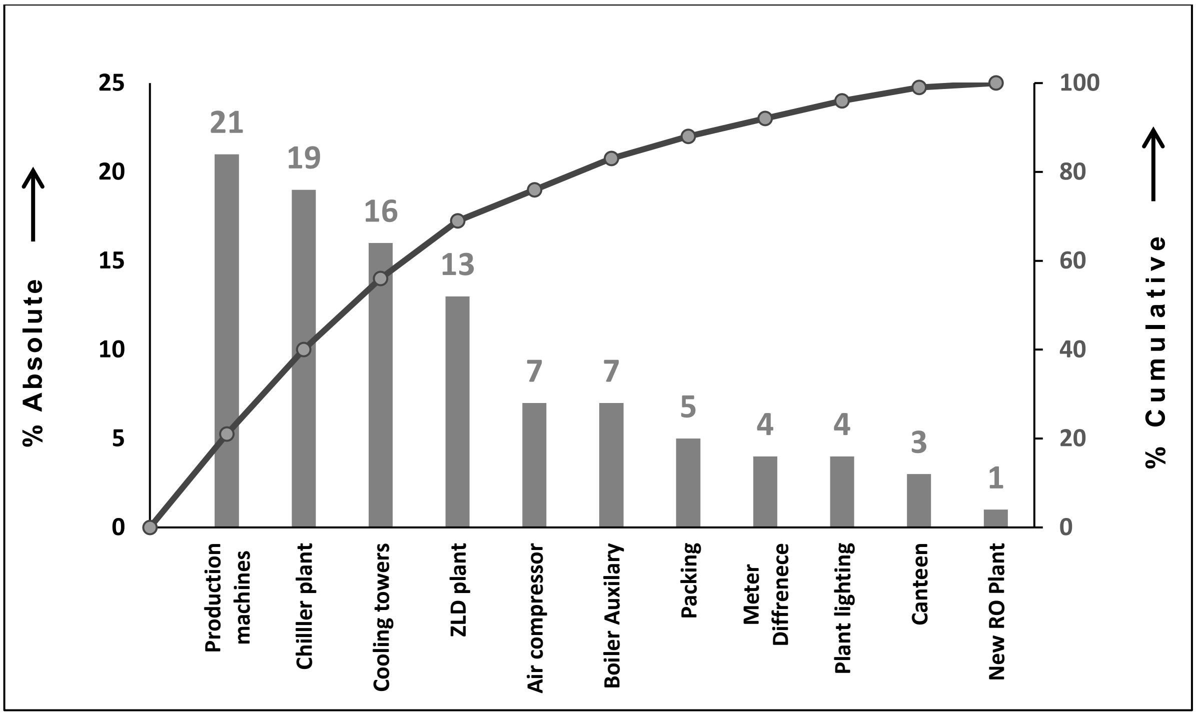


Fig 2.4 : Energy Usage Pattern : Pareto Chart

- It can be seen that the Chillers, Cooling Towers & ZLD plants are the major energy guzzlers of energy accounting to a total of 48%. Of course, production machineries account for 21 % of overall energy consumption of the plant
- The rest 7 categories contribute to 31 % only

2.4 ENCON ACCOMPLISHED

The SAPSL team has implemented the following energy conservation measures to reduce the electricity cost:

- Maintenance of acceptable power factor (0.98 to 0.99)
- Replacement of earlier chilled water pumps with constant pumping
- Installation of VFD with manual setting in Air Compressor
- Installation of enthalpy controller along with VFD in Cooling Towers
- Positioning LED light, Motion Sensors, Dimmer, etc., in illumination section.
- Exertion of Electronic Ballasts in selected locations

The personnel of SAPSL deserve appreciation for adoption of these energy conservation measures and achieving thereby handsome cost savings

2.5 SUM UP

- Thus this chapter briefs on the energy usage pattern of the facility as well as the quantum of usage
- The assignment of Detailed Energy Auditing was aimed at accelerating the ongoing energy optimisation activities, identifying avenues for cost conservation, and further fulfilling the mandatory energy audit requirement of the PED of UT of Puducherry
- Thus, the justification.

3 DETAILED ENERGY AUDIT - METHODOLOGY ADOPTED

3.1 INTRODUCTION

GSH - USPL had performed a Detailed Energy Audit [D E A] of the Solara Active Pharma Sciences Limited (SAPSL) for the purpose of evaluation of the performance of equipment, identifying measures for energy conservation and thereby effecting cost reduction. This study comprising Site and Back - Office work was conducted in various stages - over a period of a fortnight - incorporating a comprehensive approach in studying and analysing the utility related operations at the facility.

3.2 SURVEY SCHEDULE

As a part of DEA, the following 13 surveys (presented in brevity) have been carried out in order to get familiarised with the techno - commercial parameters involved in the day - to - day operation of (mainly) Utilities.

3.2.1 Utility Matters

- Identify meters & locations
- Identify areas served by meters
- Analyse energy consumption and demand profiles
- Analyse facility load factor and power factors
- Analyse rate structures and billing methods

3.2.2 Facility Overview

- Interview the facility coordinators
- Document the areas of concern
- Obtain facility floor plans and schedules
- Study utility-wise process requirement
- Document facility utility usage

3.2.3 Chillers (VAM & VCR) & Load

- Review existing mechanical plans and specifications
- Obtain submittals and equipment schedules
- Conduct walk-thru of all process locations
- Establish present operating scheme and schedule
- Document the condition of all equipment
- Review ability of equipment to serve needs and the feasibility for opting for retrofits

3.2.4 Brine & Chilled Water System

- Identify all chiller locations at site
- Identify associated pumps and areas served
- Review the system operation and condition
- Review existing chiller logs and obtain system run hours
- Document temperature and kW readings
- Determine effectiveness of cooling system
- Determine if modifications can be made to existing chillers to meet CFC issues

3.2.5 Chilled Water, Condenser Water, Cooling Tower, & Booster Pumps

- Measurement of Pump Flow Rate, Head, Power parameters (Voltage, Current, Power factor, Harmonics etc.,), Pressure Drop, Temperature etc.,
- Estimation of Actual Efficiency and comparing with design values.
- Establishing Pump Operating Point.
- Identification and suggestions for energy saving potential

3.2.6 Cooling Tower (Both Chiller & Process)

- Measurement of parameters viz, Fan Power, Water Flow Rate, Air Flow Rate, Dry Bulb Temperature (DBT), Wet Bulb Temperature (WBT), Sump Temperature, Relative Humidity etc.,

- Estimation & Evaluation of Cooling Tower Performance (Range, Approach, and Effectiveness) and comparing it with design data
- Identification and suggestions for performance improvement and energy saving potential

3.2.7 Air - Compressor & Nitrogen Plant

- FAD, Leakage assessment and quantification
- Study of actual pressure and dew point requirements
- Improvement on Volumetric Efficiency
- Reduction in compressor discharge pressure , if viable

3.2.8 Lighting

- Perform individual building walk - through
- Document existing lighting system configurations
- Document existing light levels, fixture quantities and conditions
- Measure fixture wattages
- Establish occupancy hours : room wise and building wise

3.2.9 Boiler & Thermic Fluid Heater (TFH)

- Quantity of steam generation
- Fuel usage and its calorific value
- Study of boiler efficiency & flue gas analysis
- Thermal Insulation Survey
- Steam Trap performance
- Energy / cost reduction by improving performance of Boilers / TFH, if exist, any

3.2.10 Zero Liquid Discharge (Z L D)

- Study of Effluent Treatment Plant (E T P), R O Plant and Multiple Effect Evaporator
- Identification of treated water to end use
- Process involved & its effectiveness

3.2.11 Controls

- Review existing control drawings
- Conduct building and equipment specific survey
- Check operation and accuracy of all existing controls
- Document the condition and the capability of meeting present needs
- Review the feasibility for meeting future retrofit criteria

3.2.12 Automation

- Review existing automation point list
- Review system architecture and layout
- Check accuracy and location of sensors
- Document the system features such as trending and demand limiting, if exists.
- Establish present controlling capabilities and review schedules

3.2.13 Financial

- Analyse operation and maintenance budgets
- Discuss current budget expenditures and future budget items
- Determine the approach for financing projects

Having elaborated the scope & schedule of various surveys, the generic data collection has been attempted and thus collected is as below :

3.3 GENERIC DATA

Table 3.1 : Generic Data : Listing

Client	Solara Active Pharma Sciences Ltd
No. of Years in Operation	30
Factory Address	33 & 34, Mathur Road, Periakalapet, Puducherry - 605 104
Type of Industry	Pharma
Products Manufactured	**Ibuprofen & its derivatives**
Hours of Operation	24 / day
Number of Days of Operation	350 / year
Energy Used	Electricity, Briquette, Firewood, Diesel & LPG

3.4 ENERGY DATA

- The main source of energy is electricity - obtained from PDE - that meets the electricity demand of various utilities that includes Chillers, Air Conditioners, Lighting, Pumps, ZLD, Fans & Blowers etc.,
- A solar power plant of 310 kW_p has also been installed on roof - top that provides electricity to a minor extent (2 %)
- High Speed Diesel (HSD) is used in DG sets as a back - up power source at the time of PED power outage
- Thermal energy demand is met by burning agro - briquettes in the boilers

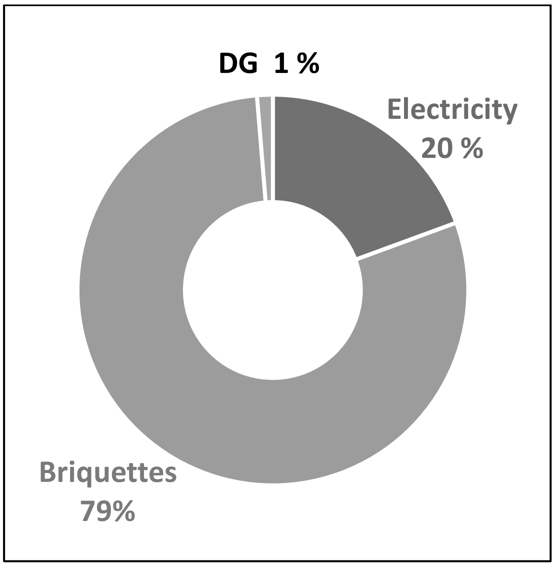
The average energy consumption recorded during the period Apr 21 to Mar 22 is tabulated below:

Table 3.2 : Energy Sources : Utilization Pattern

No	Energy Type	Unit	Apr '21 - Mar '22
1	Electricity	kWh	2 36 23 630
2	Electricity (Solar)		4 84 161
3	Briquette	tons	21 170
4	HSD	lit	1 38 343

- Based on the above, Energy and Cost Share pattern of the energy sources have been enumerated and shown in Fig 3.1

Energy Share



Cost Share

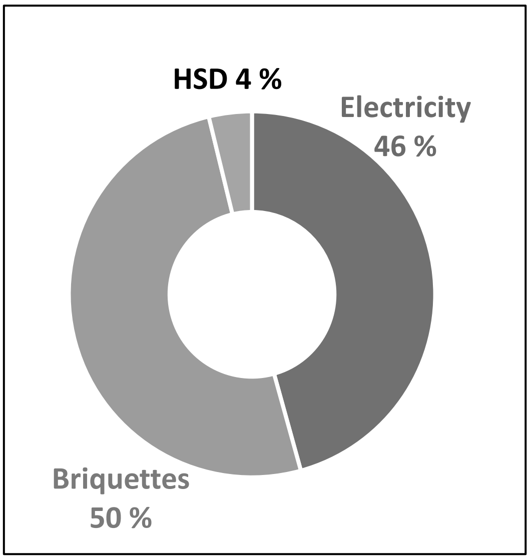


Fig 3.1 : Energy and Cost Share Diagram

- It can be seen that the cost wise contribution of electricity and thermal energy is near equal requiring attention to conserve both of them to a possible extent.

3.5 ENERGY AUDITING

- A Detailed Energy Audit (DEA) study at Solara Active Pharma Science Ltd, Puducherry awarded to the GSH - Utilities Service Pvt Ltd, Chennai in order to accelerate the ongoing energy optimization activities and to fulfil the regulatory mandate
- The Energy Audit Team consisted of 8 members spearheaded by **Dr R Sethumadhavan** Sr Director, Energy (An accredited Energy Auditor of BEE : ***AEA 0315***)
- The team included Certified Energy Auditor and Certified Energy Manager as well
- The team members are :

No	Name	Certification / Qualification
1	Dr R Sethumadhavan C E A : 4980 and A E A : 0315	BEE Accredited Energy Auditor (A E A)
2	Dr.R.Sivakumar,: E A 6098	BEE Certified Energy Manager (C E M)
3	Mr.Vimalraj Babu,: EA 32719	BEE Certified Energy Auditor (C E A)
4	Mr.Ghaneson Sathappan	HVAC & Green Building Specialist
5	Mr.Akbar Ziyad	Energy Expert
6	Mr.Veeramani	Energy Engineer
7	Mr.Chellapandi	Energy Engineer
8	Mr R Nishanth	Energy Engineer

- In all, 35 man - days were spent at the site during the period 9 - 12 June 2022 to study and evaluate the performance of Utilities
- Attempts are made in this assignment to optimise the usage of both these sources of energy viz, Electrical & Thermal

4 ENERGY CONSUMPTION & COST INCURRED - A DETAILING

4.1 INTRODUCTION

- Solara Active Pharma Sciences Ltd, Puducherry - being a process unit - is an energy intensive one and therefore consumes energy in huge quantities
- The electrical energy demand of the plant is met by three sources, namely,
  - (i) Puducherry Electricity Department (PED), Govt of Puducherry.
  - (ii) DG Sets (In - house Captive Generation)
  - (iii) Solar PV (In - house Captive Generation)
- This chapter aims at briefing the electrical energy usage in the plant and the corresponding cost implications

4.2 ELECTRICAL ENERGY SOURCING

4.2.1 Puducherry Electricity Department :

4.2.1.1 kVA Details

- The plant has a sanctioned load of 3860 kVA to meet its electricity requirements
- This fixed charges payable towards kVA contracted - on a monthly basis - is the higher of the following two :
  - (i) Actual Demand recorded in a month
  - (ii) 85 % of the Contracted Demand

  Thus, the minimum billing demand works out to 3281 kVA (85% of 3860 kVA)
- The kVA recorded month - on - month for 12 - month period [Apr - 21 to Mar - 22] Is presented in Fig 4.1

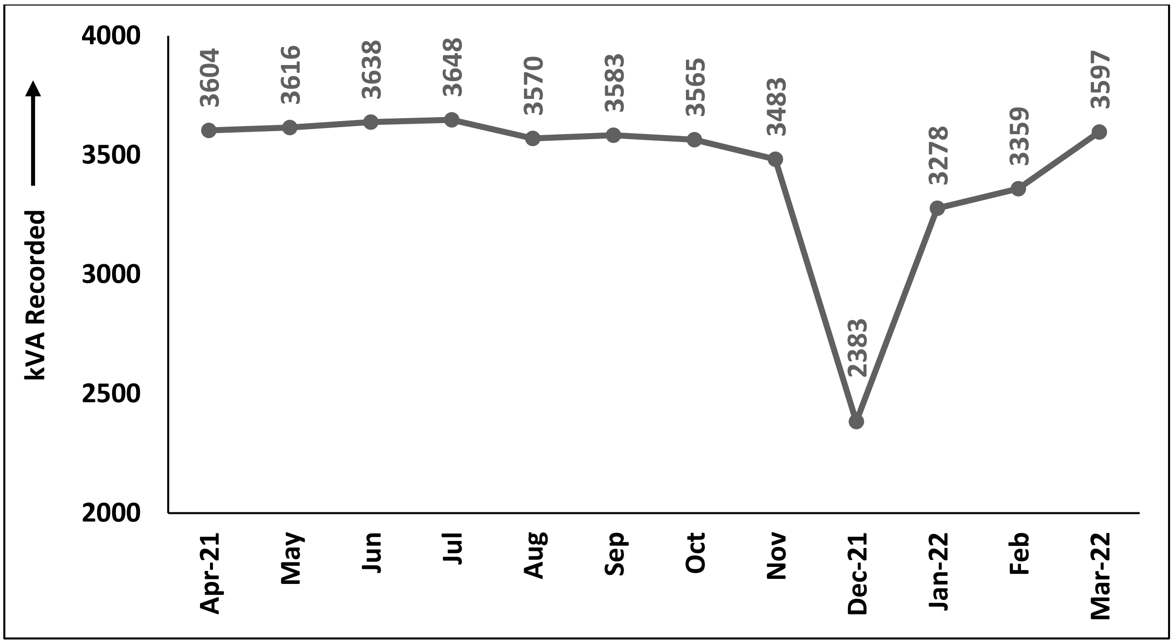


Fig 4.1 kVA Recorded : Apr 21 – Mar 22

- From the above, it can be observed that the actual demand recorded goes more than 90 % of the sanctioned load in majority of the months (9 out of 12) [probably production was at its peak]
- This indicates the optimum utilization of the Sanctioned Load by plant personnel which needs appreciation

4.2.1.2 Load Factor

- The Load factor (LF) is defined as the ratio of avg kVA computed to the actual recorded demand. This is an indicator of the utilization pattern of the sanctioned demand.
- The LF Computed for the period Apr - 21 to Mar - 22 is given in Table 4.1

Table 4.1 Load Factor : Computed : Apr'21 - Mar'22

No	1	2	3	4	5	6	7	8	9	10	11	12
Month	Apr-21	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan - 22	Feb	Mar
kVA Actual	3604	3616	3638	3648	3570	3583	3565	3483	2383	3278	3359	3597
kVA Computed	2998	2996	2929	3078	2571	3079	3007	2430	1478	2186	2921	2730
Load Factor %	83.2	82.9	80.5	84.4	72.0	85.9	84.3	69.8	62.0	66.7	87.0	75.9

- The above data is graphically presented in Fig 4.2

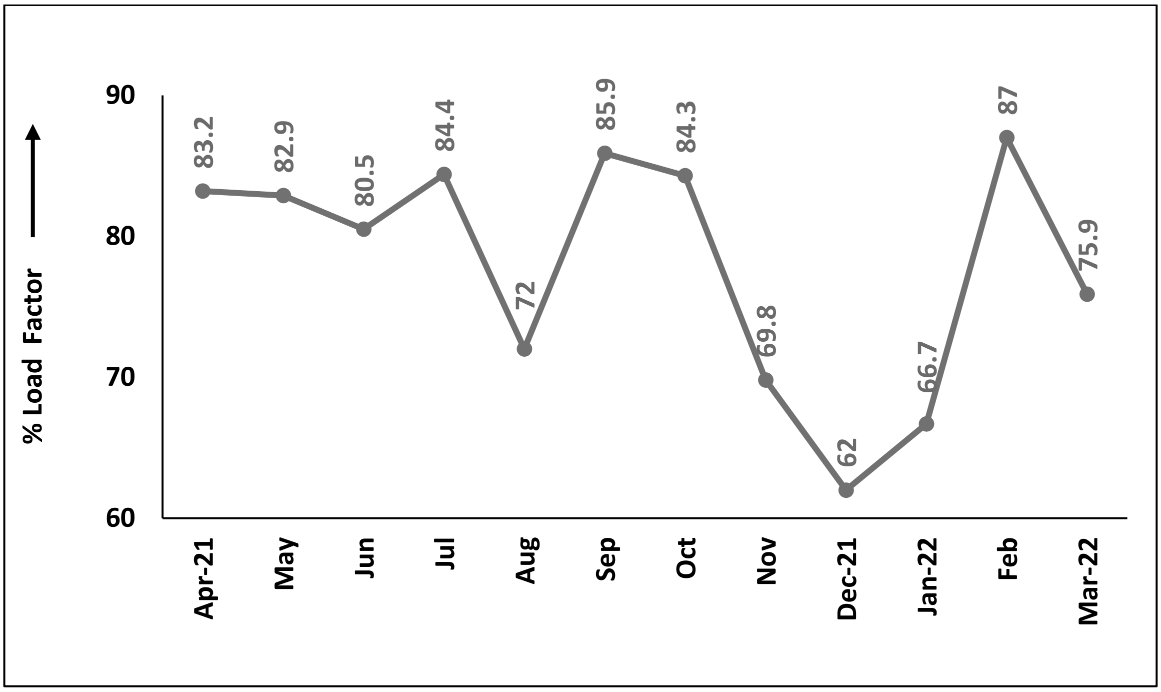


Fig 4.2 Load Factor Computed : Apr'21 - Mar'22

- It can be seen from the above table that the load factor goes above 80 % on majority of the months [7 out of 12 months] which augurs well indicating the optimum as well as uniform utilization of the sanctioned / contracted load

4.2.1.3 Energy Cost

- The Energy Charges payable to PED comprise the following three components :
  - ➢ kVA Charges
  - ➢ kVAh Charges
  - ➢ Other charges that include Electricity Tax, Meter Charges etc.,
- The break - up of total charges paid to PED month - on - month is tabulated below :

Table 4.2 : Energy Consumption + Tariff Paid Details :Apr'21 – Mar'22

No	Month	kVAh Consumption	kWh Consumption	PF	Fixed	kVAh	Other	Total
					Charges ₹			
1	Apr - 21	21 58 630	21 54 300	0.998	15 13 806	114 40 739	6 47 727	13602272
2	May	22 28 980	22 21 700	0.997	15 18 762	118 13 594	6 66 618	13998974
3	Jun	21 09 080	21 02 340	0.997	15 27 834	111 78 124	6 35 298	13341256
4	Jul	22 89 870	22 76 860	0.994	15 32 160	121 36 311	6 83 424	14351895

No	Month	kVAh Consumption	kWh Consumption	PF	Fixed	kVAh	Other	Total
					Charges ₹			
5	Aug	19 12 970	19 07 730	0.997	14 99 484	101 38 741	5 81 911	12220136
6	Sep	22 17 200	21 97 800	0.991	15 04 692	117 51 160	6 62 793	13918645
7	Oct	22 30 330	21 99 860	0.983	14 97 132	118 20 749	6 65 894	13983775
8	Nov	17 49 460	17 28 610	0.988	14 62 818	92 72 138	5 36 748	11271704
9	Dec	10 99 760	10 95 210	0.996	13 78 020	58 28 728	3 60 337	7567085
10	Jan - 22	16 26 290	16 08 520	0.989	13 78 020	86 19 337	4 99 868	10497225
11	Feb	19 62 680	19 21 710	0.979	14 10 612	104 02 204	5 90 641	12403457
12	Mar	20 31 380	19 92 220	0.981	15 10 824	107 66 314	6 13 857	12890995
Avg		**19 68 053**	**1950 572**	**0.991**	**1477 847**	**10430678**	**5 95 426**	**12503952**

Average Electricity Cost : ₹ 6.35 / kVAh

- From the above table, the following have been derived

Table 4.3 : Tariff Paid to PED : Contribution by Components

No	Component	Cost ₹ / m	%	Remarks
1	Apparent Energy Charges	1 04 30 678	83.4	kVAh contribution
2	Contracted Demand Charges	14 77 847	11.8	kVA contribution
3	Other charges	5 95 426	4.8	Electricity Tax, Metre charges etc.,
		1 25 03 952	**100**	

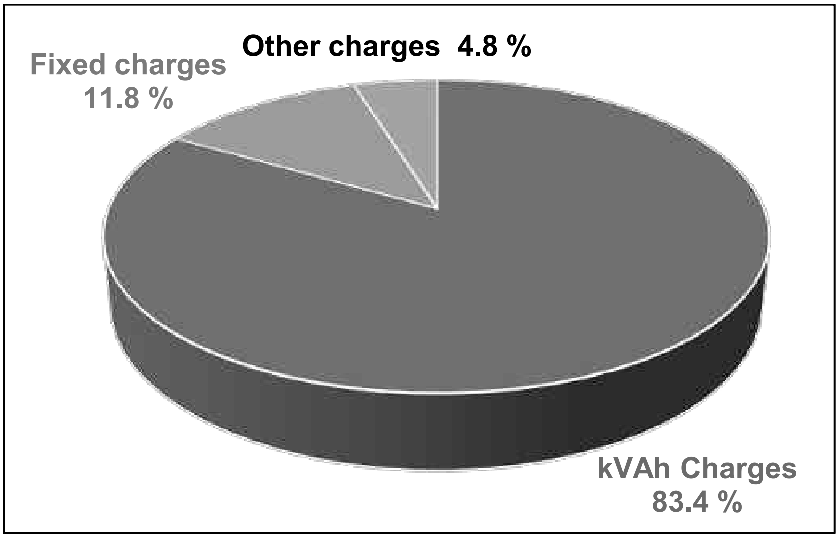


Fig 4.3 : Tariff Paid to PED : Contribution by Components

- The kVAh charges form 83.4 % and that of kVA are 11.8 %. These values are reasonable indicating not only the effective utilization of energy but also optimised payment of electricity charges to PED

4.2.2 Electricity from Solar : In - house Generation

- The facility has installed a 310 kW Solar based power plant as a part of green energy initiative
- The monthly energy generation and the cost incurred from Solar PV are as below :

Table 4.4 : Energy Generated / Consumed : in - house Solar PV System

No	Month	Energy Generated kWh	Cost ₹
1	Apr - 21	45 678	2 80 920
2	May	48 856	3 00 464
3	Jun	43 992	2 70 551
4	Jul	41 328	2 54 167
5	Aug	41 244	2 53 651
6	Sep	40 305	2 47 876
7	Oct	37 262	2 29 161
8	Nov	21 360	1 31 364
9	Dec	37 484	2 30 527
10	Jan - 22	39 862	2 45 151
11	Feb	40 473	2 48 909
12	Mar	46 317	2 84 850
Average		**40 347**	**2 48 133**
Total		**4 84 161**	**29 77 591**

The above information is presented pictorially in Fig 4.4

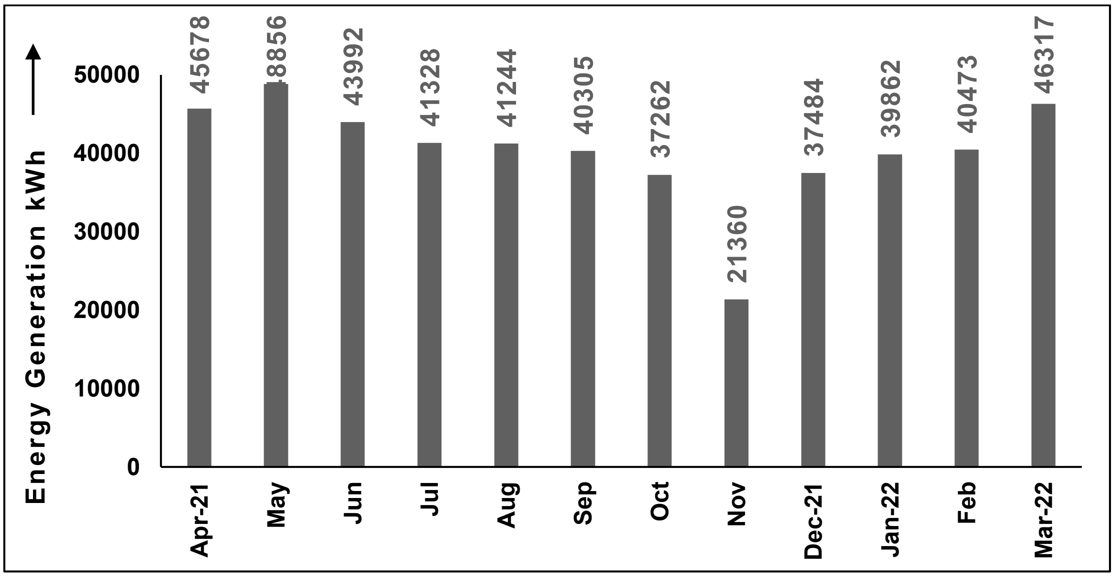


Fig 4.4 : Energy Generation : In - house : Solar

Average Electricity Cost : ₹ 6.15 / kWh

It can be observed that - on an average – about 40 000 kWh have been generated per month and used. This forms about 2% of total energy consumption of the plant. Although this quantum appears insignificant, nevertheless this baby - step is appreciated.

4.2.3 Electricity from DG sets : In - house Generation

- As informed earlier, the DG power is resorted to during PED power outage period which is a rare occurrence
- The following Table 4.5 provides the electricity generation quantum as well as the cost of generation during the period Apr-21 to Mar-22

Table 4.5 : Energy Generated and Cost incurred : In - house DG sets

No	Month	Energy Generated	HSD Consumption	Sp. Energy Gen	Cost of HSD	Total Cost of Gen	Specific Energy Cost
		kWh	litres	kWh / lit	₹		₹ / kWh
1	Apr - 21	40 425	11 410	3.54	9 81 260	10 79 386	26.7
2	May	27 493	7 768	3.54	6 68 048	7 34 852	26.7
3	Jun	1 87 979	53 075	3.54	45 64 450	50 20 895	26.7
4	Jul	62 635	17 515	3.58	15 06 290	16 56 919	26.5
5	Aug	64 224	18 084	3.55	15 55 224	17 10 746	26.6
6	Sep	21 771	6 088	3.58	5 23 568	5 75 924	26.5
7	Oct	22 864	6 456	3.54	5 55 216	6 10 737	26.7
8	Nov	8 554	2 421	3.53	2 08 206	2 29 026	26.8
9	Dec	10 360	2 936	3.53	2 52 496	2 77 745	26.8
10	Jan - 22	24 708	6 977	3.54	6 00 022	6 60 024	26.7
11	Feb	3 680	1 037	3.55	89 182	98 100	26.7
12	Mar	16 213	4 576	3.54	3 93 536	4 32 889	26.7
Average		**40 908**	**11 528**	**3.55**	**9 91 458**	**13087247**	**26.7**
Total		**4 90 906**	**1 38 343**		**11897498**	**13087243**	

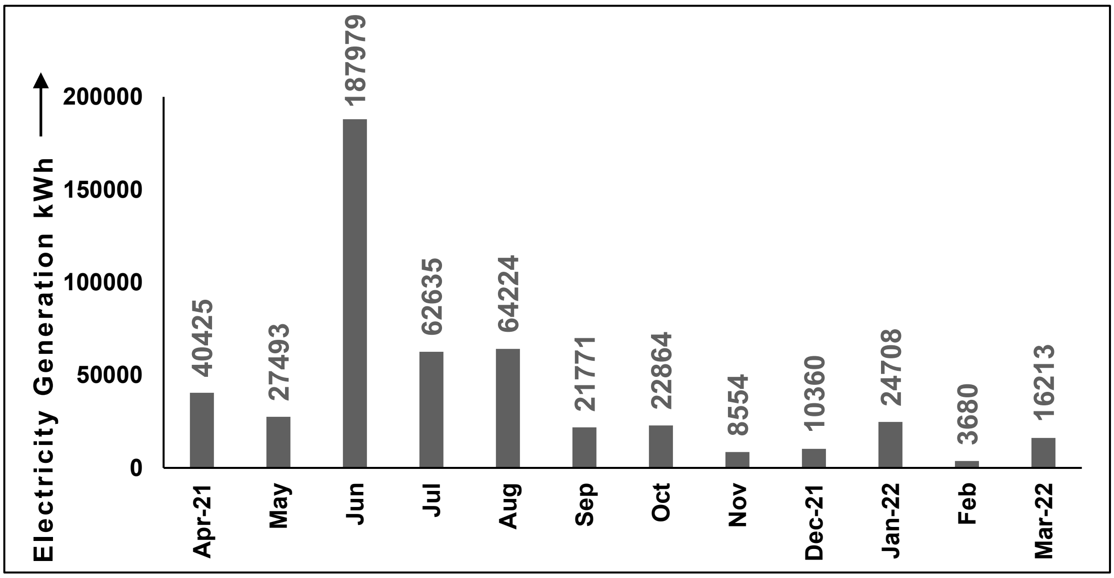


Fig 4.5 : Electricity Generation : In - house : DG Set

Average Electricity Cost : ₹ 26.70 / kWh

As expected, the cost of energy generated from the DG set is the highest of the three

4.2.4 Electricity : A Consolidation

Having accounted for electricity generation / utilization from 3 sources, a consolidation had been attempted and presented in Table 4.6

Table 4.6: Electricity Consumption Details : A Consolidation : Apr '21 – Mar '22

No	Month	Electricity Consumption kWh				Energy Cost ₹			
		PED	Solar	DG	Total	PED	Solar	DG	Total
1	Apr - 21	21 54 300	45 678	40 425	2240403	13602 272	2 80 920	1079 386	14962578
2	May	22 21 700	48 856	27 493	2298049	13998 974	3 00 464	734 853	15034291
3	Jun	21 02 340	43 992	1 87 979	2334311	13341 256	2 70 551	5020 895	18632702
4	Jul	22 76 860	41 328	62 635	2380823	14351 895	2 54 167	1656 919	16262981
5	Aug	19 07 730	41 244	64 224	20 13 198	122 20 136	2 53 651	17 10 746	141 84 533
6	Sep	21 97 800	40 305	21 771	22 59 876	139 18 645	2 47 876	5 75 925	147 42 446
7	Oct	21 99 860	37 262	22 864	22 59 986	139 83 775	2 29 161	6 10 738	148 23 674
8	Nov	17 28 610	21 360	8 554	17 58 524	112 71 704	1 31 364	2 29 027	116 32 095
9	Dec	10 95 210	37 484	10 360	11 43 054	75 67 085	2 30 527	2 77 746	80 75 357
10	Jan - 22	16 08 520	39 862	24 708	16 73 090	104 97 225	2 45 151	6 60 024	114 02 401
11	Feb	19 21 710	40 473	3 680	19 65 863	116 41 375	2 48 909	98 100	119 88 384
12	Mar	19 92 220	46 317	16 213	20 54 750	128 90 995	2 84 850	4 32 890	136 08 734
Total		234 06 860	4 84 161	4 90 906	24381 927	1492 85 337	29 77 590	13087248	165350175
Avg		**19 50 572**	**40 347**	**40 909**	**20 31 827**	**125 03 952**	**2 48 133**	**1090604**	**138 42 689**
%		**96.0**	**2.00**	**2.00**	**100**	**90.3**	**1.8**	**7.9**	**100.0**

The same are presented pictorially in Fig 4.6 & Fig 4.7

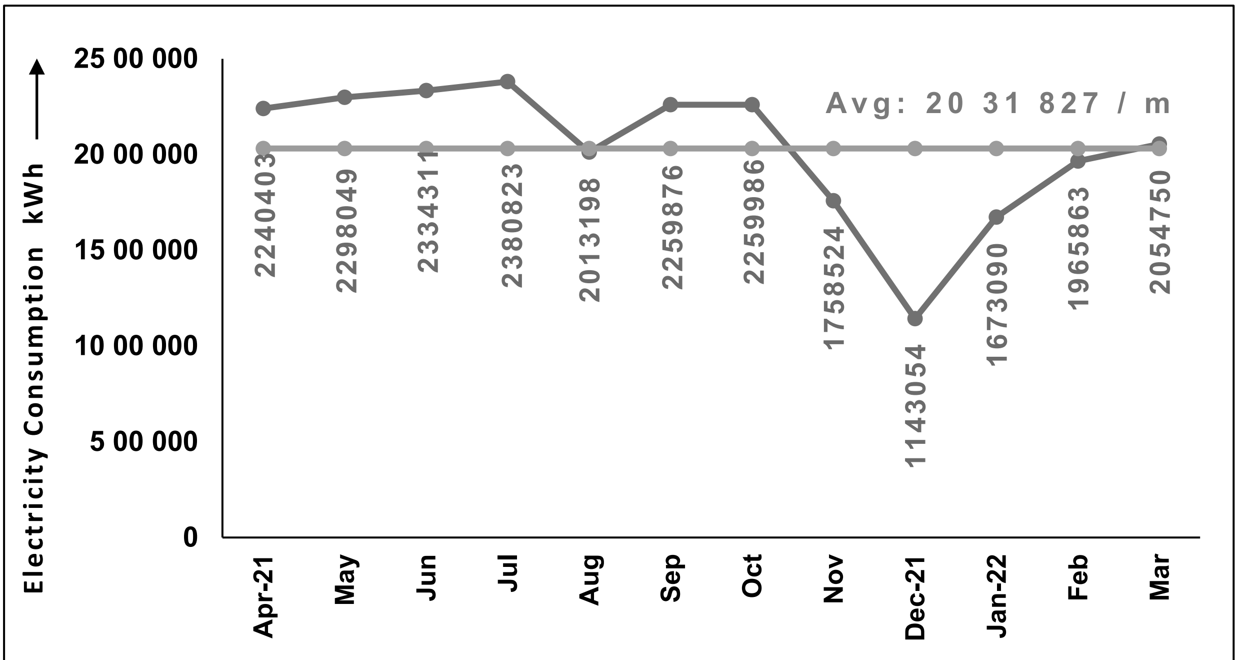


Fig 4.6:Cumulative Electricity Consumption Pattern: Apr'21 - Mar'22

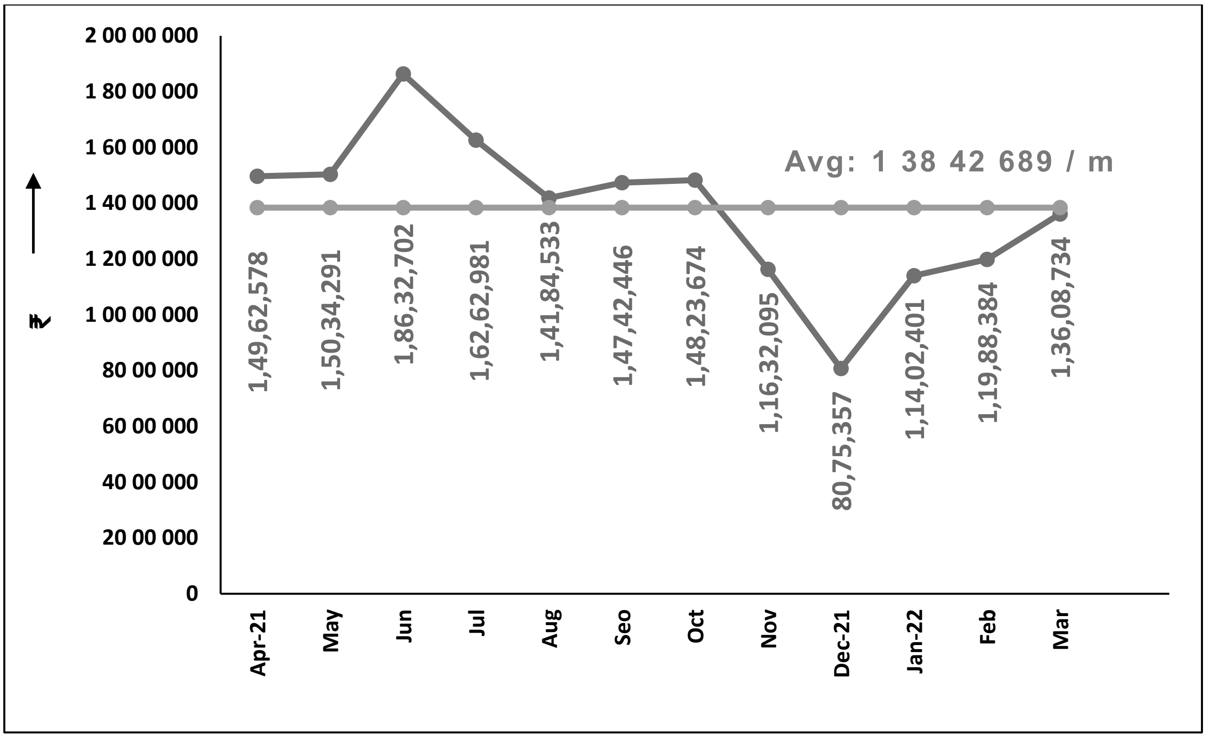
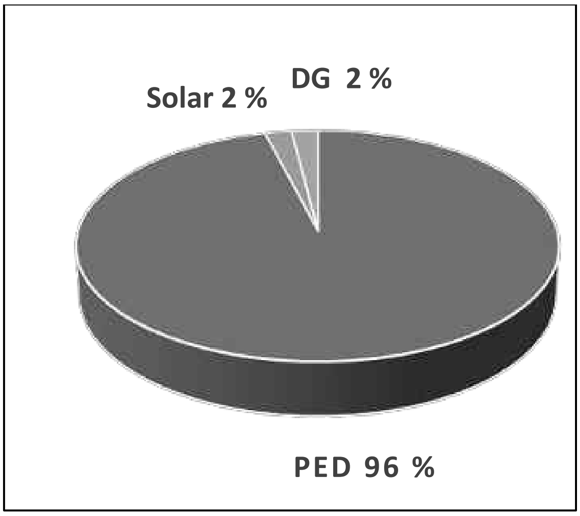


Fig 4.7: Cumulative Cost Incurred : Apr 21 – Mar 22

Armed with the above information, the Share Index Diagram (SID) has been prepared

Energy Share



Cost Share

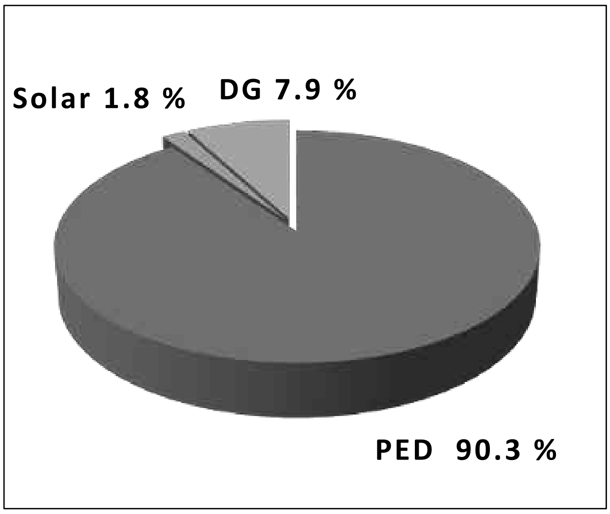


Fig 4.8 : Energy & Cost Share Diagram (EB + Solar + DG)

The weighted average unit cost of electricity generated through each of the energy sources is presented in Fig 4.9 and the weighted average cumulated one

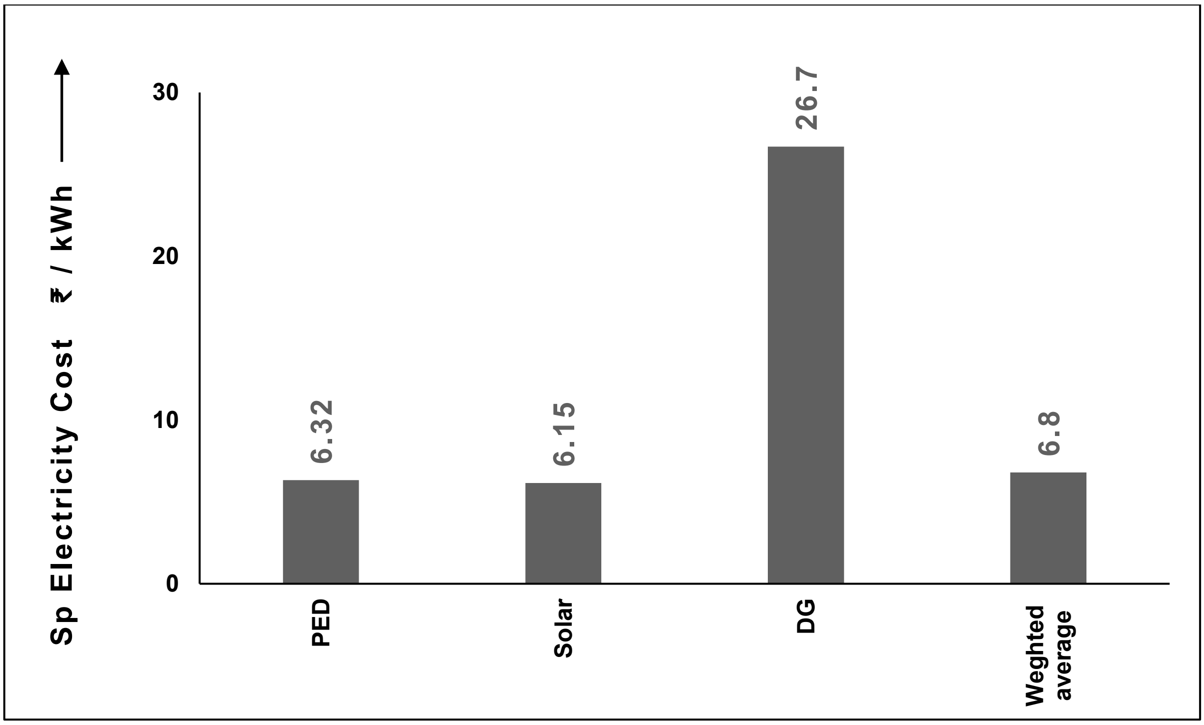


Fig 4.9 : Unit cost of Energy from Various Energy Sources

Average Electricity Cost : ₹ 6.80 / kWh

This has been made use of in the economic calculations of the Energy Conservation Schemes enumerated in the later chapters

4.3 THERMAL ENERGY

- As mentioned earlier, agro briquette is the thermal energy source that fulfils the thermal energy requirements of the process operations of the plant
- Occasionally, furnace oil fired boiler is used when the need arises by way of annual maintenance shutdown of solid fuel fired boilers.
- The boiler that is used typically throughout the year is the 16 tph **Forbes Vynck** briquette fired boiler. This boiler also has a provision to render thermal energy to thermic fluid which is used in some selected processes
- Thus, this boiler brings out steam as well thermic heat

- The steam is generated at a pressure of 24 ksc (abs) and fed to the Back Pressure Steam Turbine (575 kW) for power generation before taking the LP steam to the process use for latent heat extraction
- Fuel for the boiler is briquette which is sourced in a command area of about 80 - 100 km radius
- The techno-commercial details pertaining to the briquette are presented in the Table below :

Table 4.7 : Briquette: Techno Commercial Details : Apr 21 – Mar 22

No	Month	Briquette			₹ / ton	Overall Cost of Briquette ₹
		Consumption tons	G C V kcal / kg	Energy Equivalent Million kcal		
1	Apr- 21	2 044	3 600	7 358	6 990	1 42 87 560
2	May	2 098	3 600	7 553	7 000	1 46 86 000
3	Jun	2 124	3 750	7 965	7 280	1 54 62 720
4	Jul	2 180	3 650	7 957	7 090	1 54 56 200
5	Aug	1 719	3 700	6 360	7 180	1 23 42 420
6	Sep	2 047	3 600	7 369	6 985	1 42 98 295
7	Oct	2 015	3 600	7 254	7 000	1 41 05 000
8	Nov	1 380	3 500	4 830	6 800	93 84 000
9	Dec - 21	672	3 600	2 419	6 990	46 97 280
10	Jan - 22	1 350	3 450	4 658	6 700	90 45 000
11	Feb	1 930	3 450	6 659	6 700	1 29 31 000
12	Mar - 22	1 612	3 500	5 642	6 800	1 09 61 600
Total		**21 171**	**-**	**76 024**	**-**	**14 76 57 075**
Average		**1 764**	**3 591**	**6 335**	**6 974**	**1 23 04 756**

- From the above, the consolidation is that the Average “Thermal Energy in” is 6335 million kcal / month and the cost associated with it ₹ 1.23 crores / month
- The Furnace Oil consumption is literally Nil in the period considered

4.4 ENERGY - COST DIAGRAM

- Having established the thermal and electrical energy utilization quantity, the overall energy and cost share for the plant is established and presented in Table 4.8

Table 4.8 Energy Cost Share : Thermal & Electrical

No	Source	Energy Usage		Cost	
		kWh / m	%	₹ / m	%
1	Thermal	73 66 280	78.4	1 23 04 756	47.1
2	Electrical	20 31 828	21.6	1 38 16 430	52.9
Total		**92 80 665**	**93 98 108**	**100.0**	**2 61 21 186**

The above details are shown below through a pie diagram

Energy Share **Cost Share**

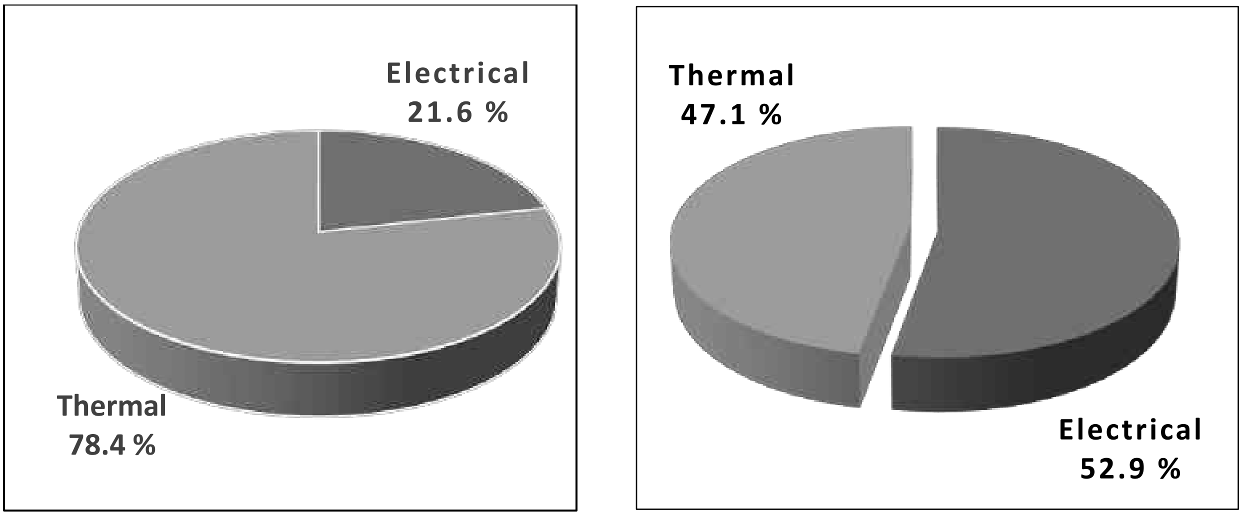


Fig 4.10 : Energy and Cost Share Diagram : Overall

4.5 SUM UP

- The thermal and electrical energy share of the plant is **78.4 % & 21.6 %** respectively while the cost share is **47.1% & 52.9 %** respectively
- This indicates that the cost spent on electrical energy is **5%** more than that spent on thermal energy

- Hence, the focus on energy auditing shall be towards optimising the electrical energy usage majorly
- Nevertheless, cost reduction in thermal energy is also welcome
- On an average the plant spends **₹ 31.0 crores / y** on energy usage alone
- Thus, the conduct of energy audit activity is justified
- This report - based on the study outcome - outlines a couple of energy - cum - cost conservation proposals that are viable both on technical and economic fronts

The management is requested to take steps to implement the “Encon” proposals on a priority basis.

5 PERFORMANCE STUDY ON THERMAL UTILITIES

5.1 INTRODUCTION

- In this chapter, an attempt is made to evaluate the performance level of thermal Utilities / Systems in the plant. This exercise is expected to indicate the ways to achieve reduction in energy consumption in these utilities wherever possible
- The scrutiny on the working / performance of the Utilities / Systems of the plant has been analysed as per the following classification :
  - (i) Boiler Performance Establishment
  - (ii) Steam Distribution Pattern
  - (iii) Condensate Recovery – a briefing
  - (iv) Steam Trap : A Diagnosis
  - (v) Hot Surface Insulation : An Examination
- Various parameters collected, measured, analysed and the ultimate outcome in terms of performance are detailed and discussed in this Chapter

5.2 UTILITIES / SYSTEMS CONSIDERED

5.2.1 Boiler Performance Establishment

- The performance evaluation of the Boiler is carried out through both Direct Method and Indirect Method.
- In the Direct Method, the steam generation rate and fuel consumption rate were recorded and the Steam – Fuel Ratio is arrived at. This ratio is multiplied by the Enthalpy Factor (= Steam Enthalpy / Fuel G C V) to arrive at the overall efficiency of the boiler
- The Indirect method was resorted to for the following two specific reasons :
  - i) Gives Independent results irrespective of Steam Flow / Water Flow measurements as well the Fuel Firing Rate

ii) This method - also known as Loss Estimation Method - is the most reliable one as it accounts for all losses that are taking place in the boiler operation and thereby offer scope for reducing the loss

- Indirect Efficiency computation involves the measurement of Key Boiler Performance Indicators (KPIs) viz Flue Gas Temperature, O_2 %, CO_2 %, CO %, Unburnt Carbon (U B C) in ash, Fuel GCV, Fuel Composition etc. These KPIs were recorded using state - of - the - art calibrated instruments, thereby ensuring the accuracy in measurement

5.2.2 Steam Distribution Pattern

- The Steam Distribution / Utilisation pattern is established based on the historic data of the plant in terms of the quantity of steam generation.
- The process sections of the plant use the HP Steam (8.5 ksc) as well as LP Steam (4.5 ksc) for their process operation
- A pareto chart had been developed to understand the steam usage pattern

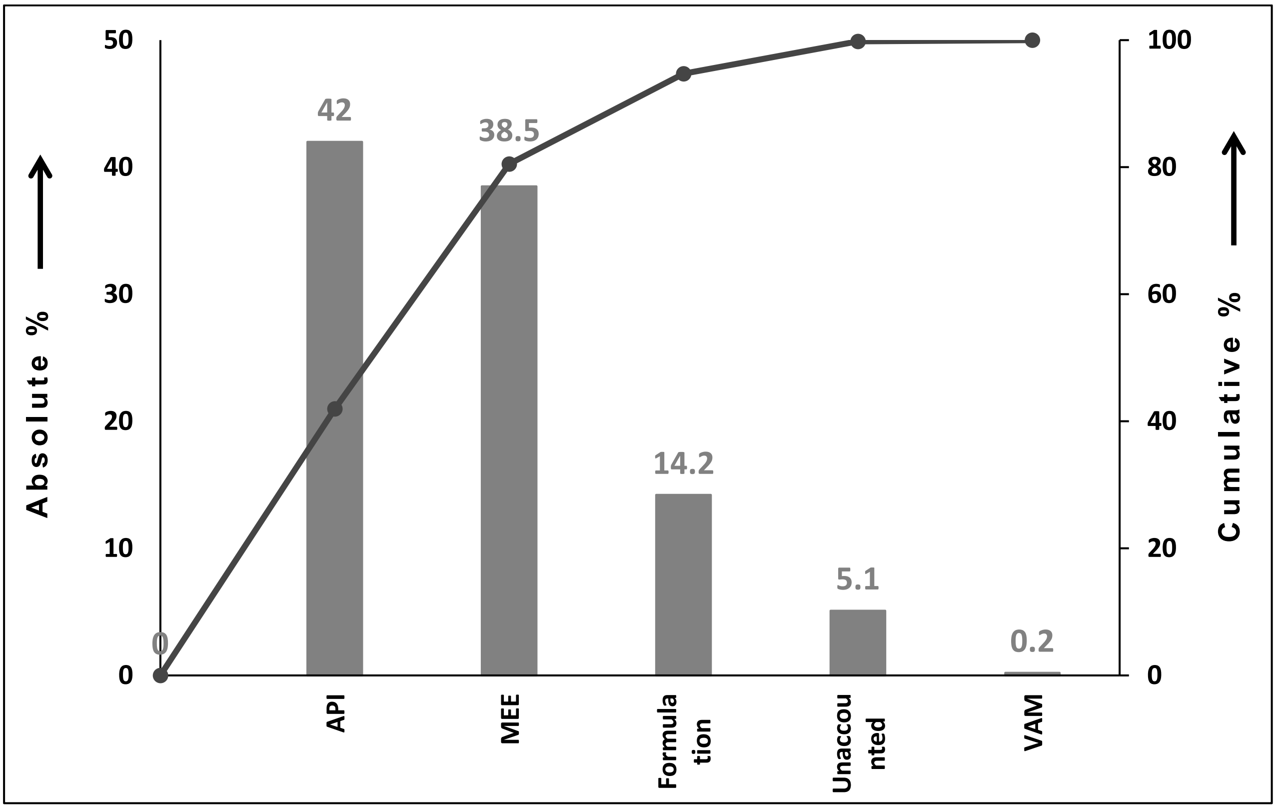


Fig 5.1 : Steam Usage Pattern : Pareto Chart

5.2.3 Condensate Recovery : A Briefing

- The condensate recovery estimation was made through the use of

    i. Historic Data

    ii. Field Level Measurements

    It was presented as a percentage of the steam generated as well as in absolute values

- This analysis gives an indication on the quantity of condensate that is drained / goes unrecovered enabling us to work further on the reduction of this.
- A Mass & Energy Balance Analysis has been made on both Steam Distribution & Condensate Recovery and that had given an in - sight into the energy that was used effectively and that was lost
- This information was made use of in the subsequent analysis

5.2.4 Steam Traps - A Diagnosis

- A diagnostic study on Steam Traps was carried out to understand the working status of the traps and the type of fault / defect encountered, if any, in these traps
- Remedial measures have been suggested for setting right the non - performing traps

5.2.5 Hot Surface Insulation - An Examination

- The steam line insulation survey throws light on the quantum of recoverable heat that is lost to the ambient because of bare / exposed / uninsulated hot pipe surfaces, flanges, joints, valves etc.
- A thermographic study had been made and the details are presented in the ensuing sections

5.3 PERFORMANCE ASSESSMENT ON UTILITIES / SYSTEMS

5.3.1 Boiler

5.3.1.1 Technical Specifications

The plant has 2 boilers (**Thermax & Forbes Vyncke**) and the technical specs are as below :

Make	Thermax , Pune.	Forbes Vyncke, Pune
Type	Travelling grate with multizone combustion	Dynamic Air cooled step grate with multizone combustion
Fuel	Briquette [crushed]	
Capacity	16 tph (f & a 100°C)	
Pressure Rating	32 bar	
Steam Quality	• Saturated	• Super - heated (Power generation sake) • Thermic Heater (1 million kcal / h)
Year of Commencement	2019	2019
Turbine Rating	-	540 kW

5.3.1.2 Steam Generation & Efficiency : Historic Data

The historic data on steam generation - as collected from the plant personnel - for the period Apr - 21 to Mar - 22 is presented below :

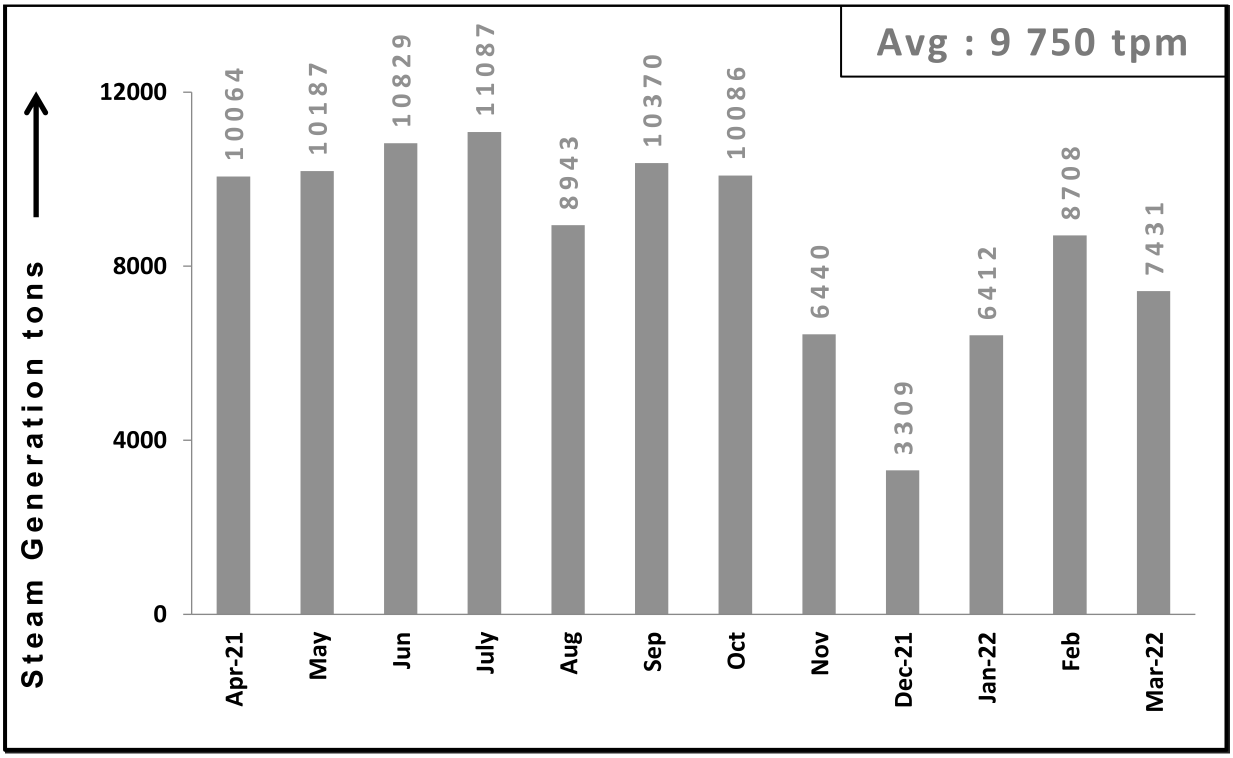


Fig 5.2 : Steam Generation Data : Apr '21 – Mar '22

- The Steam Flow Meter installed in the Steam Header is used to record the total steam generation
- The fuel (Briquette) input quantity is religiously measured so also its Moisture, Ash Content and Gross Calorific Value on a regular basis.
- Thus, through the measurement of steam flow, fuel feed rate and fuel properties, the overall operational efficiency of the boiler has been estimated by the plant personnel. This is the ‘ Direct Method’ of performance prediction
- The technical details pertaining to boiler operations are presented in Table 5.1 (Thermax boiler) & Table 5.2 (Forbes Vyncke boiler)

Table 5.1 : Performance Data : Apr ‘21 – Mar ‘22 : Thermax

No	Month	Briquette			Steam		S / F Ratio	Direct Efficiency %
		Consumption	G C V	Heat Input	Generation	Enthalpy		
		tons	kcal / kg	Million kcal	tons	Million kcal		
1	Apr - 21	311	3 600	1 120	1 270	715	4.08	63.9
2	May	155	3 600	558	664	374	4.28	67.0
3	Jun	261	3 750	979	1 286	724	4.93	73.9
4	Jul	165	3 650	602	779	439	4.72	72.9
5	Aug	80	3 700	296	379	213	4.74	72.9
6	Sep	235	3 600	846	1 144	644	4.87	75.1
7	Oct	276	3 600	994	1 283	722	4.65	72.7
8	Nov	0	3 500	0	0	0	0.00	0
9	Dec	0	3 600	0	0	0	0.00	0
10	Jan - 22	124	3 450	428	574	323	4.63	75.6
11	Feb	263	3 450	907	1 107	623	4.21	67.7
12	Mar - 22	160	3 500	560	677	381	4.23	68.0
Avg		**169**	**3600**	**608**	**764**	**430**	**4.51**	**70.8**

Fig 5.3 presents the Thermal Efficiency of the boiler computed on a month - on - month basis through Direct Method

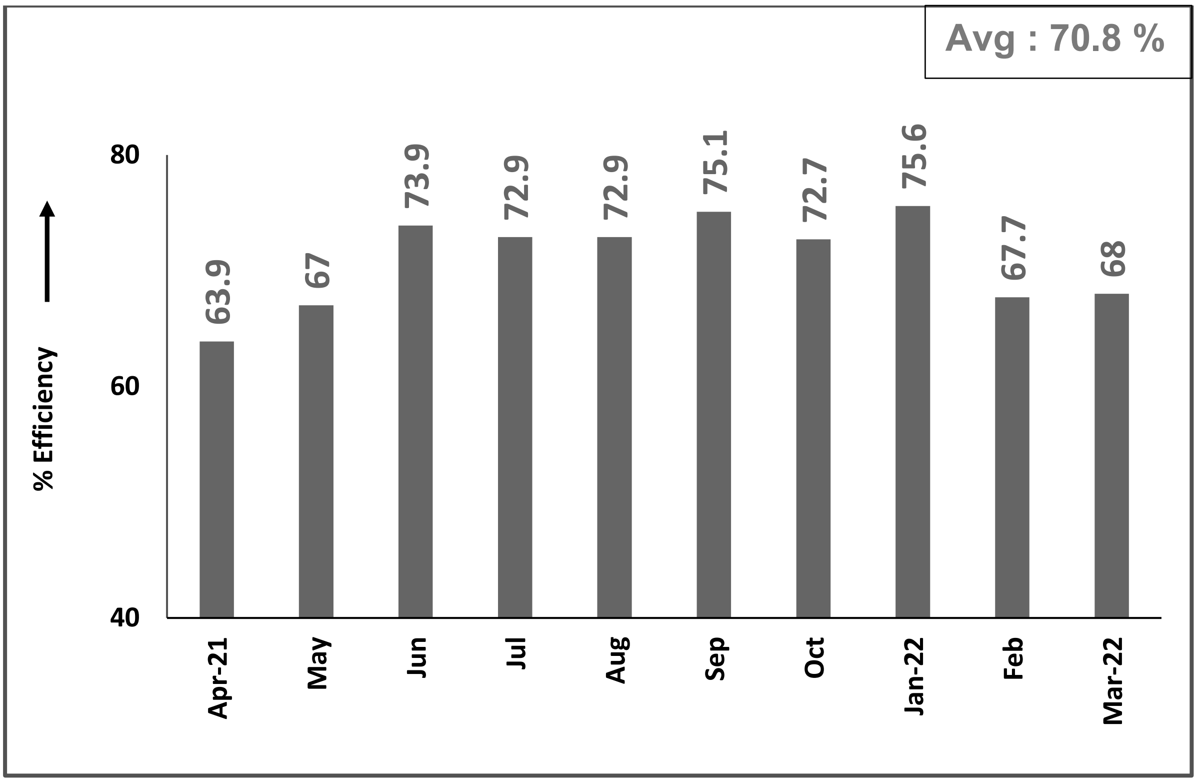


Fig 5.3 : Thermal Efficiency of the Boiler :Direct Method : Thermax

Likewise, the performance data collected on Forbes boiler is presented below in Table 5. 2

Table 5.2:Performance Data : Apr '21 – Mar '22: Forbes Vyncke

No	Month	Briquette			Steam		S / F Ratio	Direct Efficiency %
		Consumption	G C V	Heat Input	Generation	Enthalpy		
		tons	kcal / kg	Million kcal	tons	Million kcal		
1	Apr - 21	1 986	3 600	7 150	10 064	5 696	5.07	79.7
2	May	2 066	3 600	7 438	10 187	5 766	4.93	77.5
3	Jun	2 080	3 750	7 800	10 829	6 129	5.21	78.6
4	Jul	2 149	3 650	7 844	11 087	6 275	5.16	80.0
5	Aug	1 702	3 700	6 297	8 943	5 062	5.25	80.4
6	Sep	2 020	3 600	7 272	10 370	5 869	5.13	80.7
7	Oct	1 998	3 600	7 193	10 086	5 709	5.05	79.4
8	Nov	1 357	3 500	4 750	6 440	3 645	4.75	76.7
9	Dec	672	3 600	2 419	3 309	1 873	4.92	77.4
10	Jan - 22	1 346	3 450	4 644	6 412	3 629	4.76	78.2
11	Feb - 22	1 898	3 450	6 548	8 708	4 929	4.59	75.3
12	Mar - 22	1 559	3 500	5 457	7 431	4 206	4.77	77.1
Total		20 833	43 000	74 810	1 03 866	58 788	60	-
Average		1 736	3 600	6 234	8 656	4 899	4.97	78.4

Fig 5.4 presents the Thermal Efficiency of the boiler computed on a month - on - month basis through Direct Method for Forbes Vyncke boiler

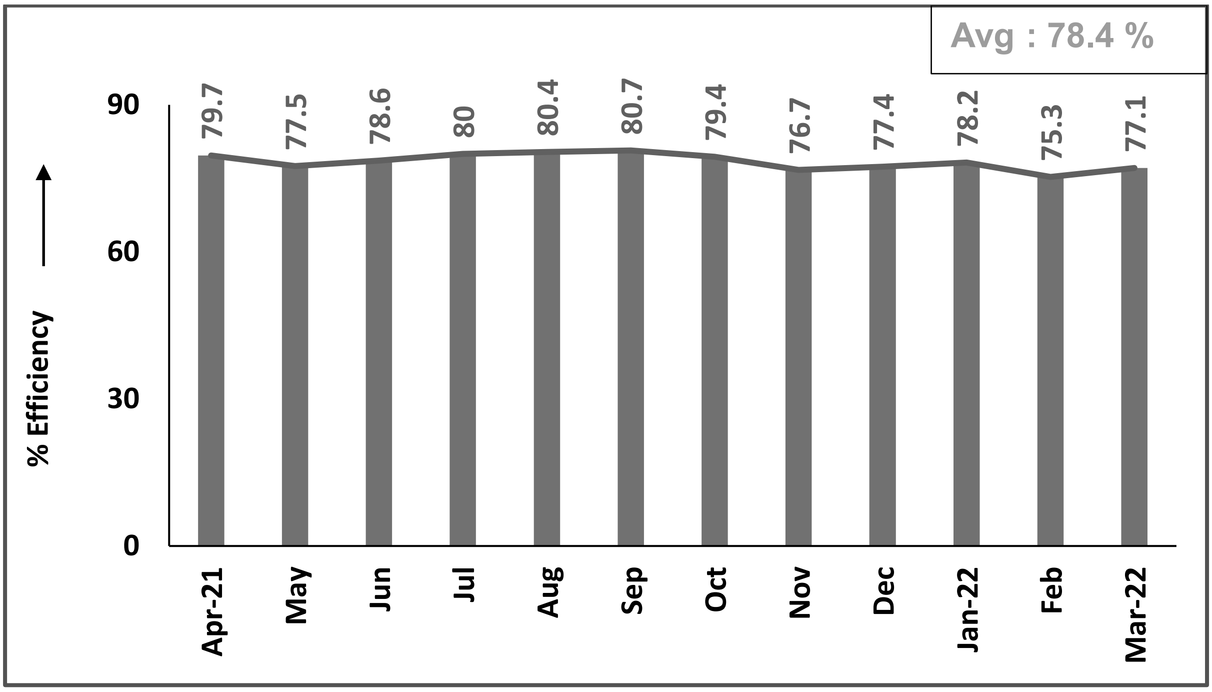


Fig 5.4 : Thermal Efficiency of the Boiler : Direct Method : Forbes

5.3.1.3 Comments

- The average overall thermal efficiencies of the Thermax & Forbes boiler is 70.8 % and 78.4 % respectively . This clearly indicates the performance superiority of Forbes boiler
- The months of July - Oct 21 (4 months) have shown an efficiency higher than 80% for Forbes boiler when it is a bit dicey
- As such , the average overall efficiency of 78.4 % obtained is marginally on the higher side as far as the Forbes boiler is concerned
- This can be ascertained for its veracity once the GCVs of Briquette are evaluated month - on - month basis

5.3.1.4 Performance Evaluation – Methodology Recommended

- At present, the Direct Efficiency Method is being practised to evaluate the performance of the boiler. This method relies upon the flow rate of steam and the fuel firing rate. This method – albeit quite acceptable – has the scope of offering efficiencies that could be a bit dicey as the measurements of steam / fuel flow may not be quite accurate. Error factor might creep in

- Hence, we had gone ahead with the evaluation of the performance of boiler through the time – tested Indirect method (also known as Loss Prediction Method) and thereby establish the overall efficiency and also the Steam Fuel Ratio
- All the data required for computing Boiler Efficiency through Indirect Method have been gathered / measured at the plant through various thermo – mechanical instruments possessed by the Auditors

5.3.1.5 Performance Data Collection : Protocol Adopted

- During the audit period, only Forbes boiler was in operation and hence the performance was evaluated for this boiler only
- To start with, the fuel properties viz Gross Calorific Value (G C V) and Proximate Analysis were obtained from the client that are lab tested
- The test report - on the fuel analysis - is presented below :

Table 5.3 : Proximate Analysis of Fuel : As Received Basis

No	**1**	**2**	**3**	**4**	**5**
Parameter	Fixed Carbon	Volatile Matter	Ash	Moisture	G C V
Unit	wt %				kcal / kg
Value	37	45.7	6.8	10.5	3900

Table 5.4 : Ultimate Analysis of Fuel : Derived from Proximate Analysis

No	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Parameter	Carbon	Hydrogen	Nitrogen	Oxygen	Sulfur	Ash	Moisture
Wt %	65.2	4.9	1.2	14.4	0	6.8	10.5

- A performance trial was taken on the Forbes Vyncke boiler on 11th Jun 2022 for a period of 200 mins (16:00 h – 19:20 h) and the following data were captured :
  - Briquette Consumption
  - Steam Flow rate
  - Steam Pressure and Temperature

- Feed Water Temperature, Pressure and Flow Rate
- Condensate Flow & Temperature
- Furnace Pressure & O_2 level
- Flue gas Temperatures at various locations

• The summary of major data collected during the conduct of trial is summed - up below :

Table 5.5 : Data Summary on Boiler Trials Conducted

No	Parameter	Unit	Data
1	Start Time	h	16 : 00
2	End time		19 : 20
3	Period of Operation	min	200
4	Steam Generation	tons	48.8
		tph	14.64
5	Briquette Consumption	tons	9.5
		tph	2.85
6	Steam Fuel Ratio	-	5.14
7	Steam Pressure & Temperature	ksc & °C	24 / 223
8	Feed Water Temperature	°C	101

5.3.1.6 Performance Evaluation through Direct Method

• Based on the data collected, the overall Thermal Efficiency of the Boiler has been computed through Direct Method

• The data consolidated for Thermal Efficiency prediction are tabulated below :

Table 5.6 : Data Consolidation : Efficiency Evaluation : Direct Method

No	Parameter	Unit	Qty
1	Steam Flow	t / h	14.64
2	Steam Pressure	ksc	24
3	Steam Temperature	°C	223
4	Feed Water Temperature at Deaerator Out		101
5	Briquette Consumption	t p h	2.85
6	Briquette GCV (as fired)	kcal / kg	3 900

Rise in Steam Enthalpy in the Boiler = (667 – 101) = 566 kcal / kg

Heat Out (Useful Heat) in Steam = (14.64 x 1 000 x 566) = 8.29×10^6 kcal / h

Heat In (Fuel Firing) = (2.85 x 1000 x 3 900) = 11.11 x 10^6 kcal / h

Hence, overall Thermal Efficiency = (8.29 / 11.1) x 100 = 74.6 %

Thus, the thermal efficiency of the Boiler has been predicted as 74.6 % through Direct Method

5.3.1.7 Performance Evaluation through Indirect Method

- The data pertaining to **Pressure - Temperature - O_2** content of the flue gas in the downstream portions of the boiler have been established through data gathered from SCADA.
- The data collected are tabulated and graphically represented below in Table 5.7 & Fig 5.5 respectively

Table 5.7 : Flue Gas Pressure & Temperature Profile - Recorded

No	Location	Pressure mm WC	Temperature °C
1	Bed	- 1	854
2	Furnace	-10	750 – 800
3	Bank Zone	- 14	660
4	Economiser Inlet	- 20	264
5	Economiser Outlet	- 40	163
6	Bag Filter Outlet	- 75	160
7	ID Suction	- 80	155
8	ID Outlet	+ 10	142

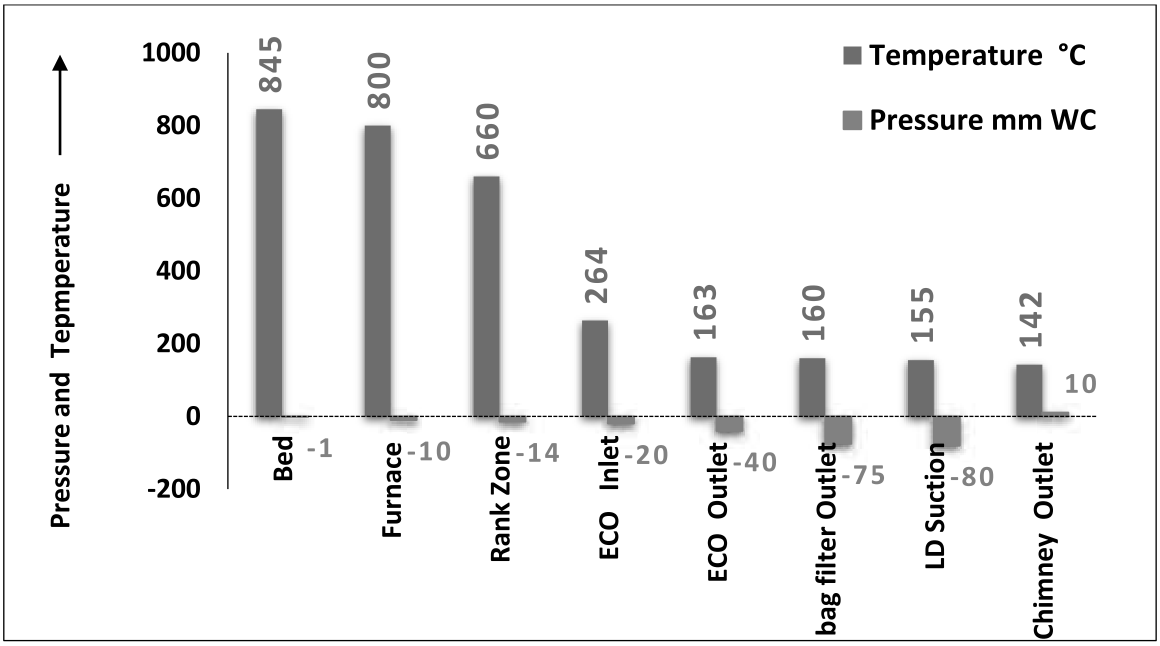


Fig 5.5 : Temperature & Pressure Profile of Flue Gas

- The temperature & pressure profiles appear acceptable
- The following data - obtained and consolidated during the boiler trial - have been made use of in the evaluation of the Boiler Thermal Performance (B T P) through Indirect Method
- The data collected included coal GCV, steam pressure & temperature, O_2 level at Economiser and temperatures of the flue gas at various locations etc.,

Table 5.8 : Data Collected during Boiler Performance Trial

No	Parameter	Unit	Value
1	Briquette Firing Rate	t / h	2.85
2	Briquette GCV	kcal / kg	3 900
3	Briquette Moisture - as fired	%	10.5
4	Feed Water Temperature	°C	101
5	Steam Pressure	kg / cm^2	24
6	Steam Temperature (saturation)	°C	223
7	O_2 Level at Furnace	%	6.5
8	Flue Gas Temperature at Economiser Outlet	°C	162
9	Mass Loading	%	91.5
10	Energy loading	%	95.9

Based on the above data, the various losses – listed below - have been estimated.

Table 5.9 : Heat Loss Computed - Breakup : Indirect Method

No	Type of Loss	%
1	Dry Flue Gas Heat Loss	9.8
2	Heat Loss due to H_2 in Fuel	7.3
3	Heat Loss due to Moisture in Fuel	1.7
4	Heat Loss due to Moisture in Air	0.4
5	Sensible Heat Loss in Ash & Heat Loss due to Unburnt in Ash + Heat Loss due to Incomplete Combustion	1.8
6	Heat Loss due to Radiation & Convection	2.0
7	Unaccounted Loss (for boiler of this rating)	2.0
Total		**25.0**

Note : Loss No : 5 : has been established through visual observation

: Loss No : 7 : has been established from Boiler standard manual

The heat loss diagram of the boiler is presented below in Fig 5.6 through Sankey Diagram

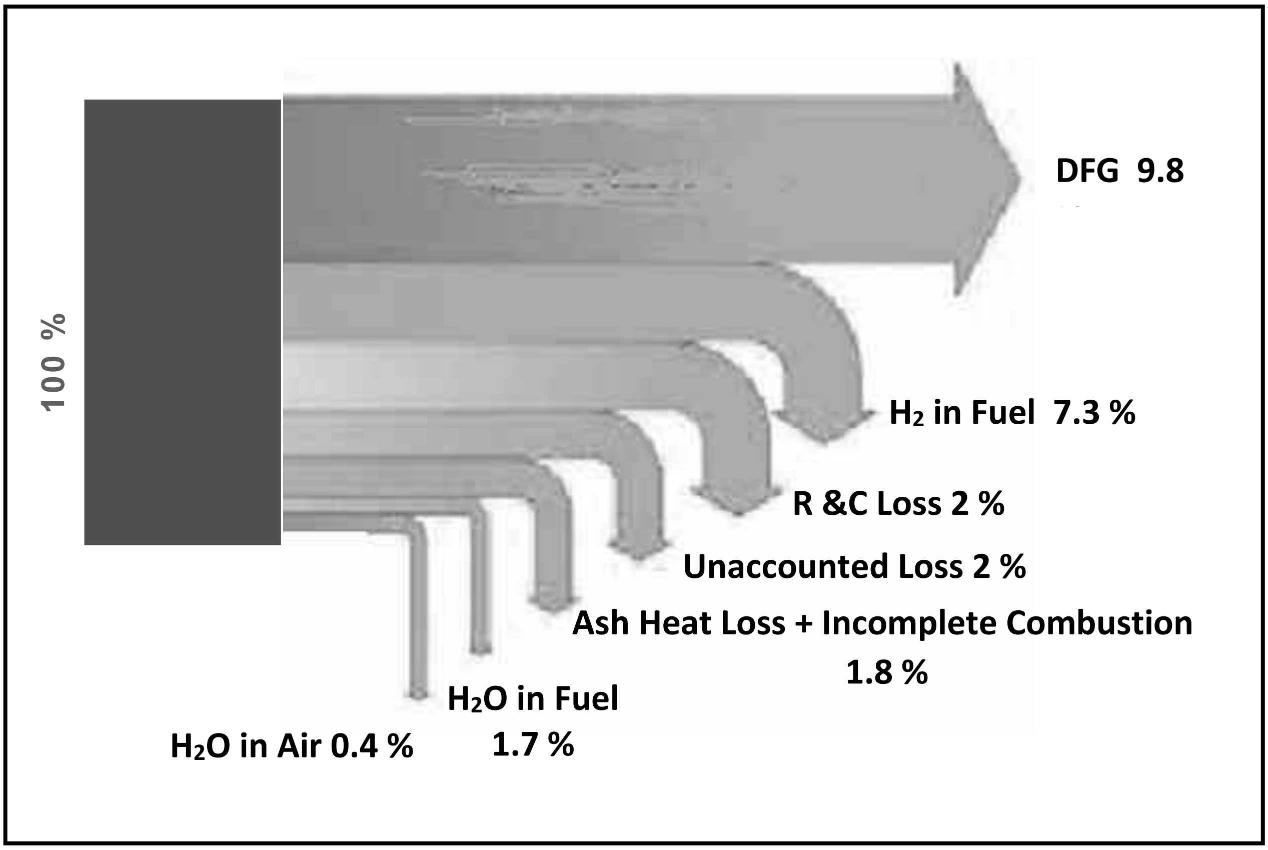


Fig 5.6 : Heat Loss Computed – Sankey Diagram : Indirect Method

Hence, Useful Heat = Boiler Thermal Efficiency = (100 – 25) = **75 %**

Thus, the realistic attainable efficiency has been worked out as 75% for this boiler.

