Report No: NSF/F/47 File No: 93

Report of Green, Environment, Energy, Air Quality, Hygiene, Soil, Water &Waste Management Audits

Submitted to

PERIYAR MANIAMMAI INSTITUTE OF SCIENCE & TECHNOLOGY, PERIYAR NAGAR, VALLAM, THANJAVUR - 613 403, TAMIL NADU, INDIA

Date of Audit: 25.11.2025
Date of Issue:
Date of Validity: 24.11.2027

Submitted by

NATURE SCIENCE FOUNDATION
[ISO/IEC 17020:2012 and ISO/IEC 17021:2015 Accredited Inspection (Reg. No.: IB 121) and Certification (Reg. No.: QM 097) Bodies by NABCB, QCI, Government of India.]
No. 2669, LIG-II, Gandhi Managar, Peelamedu
Coimbatore 641 004, Tamil Nadu, India.
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Email: director@nsfonline.org.in, Website : www.nsfonline.org.in

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Cross Reference & Traceability - File No: 93

- **Checklist No: NSF/F/45**
- **Certificate No: NSF/F/46**
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NATURE SCIENCE FOUNDATION

Dr. S. RAJALAKSHMI, M.B.A., Ph.D., FNSF, Chairperson

Mr. P. KANAGARAJ, FNSF, Secretary

Certificate of Declaration

The **Office of Nature Science Foundation**, Coimbatore, Tamil Nadu declare that

1. Nature Science Foundation has conducted onsite green audit at ***Periyar Maniammai Institute of Science & Technology, Periyar Nagar, Vallam, Thanjavur - 613 403, Tamil Nadu, India*** by deputing certified Lead Auditors and Technical Experts.
2. On the basis of audit observations by the auditors and pertinent data collected from the Auditee, the Technical Report has been prepared and being submitted.
3. Data presented in the Technical Report are verified and to best of our knowledge, the data are authentic and reliable.
4. Nature Science Foundation declares that data generated were not shared with any third parties and the soft copy of the report is available with Nature Science Foundation's Office.
5. Provided the Auditee desired to publish or share the data with other agencies, Nature Science Foundation has no conflict of interest.
6. We at Nature Science Foundation express our deep sense of gratitude to the Management for given an opportunity to conduct green audit at their premises in compliance with NAAC criteria in line with ISO/IEC 17020:2012 standards and NABCB guidelines and for whole hearted support extended at the time of onsite audit. Our sincere thanks to NAAC, IQAC Coordinators and Head of the Departments of the Organization for their intangible assistance and cooperation extended to the audit team at the time of physical facility verification.
7. Reports and Certificates are valid till 24.11.2027

Date: 25.11.2025
Place: Coimbatore

Authorized Signatory
Nature Science Foundation

Signature of the Director
NSF Audit Processes

National Accreditation Board for Certification Bodies

Accreditation Certificate

NABCB

hereby confirms that

Nature Science Foundation

No. 2669, LIG-II,Gandhi Managar,
Peelamedu, Coimbatore – 641004,
Tamil Nadu, India

complies with

NABCB Accreditation Criteria for Inspection Bodies
(ISO/IEC 17020:2012)
as Type 'A' Inspection Body

to carry out

Inspection
as per accompanying

Schedule I : Scope of Accreditation
Schedule II : Office(s) under Accreditation

Accreditation Certificate No.:		**IB 121**
Date of Initial Accreditation	:	January 10,2024
Validity of Accreditation	:	January 09, 2027

January 10, 2024
Issue Date

(RajeshMaheshwari)
Chief Executive Officer

(Please refer http://nabcb.qci.org.in for validity of the certificate or contact NABCB for any related queries)

National Accreditation Board for Certification Bodies

Schedule I

(Scope of Accreditation)

Nature Science Foundation

Type 'A' Inspection Body

IAF Scope / Field of Inspection and Specific Item(s)	Stage and Range of Inspection(s)	Inspection Requirement(s) Standards / Regulations / Methods / Procedures	
		Number Identification with year of publication	Title
IAF Scope 28 Buildings and Associated Infrastructure Green Audit	Green audit of educational institutions as per NBC2018 Part 11	NBC 2018 (Part-11) 14-2/2022 dated 26.05.2022	National Building Code Part 11 Approach to Sustainability NAAC Advisory Client Requirements in the form of QAP mentioning required specification and scope mentioned in the scope. However, the applicable National & International Codes and Standards shall be among those which are either referred in the scope statement or shall be equivalent to the standards mentioned above for the relevant scope category

January 10, 2024
Issue Date

(Rajesh Maheshwari)
Chief Executive Officer

(The schedule must be accompanied by the Accreditation Certificate No. ⊕ 121 valid upto January 09, 2027)

National Accreditation Board for Certification Bodies

Schedule II

(Offices) under Accreditation)

Nature Science Foundation

Location	Address	Key activities performed
Coimbatore Tamil Nadu (Main Office)	No 2569, LIG-II, Gandhi Managar, Peelamedu, Coimbatore – 641004, Tamil Nadu, India	Top Management functions, Quality Management System functions, administration & accounts, other key activities. Inspection contract review, Inspection planning & execution, Inspection personnel authorization & assignment, Issue of inspection reports / certificates

January 10, 2024
Issue Date

(Rajesh Maheshwari)
Chief Executive Officer

(The schedule must be accompanied by the Accreditation Certificate No. IB 121 valid upto 09 January 2027)

CONTENTS

1. GENERAL INTRODUCTION

1.1. Introduction

Green campus is an area of the Organization or the Organization as a whole itself contributing to have an infrastructure or development that is structured/planned to incur less energy, less water, less or no CO_2 emission and less or pollution free environment. Green Audit is a tool to evaluate environment management system which is systematically executed to protect and preserve the environment. Greenaudit constitutes the environmental friendly practices and education combined to promote sustenance of green environment by adopting user-friendly technology within the campus. It creates awareness on environmental ethics, resolves environmental issuesand offers solutions to various social and economic needs. It strengthens the concept of 'Green Building' and 'Oxygenated Building' which in turn provides a healthy atmosphere to the stakeholders.

1.2. Importance of National Building Code (NBC)

National Building Code (NBC) of India has a set of rules and guidelines that regulates construction of buildings and as well as ecofriendly activities of the campus without harming the environment. In order to achieve the minimum standards of welfare and safety of stakeholders of a campus, the Governing body of Central and State Governments lays down a set of guidelines to offer sustainable environment. In 1970, the National Building Code (NBC) was first published in India and the significant provisions of the Indian Building Code involve: 1. Structural safety of the building, 2. Earthquake-resistant building design, 3. Fire and life safety, 4. Solid waste management, 5. Accessibility for differently-abled and senior citizens, 6. Use of alternative building techniques and 7. Environmentally compatible building construction techniques like the use of solar power, rainwater harvesting, etc.

NBC is not only offer a standard uniform benchmark that constructors and environmentalists must meet, but they also establish safety standards along with ecofriendly atmosphere of a campus for years to come. As extreme weather conditions and fires are growing rapidly in the country, it becomes vital that buildings and structures be built and designed using the current building codes to allow for maximum safety sustainability and resilience to the stakeholders. For instance, new and updated building codes put much emphasis on conservation as energy and the degradable and non-degradable wastes are the most expensive byproduct of older regions. This will not only offer environmental benefits to future generations but will also regulate indoor air pollution and greenhouse gas emissions to protect the health of human beings.

Before the introduction of NBC in the construction industry, building commercial and residential properties used a lot of energy which adversely affected the sustainable environment. Thus, enforcing building codes to create low-energy buildings offers a tangible way for the company to help decrease the greenhouse gas emissions of the nation. While safety is the primary objective, new building codes are making significant contributions toward solving energy issues relating to the use of environmentally compatible construction techniques like planting trees, landscaping, rainwater harvesting and renewable and non-renewable energy sources.

1.3. Environment Friendly Campus

As stated earlier, Organization is liable to provide an eco-friendly atmosphere along with good quality of drinking water facility to all the stakeholders. Manuring the cultivated plants/grown within the campus may applied with organic manure, cow dung, farmyard manure and vermicompost instead of using chemical fertilizers. All non-compostable and single-use disposable plastic items, plastic utensils, plastic straws and stirrers should be avoided. Demonstration / awareness programme on establishing plastic-free environment and utility of organic alternatives for all incoming and current students, staff and faculty should be organized. Reduction of use of papers alternated with e-services, e-circulars, etc., and proper disposal of wastes, recycling and suitable waste management system should be considered to establish environment friendly campus.

The term 'auditing' is to examine the management practices and to evaluate performance of an organization in relation to environmental issues. World along with Associated Chambers of Commerce and Industry of India (ASSOCHAM), Green Building Council (IGBC) and Green Ratings Systems (GBCRS), Green Rating for Integrated Habitat Assessment (GRIHA), Bureau of Energy Efficiency(BEE), Leadership in Energy and Environmental Design (LEED), CII-GreenCo –GreenCo Rating System (CII-GRS), Food Safety Management System & OccupationalSafety & Health (FSMS), Swatch Bharath under India Clean Mission (SBICM) and International Standard Organization (ISO 2021) have formulated a series of standards in the field of environmental auditing. These standards are basically intended to guide organizations and auditors on the general principles common to the execution of environmental audits.