5.3.1.8 Steam Fuel Ratio : Derived

- The overall efficiency of the Boiler has been estimated at 75 % which is quite acceptable for the boiler of this type, capacity and the firing technique employed
- The efficiency recorded by direct method was 74.6 %
- Hence, it shall be prudent to consider - henceforth - the boiler efficiency as 75 % for all computation purposes,

- Using this data, namely the Boiler Efficiency, the Steam Fuel Ratio could be computed as below :

Fuel G C V	=	3 900 kcal / kg
Boiler Efficiency	=	75 %
Steam Enthalpy	=	566 kcal / kg
Hence, Steam Fuel Ratio	=	[3 900 x 0.75 / 566] = **5.17**

S F R = 5.17

5.3.1.9 Sum Up

- Thus, a detailed analysis on boiler operation by way of conduct of trial and with measured data on fuel quality and operating parameters, has revealed the overall boiler efficiency at 75 % . This is on - par with the efficiency computed through Direct Method.
- This boiler is loaded beyond 90% (energy basis) and that could be one of the reasons for attaining this high efficiency of operation.
- This efficiency level indicates that the boiler operation is near normal and almost optimum
- It is suggested that attempts shall be made to co - burn the casuarina wood (chopped) along with briquette - in a gradual manner - which can bring down the cost of steam reasonably due to lesser cost of wood
- This issues is discussed in Chapter 10 that deals with Energy / Cost saving measures regarding boiler operation

5.4 STEAM DISTRIBUTION

5.4.1 Scheme

- The steam is produced at 24 ksc (g) pressure in the boiler house and delivered to the Steam Turbine (540 kW) for power generation through back - pressure mode.
- The pressure of the outlet steam is 9 ksc (g) that goes for process usage at various locations

- This process steam usage is broadly classified into 2 pressure zones viz one at High Pressure and the other at Low Pressure
- Of the total quantity of steam produced, 55 % is used in the process at High Pressure (8.5 ksc) and the rest 45 % is used at lower pressures (4.5 ksc)
- The low - pressure steam goes for M E E section while HP steam goes for process usage (Formulation + A P I plants)
- Fig 5.7 shows the Steam Distribution based on the "Pressure Usage" at the process

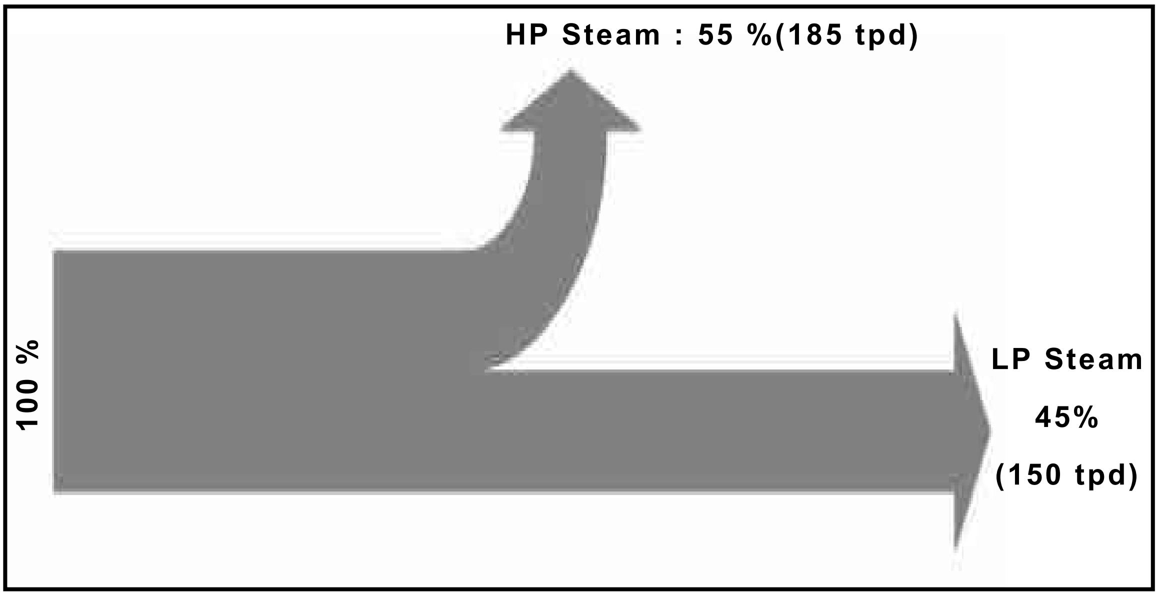


Fig 5.7: Steam Distribution Diagram : Pressure Basis

5.4.2 Steam Distribution : A Brief

A brief description on the steam usage pattern is given below :

(i) Live steam at a pressure of 0.35 ksc is injected into the De - aerator of boiler for the removal of oxygen & dissolved gases

(ii) Steam consumption takes place in the Formulation, MEE,API and VAM Sections. Both HP & LP steam are used in the process as per requirement.

Capturing the data made available by the plant personnel , a steam distribution / utilisation diagram has been prepared for the plant and is presented in Table 5.10

Table 5.10 : Steam Consumption Data : Apr '21 – Mar '22

No	Month	Steam Consumption tpd			
		Formulation	API	MEE	Total
1	Apr - 21	48	150	137	335
2	May	43	152	133	328
3	Jun	45	172	142	359
4	Jul	43	166	148	357
5	Aug	40	107	114	261
6	Sep	44	145	143	332
7	Oct	34	141	135	310
8	Nov	28	88	81	197
9	Dec 21	43	29	10	82
10	Jan - 22	41	75	61	177
11	Feb	39	146	123	286
12	Mar - 22	36	124	92	252

Fig 5.8 depicts the Steam Distribution Diagram developed based on the historic data provided

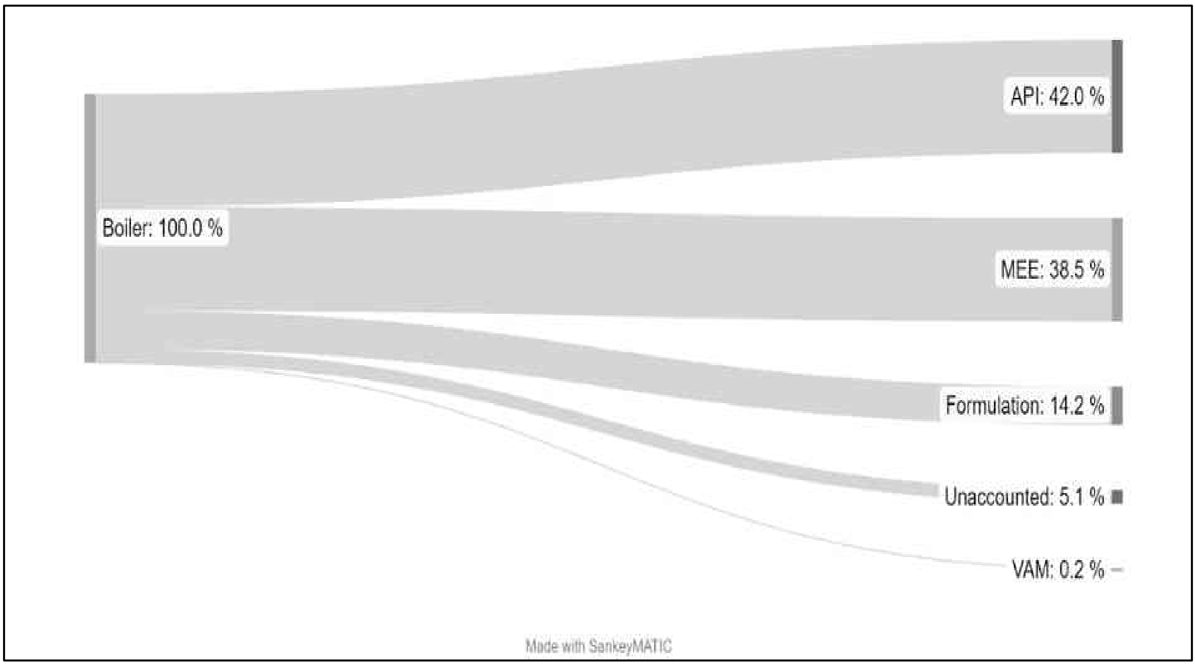


Fig 5.8 : Steam Distribution Diagram : Section wise usage

- It can be inferred that 80 % of the steam utilization is by the 2 major areas, namely, API and MEE.
- Thus, the steam distribution protocol has been briefly outlined in this section

5.5 CONDENSATE RECOVERY

5.5.1 Basics

- Condensate recovery is a process to reuse the water and the sensible heat contained in it. Recovering the condensate instead of throwing it away can save energy and also the additional requirement of make-up water. It is a fact that the overall cost of steam production can be minimized by the adoption of effective condensate recovery
- The effectiveness of the **C**ondensate **R**ecovery **S**ystem (**C R S**) is gauged by comparing the recovered quantity of condensate against the quantum of steam supplied to the process. It is generally expressed as a percentage of the steam supplied to the process.
- Higher the quantum of condensate recovery, more beneficial it is for the process facility from the financial, technical, and environmental perspective. Hence, all possible efforts shall be made to recover as much condensate as possible and send to the boiler as the financial implications of the same are quite favourable.

Steam utilization in industries is basically of two types : (i) Direct Utilization and (ii) Indirect Utilization.

- In direct utilization, steam is injected directly into the process and is used for reaction / temperature rise in the process and thereby mass addition to the final product. In direct utilization, recovery of condensate is ruled out as the steam is consumed
- In indirect utilization, latent heat of steam is used for heat transfer to the process through a heat exchanging surface. No direct mixing of steam with the product takes place in this scheme. In some cases, like tracing application, a part of sensible heat of the steam below saturation temperature is also made use of for heating

- Theoretically 100 % recovery of condensate from indirect utilization of steam is possible subjected to the purity of the condensate recovered

Thus, the condensate recovery option from steam utilization locations depends on the way the steam is utilized, viz, direct utilization or indirect utilization.

Indirect utilization gives maximum opportunity to recover condensate but due to certain constraints, recovery could be limited. However, in reality, it may not be possible to recover all the condensate as a part of condensate will be lost as flash steam or lost through vent or got contaminated by damages caused in heat exchangers etc. Further, the condensate may also be not recovered due to lack of attention or not knowing the financial benefits of recovery.

Thus, there could be a couple of reasons for not effecting the condensate recovery to the extent desired.

5.5.2 Present Scheme :

- As mentioned earlier, the steam produced in the boiler (live steam) goes for Process Operations and MEE in ZLD section.
- Currently - as per the data provided - the condensate recovery is around 60% only with 40% of the condensate not being used back
- One of the reasons for the non - recovery of the condensate is partial contamination
- Also, it was noticed that the condensate draining out of steam traps is not being collected.
- The condensate from the steam traps - installed in Main Headers & Sub - Headers lines - is not contaminated still not recovered and hence recovery should be attempted to.
- Of course, this quantum is expected to be less than 5% of total steam generated and still worth recovering it.

5.5.3 Condensate Recovery

- Condensate recovery data had been captured for a period of 6 days (6^{th} - 11^{th} June‘22) when the auditing was in progress - and is presented below

- Steam is used in the process plant, API formulation section and MEE section and accordingly condensate has also been collected from these sections and sent back to boilers
- Further, it is mentioned here that condensate from steam traps of headers as well from equipment is not collected partly because of the anticipation of possible contamination in equipment
- The plant wise steam consumption & condensate collection is enumerated in Table 5.11

Table 5.11 : Steam Consumption and Condensate Collection

No	Day	Quantity in TPD								
		Formulation			API			MEE		
		Gen	Cond	N R	Gen	Cond	N R	Gen	Cond	N R
1	06.06	38	31	7	143	125	18	128	48	80
2	07.06	37	31	7	138	123	15	144	49	95
3	08.06	36	29	7	132	119	13	146	52	94
4	09.06	37	31	6	137	127	10	153	55	98
5	10.06	36	27	9	148	112	36	151	50	101
6	11.06	39	29	10	147	115	32	154	52	102

The above details are presented in the form of chart for a better understanding

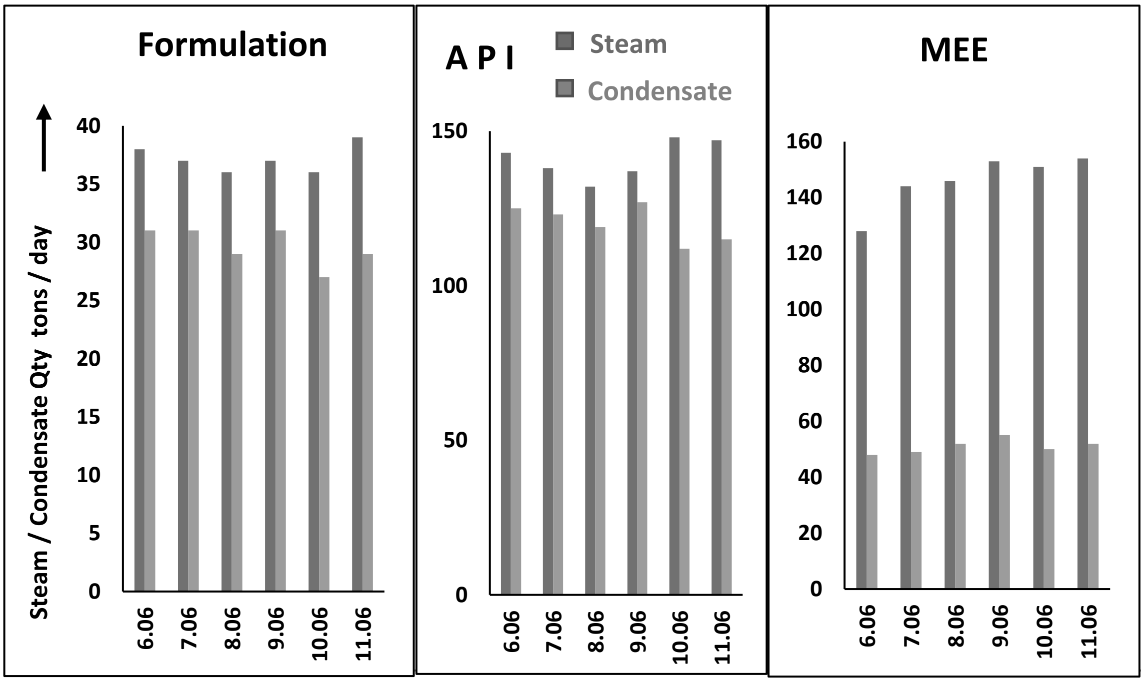


Fig 5.9 : Steam Consumption and Condensate Return

- From the above charts, the major inference is that the condensate recovery from M.E.E Section is about 35% only and the rest 65 % is going unutilised
- The condensate collection is in the range of 80 – 90 % in Formulation and API section
- A combination of above data is shown below :

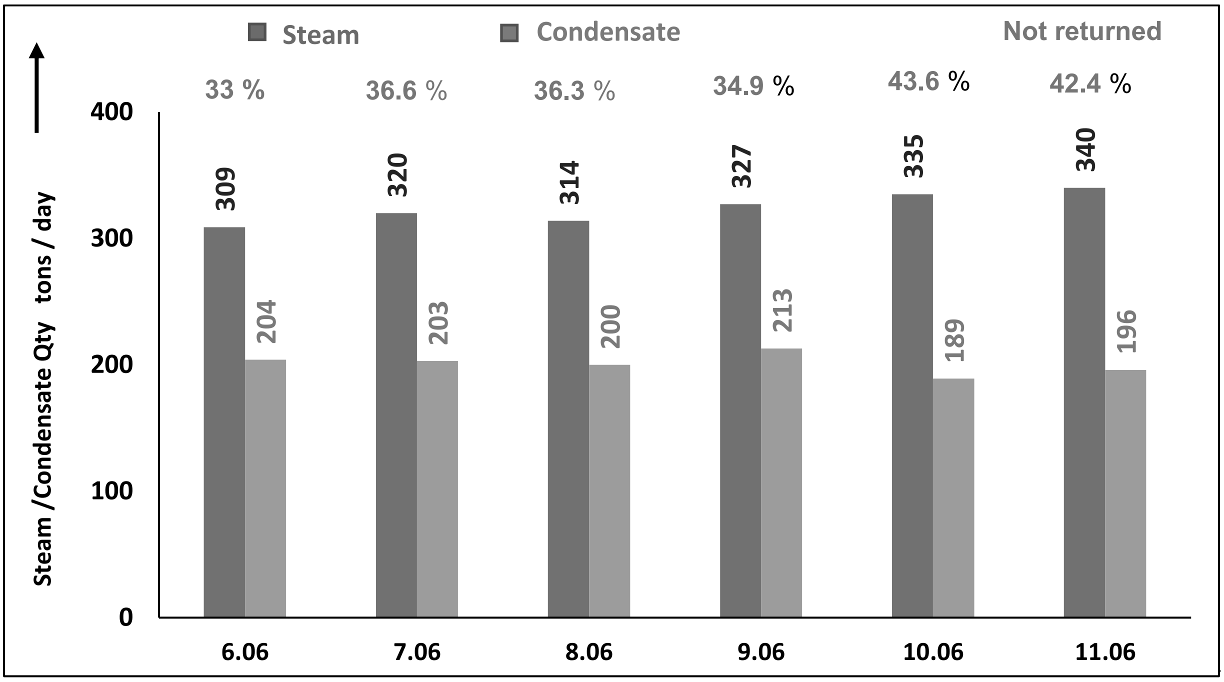


Fig 5.10 : Consolidation of Steam Consumption & Condensate Return : Cumulative Data

- Thus, it is concluded that the condensate recovery is effective to a level of 2 / 3rd and 1 / 3rd amounting to 110 tpd is lost per day. This is the cumulative data.
- As indicated earlier, attempts shall be made to recover condensate from main steam traps installed in the Headers / Sub Headers - as they would be uncontaminated which can account for not less than 10 tpd

5.5.4 Mass and Energy Aspect

- The condensate that goes unrecovered is close to 110 tons / day which is about 1/3rd of the steam generation
- The energy content of the condensate - that goes unrecovered - had been computed to be around 15 tons / day which is less than 5% only.

- Thus, it can be inferred that the energy left - out in the unrecovered condensate is only 5% of the total steam energy generated although it is 33 % on mass

Condensate Cost	=	33 % on Mass
	<	5 % on Energy

5.5.5 Sum Up

- A concise analysis has been carried out on 'Steam Distribution' as well the 'Condensate Recovery' and that had revealed that the condensate recovery is 2 / 3rd only and 1 / 3rd goes unrecovered
- However, on the energy front, the energy lost is only 5%.
- Only the major observation made was the non - collection of condensates from header line steam traps and attempts shall be initiated to collect this condensate

5.6 STEAM TRAPS

5.6.1 Preamble

- Steam Trap is a device used to discharge condensate and non-condensable gases with a negligible consumption or loss of live steam. Most steam traps are nothing more than automatic valves. They open, close or modulate automatically as per the requirement.
- The two important functions of steam trap are :
  1. Discharge the condensate as soon as it is formed (it consumes insignificant quantity of live steam)
  2. Let out air and other non-condensable gases

5.6.2 Trap Selection and Types of Traps used

- Trap selection depends on the application, the pressure differential across the trap, the amount of condensate to be discharged etc,

  The traps in Steam Distribution Line [S D L] will have to carry out two functions:

  (i) Remove Air + Condensate during start – up

  (ii) Drain out condensate that had formed during normal operation

Trap recommended for this type of application is Thermodynamic (T D). In this trap, condensate formation happens majorly due to the loss of heat from the pipe surfaces.

➢ Thermodynamic (TD) Traps : A Description

Thermodynamic (T D) Steam Traps are characterized by their intermittent operational behaviour and are best suited for installation along Steam Headers.

Fig 5.11 : Thermodynamic Trap

Typical characteristics of the Thermodynamic (T D) Trap are :

1) Relatively smaller capacity as compared to other trap types
2) Intermittent operational characteristic (open – shut – open – shut)
3) Robustness / adaptability to frequent change in pressure
4) Higher operational pressure bandwidth
5) Low weight, small size, and hence reduced surface heat loss
6) Lower investment cost
7) Simple mode of operation
8) Protection from cold and rainy climate through Isotub installation
9) Lower life cycle
10) Higher maintenance cost

The Process Traps differ in their function from that of Steam Header Line Traps in the sense that the condensate formation occurs in these traps as a result of heat transfer taking place between the steam and the user. Latent heat plays a major role in this operation and hence the quantity of condensate discharged will also be higher. Hence. these traps are normally build to handle higher quantum of condensate

The traps recommended for process applications are

- Batch operation : Float Trap with Thermostatic Vent (TV)
- Continuous operation : Float Trap with Steam Lock Release (SLR) provision

As far as the plant operation with respect to utility is concerned, the VAM Chiller shall be considered as intermittent operation

- **Float Traps (FT) : A Description**

Float traps are characterized by continuous operational behaviour. These traps work based on the difference in the density of steam and condensate. These are best suited for high condensate discharging processes both continuous and batch

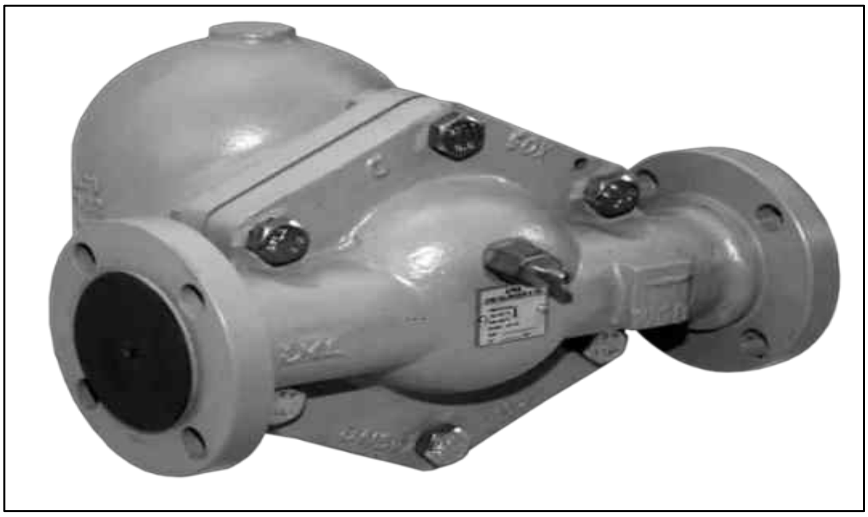


Fig 5.12 : Float Trap

Typical characteristics of the Float Trap (FT) are as below :

1) Has a large capacity for its size

2) Higher surface heat loss due to larger size. (These traps shall perennially be flooded with condensate thereby the effect of heat loss is not felt much).

3) Continuously discharges condensate at a temperature matching the saturation temperature
4) Can handle light to heavy condensate loads equally well
5) Not affected by wide and sudden fluctuations in the condensate discharge rates
6) Ability to discharge air freely when fitted with automatic air vent
7) Resistant to water hammering
8) The versions that have a **S**team **L**ock **R**elease (**SLR**) valve are the only type of traps entirely suitable for use where steam locking occurs (the **SLR** model is suitable for continuous process operations)
9) Performs better with SLR + **T**hermostatic **V**ent

Thus, the trap selection of the plant shall be like this :

Table 5.12 : Steam Trap Type : Recommended

No	Location	Type
1	Steam Distribution Header Lines	T D
2	Process	Float

5.6.3 Steam Traps - A Diagnosis

- A diagnostic study on steam traps was carried out to understand the working status of the traps and the type of fault / defect encountered, if any, in these traps
- Remedial measures have been suggested for setting right the non - performing traps

5.6.4 Functionality Check – Methodology Adopted

Thermal imaging is used as the diagnostic tool for establishing the functionality of steam trap i.e., the inlet and outlet temperature measurements are made use of

For a working trap , the steam inlet temperature shall be close to the saturation temperature corresponding to the steam pressure. Refer Table 5.13 for details

Table 5.13 : Trap Inlet Temperature – A function of Steam Pressure

No	Steam Pressure Category	Steam Pressure	Trap Inlet Temp. Range °C	
		kg / cm²(g)	T_{min}	T_{max}
1	Steam Header	26	210	240
2	HP	8.5	160	185
3	L P	4.5	155	135
		3.5	145	130
		1.5	120	105

- Trap outlet temperature shall correspond to the saturation temperature of the back pressure acting on the discharge side of the traps that are hooked on to the condensate recovery system
- This temperature shall be near to 100 °C for the traps that drain condensate to the ground and that connected to recovery system should be having a temperature corresponding to saturation temperature
- Visual / sound - based observations would also give an indication on the functionality of steam traps.

[For example, a Motor boating Trap - a trap that does not operate in the regular “Open - shut - Open - Shut” fashion any longer - can be identified by the fluttering / pulsating / quivering sound of operation synonymous with the sound a motorboat makes. This can be recognized through visual / sound based inspection of the steam trap discharge pattern.]

Thus, the functionality of steam traps was established through **Visual / Sound** based inspection and through the **Thermal Profile** across the trap.

Note: *Motor boating of trap can be identified only through sound - based observation as temperature profile of normal and motor boating trap is similar*

5.6.5 Survey Outcome

5.6.5.1 Installation Break-up Location wise : Overall

- 41 steam traps - installed in the utility side of plant - have been surveyed
- The installations are grouped into two major areas as per the locations of installation :
  - (i) Steam Distribution Line [S D L]
  - (ii) Equipment Discharge Port

The installation details w.r.t the above classification is as below :

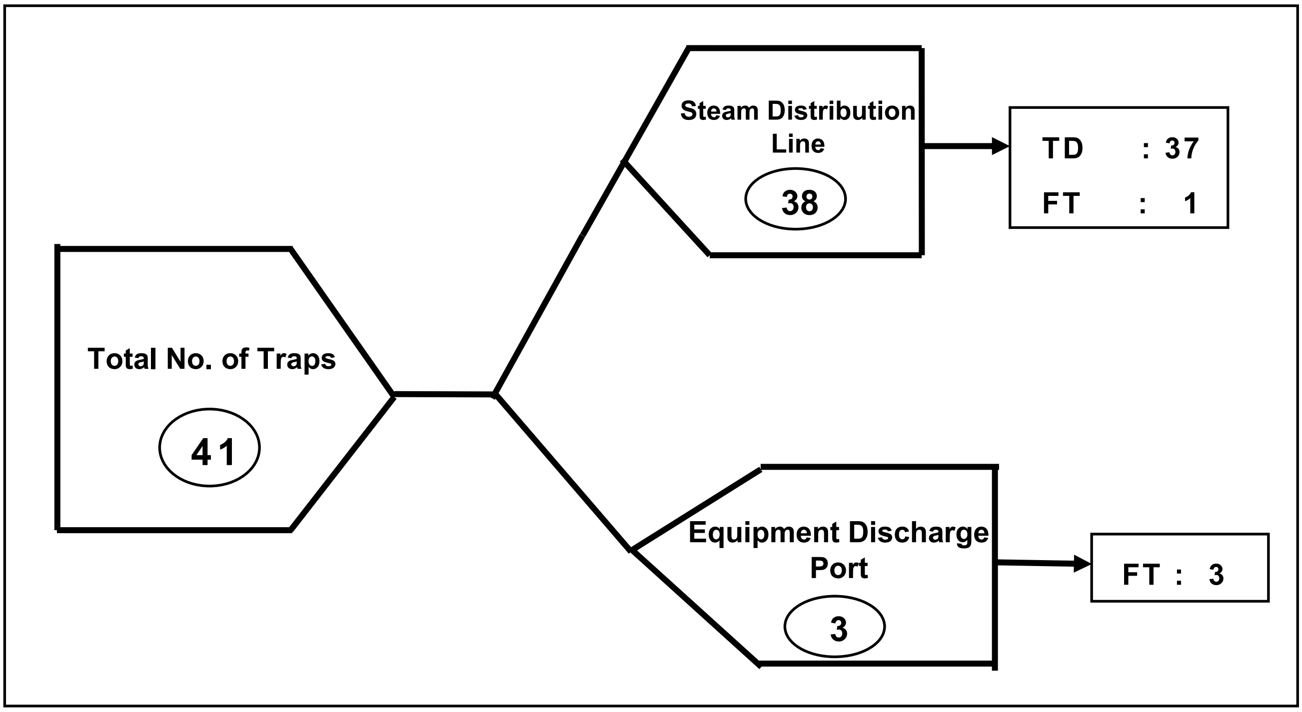


Fig 5.13 : Installation Details of Steam Traps : Location wise

➢ Functional status of these traps is given below in Fig 5.14

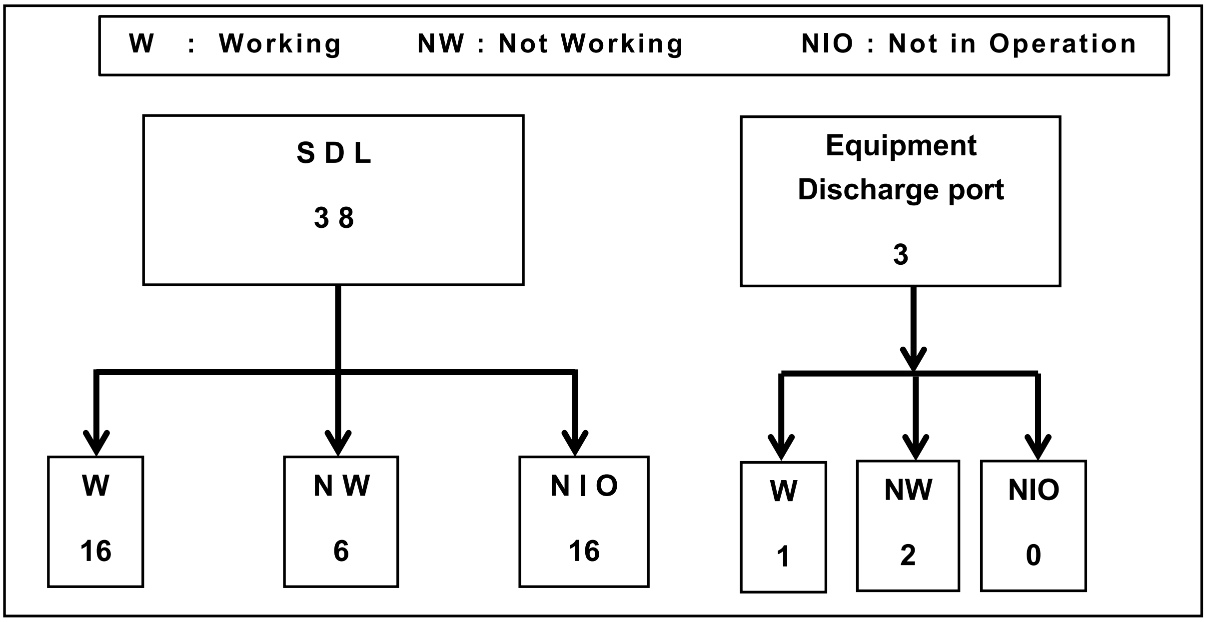


Fig 5.14 : Trap Functionality Status : A Schematic Representation

- As far as SDL is concerned , only 6 traps were not working out of 38 (**15.8 %**)
- In case of Equipment Discharge Port, 2 traps out of 3 were not working

5.6.5.2 Observations & Comments

- All the traps used in SDL are TD traps (except one) which is the correct choice .Float traps are used where there is an exceptionally high condensate discharge. In the present case, the trap selection is alright .
- All the traps used in Equipment port is F T trap which is also a correct choice.
- The problems identified with the non - working TD traps are minor in nature and hence can be set right internally during Preventive Maintenance (P M) activity.
- The flaws noticed in the operation of steam traps are

  1. Live Steam Passing : 2 Nos
  2. Motorboating : 1 No
  3. Slow Condensate Discharge : 3 Nos (2 in Equipment and one in SDL)
  4. Cold Trap : 2 Nos

  All the issues but for Slow Condensate Discharge is observed in the SDL

- The common problems observed during the audit of steam trap are as follows:

a) Out of the 41 - trap audited, 20 traps do not have any condensate recovery option which accounts for the 48.8 % of the total trap in the utility. This non – recovery is a significant loss with respect to heat recovery and water conservation

b) Most of traps which are supposed to have threaded joints are installed using welded connection which in long run makes it difficult for maintenance. Hence, we recommend going with compact model trap or trap with swappable seating and disk

c) The insulation to the T D trap is nearly non - existent. This can lead to higher condensate discharge than anticipated

d) The trap should not be closed in any of the line as this can cause water hammering as well as steam hammering .This can significantly damage the steam line. All the non - working traps shall be either dummied or the valve to the traps are closed

e) Ensure the traps are installed at every 20 to 30 m gap and at the location where there is a change in direction like bends, risers etc. The condensate return line should have an NRV

f) The correct installation of steam trap is as given below in Fig 5.15

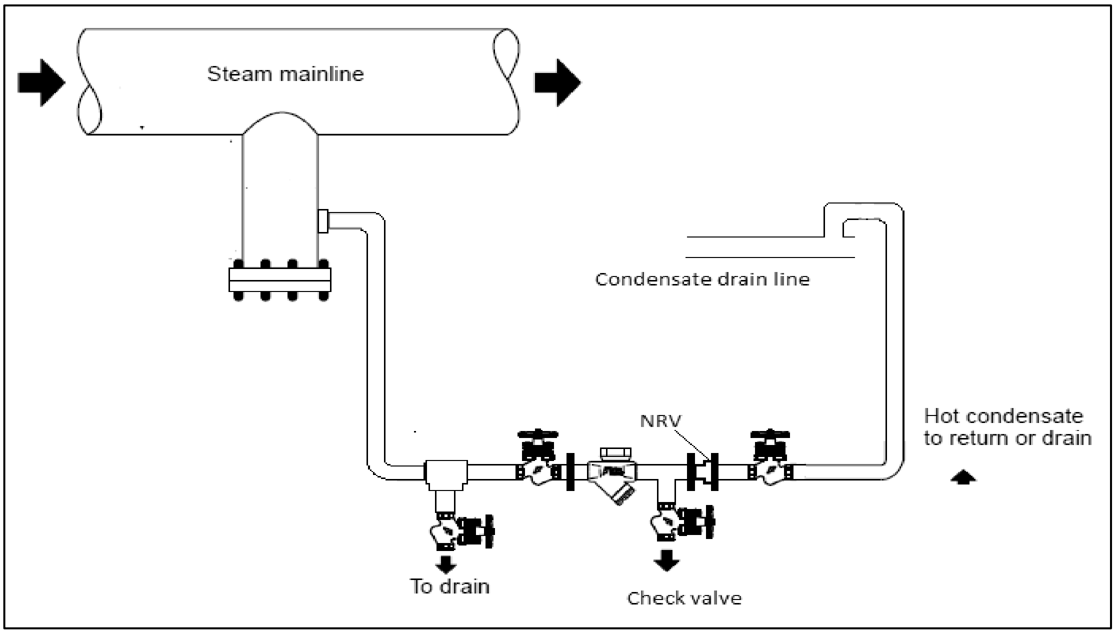
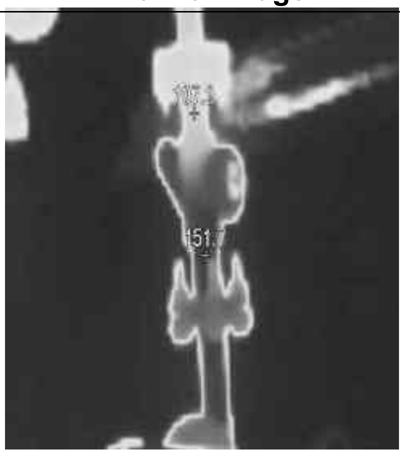


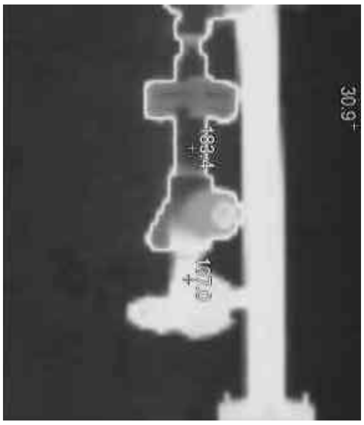
Fig 5.15 : Typical Efficient Steam Trap Lay - out : Header Line

Thermographic images of Faulty Steam Traps - numbering 8 - are presented below :

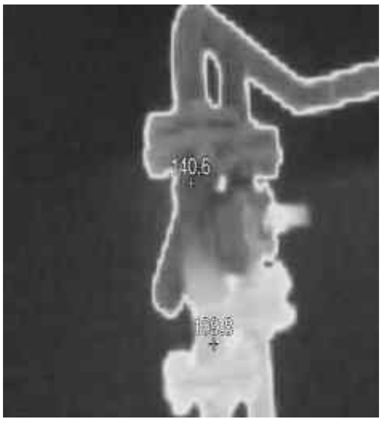
Table 5.14 : Not Performing / Faulty Traps

1) Live Steam Passing - 2 Nos

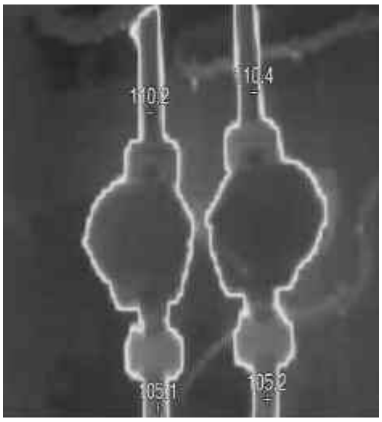
No	Location	Thermal Image	Remarks
1	Near VAM Header L P line		Steam passing to a minor extent Exit Temperature is slightly higher

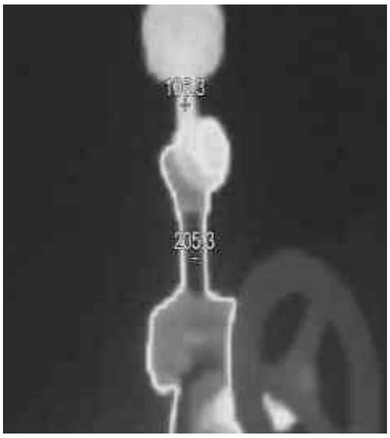
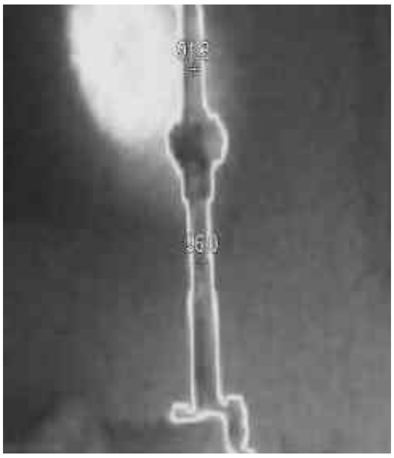
No	Location	Thermal Image	Remarks
2	Near VAM Header HP line		Steam passing to a minor extent. Exit Temperature is slightly higher

2) Motor Boating - 1 No

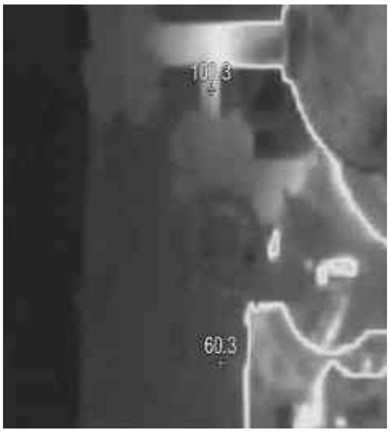
No	Location	Thermal Image	Remarks
1	H P Steam Opposite to Chiller Plant		Frequent clicking noise observed in the trap

3)Slow Condensate Discharge - 3 Nos

No	Location	Thermal Image	Remarks
1	VAM Chiller Steam Trap LP line -2 Nos		Inlet Temperature is lower

No	Location	Thermal Image	Remarks
2	Boiler Header		Lesser Inlet Temperature than the recommended range
3	Deaerator P R S Outlet		Lesser Inlet Temperature

4) Cold Trap - 2 Nos

No	Location	Thermal Image	Remarks
1	HP PRS Inlet		Inlet & Outlet Temperature: Low

No	Location	Thermal Image	Remarks
2	IP PRS Inlet		Outlet Temperature is way below 100 °C

5.6.6 Sum - up

- About 20 % of the traps need corrective action
- All attempts shall be made to rectify the faults and keep the traps in working condition.
- As a whole, the performance of the plant from steam trap perspective is decent but not great

5.7 THERMAL INSULATION OF UTILITIES

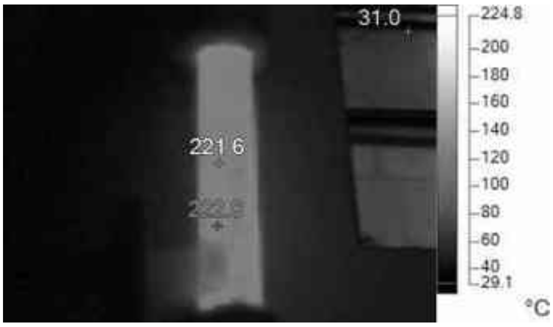
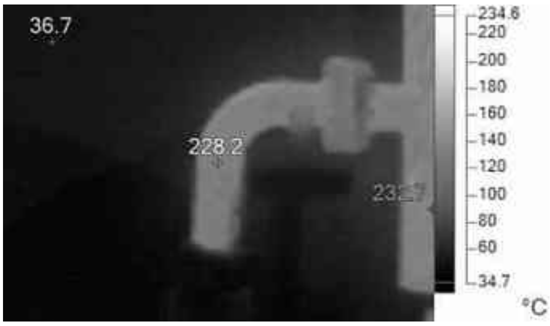
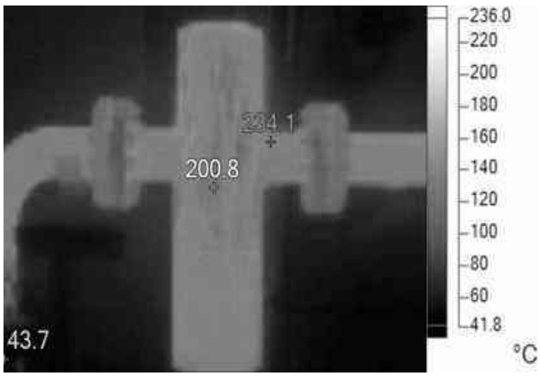
5.7.1 Introduction

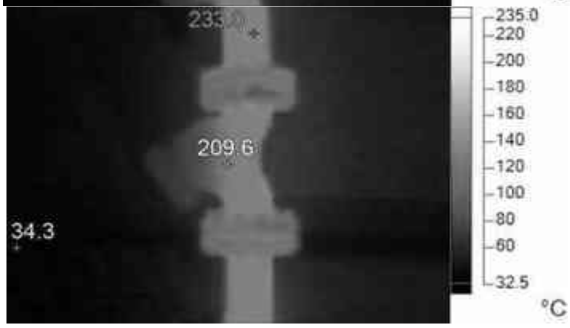
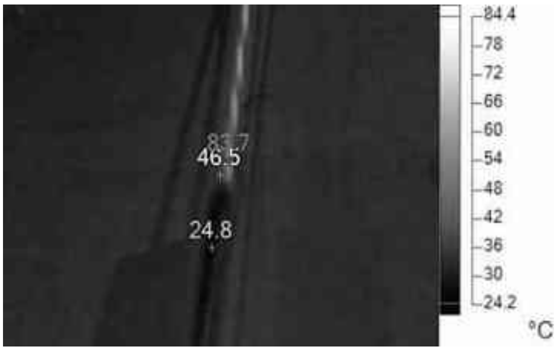
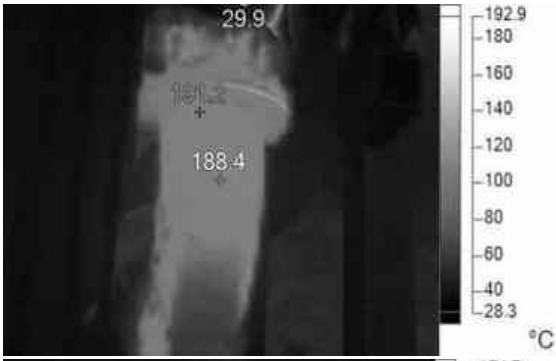
- The steam line insulation survey throws light on the quantum of recoverable heat that is lost to the ambient because of bare / exposed / uninsulated hot pipe surface, flanges, joints, valves, etc.,
- A thermo mapping survey had been undertaken on the hot surfaces associated with steam Flow / condensate return
- Thermo mapping has been done on **28** locations identified in the steam / condensate lines
- In majority of the places, it has been noticed that insulation is either damaged or not provided at all
- As it is obvious that lack of insulation would result in energy loss , an attempt was made to estimate the energy loss that is likely to occur from these places and the economics of redoing / laying the insulation

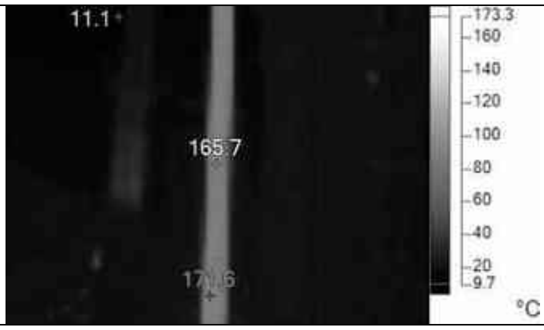
5.7.2 Locations Identified : Hot Surfaces:

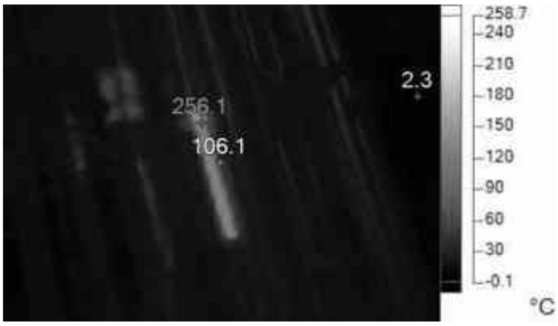
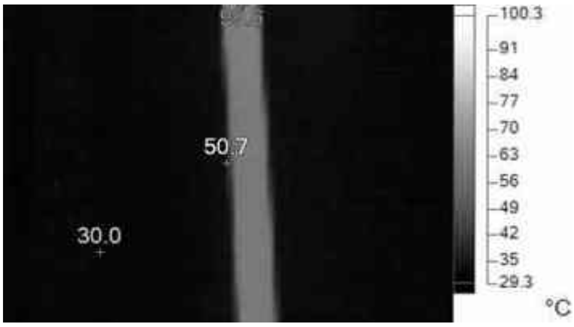
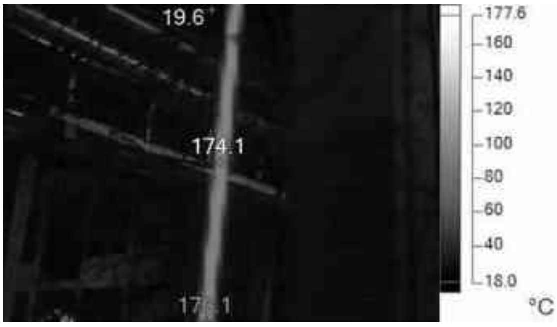
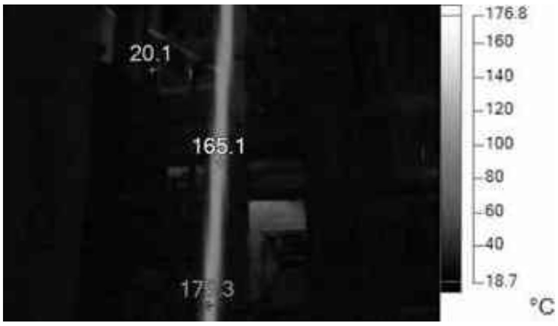
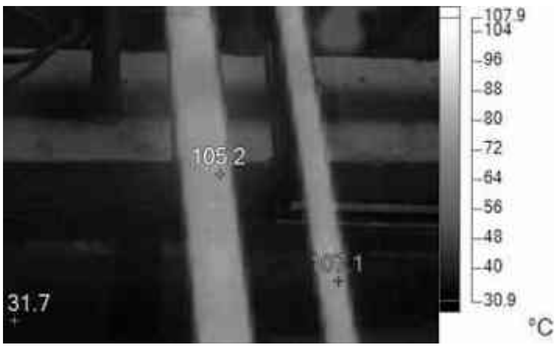
- The locations identified along with the temperature recorded are tabulated below

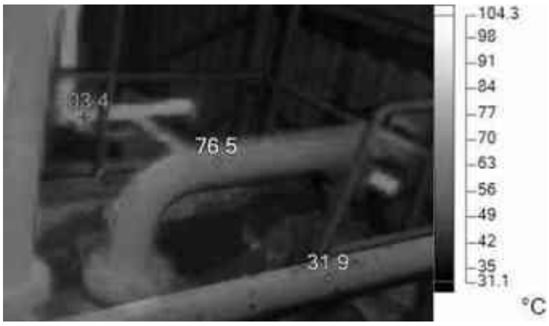
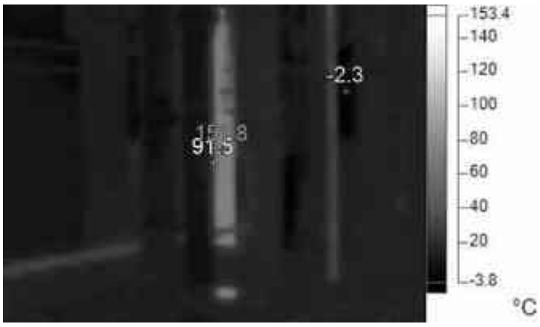
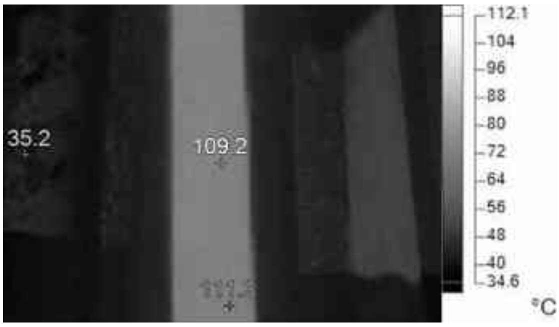
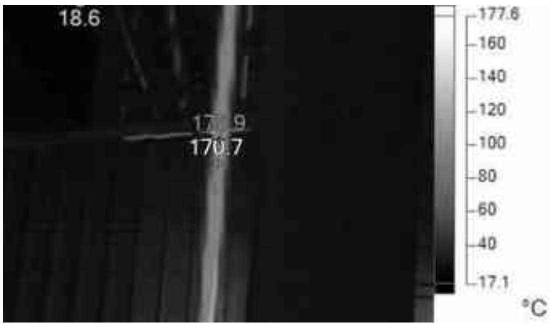
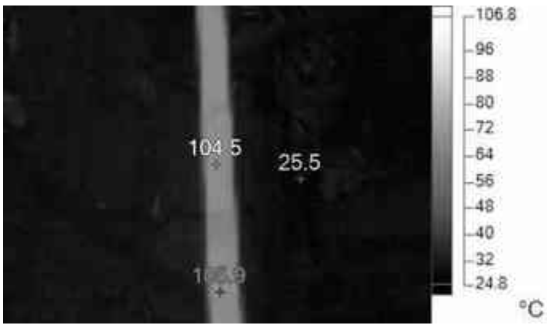
Table 5.15 : Hot Surfaces Identified

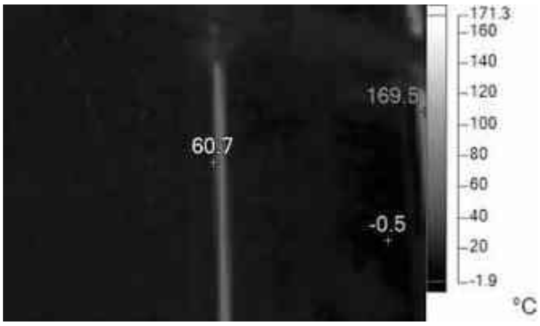
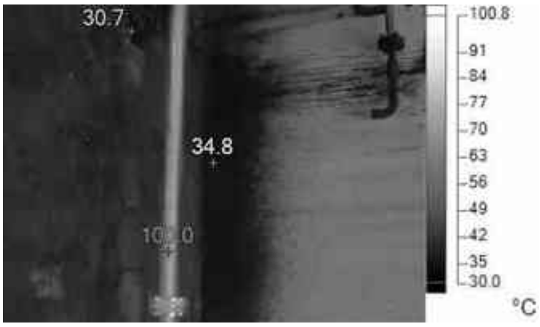
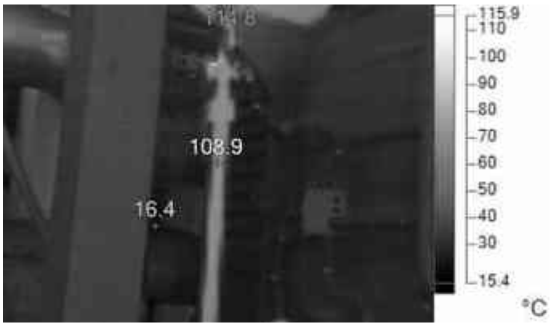
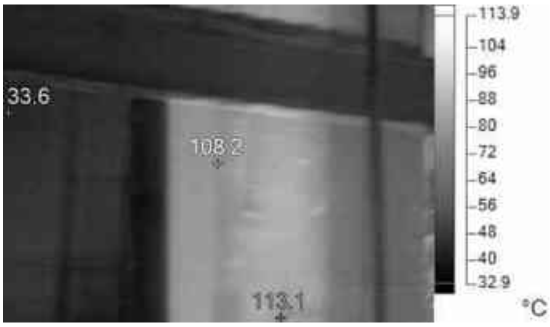
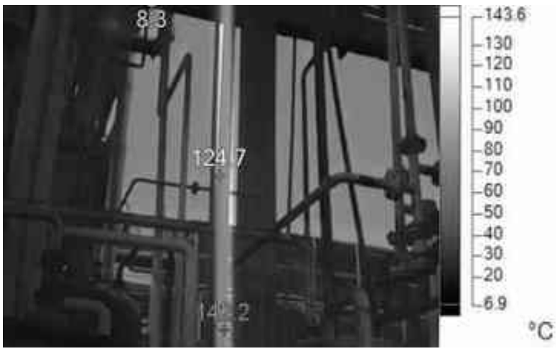
No	Location	Temp °C	Image	Remark
1	Header to Turbine - near U bend	220		Insulation Damaged
2	Header to Turbine U bend (before and after Turbine)	220		
3	Vertical Line (from Boiler PRV station)	220		
4	Turbine Inlet Separator	220		No Insulation

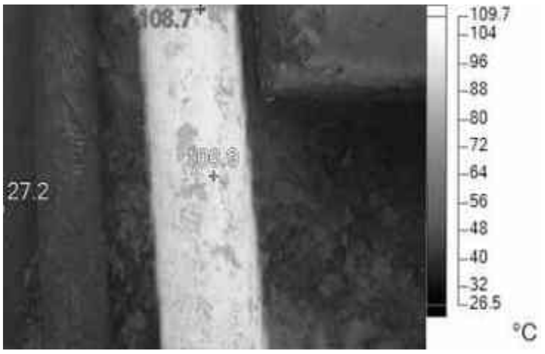
No	Location	Temp °C	Image	Remark
5	Turbine Inlet : 6“ ϕ line (After Separator)	220		**No Insulation**
6	Before Turbine Inlet : Condensate Recovery Line	65		
7	After Turbine Header	180		

No	Location	Temp °C	Image	Remark
8	After PRV	164		Insulation Damage
9	After PRV	115		
10	After PRV H P Line Rack 1	170		
11	After PRV HP Line Rack 2	170		Insulation damaged

No	Location	Temp °C	Image	Remark
12	Condensate Line HP line (Eq no : MSST 2182)	264		Insulation damaged
13	Condensate Line HP line (Eq no : MSST 2182)	100		
14	LP Steam – Line U bend	147		No insulation
15	HP Line PRV : (Eq no : MSST 2163)	170		
16	Condensate Storage Tank : PPPU pump	140		

No	Location	Temp °C	Image	Remark
17	Condensate Storage Tank : PPPU	150		No insulation
18	Condensate Area : PPPU	140		Insulation damaged
19	Condensate Line	140		No insulation
20	HP Steam Line (opposite to Chiller plant)	160		
21	Condenser HP line	100		Insulation damaged

No	Location	Temp °C	Image	Remark
22	Condensate Line near VAM Chiller	125		Insulation damaged
23	Near DM plant : Back side of the Air Compressor	105		
24	VAM Chiller Trap Line	105		No insulation
25	VAM Chiller : Heat Exchanger	150		Insulation damaged
26	Old PRV Header	148		No Insulation

No	Location	Temp °C	Image	Remark
27	Boiler opposite : Condensate Line (From MSST 2220)	100		No Insulation
28	High Vacuum Header Line	170		

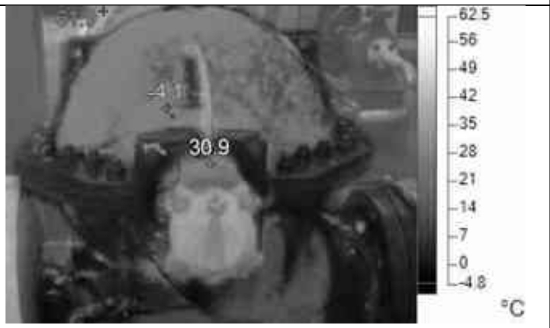
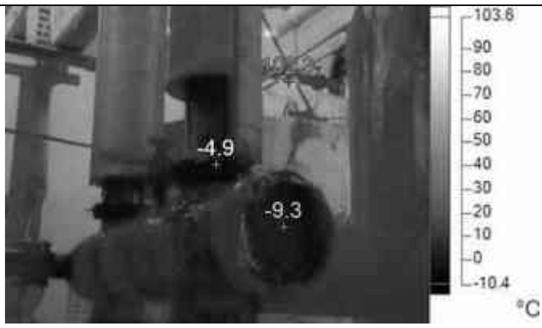
5.7.3 Observations & Comments

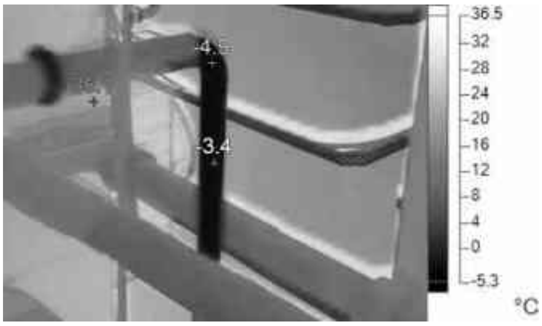
- It was observed that the temperatures recorded on these bare surfaces or insulation damage surfaces are invariably 125°C
- In a couple of locations in the boiler area, the surfaces temperatures had gone as high as 220 °C
- An estimate had been made on the heat lost due to these, having recorded not only the surface temperatures but also the corresponding opened - up surface area
- The heat loss is estimated to be 2.5 tph of steam equivalent which is more than 10 % of the steam generation. This detail on energy savings is explained in Chapter 11

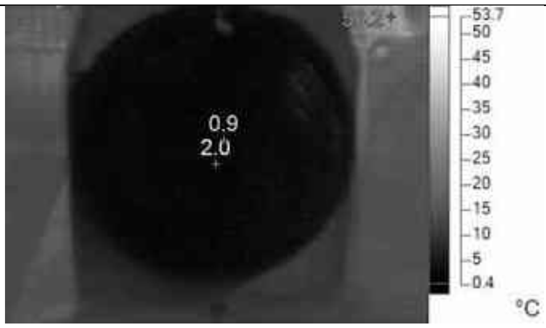
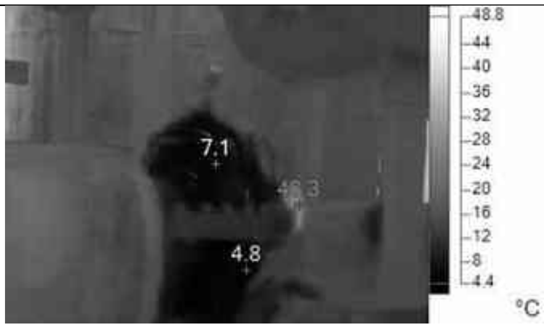
5.7.4 Location identified : Cold Surfaces

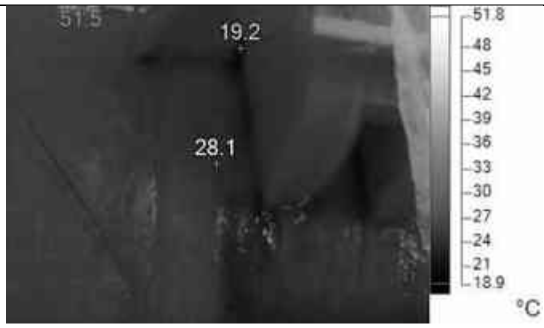
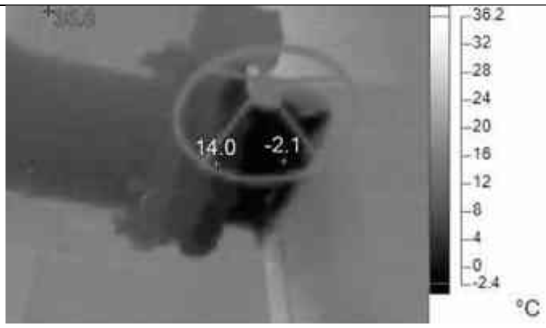
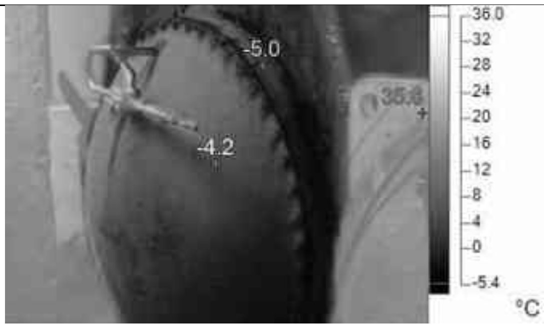
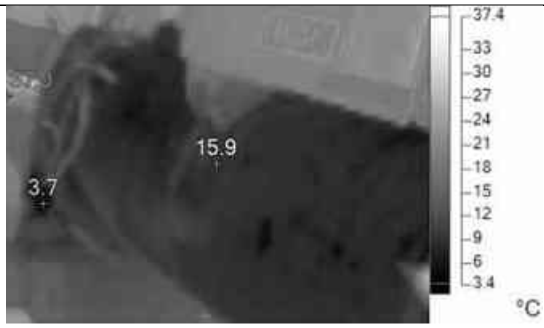
- A thermal mapping has been carried out in the cold surfaces also as it has been noticed that the insulation is either missing or damaged in a couple of locations
- 16 such locations have been identified and listed below :

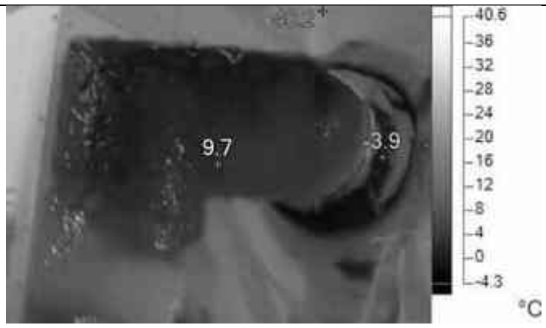
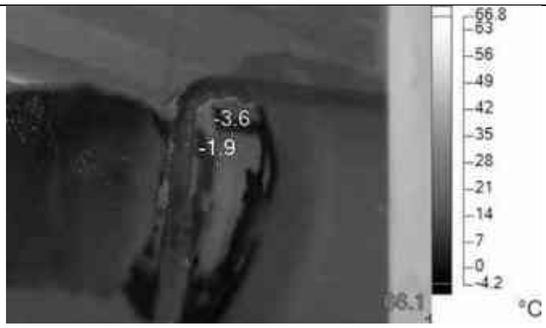
Table : 5.16 : Cold Surfaces Identified

<table>
<tr><th>No</th><th>Insulation</th><th>Temp °C</th><th>Image</th><th>Remark</th></tr>
<tr><td>1</td><td>Near VAM Chiller : Methanol Tank pump</td><td>1</td><td>
</td><td rowspan="2">No insulation</td></tr>
<tr><td>2</td><td>Near VAM Chiller : Methanol Tank Header</td><td>1</td><td>
</td></tr>
<tr><td>3</td><td>Near VAM Chiller : Methanol Tank Header</td><td>1</td><td>


</td><td rowspan="2">Insulation Damaged</td></tr>
<tr><td>4</td><td>Near VAM Chiller : Methanol Tank Bottom Header</td><td>1</td><td>
</td></tr>
</table>

No	Insulation	Temp °C	Image	Remark
5	Chiller I B U - 2 : Chiller End Cap	2		Insulation Damaged
6	Chiller Area Chiller Evaporator	18		
7	I B U - 1 : Process Pump	6		Insulation Damaged
8	IBU - 1 : Chiller Water Line to Pump	20		
9	Chilled Water Tank (U M S T - 2147)	6		No insulation

No	Insulation	Temp °C	Image	Remark
10	Pharma Chiller : (U C C H : 2022) : Chiller End Cap	-3.3		Insulation Damaged
11	Pharma Chiller : (U C C H : 2022): Chiller Surface	1		
12	Pharma Chiller : (U C C H : 2022) : Chiller Outlet Pipe	14.2		No insulation
13	U C C H : 2018 : Chiller End Cap	-4.2		
14	U C C H : 2018 : Chiller Evaporator	15.8		Insulation Damaged

No	Insulation	Temp °C	Image	Remark
15	U C C H : 2018 : Chiller Compressor	-3.6		Insulation Damaged
16	U C C H : 2022 : Chiller Inlet Pipe	20.3		No insulation

5.7.5 Observations & Comments

- Thermal energy due to lost to ambient due to the exposure of cold surfaces had been estimated having recorded both the temperatures as well the exposed surface area
- The energy lost has been computed to be equivalent to 10 TR which is significant if not high
- The energy lost due to cold surface areas gets accounted in the electrical energy consumption and hence expensive economically
- Therefore, it is recommended to attend to this “cold surface exposed” and set them correct

5.7.6 Overall Sum - up

- A detailed thermo mapping carried out on the hot / cold surfaces had revealed the “loss of energy” to an extent of 2.5 tph of steam equivalent from hot surfaces and 10 TR equivalent of refrigeration from cold surfaces
- Hence, it is recommended to attend to these and bring down the energy loss to the extent possible by way of insulating these surfaces effectively

6 ELECTRICAL DISTRIBUTION SYSTEM : FACITLTY DESCRIPTION & STUDY OUTCOME

6.1 INTRODUCTION

- The main source of electricity to the plant is from Puducherry Electricity Department (PED) at 22 kV grid supply from Kalapet substation. This is then stepped down to 433 V in the 5000 kVA main step - down transformer of the plant
- The schematic of EB distribution system is shown in Fig 6.1

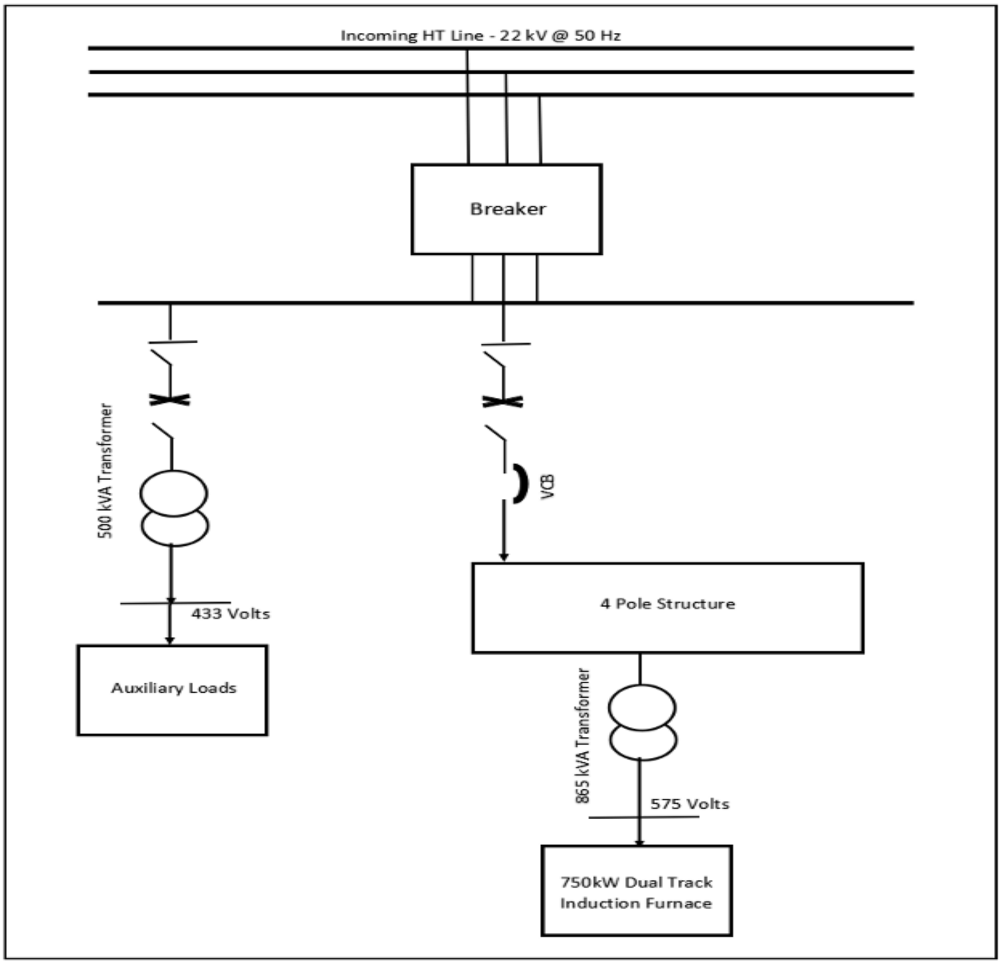


Fig 6.1 : E.B Distribution System : Existing

- All the utilities and production related equipments are connected to this 5000 kVA main transformer
- The operating voltage is about 415.

6.2 HT SERVICE

- The plant has acquired / hired HT Service - 22 kV under category HT – I
- The service details are as below

Table 6.1 : HT Service Details

No	Parameter	Value
1	Service Connection No	139
2	Circle	Rural / North
3	Sanctioned Demand kVA	3 860 kVA
4	Minimum Chargeable Demand	85 % of 3860
5	PT Ratio	22 kV / 110 V
6	CT Ratio	30 / 5 A
7	Multiplication Factor	1 000

6.3 LOAD DISTRIBUTION

- The load distribution from the transformer to the Utility & Process Equipment happens through 3 Power Control Centres (PCC) panels
- The scheme of power distribution in practiced in the plant is as below :

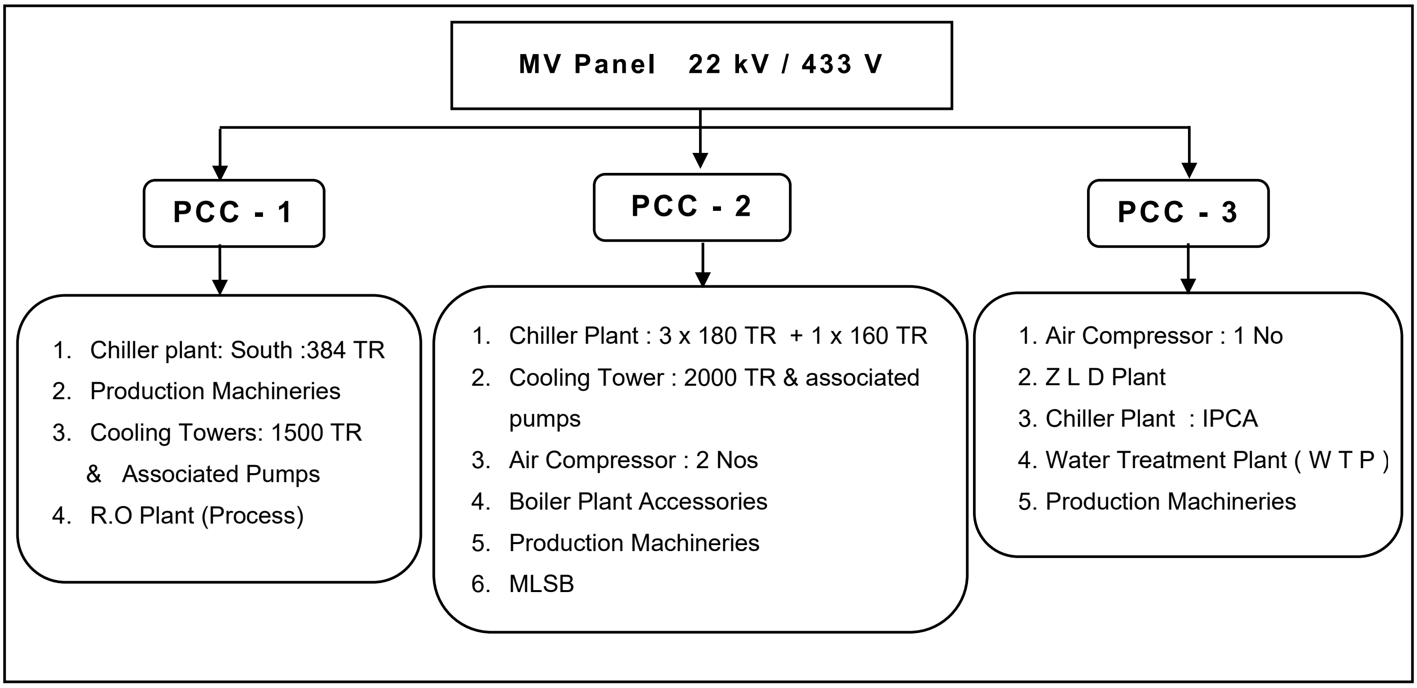


Fig 6.2 Electrical Load Distribution Scheme : Currently Practiced

- A quick estimate carried out on the load distribution pattern in the PCCs revealed the following :

Table 6.2 : Load Sharing Pattern in PCCs : Enumerated

No	1	2	3
Location	PCC 1	PCC 2	PCC 3
Energy Share %	40	30	30

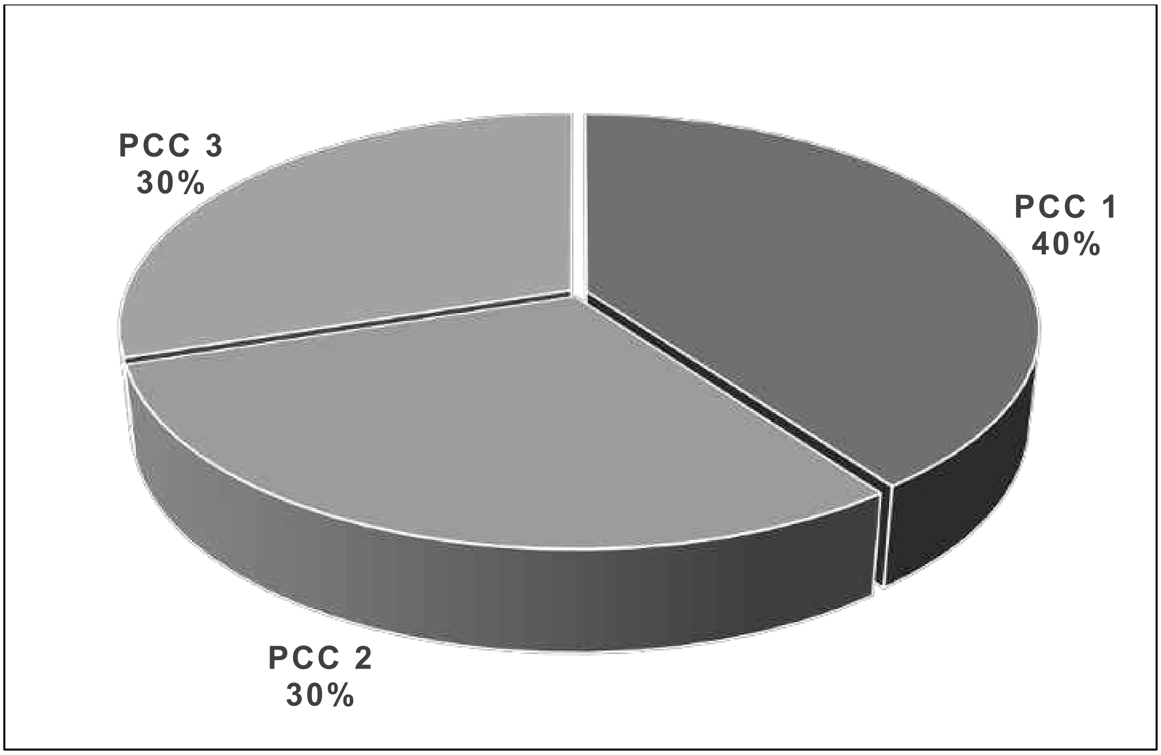


Fig 6.3 : Load Sharing Pattern in PCCs : As observed

- It can be observed that the load sharing in all the 3 PCCs is quite uniform, and it is appreciated

6.4 MV PANEL : OBSERVATION & ANALYSIS

- The plant is located farther away from the substation transmission system of PED in Kalapet. During the audit period, it was recorded that the HT voltage fluctuated between 19.5 kV to 22.4 kV and the corresponding Secondary Voltage from 404 - 420

- The tap setting was manually altered to 4th position from the existed 5th position and that could enable the receipt of secondary voltage around **405 - 415 V** . Hence, it has been suggested to the plant personnel to currently follow this setting
- Electrical power data logging was carried out on the HT side of the EB mains for a period of 24 hrs [10:15 h on 9th till 10:15 h on 10th]
- Energy consumption during this period was 76 620 kWh working out to an average load of **3190 kW**
- In reality, the power drawl ranged between **2891 kW & 3436 kW**
- Average power factor recorded varies between 0.979 to 0.998
- The power drawl trend during the 24 h period is shown below in Fig 6.4

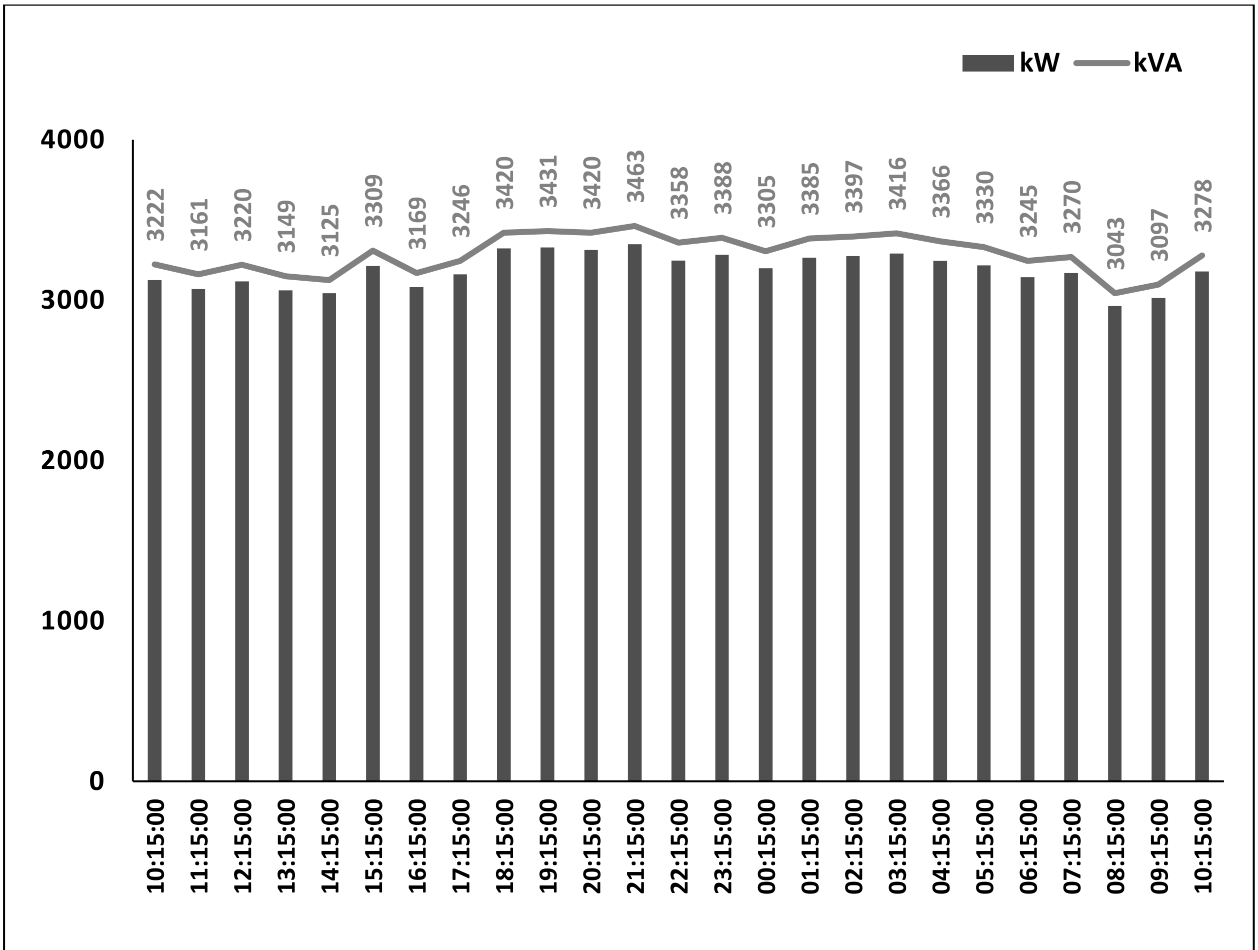


Fig 6.4 : Power Drawl Trend : Active & Apparent - HT Main

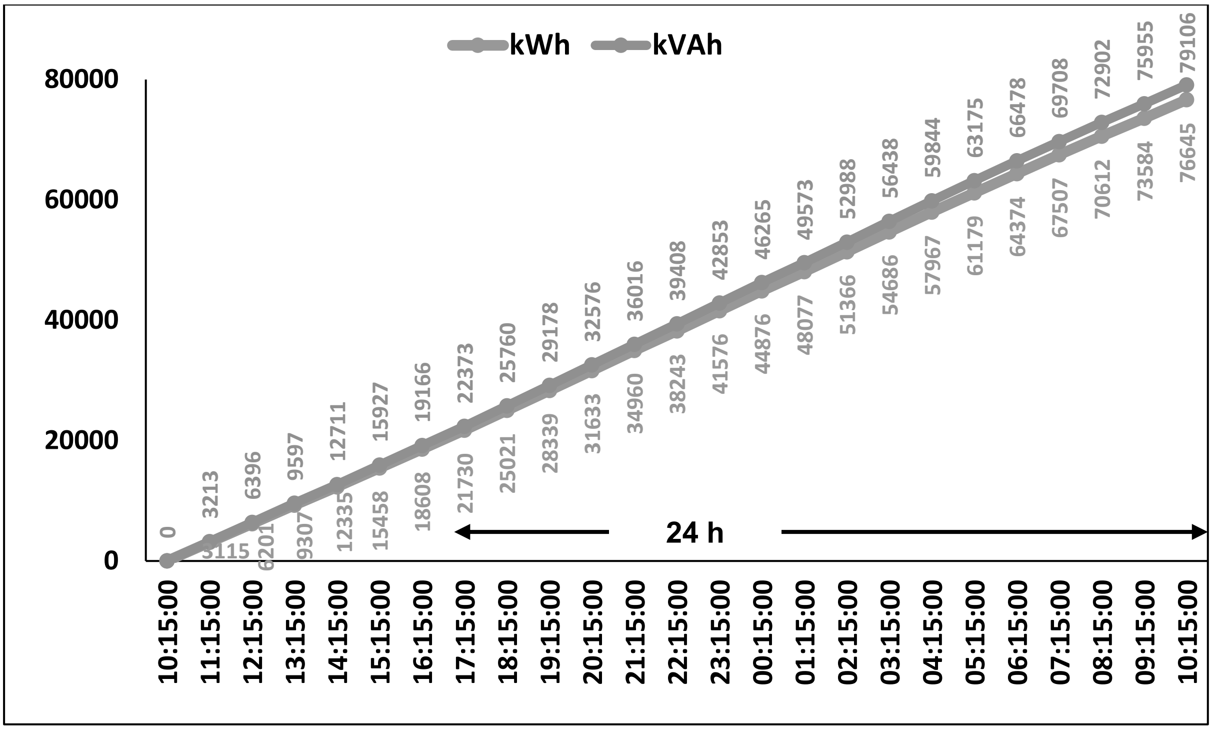


Fig 6.5 : Cumulative Power Drawl Quantity : Active & Apparent - HT Main

- The maximum and minimum kVA recorded are **3043** (08:15 h) & **3463** (21:15 h) respectively
- The instantaneous power data details captured are as below :

Table 6.3 : Instantaneous Power Data Captured : HT

No	Parameters	Unit	Phase Wise Values		
			R	Y	B
1	HT voltage 3 ϕ	V	20.8	20.9	20.8
2	HT Current 3 ϕ	Amp	83.0	93.0	93.0
3	Actual Power	kW	3151		
4	Power Factor	-	+ 0.977		
5	Apparent Power	kVA	3260		
6	Q1	kVAr	445 (inductive)		
7	Voltage Harmonics	%	1.7 - 1.8 [norm : < 3]		
8	Current Harmonics		4.2 - 5.6 [norm : < 8]		

- At the time of data logging, the LT side voltage gone as high as 444 V (1 ϕ V : 250) which will be detrimental to operation of plant motor. This excess voltage puts stress on the motors and might lead to their failure

6.5 PCC : 1 : OBSERVATION AND ANALYSIS

- Electrical power data had been logged for a period of 12 h 30 mins [750 mins from 20:45 h on 10th till 09:15 h on 11th]
- Energy consumption during this period was 12 390 kWh working out to an average load of **990 kW**
- Power drawl trend recorded during this period is shown in Fig 6.6

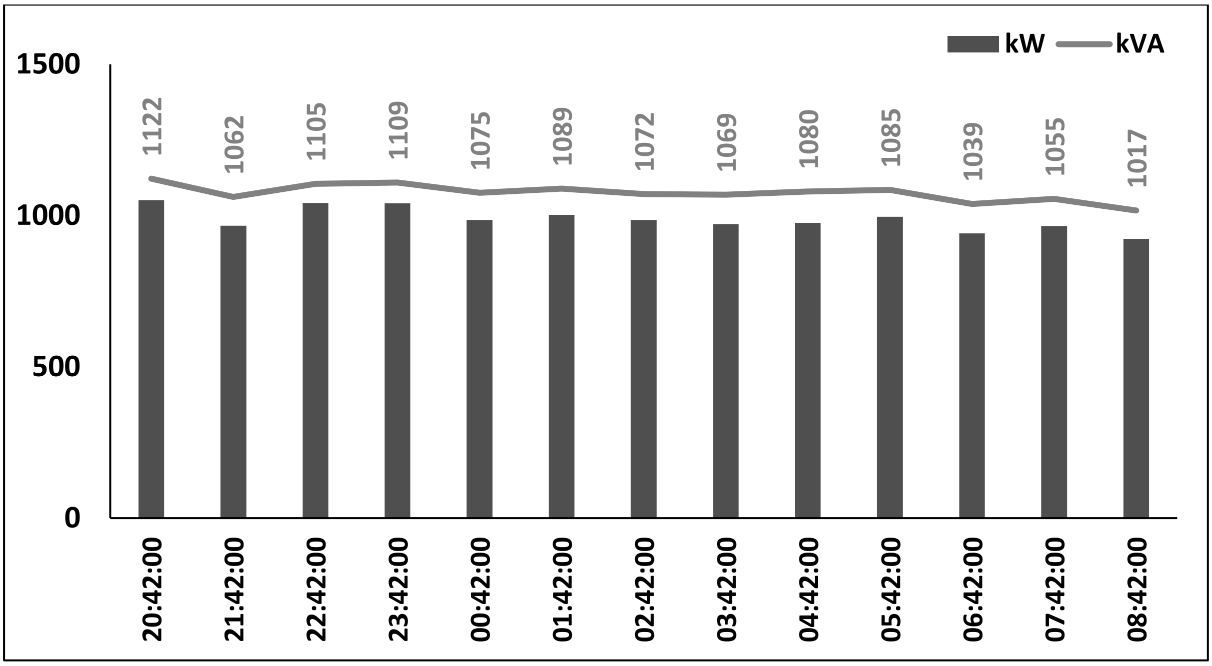


Fig 6.6 : Power Drawl Trend : Active & Apparent - PCC1

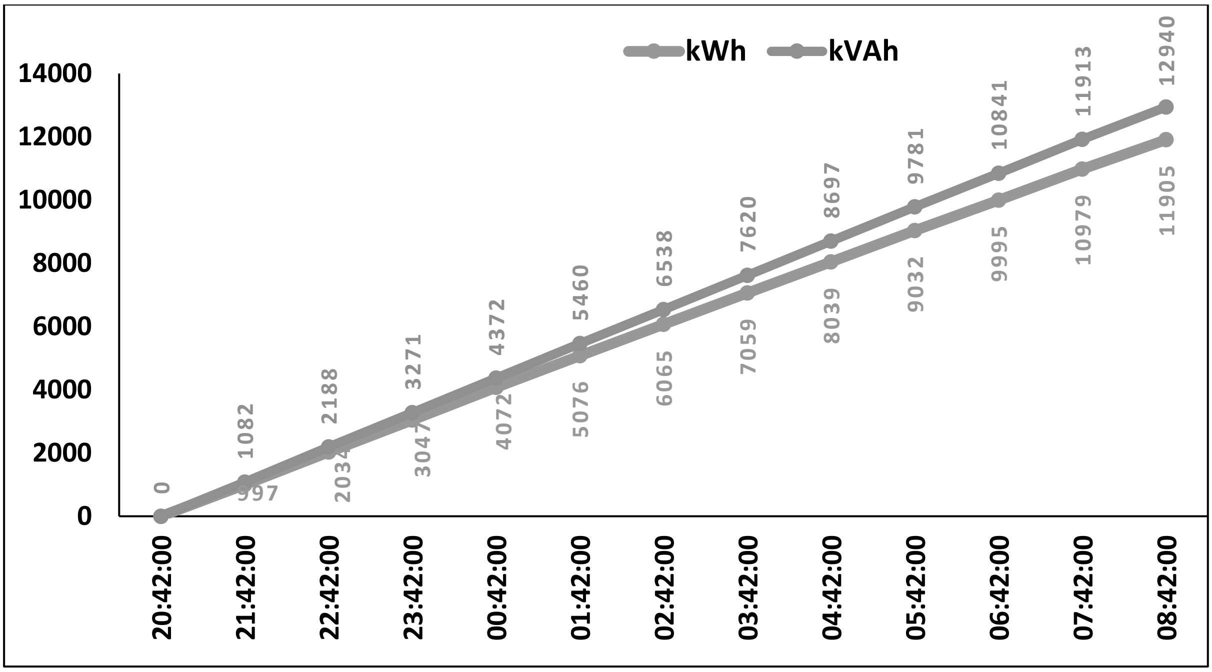


Fig 6.7 : Cumulative Power Drawl Quantity : Active & Apparent - PCC 1

- The maximum and minimum kVA recorded are **1017** (08:42 hrs) & **1122** (20:42 hrs) respectively
- The instantaneous power related data captured are tabulated in Table 6.4

Table 6.4 : Instantaneous Power Data Captured : PCC 1

No	Parameters	Unit	Phase Wise Values		
			R	Y	B
1	Voltage 3 ϕ	V	428.7	430.6	428.1
2	Voltage 1 ϕ	V	248.6	247.3	247.1
3	HT Current 3 ϕ	Amp	1522	1578	1456
4	Actual Power	kW	1043		
5	Apparent Power	kVA	1118		
6	Power Factor	-	0.936		
7	Q1	kVAr	390 (inductive)		
8	Voltage Harmonics	%	2.4 - 2.6 [norm : < 3]		
9	Current Harmonics	%	13.0 - 16.1 [norm : < 8]		

- As anticipated, the 1ϕ voltage has gone beyond **245** and that is detrimental to motor operation.
- Secondly, the current harmonics had exceeded the norms prescribed.
- These two aspects shall be given priority and rectified

6.6 PCC 2 : OBSERVATIONS & ANALYSIS

- As far as PCC 2 panel power data capture is concerned, it went on for 14 h 10 mins [850 mins from 19 :05 h on 10th till 09:15 h on 11th]
- Energy consumption during this period was 17 410 kWh which is equivalent to an average drawl of **1230 kW**
- Power drawl trend recorded is shown in Fig 6.8

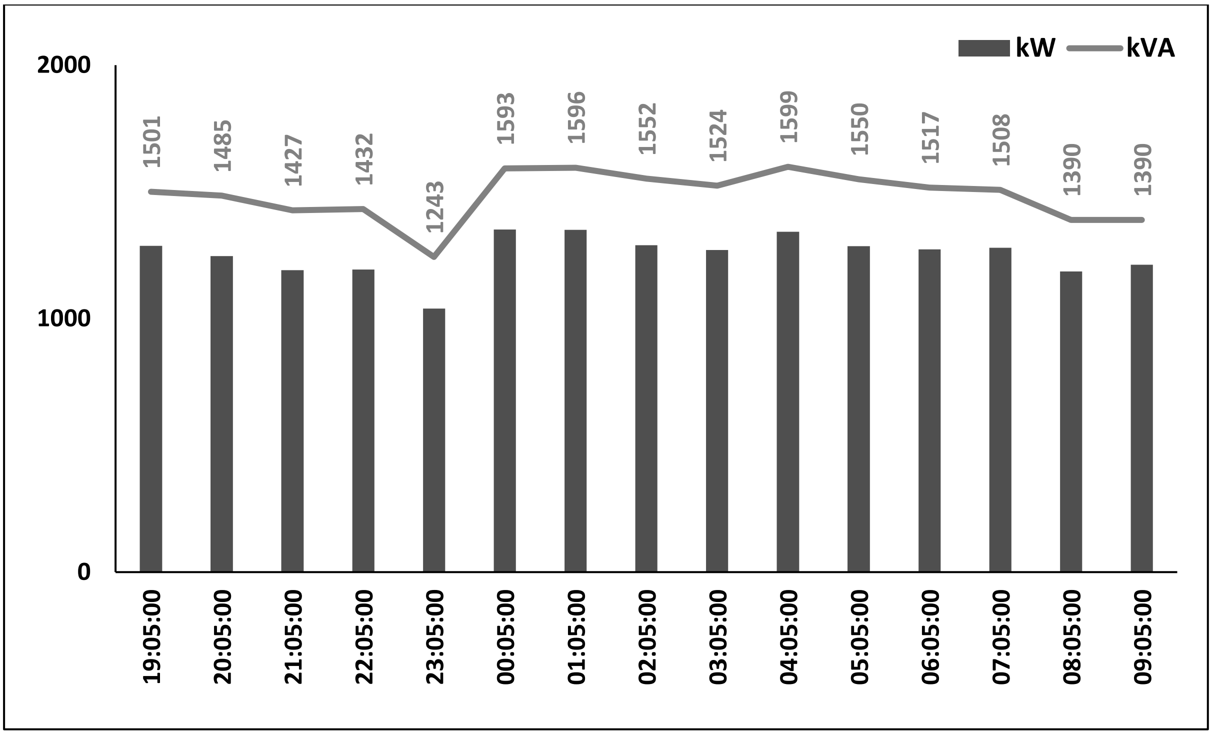


Fig 6.8 : Power Drawl Trend : Active & Apparent - PCC 2

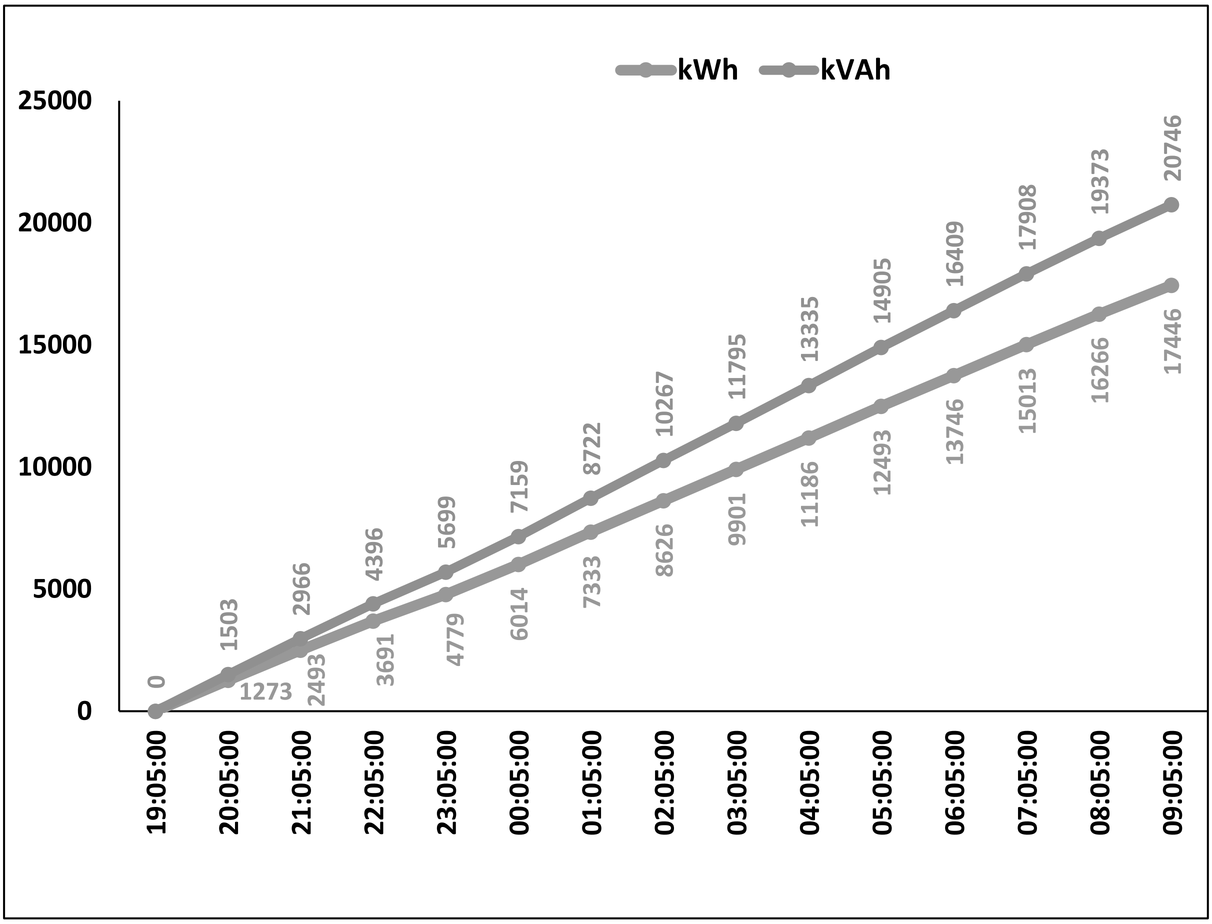


Fig 6.9 : Cumulative Power Drawl Quantity : Active & Apparent - PCC 2

- The minimum and maximum kVA recorded were **1243** (23:05 h) & **1599** (04:05 h) respectively
- The instantaneous power related data recorded are given in Table 6.5

Table 6.5 : Instantaneous Power Data Captured: PCC 2

No	Parameters	Unit	Phase Wise Values		
			R	Y	B
1	Voltage 3 ϕ	V	414.4	418	411.6
2	Voltage 1 ϕ	V	236	237	234
3	HT Current 3 ϕ	Amp	1989	2216	2052
4	Actual Power	kW	1283		
5	Apparent Power	kVA	1486		
6	Power Factor	-	0.857		
7	Q_1	kVAr	759 (inductive)		
8	Voltage Harmonics	%	2.1 - 2.7 [norm : < 3]		
9	Current Harmonics		3.4 - 4.6 [norm : < 8]		

- In this PCC - 2 panel, the major observation was the marginally higher value for 1ϕ voltage. All other parameters were found to be quite normal and fell within the stipulated limits .

6.7 PCC 3 : OBSERVATION & ANALYSIS

- The power data was logged for a time duration of 7 h 50 mins [470 mins from 10:30 h to 18:20 h on 11th] and the corresponding energy consumption was 6981 kWh. This equals to an average load of **890 kW**
- Power drawl trend recorded is shown in Fig 6.10

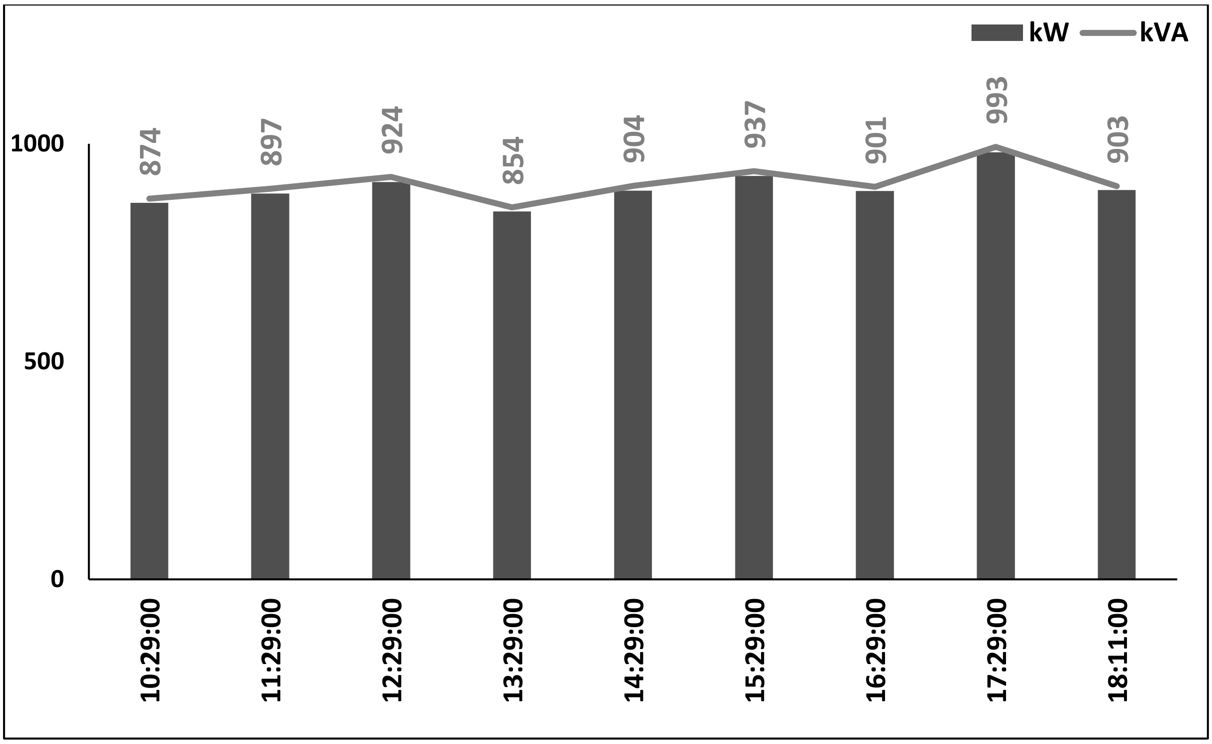


Fig 6.10 : Power Drawl Trend : Active & Apparent - PCC 3

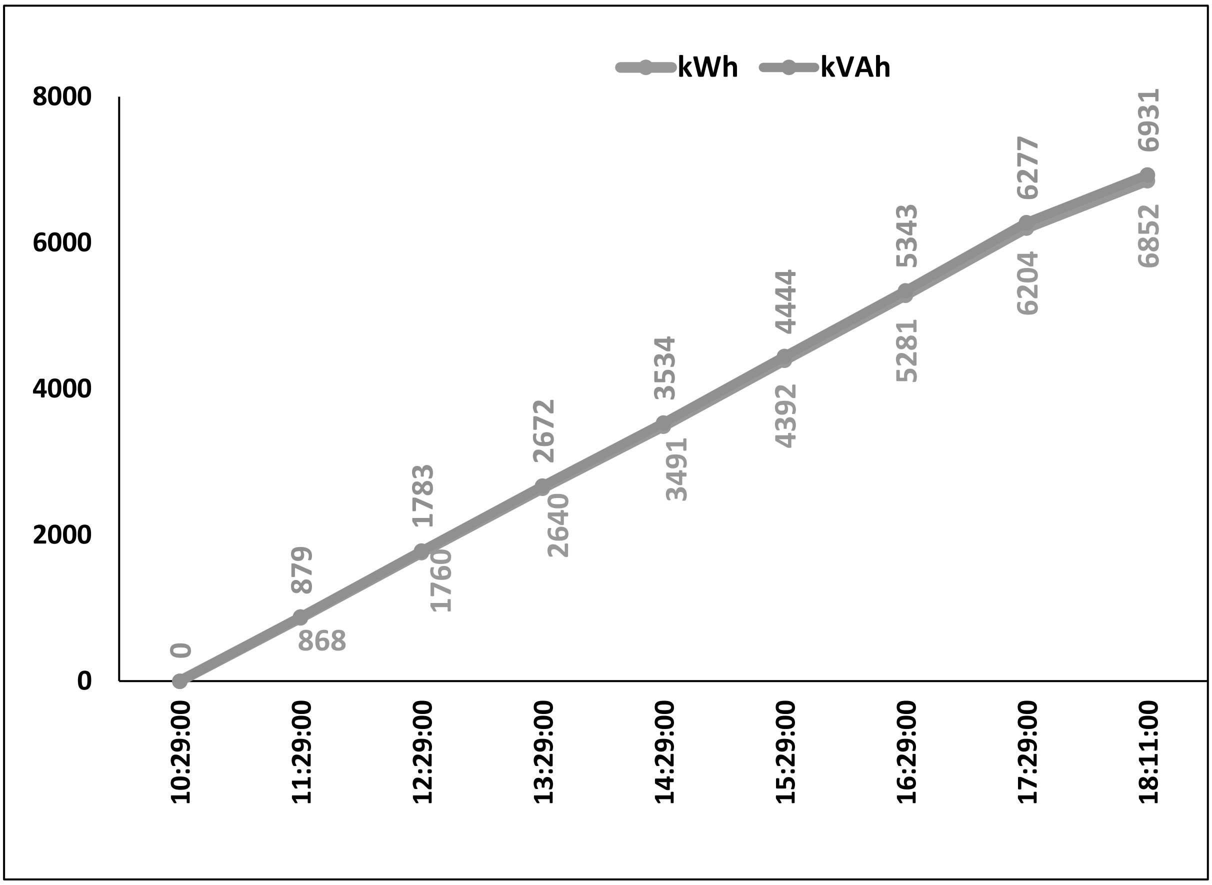


Fig 6.11 : Cumulative Power Drawl Quantity : Active & Apparent - PCC 3

- The minimum and maximum kVA recorded were **854** (13:24 h) & **993** (17:29 h) respectively
- The instantaneous power related data recorded are given in Table 6.6

Table 6.6 : Instantaneous Power Data Captured : PCC 3

No	Parameters	Unit	Phase Wise Values		
			R	Y	B
1	Voltage 3 ϕ	V	405	407	409
2	Voltage 1 ϕ	V	236.3	235.8	231.2
3	HT Current 3 ϕ	Amp	1 205	1 170	1 289
4	Actual Power	kW	865.3		
5	Apparent Power	kVA	866.1		
6	Power Factor	-	0.996		
7	Q_1	kVAr	129.1 (inductive)		
8	Voltage Harmonics	%	2.7 - 3.5 [normal : < 3]		
9	Current Harmonics		3.4 - 4.6 [normal : < 8]		

- But for the harmonics, all other instantaneous parameters recorded were quite acceptable
- Both the voltage harmonics & current harmonics have exceeded the norm to a minor extent. This may be made note of for correction

6.8 SUM UP

- Thus, this chapter made a presentation on the existing electrical distribution system, load distribution to the utilities & process machineries and also the power drawl trend which was recorded for a longer duration
- Th conclusions drawn are
  - The load distribution was near uniform amongst PCC 1,2 & 3
  - In PCC 2, harmonics level recorded had exceeded the stipulated norm and that could be the effect of many VFD operated motors attached to it.
  - As a whole, nothing adverse had been noticed / recorded as far as power distribution scheme is concerned

7 ELECTRICAL MEASUREMENTS ON MOTORS - AN ANALYSIS

7.1 INTRODUCTION

- A detailed analysis is made in this chapter on the electrical energy consumption pattern of motors connected to various utilities
- The electrical measurements on the motors were logged for a period of **15 - 30** mins to establish a correct and replicable power consumption trend
- This longer duration power logging had eliminated the possible ups & downs in the power drawl pattern of the motors and ensured the reliability of measurements recorded
- This exercise of motor load estimation has been undertaken as a part of the energy consumption observation action as it is well understood that lesser the motor loading, lower is the operating efficiency and the power factor and therefore higher is the power consumption for the given product output
- It has to be noted that poor loading of motors can result in higher drawl of current, thus reducing the lifetime of motor winding. This is to say that the kW loading of motors - also at times - can prove a very relevant factor not only from energy drawl point of view but also from the lifetime operation point of view
- Hence, it was decided to record the power loading and energy consumption pattern of motors and thereby look for corrective action as well energy conservation opportunities

7.2 BOILER SECTION : FORBES BOILER (4 MOTORS)

- There are 4 motors in operation in boiler section at the time of study and a loading study has been undertaken in all these 4 motors attached to Forbes Vyncke boiler
- The outcome of the study is as follows

Table 7.1 : Motor Loading Measurements : Boiler Section : Forbes Boiler

No	Motor I D	Rated Parameters				Measured Parameters				% Loading	
		Volts	Amps	kW	η %	Volts	Amp	PF	kW	Amps	kW
1	Feed Water Pump	415	82	45	91.5	391	74.4	0.92	45.6	90.7	92.7
2	Primary Air Fan	415	82	45	91.8	391	40	0.92	24.7	48.8	50.4
3	I D Fan : I	415	210	112	94.0	354	104	0.84	55.2	49.5	46.3
4	I D Fan : II	415	158	90	93.5	393	102	0.85	42	64.6	43.6

- The loading pattern of all these 4 motors has been shown pictorially in Fig 7.1

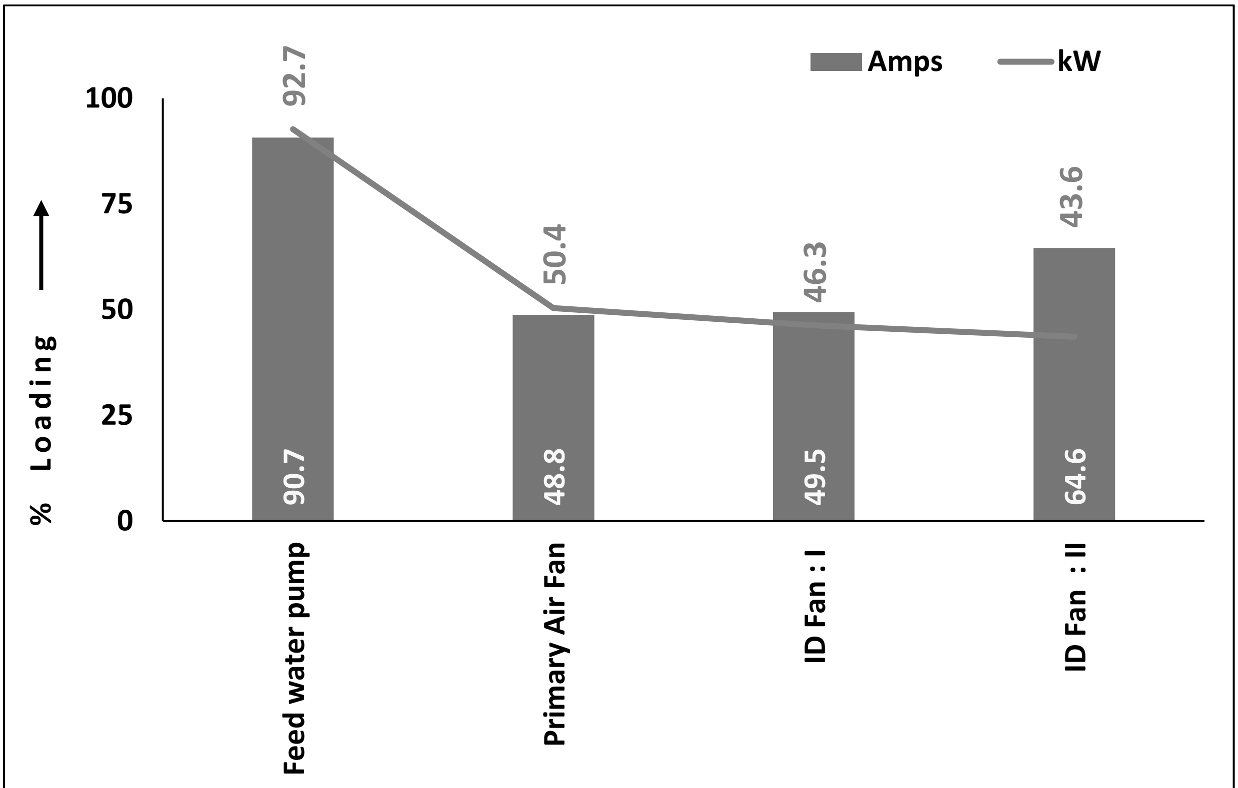


Fig 7.1 : Motor Loading Pattern : Boiler Section : Forbes Boiler

- The major inference is that the loading is lesser in all the motor except that of Feed Water Pump. The primary reason is that the motors of these utilities are fitted with **VFD** and operating in the frequency range of **35 - 40 Hz**. Thus, the lower loading on these motors
- The Feed Water Pump is loaded to 90 % and above on both ampere and kW front
- This aspect shall be made note of as this higher loading is detrimental to motor life

7.3 MOTORS : COOLING TOWER PUMPS (10 MOTORS)

- Electrical measurements have been recorded on 10 motors of various cooling tower pumps
- The break - up is as below :

No	Cooling Tower Identity	No. of. Motors
1	500 TR	1
2	1 500 TR	3
3	1 500 TR	3
4	2 000 TR	3
	Total	10

- The electrical measurements recorded are tabulated below :

Table 7.2 : Motor Loading Measurements : Cooling Tower Pumps

No	Motor I D	Rated Parameters				Measured Parameters				% Loading	
		Volts	Amps	kW	η %	Volts	Amp	PF	kW	Amps	kW
I - 500 TR Cooling Tower											
1	Pump No : 1	415	90	55	93.8	415	75	0.88	48	83.3	81.9
II - ZLD Plant											
1	Pump No : 1	415	90	55	93.8	390	79	0.87	41	87.7	69.9
2	Pump No : 2					387	77	0.84	43	85.6	73.3
3	Pump No : 3					384	75	0.92	42	83.3	71.6
III – Process CT : 1500 TR											
1	Pump No : 2	415	90	55	93.8	418	80.1	0.8	46.6	89.0	79.5
2	Pump No : 3					411	79.0	0.81	46.0	87.8	78.5
3	Pump No : 4					408	99.0	0.90	65.0	110.0	110.9
IV - Process CT : 2000 TR											
1	Pump No : 1	415	52	30	91.2	399	36.0	0.73	25.0	69.2	76.0
2	Pump No : 2		90	55	93.8	370	87.1	0.90	51.0	96.8	87
3	Pump No : 3		52	30	91.2	395	28	0.91	15.0	53.8	45.6

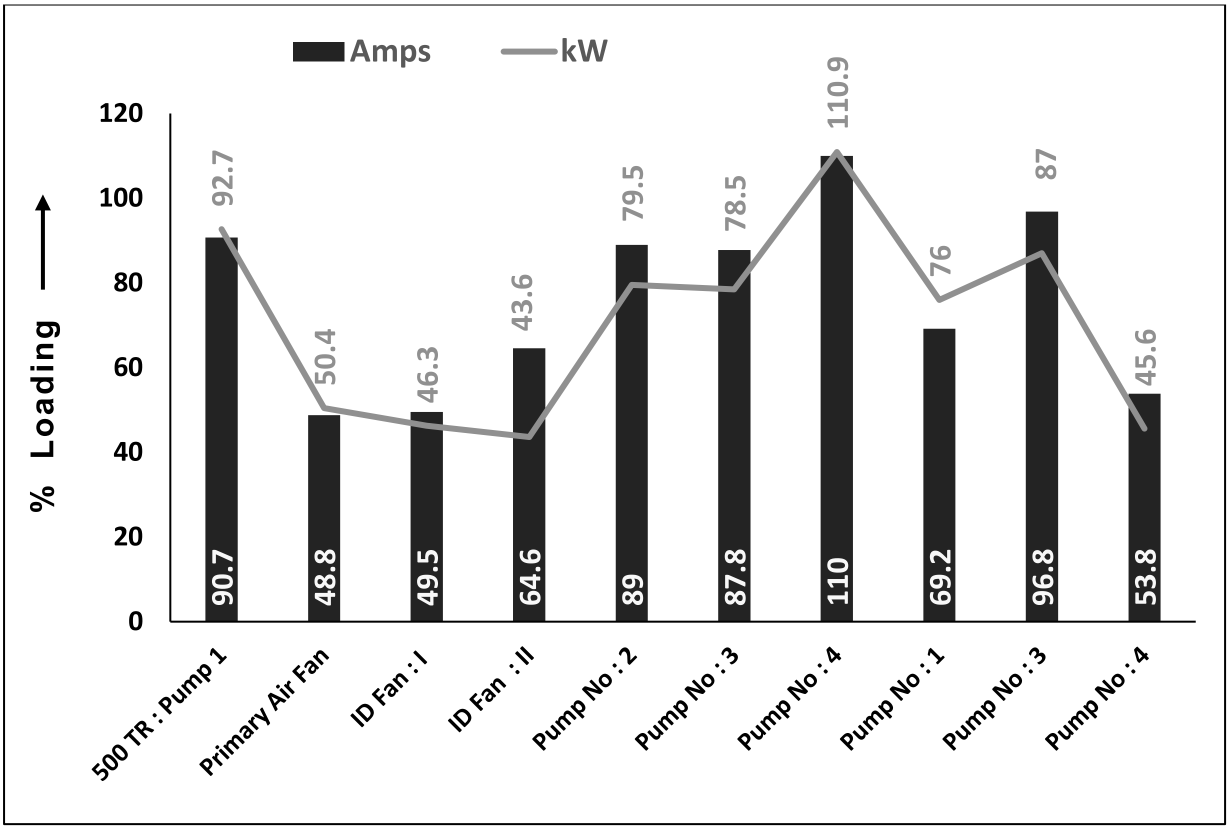


Fig 7.2 : Motor Loading Measurement : Cooling Tower Pumps

- It is heartening to note that 8 out of 10 pumps are properly loaded on the electrical front : it is appreciated
- Pump No 4 of Process Cooling Tower [1500 T R] has recorded a % loading exceeding 100 both on ampere front & kW front . Thus, it appears that the coil of this motor had undergone rewinding multiple times. This needs investigation
- On the other hand, Pump No : 3 of Process Cooling Tower (2000 T R) is lowly loaded to around 50 % (both Ampere and kW front) This aspect may be made note of.

7.4 MOTORS : COOLING TOWER FANS (9 MOTORS)

- There are 9 Cooling Tower Fans identified and electrical measurements have been recorded on all these.
- The details of measurements recorded and computed are Tabulated below :

Table 7.3 : Motor Loading Measurement : Cooling Tower Fans

No	Motor ID	Rated Parameters				Measured Parameters				% Loading	
		Volts	Amps	kW	η %	Volts	Amp	PF	kW	Amps	kW
Cooling Tower : 500 TR											
1	Fan	415	14	7.5	90.4	401	6	0.87	3.0	42.9	36.2
Cooling Tower : 1500 TR - ZLD											
1	Fan - 1	415	39	22	91.2	390	25	0.82	13.0	64.1	53.9
2	Fan - 2					389	26	0.85	13.3	66.7	55.1
Cooling Tower : 1500 TR - Process											
1	Fan : East : VFD	415	39	22	91.2	401	11	0.89	6.9	28.2	28.6
2	Fan : West : VFD						12	0.89	7.1	30.8	29.4
Cooling Tower : 2000 TR - Process											
1	Fan 1 : with VFD	415	39	22	91.2	399	25	0.75	13.0	64.1	53.9
2	Fan 2 : with VFD					400	16	0.93	10.0	41.0	41.5
3	Fan 3 : with VFD					396	13	0.50	5.3	33.3	22.0
4	Fan 4 : with VFD					400	12	0.61	7.8	30.8	32.3

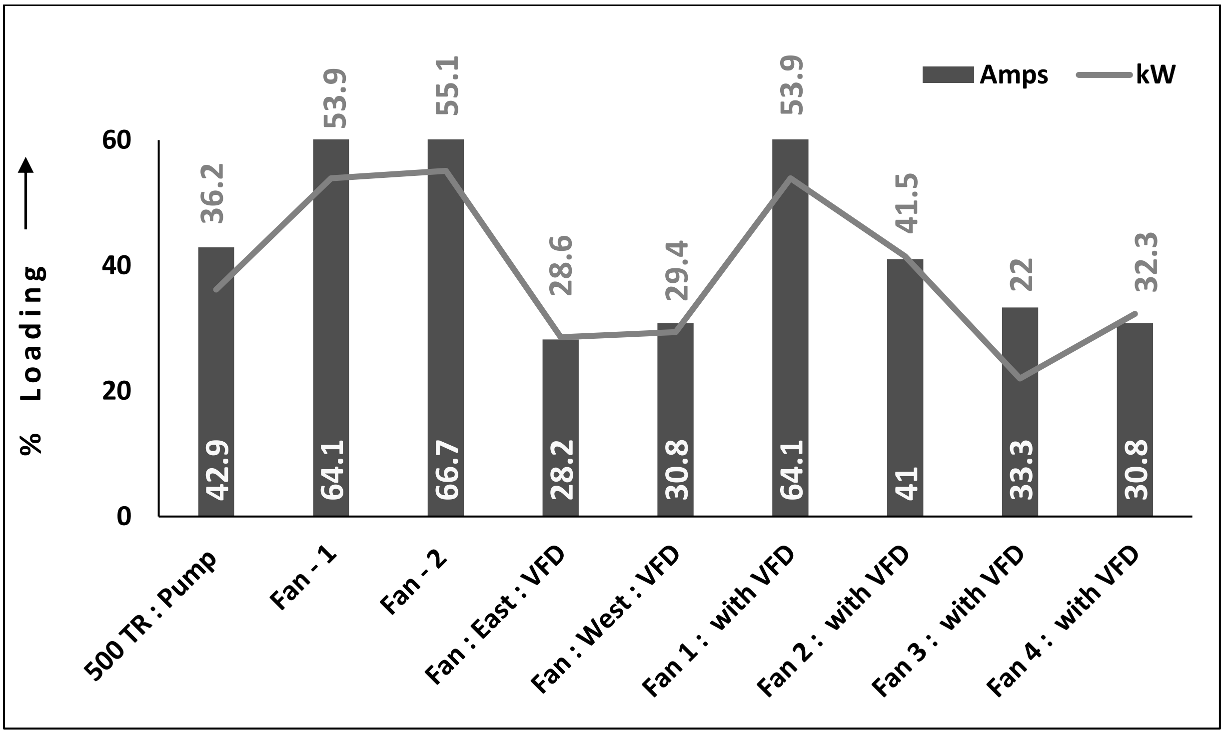


Fig 7.3 : Motor Loading Measurement : Cooling Tower Fans

- The motor of CT Fan (500 TR) had shown a low loading of around 40 % only. This motor is not fitted with VFD
- The loading is reasonable in the cooling tower fans of ZLD section although it is not optimum
- The fans of 1500 TR & 2000 TR (Process) cooling towers have shown a lesser % loading as they are all fitted with VFD and operating at 35 Hz (1 500 TR) and 42 Hz (2 000 TR) frequency
- It was noticed that the Fan - 1 of 2000 T R Cooling Tower is not fitted with VFD and hence recorded a higher % loading on amps (**64.1**%) and power (**53.9** %). All other motors - that are fitted with VFD - have shown a load of 40% or less.
- This clearly indicates that the Cooling Tower fan motors are oversized for the duty intended and fixation of VFD would make them operate an optimized fashion on energy

7.5 MOTORS : CHILLER PLANT PUMPS (9 MOTORS)

- 9 pumps come under this classification and the electrical study outcome is presented below:

Table 7.4 : Motor Loading Measurement : Chiller Plant Pumps

<table>
<tr><th rowspan="2">No</th><th rowspan="2">Motor ID</th><th colspan="4">Rated Parameters</th><th colspan="4">Measured Parameters</th><th colspan="2">% Loading</th></tr>
<tr><th>Volts</th><th>Amps</th><th>kW</th><th>η %</th><th>Volts</th><th>Amp</th><th>PF</th><th>kW</th><th>Amps</th><th>kW</th></tr>
<tr><td colspan="12">I IBU Chiller Plant</td></tr>
<tr><td>1</td><td>Pump 1 : West</td><td rowspan="3">415</td><td rowspan="3">90</td><td rowspan="3">55</td><td rowspan="3">93.8</td><td>416</td><td>80</td><td>0.93</td><td>43.0</td><td>72.0</td><td>73.3</td></tr>
<tr><td>2</td><td>Pump 2 : Aldehyde</td><td>421</td><td>76.7</td><td>0.78</td><td>43.8</td><td>69.0</td><td>74.7</td></tr>
<tr><td>3</td><td>Pump 3 : East</td><td>421</td><td>85.7</td><td>0.84</td><td>50.3</td><td>77.1</td><td>85.8</td></tr>
<tr><td colspan="12">II Chiller pump near Mechanical Storeroom</td></tr>
<tr><td>1</td><td>Pump</td><td>415</td><td>33</td><td>18</td><td>90.6</td><td>398</td><td>4.9</td><td>0.64</td><td>2.6</td><td>14.8</td><td>13.1</td></tr>
<tr><td colspan="12">III IPCA Tower Pump</td></tr>
<tr><td>1</td><td>Pump : West</td><td rowspan="2">415</td><td rowspan="2">66</td><td rowspan="2">37</td><td rowspan="2">91.2</td><td>402</td><td>58</td><td>0.90</td><td>34</td><td>87.9</td><td>83.8</td></tr>
<tr><td>2</td><td>Pump : East</td><td>403</td><td>60</td><td>0.89</td><td>37</td><td>90.9</td><td>91.2</td></tr>
<tr><td colspan="12">IV Chiller Plant</td></tr>
<tr><td>1</td><td>Pump</td><td rowspan="3">415</td><td>81</td><td>45</td><td>92.2</td><td>401</td><td>63</td><td>0.90</td><td>39.0</td><td>77.8</td><td>79.9</td></tr>
<tr><td>2</td><td>Brine Pump</td><td rowspan="2">90</td><td rowspan="2">55</td><td rowspan="2">93.8</td><td>414</td><td>74</td><td>0.87</td><td>46.0</td><td>82.2</td><td>78.5</td></tr>
<tr><td>3</td><td>Brine Pharma</td><td>408</td><td>85</td><td>0.84</td><td>50.2</td><td>94.4</td><td>85.6</td></tr>
</table>

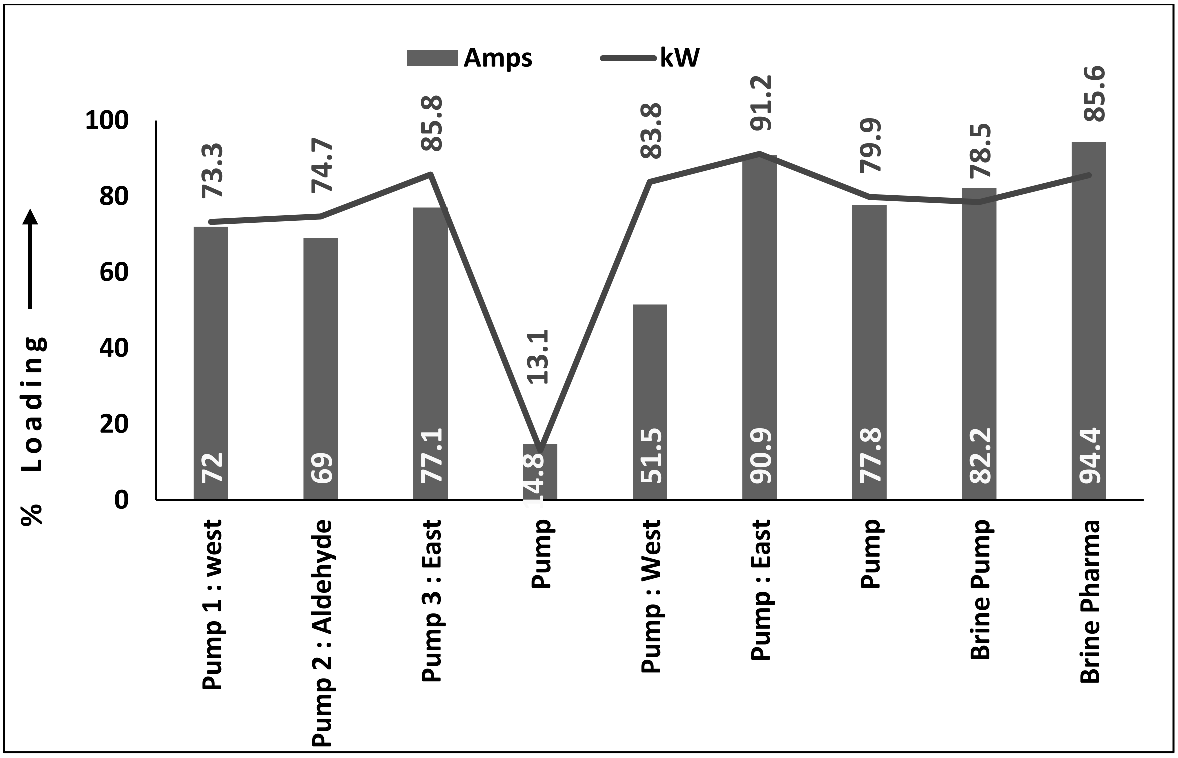


Fig 7.4 : Motor Loading Pattern : Chiller Plant Pumps

- These pumps have not been fitted with VFD and the kW loading is quite optimal in the range of 75 % + in almost all motors
- The IPCA Tower pump is quite poorly loaded at less than 15 % .This is abysmally low, and the root cause has to be identified

7.6 SUM UP

- In essence, it was observed that majority of the motors are loaded effectively / optimally barring a few
- The motor that are lowly loaded have been identified and commented upon.
- The cause for this low % loading has to be interrogated and remedial action carried out
- Majority of the motors are fitted with VFD which is an indicator of Encon Activities initiated by the plant personnel. This is appreciated

8 PERFORMANCE STUDY ON ELECTRICAL UTILITIES

8.1 INTRODUCTION

- In this chapter, an attempt is made to evaluate the performance level of various utilities of the plant. This exercise is expected to indicate the ways to achieve reduction in the energy consumption in these utilities wherever possible
- The Utilities in the plant can be grouped into 6 categories as listed below
    - Transformer
    - Capacitor Banks
    - Air Compressors
    - Cooling Towers
    - Pumping System
    - Fans and Blowers
- Various parameters measured, analysed and the ultimate outcome in terms of performance are detailed and discussed in this chapter
- The performance evaluation of chiller systems has been presented separately in Chapter No : 10

8.2 TRANSFORMERS

- The plant has one 5000 kVA transformer that steps down the voltage from 22 kV to 433 V
- Technical specifications of this transformer are :

Table 8.1 : Technical Details of the Transformer

No	Parameter	Unit	Value
1	Make	-	Voltamp, Vadodara
2	Rating	kVA	5000
3	Year of Manufacturing	-	2011

No	Parameter		Unit	Value
4	Voltage	HT Side	V	22 000
		LT Side		433
5	Current	HT Side	A	131.32
		LT Side		6666.86
6	C.T Ratio		-	30 / 5 A
7	Impedance		%	7.67
8	Frequency		Hz	50
9	OLTC		-	Not provided
10	Cooling Type			ONAN
11	No Load Loss (NLL)		kW	4.5
12	Full Load Loss (FLL)			40.9
13	Efficiency at Full Load		%	99.8
14	Optimal Loading			33.2

- The operating parameters were individually recorded on the LT side 24 h period
- The kVA and kW drawl trends recorded for 24 h are shown in Fig 8.1

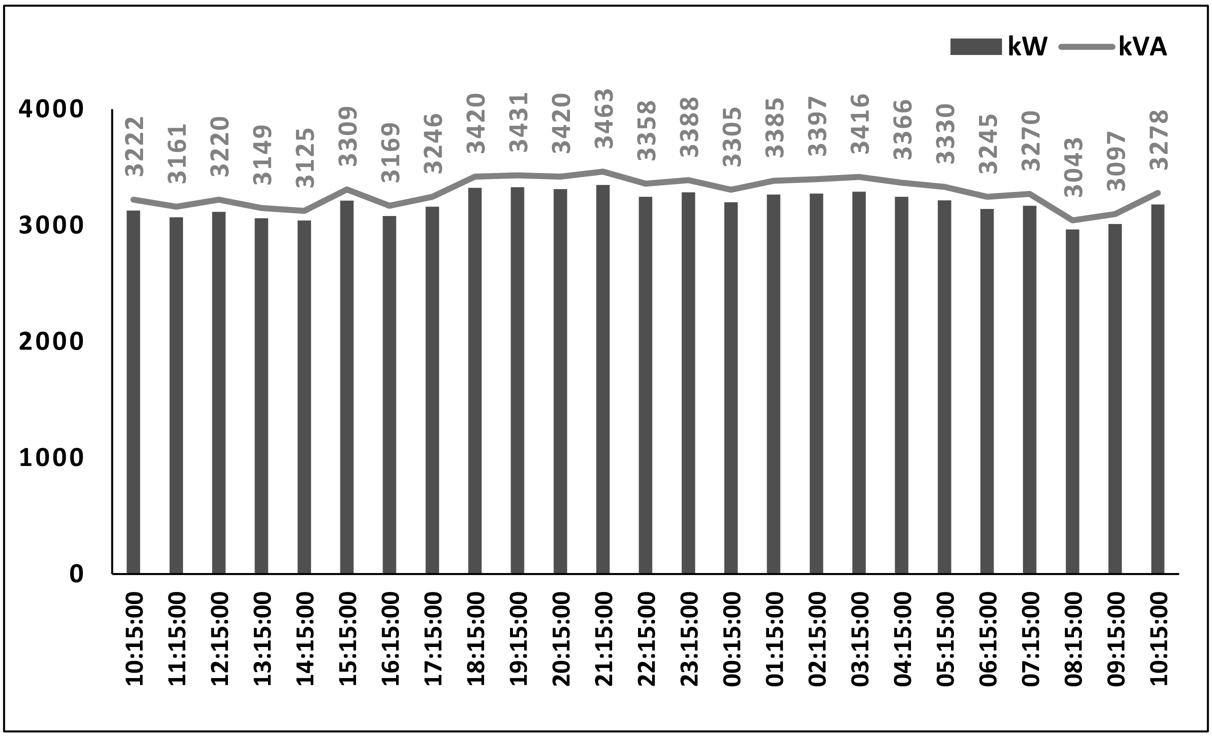


Fig 8.1 : Power Drawl Trend : Active and Apparent

The cumulative energy drawl quantities (kWh & kVAh) in the period are shown in Fig 8.2

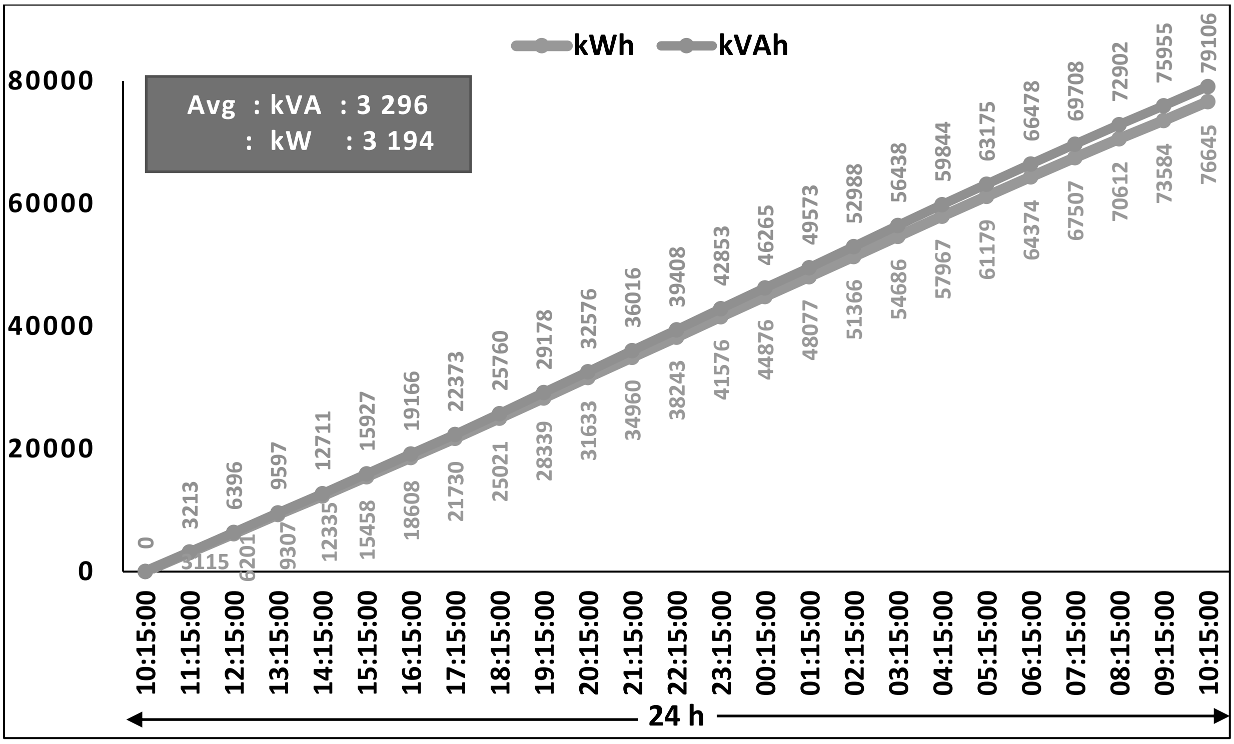


Fig 8.2 : Cumulative Power Drawl Quantity : Active and Apparent

- The average apparent and active energy drawl per hour is **3296 kVA & 3194 kW** respectively. The corresponding PF has been computed as **0.969**
- Further, based on the data captured - various parameters - that define the performance of the transformer were evaluated and presented in Table 8.2

Table 8.2 Measured / Computed Data : Performance Evaluation

No	Parameters		Unit	Value
1	Apparent Power	Avg	kVA	3296
2	Active Power		kW	3194
3	Power Factor		-	0.969
4	No Load Loss	Design	kW	4.5
5	Full Load Loss			40.9
6	Avg kVA Loading		%	65.9
7	Optimum Loading			33.2
8	Total Load Estimated		kW	22.3
9	All Day Efficiency		%	99.2

- All day efficiency has been established as 99.2 % which is quite acceptable considering the loading of 65.9 % experienced by the transformer (The optimum loading is 33.2% for the transformer of this higher rating as per the design data provided by the OEM)
- The overall loss estimated is about **540 kWh / day**
- As such, the loading of the transformer is reasonable

8.3 CAPACITOR BANKS

8.3.1 Present Status

- The Capacitor Banks are installed in the PCC panels of Powerhouse to compensate for inductance and maintenance of near unity power factor
- This is very much essential as far as this facility is concerned as the PED charges consumer / client for the apparent power used viz kVAh and not kWh
- Hence, maintaining a PF as close as possible to near unity is desirable if the cost spent on electricity is to be optimised / minimised
- Total rating of capacitor banks installed in this plant is 2800 kVAr
- The capacitor banks are divided into 5 banking panels, and they are connected to PCC panels
- Fig 8.3 depicts these details schematically

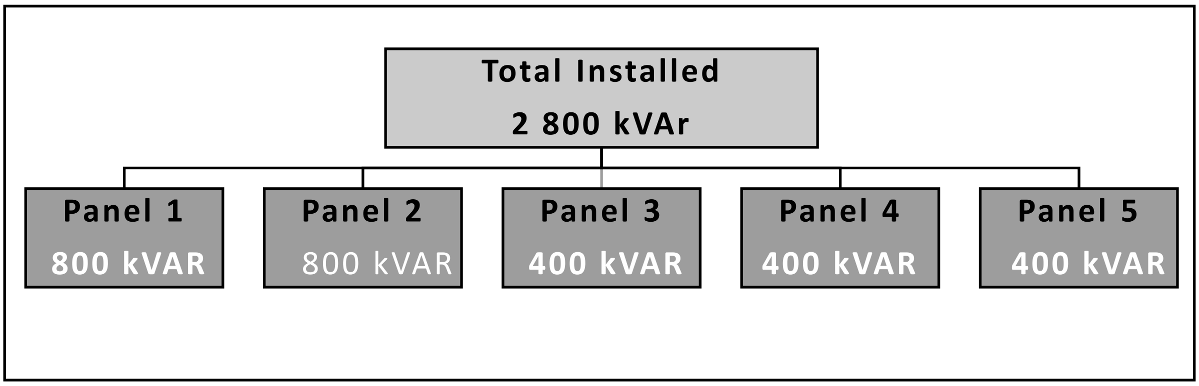


Fig 8.3 : Capacitor Banks installation : Schematic Diagram

- The working details of capacitor banks - based on visual observation - are as below :

Table 8.3 : Working Status of Capacitor Banks Installed

Panel No	Working	Non - working	Total
	kVAr		
1	800	-	800
2	600	200	800
3	400	-	400
4	100	300	400
5	400	-	400
Total	2300	500	2800

- It was noticed that 500 kVAr was not in operation making thereby only 2300 kVAr effective
- A performance study was conducted on these individual panels following the norms stipulated by B.E.E to establish the effectiveness of each one of the capacitor banks

8.3.2 Power Factor Trend Recorded : History

- The power factor trend recorded for 12 - month period [Apr 21 - Mar 22] is shown below in Fig 8.4

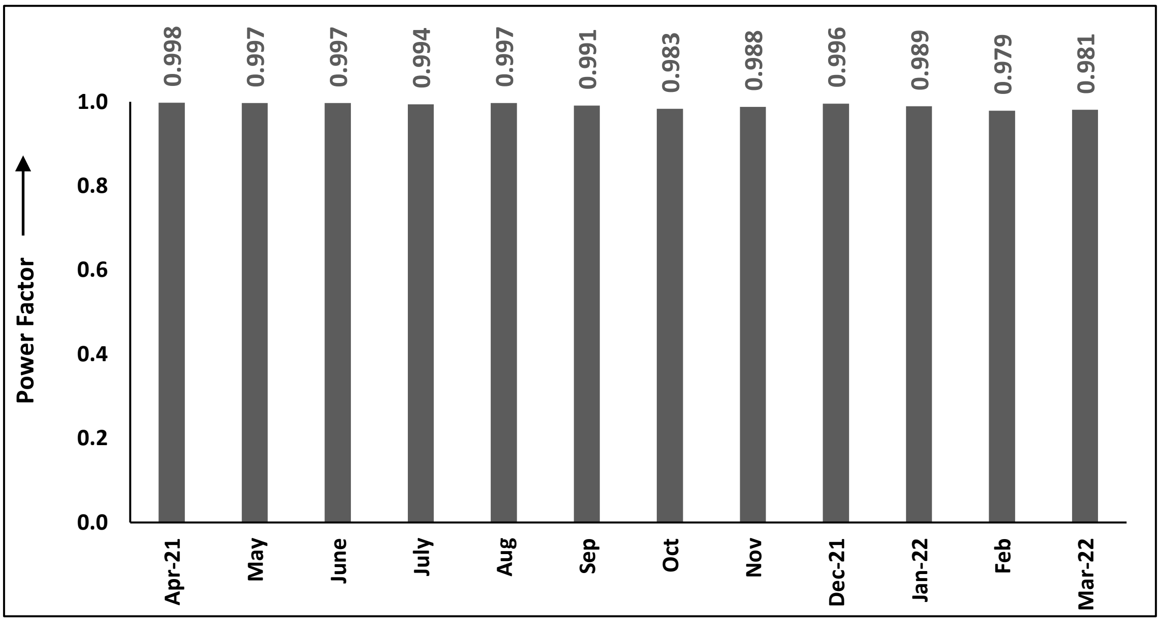


Fig 8.4 : Power Factor Trend Recorded : Apr'21 – Mar'22

- The average PF computed is only 0.991 and this has to go up if the cost saving is aimed at on EB bill payable to PED

8.3.3 Performance Evaluation

- The procedure adopted goes like this :
  - Each of the capacitor bank (100 kVAr rating) was switched ON 2 and Switched OFF and the difference obtained in kVAr is recorded .
  - This difference is then compared with CB rating (100 kVAr) and the effectiveness is arrived at.
  - The bank - wise as well as panel - wise data captured along with observation and analysis made are tabulated below:

Table 8.4 : Capacitor Bank : Effectiveness Evaluation : Panel 1 & 2

Stage	Panel - 1					Panel - 2				
	Installed	Switched		Diff	Eff	Installed	Switched		Diff	Eff
		ON	OFF				ON	OFF		
		kVAr			%		kVAr			%
1	100	524	587	63	63.0	100	494	525	31	31.0
2	100	528	608	80	80.0	100	Not working			
3	100	501	601	100	100.0	100	518	606	88	88.0
4	100	507	573	67	67.0	100	Not working			
5	100	501	573	72	72.0	100	527	597	70	70.0
6	100	504	535	31	31.0	100	509	573	64	64.0
7	100	518	574	56	56.0	100	545	632	87	87.0
8	100	524	570	46	46.0	100	525	625	100	100.0
Total	**800**			**515**	**64.6**	**800**			**440**	**550**

Table 8.5 : Capacitor Banks : Effectiveness Evaluation : Panels 3 & 4

Stage	Panel - 3					Panel - 4				
	Installed	Switched		Diff	Eff	Installed	Switched		Diff	Eff
		ON	OFF				ON	OFF		
		kVAr			%		kVAr			%
1	100	515	542	27	27.0	100	493	567	74	74.0
2	100	519	527	8	8.0	Not working				
3	100	532	550	18	18.0	Not working				
4	100	503	540	37	37.0	Not working				
Total	400			90	22.5	400			74	18.5

Table 8.6 : Capacitor Banks : Effectiveness Evaluation : Panel 5

Stage	Panel - 5				
	Installed	Switched		OFF	Eff
		ON	OFF		
		kVAr			%
1	100	534	625	91	91.0
2	100	553	602	49	49.0
3	100	554	602	48	48.0
4	100	529	567	38	38.0
Total	400			226	56.5

The summary of the outcome of the study on capacitor banks is tabulated below (derived from the above Table 8.4 through Table 8.6)

Table 8.7 : Status Report on the Effectiveness of the Capacitor Banks

Panel No	Installed Capacity kVAr	Effective kVAr	Effectiveness %
1	800	515	64.4
2	800	440	55.0
3	400	90	22.5
4	400	74	18.5
5	400	226	56.5
Total	**2 800**	**1 345**	**48.0**

The above data is graphically presented below :

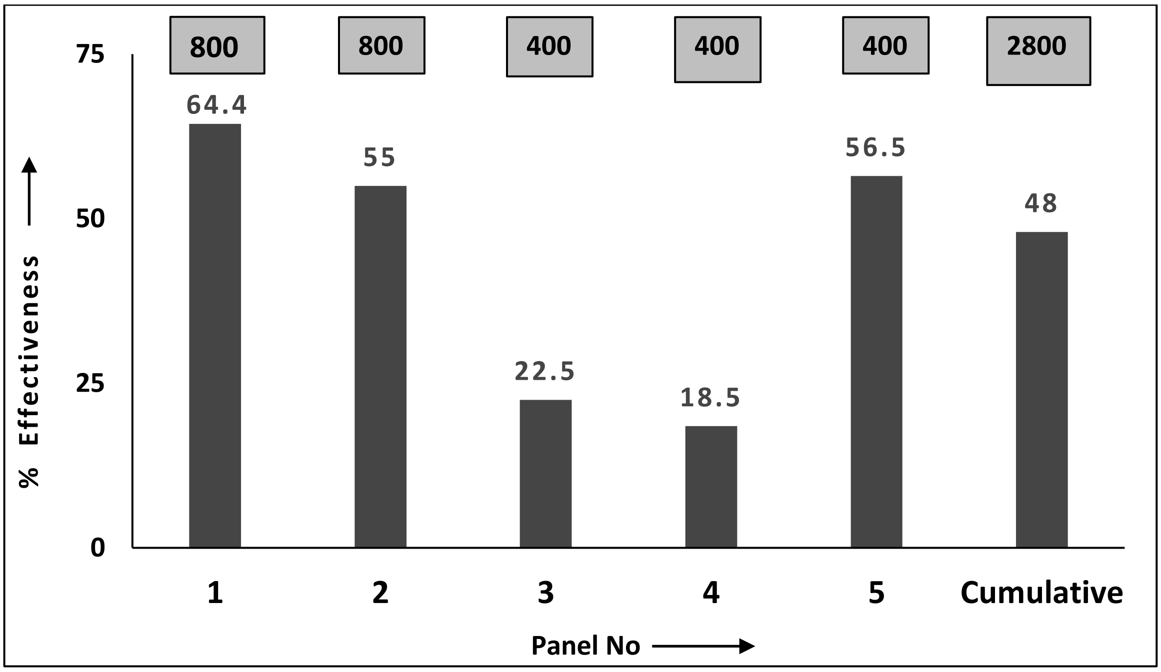


Fig 8.5 : Effectiveness : Individual Capacitor Banks & Cumulative

8.3.4 Sum - Up

- Out of 2800 kVAR of capacitance installed, 500 kVAR were not in working condition.
- Of the remaining 2300 kVAR, the useful kVAR compensated is only 1345 which forms **58.5%** only. This is **48%** only when overall installed rating is considered
- Action shall be initiated to bring the full effectiveness of the capacitor banks into the circuit
- The economics of maintaining higher PF is discussed in Chapter 10

8.4 AIR COMPRESSOR

8.4.1 Preamble

- The plant has installed 3 Screw Air Compressors (Air Cooled) to meet the process and instrument air demand of the plant
- The designed technical parameters of these air compressors are presented in Table 8.8

Table 8.8 : Design Technical Specifications : Air Compressors

No	Parameter	Unit	Compressor No		
			1	2	3
1	Make	-	Atlas Capco		
2	Model No	-	ZT 90	ZT 90	SZT 90 - VSD
3	Capacity	cfm	490		
4	Rated Power	kW	90		
5	Rated Pressure	ksc	7.5		
6	Year of Mfg	-	2020	2014	2017
7	V F D Fitment	-	No	No	Yes
8	Machine ID	-	UACP 2016	UACP 2010	UACP 2012

- As such, the air compressor operation protocol proceeds as below :
  - One compressor (either 1 or 2) will be in operation always (base load operation).
  - Compressor No : 3 - fitted with VFD - operates to take care of the “swing load”
  - When the compressed air requirement increases, other air compressor - operating at constant speed - is put into operation in addition to these two. However, this is not a regular happening

- The process air requirement pressure is 5 - 5.5 bar
- One of the major uses for air compressors is the production of N_2 using the compressed air
- It has been estimated that about 40 % of total air generation goes for N_2 production

8.4.2 Technical Measurements Recorded

- The technical details collected on the air compressors are tabulated below.
- The technical data included electrical, flow and temperature parameters in respect of air delivered

Table 8.9 : Technical Data Captured : Air Compressors 1, 2 & 3

No	Parameter	Unit	Compressor No		
			1	2	3
1	Suction Air Velocity	m / s	4.4 - 7.8	2.7 - 3.8	2.7 - 4.6
2	Pressure : Cut in	bar	5.4	5.4	5.2
3	Pressure : Cut off		5.8	5.8	5.5
4	Filter ΔP		0.011	0.006	-
5	Intercooler Pressure		1.5	2.6	1.8
6	Air Outlet Pressure		5.1	5.1	5.1
7	Air Outlet Temperature	°C	46	56	54
8	Power Drawn	kW	76.3	94.0	82.3
9	kVA Recorded	kVA	96.9	109.1	111.1

- The air flow delivered by the individual air compressors could not be measured due to the non - availability of " ***on - Line***" flow meters compounded by the non - stop operation of all the compressors that makes the conduct of individual performance trial unviable.
- But for the air flow measurements, all other relevant parameters have been collected as can be seen in Table 8.9
- The power drawl by the Air Compressor 2 is way higher than that of Air Compressor 1 and this aspect has to be looked into

8.4.3 Air Pressures Data : Observations Made

- Generation pressure of compressed air at the compressor outlet / wet air receiver outlet is **5.1 ksc**
- The compressed air pressure of the Dry Air receiver outlet is **4 ksc** thus incurring a ∆P of **1 ksc**
- The compressed air pressure readings recorded at various usage points - at the time of audit - are as below :

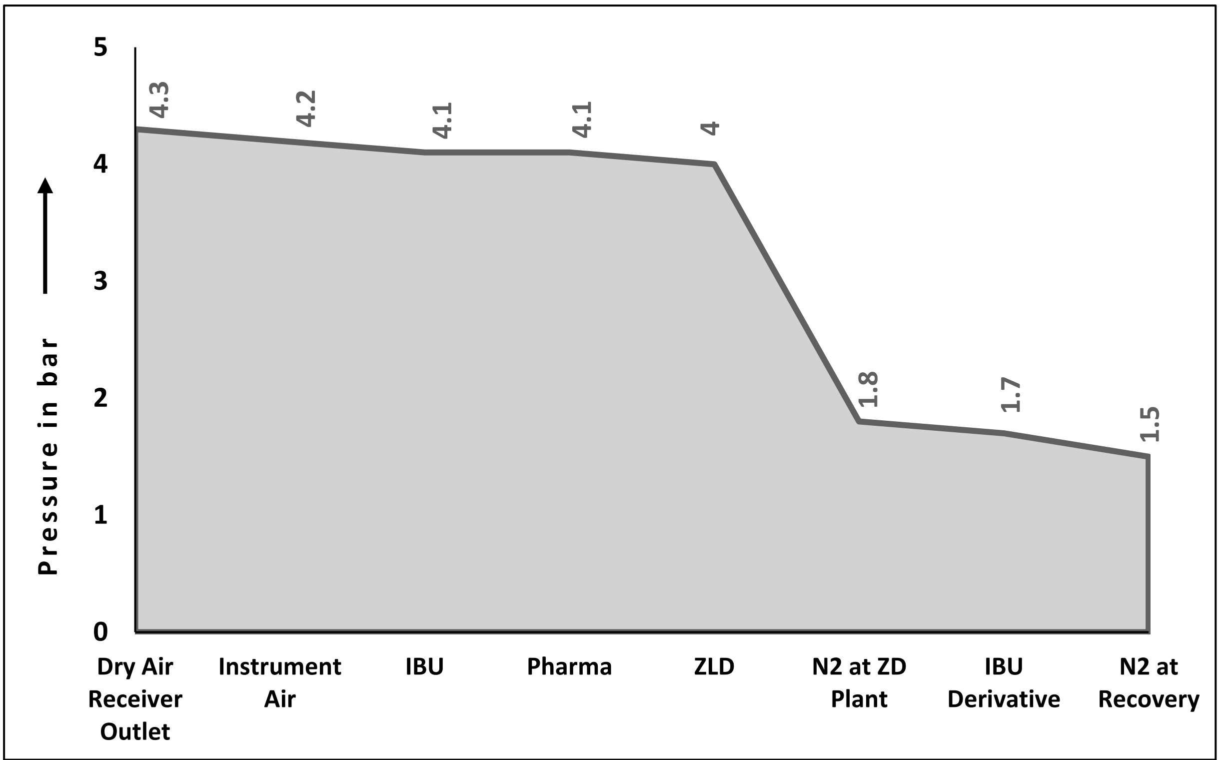


Fig 8.6 : Pressure Profile of Comp Air Delivered at Various User Locations

- It was noticed that
  - (i) ∆P Across the dryer is as high as 1.1 bar
  - (ii) Compressor air pressure gets reduced to various levels at different locations
  - (iii) N_2 generation demands a pressure of 2.6 bar while the process requires 2 bar
- A pressure optimization study may be initiated in compressed air circuit

8.4.4 Air Dryers

- The wet compressor air - coming out of compressors - is dried through air driers before being sent to the process usage at various pressures
- There are 2 Driers (refrigerant type) installed in the air compressor section and the design details are as below :

Table 8.10 : Technical Details of Air Dryer: Design Parameters

No	Parameter	Unit	Compressor No 1	Compressor No 2
1	Make	-	GEM Equipments	
2	Type	-	Refrigerant	
3	Rated Capacity	cfm	1000	1500
4	Rated Power	kW	7.4	9.0
5	Working Pressure	ksc	16	16

- Electrical and related thermal measurements have been caried out on both these driers and the result are presented below :

Table 8.11 : Electrical / Thermal Parameters : Recorded

No	Parameter	Unit	Dryer - 1	Dryer - 2
1	Voltage	V	402.1	407.7
2	Current	A	11.5	17.2
3	Actual Power	kW	6.6	10.3
4	Apparent Power	kVA	7.9	12.2
5	Power Factor	-	0.74	0.84
6	Dew Point Temperature	°C	25.2	7.6
7	Ambient Temperature		38.0	37.6
8	Exhaust Temperature		49	42

- Drier 2 consumes 52 % more energy than that of Dryer 1 (10.3 kW vs 6.6 kW)
- Likewise, the dew point temperature reaches as low as 17.6 °C in Dryer 2 whereas it is much higher in Dryer 1
- This clearly indicates the inferior performance of dryer 2. This has to be set right

8.4.5 Sum Up

- A detailed technical study could not be conducted on the air compressors due to non - availability of "on - line" flow meters compounded with continuous non - stop operation
- On an average, about 5500 kWh of energy is being consumed by the air compressors alone and that forms close to 10% of total energy consumption of entire plant
- Secondly, the performance of the Dryer 2 found wanting and that needs to be established
- Hence, it is imperative that a detailed and dedicated techno - commercial study is initiated on air compressors as it appears to offer tangible scope on energy conservation

9 PERFORMANCE STUDY ON COOLING TOWERS + ASSOCIATED PUMPS

9.1 PREAMBLE

- There are 5 Cooling Towers installed in this facility and are dedicated to various processes.
- The energy consumption of the cooling towers is estimated to be 16% of overall energy consumption of the plant . Thus, it calls for effective scrutiny in terms of its performance as well as energy consumption / optimisation .
- The number of cooling towers and the associated process details are given in the Table below :

Table 9.1 : Cooling Tower : Utilities Dedicated & Operational Status

No	Section	Chiller Medium	Rating TR	Application	No of Compartments	MoC
1	Utility	Brine + Chilled Water	2 000	Aldehyde, Pharma, IBU Chiller etc.,	4	FRP
2	Process	Process Water	1 500	IBU, Pilot, Aldehyde etc.,	4	Wooden
3	ZLD	Process Water	1 500	Z L D plant, MEE, Boiler	2	
4	Pharma	Process Water	500	Pharma, Recovery, 2 D	1	
5	IPCA	Chilled Water	800	IPCA Chiller + Block 70	2	
		Total	**6 300**		**13**	

- All the 5 cooling towers were in operation at the time of study.
- Performance assessment has been carried out on 5 cooling towers and the measurements recorded include the following :
  1) Return Cooling Water Temperature (at inlet to the CT) : [T_{IN}]
  2) Supply Cooling Water Temperature (at CT sump) : [T_{OUT}]
  3) Ambient Dry Bulb and Wet Bulb Temperature : [T_{DB} & T_{WBT}]
  4) Cooling Water Circulation Rate : [Q_{CW}]

- The cooling tower operational Range, Approach and Effectiveness are calculated using the temperatures recorded (first 3 parameters).
- The heat load handled by the cooling tower is computed using a combination of the 1st two parameters and the 4th which are detailed as below :

Range = [$T_{IN} - T_{OUT}$] °C

Approach = [$T_{OUT} - T_{WBT}$] °C

Effectiveness % = [Range / (Range + Approach)]

Heat Load = Q_{CHW} x ρ x 1 kcal / kg / °C x [T_{IN} - T_{OUT}] kcal / h

9.2 COOLING TOWERS

9.2.1 Utility Cooling Tower [2 000 T R]

- One Cooling Tower of 2000 TR rating has been dedicated towards meeting the thermal load of process operations of Aldehyde, Pharma & IBU Chiller Plants
- This Cooling Tower is operated through 4 fans and 3 pumps, and the schematic is as below :