Green Audit (ISO/IEC 17020:2012) comprised green campus, environment, energy, waste management (solid, liquid, municipal sewage, biomedical, plastic and electronic wastes), water, soil, air quality and hygienic audits are playing important role in Academic Institutions, R&D Organizations and Industries towards the accreditation process as well as maintaining a hygienic eco-friendly environment to the stakeholders in their campus. All audits will be conducted as per the Government Law and Environmental and the concept of Swachh Bharath Abhiyan under Clean India Mission.

1.4. About Nature Science Foundation (NSF)

NSF is the ISO QMS (9001:2015), EMS (14001:2015), OHSMS (45001:2018) & EnMS (50001:2018) and ISO/IEC 17020:2012 Accredited Type 'A' Inspection Body [Reg. No. IB 121] by NABCB, QCI, Ministry of Commerce and Industry, Government of India. NSF is managed by a Board of Trustees which is a Public Charitable Trust registered under the TN Societies registration Act 1975 (TN Act 27 of 1975) on 29th November, 2017 at Peelamedu, Coimbatore 641 004, Tamil Nadu, India with Certificate of Registration No. 114 / 2017. In addition, NSF has 12AA, 80G and Form 10AC certificates for income tax exemption and implanting various Government schemes. The main motto of the NSF is 'Save the Nature to Save the Future' and 'Go Green to Save the Planet'.

1.5. About the Organization

Periyar Maniammai Institute of Science & Technology

Periyar Maniammai Institute of Science & Technology is proud to be a unique institution of higher learning and academic excellence. In an endeavour to fulfil the dreams of our Mentor Thanthai Periyar and Annai Maniammaiyar, the University is dedicated to its societal responsibility for transforming students from different parts of India and abroad into stalwarts by igniting their hidden talents. As it is located in a rural area, the students are admitted from a wide range of calibre and by personal attention, and modern teaching methodology towards a Product / Process / Demo / Case Study teaching, they are shaped into career oriented professionals with bright future.

The University is making efforts to create new horizons in the arena of technical education and research. Curriculum innovation is given priority by the University to make the courses industry and research oriented. The dedicated and qualified faculty members routinely preach and practice for outcome based learning which leads towards an excellent academic career for the betterment of the students.

Vision

To be a University of global dynamism with excellence in knowledge and innovation ensuring social responsibility for creating an egalitarian society.

Mission

- Offering well balanced programmes with scholarly faculty and state-of-art facilities to impart high level of knowledge.
- Providing student - centered education and foster their growth in critical thinking, creativity, entrepreneurship, problem solving and collaborative work.
- Involving progressive and meaningful research with concern for sustainable development.
- Enabling the students to acquire the skills for global competencies.
- Inculcating Universal values, Self-respect, Gender equality, Dignity and Ethics.

1.6. Audit Team Details

1.	**Date of Audit**	: **25.11.2025**
2.	**Audit Site**	: **Periyar Manjammai Institute of Science & Technology,** Periyar Nagar, Vallam, Thanjavur -613 403, Tamil Nadu, India.
3.	**Inspection Body**	: **Nature Science Foundation** Coimbatore, Tamil Nadu, India.
4.	**Audit Scope**	: **Green, Environment, Energy, Air Quality, Hygiene, Soil, Water and Waste Management Audits as per ISO/IEC 17020:2012**
5.	**Name of the Auditing Chairman**	: **Dr. S. Rajalakshmi** ISO QMS, EMS and EnMS Certified Lead Auditor ISO 17020:2012 (Green Audit), Founder & Chairman of NSF.
6.	**Name of the Auditing Team Leader**	: **Dr. D. Vinoth Kumar** ISO QMS, EMS and EnMS Certified Lead Auditor & ISO 17020:2012 (Green Audit) Director & Technical Manager, NSF.
7.	**Name of the Lead Auditor for Green Audit + Environment Audit + Air Quality Audit**	: **Dr. D. Vinoth Kumar** ISO QMS, EMS and EnMS Certified Lead Auditor & ISO 17020:2012 (Green Audit) Director & Technical Manager, NSF.
8.	**Name of the Lead Auditor for Soil Audit + Water Audit + Hygiene Audit + Waste Management Audit**	: **Ar. N.M. Pradeep Kumar** ISO QMS, EMS and EnMS Certified Lead Auditor.
9.	**Name of the Lead Auditor for Energy Audit**	: **Er. A. Karthik** Bureau of Energy Efficiency Certified Auditor.
10.	**List of Auditees**	: **1.Dr.V.Ramachandran,** Vice Chancellor **2.Dr.P.K.Srividya,** Registrar **3.Dr.AR.Umayal Sundari,** Director IQAC **4.Dr.P.Ilangovan,** Deputy Director IQAC **5.Dr.J.Santhosh,** Staff Coordinator **6.Dr.G.Saravana Venkatesh,** Staff Coordinator **7.Dr.N.Ramesh Babu,** Staff Coordinator **8.Dr.A.Manohar,** Staff Coordinator

1.6.1. Audit Scope and Criteria

Green audits are conducted in line with National Building Code (NBC) Part 11 Approach to Sustainability as per the NAAC and NABCB advisory. NBC part 11 consists of 11 different types of clauses. In this report the eleven clauses of sustainability are differentiated into Green, Environment, Energy, Air Quality, Hygiene, Soil, Water and Waste Management audits.

S.No.	Name of the Audits	NBC covered clauses
1.	Green Audit	3. Approach to Sustainability (3.2 & 3.9), 6. Siting, Form and Design (6.2.4.), 7. External Development and Landscape (7.1.1.), 12. Constructional Practices (12.4.5. & 12.4.6.)
2.	Environment Audit	3. Approach to Sustainability (3.2, 3.7, 3.10 & 3.11), 4. Applicability of this part (4.1 and 4.2), 5. Implementation of this part (5), 6. Siting, Form and Design (6.2.1.), 7. External Development and Landscape (7.1.2, 7.2, 7.3, 7.4.), 9. Materials (9.1, 9.2, 9.3), 10. Water and Waste Management (10.1.), 12. Construction Practices (12.8. and 12.11.)
3.	Energy Audit	3. Approach to Sustainability (3.2, 3.5, 3.6 & 3.8), 6. Siting, Form and Design (6.2.2, 6.2.3, 6.2.5, 6.2.6, 6.2.7, 6.2.8, 6.2.9 & 6.2.10), 7. External Development and Landscape (7.5.), 8. Envelope Optimization (8.1, 8.2. & 8.3), 11. Building service Optimization (11.1 – 11.16), 12. Constructional Practices (12.3.4, 12.4.4 & 12.9.), 13. Commissioning, Operation, Maintenance and Building Performance Tracking (13.1, 13.2, 13.3, 13.4, 13.5 & 13.6.)
4.	Air Quality Audit	12. Construction Practices (12.4.3.)
5.	Hygiene Audit	12. Construction Practices (12.3.6 & 12.3.7.)
6.	Soil Audit	12. Construction Practices (12.4.1. and 12.4.2.)
7.	Water Audit	7. External Development and Landscape (7.3.2), 10. Water and Waste Management (10.2. – 10.5.), 12. Construction Practices (12.4.1. and 12.4.2.)
8.	Waste Management Audit	3. Approach to Sustainability (3.3 & 3.4), 10. Water and Waste Management (10.6.1. – 10.6.5.), 12. Construction Practices (12.1, 12.2, 12.3, 12.5, 12.7, 12.10.)

1.6.2. Audit Checklist Observations

The audit checklist in line with National Building Code (NBC) Part 11 – Approach to Sustainability covers 163 checkpoints. During the onsite visit, respective auditors marks not applicable and write the reason for non-applicability and wherever its applicable, auditors verifies the records / practice / documents and physical observation to confirm the same.

There are two parameters such as meeting the requirements and not meeting the requirements. Marking as meeting the requirements for the specific checkpoint reveals that the physical observation and documents are up to the mark. For some checkpoints OFI – Opportunity for Improvements will be given by the auditors. The physical observations and documents which are not up to the mark will be given as not meeting the requirements. The checkpoints under not meeting the requirements are up to the Management of the Organization to develop further.

1.7. List of Instruments used in the Inspection Process

During the on-site visit the below listed instruments are used by the Lead Auditors and Technical experts to check the specific parameters in the view of maintaining sustainability. All the instruments are calibrated by ISO 17025 accredited labs (JRTS Technical Services, Chennai, Tamil Nadu and Instruments Calibration and Test Centre, Coimbatore, TN). The frequency of calibration is six months once or 20 times after its use.

1.7.1. Oxygen Meter

Oxygen meter is used in the audit process to measure the oxygen level in the organization. The instrument is calibrated after using 20 times. Suitability of the instrument are range between 0 to 30% O_2, resolution of 0.1%, accuracy is ± (1% reading + 0.2% O_2), response time is ≤ 15 seconds, environment pressure range is 0.9 to 1.1 atmosphere, temperature range is 0 °C to 50°C, 32°F to 122°F, temperature resolution is 0.1°C, temperature accuracy is 25°C.