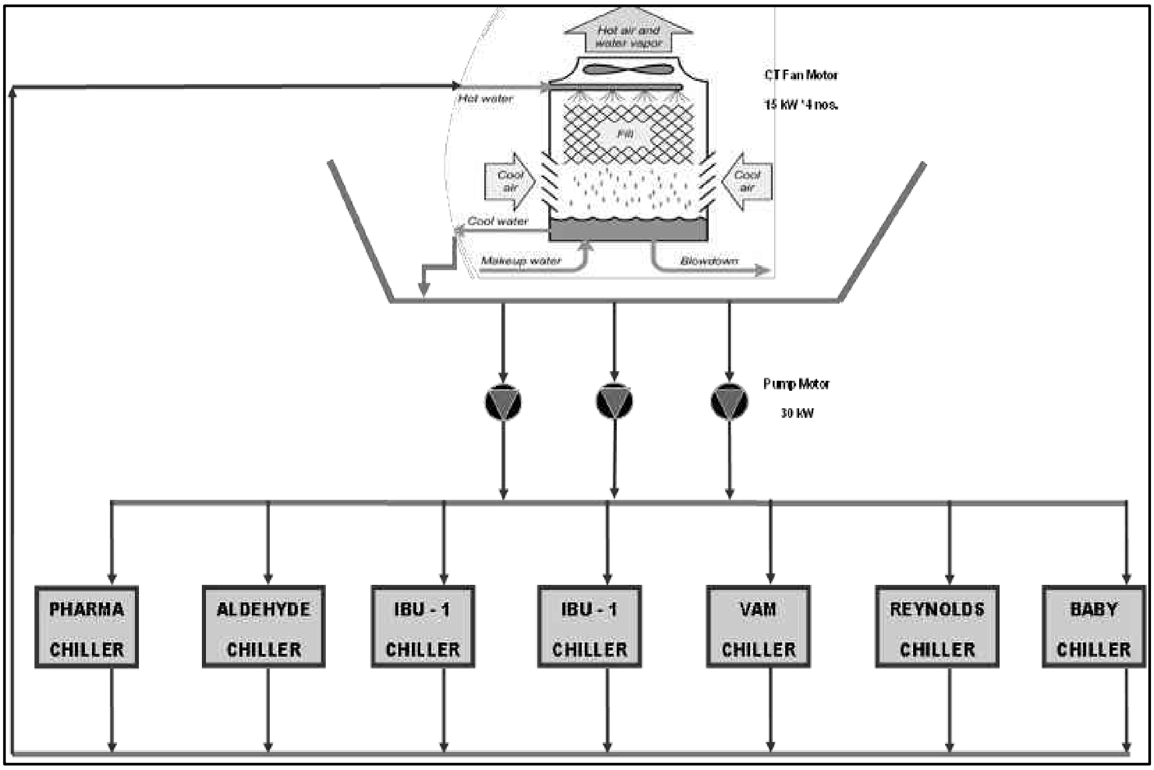


Fig 9.1 : Utility Cooling Tower [2 000 T R] Operation : Schematic

- The technical parameters measured as well that computed are presented in Table 9.2

Table 9.2 : Performance Assessment Data: Captured & Computed : Utility 2000 TR

No	Parameter		UoM	Measured Values			
				16:00	**16:30**	**17:00**	**17:30**
1	Ambient Temperature		°C	35.3	34.6	33.8	33.2
2	Relative Humidity		%	59.9	59.7	65.2	72.3
3	W.B.T near CT		°C	28.3	27.7	28.0	28.8
4	Water Temperature	In		33.8	33.8	33.8	34.4
5		Out		30.4	30.3	30.5	31.1
6	Range			3.4	3.5	3.3	3.3
7	Approach			2.1	2.6	2.5	2.3
8	Effectiveness		%	61.8	57.4	56.9	58.9
Electricity				**Fan 1**	**Fan 2**	**Fan 3**	**Fan 4**
1	Fan Power		kW	13	5.3	10	7.8
2	VFD		Hz	50	30	42	42

- The Effectiveness has been recorded as **58.8 %** for this cooling tower which is fairly reasonable

9.2.2 Process Cooling Tower (IBU : 1500 TR)

- This Cooling Tower is of 1500 TR capacity and operated through 2 fans and 3 pumps
- The scheme is presented in Fig 9.2

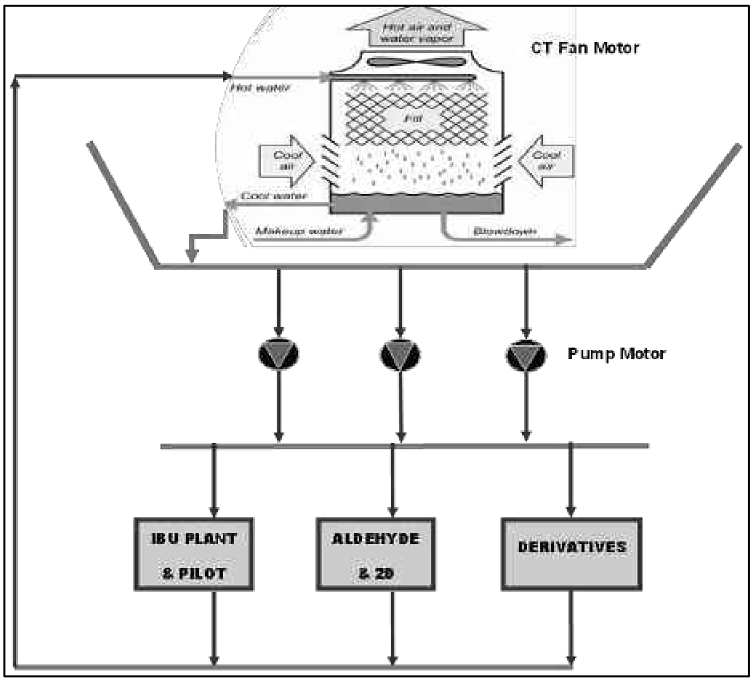


Fig 9.2: Process Cooling Tower (IBU : 1500 TR) Operation : Schematic

- The technical details computed and captured are presented in Table 9.3

Table 9.3 : Performance Assessment Data: Captured & Computed : IBU 500TR

No	Parameter		UoM	Measured Values			
				15:30	16:00	16:30	17:00
1	Ambient Temperature		°C	36.9	35.9	34.8	34.1
2	Relative Humidity		%	54.7	55.9	58.7	62.3
3	W.B.T		°C	28.6	28.0	27.6	27.8
4	Water Temperature	In		35.0	34.7	34.9	34.2
5		Out		33.8	33.6	33.8	32.3
6	Range			1.2	1.1	1.1	1.9
7	Approach			5.2	5.6	6.2	4.5
8	Effectiveness		%	18.8	16.4	15.1	29.7
Electricity				**Fan 1**		**Fan 2**	
9	Fan Power		kW	6.9		7.1	
10	Fan Frequency		Hz	35		35	

- This cooling tower fans are fitted with VFD and operate at a frequency of 35 Hz
- Despite this, the effectiveness was found to be around 25 % only due to limited ΔT recorded in the water circuit
- The approach value of greater than 5.5^{0}C recorded is on the higher side

9.2.3 Z L D Plant Cooling Tower : (1500 TR)

- One Cooling Tower of 1500 T R rating is dedicated for ZLD plant operation

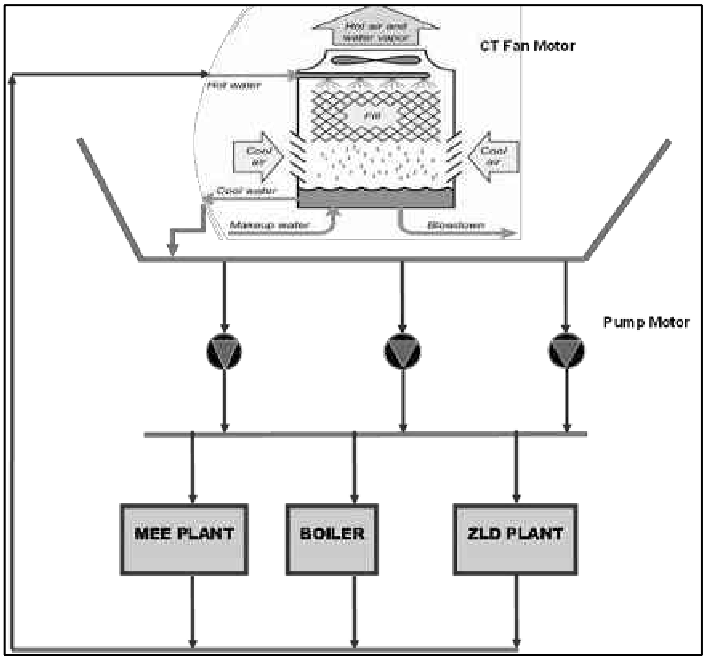


Fig 9.3 : Z L D Plant Cooling Tower Operation : Schematic

- The measurements recorded and the key performance indicators [KPIs] established subsequently are summarised in the table below

Table 9.4 : Performance Assessment Data: Captured & Computed : ZLD - 1500TR

No	Parameter		UoM	Measured Values		
				17:00	17:20	17:45
1	Ambient Temperature		°C	31.8	31.4	31.7
2	Relative Humidity		%	76	68	77
3	W.B.T near CT		°C	28.1	26.3	28.2
4	Water Temperature	In	°C	41.2	40.1	40.0
5	Water Temperature	Out	°C	33.4	33.6	33.1
6	Range		°C	7.8	6.5	6.9
7	Approach		°C	5.3	7.3	4.9
8	Effectiveness		%	59.5	47.1	58.5
Electricity				**Fan 1**	**Fan 2**	
9	Fan Power		kW	13.4	13.0	
10	Fan Frequency		Hz	50	50	

- The effectiveness of the CT was found to be reasonable at 55 % and is acceptable

9.2.4 Pharma Plant Cooling Tower : (500TR)

- There is a wooden cooling tower of 500 TR capacity that is used to meet the thermal load of the Pharma, Recovery & 2 D plants
- The scheme of operation is as below :

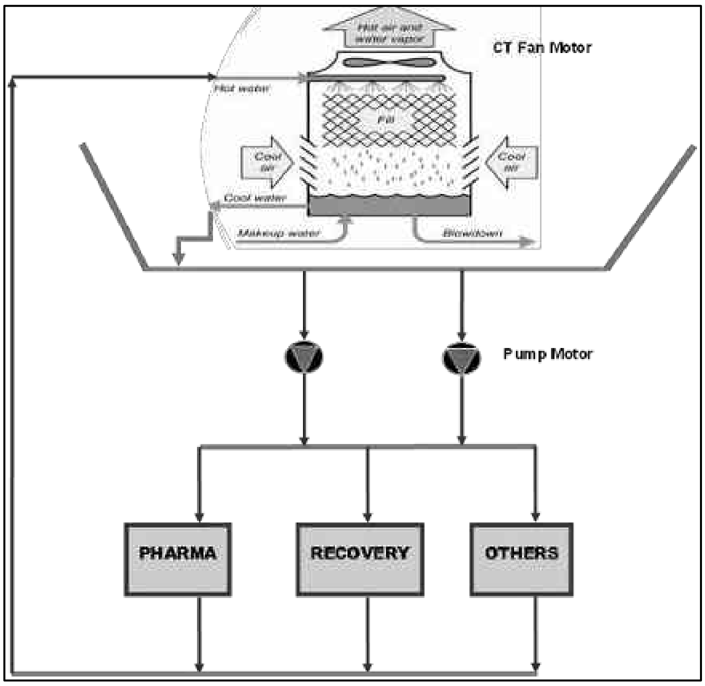


Fig 9.4 : Pharma Plant Cooling Tower Operation : Schematic

- The measurements recorded are shown in Table 9.5

Table 9.5 : Performance Assessment Data: Captured & Computed : Pharma

No	Parameter		UoM	Measured Values			
				16:00	16:30	17:00	17:30
1	Ambient Temperature		°C	35.5	34.6	34	33.5
2	Relative Humidity		%	58.1	60.2	63.4	72.1
3	W.B.T near CT		°C	28.0	27.6	27.9	28.8
4	Water Temperature	In	°C	34.7	34.1	34.6	34.7
5	Water Temperature	Out	°C	33.1	32.6	32.5	33.4
6	Range		°C	1.6	1.5	2.1	1.3
7	Approach		°C	5.1	5.0	4.6	4.6
8	Effectiveness		%	23.9	23.1	31.3	22.0
9	Fan Power		kW	3			
10	Fan Frequency		Hz	35			

- The power drawl as well the effectiveness is very low in this Cooling Tower as can be seen

9.2.5 IPCA Plant Cooling Tower (800 TR)

- A dedicated Cooling Tower of 800 TR rating has been installed on the roof top of the building having IPCA to meet the thermal load of this plant & that of Block 70

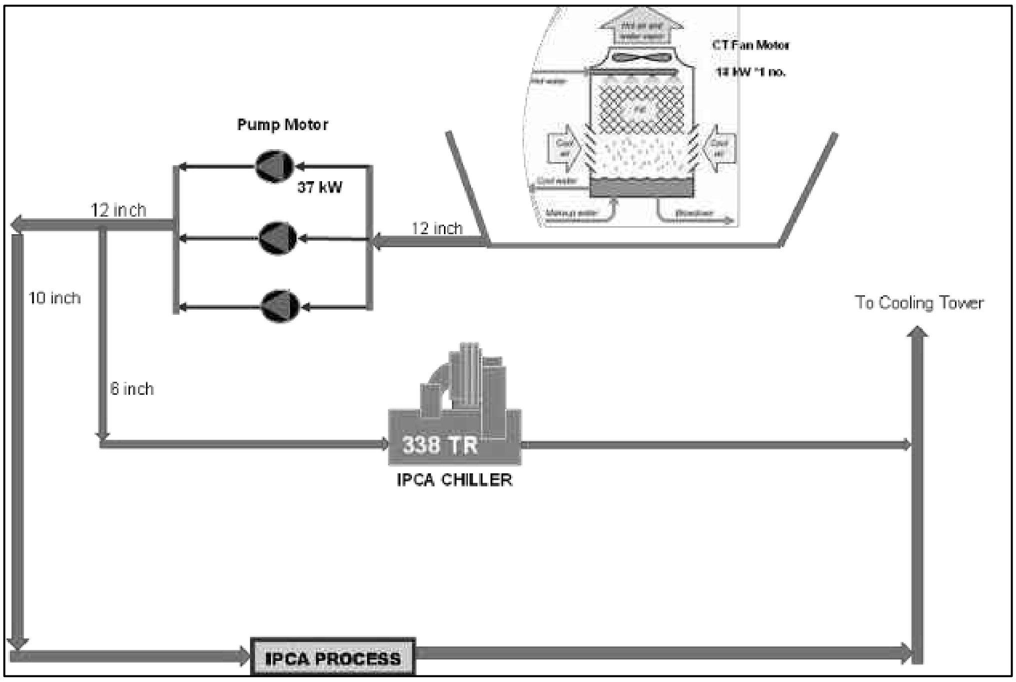


Fig 9.5 : IPCA Plant Cooling Tower Operation : Schematic

- Table 9.6 presents the measurements taken on this cooling tower

Table 9.6 : Performance Assessment Data: Captured & Computed : IPCA

No	Parameter		UoM	Measured Values	
				15:40	16:00
1	Ambient Temperature		°C	31.9	35.0
2	Relative Humidity		%	67.2	58.2
3	W.B.T near CT		°C	26.7	27.7
4	Water Temperature	In		38.2	38.0
5		Out		33.8	33.6
6	Range			4.4	4.4
7	Approach			7.1	5.9
8	Effectiveness		%	38.3	42.7
9	Fan Power		kW	10	
10	Fan Frequency		Hz	45	

- The performance established in terms of its effectiveness is seemed to be okay at 40.5 % but still can be enhanced

9.2.6 Consolidation

- The effectiveness of all the 5 cooling towers along with Approach Temperature have been plotted in Fig 9.6 and compared

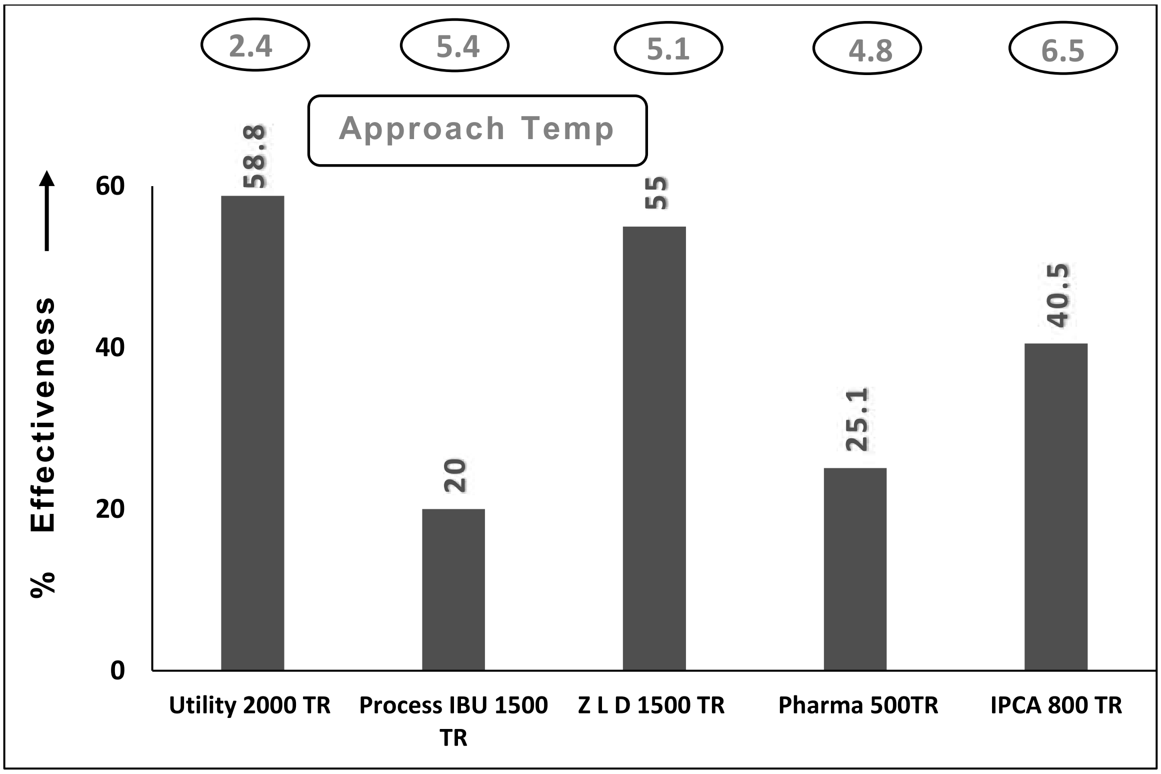


Fig 9.6 : Effectiveness and Approach Temperatures of CTs

- It was observed that higher the “Approach Temperature” lower was effectiveness
- However, the effectiveness was 55 % in the cooling tower of ZLD despite the approach temperature being 5.1 °C. This is probably due to the fact that this cooling tower has experienced a high ‘ ***Range*** ’ of 7.2 °C
- As a general remark, it is suggested that effort shall be put in to decrease the approach temperature in CTs
- As such , the performance of Cooling Towers of this plant can be ranked at 5 in a scale of 10

9.3 PUMP PERFORMANCE EVALUATION

9.3.1 Introduction

- Typically, pumps hold a significant share of energy consumption in the Utility Section of a plant. Application of the pumps ranges from transferring Raw Water, Chilled Water, Cooling Water, RO Water so on and so forth. As such, the pumps are very sensitive piece of utilities with respect to their operating parameters. The wrong selection of operating parameters viz, Flow Rate and the Pressure Head can bring down the operating efficiency of even a well - designed pumps to an abysmally low level. Hence it is important not only to procure an energy efficient pump but also operate it on the selected / designed parameters
- As far as this plant is concerned, performance study has been conducted on the pumps belonging to the following 3 categories:
  - i) Chilled Water / Brine Pumps
  - ii) Cooling Water (Condenser) Pumps
  - iii) Process Water Pumps
- The performance of the pumps has been evaluated through the measurements of the following 3 relevant parameters, viz,
  - a) Fluid Flow Rate (m^3 / h)
  - b) Total Pressure Head developed (m WC)
  - c) Input Power to the Motor (k W)

9.3.2 Chilled Water / Brine Pumps

9.3.2.1 Performance Evaluation

- A performance study has been conducted on 2 Nos of Brine Pumps and 4 Nos of Chilled Water Pumps which are in operation at the time of energy auditing
- The outcome of study is tabulated below

Table 9.7 : Performance of Pumps Handling : Brine + Chilled Water

<table>
<tr><th rowspan="3">No</th><th rowspan="3">Pump ID</th><th colspan="4">Rated</th><th colspan="4">Measured</th><th rowspan="3">Sp. Thro'put m^3 / h / kW</th></tr>
<tr><th>Flow</th><th>Head</th><th>Power</th><th>η</th><th>Flow</th><th>Head</th><th>Power</th><th>η</th></tr>
<tr><th>m^3 / h</th><th>m WC</th><th>kW</th><th>%</th><th>m^3 / h</th><th>m WC</th><th>kW</th><th>%</th></tr>
<tr><td>1</td><td>Brine Pump – 1 (Aldehyde)</td><td rowspan="6">300</td><td rowspan="4">50</td><td rowspan="4">55</td><td rowspan="4">74.2</td><td>176</td><td>38</td><td>33.0</td><td>55.2</td><td>5.33</td></tr>
<tr><td>2</td><td>Brine Pump – 1 (Pharma)</td><td>181</td><td>36</td><td>44.0</td><td>40.3</td><td>4.11</td></tr>
<tr><td>3</td><td>Chilled Water Pump - 1 IBU 1</td><td>218</td><td>36</td><td>55</td><td>38.9</td><td>3.96</td></tr>
<tr><td>4</td><td>Chilled Water Pump - 3 VAM</td><td>104</td><td>40</td><td>43.4</td><td>26.1</td><td>2.40</td></tr>
<tr><td>5</td><td>Chilled Water Pump - 1 (East)</td><td rowspan="2">40</td><td rowspan="2">45</td><td rowspan="2">72.6</td><td>176</td><td>36</td><td>37</td><td>46.6</td><td>4.76</td></tr>
<tr><td>6</td><td>Chilled Water Pump - 2 (West)</td><td>174</td><td>36</td><td>34</td><td>50.2</td><td>5.12</td></tr>
</table>

- The overall pump efficiency obtained for each pump is compared with that designed in Fig 9.7

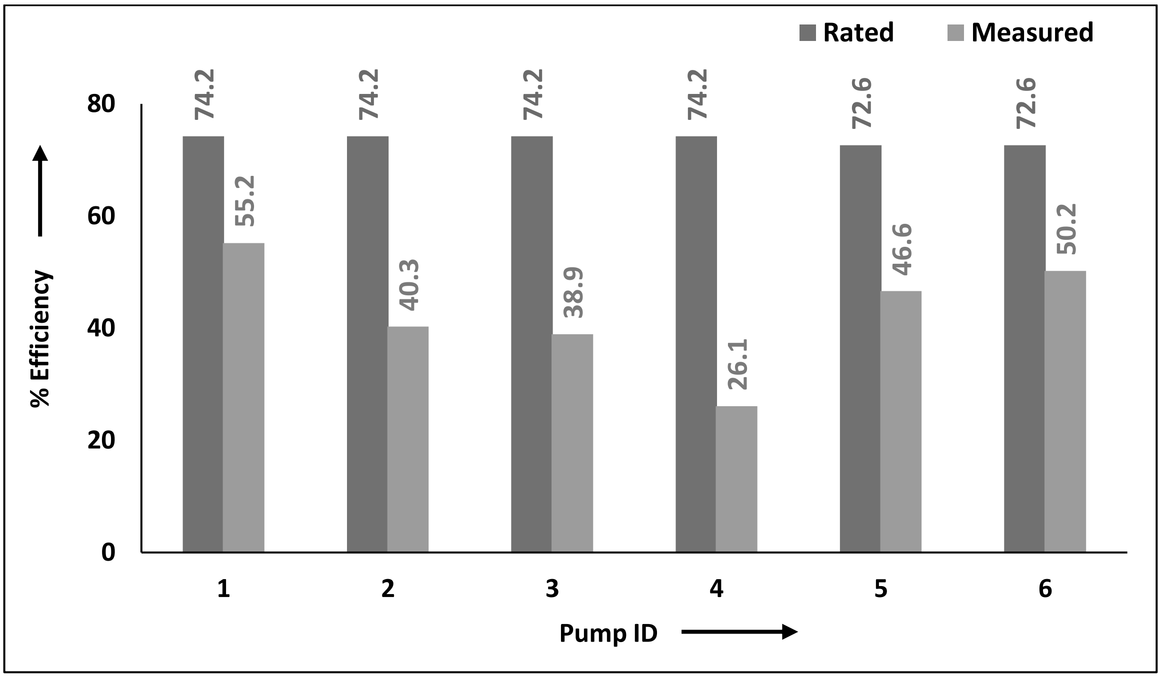


Fig 9.7: Overall Pump Efficiency: Rated vs Recorded : Chilled Water + Brine

9.3.2.2 Observations & Comments

- The overall efficiency of the pumps was found to be lower than that of the designed
- As far as Brine Pumps are concerned, the flow rates were only 60 % the designed values despite the Head developed being low. This indicates that the pumps need to be overhauled as replaced if it comes to that to achieve a better efficiency.
- Chilled Water Pumps too do no better performance. The chilled water pumps of VAM show an abysmally low efficiency of 26% as against a designed value of 74.2%
- As such, it can be said that the performance of all the 6 pumps was found wanting

9.3.3 Condenser Water Pumps : Chillers

9.3.3.1 Performance Evaluation

- 6 pumps have been analyzed for their performance that fall under the category of condenser water pumps belonging to cooling tower of chillers
- The outcome is as below:

Table 9.8 : Performance of Pumps Handling Condenser Water in CTs

<table>
<tr><th rowspan="3">No</th><th rowspan="3">Section</th><th rowspan="3">Pump ID</th><th colspan="4">Rated</th><th colspan="4">Measured</th><th rowspan="3">Sp. Thro'put m³ / h / kW</th></tr>
<tr><th>Flow</th><th>Head</th><th>Power</th><th>η</th><th>Flow</th><th>Head</th><th>Power</th><th>η</th></tr>
<tr><th>m³ / h</th><th>m WC</th><th>kW</th><th>%</th><th>m³ / h</th><th>m WC</th><th>kW</th><th>%</th></tr>
<tr><td rowspan="4">1</td><td rowspan="4">Utility CT : 2000 TR</td><td>Condenser Water pump 1</td><td colspan="2">N.A</td><td rowspan="4">30</td><td>-</td><td>209</td><td>24</td><td>23</td><td>59.4</td><td>9.09</td></tr>
<tr><td>Condenser Water pump 2</td><td colspan="2">N.A</td><td>-</td><td>208</td><td>24</td><td>22.8</td><td>59.6</td><td>9.12</td></tr>
<tr><td>Condenser Water pump 3</td><td colspan="2">N.A</td><td>-</td><td>184</td><td>24</td><td>20.2</td><td>59.6</td><td>9.10</td></tr>
<tr><td>Condenser Water pump 5</td><td colspan="2">N.A</td><td>-</td><td>131</td><td>21</td><td>14.4</td><td>52.0</td><td>9.10</td></tr>
<tr><td rowspan="2">2</td><td rowspan="2">IPCA CT 800 TR</td><td>Condenser Water pump East</td><td>311</td><td>32</td><td>37</td><td>73.2</td><td rowspan="2">440</td><td rowspan="2">27</td><td rowspan="2">72.6</td><td rowspan="2">44.6</td><td rowspan="2">6.06</td></tr>
<tr><td>Condenser Water pump West</td><td>311</td><td>32</td><td>37</td><td>73.2</td></tr>
</table>

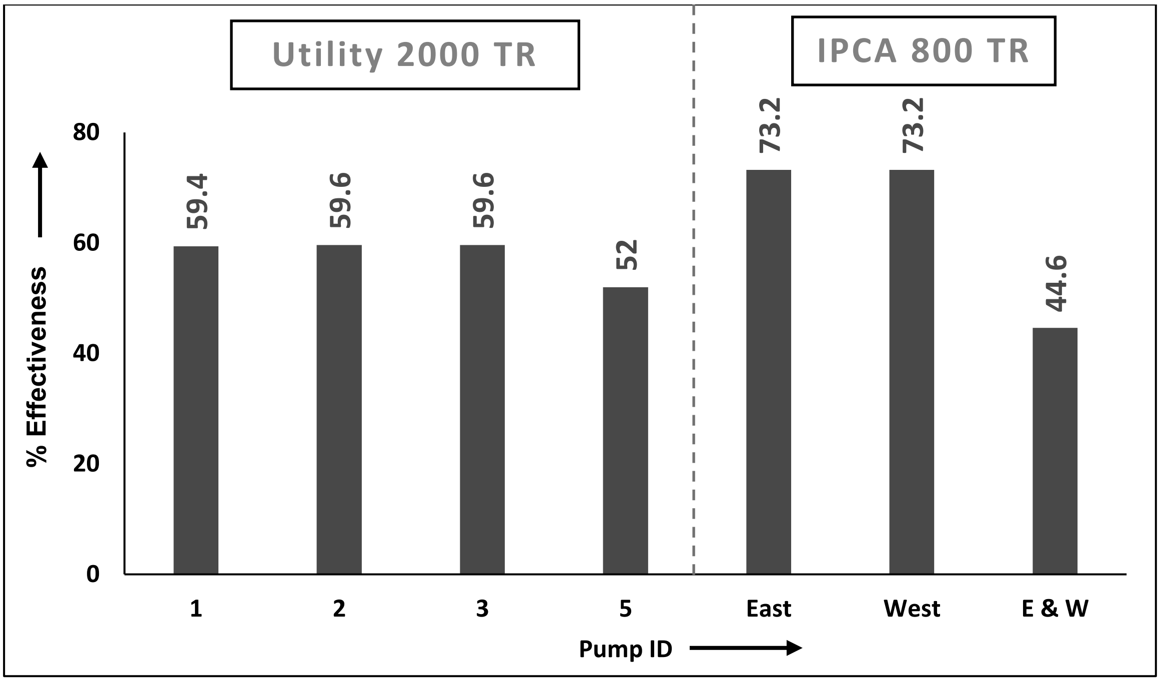


Fig 9.8 : Overall Pump Efficiency : Rated vs Recorded

9.3.3.2 Observations & Comments

- The performance of condenser water pumps of Utilities CT (2000 TR) were found to be quite uniform at 59.6% overall efficiency levels but for Pump No : 5.
- This Pump No 5 had performed a bit inferior at 52% as overall efficiency

a) As far as the Condenser Water Pumps of IPCA Cooling Tower are concerned, the individual performance of the pumps could not be estimated for want of provision. Nevertheless, the combined overall efficiency could be established and estimated as 44.6 % which is about 60% of the designed efficiency of 73.2 %

- While the head developed by these pumps had matched with that designed, the water flow rate appeared to be on the lower side. This had brought down the overall efficiency of the pumps considerably.
- Enhancing the water flow rate would improve the performance of the cooling tower as well the process.

9.3.4 Condenser Water Pumps:

9.3.4.1 Performance Evaluation

- The Condenser Pumps of Process Cooling Towers of 1500 TR, ZLD and 500 TR come under this classification and their performance have been evaluated

- The captured and computed data are tabulated below :

Table 9.9 : Performance: Condenser Water Pumps of CTs

No	Section	Pump ID	Rated				Measured				Sp. Thro'put
			Flow	Head	Power	η	Flow	Head	Power	η	
			m^3 / h	m WC	kW	%	m^3 / h	m WC	kW	%	m^3 / h / kW
1	Process CT 1500 TR	Condenser Water Pump 2	-	43	55	-	540	17	55.5	45.1	9.73
		Condenser Water Pump 3	-	43	55	-	487	15	50.1	39.7	9.72
		Condenser Water Pump 4	-	43	55	-	404	15	41.5	39.7	9.73
2	Z L D C T	Condenser Water Pump 2	300	50	55	74.3	221	25	41	36.7	5.39
		Condenser Water Pump 4	300	50	55	74.3	209	25	42	33.9	4.98
3	Process CT 500 TR	Condenser Water Pump	-	-	55	-	183	34	48	35.3	3.81

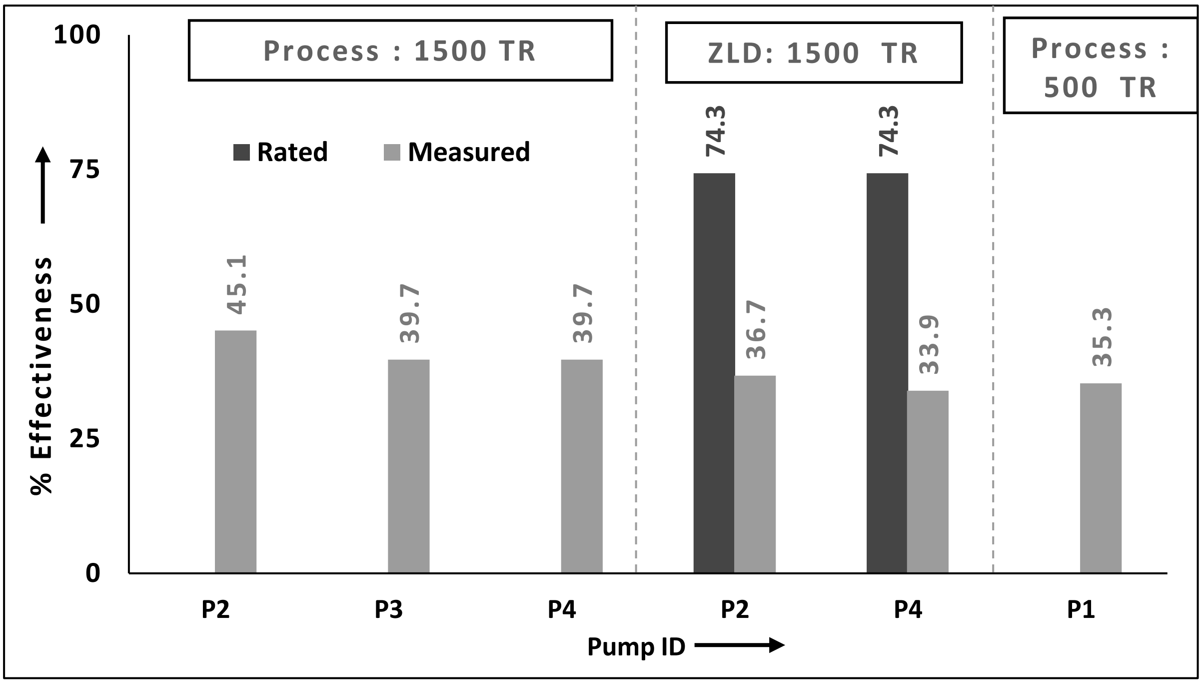


Fig 9.9 : Overall Pump Efficiency : Condenser Pumps

9.3.4.2 Observation & Comments

- None of the pumps can develop an overall efficiency of even 50 %
- The Head developed as against the designed values are much in variance and that could be one of the reasons for attaining lower efficiency levels in pump operation.
- The rated flow rates were not available and hence could not be commented upon.

9.3.5 Consolidation

- Pumps handling Brine & Chilled Water for process applications majorly perform below par at 50 % level and less.
- Pumps of Utility Section 2000 TR CT perform reasonably well showing an overall efficiency of 60 %
- Pumps - associated with 1500 TR CT, ZLD & 500 TR CT - are quite lowly at much less than 50 %
- Typically benchmark efficiencies for the pumps can be fixed at 60 % considering the age, make, usage operating parameters etc.,

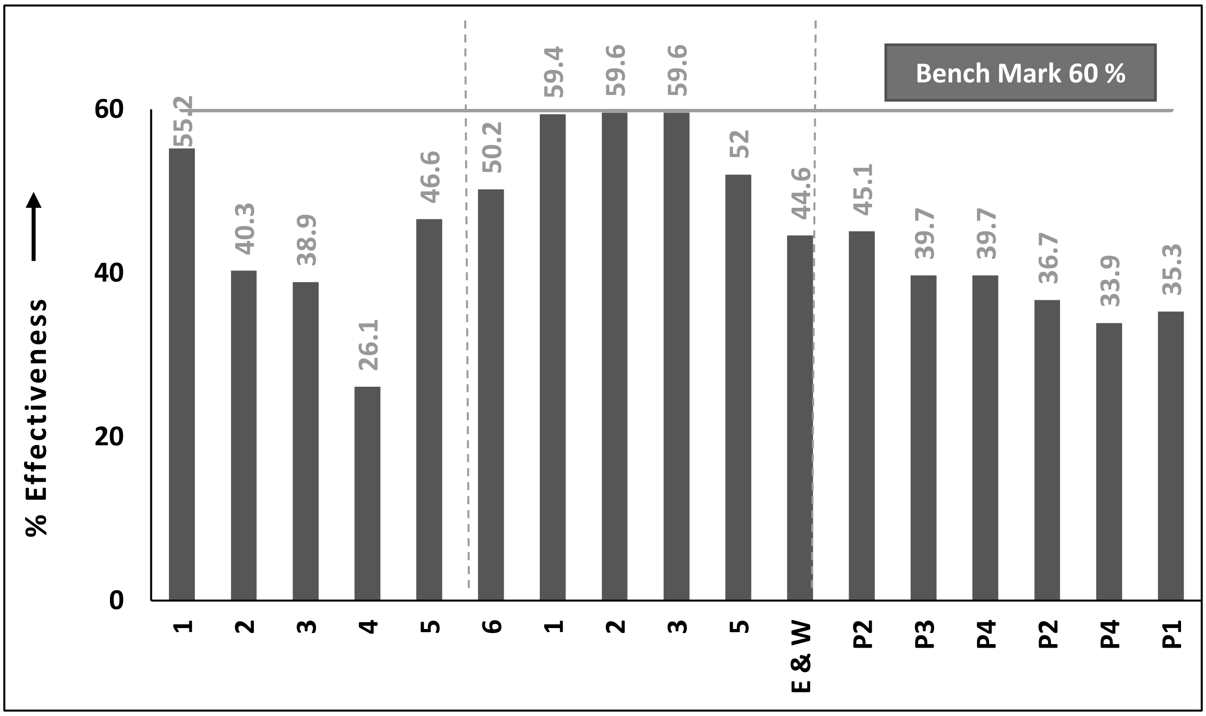


Fig 9.10 : Comparison of Pump Efficiencies vis- a -vis Benchmark Value

- The way forward is to take up a dedicated " Pump Performance Study " and look for performance improvement through various means that could include the pump replacement, pump swapping, varying the present operating parameters etc.,

10 PERFORMANCE STUDY ON CHILLERS - A DETAILED ANALYSIS

10.1 INTRODUCTION

- The Chilled Water / Brine is one of the most needed Utilities of the plant as it finds its application in maintaining required ambience inside the plant and also in the extraction of heat of various chemical reactions going - on in the manufacture of pharma products
- It is treated as a critical utility as any improper / ineffective heat extraction / transfer can lead to quality related issues that can result in the rejection of the finished good altogether. A costly affair
- As far as this industry is concerned, the energy consumption due to Chiller Plant and Cooling Towers works out to about 750 MWh / month vis – a - vis an average monthly energy consumption of 2065 MWh. This forms 36% of total energy consumption of the plant
- Chiller system accounts for 20% and the cooling tower for 16%. This information is presented pictorially in Fig 10.1

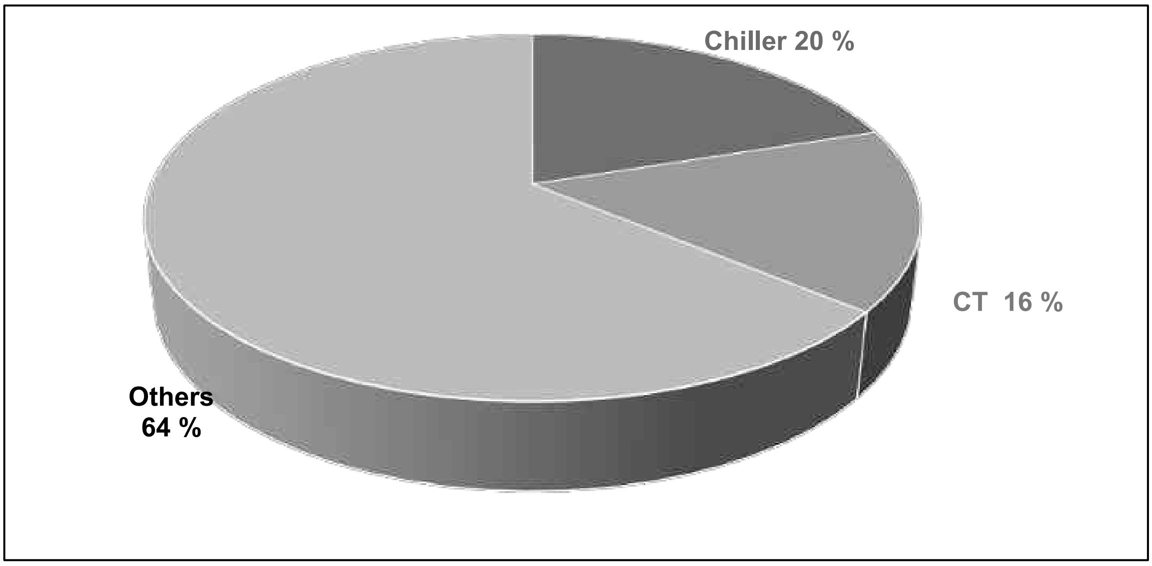


Fig 10.1 Energy Consumption Share of Chiller + Cooling Tower

- Thus, energy optimization in Chiller System assumes significance and hence is accorded top priority in pharma industries both from quality as well as from energy point of view

- The ensuing section discusses the performance of the Chiller Systems of the plant in detail

10.2 CHILLER SYSTEMS : INVENTORY & WAY FORWARD

- The Chiller Systems in this plant consist of the following :
  - (i) Water Cooled Centralised Chillers [Brine & Chilled water as “Cool Energy” transfer media]
  - (ii) Package / Ductable Air Conditioners
  - (iii) Split Air Conditioners
  - (iv) AHUs and Cooling Towers associated with Chillers
- It has been recorded that the total installed rating of Centralized Chilled Water / Brine is 2174 T R and the break - up is as follows :

Table 10.1 : Centralized Chilled Water / Brine Systems – Inventory

No	Chiller Plant System		Fluid Medium	Ref. Rating TR
1	Utility	Aldehyde	Brine [Methanol 18 %, Sp.gr : 0.95]	225
2		Pharma	Brine [$CaCl_2$ 18 %, Sp.gr : 1.01]	150
3		IBU - 1	Chilled Water	384
4		IBU - 2		384
5		VAM Chiller		480
6		Reynold	Brine [Methanol 18 %, Sp.gr 0.95]	188
7	Baby Chiller		Brine	25
8	IPCA Plant		Chilled Water	338
Total				**2 174**

- A detailed technical study on the Chiller Systems that include the performance study of Chillers, Cooling Towers, Associated Pumps and AHUs has been conducted.
- However, no such study was undertaken on ductable and split A / Cs as they are not only star - rated energy efficient systems but also operated only on the demand basis.
- The measurements recorded include Energy Consumption. Flow Rate of Water & Brine, Operating Temperatures & Pressures etc.,

- The Chiller Systems have been divided into 4 circuits - for convenience sake - and analysed
- The scheme of division of chiller circuits is as below in Table 10.2

Table 10.2 : Chiller Systems : Scheme of Operation : Break - Up

No	Circuit ID	Location	Ultimate User Plant	Cooling Tower ID
1	Circuit - 1	Utility	Aldehyde : UCCH 2018	Utility CT – 2000 TR
2	Circuit - 2		Pharma : UCCH 2022	
3	Circuit - 3		IBU -1, IBU-2, VAM (UCCH 2019)	
4	Circuit - 4	I P C A Building	I P C A Chiller (UCCH 2016)	IPCA CT - 800 TR

- The performance evaluation has been conducted on the Chiller System of each circuit and detailed in ensuing sections.

10.3 CIRCUIT NO : 1 : ALDEHYDE PLANT

- This Chiller System is Brine based and designed to take the process heat load of various reactors of this aldehyde plant
- The cooling temperature demanded in this plant is **- 5°C**
- At the time of supply, the chilled brine solution designated was Ethylene Glycol by the OEM and it has been substituted by Methanol now

10.3.1 Design Parameters

- The design parameters of this system - as per OEM - under the present circumstances is given in Table 10.3

Table 10.3 : Chilled System : Circuit 1 : Aldehyde : Design Parameters

No	Parameters	Unit	Value
1	Capacity	TR	252
2	Power Consumption	kW	248
3	Fluid Medium	-	(Methanol : 18% con)

No	Parameters	Unit	Value
4	Evaporator : Brine Solution		
	a) Flow Rate	m^3 / h	198
	b) Entering Temperature	° C	- 1
	c) Leaving Temperature		- 5
	d) Pressure Drop	m WC	7.0
5	Condenser : Cooling Tower Water		
	a) Flow Rate	m^3 / h	241
	b) Entering Temperature	° C	36
	c) Leaving Temperature		32
	d) Pressure Drop	m WC	4.0
	e) Specific Energy Consumption	kW / TR	0.984

The scheme of operation is shown in Fig 10.2

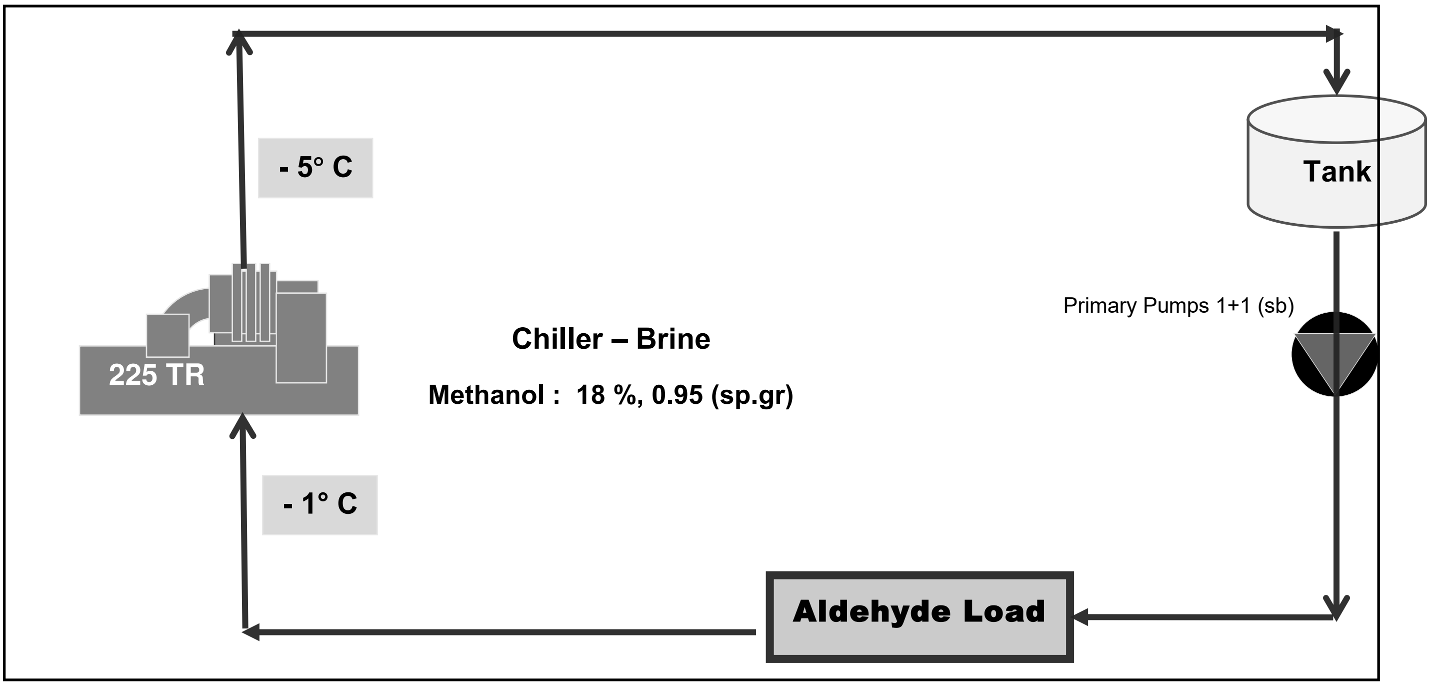


Fig 10.2 : Present Scheme of Operation : Circuit 1 : Aldehyde Plant

10.3.2 Study Parameters + Performance Evaluation

- 4 sets of measurements have been taken in order to establish the repeatability / reliability of the results of the study undertaken
- The study outcome is shown in Table10.4

Table 10.4 : Chiller System : Circuit 1 : Aldehyde : Evaluated Parameters: UFM

Display Parameter				Set 1	Set 2	Set 3	Set 4	
Date: 10.06.2022 & Time				11.10 am	12:30 pm	2.20 pm	3.10 pm	
No	Parameter		Unit	Value				
I) EVAPORATOR								
1	Set Point		°C	- 5.5				
2	Chilled Water							
	a) Flow Rate		m^3 / h	176	176	176	176	
	b) Temperature	Entering	°C	- 2.5	- 2.9	- 3.1	- 3.2	
		Leaving		- 5.4	- 5.6	- 5.6	- 5.6	
	c) Pressure	Entering	bar	1.3				
		Leaving		0.4				
3	Refrigerant							
	a) Temperature		°C	- 8.7	- 8.7	- 8.5	- 8.5	
	b) Pressure		bar	1.10	1.09	1.09	1.10	
4	Cooling Load Delivered		TR	169	157	146	140	153
5	Specific Brine Flow Rate		m^3 / h / TR	1.041	1.121	1.205	1.257	
II) CONDENSER								
6	Condenser Water							
	a) Flow Rate		m^3 / h	227	229	224	223	
	b) Temperature	Entering	°C	29.4	29.4	30.3	30.4	
		Leaving		32.1	31.9	32.7	32.7	
	c) Pressure	Entering	bar	2.1				
		Leaving		1.6				
7	Refrigerant							
	a) Temperature		°C	33.2	33.3	34.4	34.2	
	b) Pressure		bar	7.33	6.32	7.62	7.55	
8	Specific Condenser Water Flow Rate		m^3 / h / TR	1.343	1.459	1.534	1.593	
III) COMPRESSOR & MOTOR								
9	Refrigerant Discharge Temperature		°C	61	61.5	65.3	65.8	
10	Discharge Superheat			27.4	28.3	31.1	31.7	
11	R L A		%	75	71.3	70.8	67	169
12	Power Consumption		kW	177.5	169	170	158	1.10
13	Specific Energy Consumption (SEC)		ikW/TR	1.052	1.075	1.168	1.131	

10.3.3 Typical Process Parameters : A Comparison

- A comparison is made on the important operating parameters of the system - between the designed & the operating ones - that defines the performance of the chiller system
- The performance taken - up for the comparison's sake include :

(i).	Cooling Load Delivered	:	TR
(ii).	Specific Energy Consumption	:	kW / TR
(iii).	Specific Brine Flow Rate	:	m^3 / h / TR
(iv).	Specific Cooling Water Flow Rate	:	m^3 / h / TR

The above parameters are sketched in Fig 10.3

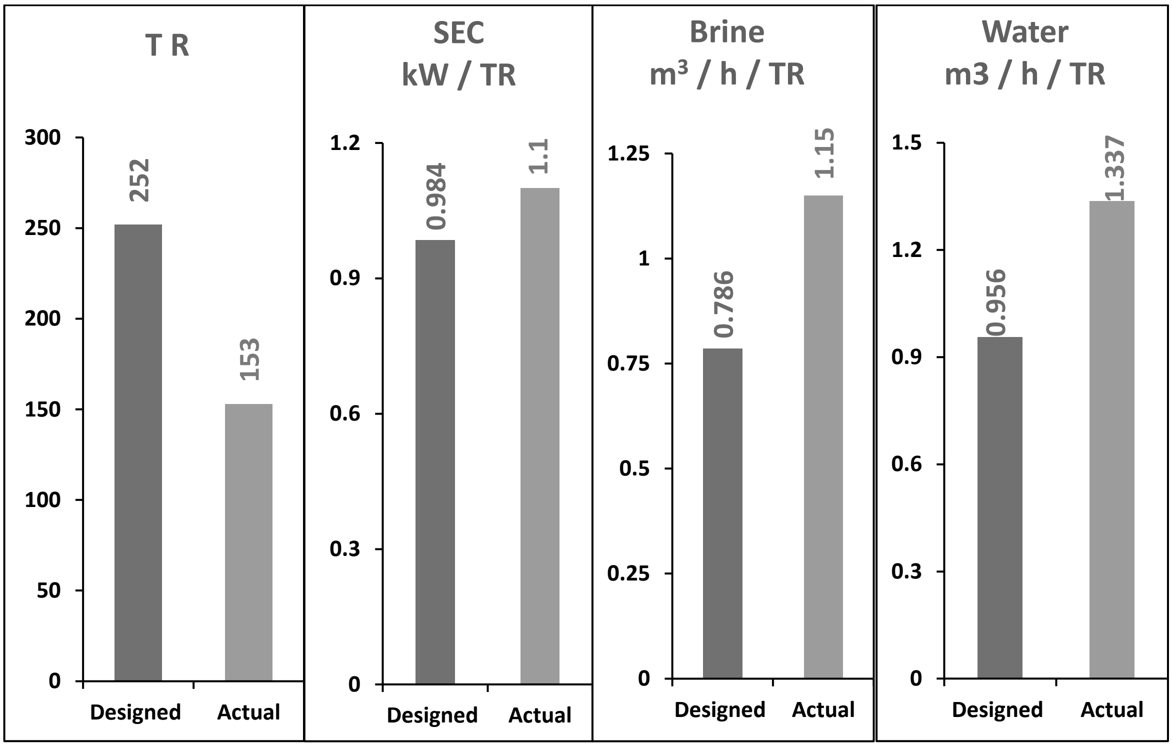


Fig 10.3 : Performance Comparison : Typical Parameters: Circuit 1

- It can be seen from the above chart that the actual operating parameters are much different (on the inferior side) from the designed values

10.3.4 Comments

- Fluid medium - currently in use - is Methanol whilst the designed one is Ethylene Glycol. This change over has been done with the consent of plant personnel. Methanol usage is likely to reduce the lifetime of evaporator coil in the long run due to its corrosive nature. Hence care has to be exercised

- Water used in the condenser was found to have varying TDS as the water evaporation is replenished with recycled water. It is imperative that a monitoring mechanism is evolved in order to keep a check on TDS of condenser water. Poor quality water will hamper effective heat transfer.
- It may be noted that the TR delivered is much lower than the designed [252 T R vs 153 T R] and efforts shall be made to identify the root cause.

10.4 CIRCUIT NO 2 : PHARMA PLANT

- This Chiller System too is brine based [Ethylene Glycol] but changed over to $Cacl_2$ as Brine solution due to process requirements.
- This plant caters to the Chilling load of the reactors of the pharma section
- The original designed temperatures were 0 / - 5°C while the current temperature values are + 1 / - 2°C

10.4.1 Designed Parameters

The designed parameters of this system are presented below [present condition] :

Table 10.5 Chiller System : Circuit 2 : Pharma Plant : Designed Parameters

No	Parameters	Unit	Value
1	Capacity	TR	189
2	Power Consumption	kW	156
3	Fluid Medium	-	CaCl2
4	**Evaporator : Brine Solution**		
	a) Flow Rate	m^3 / h	201
	b) Entering Temperature	°C	1
	c) Leaving Temperature		- 2
	d) Pressure Drop	m WC	5
5	**Condenser : Cooling Tower Water**		
	a) Flow Rate	m^3 / h	179
	b) Entering Temperature	°C	36
	c) Leaving Temperature		32
	d) Pressure Drop	m WC	3
6	Specific Energy Consumption	kW / TR	0.825

The scheme of operation is shown in Fig 10.4

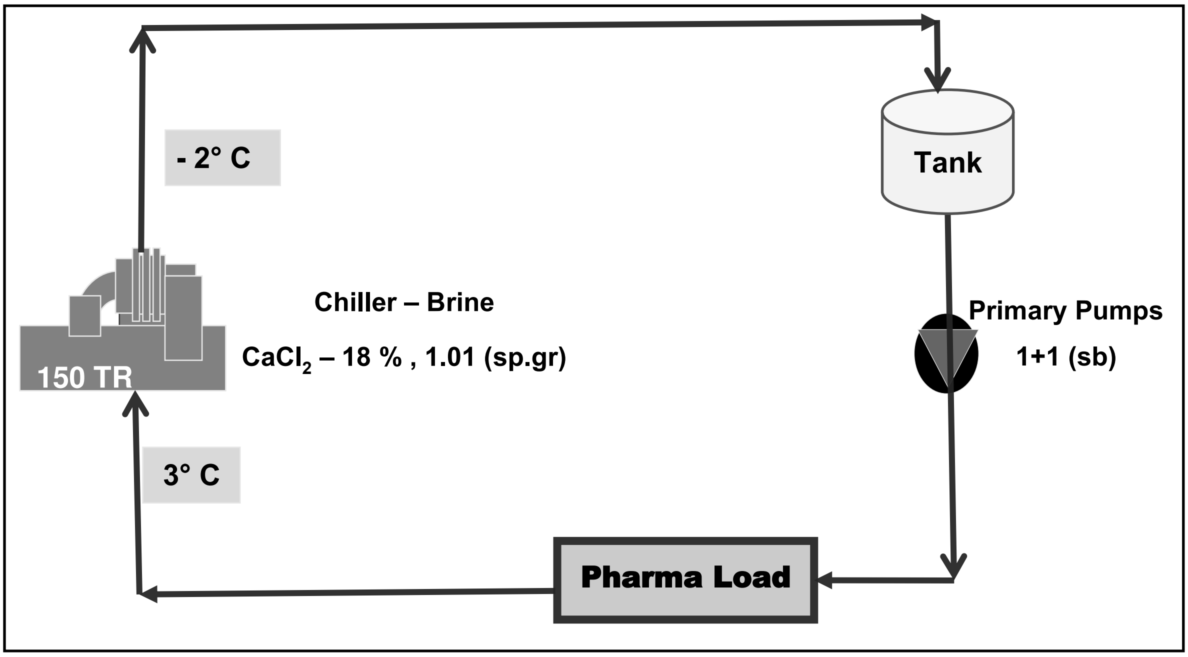


Fig 10.4 : Present Scheme of Operation : Circuit 2 : Pharma Plant

10.4.2 Study Parameters + Performance Evaluation

- 4 sets of measurements have been recorded and the same along with computed values presented in Table 10.6

Table 10.6 : Chiller System : Circuit 2 : Pharma Plant : Evaluated Parameters

Display Parameter				Set 1	Set 2	Set 3	Set 4
Date: 10.06.2022 & Time				11.20 am	12:40 pm	02.30 pm	04.40 pm
No	Parameter		Unit	Value			
I) EVAPORATOR							
1	Set Point		°C	- 3			
2	**Chilled Water**						
	a) Flow Rate		m^3 / h	182	183	184	185
	b) Temperature	Entering	°C	- 0.4	- 1	- 0.8	- 0.4
		Leaving		- 1.9	- 2	- 2.1	- 1.4
	c) Pressure	Entering	bar	4	3.9	3.9	3.9
		Leaving		3.5	3.4	3.4	3.4
3	**Refrigerant**						
	a) Temperature		°C	- 3.7	- 3.7	- 3.8	- 3.4
	b) Pressure		bar	1.54	1.55	1.54	1.58

Display Parameter				Set 1	Set 2	Set 3	Set 4	
Date: 10.06.2022 & Time				11.20 am	12:40 pm	02.30 pm	04.40 pm	
No	**Parameter**		**Unit**	**Value**				
4	Cooling Load Delivered		T R	90	61	79	110	85
5	Specific Brine Flow Rate		m^3 / h / TR	2.02	3	2.33	1.68	
II) CONDENSER								
6	**Condenser Water**							
	a) Flow Rate		m^3 / h	86	80	85	88	
	b) Temperature	Entering	°C	29.4	29.3	30.3	30.4	
		Leaving		33.5	32.4	34.0	35.2	
	c) Pressure	Entering	bar	1.7	1.7	1.7	1.7	
		Leaving		1.4	1.4	1.4	1.4	
7	**Refrigerant**							
a	a) Temperature		°C	33.9	32.5	34.3	35.9	
b	b) Pressure		bar	7.6	7.3	7.7	8.1	
8	Specific Condenser Water Flow Rate		m^3 / h / TR	0.96	1.31	1.08	0.8	
III) COMPRESSOR & MOTOR								
9	Refrigerant Discharge Temperature		°C	47	47.3	48.3	48.9	
10	Discharge Superheat			13.1	15.2	13.7	13.1	
11	R L A		%	85	67	80	96	
12	Power consumption		k W	140.8	110.7	131.0	156.6	134.7
13	Specific Energy Consumption (S E C)		kW / TR	1.564	1.815	1.658	1.425	1.59

10.4.3 Typical Process Parameters : A Comparison

- A comparison made on the parameters - that define the efficiency of the Chiller Operation - is shown below :

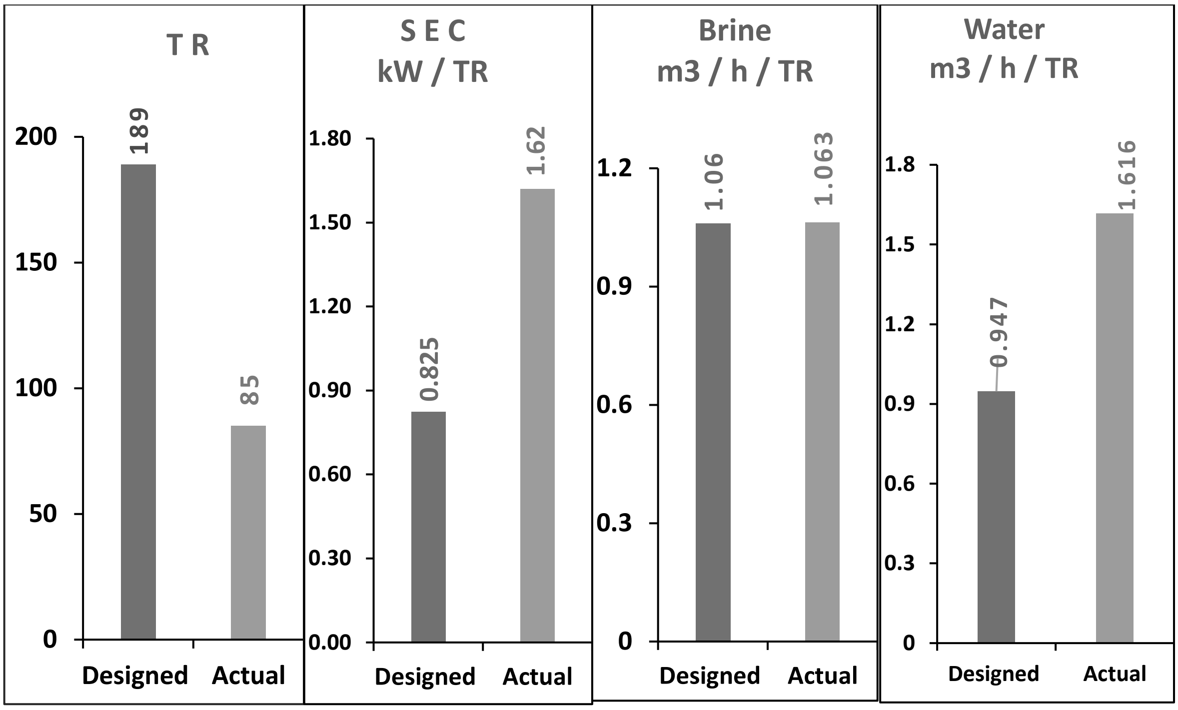


Fig 10.5 : Performance Comparison : Typical Parameters : Circuit 2

10.4.4 Comments

- Fluid medium currently in use is Calcium Chloride as against a designed media of Ethelene Glycol. Of course, this had been done with the concurrence plant personnel
- Initially, Chiller was designed with -5 / 0 °C outlet / inlet chilled brine but presently it is +1 / -2 °C
- The Specific energy consumption (SEC) is found to be quite high probably due to the low condenser water flow rate compared with the design.
- The low water flow rate in the in condenser would be affecting the heat transfer and thereby the chiller output
- Likewise, Evaporator approach temperature also needs to be improved
- The usage of $CaCl_2$ in longer run is likely to induce corrosion in evaporator coils
- TR delivered by this plant is quite low at 85 as against the designed value of 189

10.5 Circuit No 3: IBU Plant

10.5.1 Preamble

- The chiller plant in Circuit 3 supplies chilled water to the entire plant area and AHUs. Hence, to meet this demand, there are 3 Chillers employed in the circuit namely, IBU - 1, IBU - 2 and Vapour Absorption based Chiller (V A M)

- At the time of study, IBU - 2 was under maintenance and hence performance study could be carried out only on IBU - 1 and VAM Chiller.
- There are two tanks installed in this circuit for the distribution and collection of chilled water.
- The scheme of operation is shown in Fig 10.6

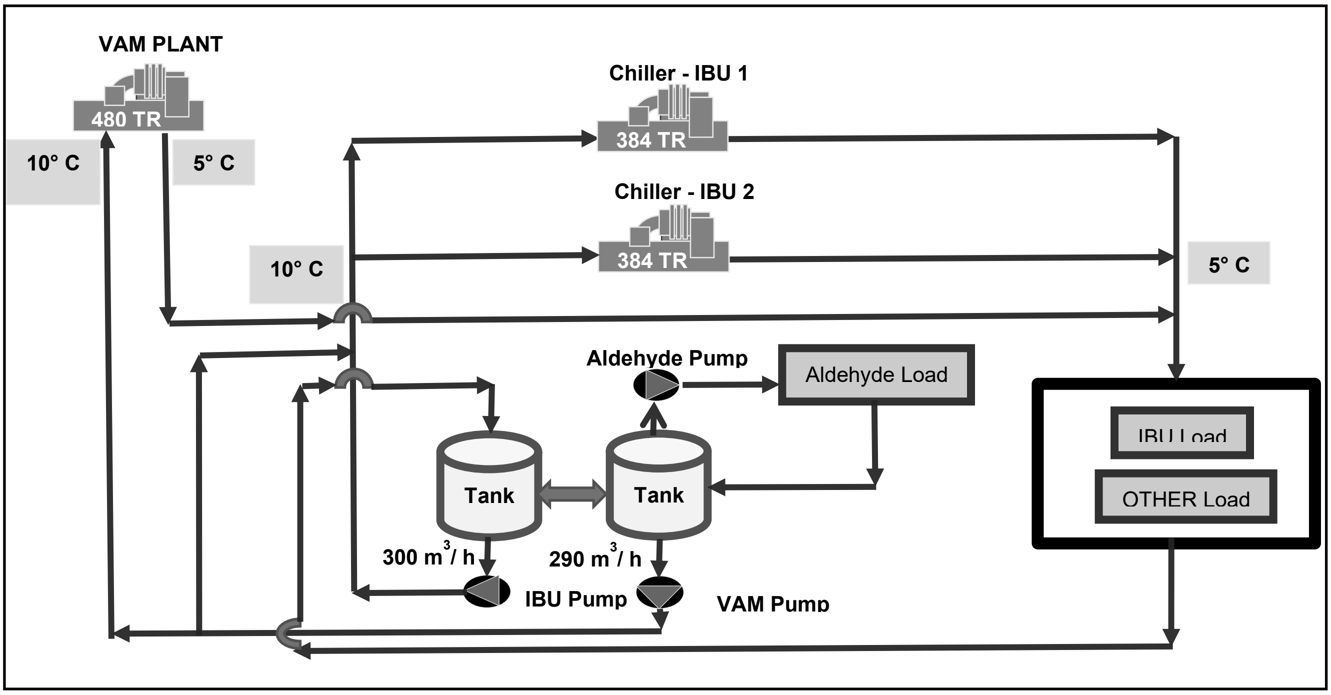


Fig 10.6: Chiller Circuit 3 : IBU Plant : Scheme of Operation

10.5.2 Design Parameters

- The design parameters - as per the OEM - of this Chiller Unit - are consolidated and tabulated below

Table 10.7 : Chiller System : Circuit 3 : IBU Plant : Design Parameters

No	Parameters	Unit	Value
1	Capacity	TR	394
2	Power Consumption	kW	260
3	Fluid Medium	-	Chilled Water
4	**Evaporator : Chilled Water**		
	a) Flow Rate	m^3 / h	231
	b) Entering Temperature	°C	10
	c) Leaving Temperature	°C	5
	d) Pressure Drop	m WC	7

No	Parameters	Unit	Value
5	**Condenser : Cooling Tower Water**		
	a) Flow Rate	m^3 / h	339
	b) Entering Temperature	°C	36
	c) Leaving Temperature		32
	d) Pressure Drop	m WC	7.7
6	Specific Energy Consumption	kW / TR	0.66

10.5.3 Study Parameters + Performance Evaluation

- 4 set of measurements have been recorded in this Chiller System too as per details provided in Table 10.8
- The study outcome is presented below, and a comparison is made in Fig 10.7

Table 10.8 : Circuit 3 : IBU Plant : Evaluated Parameters

Display Parameter				Set 1	Set 2	Set 3	Set 4	
Date: 10.06.2022 & Time				**11.30 am**	**12:50 pm**	**02.50 pm**	**03.25 pm**	
No	**Parameter**		**Unit**	**Value**				
I) EVAPORATOR								
1	Set Point		°C	**+5**				
2	**Chilled Water**							
	a) Flow Rate		m^3 / h	218.5	218.5	218.5	218.5	
	b) Temperature	Entering	°C	7.1	7.1	7.2	7.1	
		Leaving		4.9	4.9	4.9	4.9	
	c) Pressure	Entering	bar	3.9	4.1	4.1	4.1	
		Leaving		2.4	2.6	2.6	2.6	
3	**Refrigerant**							
	a) Temperature		°C	3.2	3.4	3.3	3.4	
	b) Pressure		bar	2.28	2.3	2.3	2.3	
4	Cooling Load Delivered		TR	159	159	166	159	161
5	Specific Chilled Water Flow Rate		m^3 / h / TR	1.374	1.374	1.316	1.374	
II) CONDENSER								
6	**Condenser Water**							
	Flow Rate		m^3 / h	121	107	121	124	
	Temperature	Entering	°C	29.8	29.1	30.9	30.9	
		Leaving		34.6	34.5	35.9	35.6	
	Pressure	Entering	bar	2.0	2.0	2.0	2.0	
		Leaving		1.4	1.3	1.3	1.3	

Display Parameter			Set 1	Set 2	Set 3	Set 4	
Date: 10.06.2022 & Time			11.30 am	12:50 pm	02.50 pm	03.25 pm	
No	Parameter	Unit	Value				
7	**Refrigerant**						
a	Temperature	°C	36.5	36.0	37.0	37.0	
b	Pressure	bar	8.14	7.86	8.34	8.34	
8	Specific Chilled Water Flow Rate	m^3 / h / TR	0.76	0.67	0.73	0.78	
III) COMPRESSOR & MOTOR							
9	Refrigerant Discharge Temperature	°C	51.8	50.2	53.4	52.7	
10	Discharge Superheat		15.3	15.2	16.4	15.7	
11	R L A	%	73.5	68.0	74.0	73.0	
12	Power Consumption	kW	173.4	167.5	179.0	177.5	174.4
13	Specific Energy Consumption (SEC)	ikW / TR	1.09	1.06	1.08	1.12	

Based on the study outcome, a comparison is made on the typical process parameters that define the performance of the Chiller System. The details are presented in the Fig 10.7

10.5.4 Typical Process Parameters : A Comparison

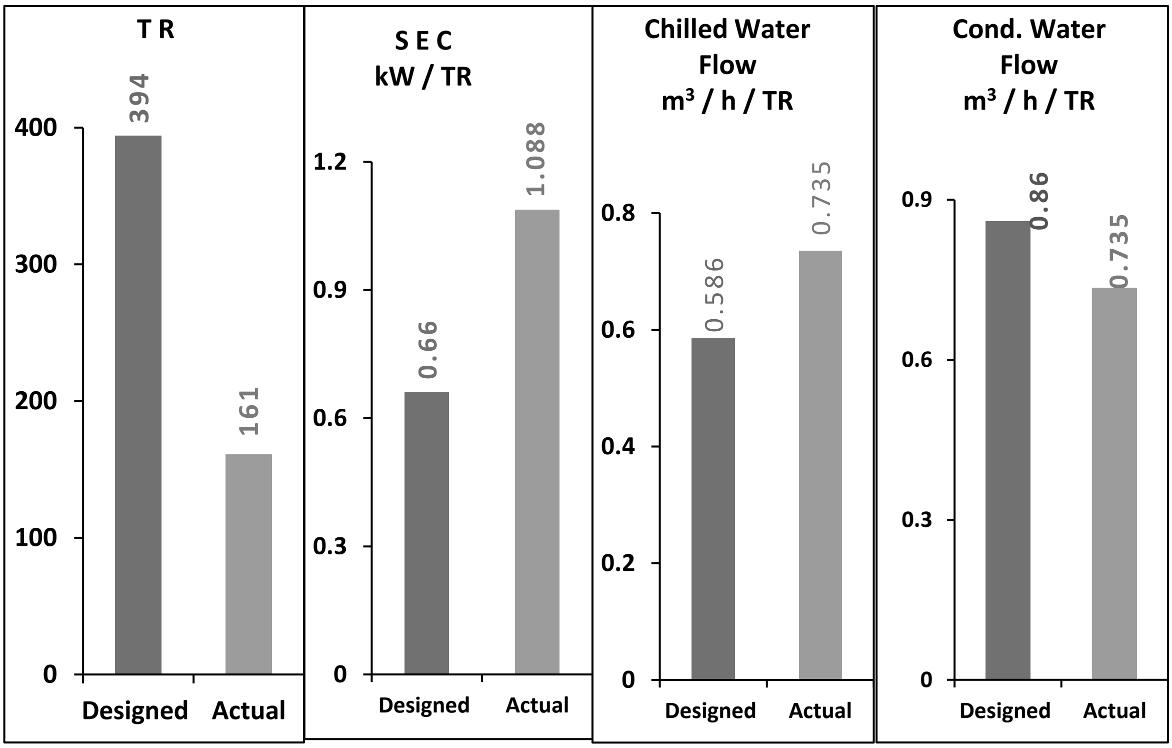


Fig 10.7 : Performance Comparison : Typical Parameters

10.5.5 Comments

- The chilled water temperature difference is low at 2.1 °C
- Specific energy consumption is quite higher (65% higher) when compared with the designed value.
- As such, the computed parameters have shown inferior parameters in comparison with the designed
- The condenser water flow rate can be enhanced.
- TDS of the condenser water needs continuous monitoring and keeping an eye on its levels

10.6 CIRCUIT NO 4: IPCA PLANT

10.6.1 Preamble

- The chiller in this circuit meets the thermal load of IPCA plant.
- Only chilled water is used in this circuit with the designed evaporator temperatures of 5°C / 10°C . However, the present operating temperatures are 8.9°C / 11°C as measured by us
- The scheme of operation is shown in Fig 10.8

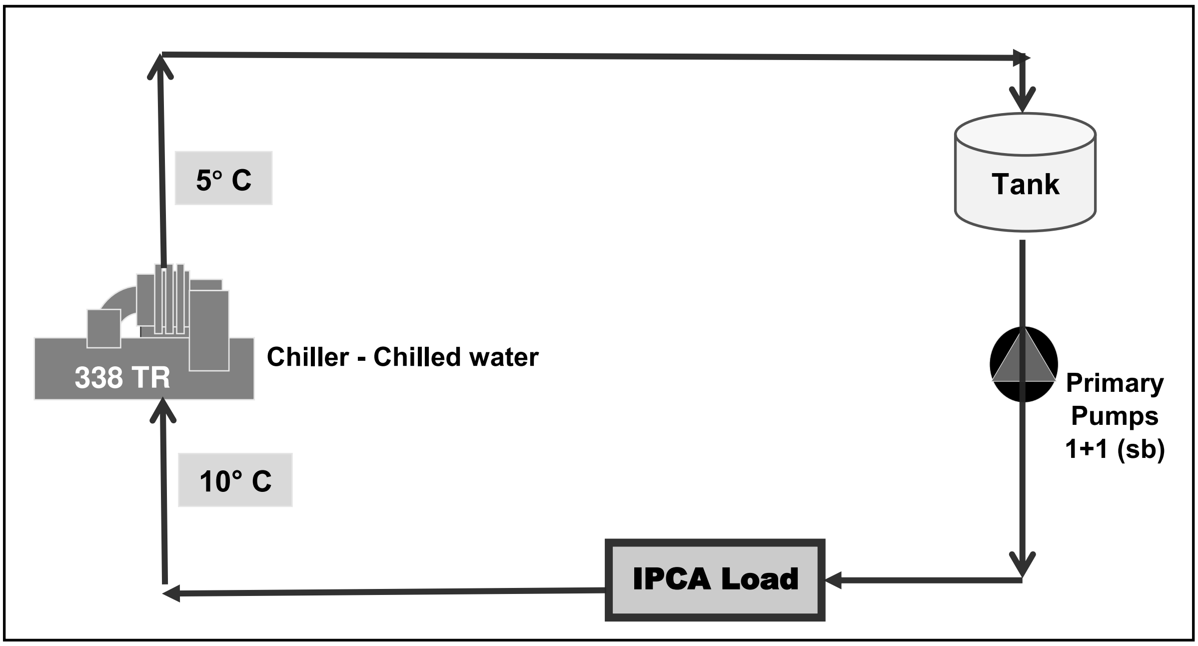


Fig 10.8 : Present Scheme of Operation : Circuit 4 : IPCA Plant

10.6.2 Design Parameters

Table 10.9 presents the designed parameters of this chiller plant

Table 10.9 : Circuit 4 : IPCA Plant : Design Parameters

No	Parameters	Unit	Value
1	Capacity	TR	338
2	Power Consumption	kW	220
3	Fluid Medium	-	Chilled Water
4	**Evaporator : Chilled Water**		
	a) Flow Rate	m^3 / h	204
	b) Entering Temperature	°C	10
	c) Leaving Temperature		5
	d) Pressure Drop	m WC	4.5
5	**Condenser : Cooling Tower Water**		
	a) Flow Rate	m^3 / h	298
	b) Entering Temperature	°C	36
	c) Leaving Temperature		32
	d) Pressure Drop	m WC	7.0
6	Specific Energy Consumption	kW / TR	0.651

10.6.3 Study Parameters + Performance Evaluation

- Only two sets of measurements have been taken on this chiller plant at 03:40 pm and 04:10 pm respectively.
- The details of the study are presented in Table 10.9

Table 10.10 : Circuit 4 : IPCA Plant: Evaluated Parameters

Display Parameter				Set 1	Set 2
Date: 10.06.2022 & Time				03:40 pm	04:10 pm
No	Parameter		Unit	Value	
I) EVAPORATOR					
1	Set Point		°C	5.5	
2	**Chilled Water**				
	a) Flow Rate		m^3 / h	175	175
	b) Temperature	Entering	°C	11.5	11.5
		Leaving		8.9	8.9
	c) Pressure	Entering		3	3

Display Parameter				Set 1	Set 2	
Date: 10.06.2022 & Time				03:40 pm	04:10 pm	
No	Parameter		Unit	Value		
		Leaving	bar	2.5	2.5	
3	**Refrigerant**					
a	Temperature		°C	4.4	4.4	
b	Pressure		bar	2.4	2.4	
4	Cooling Load Delivered		TR	151	151	151
5	Specific Condenser Water Flow Rate		m^3 / h / TR	1.16	1.16	
	II) CONDENSER					
6	**Condenser Water**					
a	Flow Rate		m^3 / h	114	114	
b	Temperature	Entering	°C	33.8	33.6	
		Leaving		38.2	38.0	
c	Pressure	Entering	bar	2.0	2.0	
		Leaving		1.1	1.1	
7	**Refrigerant**					
a	Temperature		°C	42.4	42.4	
b	Pressure		bar	9.7	9.7	
8	Specific Condenser Water Flow Rate		m^3 / h / TR	0.755	0.755	
III) COMPRESSOR & MOTOR						
9	Refrigerant Discharge Temperature		°C	55.4	54.4	
10	Discharge Superheat			10.7	10.8	
11	RLA		%	85	67	
12	Power Consumption		kW	140.0	140.4	
13	Specific Energy Consumption (S E C)		kW / TR	0.927	0.93	

- The typical process parameters comparison is depicted in Fig 10.9

10.6.4 Typical Process Parameters : A Comparison

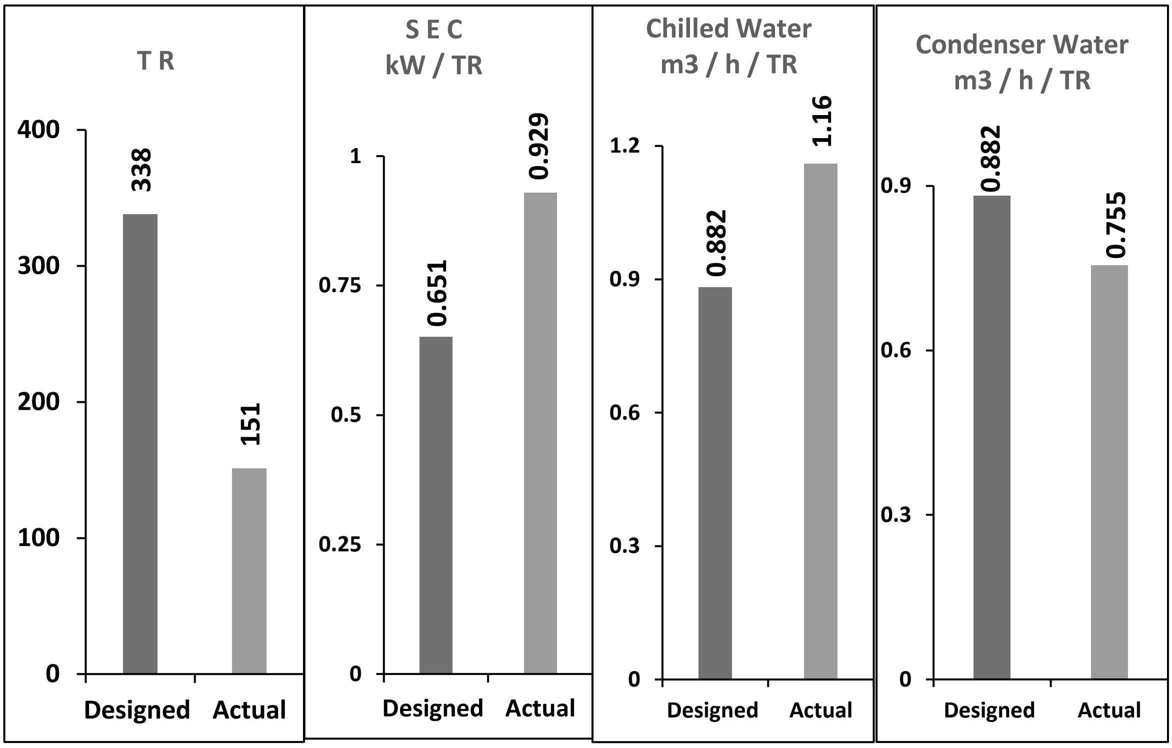


Fig 10.9 : Performance Comparison : Typical Parameters

10.6.4 Comments

- The specific power consumption is higher by almost **50%**
- Both the condenser water flow and chilled water flow rates are lesser than the designed
- The condenser & evaporator approach temperatures are high as observed by us
- The TDS of condenser water needs to be monitored regularly
- Another important aspect noted was the major portion of the CT water flows to the Process (73.5%) and only 115 m^3 / h (26.5%) flows to the chiller condenser.
- The water flow rate designed is 298 m^3 / h whereas the measured flow is only 115 m^3 / h .This is abysmally low.
- The water circuit - presently in use - is the culprit and needs to be revamped to get the required water flow rate in the chiller condenser