1.7.2. Carbon dioxide meter

Carbon dioxide meter is to measure the carbon level in the organization. The instrument is calibrated after using 20 times. Suitability of the instrument are range between 0 ~ 4000 ppm, resolution of CO_2 Meter is 1 ppm, accuracy is ≤ 1,000 ppm, repeatability is ± 20 ppm, temperature range between 0°C to 50°C, 32°F to 122°F, temperature resolution is 0.1°C, temperature accuracy is at 25°C.

1.7.3. Light (LUX) Meter

Light meter is to calculate the light intensity in the organization. Suitability of the instruments are, 5 ranges, ie., 40.00, 400.0, 4,000, 40,000, 400,000 Lux, operating temperature is 0 to 50°C, Operating humidity is less than 80% RH, Power consumption is DC 8 mA approximately. This Instrument will be calibrated yearly once or during non-functioning.

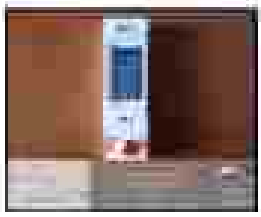
1.7.4. Sound Level Meter

Sound level meter is to measure the noise level in the organization. This instrument is calibrated yearly once or after using 20 times. Suitability of the instruments are measurement range is 30 – 130 dB, resolution is 0.1 dB, accuracy is (23±5 °C), Frequency of the instrument is 31.5 to 8,000 Hz, Operating temperature is 0 to 50 °C (32 to 122 °F), Operating humidity is less than 80% RH, Power consumption is DC 6 mA approximately.

1.7.5. pH Meter

pH meter is generally used to measure the pH level in water. It is calibrated 6 months once or after 20 times of its use. Suitability of the instrument are range of the pH meter is 0 – 14, accuracy is ± 2%, resolution of the instrument is 0.1 pH, operating temperature is 0 to 50 °C (32 to 122 °F).

1.7.6. TDS Meter



TDS meter is generally used to measure the TDS level in water. Suitability of the meter are range of TDS meter is 0 – 9990 ppm (mg/L), operating temperature is 0 to 80 °C (32 to 176 °F) and accuracy is ± 2%. This meter is calibrated six months once or 20 times after its use.

1.7.7. Air Quality Index (AQI) Meter

An AQI meter measures air pollution levels by tracking pollutants like PM2.5, PM10, nitrogen dioxide, sulfur dioxide, carbon monoxide, and ozone. The AQI scale ranges from 0 to 500, where lower numbers indicate cleaner air and higher numbers signify increasing pollution levels. This meter is calibrated six months once or 20 times after its use.

1.7.8. Deluxe Water and Soil Analysis Kit

Deluxe water and soil analysis kit is used to analyze the pH, TDS, salinity, turbidity, alkalinity dissolved oxygen of water.

1.7.9. Digital Clamp (Voltage) Meter

It is used to check the input and output voltage between two points of an electrical circuit of Alternating Current (AC) and Direct Current (DC) by means of the high resistance of the voltage that impede the flow of current.

1.7.10. Calibration Certificates of Instruments used for the conduct of audits

Calibration Certificate of O_2 Meter

Calibration Certificate of CO_2 Meter

Calibration Certificate of LUX Meter

Calibration Certificate of Sound Level Meter

Calibration Certificate of pH Meter

Calibration Certificate of TDS Meter

Calibration Certificate of Digital Clamp Meter

Calibration Certificate of AQI Meter

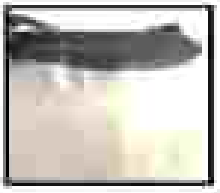
1.8. Use of Personal Protective Equipment (PPE)

Personal Protective Equipment (PPE) refers to protective clothing for the eyes, head, ears, hands, respiratory system, body, and feet. It is utilized to protect individuals from the risks of injury while minimizing exposure to chemical, biological, and physical hazards. PPE serves as the final line of defense when engineering and administrative controls are insufficient in reducing risks. Nature Science Foundation safeguards all the auditors by supplying PPE during the conduct of audits. PPE used are safety jackets, ear plugs, googles, face shield, hand gloves, shoes, etc.,

1.8.1. Safety jackets:

PPE includes safety vests and suits that can be used for inspection process which will protect body injuries from extreme temperatures, flames and sparks, toxic chemicals, insect bites and radiation.

1.8.2. Goggles and Face shield:

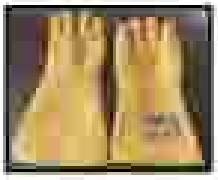


Goggles and face shield are used in the inspection process while inspecting items which would cause eye damage or loss of vision, spray or toxic liquids especially in chemistry labs, nearing the electric and electronic item.

1.8.3. Helmet:

PPE includes hard hats and headgears which will be required for tasks that can cause any force or object falling to the head. It also helps to resist penetration.

1.8.4. Hand gloves:



PPE includes safety gloves and should be used for tasks that can cause hand and skin burns, absorption of harmful substances, cuts, fractures or amputations. Selection of hand gloves is based on the application of use.

1.8.5. Safety Boots:

Foot protection is one of the most commonly used PPE and can differ depending upon the environment. Safety boots are used for tasks that can cause serious foot and leg injuries from falling or rolling objects, hot substances, electrical hazards, and slippery surfaces.

1.8.6. Ear Plug:

Ear plugs are used for tasks that can cause hearing problems and loss of hearing. Hearing protection devices reduces the noise energy reducing reaching and causing damage to the inner ear. This ear plug is mostly used near sound producing devices like power motors, gencts, generators, etc.,

Opening and closing meetings with the Head of the Organization, NAAC / IQAC Coordinators and NSF Inspection Team

Opening and closing meeting attendance sheet

2. GREEN AUDIT

2.1. Introduction

Green audit ensures the Organization's campus should have greenish with large diversity of trees, herbs, shrubs, climbers and lawns to reduce the environmental pollution and soil erosion; it is also useful in relation to biodiversity conservation, landscape management, irrigation/economic water utilization and maintenance of natural topography besides vegetation. For the benefit of stakeholders, solid waste management, recycling of water, disposal of sewage and waste materials (electronic and biomedical wastes), 'zero' use of plastics, single use plastic items, etc. should be followed consistently in the organization campus. Green Audit procedures includes the definition of green audit, methodology on how to conduct green audit at Educational Institutions and Industrial sectors as per the checklist based on National Building Code (NBC) Part 11 - Approach to sustainability and assessment of risk at 360° view.

2.2. Importance of green audit

The Management of the Organization (Auditee) should be exposed their inherent commitment towards making ecofriendly atmosphere through the green auditing and ready to encourage/follow all types of green activities. A clean and healthy environment will enhance an effective teaching/learning process. They shouldcreate the awareness on the importance of greenish initiatives through environmental education among the student members and research scholars. Green audit is the most effective, ecological approach to manage environmental complications (Rajalakshmi *et al.*, 2023). Green audit is a kind of professional care and a simple indigenized system about the environment monitoring in terms of planting more number of trees which is a duty of each and every individual who are the part of economical, financial, social and environmental factors. Green audit is a professional and useful measure for an Organization to determine how and where they are retaining the campus eco-friendly manner. It can also be used to implement the alleviation measures at win-win situation for the stakeholders and the planet. It provides an opportunity to the stakeholders for the development of ownership, personal and social responsibility.

2.3. Green audit observations

- It is observed that the Organization has wheelchair, ramp walk, lift and disable toilet facilities for disabled and different age group people.
- Monitoring plan is available for the periodic checking at regular interval to maintain sustainability.
- Adequate training and awareness programmes are conducted to the Stakeholders to promote sustainable development at all stages of building life cycle.
- More than 30% of open space is maintained as soft scapes (vegetation) to lower the energy conservation in the campus.
- Land scape design are planned to maintain the natural capacity of the site.
- Vegetation is maintained around the building to reduce energy consumption and maintain indoor climates.
- Soil health is maintained well without using any chemical fertilizers.

- Ecological design / conserving biodiversity such as Transplantation, climate and design in accordance with bio diversity, reduced pesticides and other activities are applicable because new construction is planned and raised.
- Herbal and Bamboo garden are available in the campus to maintain sustainability.
- Plant and animal species are monitored by conducting the periodic survey in the Organization.
- Traffic survey is conducted to measure the number and type of vehicles passing on the existing main roads giving access to the campus.
- List of flora, plant details in nursery and name boards for garden may be implemented in the campus.
- Lift approval certificate not available in the campus.

2.3.1. Facilities for Human Comforts (NBC checkpoint 3.2. and 3.9.)

As per the National Building Code part 11 (Approach to Sustainability) under elements of sustainability quality of plumbing services and buildings are maintained in line with the standard. Wheel chair, ramp walk, lift, and disable toilet facilities are implemented for the benefit of disabled and different age group people. As no blind persons are observed in the campus divyang (blind) reading software, signages are not available. Water management, waste management, operation and maintenance plan are followed to maintain sustainability as per the standard.

Wheel Chair and Ramp walk observed for the comfort of person with disability.

2.3.2. Natural topography, vegetation and monitoring (NBC checkpoint 6.2.4.)

Natural topography means the original geographical features and natural resources of the Site. It is observed that the organization has the natural features like rocks, water resources, slopes, landscape, pathways, etc. Vegetation is the cultivation

of a bunch of plants irrespective of the plant *taxa* for the covering of the area or ground topography. The observation at the campus indicated that there are more than 30% natural topography and vegetation. Monitoring plan for maintaining the vegetation and sustainability are evident through separate operation and maintenance team & their records for regular watering as per the micro climatic condition through irrigation.