10.7 PERFORMANCE EVALUATION THRO' SIMULATION TOOL

- The performance of all the 4 chillers have been evaluated through the measurement of flow rates of Chilled Water / Brine System and their corresponding temperature
- In addition, the power drawl of the compressor has also been recorded to arrive at the specific energy consumption
- In order to validate the parameters arrived at through measurements, a software tool, named, "Cool Pack" has been employed vet the findings. This software depicts the performance through the data recorded in respect of the refrigerant operating parameters
- The outcome of the simulation tool is tabulated below and also compared with that obtained through the actual field level measurements

10.7.1 Chiller System : Aldehyde Plant

The following data - cum - table had been constructed based on the output obtained through the simulation package

Table 10.11 Circuit 1b: Chiller System : Aldehyde Plant

No	Parameter		Unit	Aldehyde
1	Inlet Pressure	P_1	bar (abs)	2.11
2	Inlet Temperature	T_1	°C	- 8.7
3	Inlet Saturation Temperature	T_{sat}		- 8.7
4	Inlet Enthalpy	h_1	kJ / kg	392.08
5	Inlet Entropy	s_1	kJ / ^{0}C / kg	1727
6	Outlet Pressure	P_2	bar (abs)	8.6
7	Outlet Temperature	T_2	°C	65.3
8	Outlet Saturation Temperature	T_{sat}		33.9
9	Outlet Enthalpy	h_2	kJ / kg	449.54
10	Outlet Entropy	s_2	kJ / ^{0}C / kg	1814.85
11	Isentropic Temperature	$T'_{2'}$	°C	39

No	Parameter		Unit	Aldehyde
12	Isentropic Enthalpy	$h'_{2'}$	kJ / kg	421.1
13	Isentropic Efficiency	η	%	50.5
14	Compressor Power Consumption	P	kW	170.0
15	Motor Efficiency	η	%	95
16	Compressor Shaft Power	P_s	kW	161.5
17	Cooling Load Delivered		TR	156
18	C O P (Including Motor Losses)		-	2.40
19	Specific Power Consumption	S P C	kW / TR	1.08

- The pressure - enthalpy diagram simulated for the refrigeration cycle employed is shown in Fig 10.10

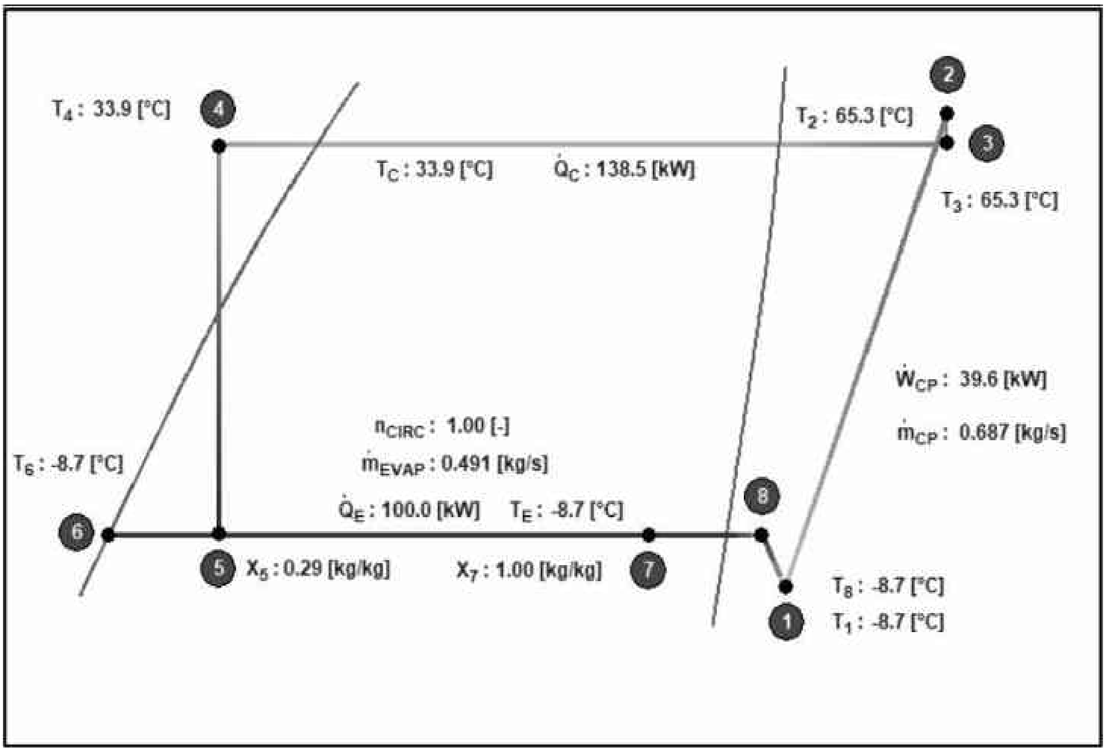


Fig 10.10 : Pressure Enthalpy Diagram: Chiller System : Aldehyde Plant

- The performance comparison of this chiller by both the methods viz., field measurements & simulation tool is shown below :

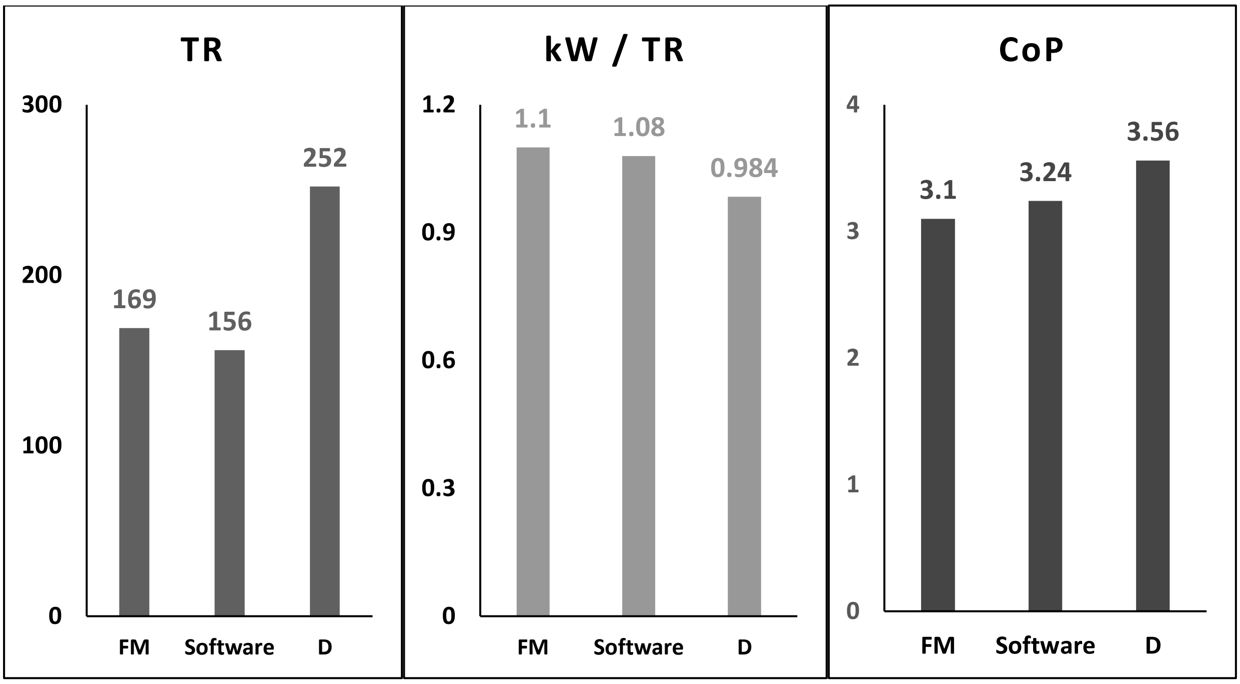


Fig 10.11 : Performance Comparison of Typical Parameters : Aldehyde Plant

- It can be seen that there is a fair agreement on the typical performance defining data of the system

10.7.2 Chiller System : Pharma Plant

- Data simulated through the software is tabulated below :

Table 10.12 : Circuit 2 : Chiller System : Pharma Plant

No	Parameter		Unit	Pharma
1	Inlet Pressure	P_1	bar (abs)	2.55
2	Inlet Temperature	T_1	°C	-3.8
3	Inlet Saturation Temperature	T_{sat}		-3.8
4	Inlet Enthalpy	h_1	kJ / kg	395.01
5	Inlet Entropy	s_1	kJ / ^{0}C / kg	1724
6	Outlet Pressure	P_2	bar (abs)	8.7
7	Outlet Temperature	T_2	°C	48.3
8	Outlet Saturation Temperature	T_{sat}		34.3
9	Outlet Enthalpy	h_2	kJ / kg	431.09
10	Outlet Entropy	s_2	kJ / ^{0}C / kg	1758.08
11	Isentropic Temperature	$T'_{2'}$	°C	38.55
12	Isentropic Enthalpy	$h'_{2'}$	kJ / kg	420.3
13	Isentropic Efficiency	η	%	70.2
14	Compressor Power Consumption	P	kW	**135.0**
15	Motor Efficiency	η	%	95

No	Parameter	Unit	Pharma
16	Compressor Shaft Power P_s	kW	128.3
17	Cooling Load Delivered	TR	89
18	C O P (Including Motor Losses)	-	2.30
19	Specific Power Consumption SPC	kW / TR	1.52

- The Pressure - Enthalpy diagram simulated is shown below :

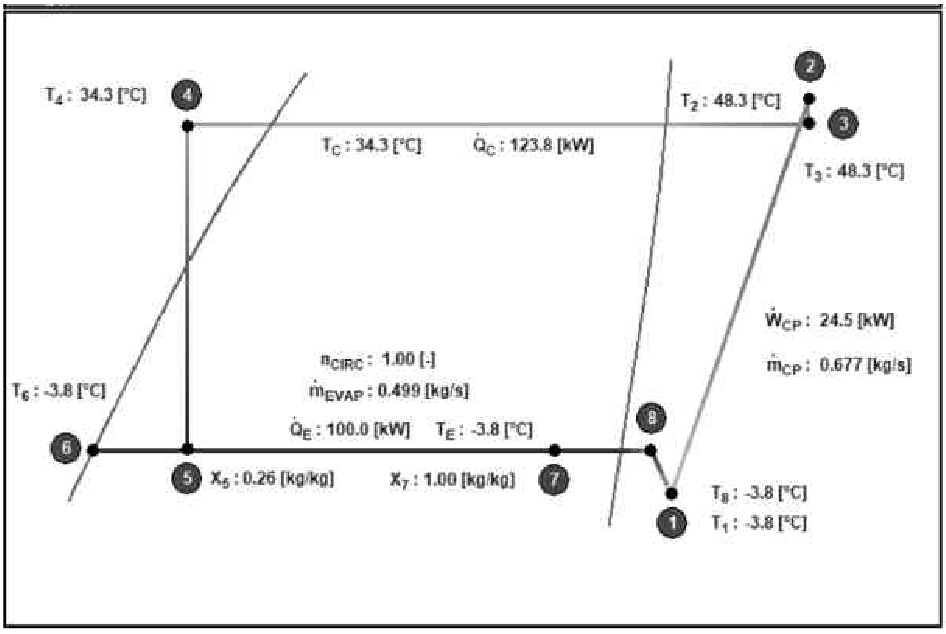


Fig 10.12 : Pressure Enthalpy Diagram : Chiller System : Pharma Plant

- The performance comparison of this Pharma chiller by both the methods viz., field measurements & simulation tool is shown below :

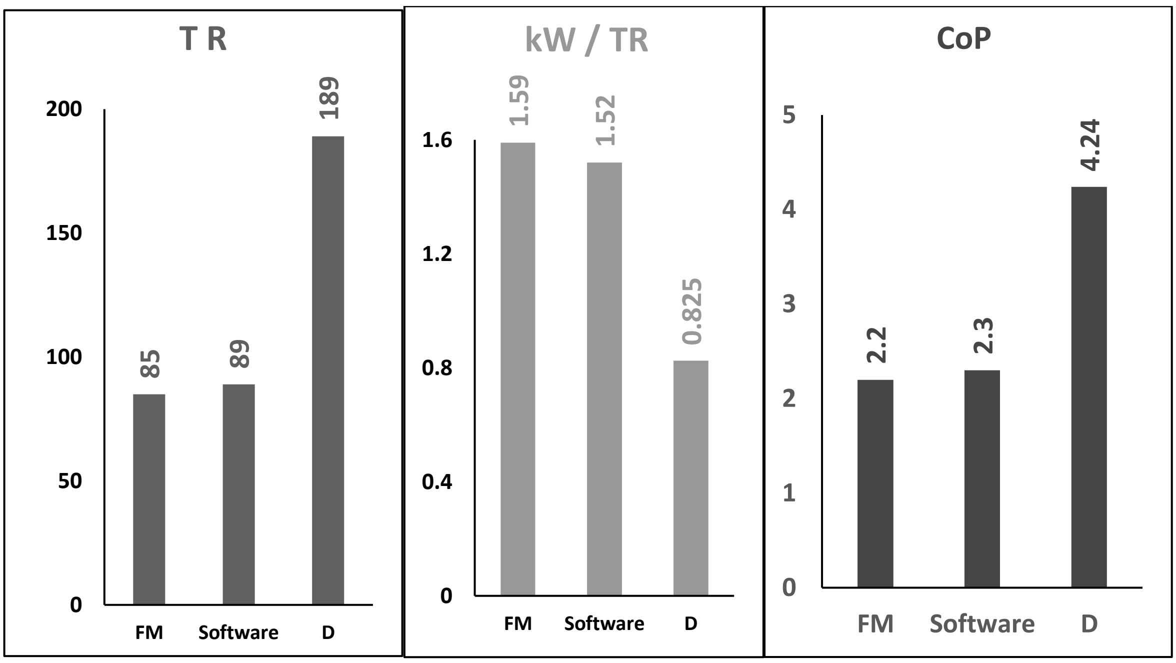


Fig 10.13 : Performance Comparison of Typical Parameters : Pharma Plant

- It can be seen that there is a fair agreement on the typical performance defining data of the system

10.7.3 Chiller System : I B U Plant

- Table 10.13 presents the outcome of "Coolpack " simulation package employed

Table 10.13 : Circuit 3 : Chiller Plant : I B U Plant

No	Parameter		Unit	IBU
1	Inlet Pressure	P_1	bar (abs)	3.29
2	Inlet Temperature	T_1	°C	3.3
3	Inlet Saturation Temperature	T_{sat}		3.3
4	Inlet Enthalpy	h_1	kJ / kg	399.08
5	Inlet Entropy	s_1	kJ / ^{0}C / kg	1720
6	Outlet Pressure	P_2	bar (abs)	9.3
7	Outlet Temperature	T_2	°C	53.4
8	Outlet Saturation Temperature	T_{sat}		36.7
9	Outlet Enthalpy	h_2	kJ / kg	435.42
10	Outlet Entropy	s_2	kJ / ^{0}C / kg	1766.87
11	Isentropic Temperature	$T'_{2'}$	°C	40
12	Isentropic Enthalpy	$h'_{2'}$	kJ / kg	420.5
13	Isentropic Efficiency	η	%	59.0
14	Compressor Power Consumption	P	kW	**175.0**
15	Motor Efficiency	η	%	95
16	Compressor Shaft Power	P_s	kW	166.3
17	Cooling Load Delivered		TR	163
18	C O P (Including Motor Losses)		-	3.23
19	Specific Power Consumption	S P C	kW / TR	1.07

- The Pressure - Enthalpy diagram simulated is shown below :

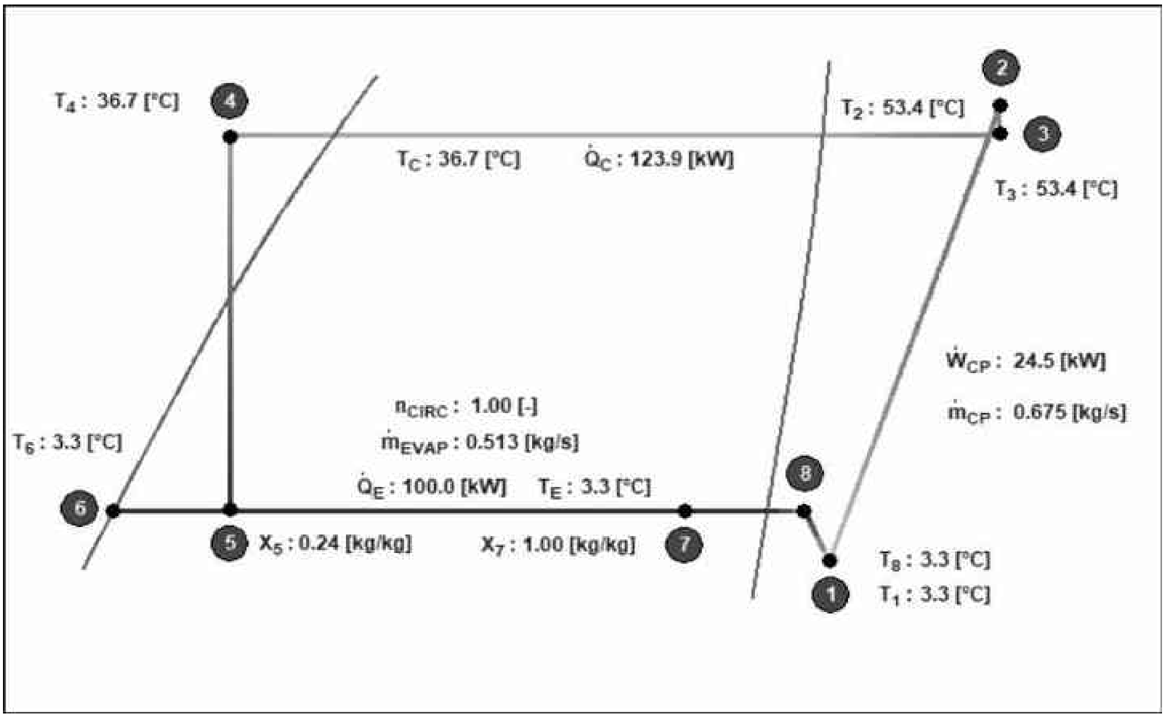


Fig 10.14 : Pressure Enthalpy Diagram: Chiller System : I B U Plant

- The performance comparison of this I B U chiller by both the methods viz., field measurements & simulation tool is shown below :

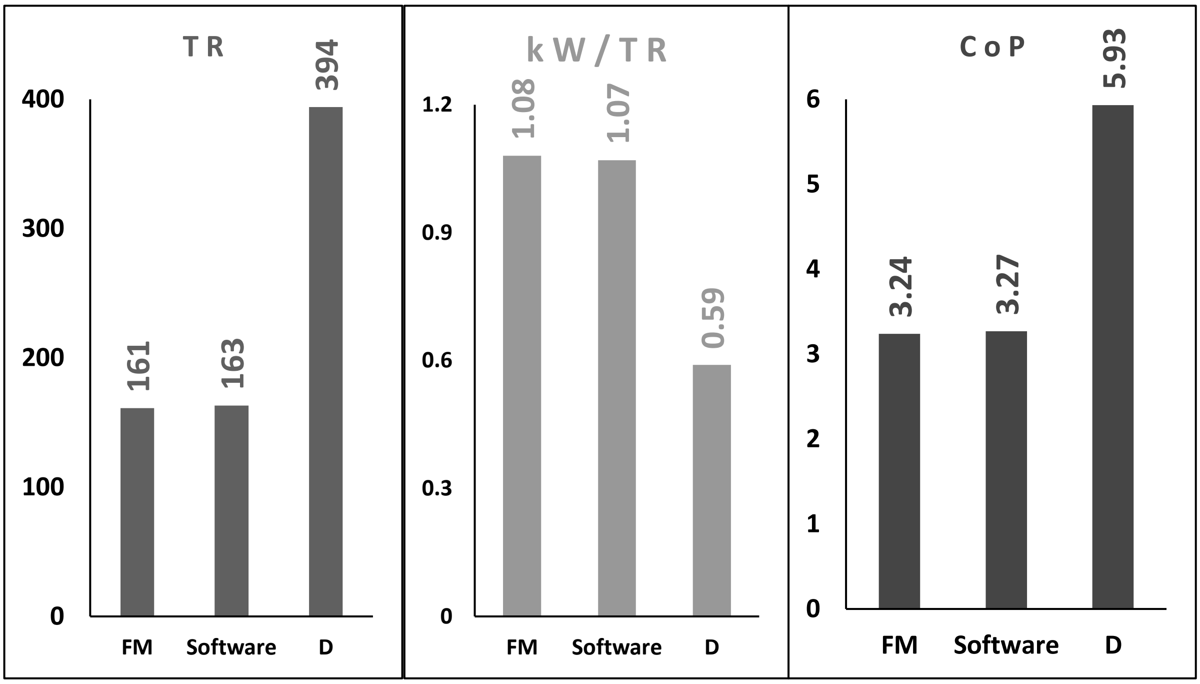


Fig 10.15 : Performance Comparison of Typical Parameters : I B U Plant

- It can be seen that there is a fair agreement on the typical performance defining data of the system

10.7.4 Chiller System : I P C A Plant

- The parameters arrive data through the software package is tabulated below :

Table 10.14 : Circuit 4 : Chiller Plant : I P C A Plant

No	Parameter		Unit	IPCA
1	Inlet Pressure	P_1	bar (abs)	3.39
2	Inlet Temperature	T_1	°C	4.1
3	Inlet Saturation Temperature	T_{sat}		4.1
4	Inlet Enthalpy	h_1	kJ / kg	399.57
5	Inlet Entropy	s_1	kJ / ^{0}C / kg	1720
6	Outlet Pressure	P_2	bar (abs)	10.7
7	Outlet Temperature	T_2	°C	54.4
8	Outlet Saturation Temperature	T_{sat}		41.9
9	Outlet Enthalpy	h_2	kJ / kg	433.65
10	Outlet Entropy	s_2	kJ / ^{0}C / kg	1752
11	Isentropic Temperature	$T'_{2'}$	°C	45.45
12	Isentropic Enthalpy	$h'_{2'}$	kJ / kg	423.3
13	Isentropic Efficiency	η	%	69.6
14	Compressor Power Consumption	P	kW	140.0
15	Motor Efficiency	η	%	95
16	Compressor Shaft Power	P_s	kW	143
17	Cooling Load Delivered		TR	157
18	C O P (Including Motor Losses)		-	3.85
19	Specific Power Consumption	SPC	kW / TR	0.91

- The Pressure - Enthalpy diagram simulated for IPCA Chiller is shown below :

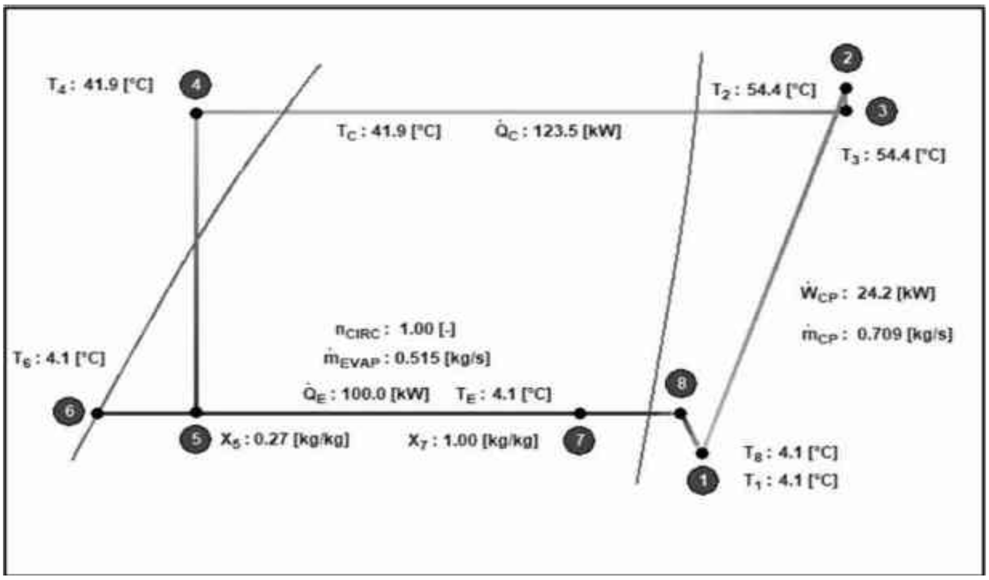


Fig 10.16 : Pressure Enthalpy Diagram: Chiller System : I P C A Plant

- The performance comparison of this IPCA chiller by both the methods viz., field measurements & simulation tool is shown below :

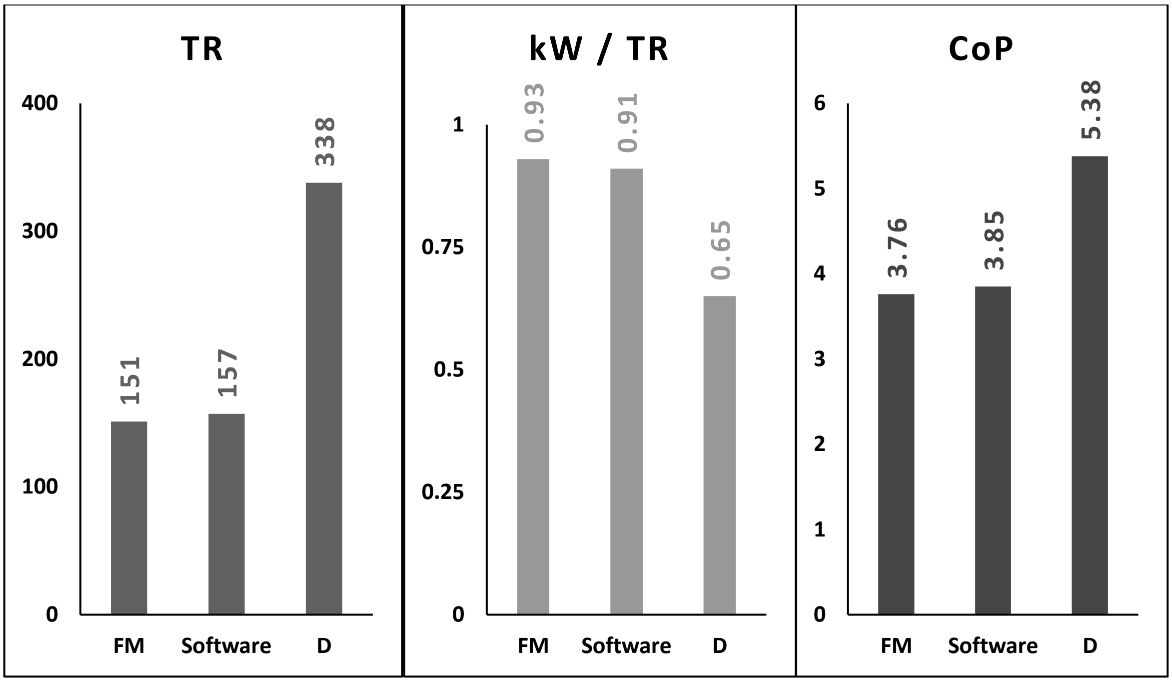


Fig 10.17 : Performance Comparison of Typical Parameters : I P C A Plant

- It can be noticed that there is a reasonably fair agreement on the typical performance defining data of the system

10.7.5 Sum - Up

- The performance of all the four chillers [Aldehyde, Pharma, IBU & IPCA] had been evaluated through
  - (i) Field level measurements of operating parameters and subsequent computations
  - (ii) Simulation software that uses the operating refrigerant properties (Cool Pack Software) to arrive at the performance data

  and are compared
- The outcome of both the methods showed not much of variance as can be seen through the charts of this section.
- This also reinforced the validity of the field level measurements carried out.

- Major Take - away from the study on chiller is the inferior performance of Chillers catering to Pharma Plant, IBU plant and IPCA.
- Only the chiller of aldehyde plant shows any resemblance towards operating to the designed value.
- In essence, it has been found that the T R delivered of all the chillers are much lower than the designed and the major culprit seems to be the lesser cooling water flow rate through the condenser.
- Suggestions are made in the ensuing sections No :11 to enhance the chiller performance

10.8 V A M Chiller

10.8.1 Preamble

- The VAM Chiller has a design rating of 480 TR and uses steam as the driving force
- It is associated with Circuit 3 that delivers chilling load to I B U Plants
- A performance trial was taken on this V AM chiller also and the details are discussed in this section

10.8.2 A Comparison : Designed vs Actual Parameters

- A performance study has been undertaken on this VAM Chiller in order to establish the operational effectiveness of this Chiller and economics of its operation since VAM uses "**live steam**" as the main energy source.
- Table 10.15 presents the information captured during the study

Table 10.15 : VAM Chiller : Designed vs Evaluated Parameters : Recorded

VAM 480 TR					
No	**Parameter**	**Unit**	**Design**	**Actual - 1**	**Actual - 2**
Cooling Capacity		**T R**	**480**	**79**	**45**
Steam Circuit - Heat In					
1	Steam Inlet Valve : Limit	%	100	100	50
2	Steam Inlet Valve : Open Position	%	100	71	50
3	Steam Flow Rate	kg / h	1982	1004	630

VAM 480 TR					
No	**Parameter**	**Unit**	**Design**	**Actual - 1**	**Actual - 2**
Chiller Water - Heat Input					
4	Chilled Water In / Out Temp	°C	10 / 5	7.2 / 5	8 / 6.7
5	Chilled Water Flow	m^3/ h	289.3	104	104
Condenser - Heat rejected					
6	Cooling water In / Out Temp	°C	36.3 / 33	29.7 / 32	30.2 / 31.4
7	Cooling Water Flow	m^3 / h	790	300	300
8	U Tube Temperature	°C	-	31.4	32.9
High Temperature Generators & Concentration of LiBr Solution					
9	Spray Solution Temperature	%		46.8	46
10	HTG Top Temperature	%		110.6	110.6
11	HTG Bottom Temperature	%		110.4	110.4
12	HTG Temperature	°C		113	113
13	LTG Temperature	°C		67	66
14	HTG Vapour Temperature	°C		70.5	70.3
15	Dilute Temperature	°C		31.1	31.8
16	Dilute Solution Concentration	%		54	54
17	Intermediate Solution Concentration	%		55.2	55.2
18	Strong Solution Concentration	%		58.5	54.4

- It can be seen that there is a wide difference in the T R achieved with reference to that designed.
- Likewise , the flow rates of steam as well as that of chilled water were also quite less ,

10.8.3 CoP & SSC Evaluation

- A dedicated study had been carried out on VAM Chiller with an objective of evaluation of **CoP** & Specific Steam Consumption (**SS C**) and thereby the efficiency of operation as well the deviation, if any, from the designed values
- The data captured & computed are tabulated below :

Table 10.16 : VAM Chiller: CoP & SSC Evaluation

No	Time	Steam			Chilled Water				CoP	SSC kg / h / TR
		Valve Limit %	Valve Set %	Flow Rate kg / h	Temp ° C in	Temp ° C out	Flow m^3 / h	Tons TR		
-	Design	**100**	**100**	**1982**	**10**	**5**	**290**	**478**	**1.26**	**4**
1	12 :10 pm	50	44	530	7.2	6	104	41	0.41	13
2	12 : 36 pm	50	47	1000	7.1	5.9	104	41	0.22	24
3	12 : 54 pm	100	71	1004	7.3	5	104	79	0.41	13
4	01 : 44 pm	50	50	630	8	6.7	104	45	0.37	14
5	03 :39 pm	55	55	670	7.6	6.3	104	45	0.35	15
6	05 : 00 pm	55	55	630	6.8	5.4	104	48	0.40	13

10.8.4 Observation & Comments

- The chilling load delivered was hardly 20 % of the designed value (it was always less than 50 TR)
- Chilled water flow rate too was on the lower side [100 m^3 / h vis - a - vis 290 m^3 / h as designed] and this is partly due to the throttling of inlet valve.
- These happenings had resulted in the attainment of very low CoP and very high SSC
- The following chart provides this information pictorially

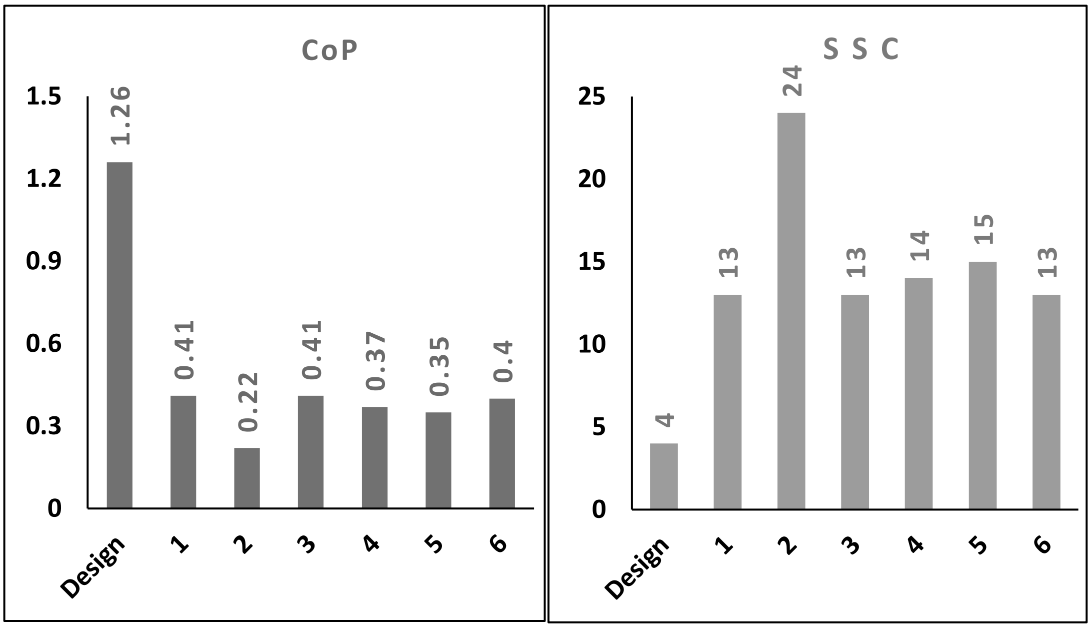


Fig 10.18 : CoP & SS C : Designed vs Recorded : VAM Chiller

- The set point - in terms of steam valve opening could not go beyond 71% at which point the system trips and gets switched off . This is to say that the VAM system could not be operated to its full load capacity at any point of time.

10.8.5 Sum Up

- As a summing up exercise, it can be concluded that the operational efficiency of VAM Chiller is quite low and on top of it, it could not be loaded beyond 70 %. This is alarming.
- Hence, the suggestion is to discontinue the use of VAM Chiller to the extent possible

11

ENERGY CONSERVATION PROPOSALS

ECM 1

STRATEGIC CO FIRING OF SIZED WOOD (CASUARINA) WITH CONVENTIONAL AGRO-BRIQUETTES IN THE PROCESS BOILER AS A COST CONSERVATION MEASURE OF

Cost Savings ₹ / y	Investment ₹	Payback Period Months
58 00 000	Nil	Immediate

Observation

- The plant has a 16 tph (f & a 100°C) Air Cooled Step Grate Furnace with Multizone Combustion - operating with agro briquettes as the source of energy - that caters to the process steam / thermic heat requirement of the plant.
- Based on the historic data provided by the plant personnel , it has been realised that the boiler operates at a near full - load and the average steam generation has been estimated as 14 tph as against the designed rating of 16 tph.
- The month wise steam generation is presented in Fig 11.1

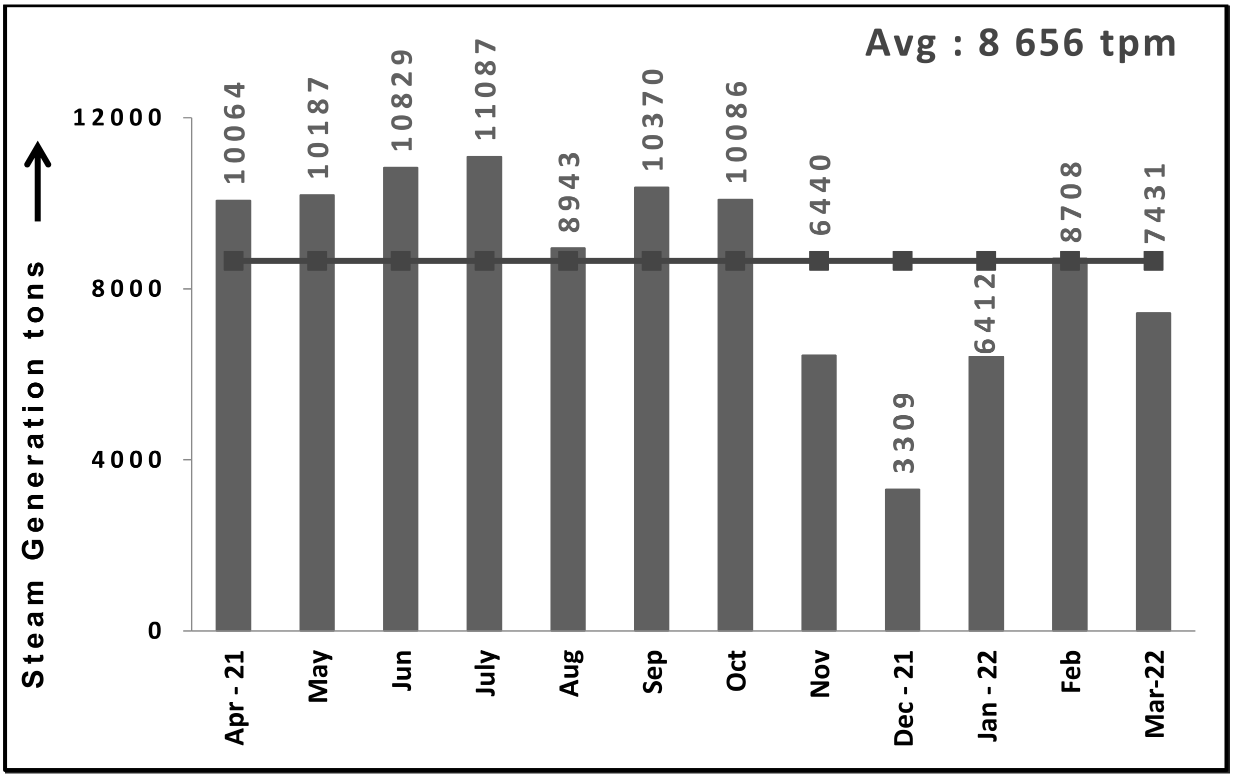


Fig 11.1 : Steam Generation Data : Apr 21 – Mar 22

- It has been captured from the historic data that the steam generation and the corresponding briquette consumption for one year period [Apr - 21 to Mar - 22] were 1 03 866 tons and 20 833 tons respectively [for Forbes Vyncke boiler]
- This brings in a steam fuel ratio (SFR) of 5.0 which is reasonable enough for a briquette having a GCV of 3900 kcal / kg
- The boiler thermal efficiency has been estimated to be in the range of 75 - 77 % which is a very standard value indicating a fair operation of the boiler form technical standpoint
- The landed cost of briquettes has been considered as ₹ 7000 / ton (annual average) and this makes the fuel cost of steam to be ₹ 1 400 / ton (only fuel cost)
- It is felt that a properly sized and appropriately harvested wood of fairly burnable quality can be co - burned with the agro briquette as a means of cost conservation since the cost of wood would be certainly lesser expensive than that of briquettes.
- This option is suggested as a means of cost conservation

Recommendations

- Therefore, we recommend substituting a minor portion (say 10% to start with) of agro briquettes with sized / dried Casuarina wood and burned in the boiler. Casuarina wood of moisture content 25% and less is suggested for co burning .
- Based on the techno commercial performance of this venture. further course of action - by way of enhanced level of briquette substitution - can be planned.
- Thus, this recommendation of partial substitution of agro briquettes with casuarina wood

Economics

Present Scenario

Briquette consumption ≈ 20 833 tons / y

Cost spent of briquettes = (20 833 tons / y x ₹ 7000 / ton) = ₹ 14.58 Crores / y

Proposed Scenario

Briquette usage recommended = 18 000 tons / y

Wood usage suggested = 2 833 tons / y

[briquette and wood shall have matchable GCV and hence can be equated 1:1 in mass]

Cost of Briquette = ₹ 7 000 / ton

Cost of wood = ₹ 5000 / ton

Hence fuel cost expected = (18 000 tons / y x ₹ 7000 / ton) + (2833 tons / y x ₹ 5000 / ton)

= ₹ 14 Crores / y

Cost savings = ₹ 58 00 000 / y

Investment = Nil

Simple Payback Period = Immediate

ECM 2 RECOVERY OF CONDENSATE FROM THE STEAM TRAPS THAT ARE OPEN TO AMBIENT AND HAVE NO COLLECTION MECHANISM

Cost Savings ₹ / y	Investment ₹	Payback Period Months
3 16 386	8 00 000	30

Observation

- There are 41 Steam Traps installed across the Header Lines in the utility area
- Out of 41 Steam Traps installed, 20 traps are open to ambient, and the condensate drained from the traps is let to the atmosphere . These condensates are typically uncontaminated as these come out of main Steam Distribution Line

Comments

- Steam traps are majorly installed across the main line of 4” and 6” diameter size at approximately 30 m distance apart
- The surface temperatures of these traps are measured to be around 60 ^oC
- For ambient temperature of 35^{o}C, the theoretical condensates generated in 4” and 6” pipeline are 12.5 kg / h and 15 kg / h respectively
- Since the condensate goes to drain without ever getting recovered, the condensate recovery can be attempted in these locations for the simple reason of fuel conservation
- The condensate generated is estimated as 12 kg / h / trap (on a conservative basis) and that is targeted for recovery / collection.

Recommendation

- Collect the condensate coming out of steam traps of Main Header Line
- Install a **P**ressure **P**owered **P**ump **P**ackage **U**nit **(PPPPU)** for the recovery of condensate. This can pump the condensate back to Deaerator and can be operated with steam pressure of 2.5 to 3 kg / cm^2
- Implementation of this scheme is sure to bring both in energy and cost saving

Economics

Condensate recovery planned from a steam trap	=	12 kg / h
Total number of steam trap that do not have collection mechanism	=	20
Hence, cumulative condensate recovery possible	=	(20 x 12 x 24) kg / day
	=	5 760 kg / day
Temperature of condensate	=	100^{0}C
Temperature of RO water going to Deaerator	=	35^{0}C
∴ Energy content of condensate	=	[5 760 x (100 – 35)]
	=	3 74 400 kcal / day
Hence, fuel equivalent	=	[3 74 400 / (3900 x 75 %)]
	=	128 kg / day
	=	(128 kg / d x 350 d /y) / 1000
	=	45 tons / y
Cost of Biomass Briquettes`	=	₹ 7 000 / ton
Cost Savings	=	[45 tons /y x ₹ 7000 / ton]
	=	**₹ 3 15 000 / y - (A)**
Cost of Raw Water	=	₹ 6 / kL
Cost saving by water conservation	=	(5.76 k L / d x 350 d / y x ₹ 6 / kL)
	=	**₹ 12 096 / y - (B)**
Steam consumption in PPPPU @ 3 kg / kL	=	(5.76 kL /day x 3 kg / kL)
	=	17 kg / d
Cost Incurred in steam	=	(17 kg / d x 350 d / y x ₹ 1.80 / kg)
	=	**₹ 10 710 / y - (C)**
Total cost savings	=	**(A)+(B)-(C)= (3 15 000 + 12 096 + 10 710)**
	=	**₹ 3 16 386 / y**
Investment	=	**₹ 8 00 000**
Simple Payback Period	=	**30 months**

ECM 3

REDUCING THE THERMAL ENERGY LOSS BY REDOING THE INSULATION WORK AFRESH IN IDENTIFIED LOCATIONS THAT HAVE EITHER DAMAGED INSULATION / PEELED OFF INSULATION EXPOSING BARE SURFACE

Cost Savings ₹ / y	Investment ₹	Payback Period Months
25 92 800	20 00 000	9

Introduction

- Uninsulated steam distribution and condensate return lines are a constant source of wasted energy
- Insulation can typically reduce the heat losses by 90 % and help to ensure proper steam pressure at utility locations
- Any surface having a temperature over 60 °C should be insulated, including boiler surfaces, steam and condensate return piping, flanges, valves, fittings etc.,
- Insulation frequently becomes damaged or removed for various reasons and normally not replaced during maintenance schedule
- Damaged or wet insulation should be repaired / replaced immediately to avoid compromising the insulating value

Observation

- Our insulation survey had revealed the existence of damaged insulation, bare surfaces, tattered insulation materials etc in a couple of locations
- We could identify 28 such locations where the insulation has to be redone.
- A detailing of this is presented in Section 5.7

Comment

- It has been observed - through our detailed Energy Audit Study and visual observation of the steam distribution system - that the insulation has given way in as many as 28 locations and therefore have to be redone / restored

- It was noticed that the Steam Headers and Condensate Recovery Lines are formidable in distance and need effective insulation repairing
- Thus, there exists equitable scope for curtailing the thermal loss by way of attending to this work of maintenance of insulation in proper condition
- It may be noted that the thermal mapping had been done on major steam header / Sub header as well in major condensate return lines only. Not all steam / condensate lines have been mapped due to the enormity of the job involved.
- The following Table 11.1 provides information on the locations identified where the insulation is either damaged / given way / not present

Table 11.1 : Damaged Insulation : Identification and Temp Measurements

No	Location	Temp °C	Remarks
Boiler Room			
1	Header to Turbine - near U bend	220	Damaged
2	Header to Turbine U bend (before and after Turbine)	220	
3	Vertical Line (from boiler PRV station)	220	
4	Turbine Inlet Separator	220	No insulation
5	Turbine Inlet : 6“ ϕ Line after Separator	220	
6	Before Turbine Inlet : Condensate Recovery Line	65	
7	After Turbine Header	180	
8	After PRV	164	
9	After PRV	115	
10	After PRV HP Line Rack (1)	170	Insulation Damaged
11	After PRV HP Line Rack (2)	170	
12	Condensate Line HP Line Eq No : MSST 2182	264	
13	Condensate Line HP Line Eq No : MSST 2182	100	
14	LP - Line U bend	147	No insulation
15	HP Line PRV : MSST 2163	170	
16	Condensate Storage Tank : PPPU	140	
17	Condensate Storage Tank : PPPU	150	

No	Location	Temp °C	Remarks
18	Condensate Area : PPPU	140	Insulation Damaged
19	Condensate Line	140	No insulation
20	HP Steam Line : opposite to Chiller Plant	160	
21	Condenser : HP Line	100	Insulation Damaged
22	Condensate Line near VAM Chiller	125	
23	Near DM plant : Air Compressor back side	105	
24	VAM Chiller : Trap Line	105	No insulation
25	VAM Chiller : Heat Exchanger	150	Insulation Damaged
26	Old PRV Header	148	No Insulation
27	Boiler : opp to Condensate Line from MSST 2220	100	
28	High Vacuum Header Line	170	

Recommendation

- Therefore, it is recommended to set right the damaged / missing insulation as a means of curtailing the energy loss
- The energy loss estimation is given below in Table 11.2

Economics

Table 11.2: Rectification of Damaged Insulation : Heat Loss Estimation

No	Area	Location	Surface Temp	Surface Area		Ambient T = 25 °C Heat Loss		
				Bare	Insulated	Bare Surface	Insulated	Avoidable
			°C	m²		Kcal / h		
1	Boiler House	Second Boiler before PRV	210	0.4	2.0	1 454	561	894
2		Header to Turbine Near U bend	220	0.5	1.0	1 704	269	1 435
3		Header to Turbine U bend before and after Turbine	220	0.2	0.5	852	135	718
4		Vertical line from the Boiler PRV Station	220	3.8	7.7	13 633	2 153	11 480

No	Area	Location	Surface Temp	Surface Area		Ambient T = 25 °C Heat Loss		
				Bare	Insulated	Bare Surface	Insulated	Avoidable
			°C	m^2		Kcal / h		
5	Boiler House	Turbine line inlet Separator	220	1.0	1.4	3 408	404	3 005
6		Turbine inlet 6 " line after Separator	220	1.4	2.9	5 113	808	4 305
7		After Turbine Header	180	1.4	2.3	3 591	646	2 945
8		after PRV	164	0.6	1.8	1 269	505	765
9		after PRV	115	0.6	1.8	670	505	165
10	Main Line	HP Line rack	170	4.8	9.6	10 821	2 692	8 129
11	Main Line	HP Line rack	170	14.4	28.7	32 463	8 075	24 387
12	HP Line Equipment Number MSST 2182 Normalization Condensate Pump Area	Condensate Line	264	2.4	6.4	11 753	1 795	9 958
13	HP Line Equipment Number MSST 2182 Normalization Condensate Pump Area	Condensate Line	100	8.0	19.9	6 869	5 608	1 261
14	Normalization Condensate Area	L P Line U bend	147	0.8	3.2	1 393	897	496
15	Equipment Number MSST 2182 Normalization Condensate Pump Area	PRV Station	170	0.5	2.9	1 082	808	275
16	Condensate Storage Tank	PPPU	140	0.84	4.2	1 345	1 181	164
17	Condensate Storage Tank	PPPU	150	0.6	1.4	1 156	404	752
18	Condensate Area	LP line	140	1.9	3.8	3 065	1 077	1 988

No	Area	Location	Surface Temp	Surface Area		Ambient T = 25 °C Heat Loss		
				Bare	Insulated	Bare Surface	Insulated	Avoidable
			°C	m²		Kcal / h		
19	Condensate Recovery Area	Condensate Line	140	6.0	16.0	9 578	4 486	5 092
20	Chiller Plant	HP Steam opposite to Chiller Plant	160	4.0	23.9	8 100	6 729	1 371
21	Condensate Line	HP Line TD	100	14.4	10.4	12 364	2 916	9 448
22	Coming from Plant near VAM Header	Condensate Line	125	16.9	52.6	22 117	14 805	7 313
23	Near DM Plant	Compressor Backside	105	1.6	4.8	1 507	1 346	162
24	VAM Chiller	Trap Line	105	3.2	9.6	3 015	2 692	323
25	VAM Chiller	Heat Exchanger	150	23.6	39.3	42 655	11 039	31 616
26	Old PRV Header	LP Line	148	6.4	25.5	11 284	7 178	4 106
27	Boiler Opposite Plant Backside	Condensate Line from MSST 2220	100	12.0	31.9	10 303	8 973	1 331
28	High Vacuum Header Line		170	5.4	37.3	12 174	10 487	1 687
Total								**1 35 569**

Avoidable Heat Loss = 1 35 569 kcal / h

Loss Equivalent of Fuel = (1 35 569 kcal / h) / (3900 kcal / kg x 75 %)

= 46.3 kg / h = (46.3 kg / h x 8 000 h / y)

= 3 70 400 kg / y

Cost of Briquette = ₹ 7.0 / kg

Cost Savings = (3 70 400 kg / y x ₹ 7 / kg)

= **₹ 25 92 800 / y**

Investment = **₹ 20 00 000**

Simple Payback Period = **9 months**

ECM 4

IMPROVEMENT OF POWER FACTOR BY RECTIFYING THE NON- OPERATIONAL / FAILED CAPACITOR BANKS IN ORDER TO SAVE ON THE ENERGY COST PAYABLE TO PUDUCHERRY ELECTRICITY DEPT

Cost Savings ₹ / y	Investment ₹	Payback Period Months
21 42 800	15 00 000	9

Observation : 1

- The plant has installed capacitor banks with a cumulative rating of 2800 kVAR
- Of this, 500 kVAr was not working rendering only 2300 kVAR as the effective capacitance available
- A performance study conducted on 5 Capacitor Banks has yielded the following results:

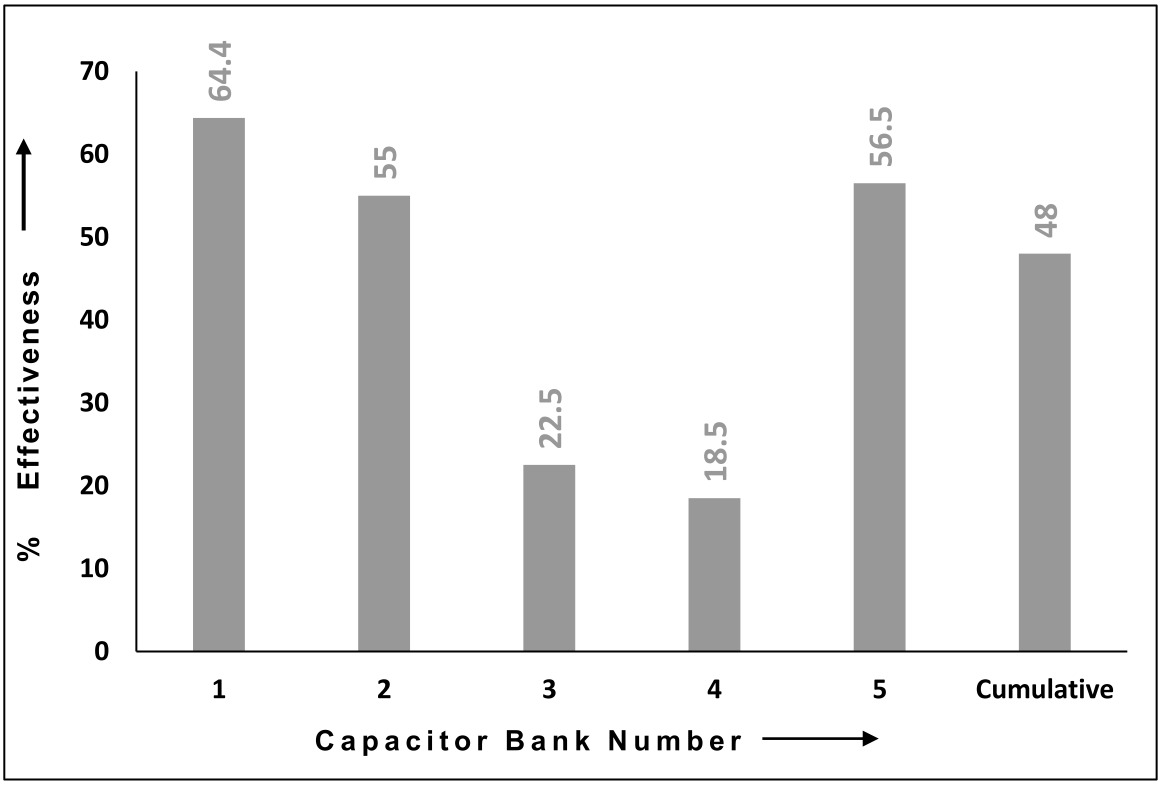


Fig 11.2 : Effectiveness of Capacitor Banks

- The outcome is that only 1345 kVAr was effective accounting for 48 % as overall effectiveness.

Observation : 2

- The power factor recorded was lesser than 0.99 in all these 4 months as can be seen Fig 11.3

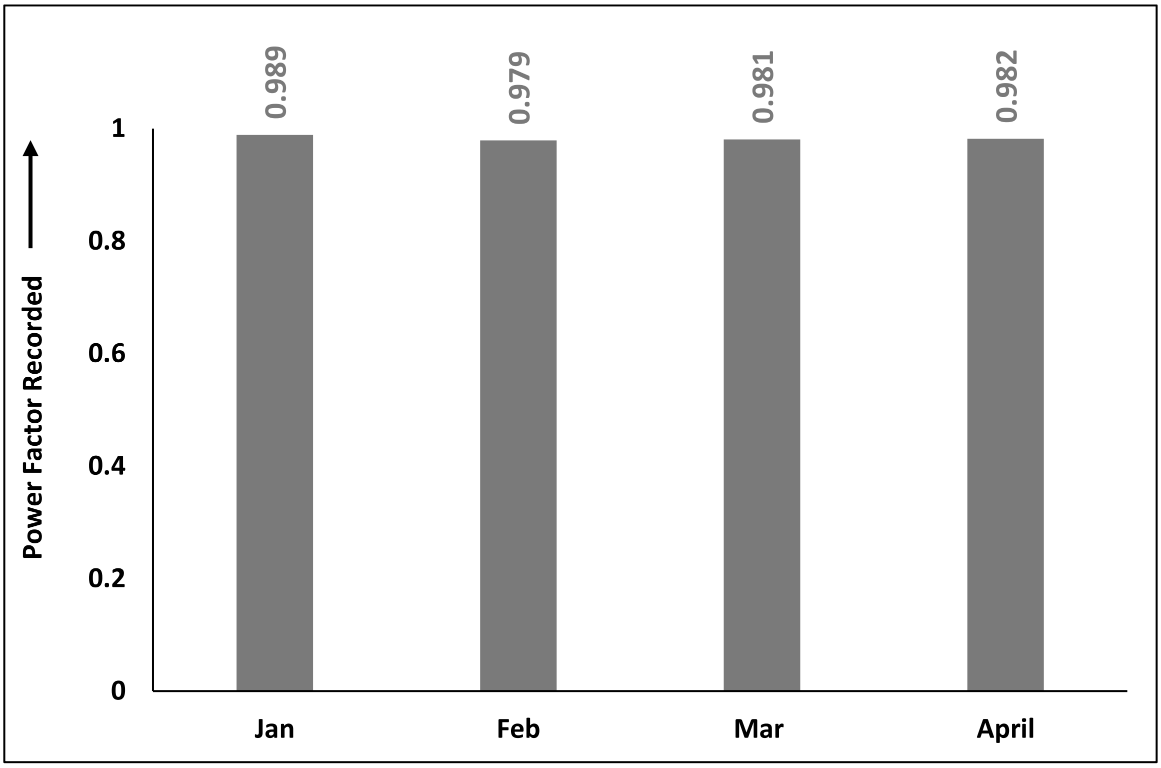


Fig 11.3 : Power Factor Recorded : Jan 21 – Apr 22

- Since the electricity is charged as per kVAh consumption, it is of ultimate importance that the power factor is maintained as close as possible to unity
- The PED charges the clients on the basis of kVAh consumed and not on kWh consumption

Recommendations

- The non - working & failed capacitors are to be replaced at the earliest and the PF level is brought back to 0.995 at the minimum if not unity
- This would enable considerable cost saving

Economics

- The electricity consumption details for the past 4 months of Y - 2022 is as below :

Table 11.3 : Energy Consumption Details : Jan - Apr 2022

No	Month	kVAh Consumption	kWh Consumption	PF	kVAh Consumption anticipated had PF been maintained at 0.995	Difference (Savings possible)
1	Jan - 22	16 26 290	16 08 520	0.989	16 16 603	9 687
2	Feb	19 62 680	19 21 710	0.979	19 31 367	31 313
3	Mar	20 31 380	19 92 220	0.981	20 02 231	29 149
4	Apr	19 25 980	19 25 980	0.982	19 35 658	34 890
					Total	**1 05 039**

kVAh savings possible = 1 05 039 kVAh in 4 months

kVAh Savings possible = (1 05 039 / 4 months) x 12 months / y

= **3 15 117 kVAh / y**

Cost savings = (3 15 117 kVAh / y x ₹ 6.80 / kVAh)

= **₹ 21 42 800 / y**

Investment = **₹ 15 Lakhs**

Simple Payback Period = **9 Months**

ECM 5

CONSTRUCTION OF ADDITIONAL POWER HOUSE NEAR THE BOILER PLANT WITH A VIEW TO (i) CONTAIN THE EXCESSIVE LOAD EXPERIENCED IN THE PRESENT POWER HOUSE (ii) REDUCE THE DISTRIBUTION LOSSES OCCURRING IN POWER TRANSMISSION TO ZLD PLANT

Cost Savings ₹ / y	Investment ₹	Payback Period Months
48 79 000	1 50 00 000	36

Observation

- A thermographic mapping combined with power measurement study conducted in the powerhouse of the plant has revealed the present occurrence of overloading of the entire powerhouse system, as it draws around 3.5 MW of power currently.
- Most of the outgoing cables of the SSBs are quite hot again indicating the overloading occurrence.
- Secondly, it has been recorded - through the power measurement - that the distribution losses between the powerhouse and the Z L D plant accounts for an energy loss of 860 kWh / d
- The ZLD plant is located quite far away from the powerhouse.
- On cumulation, it is estimated that the T & D losses would account for 10% at the present scheme of things

Comment

- Considering the quantum of energy handled by the plant (82 000 kWh / d) and the distribution losses occurring [@ 10%] in power transmission, it would not be out - of - place to recommend the construction of an additional powerhouse near the existing boiler plant

- The advantage is 3 - fold :
  - (i) Existing unbearable power load of the powerhouse would get reduced safeguarding, thereby, all the cables and associated switchgears
  - (ii) Bringing down the T & D losses to a reasonable extent
  - (iii) Addressing effectively the issues related to safety of plant as the temperature inside the powerhouse exceeds 40 °C always

Recommendation

- Hence, our recommendation is the construction of another Powerhouse near the boiler and optimise / reduce the energy loss in addition to safeguarding the existing power house operation
- The suggested infrastructures would include
  - 3000 kVA Transformer with OLTC
  - MV panel with proper switch gear
  - Armoured cables with higher current capacity
  - APFC Panels etc.,
- The total load of the plant can be shared in these two power houses in an optimised fashion

Economics

Energy consumption : present	=	82 000 kWh / d
Energy saving anticipated @ 2.5 %	=	2 050 kWh / d
	=	(2050 kWh / d x 350 d / y)
	=	7 17 500 kWh / y
Cost savings	=	(7 17 500 kWh / y x ₹ 6.80 / kWh)
	=	**₹ 48 79 000 / y**
Investment	=	**₹ 1.5 Crores**
Simple payback period	=	**36 months**

ECM 6

REDUCING THE COOLING ENERGY LOSS BY REDOING THE INSULATION WORK AFRESH IN IDENTIFIED LOCATIONS – THAT HAVE EITHER DAMAGED INSULATION /PEELED OFF INSULATION EXPOSING BARE SURFACE

Cost Savings ₹ / y	Investment ₹	Payback Period Months
3 00 288	1 50 000	6

Observation

- Uninsulated Chilled Water /Brine lines are a constant source of wasted energy
- Insulation can typically reduce the energy losses by 90 % and help ensure proper cooling at process equipment
- Any surface having a temperature below 20 °C should be insulated, including Chiller Surfaces, Chilled Water / Brine piping, flanges, valves and fittings
- Insulation frequently becomes damaged or removed for various reasons and normally not replaced during maintenance schedule
- Damaged or wet insulation should be repaired / replaced immediately to avoid compromising the insulating value
- Our insulation survey had revealed the existence of damaged insulation, bare surfaces, tattered insulation materials etc in a couple of locations
- We could identify close to 16 locations where the insulation has to be redone.
- A detailing of this is presented in Chapter 5

Comment

- It has been observed - through our detailed Energy Audit Study and visual observation of the Chilled Water / Brine Distribution System - that the insulation has given way in as many as 16 locations and therefore has to be redone / restored
- Thus, there exists equitable scope for curtailing the cooling energy loss by way of attending to this work of maintenance of insulation in proper condition

Recommendation

- Therefore, it is recommended to set right the damaged insulation as a means of curtailing the energy loss
- This action is certain to pay for itself in short run

Economics

Table 11.4 : Rectification of Damaged Insulation : Cooling Loss Estimation

No	Area	Location	Temperature °C		Surface Area m^2		Cooling Loss kcal / h		
			Bare Surface	Amb	Bare	Insulated	Bare Surface	with insulation	Avoid able
1	Near VAM Chiller	Methanol Tank Pump	1	31	2.00	5.30	685	316	369
2		Methanol Tank Header	1	31	0.38	0.67	131	40	91
3		Methanol Top Header	1	31	1.99	3.63	685	220	465
4		Methanol Tank Bottom Header from the Chiller	1	31	0.96	1.91	330	118	212
5	Chiller Area	IBU – 2 (UCCH - 2019) Chiller End Cap	2	31	1.13	1.77	375	109	266
6		Chiller Evaporator	18	31	15.07	18.8	2 087	1 164	922
7	IBU - 1 (UCCH - 2019)	Process Pump	6	31	0.28	0.47	79	29	50
8		Chilled Water Line to Process Pump	20	31	0.5	0.8	56	49	6
9	Chilled Water Tank (UMST 2147)	Front Side Process Pump	6	31	31.4	62.8	8 949	4 081	4 868
10	Pharma Chiller (UCCH – 2022)	Chiller End Cap		31	0.79	1.13	320	75	245
11		On the Circumference in the Chiller	1	31	15.07	18.84	5 278	1 244	4 034
12		Chiller Out Pipe	14.2	31	0.38	0.63	72	41	30

No	Area	Location	Temperature °C		Surface Area m^2		Cooling Loss kcal / h		
			Bare Surface	Amb	Bare	Insulated	Bare Surface	with insulation	Avoid able
13	UCCH - 2018	Chiller End Cap		31	1.07	1.77	1 134	117	1 018
14		Chiller Evaporator	15.8	31	15.07	18.84	2 535	1 244	1 290
15		Chiller Compressor		31	0.64	1.04	262	68	194
16	UCCH-2022	Chiller inlet Pipe	20.3	31	0.64	1.04	75	68	6
Total									**14 049**

Avoidable Cooling Loss = 14 049 kcal / h

= (14 049 kcal / h) / (3 024 kcal / T R)

= 4.6 T R

Average Chiller S P C = 1.2 kW / TR

Equivalent Electrical Consumption = [4.6 TR x 1.2 kW / TR x 8 000 h / y]

= 44 160 kWh / y

Cost savings = (44 160 kWh / y x ₹ 6.8 / kWh)

= **₹ 3 00 288 / y**

Investment = **₹ 1 50 000**

Simple payback period = **6 months**

ECM 7

i) FITMENT OF VARIABLE FREQUENCY DRIVE TO PRIMARY PUMPS & ii) INSTALLATION OF IN - LINE CONDENSER WATER CIRCULATION PUMP IN THE CHILLER DEDICATED FOR ALDEHYDE PLANT FOR THE SAKE OF PERFORMANCE IMPROVEMENT AND ENERGY USAGE OPTIMISATION

Cost Savings ₹ / y	Investment ₹	Payback Period Months
25 84 000	22 00 000	10

Scenario 1 : At the time of Installation

- The scheme of operation of Chiller system of aldehyde plant at the time of installation is as below :

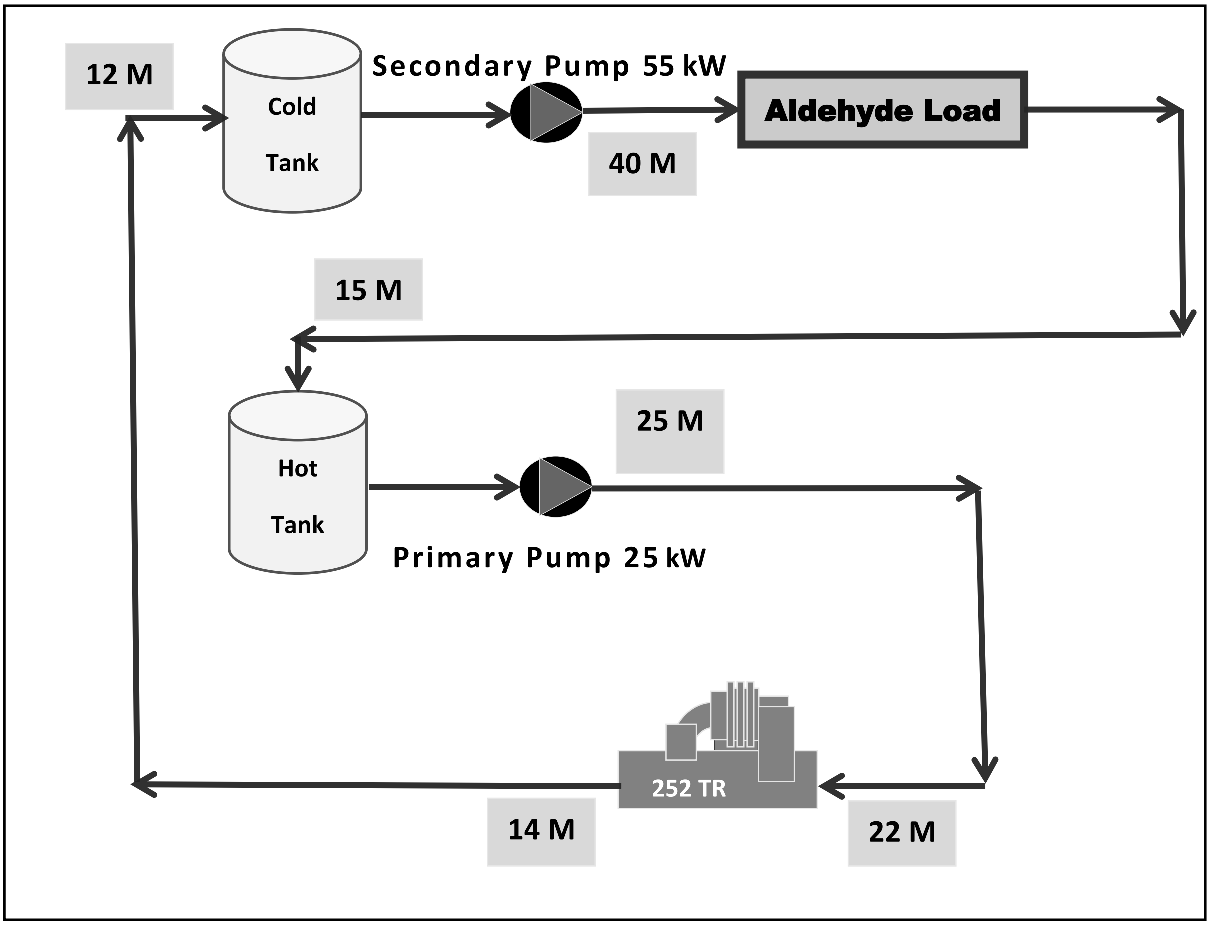


Fig 11.4 : Chiller System: Present Scheme of Operation as per OEM

- Chilled water from the chiller flows to the cold tank from where it goes to the reactors of Aldehyde plants, delivers the chilling load and returned to the hot tank. It is then pumped from the hot tank to the chiller and the schedule of operation goes like this.
- There are two pumps in operation termed Primary Pump (25 kW rating) and Secondary Pump (55 kW rating) in the Circuit

Scenario 2 : Present Scheme of Operation

- As a part of energy conservation activity, the energy team of Solara had done away with the primary - Secondary pumping scheme with a single constant speed primary pump
- The scheme of operation presently practised is shown in Fig 2

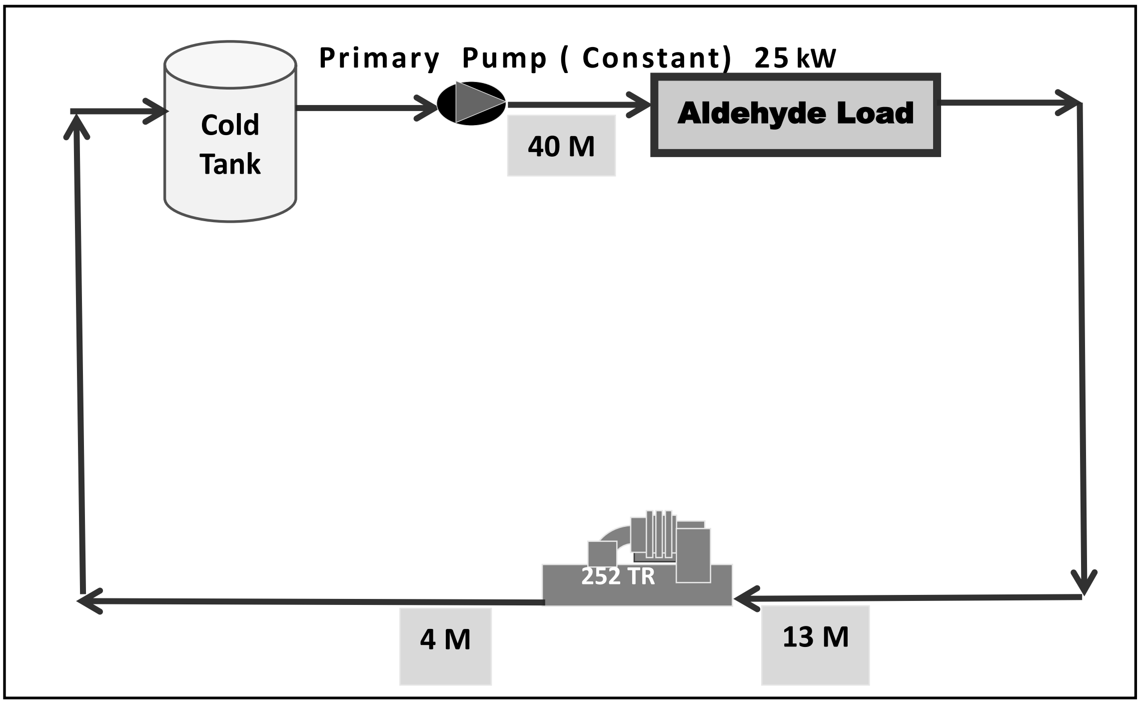


Fig 11.5 : Chiller System: Present Scheme of Operation Practised

- Adoption of this scheme had eliminated the requirement of 25 kW pump and thus an energy saving corresponding to this had resulted which was substantial
- The study conducted on this system revealed the following (can be termed as shortcomings)

(i) Higher discharge pressure from the compressor

(ii) Higher Evaporator approach temperature

(iii) Discharge superheat too was higher

- Reasons that can be attributed to the above happenings can be summed up as below
  - (i) Insufficient Refrigerant Flow
  - (ii) Improper Brine Levels
  - (iii) Higher TDS in Condenser Water
  - (iv) Improper / ineffective operation of Expansion Valve
- It is suggested that these issues are addressed effectively and eliminated to the extent possible

Scenario 3 :Proposed Scheme of Operation

The proposed scheme of operation is depicted below :

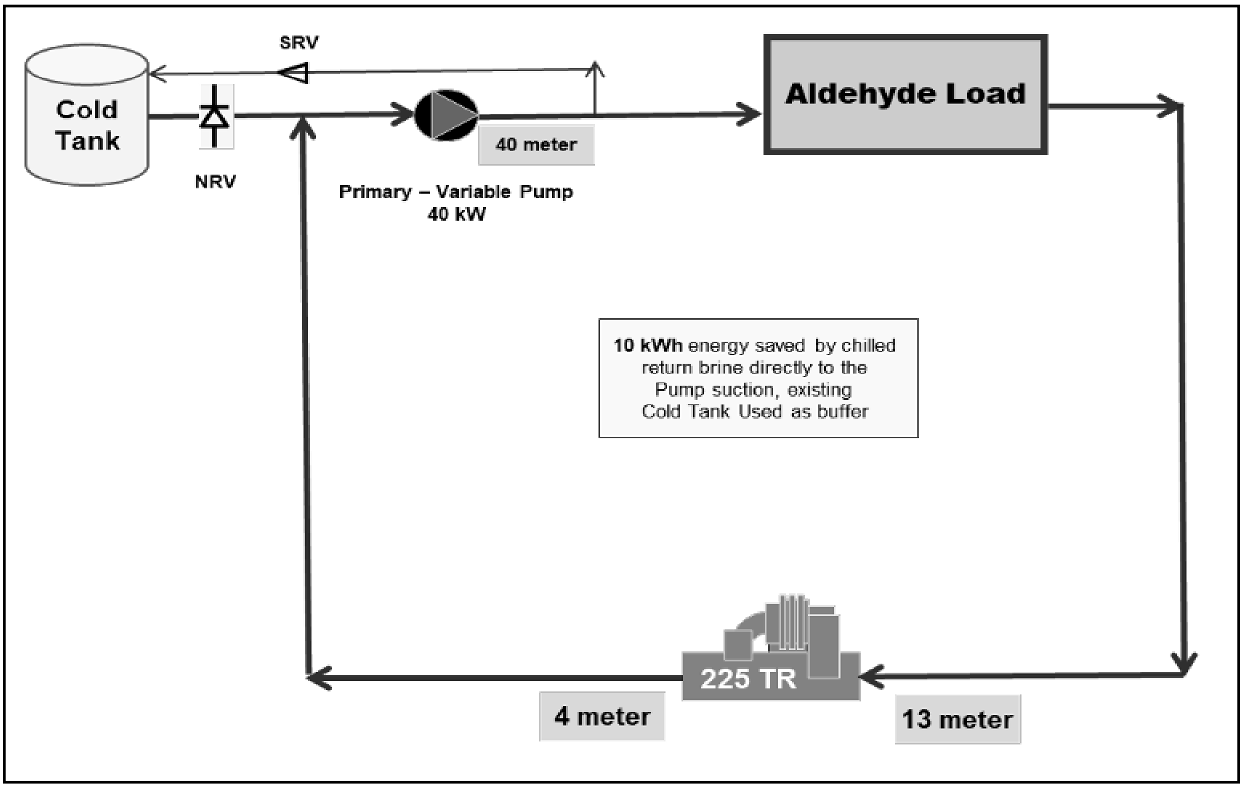


Fig 11.6 : Chiller System: Scheme of Operation Proposed

Highlights

(i) In this scheme of operation, the chilled water coming out of the chiller is connected suitably to the suction of the primary pump to take advantage of the outlet pressure of the chiller which is 7 m WC that otherwise goes unrecovered.

(ii) Primary pump shall be fitted with VFD in order to modulate the chilled water flow as per the process requirement.

(iii) Modify the condenser water circuit by way of providing a dedicated in - line condenser pump for this chiller alone

Benefits Expected

(i) Reduction in energy consumption in chilled water pumping by way of taking advantage of outlet pressure of chilled water from the chiller

(ii) Provision of dedicated condenser water circulation pump will enable the circulation of required water through the condenser which is not happening presently. Through the adoption of this scheme, the performance of the entire chiller is expected to improve.

Recommendations

Hence, our recommendations are 2 fold :

(i) Modify the chilled water circuit as suggested in Fig 3

(ii) Install a dedicated in - line condenser water pump and optimise the water flow :

The energy / cost saving will be substantial

Economics

Power drawl by Primary Pumps	:	Present	=	46 kW
	:	Anticipated	=	36 kW
	:	Power savings	=	10 kW
Specific power consumption	:	Present	=	1.15 kW / TR
	:	Anticipated	=	0.90 kW / TR
	:	Savings	=	0.25 kW / TR
Average Chilling Load Delivered			=	150 TR

Power Savings	=	(0.25 kW / TR x 150 TR)	=	37.5 kW
Overall Power reduction	=	(10 + 37.5)	=	47.5 kW
Energy Savings	=	(47.5 kW x 8000 h / y)		
	=	3 80 000 kWh / y		
Cost savings	=	(3 80 000 kWh / y x ₹ 6.80 / kWh)		
	=	**₹ 25 84 000 / y**		
Investment	=	**₹ 22 00 000**		
Simple Payback Period	=	**10 Months**		

ECM 8

ENERGY OPTIMISATION IN THE OPERATION OF CHILLER SYSTEM DEDICATED TO PHARMA PLANT BY WAY OF ADOPTION OF
a) VFD OPERATION TO THE PRIMARY BRINE CIRCULATION PUMP
b) DEDICATED IN-LINE CONDENSER PUMP FOR THIS CHILLER

Cost Savings ₹ / y	Investment ₹	Payback Period Months
33 18 400	22 00 000	8

Scenario 1

The present Scheme of operation of Chiller System of Pharma plant is depicted below :

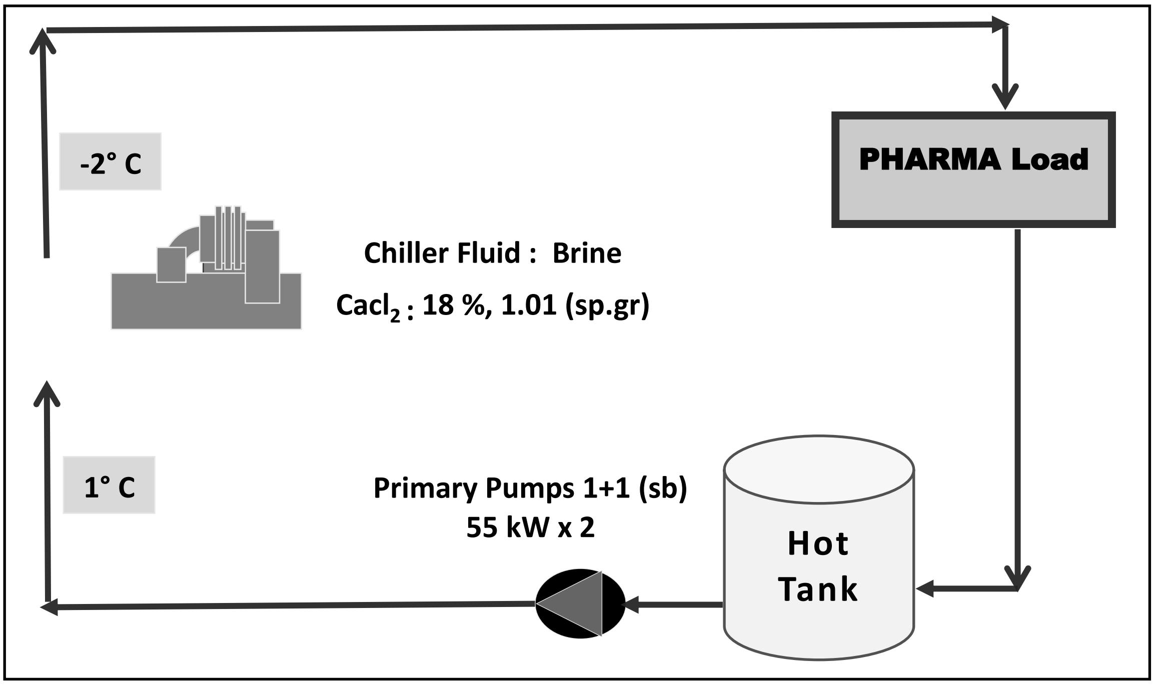


Fig 11.7 : Present Scheme of Operation: Chiller System : Pharma Plant

Shortcomings Noticed

i) Brine at pressure head of 15 m WC gets collected in the hot collection tank and from where it is sent to the chiller through a primary pump (55 kW rating) operating at a head of 40 m WC

This is to infer that the pressure head available in the Brine while it leaves the pharma plant is not made use of in optimising the power drawl by the primary pump

ii) Primary pump operates at a constant speed whereas a variable speed - through the fitment of VFD - would eventually optimise the power drawl by adopting to varying chilling load

iii) The water flow through condenser is quite low at 80 m^3 / h as against a designed rating of 180 m^3 / h. This obviously increases the Specific Power Consumption of the overall chiller system . It is presently recording a SPC of 1.6 kW / TR while the designed value is 0.82 kW / TR

iv) Chiller compressor quite old and it is operating with $CaCl_2$ as brine and not ethylene glycol. $CaCl_2$ is typically a corrosive fluid

Recommendations

The recommendation of ours goes like this

a) Adopt the following circuit for chilled Brine usage in the Pharma plant and take advantage of the pressure head available

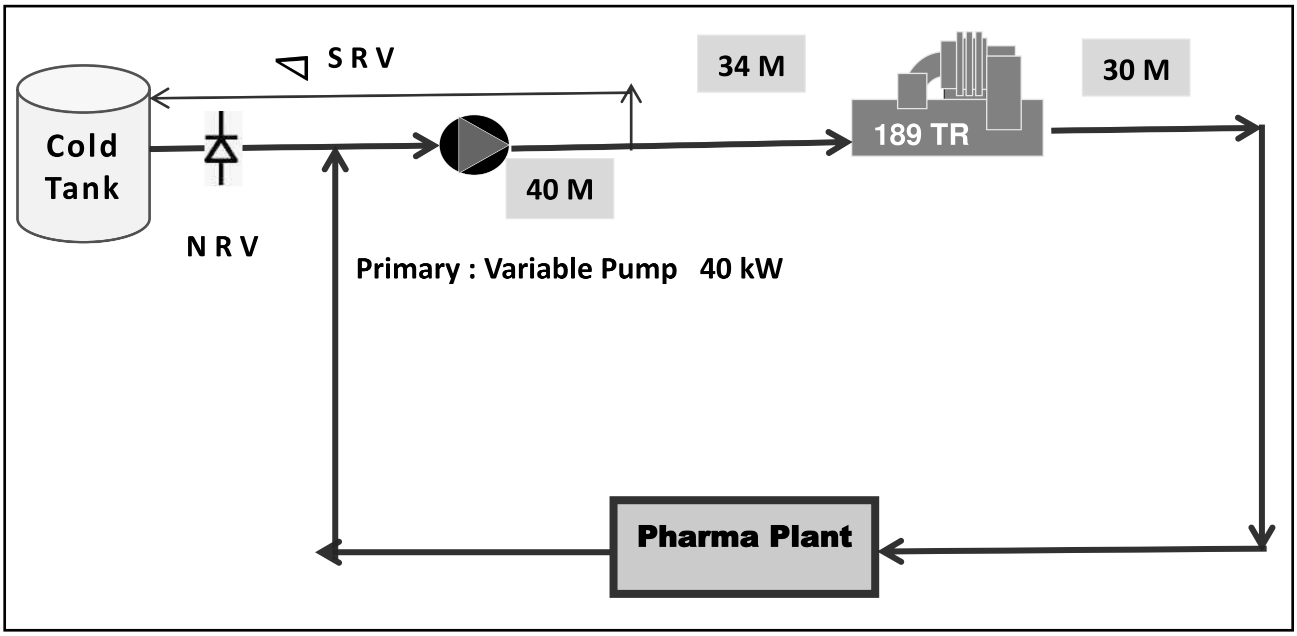


Fig 11.8 : Chiller System: Proposed Scheme of Operation : Chiller Pumping System

b) Fit VFD to the primary pump and make it operate at varying speeds as per the need

c) Install a dedicated Condenser Pump to this chiller only thereby optimising the specific energy consumption

All these 3 are bound to give considerable savings in energy and therefore the cost

Economics

Power drawl by primary pumps	:	Present	=	44 kW		
	:	Anticipated	=	34 kW		
	:	Power savings	=	10 kW		
Specific power consumption	:	Present	=	1.6 kW / TR		
	:	Anticipated	=	1.0 kW / TR		
	:	Savings	=	0.6 kW / TR		
Average Chilling Load Delivered			=	150 TR		
Power Savings	=	(0.6 kW / TR x 85 TR)		=	51 kW	
Overall Power reduction	=	(10 + 51)		=	61 kW	
Energy savings	=	(61 kW x 8000 h / y)				
	=	4 88 000 kWh / y				
Cost savings	=	(4 88 000 kWh / y x ₹ 6.80 / kWh)				
	=	**₹ 33 18 400 / y**				
Investment	=	**₹ 22 00 000**				
Simple payback period	=	**8 Months**				

ECM 9

PERFORMANCE IMPROVEMENT OF CHILLER OF IBU PLANT THROUGH ADOPTION OF THE BELOW LISTED MEASURES

a) VFD ENABLED PRIMARY BRINE CIRCULATION PUMP OPERATION

b) PROVISION OF DEDICATED IN-LINE CONDENSER PUMP FOR THIS CHILLER

Cost Savings ₹ / y	Investment ₹	Payback Period Months
27 20 000	22 00 000	10

Present Scenario

The present scheme of operation practiced in the Chiller Plant of IBU section is as below :

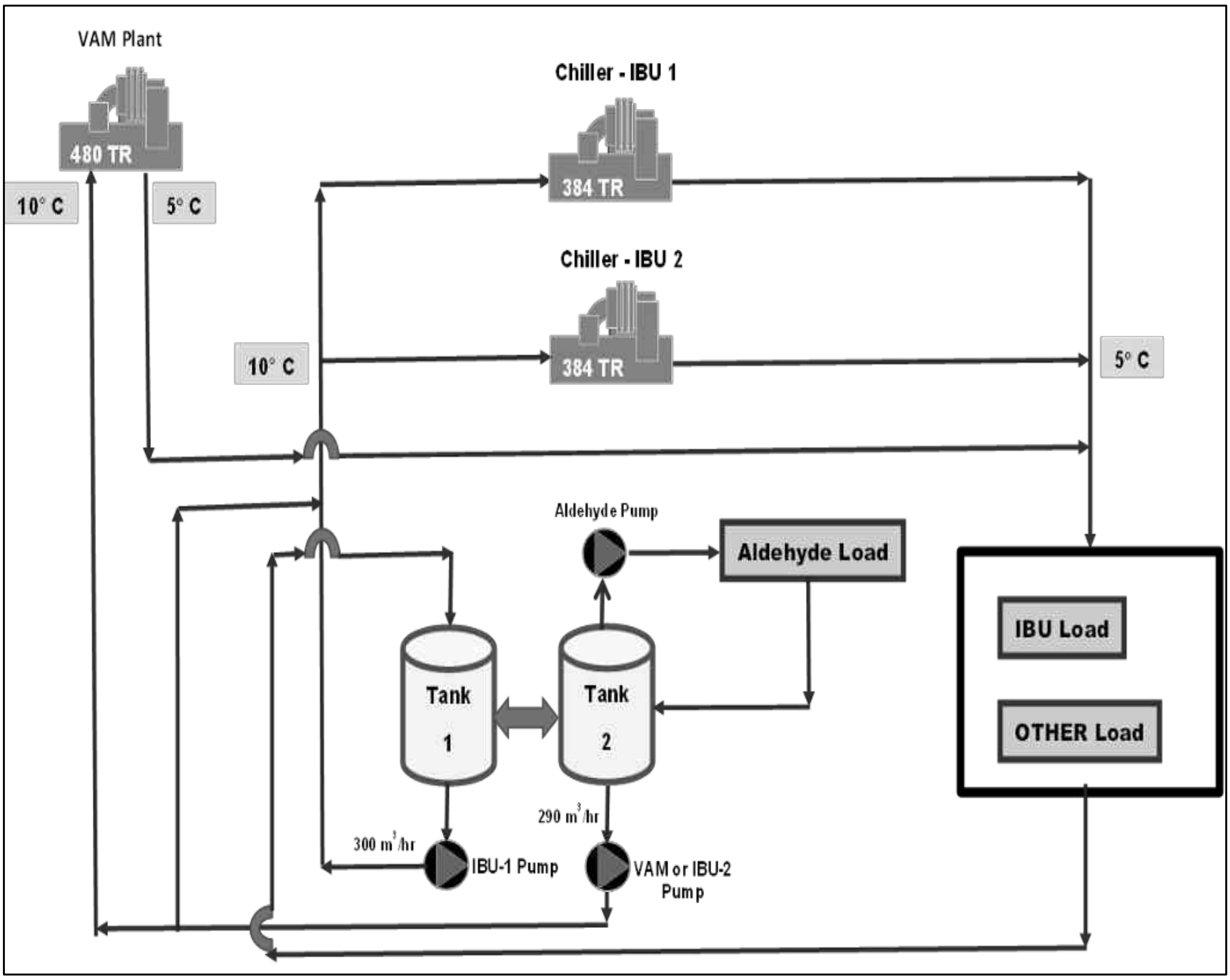


Fig 11.9 : Chiller System: Present Scheme of Operation : I B U Plant

As recommended in our earlier Encon proposals the following are suggested for the betterment of Chiller operation

(i) Replace the Primary - Constant Chilled Water Circulation Pump by the Primary Variable Pump

(ii) Install a dedicated in - line condenser water pump for IBU - 1 & VAM chiller

(iii) Provide needed controls towards integration of IBU Chiller, VAM Chiller, Primary - VFD Pump, in - line Condenser Pump etc.,

Benefits

(i) Reduction in power drawl by the primary pump due to the fitment of VFD

(ii) Improvement in the SEC - in terms of kW / TR through the adoption of dedicated condenser pump

(iii) Better control on the process parameters (flow, temperature & pressure)

Recommendations

Follow the suggestions made in the proposed scheme to optimize the energy consumption in the chiller operation, namely, use of V F D fitted primary pump, dedicated condenser pump and appropriate process controls

Economics

Power drawl by Primary Pump - Constant	: Present	=	55 kW
	Anticipated	=	45 kW
	Power savings = (55 - 45)	=	10 kW
Specific Energy Consumption :	Present	=	1.1 kW / TR
	Anticipated	=	0.85 kW / TR
	Savings	=	0.25 kW / TR
Average Chilling Load delivered		=	160 TR

Hence, Power savings	=	(0.25 kW / TR x 160 TR)	=	40 kW
Total Power Savings	=	(10 + 40)	=	50 kW
Energy savings	=	(50 kW x 8 000 h / y)		
	=	4 00 000 kWh / y		
Cost savings	=	(4 00 000 kWh / y x ₹ 6.80 / kWh)		
	=	**₹ 27 20 000 / y**		
Investment	=	**₹ 22 00 000**		
Simple Payback Period	=	**10 months**		

ECM 10 ENERGY OPTIMIZATION MEASURES PROPOSED IN IPCA CHILLER OPERATION

Cost Savings ₹ / y	Investment ₹	Payback Period Months
25 84 000	20 00 000	10

Background

- The chilled water system installed in the IPCA building has a capacity of 338 TR and design to deliver chilled water to IPCA building No : 70
- A cooling tower of 800 TR has been installed to take the thermal load of the chilled water plant and also the process heat load of various reactors

Observations

- As per the P & ID of IPCA plant, the rating of cooling tower is only 500 T R
- Condenser water flow rate measured was only 114 m^3 / h vis - a - vis a designed value of 300 m^3 / h
- Likewise, chilled water flow is marginally less at 175 m^3/ h against a designed value of 204 m^3/ h
- The size of water pipelines appears inadequate
- Only a limited quantity of water flows through the condenser of the Chiller due to the restriction in pipe size
- The entering temperature of water flows through the condenser of the chiller due to restriction in pipe size
- The entering temperature of water to the cooling tower is 34 °C even with low ambient condition
- Evaporator approach temperature is high at 3 °C
- All these point to the inadequate capacity of the cooling tower that leads to inefficient operation of the chiller

The existing scheme of operation is presented below :

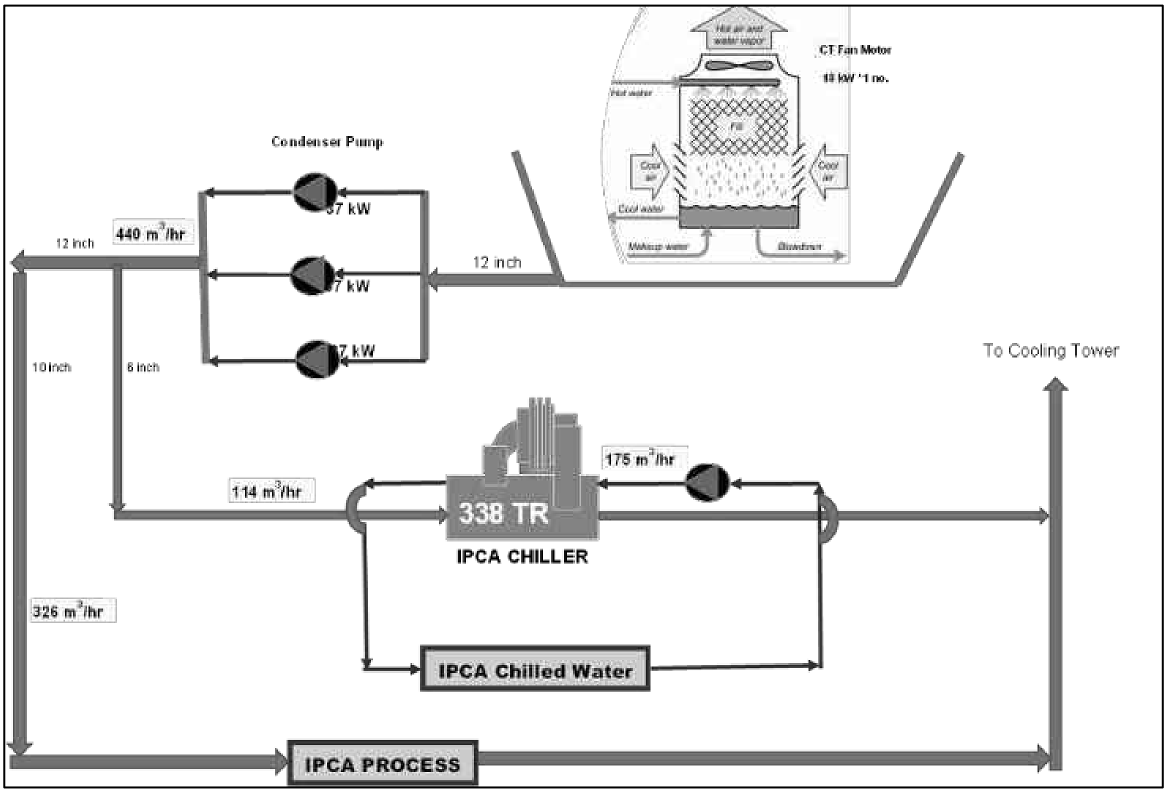


Fig 11.10: Present Scheme of Operation : IPCA Chiller System

Suggestions

Since the CT is of inadequate capacity, the following suggestions are made for the betterment of the chiller operation:

(i) Replace the Chilled Water Primary - Constant pump with Primary - Variable pump

(ii) Use the existing 3 (2+1 standby) condenser water pumps only for process cooling water application

(iii) Install an energy efficient ***in - line vertical condenser pump*** to maintain the required water flow rate in the chiller condenser

(iv) Enable the entire operation of IPCA Chiller, Primary VFD Pumps, Condenser Pumps etc., through adequate controls

Benefits

The benefits that can result - through the adoption of above - are listed below :

(i) Energy saving through adoption of Primary - Variable Pump

(ii) Specific Power Consumption (kW / TR) reduction to a reasonable extent

(iii) Fitment / operation of Chiller to the near designed capacity facilitating enhanced production

Recommendations

The recommendation is to adopt the schemes made in the above section on "***Suggestion***"

The energy - cum - cost saving will be commensurate with the investment

Economics

Power drawl by Primary Pump - constant	: Present	=	52.6 kW	
	: Anticipated	=	42.6 kW	
	Power Savings	=	(52.6 - 42.6)	= 10 kW
Specific Energy Consumption :	Present	=	0.95 kW / TR	
	Anticipated	=	0.70 kW / TR	
	Savings	=	0.25 kW / TR	

Average chilling load delivered	=	150 TR
Hence, Power Savings	=	(0.25 kW / TR x 150 TR) = 37.5 kW
Total Power Savings	=	(10 + 37.5) = 47.5 kW
Energy Savings	=	(47.5 kW x 8 000 h / y)
	=	3 80 000 kWh / y
Cost savings	=	(3 80 000 kWh / y x ₹ 6.80 / kWh)
	=	**₹ 25 84 000 / y**
Investment	=	**₹ 20 00 000**
Simple Payback Period	=	**10 months**

ECM 11 — INSTALLATION OF NEW ENERGY EFFICIENT , LOW APPROACH COOLING TOWER REPLACING THE EXISTING 2000 TR UTILITY COOLING TOWER FOR THE SAKE OF ENERGY CONSERVATION

Cost Savings ₹ / y	Investment ₹	Payback Period Months
10 05 312	20 00 000	24

Observation

- There is a 2000 TR rated cooling tower that caters to the Utility section of the plant
- The loads connected to this 2000 TR chiller are shown below in Fig 11. 11

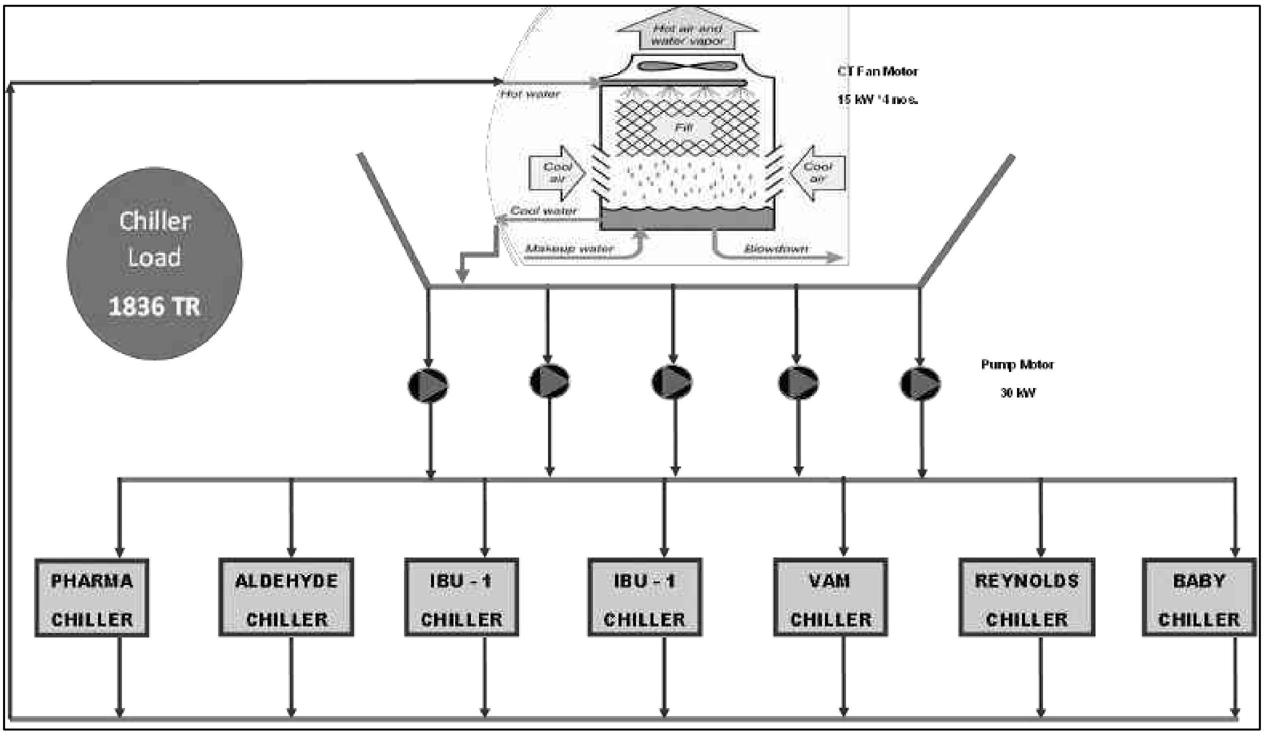


Fig 11.11 : loads connected to 2000 TR Cooling Tower

- A performance study has been conducted on this C T and presented in Chapter 9
- The Material of Construction of this CT is FRP and there are 4 compartments in this CT. Each compartment is fitted with an Induced Draft Fan
- Thus, there are 4 ID Fans in operation (3 of them are fitted with VFDs) and consume a cumulative power of 36.1 kW

- The chilling load of this Chiller has been estimated as 440 T R and the heat rejection load as 650 T R
- Thus, the specific power drawl works out to 0.082 kW/ TR

Comment

- The specific power drawl of 0.082 kW / TR with reference to Fan power appears to be on the higher side
- Energy Efficient , low approach cooling towers demand a specific power drawl of only 0.04 kW / T R.

Recommendation

- Therefore, it is recommended to replace the existing cooling tower with an energy efficient low approach cooling tower
- This action is certain to pay for itself in short run

Economics

Specific Power Drawl of 4 CT Fans

	: Present	=	0.082 kW / TR $_{cooling}$
	: Anticipated	=	0.040 kW / TR $_{cooling}$
Power savings		=	0.042 kW / TR $_{cooling}$
Energy savings		=	(0.042 kW / TR x 440 TR x 8000 h / y)
		=	**147 800 kWh / y**
Cost savings		=	(1 47 800 kWh / y x ₹ 6.8 / kWh)
		=	**₹ 10 05 312 / y**
Investment		**=**	**₹ 20 00 000**
Simple payback period		=	**24 months**

ECM 12 — PRESSURE DROP REDUCTION AT COMPRESSOR AIR GENERATION LOCATION

Cost Savings ₹ / y	Investment ₹	Payback Period Months
9 16 300	2 00 000	< 3

Observation : 1

- Compressed air is generated at a pressure of 5.1 bar and sent to the air receiver tank through a refrigerant dryer
- It has been noticed that the pressure of the compressor air at the dryer outlet is 4 bar
- It appears therefore, that , a ΔP of 1.1 bar is occurring at the dryer itself
- This ΔP of 1.1 bar across the dryer is relatively on the higher side

Comments

- The energy consumption in compressed air section is estimated as 5500 kWh / day
- It shall be prudent to reduce the ΔP across the dryer to 0.5 bar and lesser
- This shall reduce the generation air pressure at the compressor outlet to 4.5 bar - a reduction of 0.5 bar which is equivalent to 10 % reduction
- This reduction in generation pressure is expected to reduce the energy consumption to a reasonable extent

Recommendations

Hence, the following activities are recommended to bring down the energy consumption in the compressed air generation

- Replacement of pre - air filters provided in the air dryer (both at inlet & outlet)
- Service the air dryer with OEM

Economics

Pressure at the air compressor outlet :

	present	=	5.1 bar
	suggested	=	4.5 bar

Power reduction = [$6.1^{0.26}$ - 1] **/** [$5.5^{0.26}$ - 1] = 7%

Energy consumption	present	=	5 500 kWh / d
	anticipated @ 93%	=	5 115 kWh / d
Energy savings		=	385 kWh / d
		=	(385 kWh / d x 350 d / y)
		=	1 34 750 kWh / y
Cost savings		=	(1 34 750 kWh / y x ₹ 6.80 / kWh)
		=	**₹ 9 16 300 / y**
Investment		=	**₹ 2 00 000**
Simple payback period		=	**< 3 months**

ECM 13 ENERGY OPTIMIZATION THROUGH THE USE OF *IoT* MONITORING SYSTEM IN THE COMPRESSED AIR SYSTEM CIRCUIT

Cost Savings ₹ / y	Investment ₹	Payback Period Months
5 23 600	5 00 000	< 12

Observations

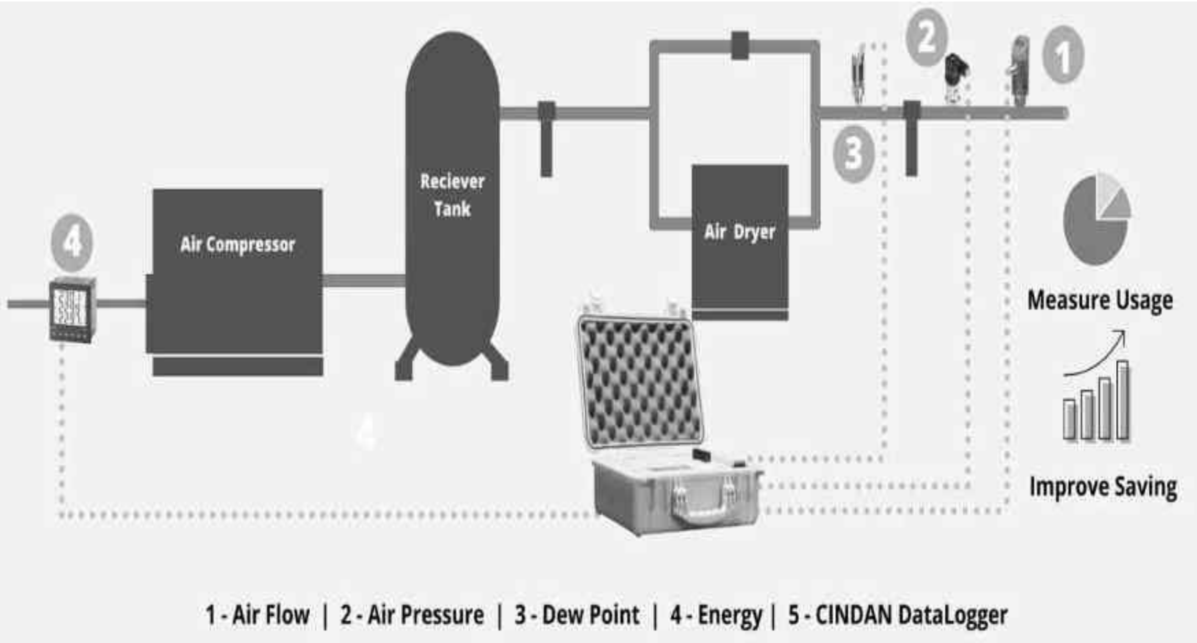
- The plant has installed 3 screw air compressors to meet the process air requirements that include instrumentation air requirement also
- In addition, part of the compressed air is used for N_2 generation for in house process usage
- On an average, 5500 kWh of energy is consumed daily by air compressor systems alone
- The compressed air is used at 7 locations in the plant (details are already presented in Section 8) requiring varying pressures
- It was recorded that pressure gauges have been provided at a couple of locations and few gauges were found to be not working

Comment

- It was noticed that the compressed air is used at 7 different locations at different pressures
- Surprisingly, the air flow rates (either cumulative or individual) are not being monitored
- As such, the instrumentation in the compressed air system appears inadequate
- Further, due to the non - stop (continuous) operation of the process / air compressors, the performance related parameters of the air compressor (like FAD, Specific Energy Consumption, Pressure Drop in the air distribution system etc.,) are not being recorded / monitored

Recommendation

- Our recommendation therefore is to enable IoT monitoring system in the compressed air circuit not only to monitor the compressed air usage pattern but also to optimise its usage thereby effecting energy conservation.
- The scheme proposed is depicted below:



Economics

Energy consumption of air compressor circuit	=	5500 kWh / d
Energy saving anticipated @ 4%	=	(5500 kWh / d x 4 %)
	=	220 kWh / d
	=	[220 kWh / d x 350 d / y]
	=	77 000 kWh / y
Cost savings	=	(77 000 kWh / y x ₹ 6.80 / kWh)
	=	**₹ 5 23 600 / y**
Investment	=	**₹ 5 00 000**
Simple payback period	**<**	**12 months**

ECM 14

REPLACEMENT OF EXISTING CONVENTIONAL LUMINAIRES WITH APPROPRIATE ENERGY EFFICIENT *LED* LAMPS FOR THE SAKE OF ENERGY CONSERVATION

Cost Savings ₹ / y	Investment ₹	Payback Period Months
2 48 200	2 50 000	12

Observation

- 215 Nos of High - Pressure Sodium Vapour (H P S V) Lamps of 125 W rating have been installed in various locations of the plant
- The location wise installation details of HPSV Lamps are as below :

Table No : HPSV Lamps : Location wise Installation

No	Location	Type of Fitting
1	I B U Plant	14
2	Pharma Plant	80
3	Aldehyde Plant	18
4	Pilot Plant	8
5	IBU Derivative Plant	19
6	D C Packing	0
7	2 D Block	17
8	I B U Packing - I	4
9	I B U Packing - II	9
10	Raw Material Store	2
11	I P C A Plant	44

- On an average, energy consumption due to these HPSV lamps is expected to be around 450 kWh / d, thus indicating an operating load of about 30 kW
- The plant has already initiated the programme of replacing conventional Fluorescent Tube Lights by LED for energy conservation's sake and literally there are only a handful of tube lights in use in the plant at present

Comments

- Conventional luminaires consume more power for a given lumens output
- Also, the lifetime of conventional luminaires is limited
- The present trend is to replace these conventional luminaires with energy efficient & longer life LED lamps
- Further, the HPSV lamps produce monochromatic colour that is unsuitable for indoor applications

Recommendation

Hence, the recommendation is to replace the conventional HPSV lamps by LEDs of appropriate wattages effecting no sacrifice on the lux level requirement at the user locations

Economics

Energy consumption due to HPSV lamps Present = 450 kWh / d

Energy consumption due to LED lamps of appropriate wattage = 350 kwh / d

Energy Savings = (450 – 350) = 100 kWh / d

= (100 kWh x 365 d / y)

= 36 500 kWh / y

Cost Savings = (36 500 kWh / y x ₹ 6.8 / kWh)

= **₹ 2 48 200 / y**

Investment = **₹ 2 50 000**

Simple Payback Period = **12 months**

12

PERFORMANCE CENTRIC PROPOSALS

PCP 1

INSTALLATION OF 2 WAY – VALVES IN PLACE OF EXISTING 3 WAY VALVES IN IDENTIFIED AIR HANDLING UNITS

INTRODUCTION

- The chilling ambience inside the plant is obtained by the circulation of chilled water through Air Handling Units (AHUs) located / installed appropriately inside the plant
- The chilled water to these AHUs is delivered by the IBU, VAM, & IPCA Chillers as per the requirements
- Chilled water from IPCA Chiller is circulated through 13 AHUs.
- Likewise, chilled water from IBU / VAM chiller is passed through 14 AHUs
- Various energy related measurements have been recorded with reference to these AHUs and are listed below:

DATA COLLECTION

AHU Serviced by IPCA Chiller : Data Captured

- There are 13 AHUs that were supplied with Chilled Water produced from IPCA Chiller
- The details are as below in Table 12.1

Table 12.1 : AHUs of IPCA Chiller : Data Captured

No	Location	AHU ID	Motor kW	Air Flow CFM	Chilled Water inlet	Chilled Water outlet	Chilled Water delta T	Valve Type	Pr Inlet	Pr Outlet	ΔΠ
					(˚C)				3 - W	ksc	
1	IBU packing / P 15 AHU0012	AHU 1	15	7 000	9.1	16.1	7	NO	2.4	1.5	0.9
2	IBU packing / P 15 AHU0013	AHU 2	10	4 700	9.7	13.8	4.1	NO	2.8	1.8	1
3	IBU packing / P 15 AHU0009	AHU 3	5.5	2 000	9.7	13.5	3.8	NO	2.8	1.8	1
4	IBU packing / P 15 AHU0007	AHU 4	15	8 500	9.1	15.1	6	NO	2.3	1.6	0.7
5	IBU packing / P 15 AHU0014	AHU 5	15	7 000	9.1	15.2	6.1	NO	2.3	1.6	0.7

No	Location	AHU ID	Motor kW	Air Flow CFM	Chilled Water inlet	Chilled Water outlet	Chilled Water delta T	Valve Type	Pr Inlet	Pr Outlet	ΔΠ
					(˚C)			3 - W	ksc		
6	IBU packing / P 15 AHU0010	AHU 6	15	8 000	9.7	13	3.3	NO	2.4	1.8	0.6
7	IBU packing / P 15 AHU0008	AHU 7	15	9 100	9.1	16.1	7	NO	2.3	1.9	0.4
8	IBU packing / 2 / M / AHU2043	AHU 2	7.5	5 000	8	10.8	2.8	Yes	3	2.3	0.7
9	IBU packing / 2 / M / AHU2042	AHU 1	10	6 700	8	10.5	2.5	Yes	3	2.3	0.7
10	IBU packing / 2 / M / AHU2041	AHU 3	15	9 500	8	10.3	2.3	Yes	3	2.3	0.7
11	Pharma / M / AHU 2050	AHU 1	5	1 500	10	23.5	13.5	No	2.2	2.2	0
12	Pharma / M / AHU 2069	AHU 2	20	12 000	5	11	6	Yes	3.9	2.7	1.2
13	Pharma / M / AHU 2070	AHU 3	10	6 000	6.2	12.9	6.7	Yes	2.2	1.8	0.4

AHU Serviced by IBM : VAM Chiller : Data Captured

- There are 14 AHUs that were supplied with chilled water produced from IBU / VAM Chiller
- The details are as below in Table 12.2

Table 12.2 : AHU OF IBU / VAM : Data captured

No	Location	AHU ID	Motor kW	Air Flow CFM	Chilled Water Inlet	Chilled Water Outlet	Chilled Water Delta T	Valve Type	Pr Inlet	Pr Outlet	ΔP
					(˚C)			3 - W	ksc		
1	2 D Block / M / AHU 2064	AHU 8	20	8 000	6.6	9.1	2.5	Yes	2.2	1.8	0.4
2	2 D Block / M / AHU 2065	AHU 9	8.5	2 500	5	10	5	Yes	2.2	1.2	1
3	2D Block / M / AHU 2068	AHU 1	5	1 500	5.5	8.4	2.9	Yes	No Provision		
4	D C Packing	AHU 1	15	15 000	5.9	10	4.1	Yes	2.3	1.6	0.7
5	Pilot Plant / M / AHU 2046	AHU 1	7.5	2 500	8	11	3	Yes	2.2	1.8	0.4
6	Pilot Plant / M / AHU 2048	AHU 2	7.5	4 600	8	15.8	7.8	Yes	2.2	1.8	0.4
7	Pilot Plant / M / AHU 2047	AHU 3	7.5	3 500	8	9	1	Yes	2.2	1.8	0.4

No	Location	AHU ID	Motor kW	Air Flow CFM	Chilled Water Inlet	Chilled Water Outlet	Chilled Water Delta T	Valve Type	Pr Inlet	Pr Outlet	ΔP
					(˚C)			3 - W	ksc		
8	2 D Block / M / AHU 2024	AHU 2	10	1 000	7.5	14.1	6.6	No	1.5	1.3	0.2
9	2 D Block / M / AHU 2029	AHU 3	10	1 000	7.5	12.5	5	No	1.8	1.5	0.3
10	2 D Block / M / AHU 2030	AHU 4	7.5	5 000	7.5	13.7	6.2	No	1.8	1.5	0.3
11	2 D Block / M / AHU 2031	AHU 5	3	2 500	7.5	14.9	7.4	No	1.8	1.2	0.6
12	2 D Block / M / AHU 2032	AHU 6	5	3 500	7.5	10.9	3.4	No	1.8	1.5	0.3
13	2 D Block / M / AHU 2033	AHU 7	3	1 500	7.5	15.6	8.1	No	1.2	1	0.2
14	2D BLOCK	AHU 10	5	1 500	8	13.5	5.5	No	3	2.3	0.7

Observations

- Chilled water flow is controlled presently by 3 - way valve in 5 out of 13 AHUs of IPCA Chiller . Similarly, 7 out of 14 AHUs (IBU / VAM Chiller) have 3 - way valve fitted with
- The rest 15 AHUs are not provided with valves at all
- Chilled water outlet temperatures were found to be invariably higher in all AHUs.
- It has been recommended earlier in our Encon proposal to fit VFD to the Primary Pumps of all Chillers which are currently operating at constant speed
- The fitment of VFD is certain to bring in energy savings
- As a fall - out of this, the AHUs can be fitted with 2 - way valves which are not only an appropriate choice under the altered circumstances and also bring down the ΔP across them .
- This reduction in ΔP is bound to reduce the energy consumption in chilled water flow, thereby save on energy
- Thus, the installation of 2 - way valve replacing 3 way valve is bound to save energy to a reasonable extent. Hence this suggestion.

PCP 2

INSTALLATION OF WATER COOLED VRF CONDENSER UNIT FOR MICROBIOLOGY LAB DX UNIT

Observation

- The microbiology lab - located above the canteen - is cooled by 3 AHUs with DX coils with a refrigeration rating of 30 TR. Each of the condenser is air - cooled.
- Additionally, many split A / Cs of varying capacities are installed in the IT and other Departments
- All the Condenser Units are located besides the AHU condenser of microbiology lab

Comment

- CoP of water - cooling system is way ahead of that of an air - cooled system.
- Therefore, it would be prudent to replace the existing multiple condenser coil units with a single water cooled 30 T R condenser VRF unit
- With the added advantage of VRF, the CoP of the system can go as high as 6 to 7
- The additions will be ***a cooling tower with condenser unit and a pump***
- This arrangement is being suggested mainly to conserve electricity

Way Forward

Use of dedicated water cooled VRF system should be considered for series of split A/C and DX unit.

PCP 3 REPLACEMENT OF EXISTING MEN'S URINAL WITH WATERLESS URINAL

Observation

- This site has more than 100 men manning each shift
- Urinals consume 1.5 litres of water per usage as per the quick observation made by us
- Thus, the water consumption in Urinals is estimated to be 1.0 kL / day

Comment

- The water usage in the men's urinal can be reduced with the retrofit of "Waterless urinal"
- Waterless Urinal requires 95 % less water compared to the traditional men's urinal
- There are 2 types of waterless urinal in vogue : Chemical Type and Mechanical Type
- Mechanical type offers advantage that it doesn't require any consumable. Due to the superior & special design, the odour is non - existent

Working of a Mechanical Waterless Urinal

- Waterless Urinal of mechanical type works on very simple principle of buoyancy effect
- The Urinal will be fixed with a mechanical float made of plastic material.
- Once urination is done, due to the difference in then density of urine and float, float comes up and urine goes to the pipe.
- Once urination is completed, the float goes to the normal location, closing the pipe. This prevents the odour from the pipe
- Since all the urinal is designed in such a way that minimal urine remains in it after usage. Any remaining urine in the ceramic will less than 10 mL and all the ammonia will be evaporated.
- To avoid the urine staining it is recommended to clean the urinal twice a day for which only water is required and hence the 95 % efficacy

The working mechanism is explained in the Fig 12.1

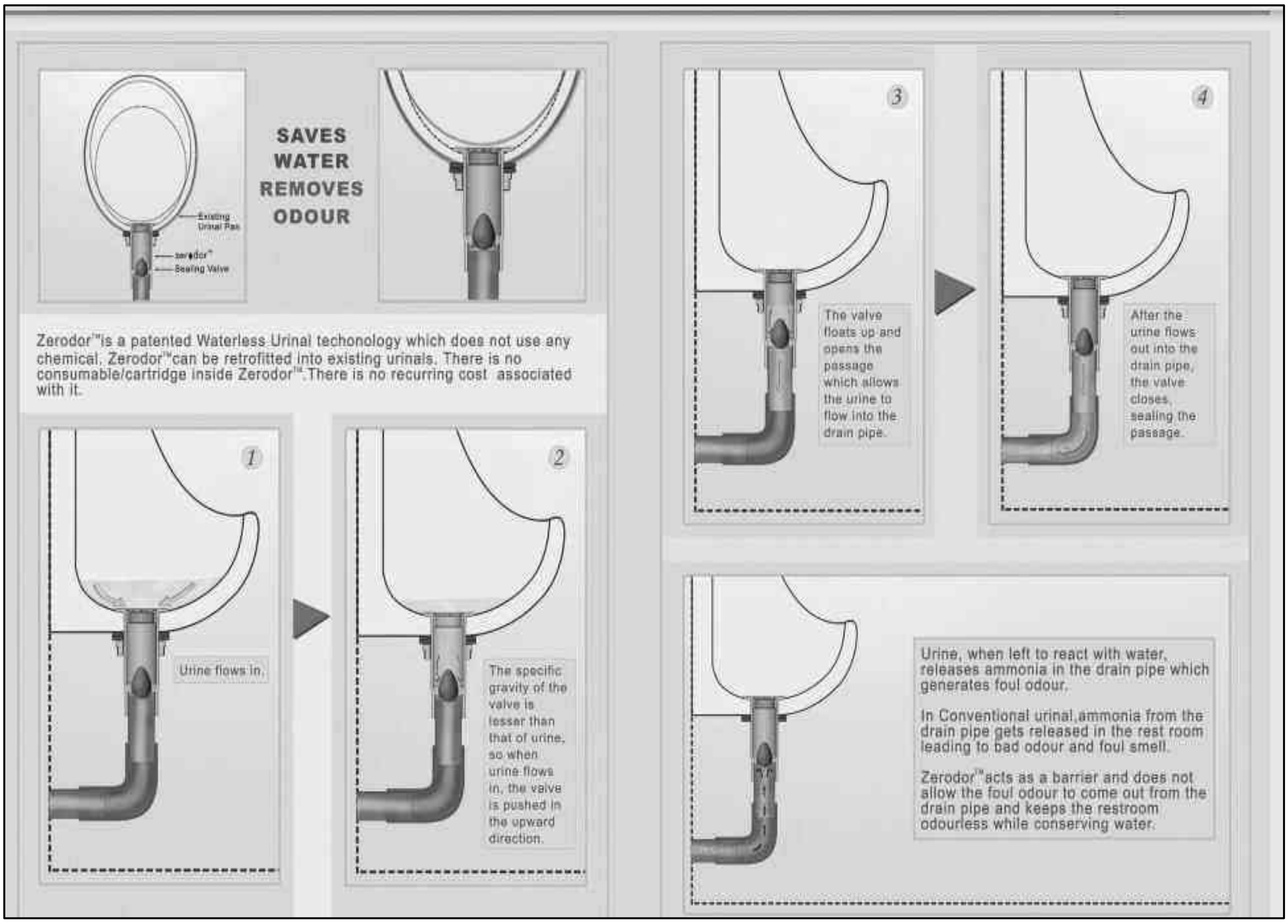


Fig 12.1 : Working of a Waterless Urinal

Recommendation

- Hence, our recommendation is to replace the existing men's urinal with "Waterless Urinal"
- To avoid the urine staining, it is recommended to clean the urinal twice a day with water
- Water savings can be as high as 1.0 kL / day

This proposal is more from performance perspective

13 CONSOLIDATION AND CONCLUSION

13.1 SUMMARY OF IDENTIFIED ENCON PROPOSALS

- The Detailed Energy Assessment (D E A) study carried out on various utilities of the plant, that include Transformers, Air Compressors, Chillers, Cooling Towers, Boiler etc., had revealed a reasonable scope for optimised usage of energy in these.
- Based on our study, **14** energy conservation proposals have been identified, the details of which are presented below

Table 13.1 : Energy Conservation Proposals Identified : A Summary

No	Proposal Description	Energy Savings	Cost Savings	Investment	Payback Period
		kWh / y	₹ / y	₹	months
1	Strategic Co - Firing of sized wood (Casuarina) with conventional Agro-Briquettes in the process boiler as a cost conservation measure of	-	58 00 000	Nil	Immediate
2	Recovery of Condensate from the Steam Traps that are open to ambient and have no collection mechanism	-	3 16 386	8 00 000	30
3	Reducing the Thermal energy loss by redoing the insulation work afresh in identified locations that have either damaged Insulation / Peeled Off insulation exposing bare surface	-	25 92 800	20 00 000	9
4	Improvement of power factor by Rectifying the non- operational / failed Capacitor Banks in order to save on the energy cost payable to PED	3 15 117	21 42 800	15 00 000	9
5	Construction of additional Powerhouse near the Boiler Plant with a view to i)Contain the excessive load experienced by the present Powerhouse ii) Reduce the distribution losses occurring in power transmission to ZLD plant	7 17 500	48 79 000	1 50 00 000	36
6	Reducing the cooling energy loss by redoing the insulation work afresh in identified locations that have either Damaged Insulation /Peeled Off insulation exposing bare surface	44 160	3 00 288	1 50 000	6
7	i) Fitment of Variable Frequency Drive to Primary Pumps & ii) Installation of in - line Condenser Water	3 80 000	25 84 000	22 00 000	10

No	Proposal Description	Energy Savings	Cost Savings	Investment	Payback Period
		kWh / y	₹ / y	₹	months
	Circulation Pump in the Chiller dedicated for Aldehyde Plant for the sake of performance improvement and Energy Usage Optimization				
8	Energy optimization in the operation of Chiller System dedicated to Pharma Plant by way of adoption of (i) VFD operation to the primary brine circulation pump (ii) dedicated in - line condenser pump for this chiller	4 88 000	33 18 400	22 00 000	8
9	Performance improvement of chiller of IBU plant through adoption of the below - listed measures: (i) VFD operation to the primary brine circulation pump & (ii) dedicated in - line condenser pump for this chiller	4 00 000	27 20 000	22 00 000	10
10	Energy Optimization measures proposed in I P C A Chiller operation	3 80 000	25 84 000	20 00 000	10
11	Installation of new Energy Efficient, Low Approach Cooling Tower replacing the existing 2000 TR Utility Cooling Tower for the sake of Energy Conservation	1 47 800	10 05 312	2 00 000	24
12	Pressure drop reduction in Compressor Air generation location	1 34 750	9 16 300	2 00 000	< 3
13	Energy optimization through the use of IoT monitoring system in the Compressed Air system circuit	77 000	5 23 600	5 00 000	< 12
14	Replacement of existing conventional luminaires with appropriate energy efficient LED lamps for the sake of Energy Conservation	36 500	248200	2 50 000	12

The overall anticipated saving is computed as 3120 **MWh / y** in energy and **₹ 3.0 Crores / y** in cost with a onetime investment of **₹ 3.1 Crores** which shall get paid back in about **12 months**. The energy savings expected is 13 % of overall energy consumption of the plant

13.2 AUDIT OBSERVATIONS

- The table drawn below sums - up our observations in respect of Utilities that were at work at the time of detailed energy audit study

Table 13.2 : Audit Observations & Remarks

No	Utilities	Observations & remarks
1	Transformer	• The plant has one 5000 kVA transformer in use which is loaded to around 65% • All day efficiency has been computed as 99.2 % which is quite acceptable • The energy loss estimated was only 22 kW • Thus, the operation of the present transformer appears quite alright
2	Power Control Centre (P C C)	• The load requirement of the plant is distributed through 3 PCCs that are loaded uniformly to a major extent • Harmonics levels in PCC 2 were found to be much higher than the stipulated norms mainly due to the operation of many VFD fitted motors in this PCC • As a whole, nothing adverse has been noticed in the operation of PCCs
3	Capacitor Banks	• The plant has installed 2800 kVAr power factor panels of which only 2300 kVAr were in operation at the time of study • An effectiveness test conducted on capacitor banks has shown an effectiveness of only 48 % (1345 kVAr) indicating the urgency to set right the capacitor banks • This is so, since the plant is charged for kVAh consumed and not kWh • Currently the PF hovers around 0.98 only and hence this suggestion
4	Utility Motors	• Load studies (both kW & Ampere) have been conducted on 32 identified motors that are fitted to Pumps / Fans of Chillers / Boilers / Cooling Towers • The loading had been found to be optimal in majority of the motors barring a few • One of the notable features was the fitment of VFD to appropriate motors for the sake of energy efficiency and that is lauded
5	Air Compressors	• There are three air compressors in operation to meet the process demand • These air compressors are not adequately instrumented making the evaluation of the operating performance a difficult task • Energy consumption due to Air Compressors alone is close to **5500 kWh / d** which accounts for 8 % of the total energy consumption of the plant • It was also noticed that the performance of one of the Driers is not up to the mark • More attention is needed to be paid in respect of the operation of the air compressors as these are energy guzzlers

No	Utilities	Observations & remarks
6	Cooling Towers	• There are 5 cooling towers of cumulative load of **6300 TR** installed in the plant • It was recorded that the effectiveness of 2 out of 5 CTs are quite less and that of one cooling tower is only moderate. • It is felt that the performance levels of all cooling towers will have to be enhanced • A dedicated effort in this direction is suggested
7	Pumps of Chiller + Process CTs	• In all, 19 pumps have been studied for their performance • Pumps of Utility section 2000 TR perform reasonably well while the pumps handling Brine, Chilled Water, Process Water in ZLD,1500 TR& 500 TR were all performing below par Hence, it is recommended to take up a dedicated study on these pumps to upgrade the efficiency, wherever possible , by way of pump swapping, pump replacement ,operating parameters optimisation of the pumps nearer to the designed parameters
8	Chiller Systems	• There are 4 Chillers in the plant operating on Vapour Compression Principle and one on Vapour Absorption Principle • A performance study conducted had revealed that 3 (Aldehyde, IBU & IPCA) Chillers delivered TR at the rate of less than 50 % of that designed. • Likewise, Specific Energy Consumption evaluated in terms of “kW/ TR “ for all the 3 Chillers were found to be higher. • The performance of VAM Chiller is below par • A detailed & focussed study may be taken – up on all the Chillers in order to weed out the inefficiencies encountered in the operation • In short, it is time that the performance of Chillers is enhanced
9	Boilers	• The plant has installed 2 agro briquette fired boilers of **16 tph** capacity each • Forbes Vyncke boiler is majorly used, and it offers an overall thermal efficiency of around 75% . The major loss is due to H_2 which cannot be avoided since the fuel fired is an agro residue • The steam fuel ratio recorded is 5.17 which is quite acceptable
10	Steam Traps	• There were 41 steam traps installed in the steam header and sub header lines that were diagnosed • Of these, 16 were not in operation and 8 were faulty traps. These will have to be set right • Further, it was noticed that the condensate from the traps is not collected which is a waste of mass & energy. • Hence, efforts shall be made to collect the unrecovered condensate and use it back in the boiler

No	Utilities	Observations & remarks
11	Condensate Recovery	• Overall condensate recovery was 2/3rd of the steam generation • The condensate that goes unrecovered is as much as **110 tons / day** and hence action must be initiated to collect the unrecovered condensate to the extent possible • This can result in reasonable savings in cost
12	Insulation	• A thermographic survey was undertaken on hot surfaces as well as cold surfaces of the plant • In a couple of locations, it was found that the insulations were damaged / peeled off exposing bare surfaces • An estimate has been made on the "**Energy Los**t" due to faulty insulation and presented in Chapter 11 Therefore, it is suggested that the insulation shall be redone at the locations identified in order to minimize the energy / cost loss
13	Illumination	• The plant has replaced majority of the conventional luminaires with LED lamps • Energy consumption due to illumination accounts for less than 3% of total energy consumption of the plant which is reasonable / acceptable enough. A solitary suggestion made in the report is to replace the 215 Nos of 125 W HPSV by appropriate equivalent LED lamps to further prune down the energy consumption due to illumination

13.3 SUM - UP

➢ As a sum up exercise , our conclusions are stated below :

a) The following utilities perform to satisfactory levels :

- Transformers
- Boilers
- PCCs
- Illumination
- Steam Traps
- Motor in respect of their Loading

b) The following utilities require “re - visit” in order to make them perform better from energy consumption perspective :

- ❖ Air Compressors
- ❖ Cooling Towers
- ❖ Pumps
- ❖ Chillers
- ❖ Condensate Recovery System

- Further, attention shall be focused specifically on the Load Sharing / Distribution through the Powerhouse as it appears to have been overloaded and has poor ventilation for heat dissipation
- Similarly, the compressed air distribution scheme shall be taken up for scrutiny as it appears that the operation is inefficient at present compounded by poor instrumentation
- Recommendations have been made to address these identified major issues and that will likely call for investment
- The energy conservation proposals made in this report are techno - commercially viable & attractive ones and hence, shall be taken up for implementation to weed out the technical inadequacies pointed out

As such, the performance of the utilities can be graded in the range of 6 - 7 in the scale of 10 and the aim shall be to upgrade this further.

14 THERMOGRAPHY STUDY OUTCOME

14.1 INTRODUCTION

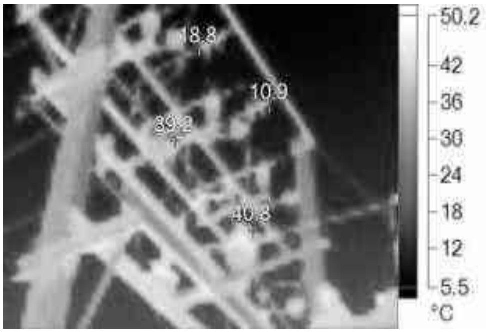
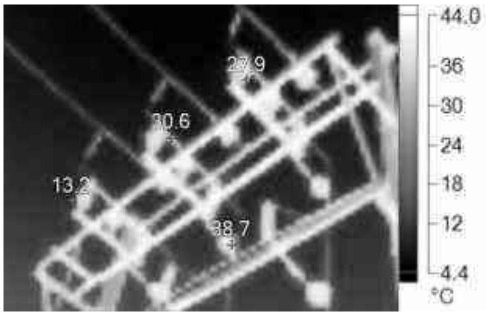
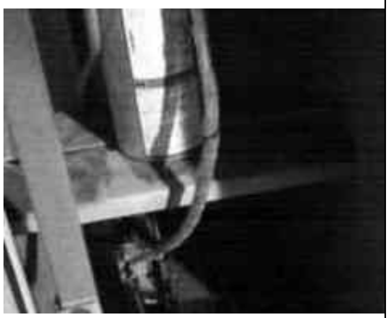
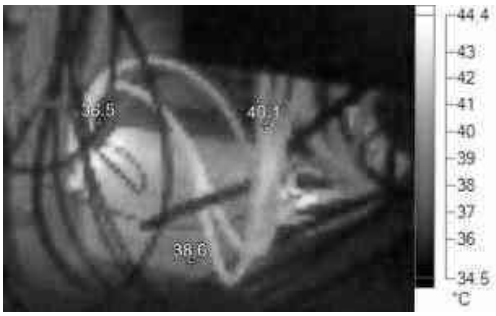
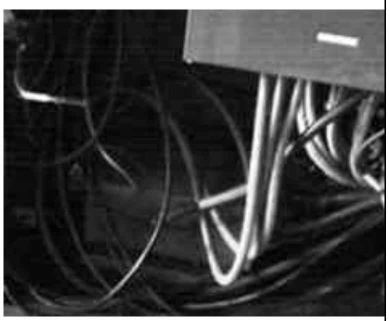
- Thermography is an extremely influential method of practically monitoring, sensing, and recording the temperature – a reflection of heat. It further assists in effectively troubleshooting any electrical, mechanical, electronics and structural system. Infrared Thermal Imaging offers accurate data related to the problems that remain undetected using standard visual inspection and diagnostic techniques. It offers solutions to the problems that cannot be seen with the naked eye being clearly visible with thermal imaging. An assessment of electrical safety has been done using thermal imaging camera.
- The thermal images captured on electrical systems include Panel Boards, Cables, Bus Bars etc. In all, thermo mapping was carried out at 127 locations. It is suggested that the electrical system issues are sorted out at the earliest as they impact the safety. The thermal images captured are expected to bring in safety in electrical systems, savings in terms of energy (though not significant) as well as reduction in maintenance cost to the management.
- The International Electrical Testing Association provides the guidelines [shown in the following Table] that aid in determining the degree of severity of an electrical problem.

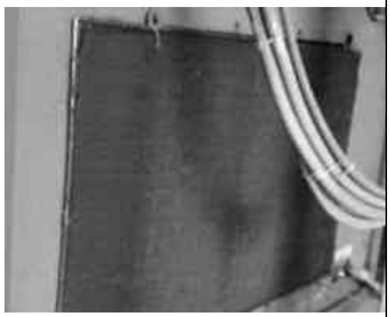
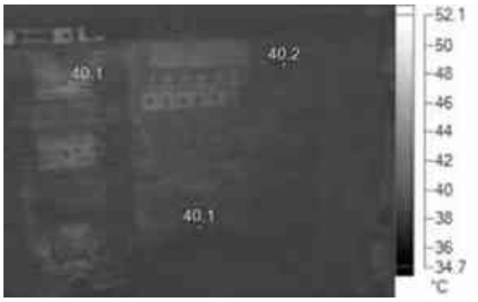
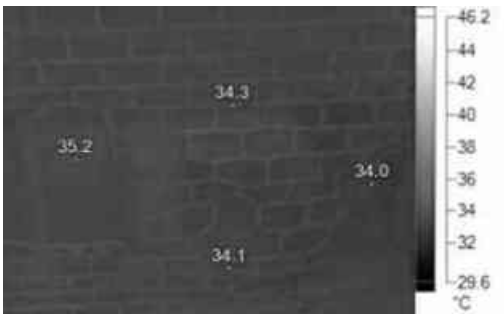
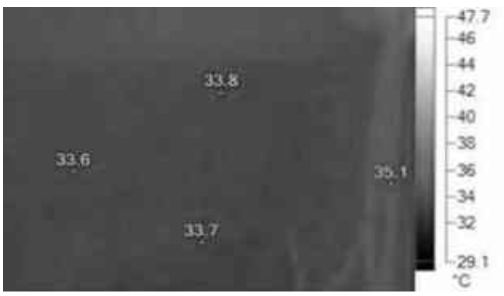
Problem Classification	Temperature Range	Comments
Mild	30 °C - 40 °C	Repair during regular maintenance schedule ; Limited probability of physical damage
Moderate	41 °C - 60 °C	Repair soon (2 - 4 weeks). Watch load and change accordingly. Inspect for physical damage.
Serious	61 °C - 70 °C	Repair within 1 or 2 days. Replace component and inspect the surrounding components for probable damage.
Critical	Above 70 °C	Repair immediately. Replace component, inspect surrounding components for damage

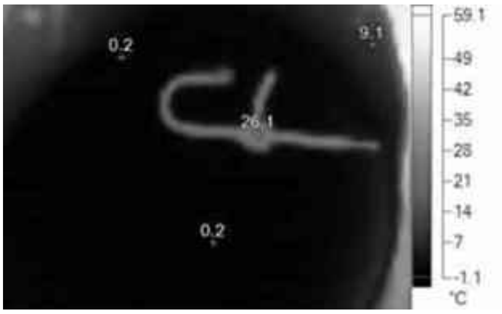
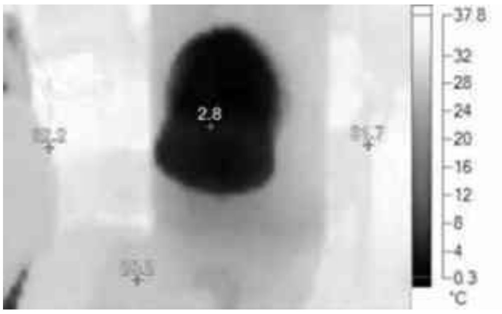
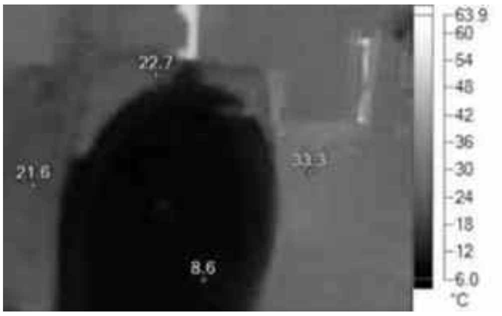
14.2 OUTCOME

The outcome is presented in this section as per the categorisation made

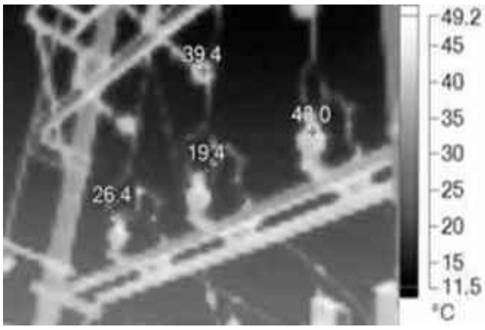
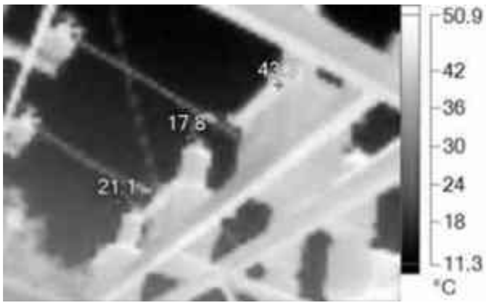
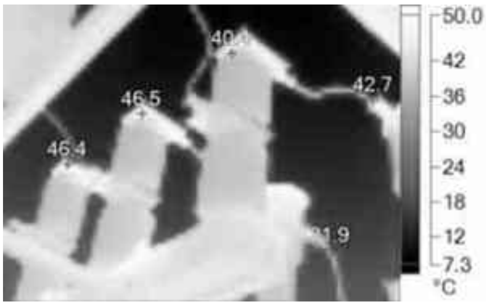
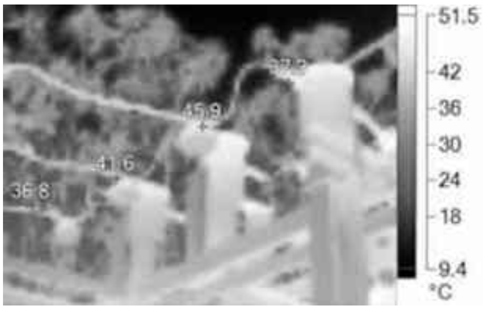
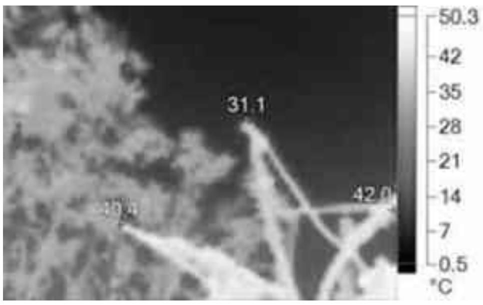
14.2.1 Category : Mild : No of Locations : 13 : Temp: 30 - 40 °C

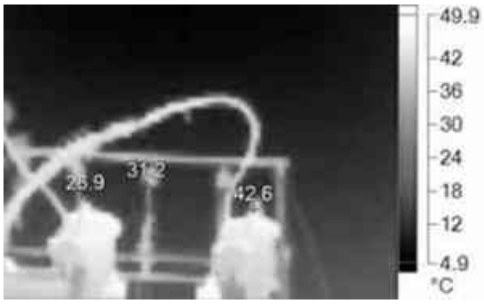
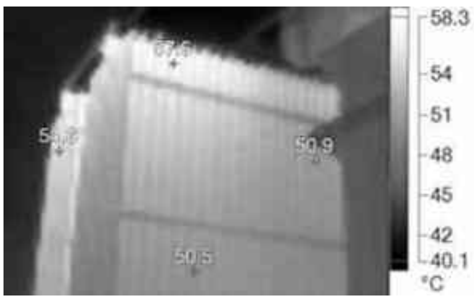
No	Location	Thermal image	Normal image	Temp° C	Time
1	22 kV Two Pole Switch Yard			**40.8**	**12:44 PM**
2	22 kV Switch Yard			**38.7**	**12:44:49 PM**
3	Capacitor Panel 4, 15 kVAR Capacitor			**39.6**	**5:01:45 PM**
4	UACP 2012			**40.1**	**5:52:13 PM**

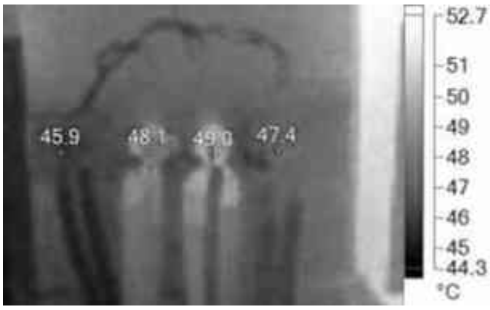
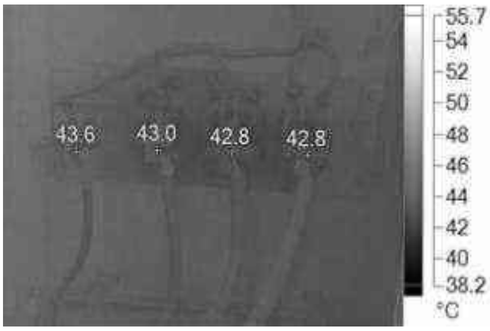
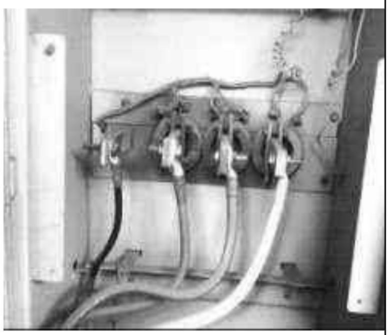
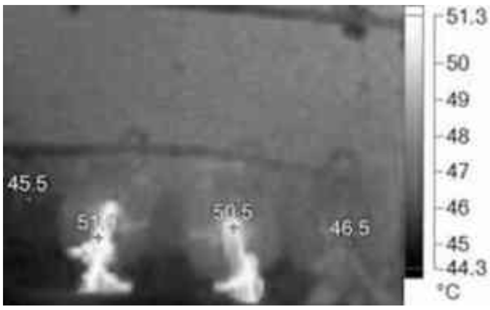
No	Location	Thermal image	Normal image	Temp° C	Time
5	UACP 2016 I / C from PC 02 / 113			**33.9**	**6:03:18 PM**
6	Lighting panel IBU plant MLDB 01 / F10			**40.2**	**4:40:45 PM**
7	Lighting Panel Powerhouse D B - 01			**38.7**	**4:40:39 PM**
8	Air Compressor 2010 I / C			**35.2**	**6:00:45 PM**
9	Boiler House Block – 25 Air Compressor UACP 2012			**33.8**	**6:02:09 PM**

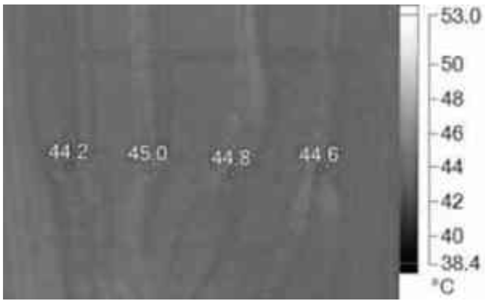
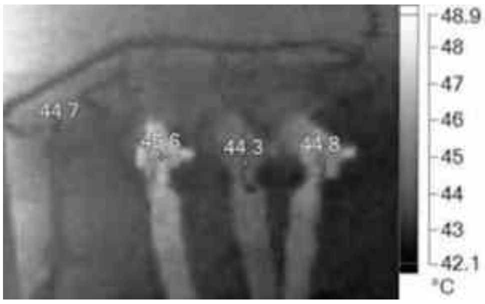
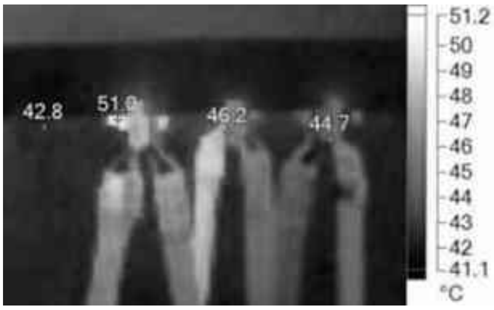
No	Location	Thermal image	Normal image	Temp° C	Time
10	Chiller Unit UCCH 2018			36.1	8:00:35 PM
11	Chiller Unit UCCH 2018			32.2	8:02:18 PM
12	Chiller Unit UCCH 2019			33.3	8:04:02 PM
13	Chiller Unit UCCH 2022			37.3	8:02:11 PM

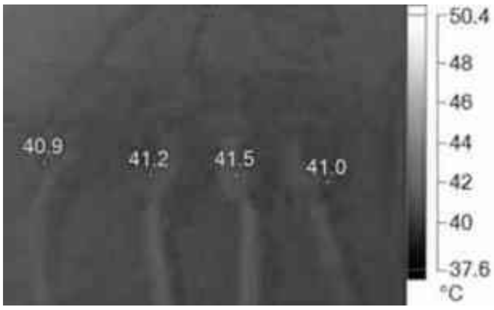
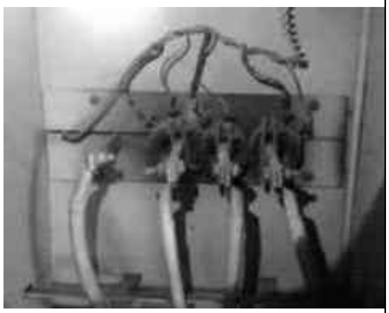
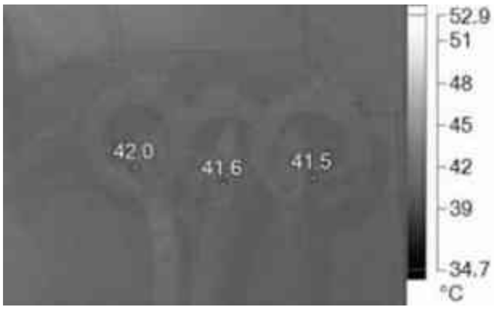
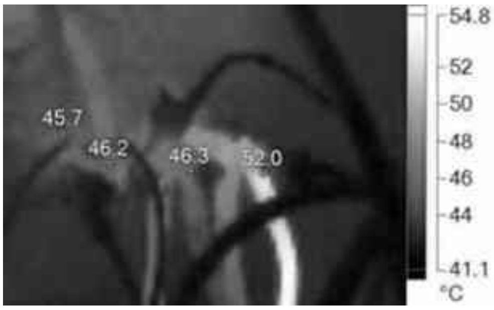
14. 2 .2 : Category : Moderate : No of Locations : 73 : Temp: 40 - 60 °C

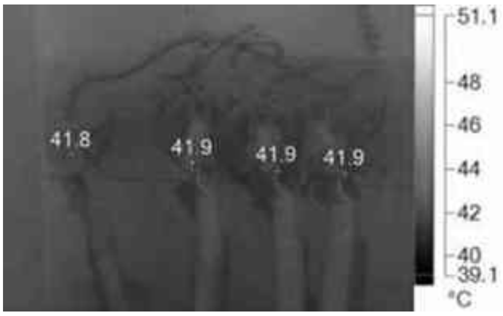
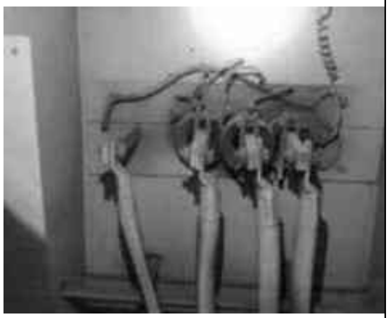
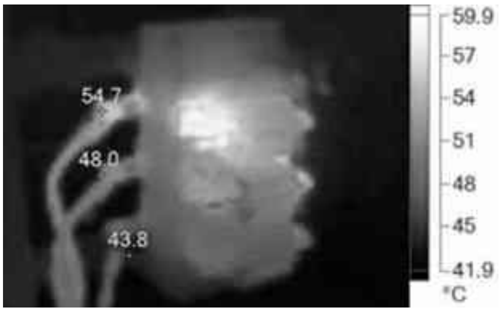
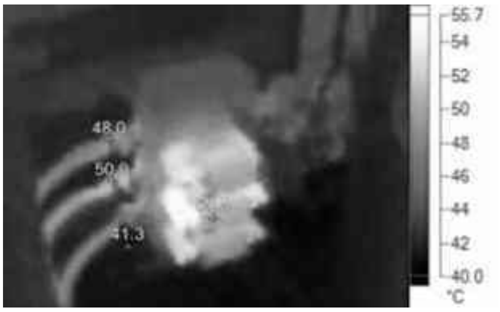
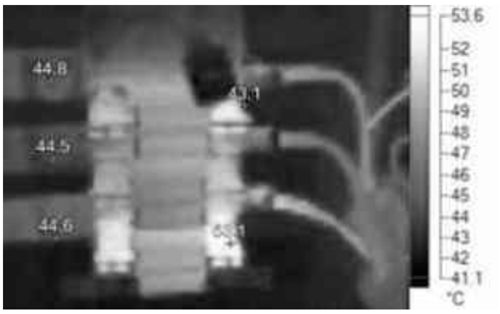
No	Location	Thermal image	Normal image	Temp° C	Time
1	22 kV switch Yard two pole switch			**43.0**	**12:45:02 PM**
2	22 kV switch Yard			**43.3**	**12:45:26 PM**
3	22 kV Switch Yard C T & P T			**46.5**	**12:46:29 PM**
4	22 kV Switch Yard C T			**45.9**	**12:47:16 PM**
5	22 kV switch Yard H T Cable Terminal Side			**42.0**	**12:47:53 PM**

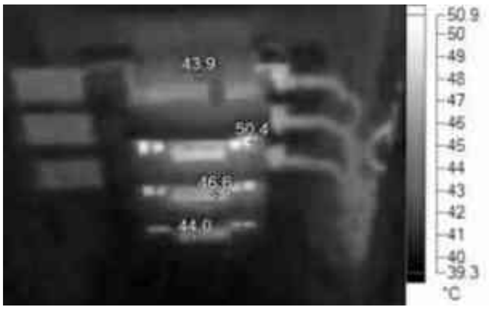
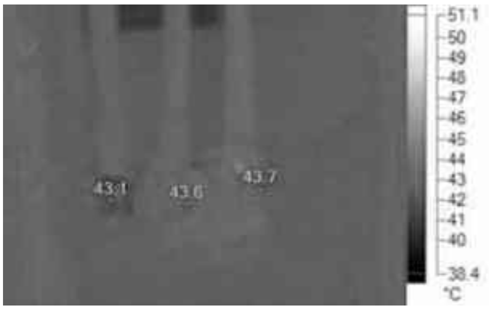
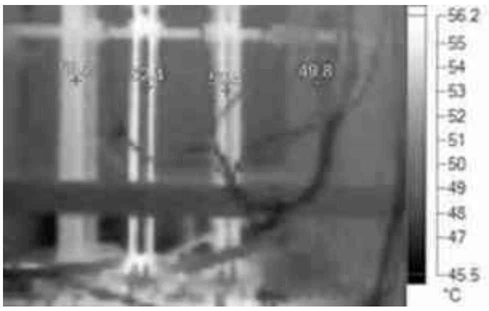
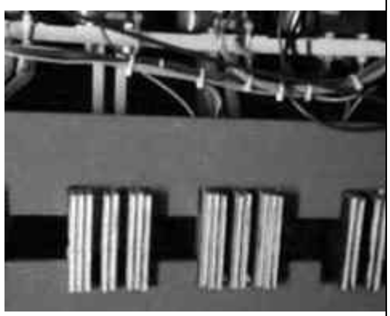
No	Location	Thermal image	Normal image	Temp° C	Time
6	22 kV HT Yard P T & C T			**42.6**	**12:47:59 PM**
7	5 MVA Transformer Main View			**59.9**	**12:49:24 PM**
8	5 MVA Transformer H T Cable Side			**55.8**	**12:50:29 PM**
9	5 MVA Transformer Side view			**57.6**	**12:50:36 PM**
10	1 IPCA & Recovery O / G			**43.0**	**1:11:03 PM**

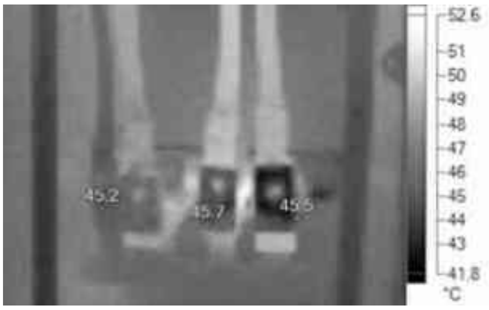
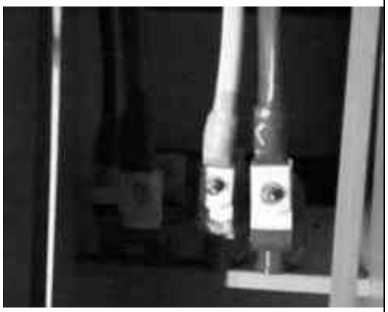
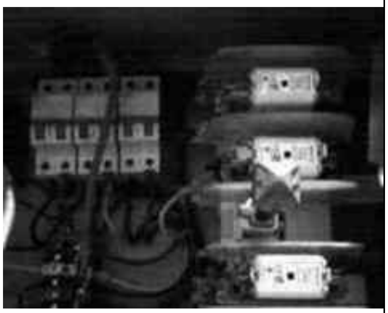
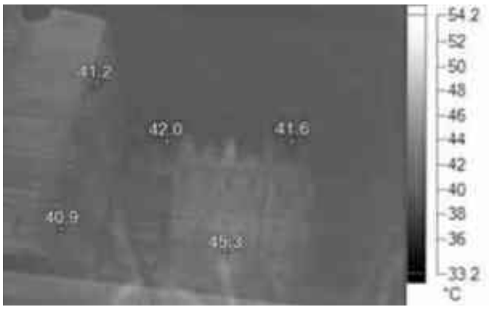
No	Location	Thermal image	Normal image	Temp° C	Time
11	1 Air Compressor west O / G			**44.9**	**1:13:05 PM**
12	1 IBU private PC 01 / 08 O / G			**49.0**	**1:18:07 PM**
13	1 Pharma South & Pillar Main			**46.1**	**1:19:09 PM**
14	1 Fire hydrant O / G			**43.6**	**1:19:25 PM**
15	1 Pilot Plant & Canteen PC (01 / 03)			**51.0**	**1:20:25 PM**

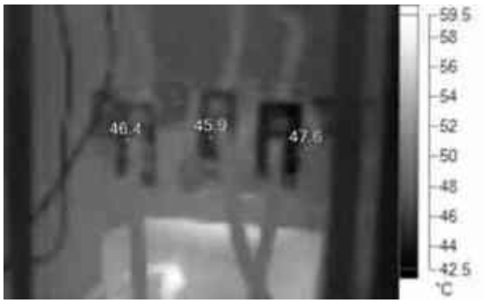
No	Location	Thermal image	Normal image	Temp° C	Time
16	1 IBU & Aldehyde PC 01 / 14			**45.0**	**1:21:10 PM**
17	PCC 2 IBU Packing PC 02 / 02			**46.6**	**1:23:02 PM**
18	PCC2 Chiller Plant North			**42.6**	**1:24:41 PM**
19	PCC - 2 Boiler PC 02 / 06			**45.3**	**1:26:09 PM**
20	PCC -2 Aldehyde PC 02 / 07			**51.0**	**1:26:44 PM**