Natural Topography and Vegetation at the Campus

2.3.3. Landscape design and soil erosion control (NBC Checkpoint 7.1.1. – 7.1.3.)

Landscape design is an important feature for any disasters to control especially with respect to the soil erosion. In general, soil erosion occurs if the design of the land is not altered so as to prevent the slope features by strong vegetation and use of a plant buffer zone as safe for escape of nutrients or fertilizers entering the streams. Observation revealed that the audited site has very good landscape design without disturbing the natural vegetation. Contour ploughing is being done at right angles to the slope wherever possible and ridges and furrows are properly maintained to break the flow of water down to the empty land. These activities are widely adopted to control soil erosion in the campus. Microclimatic conditions are considered, during winter season irrigation and watering to plants are controlled as per the water management plan. External landscapes are designed based on the shading pattern of the building. Green vegetation are available around the building to reduce the energy consumption.

2.3.4. Establishment of different gardens, vertical landscaping and roof gardens (NBC Checkpoint 7.1.1. – 7.1.3.)

It is observed that Organization has implemented and maintaining gardens to lower the energy consumption. To maintain certain biomass critical for human health and also to reduce the bio-retention through water flow rates different types of gardens like Herbal and Bamboo garden is implemented in the campus.

Ornamental and Herbal Garden observed in the Campus

2.3.5. Survey of Flora and Fauna (NBC Checkpoint 12.4.5. and 12.4.6.)

Ensuring the rich biodiversity in the green campus is an important parameter which reflects the real-time ecosystem. In general, plants improve the outdoor air quality with increased oxygen levels and reduced temperature and carbon dioxide. The record on maintenance of the plant biomass and its management are important with respect to green campus initiatives. The existence of such plants in the green campus are recorded for the rich flora which are being considered as a value addition to the campus.

3. ENVIRONMENT AUDIT

3.1. Introduction

Environmental (Eco) audit is quantitative and qualitative data to track air, soil and water and to gain actionable insights to improve the operational performance in the atmosphere. It provides a 360° view of a surrounding campus and makes it easy for Owners / Managers / Environmentalists to collaborate, measure, control and reduce environmental negative impacts. Finally, it leads to enhance the quality of life of all living organisms. Eco audit initiatives are the need of the hour across the world due to changing environmental conditions and global warming besides ever-increasing human population and anthropogenic activities (NCP, 2016). Eco audit aims to make a sustainable and friendly environment for the stakeholders. In this context, to conserve eco-friendly atmosphere of an organization, well-developed environmental objectives and targets should be undertaken to reduce the harmful effects to a greater extent (Gnanamangai *et al.*, 2021).

The audit process can remarkably minimize the environmental pollution in the campus which in turn reduces the impact of global warming scenario. As per the Rules and Regulations laid by Government, the environmental legislations should be followed by all the Institutions and Organizations and make sure that their activities should not degrade the environment. The environmental audit involves systematic documentation of periodic objective review by a regulated entity on available facilities, their operations and practices related to resolve the environmental requirements. In general, environmental audit is planned to achieve an optimum resource utilization and improved process performance in the audit sites. Venkataraman (2009) stated that it is a 'Common Sense Approach' to identify the problems and solve those problems pertaining to curb eco-friendly atmosphere. Environmental audit enables an overall and complete overview at the audit sites to facilitate our understanding of flow of materials and to focus the priority areas where waste reduction is achieved thereby cost saving is made possible.

Purpose of the audit is to determine performance of the environmental management systems and equipmentrelated to environmental safety. Audit reports can provide key information to the management in relation to risk areas, progress towards strategic objectives and targets. Audit work can be undertaken voluntary for the benefit/advantage of the company and it can be executed with the help of environmental auditing authorities. As mentioned earlier, it helps in the proper natural resource utilization and on the whole, it improves the quality of environment.

An environmental auditor will study an organization's performance towards the environmental sustainability in a systematic manner where environmental management systems and equipment are performing with the aims of a) facilitating management control of environmental practices, b) assessing compliance with company policies, c) facilitating profeasional competence, d) sustenance activities without harming the environment and e) practicing the environmental conservation.

3.2. Organization Details

Table 1. Campus details

S.No.	Details / Descriptions	Quantity
1.	Total strength of Students	6328
2.	Total strength of Employees	500
3.	Total number of Buses in the campus	41
4.	Number of Cars entering in the campus	61
5.	Number of Motorcycles entering in the campus	688
6.	Number of other vehicles (Lorry, Ambulance, Jeep, Trucks, Cranes, Poclain, and etc. entering in the campus)	03
7.	Number of E-Vehicles	Nil
8.	Number of RO Water Plants	10
9.	Number of Bore wells	05
10.	Number of Open wells	Nil
11.	Number of Water reservoirs	01
12.	Number of Wastewater treatment facility	01
13.	Number of Rain harvesting system	03
14.	Number of Composting pits and Vermicomposting units	01

3.3. Environment audit observations

- The construction is proposed based on the applicable climatic zone and geological conditions.
- Human comforts such as wheelchair access, ramp walks and fire safety measures are thoughtfully incorporated.
- To reduce the demand of water, rain water harvesting system is implemented.
- Training and awareness programmes records are available to maintain sustainability.
- Fire extinguishers are available in the building to consider the safety of all the Stakeholders and maintained properly.
- Fire extinguishers and first aid kits may be placed in shuttle buses as a precautionary safety measure.
- It is observed that the mock drills and awareness programmes are conducted for disaster management.
- Parking is provided under the tree shade to reduce the Heat Island effect (Temperature).
- Use of potable and non-potable waters are identified and differentiated to conserve water.
- Public transport facilities are available in the campus to control air pollution.
- E-vehicle is not available in the campus.
- Pedestrian pathways are well maintained and enhanced with tree plantations to provide adequate shade.
- Biogas & STP unit is available in campus, but need to be strengthen in terms of functioning.

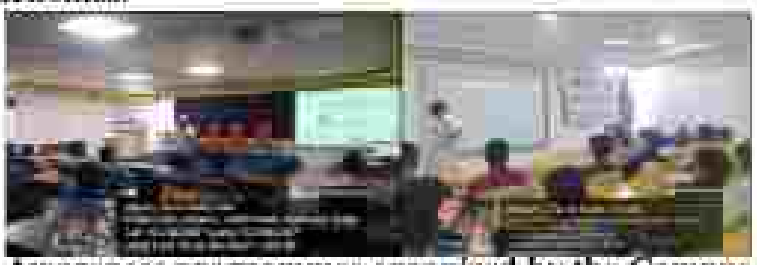
- Zebra crossing not observed in the campus.
- LPG cylinders are stacked in the kitchen, blocking the staircase pathway, and the designated gas bunk is not equipped with fire extinguishers.

3.3.1. Integrated Water Management System (NBC Checkpoint 3.7. and 7.2.1.)

Water is one of the major source of living. Per captia water consumption in the building is calculated as per the water management plan (litres / person/ day). To reduce the demand of water consumption rain water harvesting unit is implemented and practiced.

3.3.2. Corporate Governance (NBC Checkpoint 3.10.)

Training and awareness programmes are conducted to the stake holders to maintain sustainability. Some of the programmes conducted by the Organization are Swachh Bharat activities.



Awareness programmes organized by the Campus

3.3.3. Safety measures and green building conservation code (NBC Checkpoint 3.11.)

Environmental safety measures are very important in the buildings as far as students, staff members and other stakeholders are concerned and it requires vigilance and awareness. Management should extend by issuing guidance and the best safety tools. The organization has a police force, escort services, call boxes, first aid box, fire extinguishers, fire alarms, security systems and staffs towards the safety measures. Organization has very good safety measures as per the green building conservation code such as fire extinguisher and fire bell and alarms in all the place. In addition, in all the place, 'Exit', 'Entry' and other sign boards kept across the place to give safety to the stakeholder. It is observed that Fire Extinguisher are maintained properly which is evident through AMC. Regular mock drill and awareness programmes are conducted at regular intervals considering the safety of stake holders. Disaster management plan and emergency preparedness are available as the safety of the stakeholders.

Fire safety measures and first aid kit were observed inside the campus

3.3.4. Applicability and Implementation (NBC checkpoint 4 and 5)

Guidelines of Architect, Designer and Civil contractor for the existing building addresses the choice of material, design methodology, operation and maintenance related options, etc., as observed during the onsite audit.

3.3.5. Parking facilities to reduce Heat Island Effect (NBC checkpoint 7.4.1.)

Heat island effect denotes the temperature level. It is observed that the vehicles are parked under the Tree shade to reduce the heat island effect for the benefit of stakeholders and to maintain sustainability. To reduce the heat island effect parking areas are made up of high albedo materials with light coloured paints observed in the organization.

Vehicles parked under the tree shades to reduce the carbon emission

3.3.6. Public transport, low emitting vehicles and control of car smokes (NBC Checkpoint 7.4.1. – 7.4.7)

The organization has not provided electric vehicles to promote an eco-friendly environment within the campus and to reduce carbon dioxide emissions. However, students are encouraged to use bicycles as an alternative mode of transportation. The tree species are planted abundantly to provide shade to the pedestrian.

3.3.7. Pedestrian path facility at the campus (NBC Checkpoint 7.4.3.)

The concept of pedestrian path is to give safe space to walk freely by the pedestrian. It is very important in the green campus in terms of freely walk pedestrians or people going on foot without any obstacles. The pedestrian path is otherwise called as zebra crossing by the combination of black and white stripes remained to characterize the zebra. In addition, pedestrian path is created in the green campus along with road side which meant for walking only using special cement bricks and stones. The pedestrian path aims to end circulation not only cars, buses, vans, trucks and other vehicles but also giving safe space to the pedestrians, where cross and pass through blocks and also forcing vehicles to comply with it. The audited organization is having very good facility in creating pedestrian path for stakeholders with all the facilities such as accessible public toilets, barrier free environment, dustbins, stone benches, etc. Use of bicycles are encouraged in the Campus to control carbon emission and air pollution.

Pedestrian path and Stone benches available in the campus

3.3.8. Carbon footprint

Carbon footprint means measuring/recording the greenhouse gases (GHG) emissions of an organization within its defined boundary. Observations on carbon dioxide and oxygen levels monitored in different parts of the campus are presented under Air Quality Audit section while observation on carbon footprint due to electricity usage per year at the Organization along with other fossil fuel utility are presented under Energy Audit portion of this Technical Report.

3.3.9. Selection of Building Material (NBC checkpoint 9.1. – 9.3.)

Building materials are selected as per the Guidelines to Architect, Designer and Civil contractors. Low carbon emitting cements, bricks, etc., are used for the construction and recycled glass materials are used for windows. Construction material are not stored in the campus. Existing building service life plan is available and all are as per the National Building Code.

3.3.10. Waste and Water management activities (NBC Checkpoint 10.1.)

Management of water and waste are the two important parameters which plays a vital role to maintain sustainability. Rainwater harvesting is implemented and maintained properly for water conservation. It is observed that colored dustbins are used in the Organization to segregate the waste at the source of generation.

Waste management activities in the Campus

3.3.11. Post Occupancy maintenance

Post occupancy maintenance is the activities performed after the completion of construction work and handed over to the owner for further maintenance. The following activities are observed during the onsite visit as post occupancy maintenance

- Vegetation and plants are maintained properly with regular watering.
- Soil is maintained well without adding any chemical fertilizers and pesticides.
- Rainwater harvesting is available to meet the demand of water consumption.
- Considering the safety of the stakeholders fire extinguisher, and health care room facilities are available.

Post Occupancy maintenances observed in the campus

4. ENERGY AUDIT

4.1. Introduction

An energy audit is a survey in which the study of energy flows for the purpose of conservation is examined at an organization. It refers to a technique or system that seeks to reduce the amount of energy used in the Organization without impacting the output. The audit includes suggestions of alternative means and methods for achieving energy savings to a greater extend. Conventionally, electrical energy is generated by means of fossil fuels, hydraulic and wind energy. The availability of fossil fuels and their depletion rate, insist the need for alternate energy systems and conservation of conventional electricenergy. In general, the primary objective of an energy auditing and management of energy consumption is to offer goods or services at the lowest possible cost and with the least amount of environmental impact.

Energy Conservation Building Code (ECBC) is established in the year 2017, which provides minimum requirements for the energy-efficient design and construction of buildings across India. It also provides two additional sets of incremental requirements for buildings to achieve enhanced levels of energy efficiency that go beyond the minimum requirements. Bureau of Energy Efficiency (BEE) came into force in 2002 towards implementation of energy saving practices in an organization. Energy-efficiency labels are information affixed to manufactured products and usually communicate the product energy performance.

BEE Star Rating Scheme is based on actual performance of the building as well as equipment in terms of specific energy usage termed as 'Energy Performance Indicator' by means of star ratings labelled items used which will be useful for energy savings in a sustainable manner (Mishra and Patel, 2016). Energy audit programme provide aid in maintaining a focus on energy price variations, energy supply availability and efficiency, determining an appropriate energy mix, identifying energy-saving technology, retrofitting for energy-saving equipment and so on (Gnanamangai *et al*., 2021). In general, an energy audit process dealt with the driving energy conservation concepts into reality by giving technically possible solutions within a specified time limit while considering the economic and other organizational issues. It also dealt with the uncover ways to cut operating expenses or reduce energy use per unit of production interms of savings. It serves as a "benchmark" for managing energy in the organization for planning more energy-efficient use across the board.

4.2. Energy audit observations

During onsite audit the following departments were verified for physical facility availability.

- Adequate awareness programmes are organized and conducted to the stakeholders for the proper handling and maintenance of the appliances.
- Adequate external and vertical shading are provided to conserve energy.
- Natural ventilation through windows and shading is available adequately to reduce the energy consumption.
- It is observed that large foliage trees are planted inside the campus to reduce noise pollution.

- Low emitting lights are fixed as per the LPD mentioned in National Building Code (NBC) Part-11(Approach to Sustainability) ensuring safety and comfort.
- External and internal signage lifts are differentiated to support conserve energy.
- 'Danger' and 'warning boards' are available near generator and UPS.
- Building Integrated Photovoltaic system like power storage system, backup power supplies, wiring and safety disconnects are available.
- Outside air is introduced through windows for ventilation in the conditioned spaces.
- Energy-efficiency three star rated appliances (AC, Air cooler, Refrigerator, etc.,) are procured to conserve energy.
- Awareness posters like 'Turn off when not in use', 'Save Energy', etc., placed to promote awareness for conserving energy in the campus.
- All the artificial lighting system are monitored and controlled through partial availability of sensors.
- Operation and maintenance manual are observed in the on-site.
- No emissions and leaks are observed.
- Instruments and equipment are properly calibrated and maintained.
- Noise levels observed in the different location resulted in normal range.
- Adequate training and awareness programmes are conducted to the stakeholders for energy conservation.
- Solar Panels are not available.
- Standard Operating Procedure are not available for utility equipments like UPS and Transformer.
- Lighting level not meeting standard requirements of 250-300 Lux in most places. eg., Library, Physics Lab

4.2.1. Energy Efficient Design and Process (NBC Checkpoint 3.5, 3.6 & 3.8.)

The campus currently not installed solar panels to utilize renewable energy sources, however, solar water heaters are presently available. Local resources are made available in post occupant stage as per the operation and maintenance plan. Standard Operating Procedures are not available for UPS and transformer.

Solar water heater observed in the campus

4.2.2. Lighting facilities (NBC Checkpoint 6.2.2 – 6.2.10, 7.1.1.2 and 7.5)

External shading facilities are made based on the sun path to reduce the energy consumption. Day light integration is implemented in the building by placing adequate number of windows. Electrical lighting facilities during day time increases the energy consumption, it is observed that sufficient day lighting facilities are available through windows which in turn reduce the energy consumption bill of the Organization. Artificial lighting facilities are regularly monitored and maintained. In some areas sensor lights are implemented to save energy. External and internal signage lifts are made up of recycled material with maximum light intensity. In the buildings windows head are higher to penetrate day light.

Natural Lighting facilities observed during day time

4.2.3. Building Service Optimization (NBC Checkpoint 11)

To save energy in the buildings there should be a proper plan for HVAC system. In the organization it is observed that adequate natural ventilation is implemented and practices. In some places exhaust fans are used for ventilation especially in the canteen and laboratories. To reduce the heat inside the building shading patterns are maintained by planting trees in and around the campus. Solar panels are implemented at the roof top to reduce the heat and to save energy. Air conditioning are provided at specific areas. Energy conservation plays a vital role in maintaining the sustainability. It is observed that the Organization has replaced all the tube light with CFL / LED lamps, has proper metering and sub metering facilities, availability of BEE star rated appliances in Air cooler, lift, AC, generator, etc., Solar water heater and panels are implemented to conserve energy. Instruments and meters are properly maintained and calibrated at regular intervals or annual maintenance plan is observed as one of the energy saving opportunity. Adequate energy saving awareness programmes are conducted to the stakeholders. Emissions and leaks are monitored through operation and maintenance manual.

Energy conservation facilities observed in the Campus

4.2.4. Energy consumption and cost profile (NBC Checkpoint 12.3.4.)

The following chart shows the profile of energy consumed and the cost for one year by the auditee (Figures 1 & 2; Table 2).