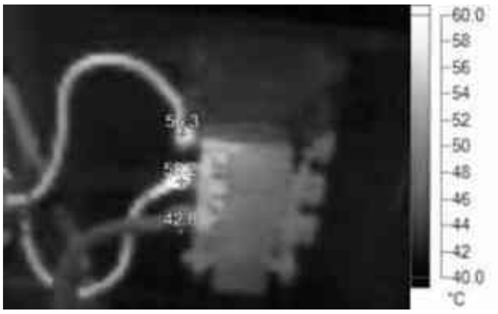
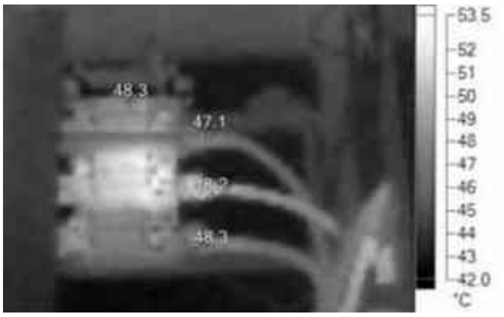
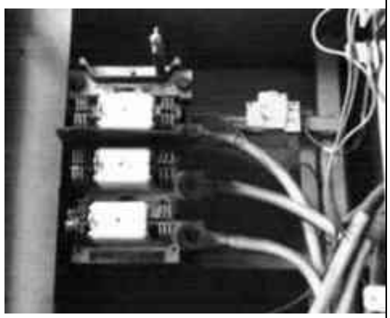
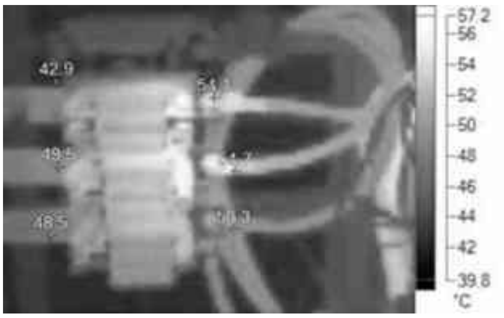
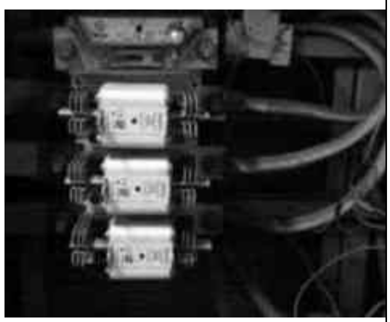
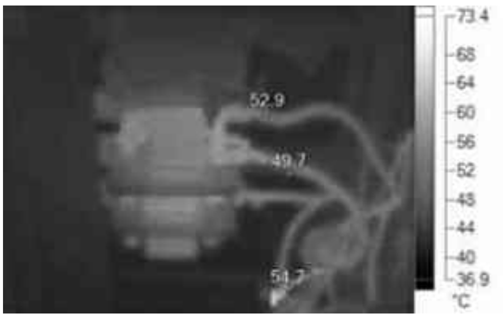
No	Location	Thermal image	Normal image	Temp° C	Time
21	PCC 2 Cooling Tower East PC 02 / 08			**50.4**	**1:27:09 PM**
22	PCC - 2 Pharma North O / G			**41.5**	**1:27:37 PM**
23	PCC - 2 IBU Packing P C 02 / 11			**41.6**	**1:28:01 PM**
24	2 NEW 120 HP Air Compressor PC 02 / 13			**52.0**	**1:30:01 PM**
25	02 ETP PC 02 / 15 O / G			**49.7**	**1:31:32 PM**

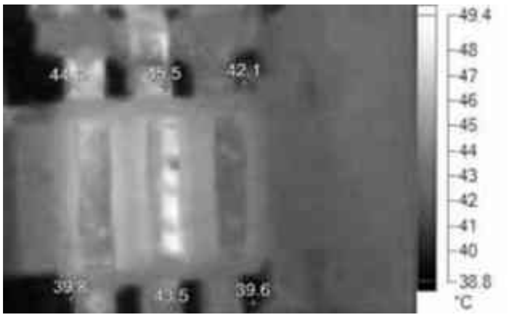
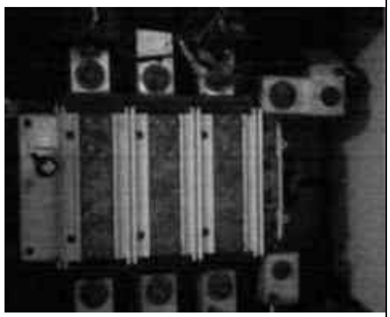
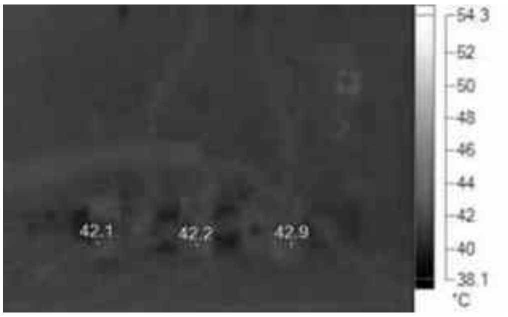
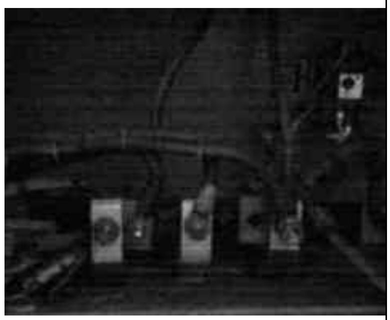
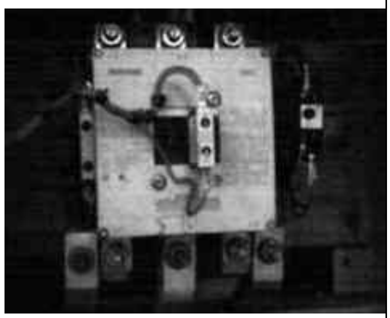
No	Location	Thermal image	Normal image	Temp° C	Time
26	2 new RO (PC 02 / 16)			**41.9**	**1:31:52 PM**
27	MV Panel Room Capacitor Panel - 1			**54.7**	**3:59:03 PM**
28	Capacitor Panel 1 Capacitor - 4 O / G			**50.4**	**3:59:12 PM**
29	Capacitor Panel			**43.9**	**4:01:03 PM**
30	Capacitor Panel			**53.1**	**4:01:12 PM**

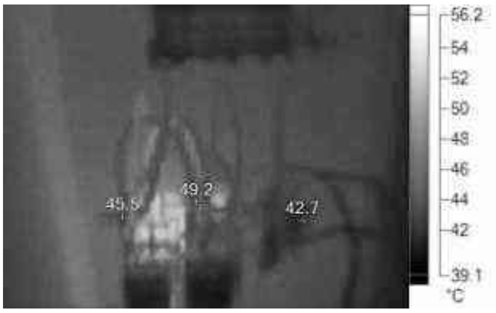
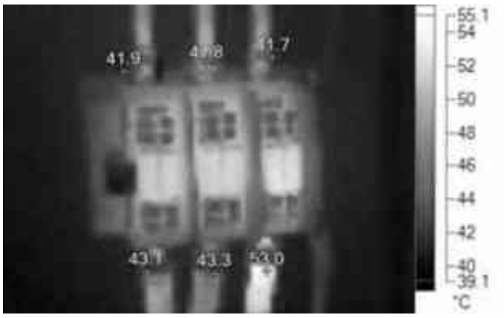
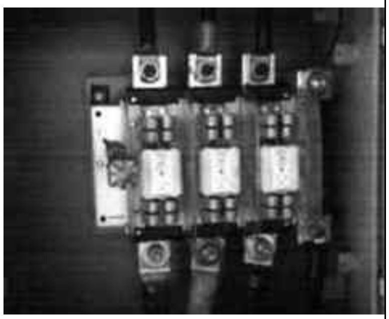
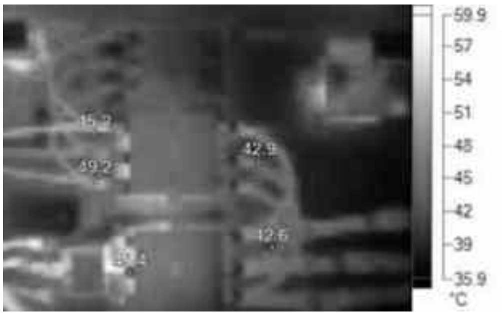
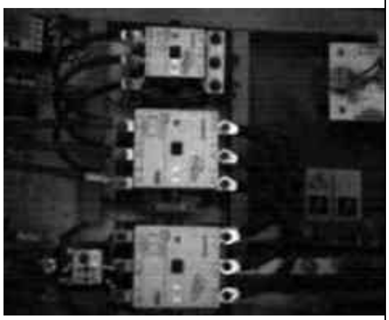
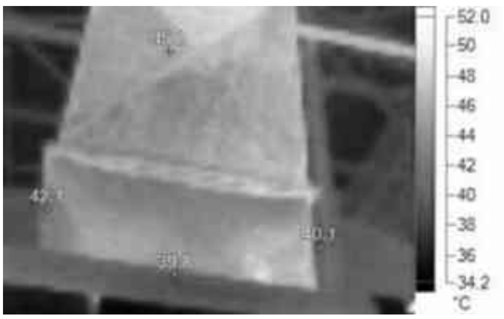
No	Location	Thermal image	Normal image	Temp° C	Time
31	Capacitor Panel			**50.4**	**4:01:22 PM**
32	PCC - 03 Pillar UPS O / G			**44.9**	**4:05:14 PM**
33	03 Cinacalcet Main O / G			**43.7**	**4:05:30 PM**
34	3 Main Incomer MV 01 / 04			**53.2**	**4:08:03 PM**
35	3 Main Incomer MV 01 / 04			**50.3**	**4:08:13 PM**

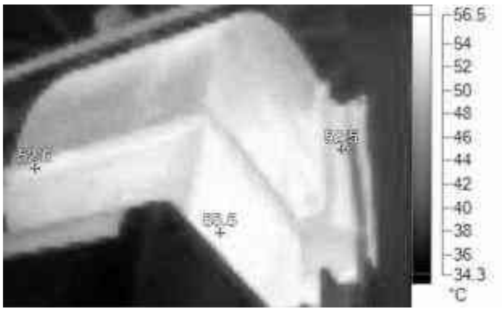
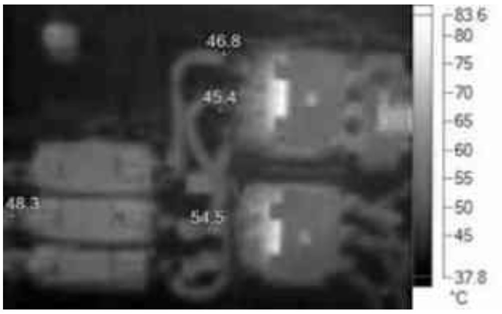
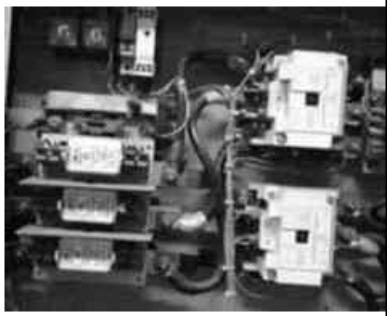
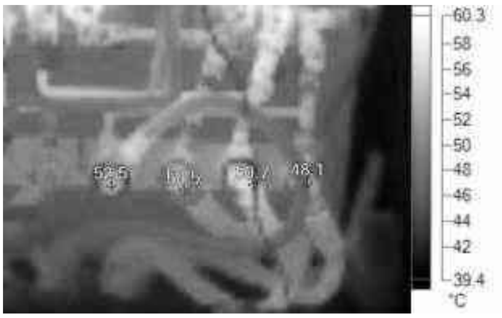
No	Location	Thermal image	Normal image	Temp° C	Time
36	3 PC 03 / 08 New 120 HP Air Compressor South			**45.7**	**4:08:28 PM**
37	Lighting Panel back side Pharma Plant MLDB 01 / F 20			**47.2**	**4:30:02 PM**
38	Lighting Panel Back Side 2 D Plant M L D B U 1 / F 19			**42.2**	**4:30:31 PM**
39	Lighting Panel back side Aldehyde Plant MLDB 01 / F18			**45.9**	**4:30:47 PM**
40	Lighting Panel back side Powerhouse D B 3			**45.3**	**4:31:02 PM**

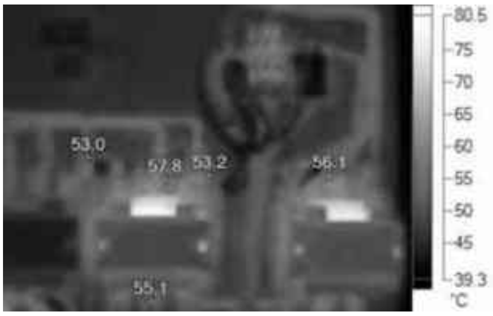
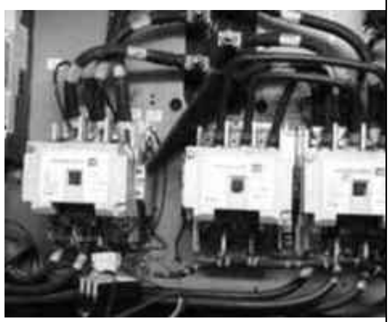
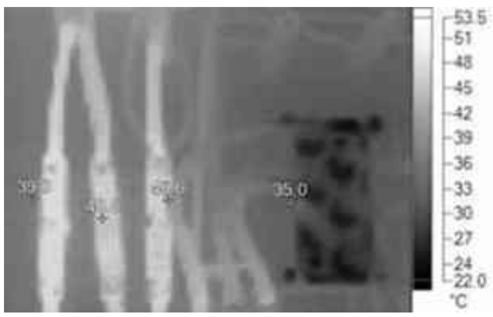
No	Location	Thermal image	Normal image	Temp° C	Time
41	3 panel PC 03 / Capacitor 100 kVAR			**47.1**	**4:36:39 PM**
42	3 panel PC 03 / 10 Capacitor 2 x 50 kVAR O / G			**48.1**	**4:36:50 PM**
43	3 panel Trane Chiller West 450 T R			**47.6**	**4:37:00 PM**
44	Lighting Panel Powerhouse DB MLDB 01 / F09			**48.5**	**4:40:52 PM**
45	Capacitor Panel -2 Incomer			**43.8**	**4:40:59 PM**

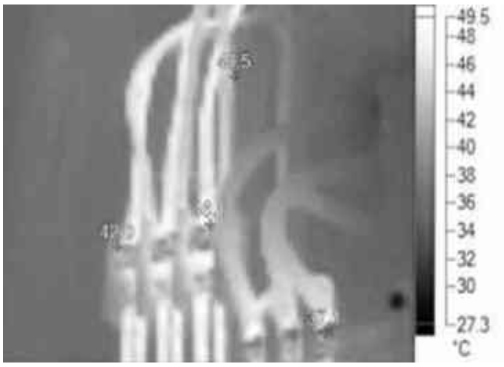
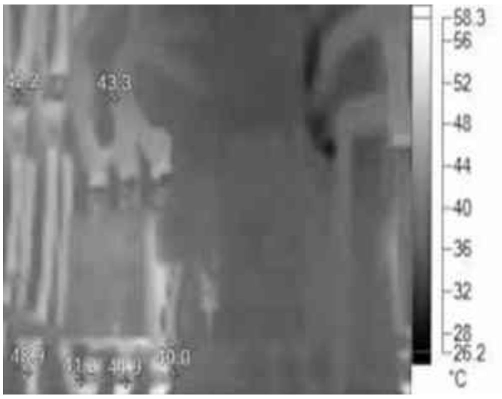
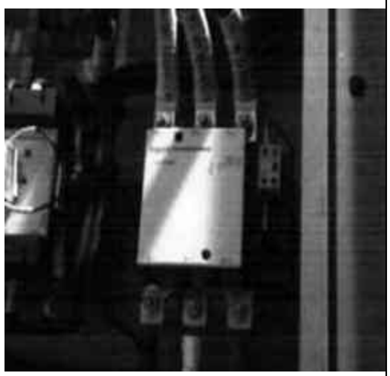
No	Location	Thermal image	Normal image	Temp° C	Time
46	Capacitor Panel -2 Capacitor O / G -1			**44.5**	**4:44:37 PM**
47	Capacitor Panel -2 Capacitor O / G - 4			**58.2**	**4:47:46 PM**
48	Capacitor Panel -2 Capacitor O / G - 6			**48.3**	**4:49:07 PM**
49	Capacitor Panel -2 Capacitor O / G - 7			**54.7**	**4:49:15 PM**
50	Capacitor Panel -2 Capacitor O / G - 8			**54.7**	**4:49:25 PM**

No	Location	Thermal image	Normal image	Temp° C	Time
51	Capacitor Panel - 3 incomer			**45.5**	**4:53:00 PM**
52	Capacitor Panel 3 , 2 x 50 kVAR Capacitor (F1)			**43.9**	**4:53:19 PM**
53	Capacitor Panel 3, 2 x 50 kVAR Capacitor (F 2)			**42.9**	**4:53:25 PM**
54	Capacitor Panel - 4 Main Incomer			**44.0**	**4:53:38 PM**
55	Capacitor Bank - 4 , 15 kVAR			**46.9**	**5:01:10 PM**

No	Location	Thermal image	Normal image	Temp° C	Time
56	Capacitor Panel 4 , 50 kVAR Stage -1			**49.2**	**5:03:13 PM**
57	Air Compressor 2012 Main Incomer			**53.0**	**5:51:28 PM**
58	UAC P2010 Incomer			**49.2**	**5:54:06 PM**
59	Air Compressor 2010 I / C			**60.1**	**6:00:24 PM**
60	Boiler House Block - 25 Air Compressor UACP 2012			**45.8**	**6:01:57 PM**

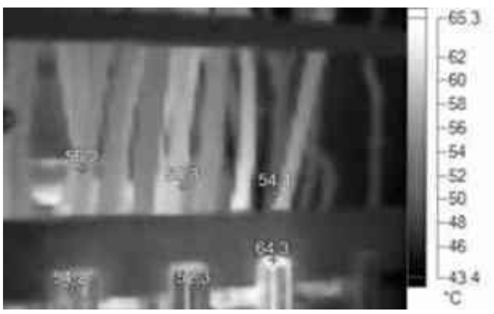
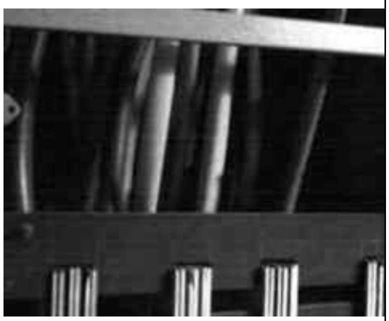
No	Location	Thermal image	Normal image	Temp° C	Time
61	UACP 2016 I / C from PC 02 / 113			**55.5**	**6:03:28 PM**
62	MC 208 / 08 Chilled Water 75 HP (west) North Chiller			**48.3**	**6:32:35 PM**
63	MC 208 / F08 Chilled Water 75 HP (West) North Chiller			**53.5**	**6:33:23 PM**
64	MC 2 08 / F06 Pharma Chiller O / G			**53.3**	**6:34:18 PM**
65	500 TR Pharma Cooling Tower			**52.5**	**6:40:10 PM**

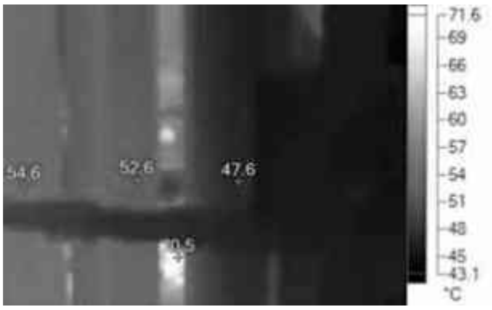
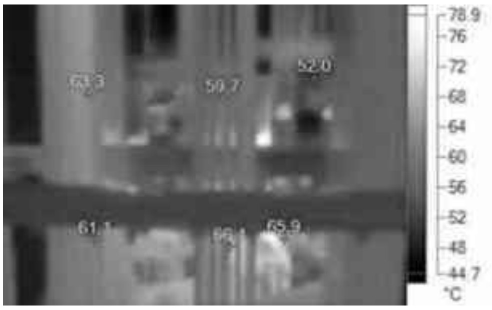
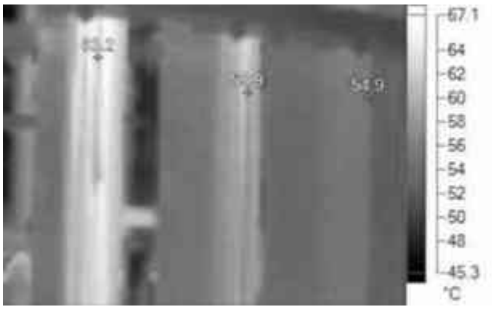
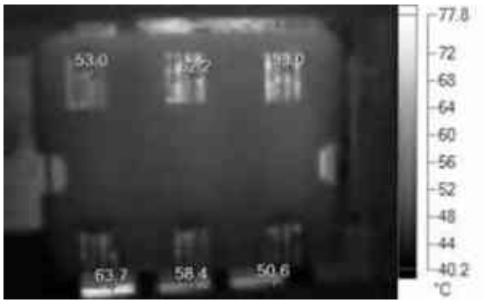
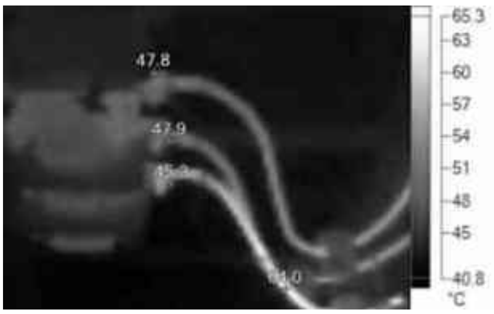
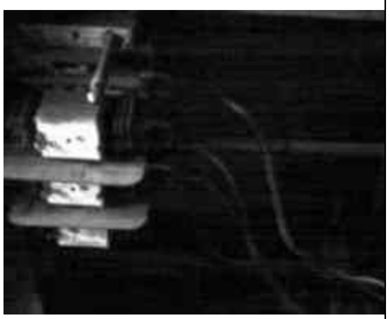
No	Location	Thermal image	Normal image	Temp° C	Time
66	500 TR Pharma Cooling Tower			**57.8**	**6:40:20 PM**
67	Chiller Unit UCCH 2022			**44.7**	**7:58:22 PM**
68	Chiller Unit UCCH 2022			**45.2**	**7:58:37 PM**
69	Chiller Unit UCCH 2019			**48.6**	**7:59:56 PM**
70	Chiller Unit UCCH 2018			**47.0**	**8:00:05 PM**

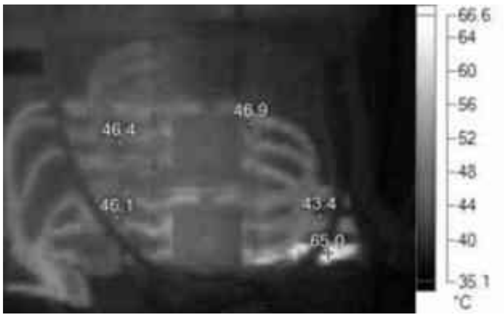
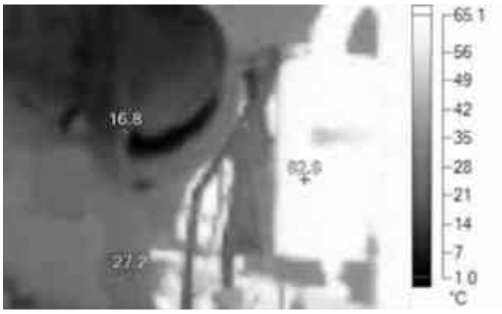
No	Location	Thermal image	Normal image	Temp° C	Time
71	Chiller Unit UCCH 2019			46.1	8:04:17 PM
72	Chiller Unit UCCH 2019			48.9	8:04:31 PM
73	Chiller Unit UCCH 2019			53.3	8:04:38 PM

14.2.3 Category : Serious : No of Locations : 13 : Temp: 60 - 70 °C

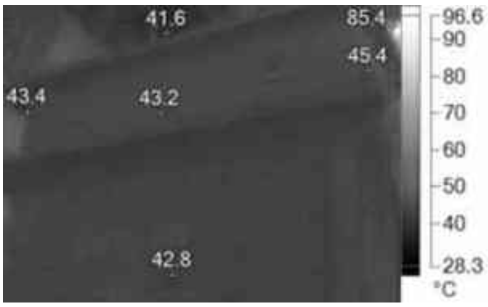
No	Location	Thermal image	Normal image	Temp° C	Time
1	5 MVA Transformer Side View			69.3	12:51:05 PM

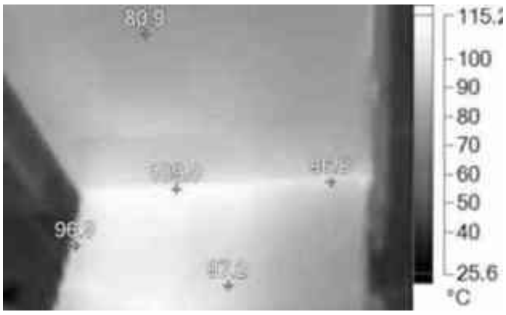
No	Location	Thermal image	Normal image	Temp° C	Time
2	1 Chiller south PC 01 / 06			**65.9**	**1:16:17 PM**
3	1 IPCA PC 01 / 09 O / G			**71.1**	**1:18:40 PM**
4	EPCC-2 Cooling Tower South P C 2 / 03			**121.9**	**1:23:59 PM**
5	2 New 120 HP Air Compressor West			**98.1**	**1:28:49 PM**
6	PCC Panel - 3 Z L D O / G			**64.3**	**4:04:05 PM**

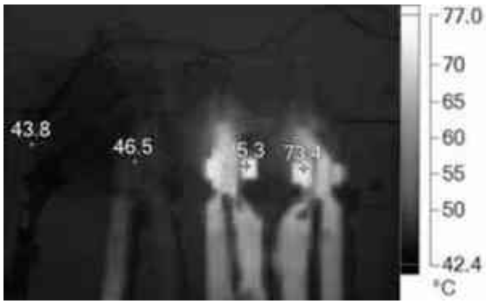
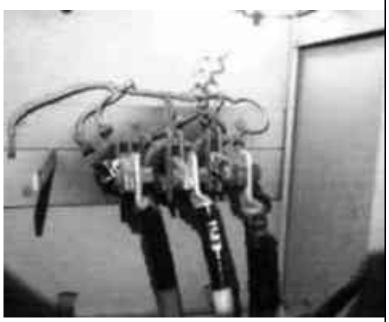
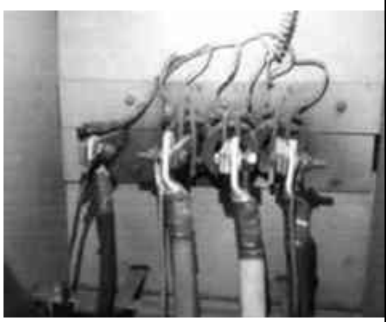
No	Location	Thermal image	Normal image	Temp° C	Time
7	5 MVA Transformer LT Incomer			**70.5**	**4:13:19 PM**
8	5 MVA Transformer Secondary Side LT Main Incomer			**65.9**	**4:13:29 PM**
9	5 MVA Transformer Secondary Side LT Main Incomer			**63.2**	**4:13:39 PM**
10	Lighting Panel Main Incomer			**63.7**	**4:39:18 PM**
11	Capacitor Panel -2 Capacitor O / G -2			**64.0**	**4:45:02 PM**

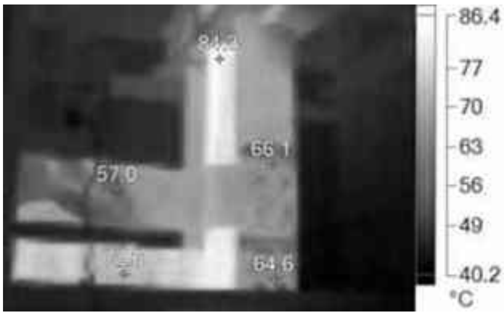
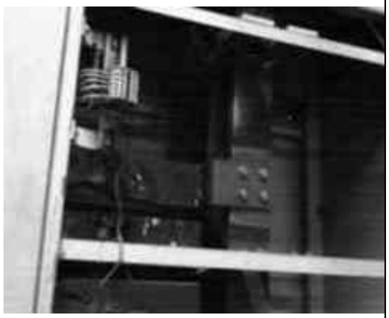
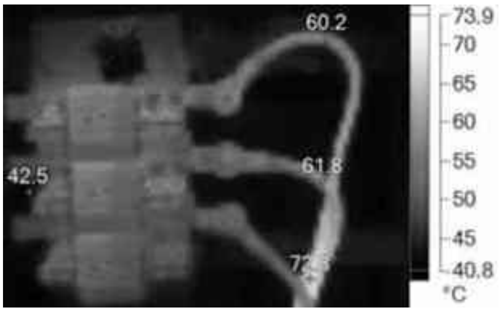
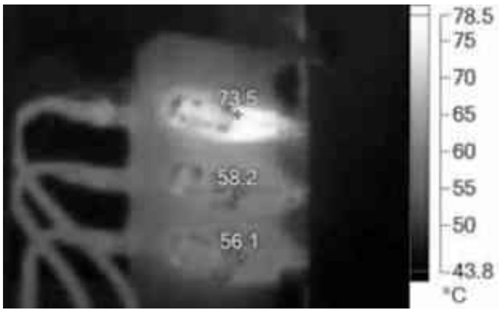
No	Location	Thermal image	Normal image	Temp° C	Time
12	Air Compressor UACP 2010 Incomer			**65.0**	**5:57:53 PM**
13	Chiller Unit UCCH 2022			**62.8**	**8:00:45 PM**

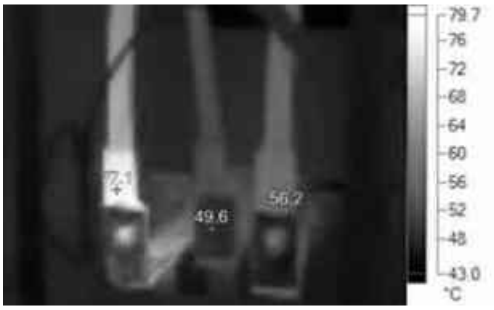
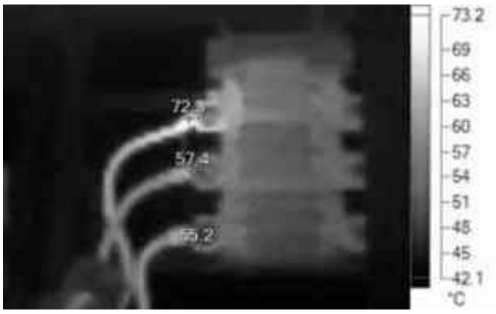
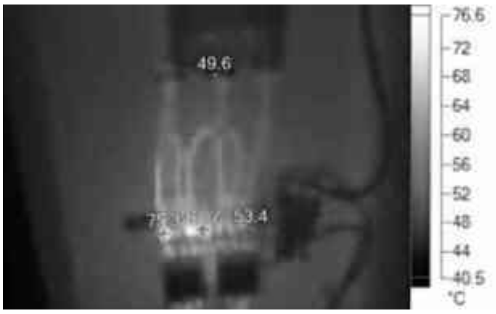
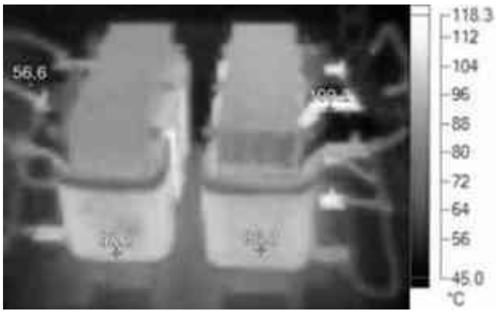
14.2.4 Category : Critical : No of Locations : 28 Temp: > 70 °C

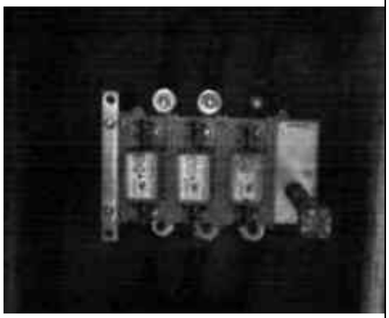
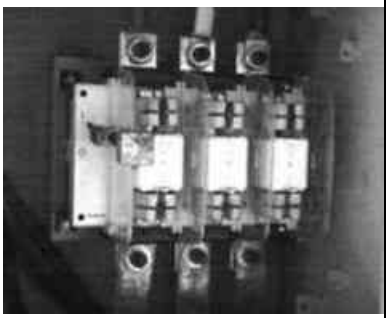
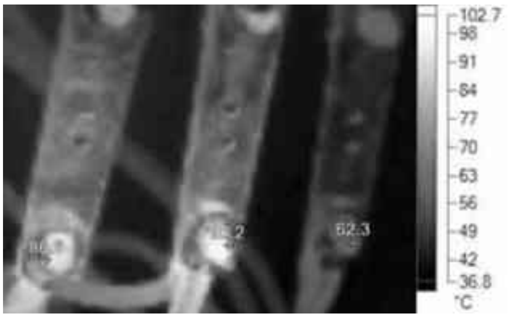
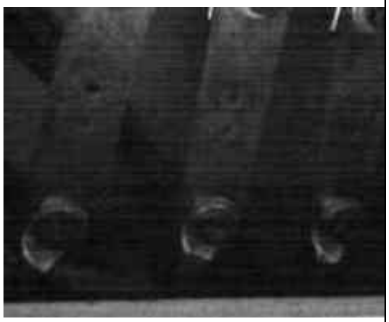
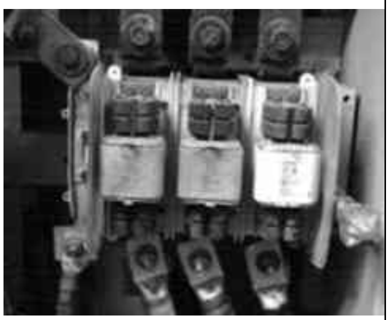
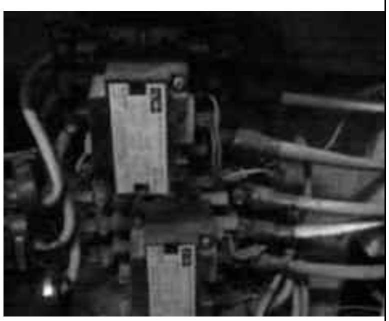
No	Location	Thermal image	Normal image	Temp° C	Time
1	5 MVA Transformer Main View			**83.9**	**12:49:46 PM**
2	5 MVA Transformer H T Side			**85.4**	**12:50:15 PM**

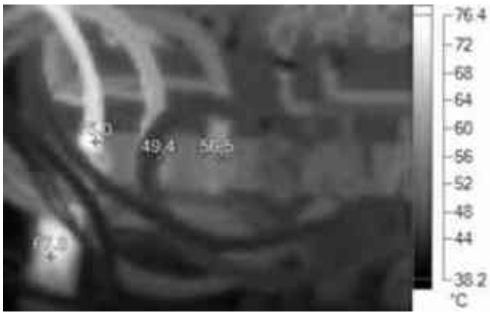
No	Location	Thermal image	Normal image	Temp° C	Time
3	5 MVA Transformer Side View			75.1	12:50:53 PM
4	5 MVA Transformer Bus Bar Side - LT			111.1	12:51:24 PM
5	5 MVA transformer LT Bus Bar Side			109.0	12:51:32 PM
6	MV Panel Room 5 MVA Transformer Side View			108.0	12:51:47 PM
7	1 New I B U Private PC 01 / 02			96.0	1:11:42 PM

No	Location	Thermal image	Normal image	Temp° C	Time
8	01 Cooling Tower (west) PC01 / 04 O / G			**85.9**	**1:14:08 PM**
9	1 PC Packing PC 01 / 05 O / G			**76.4**	**1:15:07 PM**
10	PCC 2 Chiller Plant South PC 02 / 05			**75.3**	**1:25:16 PM**
11	2 TRANE Chiller East 300 TR			**150.8**	**1:31:01 PM**
12	2 Lighting PC 02 / 17			**75.2**	**1:32:05 PM**

No	Location	Thermal image	Normal image	Temp° C	Time
13	Capacitor Panel -1 Incomer			**84.3**	**3:53:13 PM**
14	Capacitor Panel -1 Capacitor - 3 O / G			**74.1**	**3:54:38 PM**
15	Capacitor Panel -1 Capacitor - 5 O / G			**72.8**	**3:55:13 PM**
16	MV Panel Room Capacitor Panel -1 Capacitor No - 2 O / G			**73.5**	**3:58:54 PM**
17	PCC Panel - 3 Z L D O / G			**73.7**	**4:04:21 PM**

No	Location	Thermal image	Normal image	Temp° C	Time
18	PCC -03 Panel PC 03 / 06 IPCA 3rd Floor new Trane Chiller Main O / G			**77.1**	**4:05:54 PM**
19	Capacitor Panel -2 Capacitor O / G -3			**72.3**	**4:45:14 PM**
20	Capacitor Panel 4 , 50 kVAR Stage - 1			**75.3**	**5:02:11 PM**
21	Capacitor Panel 4 , 50 kVAR Stage -1			**109.2**	**5:02:30 PM**
22	Capacitor Panel 4 : 50 kVAR No: 2			**110.0**	**5:03:35 PM**

No	Location	Thermal image	Normal image	Temp° C	Time
23	UACP 2016 Incoming From PC0 2113			**101.7**	**5:52:46 PM**
24	Boiler House Air Compressor 2010 Incomer			**80.3**	**5:55:44 PM**
25	Boiler House Air Compressor 2010 Incomer			**92.2**	**5:56:26 PM**
26	Cooling Tower Electrical Panel Room I / C from PC 02 / 08			**115.2**	**6:31:07 PM**
27	MC 208 / F 06 Pharma Chiller O / G			**79.9**	**6:34:07 PM**

No	Location	Thermal image	Normal image	Temp° C	Time
28	500 TR Pharma Cooling Tower			**75.0**	**6:39:58 PM**

14.3 SUM - UP

The abnormalities noticed is summed up below as per the severity status

Table 14.1: Abnormalities Noticed : Categorization

No	Severity	No. of Locations
1	Mild	13
2	Moderate	73
3	Serious	13
4	Critical	28
Total		**127**

The occurrence of faults can be attributed to

(i) Suspected insufficient airflow

(ii) Loose connections.

(iii) Deterioration of distribution lines (Cables)

The possible remedies are

(i) Check & Re do / Re terminate the cables / busbars etc as per the observations made.

(ii) Provide adequate cooling.

(iii) Provide new & properly sized (Current carrying capacity) cables

These abnormalities shall be attended to at the earliest opportunity

15 INSTRUMENTS USED

15.1 THERMAL - 7

1) Multi Stem Thermometer

2) IR Gun

3) Temperature Logger

4) Thermal Imager

5) Thermo Hygrometer

6) Sling Psychrometer

7) RH Data Logger

15.2 FLOW - 3

1) Vane Type Anemometer

2) Pitot Tube with Manometer

3) Ultrasonic Flow Meter

15.3 PRESSURE - 2

1) Pressure Gauge

2) Digital Manometer

15.4 ELECTRICAL - 4

1) Clamp Meter

2) ALM 10

3) ALM 20

4) ALM 30

15.5 OTHERS - 1

1) Distance Meter

Total No of Instruments Used : 17

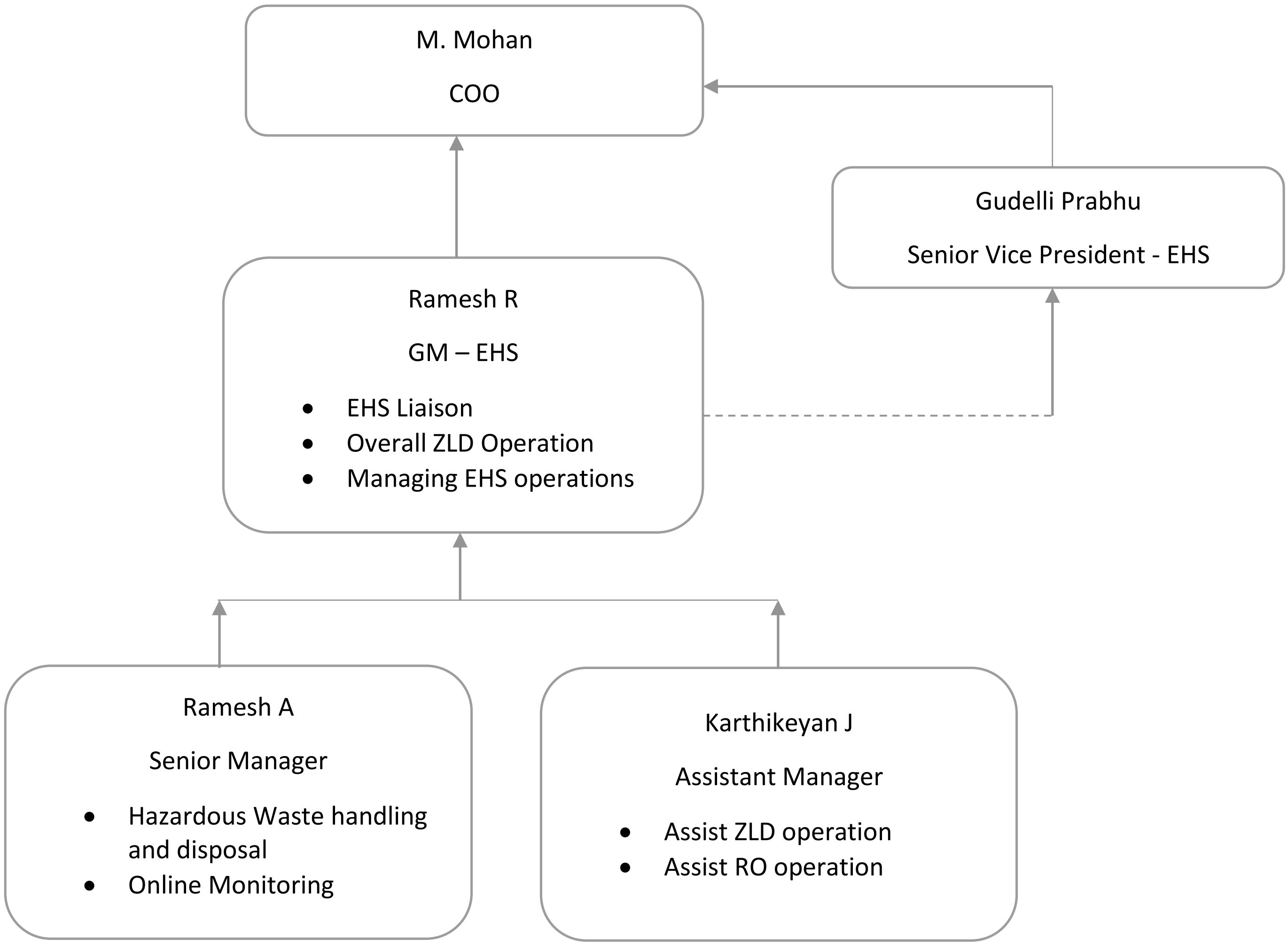
Annexure-7

Greenbelt details and Photograph

Name of the Plant	Scientific Name	Existing
Silver wattle	*Acacia dealbata*	20
Sarakonnai	*Cassia Fistula*	10
Yellow Konnai	*Cassia siamea*	18
Gulmohar	*Delonix regia*	20
Neem Tree	*Azadirachta indica*	65
Coconut Tree	*Cocos nucifera*	110
Mango Tree	*Mangifera indica*	15
Cashew Tree	*Anacardium occidentale*	100
Bamboo Tree	*Bambusa vulgaris*	1500
Jack tree	*Artocarpus heterophyllus*	11
Guava Tree	*Psidium guajava*	10
Sapota	*Manilkara zapota*	12
Teak	*Tectona grandis*	100
Eucalyptus	*Eucalyptus globus*	12
Palm Tree	*Syagrusromanzoffiana*	9
Drumstick	*Moringa oleifera*	15
Tamarind	*Tamarindus indica*	5
Citrus	*Citrus limon*	25
Christmas	*Araucaria columnaris*	15
Pomegranate	*Punica granatum*	12
Total		**2084**

Annexure-8

Environment Management Cell Organogram



Annexure -9

CSR ACTIVITY

CSR Spent details of Solara - Pondy from 2018 to 2021 (4 years)

S. No	Title	Sub - Title	2018-19	2019-20	2020-21	2021-22 upto Nov 2021
1	**Education**	Best Student Award	131910	107000	34000	83310
		Law College & University Support / Digital Library Infrastructure sponsored to Law College	118900	162500	15000	565195
		Examination Skill Development Program - Vanam Vasapadum / Neet Coaching	222080	300000	-	-
		Sponsorship for Local Rural Sports	15000	45000	91531	-
		Life Skills Trrainng 7th, 8th, 9th &11th students @ Kalapet Schools & Students Counselling & Teacher support program to Govt Schools of Kalapet	240000	196000	-	-
		Infrastructure improvement @SVRCC	-	500000	-	275000
		Total	**727890**	**1310500**	**140531**	**923505**
2	**Health**	Dispensary	1489788	1945597	1703021	1009096
		Maintenanace of RO Plants	1541240	1533750	2043906	839196
		Awareness program on Personal Hygenine, Waste Mgt & Health Camps	-	260825	-	-
		Repair & Replacement of RO plants / Tsunami Quarter plant	98493	417104	-	-
		Total	**3129521**	**4157276**	**3746927**	**1848292**
3	**Branding & Others**	NGO / Branding / Others	847253	188900	233828	373002
		Local Poilice Station support	-	-	277832	63000
		Covid Pandemic Relief Activities / Flood Relief Activities/ Covidcare Centre in University / Fund given to CM for Covid care activities	-	-	1445702	2483636
		New Inintiative	190000	-	-	35910
		Sponsorship - Laxmi SV Machine	-	-	100000	-
		Total	**1037253**	**188900**	**2057362**	**2955548**
Grand Total			**4894664**	**5656676**	**5944820**	**5727345**

CSR activity Photograph

Health awareness camp

Life skill training to Govt. school students

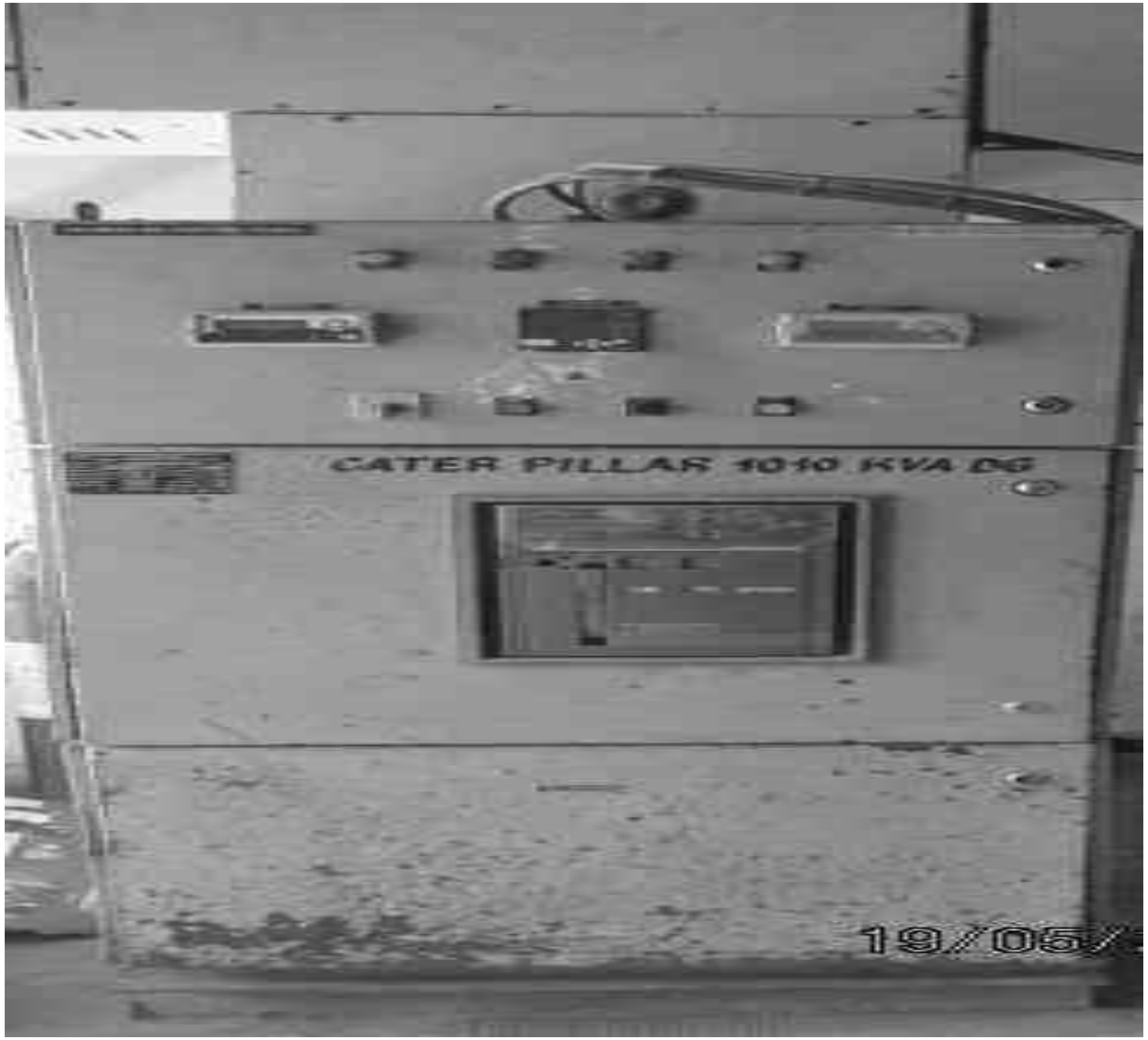
Annexure - 10

Raw materials storage area Photograph

Diesel Generator set

Annexure - 11

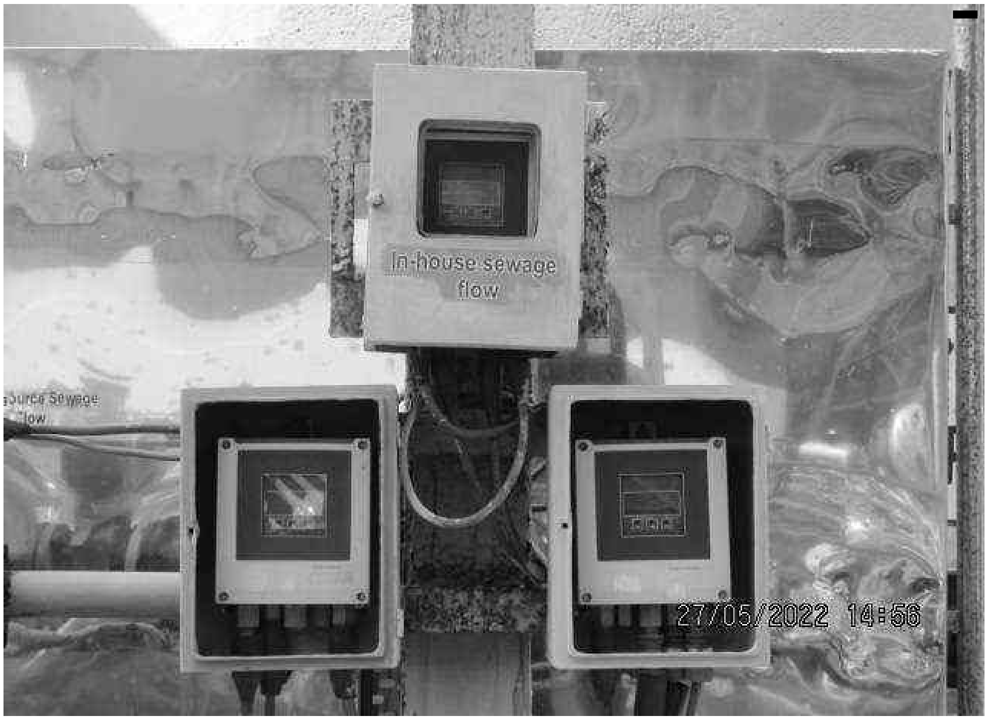
SOLARA
Active Pharma Sciences


CATER PILLAR 1010 KVA DG
19/05/


19/05/

Web cam and Flow meter photograph

Annexure -12




RECORDER
YOKOGAWA
OVERVIEW

Annexure - 13

FORM-V

[See Rule12(2)]

CERTIFICATE OF REGISTRATION FOR EXISTING USER OF GROUNDWATER

Registration No.: 4-2023/PGWA/CR/-Renewal/Industrial & Other/2022-23

With reference to his/ her application No. **841** dated **20-03-2023** **M/s. SOLARA ACTIVE PHARMA SCIENCES LIMITED, Mathur Road, Periyakalapet, Puducherry 605 104** is hereby granted certificate of registration recognising the use of Tube well located at R.S. No **33** at **KALAPET** village of **OULGARET** commune in **PUDUCHERRY** region for **Industrial & Other(Industrial)** purpose, conforming to the following specifications:-

(i) Type of Well	:	Tubewell
(ii) Depth	:	220 Metres
(iii) Diameter	:	200 Millimetres
(iv) Aquifer tapped	:	Cuddalore Sandstone
(v) Type of Pump installed	:	Submercible
(vi) H.P of the motor pump installed	:	15 H.P.
(vii) No . of hourse operated	:	14Hrs.
(viii) Quantity of groundwater extracted per day	:	115000 Litters / per day
(ix) Quantity of groundwater transported per day	:	0 Litters / per day
(x) Well Status	:	Functioning

2. This certificate is also subject to the following condition :-

i. The certificate holder should not deviate from the specifications regarding the well above-mentioned.

ii. The GroundWater Authority or any person duly authorized by it shall have the right to enter and inspect the place with such assistance as may be necessary to satisfy whether the conditions and restrictions specified in this certificate are being complied with.

iii. The GroundWater Authority, for technical reasons may alter, amend or vary the terms of certificate of registration giving 15 days notice to the certificate holder specifying the reasons.

iv. The certificate holder should maintain a register in Form - VII - (A) and should upload the monthly report in Form - VIII - (A) appended.

(V) Any other conditions (to be specified)

(a) This certificate is valid till 31-03-2025

(b) The certificate holder should apply for renewal in Form-IV at this authority's website[https://pgwa.py.gov.in],before 90 days its validity period of this Certificate of Registration (i.e.) on or before 31.12.2024. Otherwise,it will attract a late fee of Rs.1000/-.

(c) A copy of this Certificate of Registration should be kept in the industry and the same has to be shown during the inspection of Government officials.

(d) The daily water consumption register should be strictly and properly maintained in accordance with Form - VII - (A) and a monthly report on consumption of groundwater from the tube well in Form - VIII - (A) should be submitted at this authority's Website [https://pgwa.py.gov.in] before 10th day of succeeding month without fail.

(e). the certificate holder should remit the fee for groundwater extraction from this tubewell @ Rs.1.40 (One Rupees Fourty Paise Only) per every 1000 liters of groundwater extraction.at this authority office,along with the above said monthly report.

(f) Any deviation / Violation of the above / below if any mentioned conditions will attract penal action as per the sub - section (b) (i) & (ii) of Section 20 of 'The Pondicherry Ground Water (Control & Regulation) Act '[(i) for the first offence with fine which may extend to five thousand rupees: and (ii) for the second and subsequent offence, with imprisonment for a term which may extend to six months, or with fine which may extend to ten thousand rupees, or with both].

(g) This Certificate of Registration will liable for cancellation, if the certificate holder failed to comply with the conditions stipulated in this Certificate of Registration, as per Sub Section (b) of Section 12 of 'The Pondicherry Ground Water (Control & Regulation) Act, 2002'

h)The total drawl of ground water from the tubewell should not exceed 1,15,000 lts per day (i.e.1,10,000 lts for M/s. Solara Active Pharma Science Limited and 5,000 lts for M/s. Stride Shasun Limited Unit-II).

PONDICHERRY GROUND WATER AUTHORITY
PONDICHERRY

Place: Pondicherry
Date: 20-03-2023

Signature of Member Secretary
GroundWater Authority

Annexure -14

Rain water harvesting system Photograph

Annexure - 15

LED Light photograph

Annexure - 16

Hazardous chemicals storage area

Spent carbon storage area

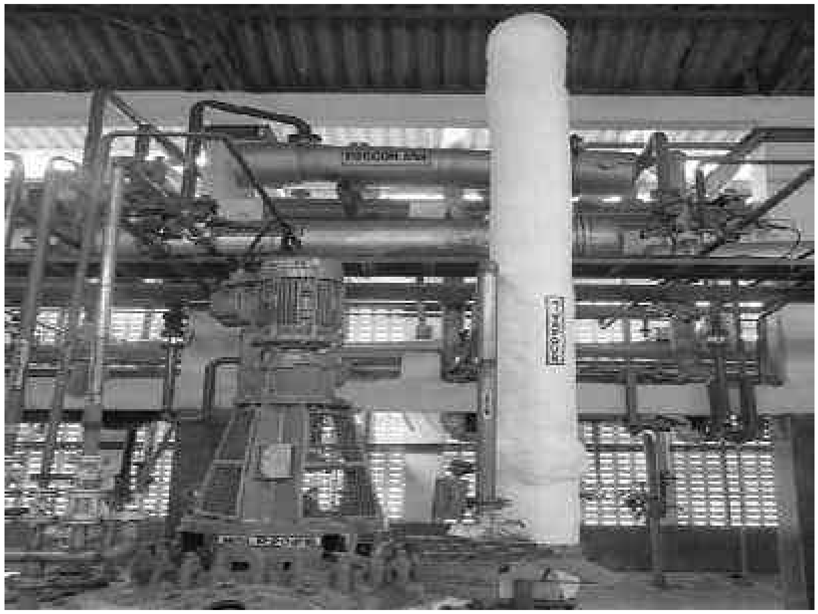
Spent solvent storage area

Flame arrestors photograph

Automated Filling system Photograph **Annexure - 17 a**

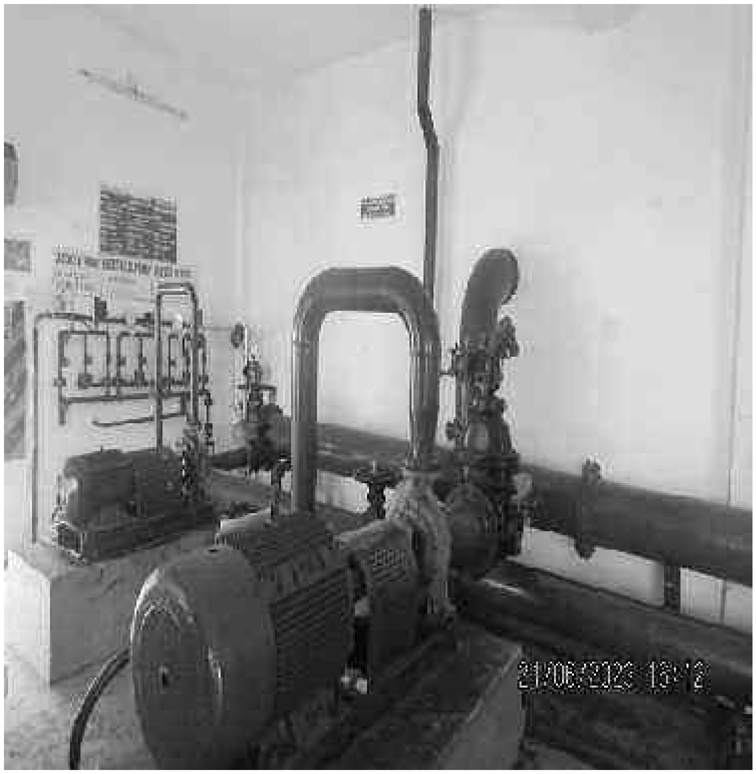
Annexure - 17b

Closed Batch feed system & Vent condenser



Annexure - 18

Fire fighting system Photograph



Annexure-19

Personal protective equipment photograph

Annexure - 20

Safety training photograph


WORK RELATED
MUSCULOSKELETAL
DISORDERS
GROWTH

SRI LAKSHMI NARAYANA INSTITUTE OF MEDICAL SCIENCES
OSUDU, AGARAM VILLAGE, VILLIANUR COMMUNE, KUDAPAKKAM POST, PUDUCHERRY - 605 502.

MEDICAL REPORT

EMP ID	: 50001233
UHID NO	: 22-251069
Name	: CHANDRU GANESH
Age	: 37
Gender	: Male
Height	: 178 Cm
Weight	: 92 Kg
Report Date	: 13/10/2022

MEDICAL EXAMINATION

Vitals	: BP:120/80mmHg PR:80/BPM
CNS	: NAD
Ear Nose & Throat	: No ENT Problems
Skin Checkup	: No Skin Problems
Contagious Disease	: No

INVESTIGATIONS

Audiometric	: Report enclosed
Blood Group	: A1B+ve
Vision checkup	: Report enclosed
Blood and urine investigations	: Report enclosed
PFT	: Report Enclosed
ECG	: Report enclosed
X-ray	: Report enclosed

FITNESS & OBSERVATION

FIT

Dr. S. SIVAKUMAR, MBBS.
Reg. No: 59986
Senior Resident General Surgery
Sri Lakshmi Narayana Institute of Medical Sciences
Osudu, Kudapakkam, Puducherry-605 502.

SRI LAKSHMI NARAYANA INSTITUTE OF MEDICAL SCIENCES

Osudu, Agaram Village, Kudapakkam Post, Villiyanur Commune,
Pondicherry – 605 502

Name: UHID No:22-251069
CHANDRU GANESH
37 / M - SPL CAMP
G.MEDIV
KALAPET - Puducherry

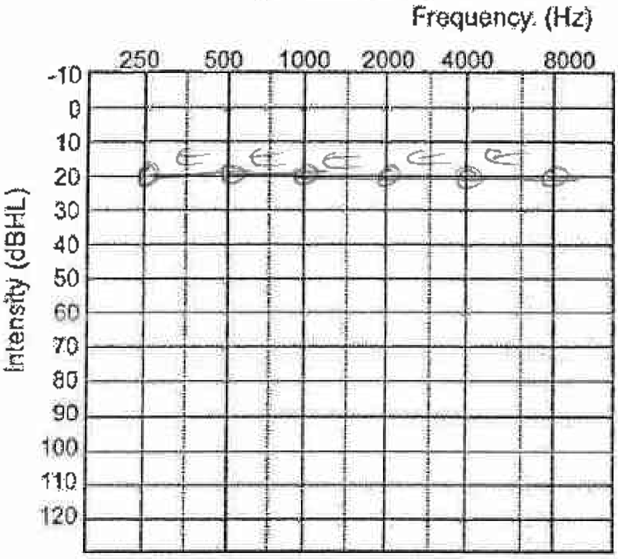
Age .... Sex .... Test Reliability ....

Complaint : ....

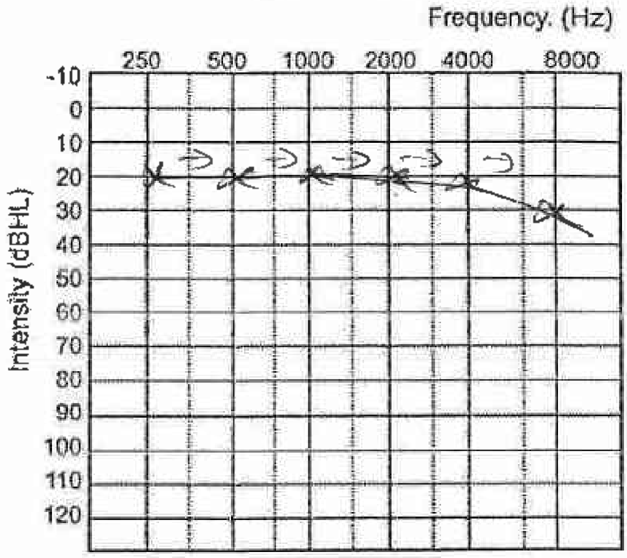
Date:

AUDIOGRAM

RIGHT EAR



LEFT EAR



Speech Audiometry

	PTA (dBHL)	SRT (dBHL)	SDS (%)	UCL (dBHL)
RIGHT	20			
LEFT	20			

TFT

	RIGHT	LEFT
Rinne		
Weber		

Symbols:

	A.C	B.C	MASKED A.C	MASKED B.C	N.R	
RIGHT	O	<	Δ	[	O	X
LEFT	X	>	□	]	{	}

Provisional Diagnosis :

Hearing with in normal limits

Recommendation :

ENT review

Follow up

Dr. R. NITISH TIMOTHY, M.S.,
Reg. No: 106008
ASSISTANT PROFESSOR

157

SRI LAKSHMI NARAYANA INSTITUTE OF MEDICAL SCIENCE

DEPARTMENT OF OPHTHALMOLOGY

Osudu Agaram Village,Koodapakkam - Post, Puducherry - 605502.

NAME: Chandraganesh Age: 37/M DATE: 13/10/22

REG. NO: 50001233

	RIGHT EYE	LEFT EYE
DISTANT VISION	6/6	6/6
NEAR VISION	N/6	N/6
COLOUR VISION	N	N
REMARKS	N	
REFER	To Slims	

Dr. K. WASIM ALI RAJA
MBBS, DO, DNB, FICO, MRCS
Reg. No.: 92972
ASSISTANT PROFESSOR
DEPARTMENT OF OPHTHALMOLOGY
SRI LAKSHMI NARAYANA INSTITUTE OF MEDICAL SCIENCES, PUDUCHERRY.

CONSULTANT NAME & SIGNATURE

SRI LAKSHMI NARAYANA INSTITUTE OF MEDICAL SCIENCES
OSUDU, AGARAM VILLAGE, VILLIANUR COMMUNE, KUDAPAKKAM POST, PUDUCHERRY - 605 502.

NAME	MR. CHANDRUGANESH	AGE/ SEX:	37/M
UHID	157	DATE:	15/10/2022

HAEMATOLOGY

Specimen	Test Name	Result	Normal Values
EDTA BLOOD	Hb	16.4	13 - 17 gm/dl
	WBC COUNT	6,900	4,000 - 11,000/cmm
	RBC Count	5.5	4 - 5.6 milliom/Cmm
	PCV	50	40- 54%
	MCV	90	76-96 fl
	MCH	29	27-32 pg
	MCHC	32	30 - 35 %
	DIFFERENTIAL COUNT		
	POLYMORPHS	43	40 - 75 %
	LYMPHOCYTES	38	20 - 45 %
	EOSINOPHILS	10	1 - 6 %
	MONOCYTES	08	2 - 10 %
	BASOPHILS	01	0 - 1 %
	PLATELET	2.1	1.5 - 4.0 Lakhs/cmm

AUTHORIZED SIGNATORY

SLIMS CENTRAL LAB PATHOLOGIST

SRI LAKSHMI NARAYANA INSTITUTE OF MEDICAL SCIENCES

OSUDU, AGARAM VILLAGE , VILLIANUR COMMUNE, KUDAPAKKAM POST, PUDUCHERRY - 605 502.

CLINICAL PATHOLOGY

URINE EXAMINATION

NAME: MR. CHANDRAGANESH	AGE/SEX: 37 /M
UHID NO: 157	DATE: 13.10.2022
PHYSICAL EXAMINATION	
Quantity	10 ml
Colour	Pale amber
Appearance	clear
Odour	Ammoniacal
Reaction (PH)	Acidic
CHEMICAL EXAMINATION	
Albumin	NIL
Sugar	NIL
MICROSCOPIC EXAMINATION	
Pus Cells	4-6 /hpf
RBCs	Nil
Casts	Nil
Crystals	NIL
Epithelial Cells	3-4 /hpf

SLIMS

13/10/22

AUTHORIZED SIGNATORY

PATHOLOGIST

SRI LAKSHMI NARAYANA INSTITUTE OF MEDICAL SCIENCES
OSUDU, AGARAM VILLAGE, VILLIANUR COMMUNE, KUDAPAKKAM POST, PUDUCHERRY - 605 502.

NAME	MR. CHANDRU GANESH	AGE/SEX: 37/M	DATE: 13/10/2022
UHID	157		

BIOCHEMISTRY REPORT

Specimen	Test Name	Result	Unit	Normal Values
Serum	FBS	83	mg/dl	70 - 110 mg/dl
	PPBS	126	mg/dl	< 160 mg/dl
	Urea	35	mg/dl	15 - 40 mg/dl
	Creatinine	0.9	mg/dl	0.7 - 1.4 mg/dl
LIPID PROFILE				
Serum	Cholesterol	163	mg/dl	150 - 220 mg/dl
	Triglyceride	101	mg/dl	Male : 60 - 165 mg/dl Female : 40 - 145 mg/dl
	HDL Cholesterol	32	mg/dl	30 - 75 mg/dl
	LDL	111	mg/dl	60 - 175 mg/dl
	VLDL	20	mg/dl	20 - 40 mg/dl
LIVER FUNCTION TEST				
Serum	Total Bilirubin	0.8	mg/dl	0.2 - 1.2 mg/dl
	Direct Bilirubin	0.2	mg/dl	0.2 - 0.4 mg/dl
	Total Protein	7.0	gm/dl	6.0 - 8.0 gm/dl
	Albumin	4.1	g/dl	3.5 - 5.0 g/dl
	Globulin	2.9	g/dl	2.5 - 3.5 g/dl
	SGOT	24	IU/L	0 - 46 IU/L
	SGPT	32	IU/L	0 - 49 IU/L
	ALP	196	IU/L	Male : 80 - 306 U/L Female : 64 - 306U/L
EDTA	HbA1C	5.8	%	4.6-6.2%

14.10.22
AUTHORIZED SIGNATORY

Dr. A. SWATHIKA, M.B.B.S., M.D.,
Reg. No: 99791, ID-3020
Assistant Professor
Department of Biochemistry
SLIMS, Puducherry - 605 502.

SLIMS HOSPITAL
PUDUCHERRY
PFT REPORT

Easy one [TM] DIAGNOSTIC EU. 6.7
[o]indel 2000-2011
Easy/ware 2.26.0.0 . 26/02/2022
SN. 121577 Ret No: 33

Patient Information

Emp ID:50001233
Name:CHANDRU GANESH
UHID: 22-251069
Age: 37
Height:178 Cm
Weight: 92 Kg
Gender: Male
Ethnic: ASIAN
Smoker: NO
Asthma: NO

Test Information

Test Date:13/10/2022
PostTime:3
Test Mode: DIAGNOSTIC
Syst. Interpret: GOLD/Hardie
Predicted Ref: GOLD/Hardie
Value Select: BEST TRIAL
Tech ID
Automated OC: ON
BTPS (INEX): 1.11/ 1.02

FVC Test Results   Your FEV1 is 85% Predicted

Parameter	Trial1	Trial2	Trial3	Pred.	%Pred.
FVC[L]	2.56	2.35	2.14	3.60	68
FEV1[L]	1.99	2.29	2.00	2.5	85
FEV1/FVC[½]	92.7	90.2	82.7	84.9	110
PEF[L/min]	359.8	429.1	339.1	398.3	76
MEF25.75[L/s]	4.13	4.29	3.21	4.05	97
MEF75[L/s]	5.00	6.27	5.15	4.96	89
MEF50[L/s]	5.28	5.17	4.17	9.25	99
MEF25[L/s]	2.37	2.29	5	1.85	126
FIVC[L]	0.19	2.08	2.35	3.60	6
FIF[L/min]	91.5	151.3	138	89	97

*Indicates below LLN

Syst. Interpret : Normal Spirometry

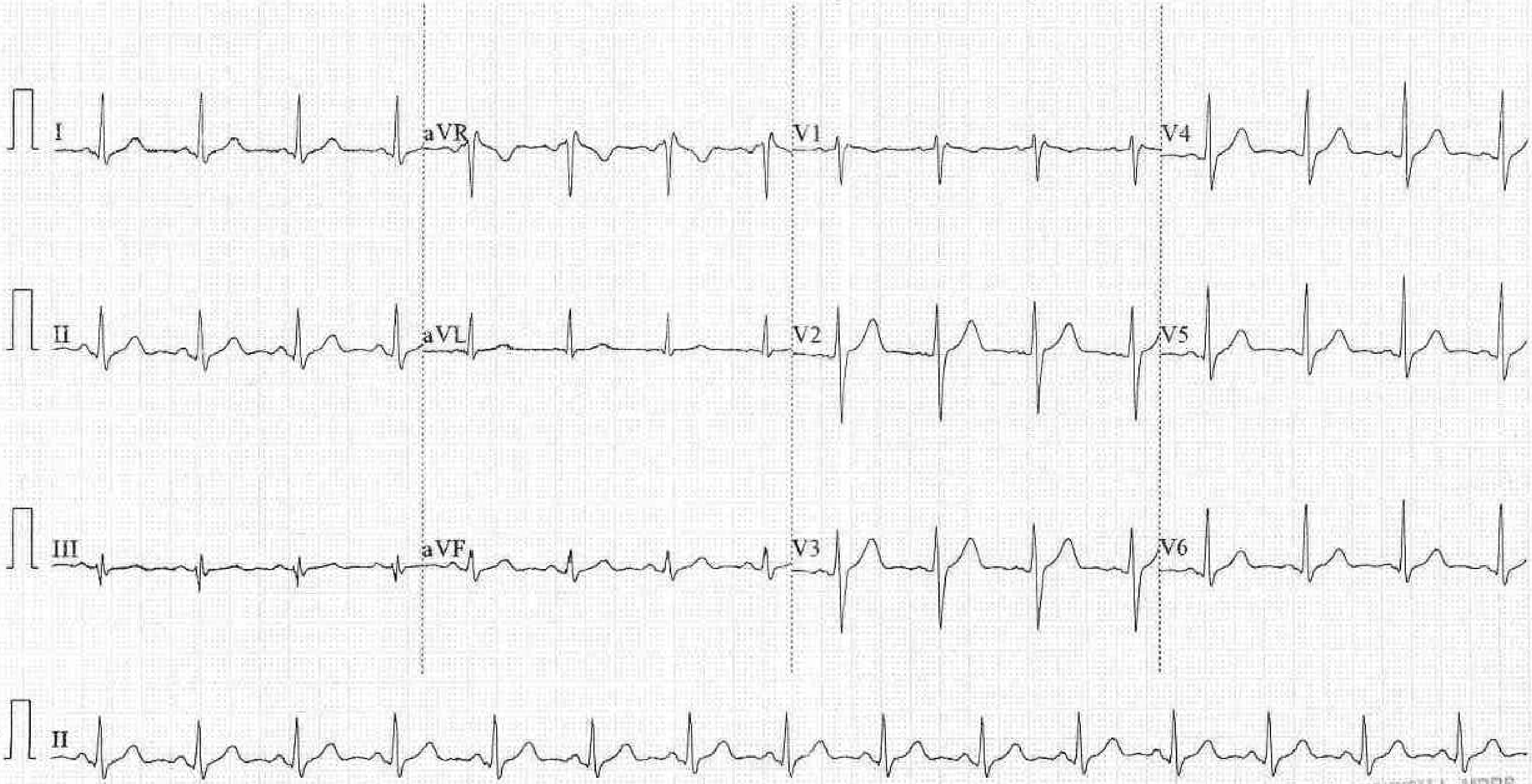
Dr. K.VIGNESH MBBS MD.
Reg No : 104267
SENIOR RESIDENT
RESPIRATORY MEDICINE
Sri Lakshmi Narayana Institute of
Sciences, Osudu, Kudapakkam,
Puducherry - 605 502.

13-10-2022 11:36:59 AM
ID: 157
chandra ganesh
Male 37Years

HR	: 91	bpm
P	: 101	ms
PR	: 132	ms
QRS	: 104	ms
QT/QTc	: 352/434	ms
P/QRS/T	: 57/18/44	°
RV5/SV1	: 1.138/0.601	mV

Diagnosis Information:
Sinus Rhythm
Normal ECG

Report Confirmed by:



GUPTHA, MBBS.,
Reg. No. 90078
Senior Resident General Medicine
of Medical Sciences

0.67~100Hz AC50 25mm/s 10mm/mV 4*2.5s+1r ♥91 SE-1200Express V2.01 SEMIP V1.7 SLIMS

SRI LAKSHMI NARAYANA INSTITUTE OF MEDICAL SCIENCES
Osudu, Agaram Village, Villianur Commune, Kudapakkam Post,
Pondicherry - 605 502.

BLOOD CENTRE REPORT

Date : 13/10/22

Patient's Name	:	Chandrugan
Age / Sex	:	37/M
IP / UHID	:	157
Ward	:	MHC
Blood Grouping	:	A,B
Rh Typing	:	Positive
(Coombs) DCT	:	—
(Coombs) ICT	:	—

Tech Sig.

S. Agalya
Blood Centre / In-charge
Medical Officer

SRI LAKSHMI NARAYANA INSTITUTE OF MEDICAL SCIENCES
OSUDU, AGARAM VILLAGE , VILLIANUR COMMUNE, KUDAPAKKAM POST, PUDUCHERRY - 605 502.

NAME: CHANDRU GANESH **AGE/SEX:37yrs/MALE**

OP/IP ID:50001233 **DATE: 13/10/2022**

CHEST X-RAY PA VIEW

- Trachea is in midline
- Lung fields are clear.
- CT RATIO – normal
- Heart and aorta appears normal.
- Both CP angles are clear.
- Both hila appear to be normal.
- Visualized bony cage appears normal.

IMPRESSION:

- **NO SIGNIFICANT RADIOLOGICAL ABNORMALITY DETECTED.**

RADIOLOGIST

DEPARTMENT OF RADIOLOGY
SRI LAKSHMI NARAYANA
INSTITUTE OF MEDICAL SCIENCES
PUDUCHERRY - 605 002.

Annexure - 22

Vehicle parking area photograph

Annexure - 23

SOLARA
Active Pharma Sciences

ENVIRONMENT, HEALTH & SAFETY POLICY

Solara Active Pharma Sciences Limited is committed to proactively adopt, improve and maintain a high standard of Environmental, Health & Safety (EHS) across all sites and locations.

We shall strive to achieve **Goal Zero** i.e. zero safety accidents, zero injuries and zero incidents that cause harm to the environment...
To move to **Goal Zero** we will:

- Comply with all applicable requirements (Legal, Others) with regards to EHS
- Inculcate a positive EHS culture throughout the organization
- Foster awareness and provide appropriate training for all employees to support Goal Zero
- Provide a safe & healthy workplace to our employees, contractors, sub-contractors, visitors and all other stakeholders
- Encourage a collaborative and a participative approach towards EHS with all employees, contingent employees and visitors on site.
- Enable all employees, contingent employees and visitors to identify and report EHS hazards, conditions and near misses
- Reduce the EHS impact of our products throughout their lifecycle
- Make best efforts to work with suppliers and business partners who run safe and environmentally responsible operations
- Work towards mitigation of pollution and conservation of precious resources like water and energy by optimizing their utilization
- Establish specific and measurable objectives to achieve continual improvement of our EHS performance. Monitor performance of all sites / locations on a regular basis and encourage achievement of the objectives

Bharath R Sesha
Managing Director & Chief Executive Officer

Issue Date: **21.09.2020**
Next revision date: **21.09.2023**

சுற்றுச்சூழல் சுகாதாரம் மற்றும் பாதுகாப்பு கொள்கை

SOLARA
Active Pharma Sciences

சொலாரா ஆக்டிவ் பார்மா சயின்சஸ் லிமிடெட் நிறுவனம், முழுமைக்கும் சுற்றுச்சூழல், சுகாதாரம் மற்றும் பாதுகாப்பு தொடர்புடைய உயர்தரமான கொள்கையை பின்பற்றுவது, மேலும் அவற்றை மேன்மைப் படுத்துவதை குறிக்கோளாகக் கொண்டு முனைப்புடன் செயல்படுத்துதல்.

சுற்றுச்சூழலக்கு கேடு விளைவிக்கும் காரணிகளற்ற மற்றும் விபத்து இல்லாத சூழலை உருவாக்கும் இலக்கை அடைய கீழ்கண்ட வகையில் முயற்சி செய்வோம்.

சுற்றுச்சூழல் சுகாதாரம் மற்றும் பாதுகாப்பு குறித்த சட்டம் சார்ந்த அல்லது நமது நிறுவனத்திற்கு பொருந்தும் மற்ற அனைத்து தேவையான விதிமுறைகளை செயல்படுத்துதல்.

நமது நிறுவனம் முழுவதற்கும் பொருந்தும் தெளிவான உறுதியான சுற்றுச்சூழல், சுகாதாரம் மற்றும் பாதுகாப்பு நடை முறைகளை பின்பற்ற அறிவுறுத்தல்

நமது இலக்கை எவ்வித குறைகளும் இன்றி அடைய அதற்கு ஏற்ப அனைத்து தொழிலாளர்களுக்கும் உரிய பயற்சி அளித்தல் மற்றும் அவர்களிடையே விழிப்புணர்வை ஏற்படுத்துதல்

நமது தொழிலாளர்கள், ஒப்பந்தக்காரர்கள், துணை ஒப்பந்தக்காரர்கள், பார்வையாளர்கள் மற்றும் அனைத்து பிற பங்குதாரர்களுக்கும் பாதுகாப்புடன் கூடிய சுகாதாரமான பணி செய்யும் இடத்தை உருவாக்குதல்

பணிசெய்யும் இடத்தில் உள்ள அனைத்து பார்வையாளர்கள், தொழிலாளர்கள் மற்றும் ஒப்பந்த தொழிலாளர்களை சுற்றுச்சூழல், சுகாதாரம் மற்றும் பாதுகாப்பு தொடர்புகளை ஒருங்கிணைந்த முனைப்புடன் செய்ல்படும் அணுகு முறையை ஊக்குவித்தல்

அனைத்து தொழிலாளர்கள், ஒப்பந்த தொழிலாளர்கள் மற்றும் பார்வையாளர்கள் சுற்றுச்சூழல், சுகாதாரம் மற்றும் பாதுகாப்பு இவற்றில் ஏற்படும் ஆபத்து மற்றும் கேடு விளைவிக்கும் காரணிகளை இனம் கண்டு அவற்றில் உள்ள குறைபாடுகளை நிர்வாகத்திற்கு தெரிவித்தல்

நமது உற்பத்தி பொருட்களின் பயன்பாட்டு காலம் வரை, ஏற்படும் சுற்றுச்சூழல், சுகாதாரம் மற்றும் பாதுகாப்பு தொடர்பான எதிர் விளைவுகளை மட்டுப் படுத்துதல்

சுற்றுச்சூழல், சுகாதாரம் மற்றும் பாதுகாப்பை மேம்படுத்தும் பொறுப்புடன் செயல்படும் வணிகபங்குதாரர் மற்றும் தேவைப்படும் பொருட்களை நிறுவனத்திற்கு வழங்குபவர்களுடன் இணைந்து செயல்பட சீரிய முயற்சி மேற்கொள்ளப்படுதல்

அரிதான வள ஆதாரங்களான நீர் மற்றும் மின்சாரத்தை சேதமின்றி அதிகமாக பயன்பெறும் வகையில் பயன்படுத்துதல் மற்றும் அவற்றை பாதுகாத்தல் / பராமரித்தல். மேலும் சுற்றுச்சூழல் தூய்மை கேடுகளை மட்டுப்படுத்தும் நோக்கோடு செயல்படுதல்

நமது சுற்றுச்சூழல், சுகாதாரம் மற்றும் பாதுகாப்பு செயல்பாடுகள் தொடர்ந்து மேன்மை அடையும் வகையில், குறிப்பிட்ட அளவீடு / மதிப்பீட்டு கொள்கைகளை உருவாக்குதல். அனைத்து பணி இட செயல்பாடுகளை தொடர்ந்து கண்காணித்தல். மற்றும் நமது கொள்கைகளின் நோக்கம் நிறைவேற ஊக்குவித்தல்.