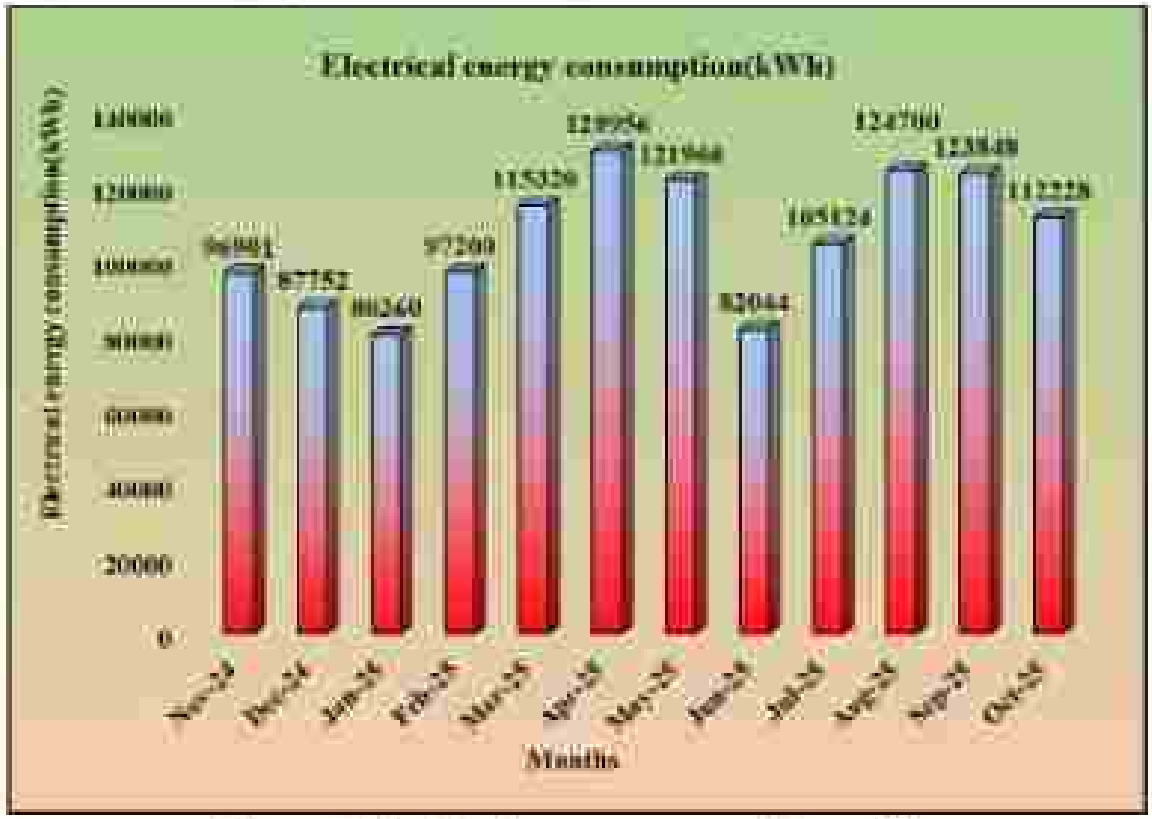


Figure 1. Electrical energy consumption profile

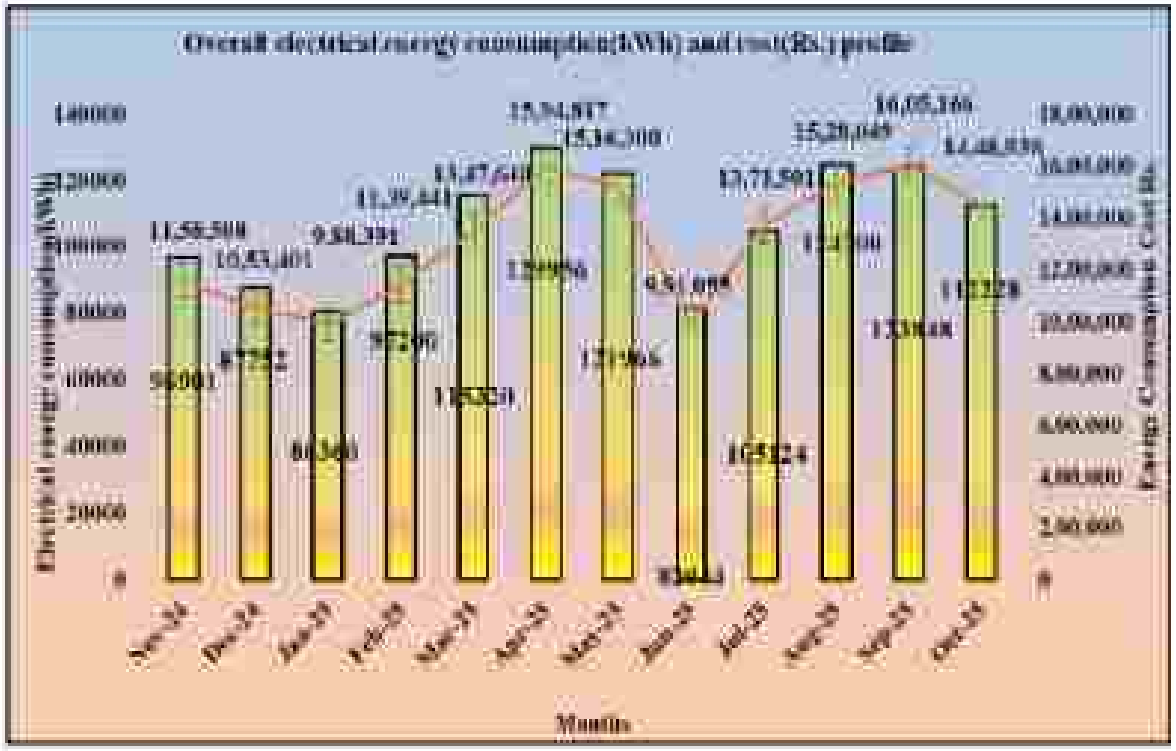


Figure 2. Overall electrical energy consumption and cost profile

Table 2. Electrical energy consumption and cost profile in the Institution

S. No	Months	Rating / Capacity units in kWh	Cost in Rs.
1.	November 2024	96901	11,58,508
2.	December 2024	87752	10,53,401
3.	January 2025	80360	9,88,391
4.	February 2025	97200	11,39,441
5.	March 2025	115320	13,47,640
6.	April 2025	129956	15,94,817
7.	May 2025	121966	15,16,300
8.	June 2025	82044	9,91,055
9.	July 2025	105124	13,71,501
10	August 2025	124700	15,28,049
11.	September 2025	123848	16,05,166
12.	October 2025	112228	14,48,930

4.2.5. Power consuming equipment and electrical appliances

Other than electrical energy from grid, energy generated using fossil fuels for the year are presented in the Table 3.

Table 3. Annual Energy Consumption of Fuels in the Campus

S. No	Month	Diesel consumption (Liters)	Petrol consumption (Liters)	LPG consumption (kg)
1	November 2024	1000	Nil	Nil
2	December 2024	561	Nil	Nil
3	January 2025	700	Nil	Nil
4	February 2025	491	Nil	Nil
5	March 2025	50	Nil	Nil
6	April 2025	50	Nil	Nil
7	May 2025	661	Nil	Nil
8	June 2025	189	Nil	Nil
9	July 2025	799	Nil	Nil
10	August 2025	889	Nil	Nil
11	September 2025	658	Nil	Nil
12	October 2025	623	Nil	Nil

4.2.6. Carbon footprint

The carbon footprint per year is calculated (www.carbonfootprint.com) based on electricity usage per year in which CO_2 emission from electricity and the sum of transportation per year in terms of number of the shuttle buses service operated by the Organization and number of cars, motorcycles and trucks entering in the Organization campus. These factors are multiplied with total number of trips in each day and approximate travel distance of vehicles covered in each day with a coefficient (0.01) to calculate the emission of CO_2 in metric tons per year. Humans contribute to a massive increase of carbon dioxide emissions by burning fossil fuels, deforestation, and other industrial activities.

4.2.7. Calculation of carbon footprint

The carbon footprint analysis can be calculated based on the earlier reports as stated in www.carbonfootprint.com which is the sum of electricity usage per year. According to the data provided by the Management, carbon emission due to electricity consumption and fossil fuels are presented hereunder.

The CO_2 emission from electricity

= (electricity usage per year in kWh/1000) x 0.84, where 0.84 is the coefficient to convert kWh to metric tons

= (1277399 kWh/1000) x 0.84

= 1073.02 metric tons

According to the above calculations, carbon emission due to electricity usage per year accounts for 1073.02 metric tons.

Transportation per year (Shuttle)

= (Number of the shuttle vehicle in the campus x (2) x total trips for shuttle bus service each dayx approximate travel distance of a vehicle each day inside campus only (20 km)x 365/100) x 0.01

= ((41 x 20 x 1 x 365)/100)) x 0.01
= 29.93 metric tons

365 is the number of days per year
0.01 is the coefficient to calculate the emission in metric tons per 100 km for bus

a. Transportation per year (Car)

= (Number of cars entering the campus x 2 x approximate travel distance of a vehicle each day inside campus only (in kilometers) x 365/100) x 0.02
= ((61 x 20 x 1 x 365)/100)) x 0.02
= 89.06 metric tons

365 is the number of days per year
0.02 is the coefficient to calculate the emission in metric tons per 100 km car

b. Transportation per year (Motorcycles)

= (Number of motorcycles entering the campus x 2 x approximate travel distance of avehicle each day inside campus only (in kilometers) x 365/100) x 0.01
= ((688 x 20 x 1 x 365)/100)) x 0.01
= 502.24 metric tons

365 is the number of days per year
0.01 is the coefficient to calculate the emission in metric tons per 100 km for motorcycles.

c. Total Carbon emission per year

= total emission from electricity usage + transportation (bus, car, motorcycle)
= (1073.02 + 29.93 + 89.06 + 502.24)
= 1694.25 metric tons

4.2.8. Noise level measurements (NBC Checkpoint 12.4.4.)

Noise is all unwanted sound or set of sounds that causes annoyance or can have a health impact and noise level is measured in decibels (dB). The body can also respond to lower noise levels. Level of noise are expected tobe within 55 dB in residential areas, including institutions. Class room noise levels aresupposed to be around 50 db. Sound Level Meter / Noise Thermometer are used to measure the noise level in the surroundings which converts the sound signal to an equivalent electrical signal and the resulting sound pressure level in decibels (dB) referenced to 20 µPa. Noise level prescribed by Central Pollution Control Board was presented in the Table 4. Noise level are measured at various location in the campus are detailed in the Table 5 and Figure 3.

Table 4. Noise level standard prescribed by Central Pollution Control Board, Government of India

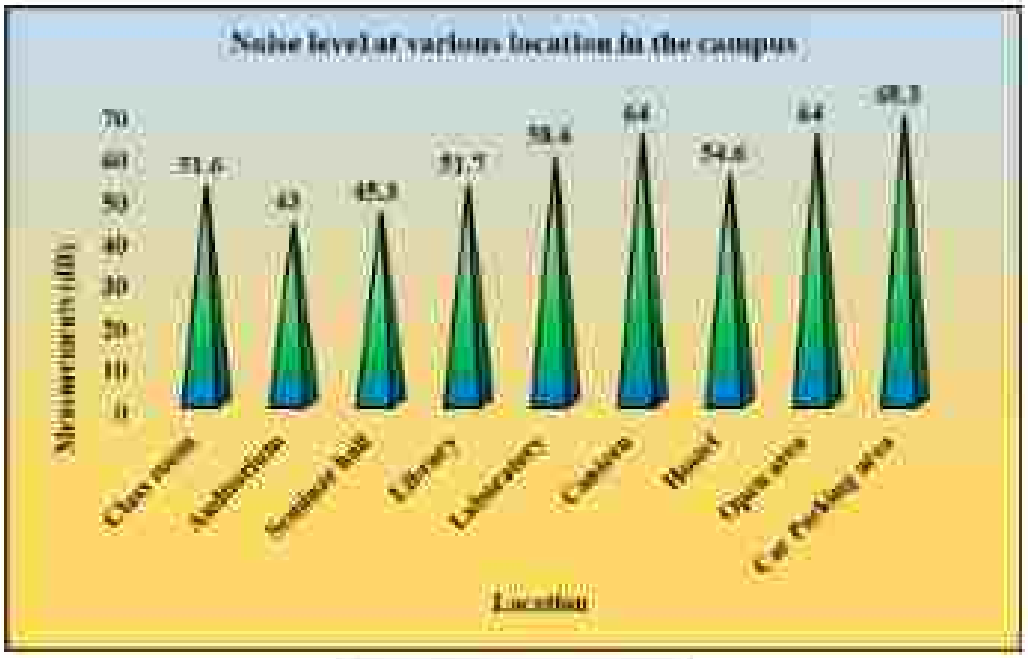
Area Code	Zone	Limits in dB (A) Leq	
		Day Time	Night Time
A	Industrial	75	70
B	Commercial	65	55
C	Residential	55	45
D	Silence	50	40

Source: IS - 12065 – 1987

Table 5. Noise level at various location in the campus

S. No	Locations	Measurements (dB)	Major noise sources	Remarks
1.	Class room	51.6	Students and Staff	No Noise Pollution
2.	Auditorium	43.0	Students	No Noise Pollution
3.	Seminar hall	45.3	Students	No Noise Pollution
4.	Library	51.7	Staff members	No Noise Pollution
5.	Laboratory	58.6	Students	No Noise Pollution
6.	Canteen	64.0	Students and Staff	No Noise Pollution
7.	Hostel	54.6	Students	No Noise Pollution
8.	Open area	64.0	Students and staff	No Noise Pollution
9.	Car Parking area	68.3	Vehicles	No Noise Pollution
	Mean	55.70		
	SE	1.66		
	CD	2.95		

Figure 3. Noise level at various location in the campus



Noise level measured in various locations at the Campus

4.2.8.1. Light intensity measurement at the campus

Light intensity or light output is used to measure whether a particular light source provides enough light for an application needed. There is a well-established light level recommendation for a wide range of applications in lighting industry and also for the type of space. Light intensity is measured in terms of lumens per square foot (foot-candles) or lumens per square meter (lux). A light meter (lux meter) is used to measure the amount of light in a space/on a particular work surface. The light meter consists of a sensor that measures the light falling on it and provides the user with a measurable illuminance reading. Light meters are an especially useful tool for measuring light for safety or over-illumination. Light intensity measured at various locations in the Campus are detailed in the Table 6 and Figure 4.

Table 6. Light intensity measured at various locations in the Campus

S. No	Type of Spaces	Illuminances (LUX)
1.	Class room	128
2.	Auditorium	125
3.	Seminar hall	140
4.	Library	178
5.	Laboratory	195
6.	Canteen	239
7.	Hostel	219
8.	Open area	984
9.	Car Parking area	1116
	Mean	369.33
	SE	21.78
	CD	38.81

Source: IS: 6665-1972

Light intensity analysis in the Campus

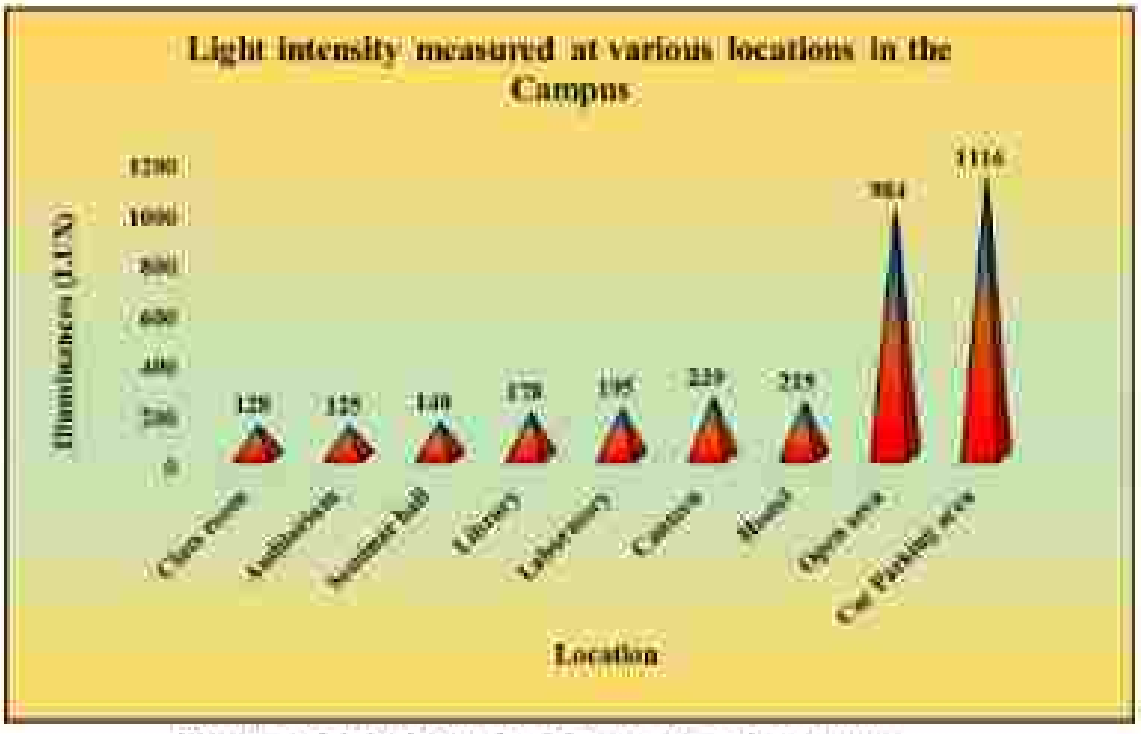


Figure 4. Light intensity Measured at the campus

4.2.8.2. Voltage Measurement at the Campus

Voltage measurement in AC & DC at different places in the campus is measured using the clamp (voltage) meter to reduce the energy consumption are shown in the Table 7.

Table 7. Voltage measured at various locations in the Campus

S.No	Name of the Place	AC & DC Voltage Measurement [Volt (v)]
1.	Class Room (AC)	241
2.	Auditorium (AC)	236
3.	Seminar Hall (AC)	237
4.	Library (AC)	240
5.	Laboratory (AC)	214
6.	Canteen (AC)	218
7.	Power Room (AC)	225
8.	Generator Area (AC)	227
9.	Battery (DC)	13.13
SD±		1.73

Source: BEE, 2015, Bureau of Energy Efficiency

Voltage intensity measured at the Campus

4.2.9. Operation and Maintenance (NBC Checkpoint 13)

During commissioning and handover, operation and maintenance plan was made and proper training was given to the correspondence staffs, which is evident through Operation and Maintenance (O&M) plan. The plan addresses the overall operation and maintenance of the building and proper monitoring facilities.

5. AIR QUALITY AUDIT

5.1. Introduction

When the air is clear and contains only small amounts of solid particles and pollutant then the air quality is determined as good. Air is the mixture of gases, as air is moving its quality can be changed day to day. Temperature, wind movements are also major reason for air quality. Air quality audits play a vital role in assessing the purity of air, ensuring safe respiration for humans and animals, and supporting healthy plant growth. It is being assessed by measuring some parameters such as O_2 and CO_2 along with air quality index in an organization.