Bharath R Sesha
Managing Director & Chief Executive Officer

Issue Date: **21.09.2020**
Next revision date: **21.09.2023**

Annexure-24

EMP Budget

Particulars	Investment in Crores		
	Existing	**Proposed**	**After Change in product mix**
EMP			
MEE	10	Nil	10
ETP	15	Nil	15
RO Plant	4	Nil	4
Green Belt Area	1	Nil	1
DG with Acoustic	2	Nil	2
Online Monitoring system	1	Nil	1
Air Pollution Equipment's			
Boiler & Chimney	4.5	Nil	4.5
DG Chimney	0.5	Nil	0.5
Scrubber	0.25	Nil	0.25
Environmental health and safety measures			
Safety Equipment's	1	Nil	1
OHC	0.5	Nil	0.5
Annual Medical Check up	0.25	Nil	0.25
Total	**40**	**0**	**40**
Recurring Cost/month	**1.5**	**0**	**1.5**

Advertisement copy in English

Annexure - 25

on of the workshop.
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from Nothing. This
a part of the com-
solution that SAS
ing to Army Public

gave up land for mines'

EXPRESS NEWS SERVICE
@ Cuddalore

A joint committee of various outfits, held a public meeting at Neyveli petitioned the NLCIL management demanding a monthly salary of ₹50,000 and compensation for those who gave their houses for the mine. They warned NLCIL they will launch a human chain protest on May 18, if their demands were not met in ten days.

NLCIL Urimai Meetpu Kottamaipinar (Joint Committee) had organised a public meeting at Periyar Square in Neyveli on Wednesday. NLC[illegible] Contract Workers U[illegible] special secretary M Sekar led the meeting, TN Associat[illegible] Joint Association State p[illegible]dent P Ravindran, distri[illegible] State-level officials of [illegible], NMK and unions were [illegible]t.

In this meeting, they also said that contract workers who were missed out in seniority list must be added, permanent jobs for the kin of those who gave lands to NLCIL. Compensation and alternative residential areas must be given to residents to who gave their houses for mines, they demanded.

KAMARAJAR PORT LIMITED
(A Company of Chennai Port Authority - Govt. of India)
CIN No.: U45203TN1999PLC043322

PUBLIC NOTICE

It is informed that Ministry of Environment, Forest and Climate Change has accorded CRZ clearance for "Establishment of 1MLD RO Desalination Plant at M/s.Kamarajar Port Limited, Vallur Post, Chennai-120" and copies of clearance letters are available with the Tamil Nadu Pollution Control Board (TNPCB) and may also see on the website of the Ministry of Environment, Forest and Climate Change at https://parivesh.nic.in/.

Dy. General Manager (Civil)
044-27950030

M/s. SOLARA ACTIVE PHARMA SCIENCES LIMITED
R.S.No.33 & 34, Mathur Road, Periyakalapet,
Puducherry.-605014

PUBLIC NOTICE

This is to inform the public that by SEIAA, Puducherry has issued Environmental Clearance to M/s. SOLARA ACTIVE PHARMA SCIENCES LIMITED vide letter No.SEIAA/PY/EE/247066/2021 dated: 27.04.2022 for proposed change in product mix without increase in total productions capacity at R.S.No.33 & 34, Mathur Road, Periyakalapet, Puducherry State. The environmental clearance issued by SEIAA, Puducherry (State Environmental Impact Assessment Authority) is available in the official website of SEIAA., Puducherry and clearance are available with the Puducherry Pollution control Committee.

- M/s. SOLARA ACTIVE PHARMA SCIENCES LIMITED,
Authorised Signatory

CBIC - TUMAKURU INDUSTRIAL TOWNSHIP LTD (CBIC-TITL)
5th Floor, Khanija Bhavan, Race Course Road, Bengaluru – 560 001.
Phone No. 22267900, Fax : 22267901 website : www.kiadb.in
email: mdcbic23@gmail.com

No.CBICTITL/CFO/E-Auction-02/1560/2022-23 Date: 04.05.2022

PAPER PUBLICATION

Advertisement copy in Tamil (vernacular language)


வு எழுதினர்.

மாணவர்களும், 2918 மாணவிகள் உட்பட 5901 மாணவர்கள் 10ம் வகுப்பு மாணவர்கள் அரசு பொதுத் தேர்வு எழுதினர்.

பல்வேறு மையங்களில் ஆரணி கல்வி மாவட்ட அலுவலர் சந்தோஷ் ஆய்வு செய்தார். த் தேர்வு எழுதினர். பல்வேறு மையங்களில் ஆரணி கல்வி மாவட்ட அலுவலர் சந்தோஷ் ஆய்வு செய்தார்.

சொலாரா ஆக்ட்டிவ் பார்மா சயின்சஸ் லிமிடெட்
ரி ச எண்: 33 & 34 மாத்தூர் ரோடு
பெரியகாலாப்பெட் - 605014

பொது அறிவிப்பு

இதனால் பொதுமக்களுக்கு அறிவிப்பு என்னவென்றால் மாநில சுற்றுச்சூழல் பாதிப்பு மதிப்பீட்டு ஆணையம் புதுச்சேரி கடிதம் எண் : SEIAA/PY/EE/247066/2021 தேதி 27/04/2022 வாயிலாக சொலாரா ஆக்ட்டிவ் பார்மா சயின்சஸ் லிமிடெட் (Solara Active Pharma Sciences Limited) அவர்களுக்கு கீழ்க்கண்ட ரி ச எண்: 33&34 புதுச்சேரியில் அமைந்துள்ள கம்பெனிக்கு மொத்த உற்பத்தித்திறனில் அதிகரிப்பு இல்லாமல் தயாரிப்பு கலவையில் முன்மொழியப்பட்ட மாற்றத்தை ஏற்று உற்பத்தி செய்ய சுற்றுசூழல் இசைவு சான்று வழங்கியுள்ளது. அனுமதி ஆவணங்களின் நகல்கள் மாநில சுற்றுசூழல் பாதிப்பு மதிப்பீட்டு ஆணையத்திலும் மற்றும் புதுச்சேரி மாசு கட்டுப்பாடு வாரியம் அலுவலகத்திலும் உள்ளன.

சொலாரா ஆக்ட்டிவ் பார்மா சயின்சஸ் லிமிடெட்

thinaboomi.com தினபூமி, மே 07, 2022

Annexure - 26

SOLARA
Active Pharma Sciences

Communication Address :
Solara Active Pharma Sciences Limited
R.S.No. 33 & 34,
Mathur Road, Periyakalapet
Puducherry - 605 014. India
Tel: +91 413 2654100, Fax: +91 413 2655154

13/05/2022

To

Member Secretary
Puducherry Pollution Control Committee,
3 rd. Floor, PHB Building,
Anna Nagar, Puducherry -605005.

Dear Sir,

Sub: (1) Environmental clearance - EC22B058PY151130 dated 27.04.2022., to the proposed project activity Under the provision of EIA notification 2006 – Regarding

With reference to the above subject (1), as per the environmental clearance terms and conditions specified, under Miscellaneous Section X, (I) & (II), we like to submit the details for your consideration.

----------- x ----------x-----------x ----------

(X) (I) The project proponent shall make public the environmental clearance granted for their project along with the environmental conditions and safeguards at their cost by prominently advertising it at least in two local newspapers of the District, of which one shall be in the vernacular language within seven days and in addition this shall also be displayed in the project proponent's website permanently.

we have given advertisement in three Local newspapers, in that two in vernacular language and one in English, we have enclosed the copy of the evidence for your kind reference.

We have published the Environmental clearance copy in our Solara website.

(X) (II) The copies of the environmental clearance shall be submitted by the project proponents to the Heads of local bodies, Panchayats and Municipal Bodies in addition to the relevant offices of the Government (Industries Department and PPCC) who in turn has to display the same for 30 days from the date of receipt.

RECEIVED
DATE 17/05/2022

Communication Address :
Solara Active Pharma Sciences Limited
R.S.No. 33 & 34,
Mathur Road, Periyakalapet
Puducherry - 605 014. India
Tel: +91 413 2654100, Fax: +91 413 2655154

We have submitted the copy of Environmental Clearance letter to Directorate of Industries & commerce (DIC), Oulgaret Municipality and Puducherry Pollution Control Committee and copy of the letter is enclosed for your ready reference.

This is for your information and kind consideration.

For **Solara Active Pharma Sciences limited**

M. Mohan

Sr. Vice President (Operations)

Reference

1. The Copy of Advertisement of EC into Indian Express
2. The Copy of Advertisement of EC to Thina boomi in Vernacular Language
3. The Copy of Advertisement of EC to Thamizhmurasu in Vernacular Language
4. The Copy of Environment Clearance Published in Solara website
5. The Copy of submitted letter - Directorate of Industries and commerce
6. The Copy of submitted letter - Oulgaret Municipality
7. The Copy of submitted letter – Puducherry Pollution Control Committee

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EXPRESS NEWS SERVICE
@ Cuddalore

A joint committee of various outfits, held a public meeting at Neyveli petitioned the NLCIL management demanding a monthly salary of ₹50,000 and compensation for those who gave their houses for the mine. They warned NLCIL they will launch a human chain protest on May 18, if their demands were not met in ten days.

NLCIL Urimai Meetpu Kottamaipinar (Joint Committee) had organised a public meeting at Periyar Square in Neyveli on Wednesday. NLCIL Jeeva Cor tract Workers Union specia secretary M Sekar led the meet ing, TN Association Joint As sociation State president I Ravindran, district and State level officials of MMK, NMI and unions were present.

In this meeting, they als said that contract workers wh were missed out in seniorit list must be added, permanen jobs for the kin of those wh gave lands to NLCIL. Compen sation and alternative residen tial areas must be given to resi dents to who gave their house for mines, they demanded.

M/s. SOLARA ACTIVE PHARMA SCIENCES LIMITED
R.S.No.33 & 34, Mathur Road, Periyakalapet,
Puducherry -605014

PUBLIC NOTICE

This is to inform the public that by SEIAA, Puducherry has issued Environmental Clearance to M/s. SOLARA ACTIVE PHARMA SCIENCES LIMITED vide letter No.SEIAA/PY/EE/247066/2021 dated: 27.04.2022 for proposed change in product mix without increase in total productions capacity at R.S.No.33 & 34, Mathur Road, Periyakalapet, Puducherry State. The environmental clearance issued by SEIAA, Puducherry (State Environmental Impact Assessment Authority) is available in the official website of SEIAA., Puducherry and clearance are available with the Puducherry Pollution control Committee.

- M/s. SOLARA ACTIVE PHARMA SCIENCES LIMITED,
Authorised Signatory

வு எழுதினர்.

மாணவர்களும், 2918 மாணவிகள் உட்பட 5901 மாணவர்கள் 10ம் வகுப்பு மாணவர்கள் அரசு பொதுத் தேர்வு எழுதினர்.

பல்வேறு மையங்களில் ஆரணி கல்வி மாவட்ட அலுவலர் சந்தோஷ் ஆய்வு செய்தார். த் தேர்வு எழுதினர். பல்வேறு மையங்களில் ஆரணி கல்வி மாவட்ட அலுவலர் சந்தோஷ் ஆய்வு செய்தார்.

சொலாரா ஆக்ட்டிவ் பார்மா சயின்சஸ் லிமிடெட்
ரி ச எண்: 33 & 34 மாத்தூர் ரோடு
பெரியகாலாப்பெட் - 605014

பொது அறிவிப்பு

இதனால் பொதுமக்களுக்கு அறிவிப்பு என்னவென்றால் மாநில சுற்றுசூழல் பாதிப்பு மதிப்பீட்டு ஆணையம் புதுச்சேரி கடிதம் எண் : SEIAA/PY/EE/247066/2021 தேதி 27/04/2022 வாயிலாக சொலாரா ஆக்ட்டிவ் பார்மா சயின்சஸ் லிமிடெட் (Solara Active Pharma Sciences Limited) அவர்களுக்கு கீழ்க்கண்ட ரி ச எண்: 33&34 புதுச்சேரியில் அமைந்துள்ள கம்பெனிக்கு மொத்த உற்பத்தித்திறனில் அதிகரிப்பு இல்லாமல் தயாரிப்பு கலவையில் முன்மொழியப்பட்ட மாற்றத்தை ஏற்று உற்பத்தி செய்ய சுற்றுசூழல் இசைவு சான்று வழங்கியுள்ளது. அனுமதி ஆவணங்களின் நகல்கள் மாநில சுற்றுசூழல் பாதிப்பு மதிப்பீட்டு ஆணையத்திலும் மற்றும் புதுச்சேரி மாசு கட்டுப்பாடு வாரியம் அலுவலகத்திலும் உள்ளன.

சொலாரா ஆக்ட்டிவ் பார்மா சயின்சஸ் லிமிடெட்

தினபூமி,
thinaboomi.com மே 07, 2022

அடுத்த தமிழக பகுதியான மாத்தூர் கிராமம் மாரியம்மன்கோயில் தெருவைச் சேர்ந்தவர் சரவணன் (55), விவசாய கூலி

சொலாரா ஆக்டிவ் பார்மா சயின்சஸ் லிமிடெட்
ரீ ச எண் 33 & 34, மாத்தூர் ரோடு,
பெரியகாலாபெட், புதுச்சேரி-605014.

பொது அறிவிப்பு

இதனால் பொதுமக்களுக்கு அறிவிப்பது என்னவென்றால் மாநில சுற்றுசூழல் பாதிப்பு மதிப்பீட்டு ஆணையம் புதுச்சேரி கடிதம் எண் SEIAA/PY/EE/247066/2021 தேதி 27/04/2022 வாயிலாக சொலாரா ஆக்டிவ் பார்மா சயின்சஸ் லிமிடெட் (Solara Active Pharma Sciences Limited) அவர்களுக்கு கீழ்க்கண்ட ரீ ச எண் 33 & 34 புதுச்சேரியில் அமைந்துள்ள கம்பெனிக்கு மொத்த உற்பத்தித்திறனில் அதிகரிப்பு இல்லாமல் தயாரிப்பு கலவையில் முன்மொழியப்பட்ட மாற்றத்தை ஏற்று உற்பத்தி செய்ய சுற்றுசூழல் இசைவு சான்று வழங்கியுள்ளது. அனுமதி ஆவணங்களின் நகல்கள் மாநில சுற்றுசூழல் பாதிப்பு மதிப்பீட்டு ஆவணங்களின் நகல்கள் மாநில சுற்றுசூழல் பாதிப்பு மதிப்பீட்டு ஆணையத்திலும் மற்றும் புதுச்சேரி மாசு கட்டுப்பாடு வாரியம் அலுவலகத்திலும் உள்ளன.

சொலாரா ஆக்டிவ் பார்மா சயின்சஸ் லிமிடெட்

இவருக்கு வலிப்பு நோய் இருந்து வந்தது. இந்நிலையில் இன்று காலை அதே பகுதியில் உள்ள ஆழி குளத்தில் துணி துவைப்பதற்காக வீட்டில் இருந்து வேட்டி, சட்டைகளை எடுத்துச் சென்றுள்ளார். அவர் துணி துவைத்துக் கொண்டிருந்தபோது திடீரென வலிப்பு ஏற்பட்டு மயங்கி தண்ணீரில் விழுந்தார். இந்நிலையில் அதே பகுதியை சேர்ந்த பள்ளி சிறுவர்கள் இன்று விடுமுறை என்பதால் குளத்தில் குளிக்க சென்றனர். அங்கு சரவணன் தண்ணீரில் மயங்கி கிடந்ததைக்கண்டு அதிர்ச்சி அடைந்து சத்

போலீசுக்கு தகவல் கொடுத்தனர். கோட்டக்குப்பம் சப்-இன்ஸ்பெக்டர் முத்துக்குமார் தலைமையிலான போலீசார் குளக்கரைக்கு சென்று பார்த்தபோது அங்கு சரவணன் தண்ணீரில் மிதந்த நிலையில் இறந்து கிடந்தார். இதையடுத்து உடலை மீட்ட போலீசார் பிரேத பரிசோதனைக்காக கனகசெட்டிக்குப்பம் தனியார் மருத்துவமனைக்கு அனுப்பி வைத்தனர். வலிப்பு ஏற்பட்டு சரவணன் இறந்தது தெரியவந்தது. போலீசார் தொடர்ந்து விசாரணை நடத்தி வருகின்றனர்.

கொண்ட
வருடங்க
இறந்துவி
லையில்

எல்

புதுச்சேரி
காணிப்பு
கனியமு
டுள்ள செ
புதுச
லம் து
யத்திலிரு
மின் அழு
சில பரா
மேற்கொ

Printed and Published by, R.M.R.Ramesh on behalf of KAL Publications (F
Editor: R.M.R.Ramesh R.N.I. Regn. No. PONTAM/2001/6021 P

ABOUT US

WHO ARE WE?

Solara Active Pharma Sciences is a young, dynamic, entrepreneurial and customer-oriented API manufacturer. We have a legacy of over three decades and trace our origins to the API expertise of Strides Shasun Ltd. and the technical know-how of human API business from Sequent Scientific Ltd.

We are poised to bridge the industry gap by delivering value-based products while maintaining focus on customer needs. We have 140+ scientists working at our two R&D Centers and 5 API manufacturing facilities armed with global approvals and 2 dedicated R&D facilities. We stand by our vision to Respect our partners by maintaining Integrity and operational Transparency, which we intend to achieve through developing utmost Efficiency across the organization.

https://portal.solara.co.in/applic | EHS – Solara Active Pharma Scie | EHS – Solara Active Pharma Scie

https://solara.co.in/ehs/

ONE DRIVE LINK | ComplianceWire | EMPLOYEE INFOR... | OmniApp Login | Welcome to TrackW... | https--portal.solara.... | 172.21.102 Firewall | Rittal CMC III PU (1... | Other favorites

SOLARA | PRODUCT & SERVICES | FACILITIES AND REGULATORY | INVESTOR RELATIONS | RESPONSIBILITIES | CONTACT

Environmental Clearances

Cuddalore API | Puducherry API | Mangalore API

Environmental Clearance
Puducherry API

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ENG 17:21 11/05/2022

ENVIRONMENTAL CLEARANCE

PARIVESH (Pro-Active and Responsive Facilitation by Interactive, and Virtuous Environmental Single-Window Hub)

Government of India
Ministry of Environment, Forest and Climate Change
(Issued by the State Environment Impact Assessment Authority(SEIAA), Puducherry)

To,

The VP
MS. SOLARA ACTIVE PHARMA SCIENCES LIMITED
Mathur Road, Periakalapet Puducherry -605014

Subject: Grant of Environmental Clearance (EC) to the proposed Project Activity under the provision of EIA Notification 2006-regarding

Sir/Madam,

This is in reference to your application for Environmental Clearance (EC) in respect of project submitted to the SEIAA vide proposal number SIA/PY/IND3/247066/2021 dated 29 Dec 2021. The particulars of the environmental clearance granted to the project are as below.

1.	**EC Identification No.**	**EC22B058PY151130**
2.	**File No.**	247066/SEIAA/PY/EE/2022
3.	**Project Type**	New
4.	**Category**	B2
5.	**Project/Activity including Schedule No.**	5(f)-API
6.	**Name of Project**	Proposed Change In Product Mix Without Increase In Total Production Capacity (4812 TPA)
7.	**Name of Company/Organization**	MS. SOLARA ACTIVE PHARMA

Communication Address :
Solara Active Pharma Sciences Limited
R.S.No. 33 & 34,
Mathur Road, Periyakalapet
Puducherry - 605 014. India
Tel: +91 413 2654100, Fax: +91 413 2655154

29/04/2022

To

The Director,
Directrate of Industries and Commerce,
Govt of Pudhucherry,
Thattanchavady
Puducherry -9

Dear Sir,

Sub: Grant of Environment clearance (EC) to the proposed activity under the provision of EIA Notification 2016 – Regarding

We are pleased to announce you that M/s Solara Active Pharma sciences limited got Environment clearance (EC) from SEIAA Puducherry, with reference Vide (1) we submitting the Environment clearance copy to your good office for reference. The particulars of the environmental Clearance granted are as below.

EC Identification	EC22B058PY151130
File No	247066/SEIAA/PY/EE/2022
Project type	New
Category	B2
Project	API
Name of the Company	Solara Active Pharma Sciences Limited

Reference

1. Copy of Environment Clearance - MoEF issued by State Environment Impact Assessment Authority (SEIAA), Puducherry EC Identification: EC22B058PY151130 date of issue EC – 27/04/2022.

For **Solara Active Pharma Science limited**

M. Mohan
Sr. Vice President (Operations)

RECEIVED. DATE: 29/4/22
Directorate of Industries & Commerce
Puducherry.

SOLARA
Active Pharma Sciences

Communication Address :
Solara Active Pharma Sciences Limited
R.S.No. 33 & 34,
Mathur Road, Periyakalapet
Puducherry - 605 014, India
Tel: +91 413 2654100, Fax: +91 413 2655154

29/04/2022

To

The Commissioner,
Oulgaret Municipality,
Jawagar Nagar Boomiyanpet,
Puducherry

8536
29/4/22
DESPATCHER
OULGARET MUNICIPALITY,
JAWAHAR NAGAR,
PUDUCHERRY-605 005

Dear Sir,

Sub: Grant of Environment clearance (EC) to the proposed activity under the provision of EIA Notification 2016 – Regarding

We are pleased to announce you that M/s Solara Active Pharma sciences limited got Environment clearance (EC) from SEIAA Puducherry, with reference Vide (1) we submitting the Environment clearance copy to your good office for reference. The particulars of the environmental Clearance granted are as below.

EC Identification	EC22B058PY151130
File No	247066/SEIAA/PY/EE/2022
Project type	New
Category	B2
Project	API
Name of the Company	Solara Active Pharma Sciences Limited

Reference

1. Copy of Environment Clearance - MoEF issued by State Environment Impact Assessment Authority (SEIAA), Puducherry EC Identification: EC22B058PY151130 date of issue EC – 27/04/2022.

For **Solara Active Pharma Science limited**

M. Mohan
Sr. Vice President (Operations)

SOLARA
Active Pharma Sciences

Communication Address :
Solara Active Pharma Sciences Limited
R.S.No. 33 & 34,
Mathur Road, Periyakalapet
Puducherry - 605 014. India
Tel: +91 413 2654100, Fax: +91 413 2655154
29/04/2022

To

Member Secretary
Pudhucherry Pollution Control Committee,
3 rd Floor, PHB Building,
Anna Nagar, Puducherry -605005.

Dear Sir,

Sub: Grant of Environment clearance (EC) to the proposed activity under the provision of EIA Notification 2016 – Regarding

We are pleased to announce you that M/s Solara Active Pharma sciences limited got Environment clearance (EC) from SEIAA Puducherry, with reference Vide (1) we submitting the Environment clearance copy to your good office for reference. The particulars of the environmental Clearance granted are as below.

EC Identification	EC22B058PY151130
File No	247066/SEIAA/PY/EE/2022
Project type	New
Category	B2
Project	API
Name of the Company	Solara Active Pharma Sciences Limited

Reference

1. Copy of Environment Clearance - MoEF issued by State Environment Impact Assessment Authority (SEIAA), Puducherry EC Identification: EC22B058PY151130 date of issue EC – 27/04/2022.

For Solara Active Pharma Science limited

M Mohan
Sr. Vice President (Operations)

DEPARTMENT OF SCIENCE TECHNOLOGY AND ENVIRONMENT
RECEIVED
DATE: 2/4/4/22

Annexure - 27

Display Board Photograph

Annexure - 28

SOLARA
Active Pharma Sciences

Communication Address :
Solara Active Pharma Sciences Limited
R.S.No. 33 & 34
Mathur Road,
Puducherry - 605 014, India
Tel: +91 413 265 Fax: +91 413 2655154

2022

To

The Member Secretary,
Pondicherry Pollution Control Committee,
Puducherry-5

Respected Sir,

Sub: Submission of **"Form –IV " Statement for the year 2021-2022.**

With reference to the above mentioned subject, here with we are submitting of **"Form –IV"** for the period of "April-2021 to March -2022"

This is for your kind information and record.

Thanking you,

For Solara Active Pharma Sciences Limited

M. Mohan
Chief Operations Officer

DEPARTMENT OF SCIENCE TECHNOLOGY AND ENVIRONMENT
RECEIVED
DATE 29/8/22

FORM – IV

[See rules 6 (5), 13 (8), 16 (6) and 20 (2) and 22 (2)]

FORM FOR FILING ANNUAL RETURNS BY THE OCCUPIER OR OPERATOR OF FACILITY

[To be submitted by occupier/operator of disposal facility to state Pollution Control Board/Pollution Control Committee by 30th June of every year for the preceding period April 2021 to March 2022]

1.	Name and address or the generator/operator of facility	:	Hariharan. S ED & CFO / OCCUPIER Solara Active Pharma Sciences Limited R.S.No.33 & 34 Mathur Road, Periyakalapet, Puducherry -605014, India	
2	Authorization No and date of issue	:	4/PPCC/HWM/JSA/2016/384, dated ;30.06.2016 4/PPCC/HWM/JSA/2017/602	
3	Name of the authorized person and full address with telephone and fax number	:	M. MOHAN Chief Operations Officer Solara Active Pharma Sciences Limited R.S.No.33 & 34, Mathur Road, Periyakalapet, Puducherry -605014, India, Tel: 0413 2654100, Fax: 0413 2655154	
4	Description of hazardous waste	:	Physical form with description	Chemical form
			Liquid – Sodium dichromate solution	Toxic & Corrosive
			Solid – ETP Sludge	Corrosive
			Liquid – Spent Lubricating Oil	Flammable
			Solid – Waste / Residues Containing oil	Flammable
			Liquid – Spent Solvents	Flammable

			Solid – Distillation Residues	Flammable
			Solid – Process Residues and wastes	Flammable
			Solid – Spent Catalyst / Spent Carbon	Flammable
			Solid – Off Specification Products	-
			Solid – Date Expired discarded and off specification drugs / Medicines	-
			Liquid – Spent Organic Solvents	Flammable
			Solid – Sludge from treatment of waste water arising out of cleaning / disposal of barrels / containers	-
			Solid – Discarded containers / barrels / liners contaminate with HW / Chemicals	-
			Solid – Chemical Sludge from waste water Treatment	-
			Solid – Oil and grease skimming residues	Flammable
			Solid – Spent Catalyst	Flammable
			Solid – Spent Carbon	Flammable

5	Quantity of hazardous wastes(in MTA)	:	Waste Category/ Schedule No.	Description of waste	Accumulated quantity as on 31.03.2021 TPA/KLA	Generation during the period Apr'21 to Mar'22 TPA/KLA	Quantity Disposed during the period Apr'21 to Mar'22 TPA/KLA	Accumulated quantity as on 31.03.2022 TPA/KLA
			Class A of Schedule II	Waste Sodium dichromate solution	35.00	18439	18452.52	21.48
			34.3 of Schedule I	ETP Sludge	Nil	Nil	Nil	Nil
			5.1 of Schedule I	Spent Lubricating Oil	1.01	0.75	1.76	Nil
			5.2 of Schedule I	Waste / Residues Containing oil	0.72	Nil	Nil	0.72
			20.2 of Schedule I	Spent Solvents	21.49	722	706.62	36.87
			20.3 of Schedule I	Distillation Residues	Nil	43	43	Nil
			28.1 of Schedule I	Process Residues and wastes	25.05	672.2	692.27	4.98
			28.3 /28.2 of Schedule II	Spent Catalyst / Spent Carbon	Nil	Nil	Nil	Nil
			28.3 of Schedule II	Off Specification Products	Nil	0.207	0.207	Nil
			28.4 of Schedule II	Date Expired discarded and off specificatio	0.15	Nil	Nil	0.15

			n drugs / Medicines				
		28.6 of Schedule II	Spent Organic Solvents	Nil	Nil	Nil	Nil
		33.2 of Schedule I	Sludge from treatment of waste water arising out of cleaning / disposal of barrels / containers	Nil	Nil	Nil	Nil
		33.1 of Schedule I	Discarded containers / barrels / liners contaminate with HW / Chemicals	7.21	188.5	190.74	4.97
		34.3 of Schedule I	Chemical Sludge from waste water Treatment	2.2	Nil	Nil	2.2
		34.4 of Schedule I	Oil and grease skimming residues	0.04	Nil	Nil	0.04
		35.2 of Schedule I	Spent Catalyst	0.03	Nil	Nil	0.03
		35.3 of Schedule I /28.3	Spent Carbon	7.86	12.9	16.6	4.16
		35.3 of Schedule I	Chemical Sludge from waste Water	114.89	3956.5	3958.59	112.8

6	Description of Storage	:	Hazardous wastes are stored in HDPE / MS Barrels and kept over the impervious platform.	Mode of Packing	Mode of Transportation	Date of Transportation
7	Description of Treatment	:	Under closed shed.			
8	Details of Transportation		Not Applicable			
9	Details of disposal of hazardous waste	: : : :	Name & address of consignee	Mode of Packing	Mode of Transportation	Date of Transportation
			Refer Manifest			
10	Quantity of useful materials sent to the manufactures and others	:	Name & address of consignee		Quantity in Tons / KL	
		:	Refer Manifest	Not Applicable	Not Applicable	
		: :	Name and type of materials sent back to			
			Manufacturers			
			Others			

Date: 28.06.2022.

Place: Puducherry.

Signature : M. [signature]

Solara Active Pharma Sciences Limited
Puducherry 605 014
Periyakalapet

Hazardous Waste disposal vendors Details Finacial year 2021 - 2022

SLNO	Name of Hazardous Waste Generated	Details of Schedule and Category NO:	HW Disposed Authorized vendors	Opening Stock MT	Generation Quantity MT	Quantity disposed to Vendors MT	Total Quantity disposed MT	Closing Stock MT
1	Waste sodium dichromate solution	Class A of Schedule II	Rishab intermediates, A-70, PIPDIC industrial estate, Sedarapet Puducherry	35	18439	7403.53	18452.52	21.48
			Tanwell,S.F No: 25/1 Vairapalayam ERODE T.k & Dt			816.72		
			Ayes & Dyes,S.F NO.25/1, Ayanambakkam Chennai Village Ambattur, Thiruvallur			1512.25		
			Arihant intermediates Pvt Ltd, S.F No: 90/1, Sathmai village Maduranthagam taluk, Chengalpet dist,			5396.96		
			Premier Chemical Industries, S.F.No. 123/8B, 123/9A, Thuthipet Village, Villianur panchayat, Puducherry			2571.49		
			RSK intermediates R.S.No 1/3-5, Karasur, Villianur panchayat, Puducherry			365.39		
			Balaji Chemicals, Tindivanam, S.F.no: 54/5 Kallakolthur Village, Tindivanam T.K, Villupuram DT			386.18		
2	Spent lubricanting Oil	5.1 Schedule I	Sri Gowri industries S.F no 79/4 kondalakuppam, Vanur TK, Villupuram DT	1.01	0.75	1.76	1.76	-
3	Waste Residue/ Containing Oil	5.2 schedule I		0.72	-	-	-	0.72
4	Spent solvents	20.2 of Schedule I	Pentalcoat Resins Rs.No 30/1,2 Kondalankuppam, Vanur.Villupuram T.K	21.49	722	648.71	706.62	36.87
			Keerthiga Chemicals SF.No.1364/2 uppilamangalam, East village , karur			33.09		
			OZPEC CHEMICAL INDUSTRIAL Private Limited, SF.No.218/2A6, Door No 3/290 VARAPATTY Village,SULUR Taluk,Coimbatore District.			24.82		

5	Distillation residues	20.3 ofSchedule I	[illegible] T.K	–	43	1.03	43	–
			Keerthiga Chemicals SF.No.1364/2 uppilamangalam, East village , karur			41.97		
6	Process residues and Wastes	28.1 of Schedule I	Keerthiga Chemicals SF.No.1364/2 uppilamangalam, East village , karur	25.05	672.2	91.81	692.27	4.98
			Pentakcoat Resins vanur Rs.No 30/1,2 Kondalankuppam, Vanur.Villupuram T.K			600.46		
7	Spent Catalyst/spent carbon	28.2 of Schedule II	Sandhiya Enviro Tech system 3/2A Ariyour road Vedampattu Villupuram	–	–	–	–	–
8	Off specification products	28.3 of Schedule II	E nano incintech, #342/B, 2nd Phase, 2nd Sector, Industrial Area, Kanakapura taluk, 562112, Harohalli, Karnataka 562135	–	0.207	0.207	0.207	–
9	Date Expired Discarded and off specifications drugs/medicines	28.4 of Schedule II		0.15	–	–	–	0.15
10	Spent Organic solvent	28.5 of Schedule II	OZPEC CHEMICAL INDUSTRIAL PLD,SF.No.218/2A6, Door No 3/290 VARAPATTY Village,SULUR Taluk,Coimbatore District.	–	–	–	–	–
			Pentakcoat Resins vanur Rs.No 30/1,2 Kondalankuppam, Vanur.Villupuram T.K			–		
11	Discarded containers/barrels/liner /barries with contaminate with HW/Chemicals	33.3 Of Schedule I	Universel Barrels Plot No A-19 Kattukuppam, Puducherry	7.21	188.5	9.11	190.74	4.98
			Gray Globe carbuoys S.F No:87/1 A1 part, Chinnavarigam Village, Ambur Taluk, Vellore DT			181.63		
12	Chemical sludge from waste water	34.3 of Schedule I		2.2	–	–	–	2.2

13	Oil and Grease skimming residues	34.4 of Schedule I		0.04	–	–	–	0.04
14	Spent Catalyst	35.2 of Schedule I		0.03	–	–	–	0.03
15	Spent carbon	35.3 / 28.3 of Schedule I	Sandhiya Enviro Tech system 3/2A Ariyour road Vedampattu Villupuram	7.86	12.9	16.6	16.6	4.16
16	Chemical sludge from waste water	35.3	Mother Earth Environ Tech, Plot No.217, KIADB Industrial Area,Karnataka	114.89	3956.5	2267.75	3958.59	112.8
			Arunachalla enterprises No. 207-A, Allwin Nagar 1st Cross, Kovai Main Rd, LNS Post, Karur, Tamil Nadu 639002			1690.84		

SOLARA
Active Pharma Sciences

Communication Address :
Solara Active Pharma Sciences Limited
R.S.No. 33 & 34,
Mathur Road, Periyakalapet
Puducherry - 605 014. India
Tel: +91 413 2654100, Fax: +91 413 2655154

Date: 26.09.2022

To

The Member Secretary,
Puducherry Pollution Control Committee,
Puducherry -5

Respected sir,

Sub: Submission of **Environment statement "FORM –V"** for the year 2021-2022

With reference to the mentioned Subject, here with we are submitting the Environment statement **" Form – V "** for the year of April-2021 to March 2022.

This is for your kind information and record please

Thanking you,

For Solara active pharma sciences Limited.,

M. Mohan
Chief Operations Officer

26/9/2022

FORM-V

ENVIRONMENTAL STATEMENT

Environmental statement (for the financial Year ending with 31st March 2 0 2 2

1. Name and address of the owner/ Occupier of the industry Operation or process	Jithesh Devendira Solara Active Pharma Sciences Limited, R.S. No. 33 & 34 Mathur Road, Periyakalapet, Puducherry-605 014, India.
ii. Industry category primary- (STC Code) Secondary- (STC Code)	RED
iii. Production category/Units	Pharmaceutical - API
iv. Year of establishment	1986
v. Date of the last environmental Statement Submitted	29.09.2021

PART-B

1. Water consumption in m3/day

Domestic : 29 KL
Industrial : 105 KL
Total :110 KL
Sewage Treated Effluent water (STEW) purchased from PWD
Maximum quantity of 566 KLD as per CTO.

S.No	Name of products	Process water consumption per unit of products (KL)- During the previous year from April 2020 to March 2021.	Process water consumption per unit of products (KL)- During the current year from April 2021to March 2022.
Please Refer Annexure - I			

Name of raw materials*	Name of products	Raw material consumption per unit of output –During the previous year from April-2020 to March -2021	Raw material consumption per unit of output – During the current year from April 2021 to March -2022
Please Refer Annexure – II			

**Industry may use codes if disclosing details of raw material would violate contractual obligations, otherwise all industries have to name the raw materials used.*

PART-C

Pollution discharged to environment/unit of output

(Parameter as specified in the consent issued)

<table>
<tr><th>Pollutants</th><th>Quantity of pollutants discharged (mass/day)</th><th>Concentration of Pollutants discharged (mass/volume)</th><th>Percentage of variation from prescribed standards with reasons</th></tr>
<tr><td>Water</td><td colspan="3">No water pollutants are discharged to the environment as the effluent generated is treated in the ZLD Plant & recycled within the unit.</td></tr>
<tr><td>Air</td><td>APC Measures. (Cyclone separator, Bag Filter available)</td><td>Standard prescribed By PPCC.</td><td>Nil</td></tr>
</table>

PART-D

Hazardous Wastes

(As specified under Hazardous wastes (management & Handling Rules, 1989))

S.No.	Hazardous wastes	Total quantity During the current year from April-2020 to March-2021 (MT)	Total quantity During the current year from April-2021 to March-2022 (MT)
1	Waste Dichromate Solution	23659.04	18452.52
2	5.1. Spent lubricant oil	Nil	1.760
3	34.3 ETP Sludge	Nil	Nil
4	5.2. wastes /residues containing oil	Nil	Nil
5	20.2 Spent Solvents	676.12	706.62
6	20.3 Distillation Residues	Nil	43.00
7	28.1 Process Residues and Wastes	692.36	692.27
8	28.2 Spent catalyst/ Spent carbon	Nil	Nil
9	28.3 off specification products	Nil	0.207
10	28.4 Date Expired discarded and off specification drugs / Medicines	Nil	Nil
11	28.5/28.6 Spent Organic solvent	17.14	Nil
12	33.2 Sludge from treatment of wastewater arising out of cleaning / disposal of barrels / containers	Nil	Nil
13	33.3 Discarded containers/barrels/liners contaminate with HW/Chemicals	231.3	190.74
14	34.3 Chemical Sludge from wastewater Treatment	Nil	Nil
15	34.4 Oil and grease skimming residues	Nil	Nil
16	35.2 Spent Catalyst	Nil	Nil
17	35.3/28.3 Spent Carbon	31.78	16.60
18	35.3 chemical sludge from wastewater Treatment.	4408.79	3958.59

PART-E
Solids Wastes

S.No.	Solids wastes	Total quantity During the current year from April 2020 to March 2021 MT	Total quantity During the current year from April 2021 to March 2022 MT
1	From Process (Fly Ash)	680	610
2	From Pollution Control Facilities	3.0	Nil
3	Quantity recycled or reused within the unit.	Nil	Nil

PART-F

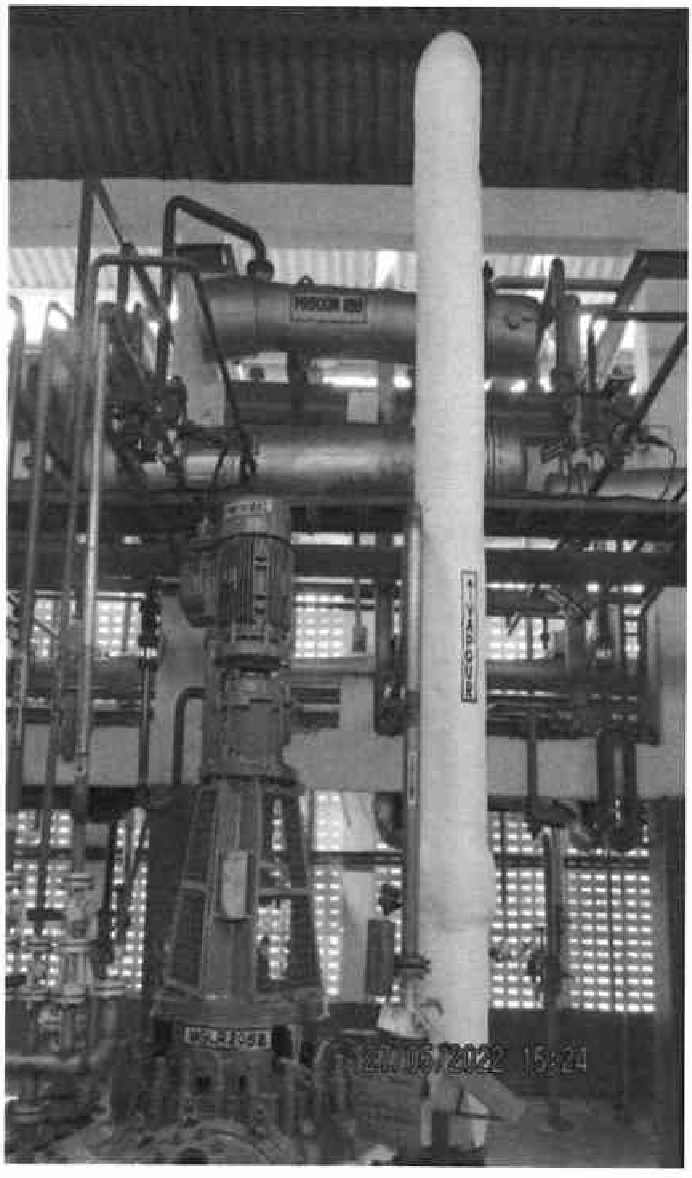
Please specify the characteristics (in terms of concentration and quantum) of Hazardous as well as solid wastes and indicate disposal practice adopted for both these categories of wastes.

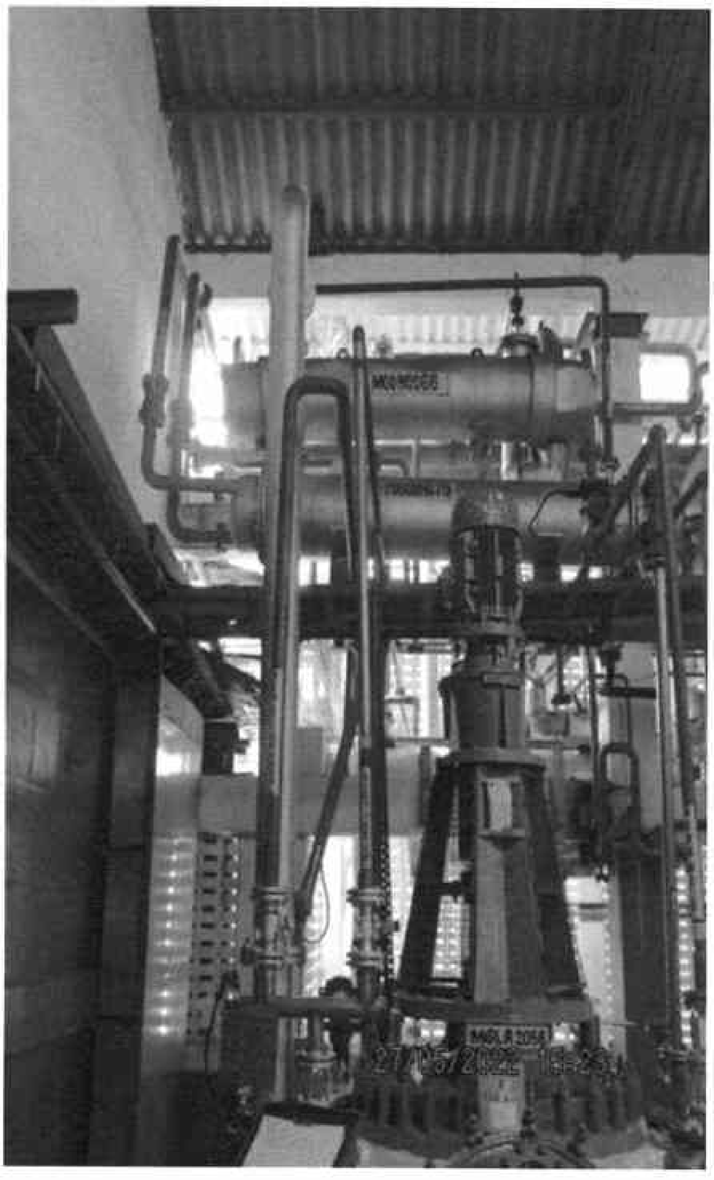
Specification	Hazardous waste	Solid waste
Characteristics	1.Process Wastes: Liquid / Tarry Residues. 2.ETP Sludge: Solids/semi solids	Fly Ash: Solids
Disposal	Process Residues: Stored in HDPE barrels over impervious platform under closed shed. Disposal to Co-Processing industry and Recycle ETP Sludge: Chemical sludge from wastewater treatment category no 35.3 disposal to co-processing industry/TSDF. Bio Sludge - Generated from Bio clarifier and sent to Thickener and followed by centrifuge and finally will get the Bio sludge disposal to TSDF	Fly Ash: Sold As manure

PART-G

Impact of the pollution control measures taken on conservation of natural resources and consequently on the cost of production:

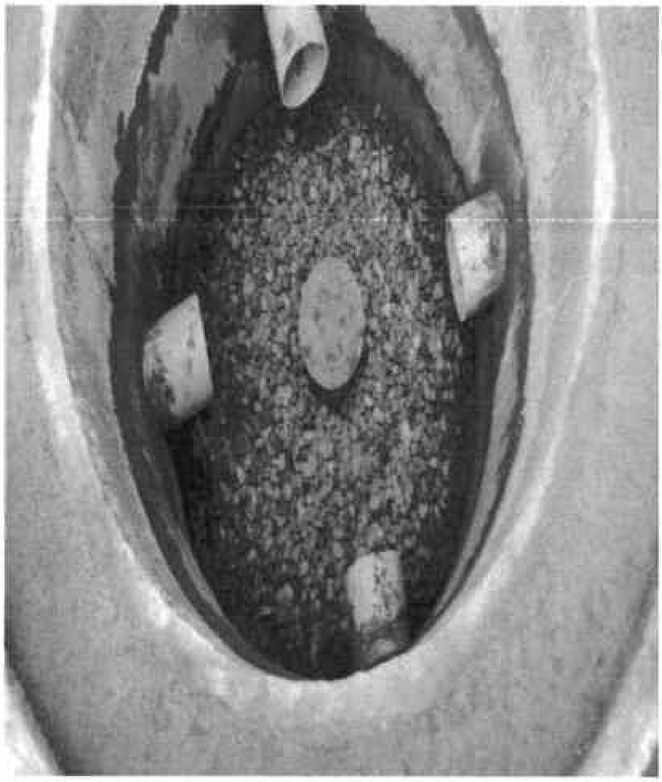
- All solvents process reactors are connected to condensers to avoid organic vapour losses and exposure.



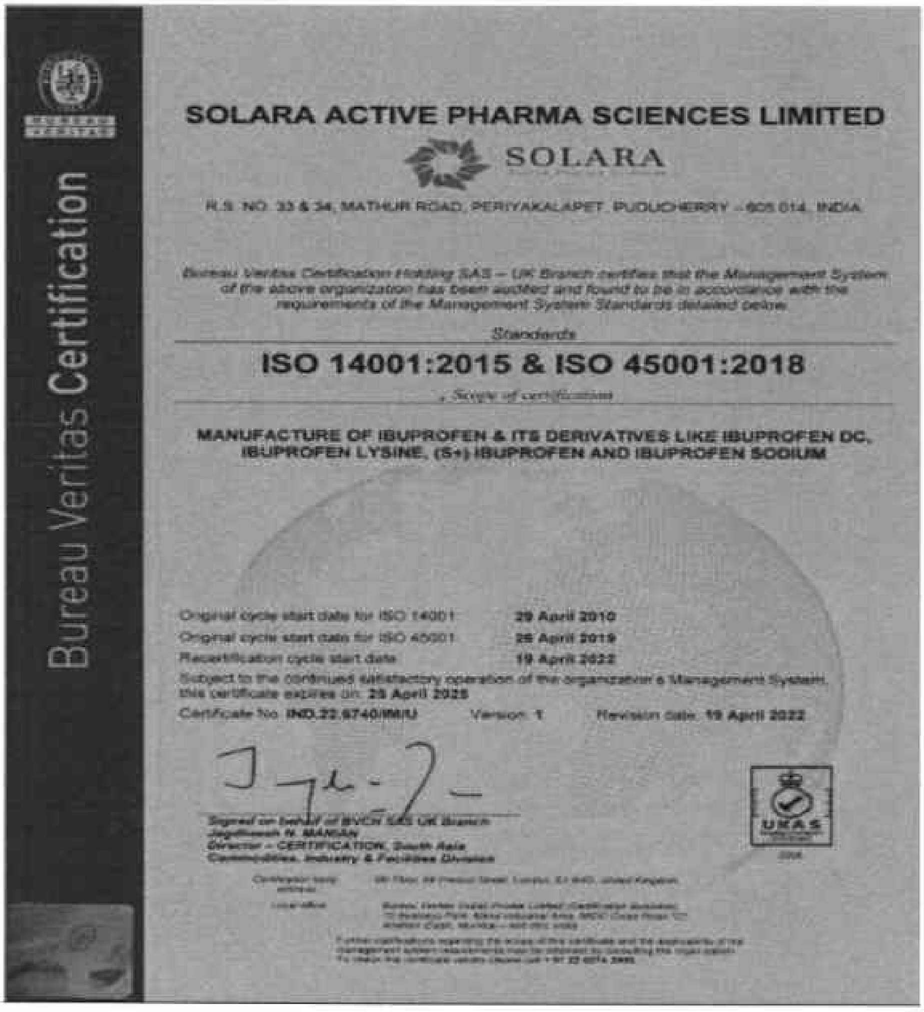


- Sapling were planted at "Ahad ka Amrit Mahotsav" for the 75th Independence Day celebration.


- Tsunami quarters Rainwater Harvesting pit provided for community usage.

- Management system, Re- certification obtained for ISO 14001 : 2015 & ISO 45001 : 2018



Bureau Veritas Certification

SOLARA ACTIVE PHARMA SCIENCES LIMITED

SOLARA

R.S. NO. 33 & 34, MATHUR ROAD, PERIYAKALAPET, PUDUCHERRY – 605 014, INDIA

Bureau Veritas Certification Holding SAS – UK Branch certifies that the Management System of the above organization has been audited and found to be in accordance with the requirements of the Management System Standards detailed below

Standards

ISO 14001:2015 & ISO 45001:2018

Scope of certification

MANUFACTURE OF IBUPROFEN & ITS DERIVATIVES LIKE IBUPROFEN DC, IBUPROFEN LYSINE, (S+) IBUPROFEN AND IBUPROFEN SODIUM

Original cycle start date for ISO 14001: **29 April 2010**

Original cycle start date for ISO 45001: **25 April 2019**

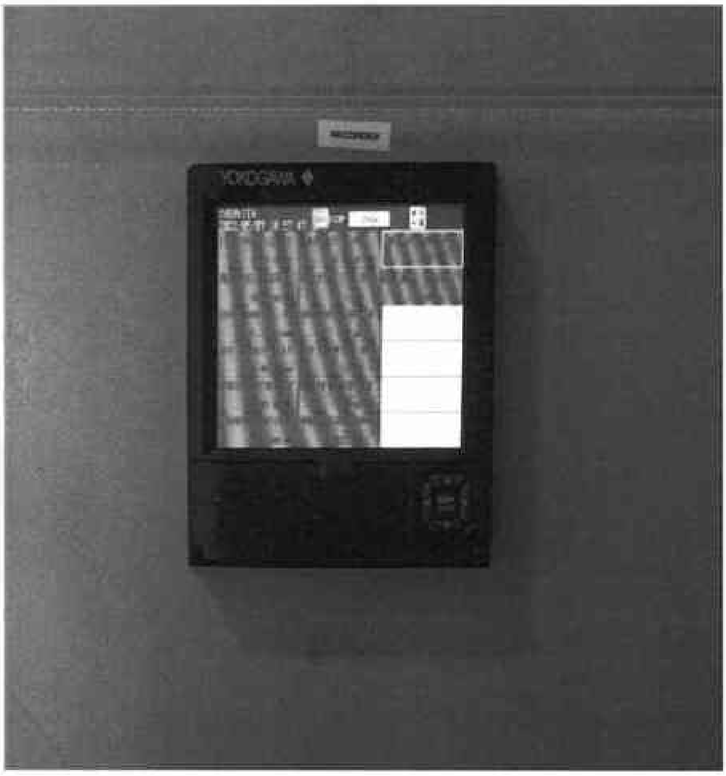
Recertification cycle start date: **19 April 2022**

Subject to the continued satisfactory operation of the organization's Management System, this certificate expires on: **28 April 2025**

Certificate No: **IND.22.6740/IM/U** Version: **1** Revision date: **19 April 2022**

Signed on behalf of BVCH SAS UK Branch
Jagdheesh N. MANIAN
Director – CERTIFICATION, South Asia
Commodities, Industry & Facilities Division

- Continuous online monitoring system (OCEMS)is connected to PPCC and CPCB.



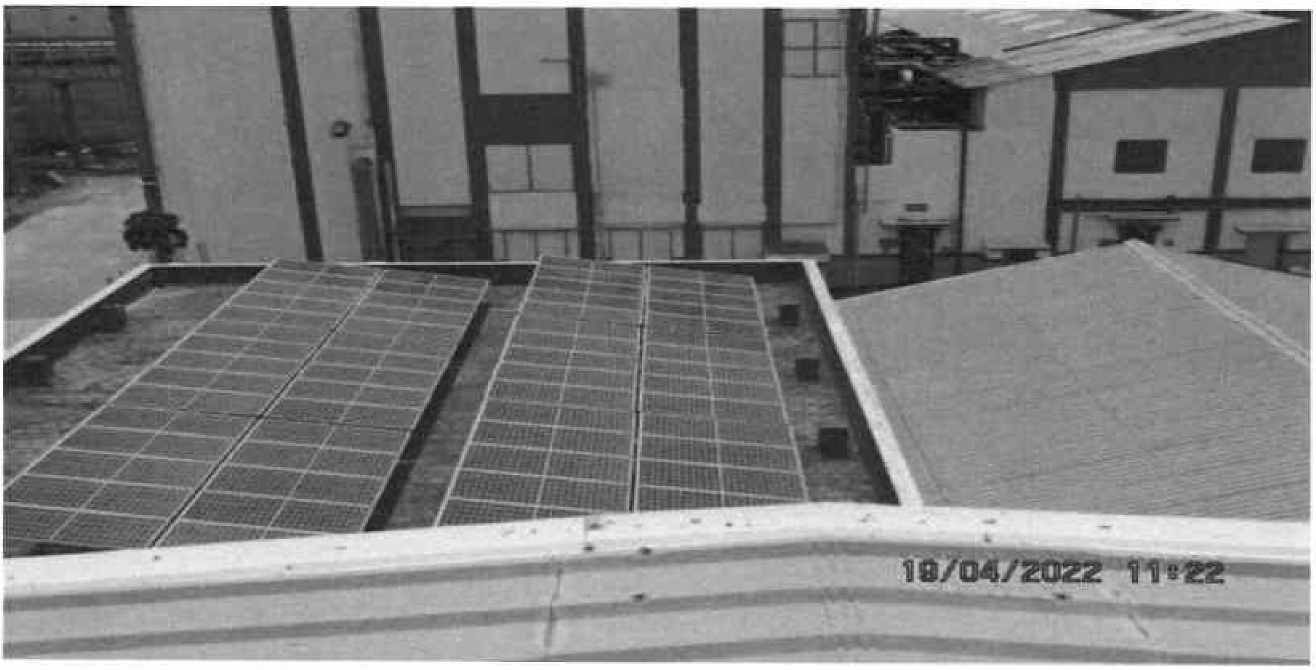

- The lights are changed with CFL to LED to reduce power consumption.

PART-H

<u>Additional measures / investment proposal for Environmental protection including abatement of pollution:</u>

1. Sewage Treated Effluent Water (STEW) received from PWD and further treated in our ZLD-ETP system and reused to non-process operation.

2. Solar Power is installed in the Capacity of 360 KWP, All the Roof Sheet Solar Power Panel is Provided.



3. Hazardous waste details displayed in LED board 24*7 in front our industry.

4. We are in progress of Installing Sludge Rotary Dryer to minimize the sludge disposal quantity using Flue gas from the boiler.

   Flue gas at 140 Deg from boiler is sent to drying section for drying purpose. Flue gas from Boiler is heated from 140 deg C to 160 Deg C in a thermic fluid heat exchanger. Sludge Feeding is done at controlled rate. The sludge material and hot air come in indirect contact with each other and drying takes place. The moisture removed from the product is carried away by the exhaust air. feed material comes into agitator which breaks the lumps and keeps the material in floating condition. As the material particle size reduces and is dried, becomes light and gets conveyed with exhaust air. The exhaust gases are then passed through cyclone. The product is separated and collected at the bottom. The exhaust gases are further passed through a ventury scrubber. Clean air is then exhausted to the atmosphere. The entire operation of the plant is controlled through an Automation operating panel.

Purchase order raised. Project proposal will be completed in another 10 months period tentatively.

SOLARA

Purchase Order

Supplier Address **MOJJ ENGINEERING SYSTEMS LIMITED (0031009836)** General Block, 81-B/15, MIDC BHOSARI, PUNE 411026 GSTIN: 27AABCM1797L1Z0 PAN : AABCM1797L Tel No : 9766640675 Fax No : Contact Person & No: - Email ID : pankaj.ekad@moggpune.com	**PO No** : **5500013842** **PO Date** : **30.05.2022** **PO Currency** : **INR** **Amendment No** : **Amendment Date** : **Your Quotation No.& Date** : **Old Reference NO.** :
Billing Address Solara Active Pharma Sciences Limited API Puducherry R.S. No. 33 & 34 Mathur Road,Periakalapet Puducherry 605014 Puducherry-INDIA GSTIN: 34AAYCS2093N1ZH PAN: AAYCS2093N Tel No:0413-2654100 Fax No:+91 4132655154	**Delivery Address** Solara Active Pharma Sciences Limited API Puducherry R.S. No. 33 & 34 Mathur Road,Periakalapet Puducherry 605014 Puducherry-INDIA. GSTIN : 34AAYCS2093N1ZH PAN : Tel No :0413-2654100 Fax No : +91 4132655154

We are pleased to place the order as per below mentioned price, terms & conditions.

Item No	Item Details	Quantity UOM	Unit Rate INR	Discount	Amount INR	Taxes INR	Total INR
10	- Thermic Fluid AIR HEATER HSN/SAC:	1.000 EA	750,000.00	0.00	750,000.00	IGST:18% 135,000.00	885,000.00
20	- DUCTING HOT AIR HSN/SAC:	1.000 LOT	630,000.00	0.00	630,000.00	IGST:18% 113,400.00	743,400.00
30	- AIR DISTRIBUTOR & Agitator assembly HSN/SAC:	1.000 EA	1,350,000.00	0.00	1,350,000.00	IGST:18% 243,000.00	1,593,000.00
40	- SPIN DUCT HSN/SAC:	1.000 LOT	900,000.00	0.00	900,000.00	IGST:18% 162,000.00	1,062,000.00
50	- CYCLONE SEPARATOR HSN/SAC:	1.000 SET	1,800,000.00	0.00	1,800,000.00	IGST:18% 324,000.00	2,124,000.00
60	- ROTARY VALVE HSN/SAC:	1.000 EA	150,000.00	0.00	150,000.00	IGST:18% 27,000.00	177,000.00
70	- DUCTING INTERCONNECTING & Powder HSN/SAC:	1.000 LOT	450,000.00	0.00	450,000.00	IGST:18% 81,000.00	531,000.00
80	- EXHAUST BLOWER WITH MOTOR HSN/SAC:	1.000 EA	1,125,000.00	0.00	1,125,000.00	IGST:18% 202,500.00	1,327,500.00
90	- WET SCRUBBER assembly HSN/SAC:	1.000 SET	2,025,000.00	0.00	2,025,000.00	IGST:18% 364,500.00	2,389,500.00
100	- Feed conditioner HSN/SAC:	1.000 LOT	1,035,000.00	0.00	1,035,000.00	IGST:18% 186,300.00	1,221,300.00

Purchase Order

[illegible]

PO Number: 5500013842
PO Date: 30.05.2022

PO Version Number:
PO Version Date:

Item No	Item Details	Quantity UOM	Unit Rate INR	Discount	Amount INR	Taxes INR	Total INR
110	- SCREW FEEDER HSN/SAC:	1.000 SET	735,000.00	0.00	735,000.00	IGST:18% 132,300.00	867,300.00
120	- Control panel HSN/SAC:	1.000 SET	750,000.00	0.00	750,000.00	IGST:18% 135,000.00	885,000.00
130	- Insulation and caldding HSN/SAC:	1.000 LOT	450,000.00	0.00	450,000.00	IGST:18% 81,000.00	531,000.00
140	- Cables and trays HSN/SAC:	1.000 LOT	450,000.00	0.00	450,000.00	IGST:18% 81,000.00	531,000.00
Total				**0.00**	**12,600,000.00**	**2,268,000.00**	**14,868,000.00**
						Freight Charges	**0.00**
						Loading and Unloading charges	**0.00**
						Clearing & Forwarding	**0.00**
						Storage Charges	**0.00**
						Insurance	**0.00**
						Development Charges	**0.00**
						Others	**0.00**
Grand Total	ONE CRORE FORTY EIGHT LAKH SIXTY EIGHT THOUSAND RUPEES ONLY						**14,868,000.00**

ICICI LOMBARD GENERAL INSURANCE CO LTDPolicy No:2002/169820707/03/000 dt.31.03.2023

Terms of Payment: See Remarks
Incoterms:
Incoterms Location:
Remarks/Special Instructions:

Material Should Be Supplied as per the above mentioned specification number and manufacturer(s)
Payment terms:
40% advance along with the order.
Balance against Proforma invoice prior to despatch but after final inspection

DELIVERY SCHEDULE:
The deliveries shall be with part shipment.
Delivery starts on Ex works basis : 16 Weeks
Delivery ending on Ex works basis : 18 Weeks
Installation starts after : 16 Weeks (Estimated)
Commissioning and Product Trials complete before: 22 Weeks (Estimated)
Total duration of project from starting to completion of commissioning : 22 Weeks (Estimated

Detailed Delivery Schedule

5. We have initiated purchase order for installing Organic waste convertor for our canteen waste and Garden wastes.

SOLARA

Purchase Order

Solara Active Pharma Sciences Limited [illegible]

Supplier Address **GREENERA ENGINEERING LLP (0031009830)** B/12. Sitaba Estate, Nr Anup Estate, AHMEDABAD Gujarat 380026 GSTIN: 24AATFG4315K1Z6 PAN : AATFG4315K Tel No : 9099908106 Fax No : Contact Person & No: - Email ID : info@greeneraengineering.com	**PO No** : **5500014327** **PO Date** : **21.07.2022** **PO Currency** : **INR** **Amendment No** : **Amendment Date** : **Your Quotation No.& Date** : **Old Reference NO.** :
Billing Address Solara Active Pharma Sciences Limited API Puducherry R.S. No. 33 & 34 Mathur Road,Periakalapet Puducherry 605014 Puducherry-INDIA GSTIN: 34AAYCS2093N1ZH PAN: AAYCS2093N Tel No:0413-2654100 Fax No:+91 4132655154	**Delivery Address** Solara Active Pharma Sciences Limited API Puducherry R.S. No. 33 & 34 Mathur Road,Periakalapet Puducherry 605014 Puducherry-INDIA. GSTIN : 34AAYCS2093N1ZH PAN : Tel No :0413-2654100 Fax No : +91 4132655154

We are pleased to place the order as per below mentioned price, terms & conditions.

Item No	Item Details	Quantity UOM	Unit Rate INR	Discount	Amount INR	Taxes INR	Total INR
10	- Organic waste composting machine HSN/SAC:	1.000 EA	656,100.00	0.00	656,100.00	IGST:12% 78,732.00	734,832.00
Additional information:							
Total				**0.00**	**656,100.00**	**78,732.00**	**734,832.00**
						Freight Charges	**0.00**
						Loading and Unloading charges	**0.00**
						Clearing & Forwarding	**0.00**
						Storage Charges	**0.00**
						Insurance	**0.00**
						Development Charges	**0.00**
						Others	**0.00**
Grand Total	SEVEN LAKH THIRTY FOUR THOUSAND EIGHT HUNDRED THIRTY TWO RUPEES ONLY						**734,832.00**

ICICI LOMBARD GENERAL INSURANCE CO LTDPolicy No:2002/169820707/03/000 dt.31.03.2023

Terms of Payment: See Remarks
Incoterms:
Incoterms Location:
Remarks/Special Instructions:
Material Should Be Supplied as per the above mentioned specification number and manufacturer(s)
Payment Terms : 50% Advance,balance before Dispatch.
Delivery : 3-4 Weeks

PART-I

Any other particulars in respect of environmental protection and abatement of pollution.

- Standby 16 TPH boiler with all APC measure installed
- In house LDAR study conducted by every three months to reduce VOC emission.
- Creating awareness of Environmental awareness and better environmental practices among employees, Visitors and students through trainings, Etc.

Annexure I

YEAR April 2020-March 2021		Production in MTA	4600.24
S.No	**Raw Material Name**	**Total Raw Water Consumption in MT**	**Raw Material Consumption /Mt of Product**
1	Ibuprofen & Ibu derivatives	29771	6.47

YEAR April 2021-March 2022		Production in MTA	3534
S.No	**Raw Material Name**	**Total Raw Water Consumption in MT**	**Raw Material Consumption /Mt of Product**
1	Ibuprofen & Ibu derivatives	35361	10.00

Annexure II

RAW MATERIAL CONSUMPTION			
PRODUCTION: IBUPROFEN			
YEAR April 2020-March 2021		Production in MTA	4326.60 MTA
Sl. No	Raw Material Name	Total Raw Material Consumption in MT	Raw Material Consumption /Mt of Product
1	Acetone	5772.56	1.33
2	Activated Carbon	18.91	0.004
3	Aldehyde	4680.46	1.08
4	Dilute Sulphuric Acid	12114.82	2.8
5	Hexane	7215.70	1.67
6	Hydrochloric Acid	1330.51	0.30
7	IBAP	4485.44	1.04
8	Isopropyl Alcohol (IPA)	16264.58	3.76
9	Mono Chloro Acetate (MCA)	3588.35	0.83
10	Sodium Bicarbonate	585.06	0.13
11	Sodium Dichromate	2730.27	0.63
12	Sodium Hydroxide	2535.25	0.58
13	Sodium Metal	842.65	0.19
14	Sulphuric Acid	586.08	0.13

RAW MATERIAL CONSUMPTION			
Ibu Derivatives (Ibu DC, Lysine, Sodium, S+ Ibuprofen)			
YEAR April 2020-March 2021		Production in MTA	384.22 MT
S.No	Raw Material Name	Total Raw Material Consumption in MT	Raw Material Consumption /Mt of Product
1	Ibuprofen	1205.82	3.14
2	Isopropyl Alcohol (IPA)	5892.08	15.3
3	Toluene	1808.73	4.7
4	Sodium Hydroxide	41.11	0.10
5	DL. Lysine	246.65	0.64
6	Hexane	1351.07	3.51
7	Hydrochloric Acid	479.59	1.24
8	Methanol	230.20	0.60
9	SPBA	317.90	0.83

Annexure II

RAW MATERIAL CONSUMPTION			
PRODUCTION: IBUPROFEN			
YEAR April 2021-March 2022		Production in MTA	3534 MT
S.No	Raw Material Name	Total Raw Material Consumption in MT	Raw Material Consumption /Mt of Product
1	Acetone	5287.61	1.50
2	Activated Carbon	17.13	0.005
3	Aldehyde	4283.64	1.21
4	Dilute Sulphuric Acid	10976.82	3.11
5	Hexane	6620.90	1.87
6	Hydrochloric Acid	803.18	0.23
7	IBAP	2744.20	0.78
8	Isopropyl Alcohol (IPA)	12861.62	3.64
9	Mono Chloro Acetate (MCA)	6015.15	1.70
10	Sodium Bicarbonate	1137.84	0.32
11	Sodium Dichromate	2583.57	0.73
12	Sodium Hydroxide	1606.36	0.45
13	Sodium Metal	508.68	0.14
14	Sulphuric Acid	1070.91	0.30

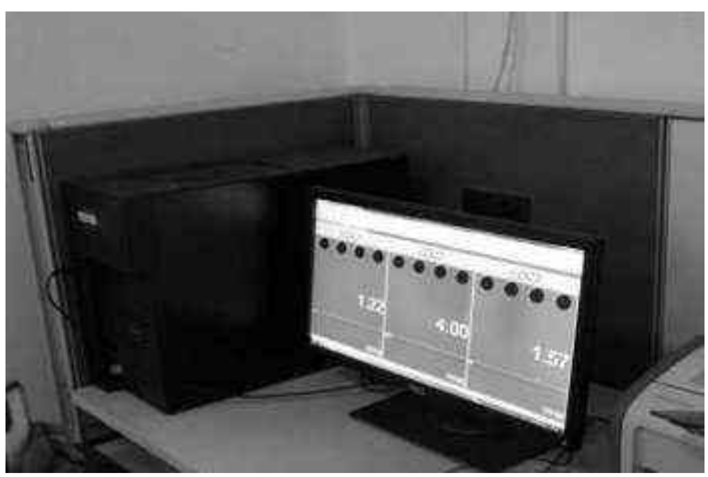
RAW MATERIAL CONSUMPTION			
Ibu Derivatives (Ibu DC, Lysine, Sodium, S+ Ibuprofen)			
YEAR April 2021-March 2022		Production in MTA	355.20 MT
S.No	Raw Material Name	Total Raw Material Consumption in MT	Raw Material Consumption /Mt of Product
1	Ibuprofen	1114.74	3.13
2	Isopropyl Alcohol (IPA)	5447.05	15.33
3	Toluene	1672.117	4.70
4	Sodium Hydroxide	38.00	0.10
5	DL. Lysine	228.02	0.64
6	Hexane	1249.02	3.51
7	Hydrochloric Acid	443.37	1.24
8	Methanol	212.81	0.59
9	SPBA	293.89	0.82

Annexure - 29

Chillers photograph

Annexure - 30

VOC sensors Photograph



Strom water drain photograph

Annexure - 31

SOLARA
Active Pharma Sciences

Communication Address
Solara Active Pharma Sciences Limited
R.S.No. 33 & 34,
Mathur Road, Periyakalapet
Puducherry - 605 014. India
Tel: +91 413 2654100. Fax: +91 413 2655154

Date :28.10.2020

The Member Secretary,
Puducherry Pollution Control Committee,
Government of Puducherry -- 5

Sub: Updating of Hazardous waste category number as per rule 2015 MOEF notification dated 04.04.2016 and Renewal of Hazardous Waste Authorization and Name change to M/s Solara Active pharma sciences Ltd.

Ref: Our Hazardous waste authorization No: 4/PPCC/HWM/JSA/2016/384 dated 30.06.2016 and renewal Expired on 30.11.2020.

With reference to the above subject, we bring to your good self that we got authorization from PPCC, Puducherry for collection, Storage, transport and disposal of hazardous waste as per rule 2008 as above said reference dated 30.06.2016 .Our Hazardous waste Authorization is validity period up to 30.11.2020 and renewal online application submitted on 27.10.2020 .

Whereas the rules, namely Hazardous and other wastes (Management and Transboundary Movement) Rules, 2015, were published by the Government of India in the Ministry of Environment, Forest and Climate Change notification dated 04.04.2016.

As per new Hazardous waste rule the categorization of hazardous waste number were changed, hence we need to update the hazardous waste category number.

Following are the Existing authorization quantity of waste approved by PPCC as per hazardous waste rule amended.

2-11-2020

SOLARA
Active Pharma Sciences

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Solara Active Pharma Sciences Limited
R.S.No. 33 & 34.
Mathur Road, Periyakalapet
Puducherry - 605 014. India
Tel: +91 413 2654100, Fax: +91 413 2655154

Kindly renew our Hazardous waste Authorization for 5 Five Years.

Thanking you,

Yours faithfully,

For Solara Active Pharma Sciences Limited,

30/10/2020
P.Sathiyanarayanan
General Manager

Enclsoed:1. The copy of H.W authorization
2.The copy of vendor Agreement
3.The original D.D
4.The copy of Online Application

PART – C : Treatment, Storage and Disposal Facility (TSDF) Operators		Not Applicable
7 a. i)	Location address of TSDF site	
ii)	Safe storage of the waste and storage capacity	
iii)	The treatment processes and their capacities	
iv)	Secured Landfills	
v)	Incineration, if any	
vi)	Leachate Collection and Treatment System	
vii)	Fire Fighting Systems	
viii)	Environmental management plan including monitoring	
ix)	Arrangement for transportation of waste from Generators	
b)	Any other activities undertaken at the Treatment, storage and disposal facility site	
c)	Layout map of the TSDF	ATTACHED
d)	Copy of prior Environmental Clearance	ATTACHED
PART-D :Recyclers/Pre-processors/Co-processors/Users of hazardous or other wastes : No		
8 i)	Nature and quantity of different wastes received per annum from domestic sources or imported or both:	

Hazardous & Other Wastes Type	Passbook Type	Quantity	Source(Domestic/Imported)

ii)	Installed capacity as per registration issued by the District Industries Centre or any other authorised Government agency	ATTACHED
iii)	Details of secured storage of wastes including the storage capacity	
iv)	Process description including process flow sheet indicating equipment details, inputs and outputs (input wastes, chemicals, products, by-products, waste generated, emissions, waste water, etc.)	ATTACHED
v)	Details of end users of products or by-products	
vi)	Details of pollution control systems such as Effluent Treatment Plant, scrubbers, etc. including mode of disposal of waste	
vii)	Details of occupational health and safety measures	
viii)	Has the facility been set up as per Central Pollution Control Board guidelines? If yes, provide a report on the compliance with the guidelines	
ix)	Arrangements for transportation of waste to the facility	

Place: PUDUCHERRY

Date: 30/10/2020

Signature of the Applicant

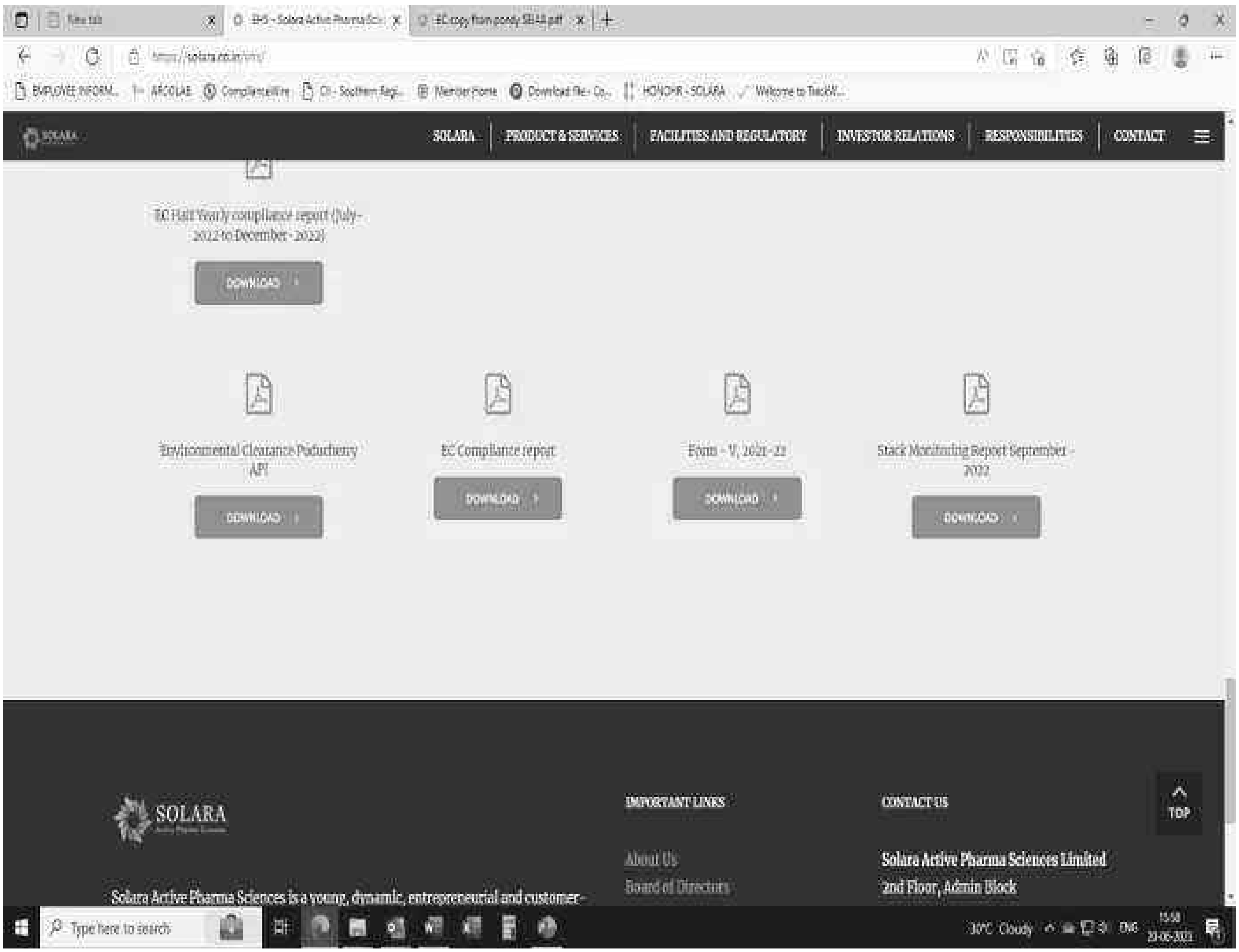
Name and Designation

P. SATHIYANARAYANAN

GENERAL MANAGER

Annexure - 33

Screenshot of EC compliance report uploaded in the company website



Annexure - 34

SOLARA
Active Pharma Sciences

Communication Address
Solara Active Pharma Sciences Limited
R.S.No. 33 & 34,
Mathur Road, Periyakalapet
Puducherry 605014, India
Tel: +91 413 2654100, Fax: +91 413 2655154

Date :19.12.2022

The Director,
CPCB Zonal Office,
77-A, South Avenue Road,
Ambattur Industrial Estate,
Ambattur Taluk, Thiruvallur District,
Chennai - 600 058.

Sir,

Sub: Submission of six monthly Environmental Clearance Compliance statement for December 2022 (for the period from April -2022 to September - 2022) for "M/s Solara Active Pharma Science Limited – Change in product mix without increase in total production capacity" at R.S. Nos. 30/4pt, 32/1A, 32/2, 32/3, 33/1, 33/10, 33/11, 33/13, 33/2, 33/3, 33/4,33/5, 33/6, 33/9, 34/1, 34/2, 34/3, 34/4, 34/5, 34/6, 34/7, 34/8, 35/4, 35/5, 35/6, 35/7, 36/5, Periyakalapet, Mathur Road, Puducherry.

Ref: EC vide F.No 247066/SEIAA/PY/EE/2022 dated: 27.04.2022.

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We submit herewith the six monthly Environmental Clearance Compliance statement for "M/s Solara Active Pharma Sciences Limited – Change in product mix without increase in total production capacity" at R.S. Nos. 30/4pt, 32/1A, 32/2, 32/3, 33/1, 33/10, 33/11, 33/13, 33/2, 33/3, 33/4,33/5, 33/6, 33/9, 34/1, 34/2, 34/3, 34/4, 34/5, 34/6, 34/7, 34/8, 35/4, 35/5, 35/6, 35/7, 36/5, Periyakalapet, Mathur Road, Puducherry for December 2022 (for the period from April 2022 to September 2022) along with the supporting documents for your perusal.

Thanking you

Communication Address
Solara Active Pharma Sciences Limited
R.S.No. 33 & 34,
Mathur Road, Periyakalapet
Puducherry - 605 014. India
Tel: +91 413 2654100, Fax: +91 413 2655154

SOLARA
Active Pharma Sciences

भारतीय डाक
India Post

Counter No:2,27/12/2022,21:25
To:MINISTRY OF ENVIRO,CH
PIN:600006, Greams Road S.O
From:SOLARA ACTI.LITTLE MOUNT
Wt:477gms
Amt:35.40(Cash)Tax:5.40
<Track on www.indiapost.gov.in>
(Dial 18002666868) (Wear Masks, Stay Safe)

Date : 19.12.2022

The Director,
The Ministry of Environment and Forest & Climate Change,
Integrated Regional Office,
1st Floor, Additional Office Block for GPOA,
Shastri Bhawan, Haddows Road,
Nungambakkam, Chennai – 600 006.

Sir,

Sub: Submission of six monthly Environmental Clearance Compliance statement for December 2022 (for the period from April -2022 to September - 2022) for "M/s Solara Active Pharma Science Limited – Change in product mix without increase in total production capacity" at R.S. Nos. 30/4pt, 32/1A, 32/2, 32/3, 33/1, 33/10, 33/11, 33/13, 33/2, 33/3, 33/4,33/5, 33/6, 33/9, 34/1, 34/2, 34/3, 34/4, 34/5, 34/6, 34/7, 34/8, 35/4, 35/5, 35/6, 35/7, 36/5, Periyakalapet, Mathur Road, Puducherry.

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Thanking you