5.2. Measurement of carbon dioxide level in the campus

Climatic conditions of the earth changed now-a-days due to a massive increase in global warming and environmental changes including human population and human activities. In addition, primarily fossil fuel burning and an extensive usage enhances heat-trapping greenhouse gas levels in the atmosphere. Global warming is driven by human-induced emissions of greenhouse gases which resulted in paramount shifts in weather patterns. In general, a portable CO_2 Analyzer is used to measure the level of carbon dioxide in the atmosphere at different places across the campus.

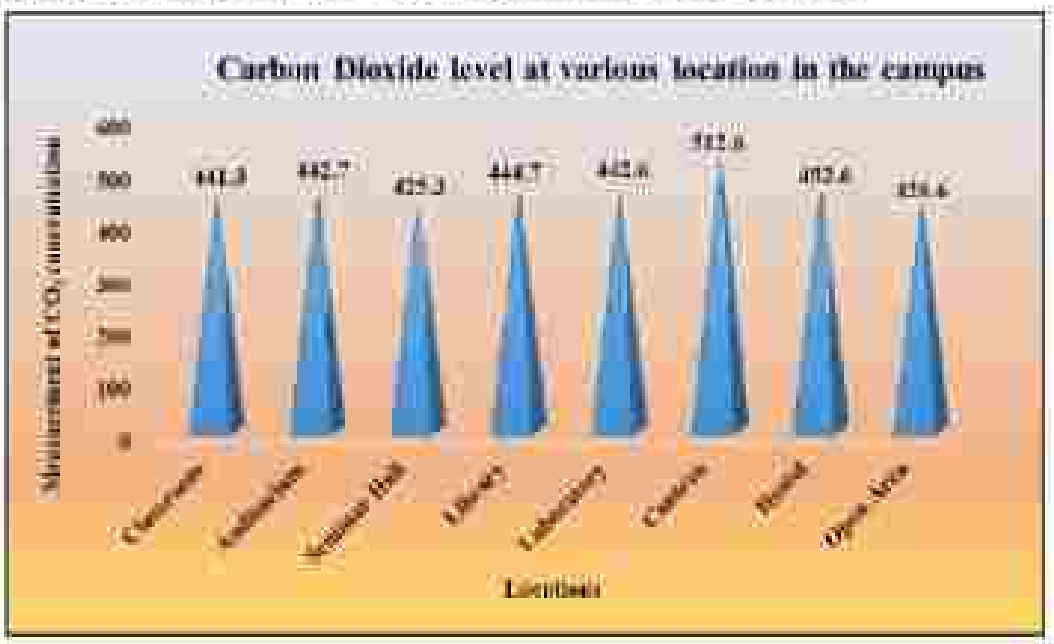
5.3. Air quality audit observations (NBC Checkpoint 12.4.3.)

It is observed that carbon dioxide and oxygen values are acceptable range. The air circulation is very good in all the places which in turn useful to give pure air to the stakeholders. The observation showed that the concentration of CO_2 in the atmosphere is found to be optimal which did not exceed the critical limit of CO_2. It is further revealed that all the selected locations are having pure air without any air contaminants with good air exchange/circulation in the campus. Some of the places like Canteen are recorded with high level of carbon dioxide level due to student mobilization and themaximum number of electrical items fixed from which the carbon dioxide emission was observed followed by all laboratories, class rooms, hostels, open places, car parking areas, seminar and auditorium halls (Table 8; Figure 5).

Table 8. Measurement of CO_2 concentration in the Campus

S. No.	Different locations of the Organization's Campus	Carbon dioxide level (ppm)*	Remarks
1.	Classroom	441.3	Within permissible limits
2.	Auditorium	442.7	Within permissible limits
3.	Seminar Hall	425.3	Within permissible limits
4.	Library	444.7	Within permissible limits
5.	Laboratory	442.6	Within permissible limits
6.	Canteen	512.6	Within permissible limits
7.	Hostel	452.6	Within permissible limits
8.	Open Area	426.6	Within permissible limits
Mean		448.58	
SEC ±		1.66	
CD at P=0.05%		2.76	

Figure 5. Measurement of CO_2 concentrations in the Campus



Analysis of CO_2 concentration in the Campus

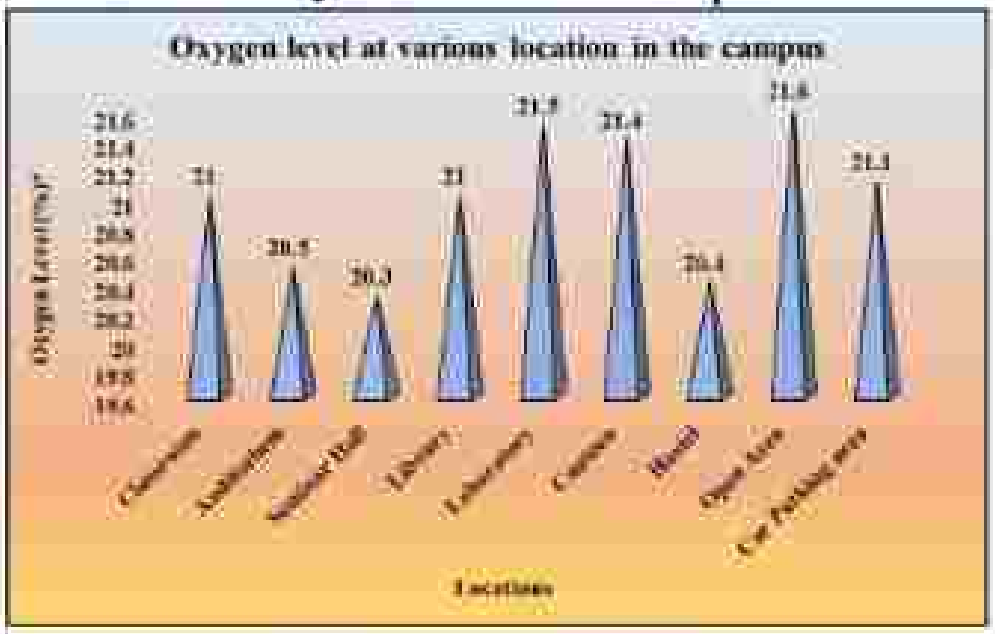
5.4. Atmospheric oxygen level measurements analysis and interpretation

Oxygen level refers to the amount of oxygen available within the atmosphere or water bodies. Oxygen is produced/released as a by-product of photosynthesis, the metabolic activity of all green plants besides certain microbes. Oxygen plays a paramount role in metabolic activities like respiration and the energy-producing chemistry of all living organisms. In order to quantify the oxygen level, Oxygen Meter is used. The atmosphere contains 18-21% oxygen concentration, 75-78.5% nitrogen and 2-3% other gases like carbon dioxide, neon and hydrogen. The amount of oxygen level in the atmosphere is determined by abiotic factors like altitude, latitude and longitude and biotic factors like plantations in the surroundings. If it excess, it causes oxygen toxicity and oxygen poisoning by creating coughing, breathing trouble and damage the lungs to human beings. The oxygen level of different places at the campus are monitored and presented (Table 9; Figure 6)..

Table 9. The oxygen concentration at different places of the organization

S. No	Location	Oxygen Level (%)*	Remarks
1.	Classroom	21.0	O_2 level is good
2.	Auditorium	20.5	O_2 level is good
3.	Seminar Hall	20.3	O_2 level is good
4.	Library	21.0	O_2 level is good
5.	Laboratory	21.5	O_2 level is good
6.	Canteen	21.4	O_2 level is good
7.	Hostel	20.4	O_2 level is good
8.	Open Area	21.6	O_2 level is good
9.	Car Parking area	21.1	O_2 level is good
	Mean	21.01	
	SEC ±	0.18	
	CD at P=0.05%	0.32	

Figure 6. Measurement of O_2 concentration in the Campus



Analysis of O_2 concentration in the Campus

5.5. Air Quality Index (AQI) Analysis

AQI has been analyzed using an AQI Meter. It is a kind of measurement tool used to communicate the level of air pollution in a simple and understandable way. In general, it indicated the presence of key pollutants such as PM2.5, PM10, nitrogen dioxide (NO_2), sulfur dioxide (SO_2), carbon monoxide (CO) and ozone (O_3). The AQI scale ranges from 0 to 500, where lower numbers signify cleaner air and higher numbers indicate increasing pollution levels. These levels are colour-coded from "Good" (Green: 0–50) to "Hazardous" (Maroon: 301–500). Poor air quality can significantly affect human health, particularly for sensitive groups like children, the elderly and individuals with asthma or respiratory issues. On days when the AQI is high, students are advised to limit outdoor activities, wear N95 masks, and stay indoors when possible.

Air Quality Index (AQI) Analysis of different places at the campus are monitored and presented in the Table 11; Figure 7. AQI scale and PM2.5 / PM10 concentrations according to Central Pollution Control Board of India is given in the Table 10. It is recommended that planting a large number of native trees in the organization using as an air purifiers and reducing vehicle emissions on campus can help to improve air quality in a significant level. Promoting walking, cycling, carpooling and the use of electric or public transport are practical steps towards cleaner air. Educational institutions should regularly display AQI updates through digital boards or mobile apps to raise awareness. By staying informed and making conscious choices, students and staff can contribute to a healthier and safer campus environment.

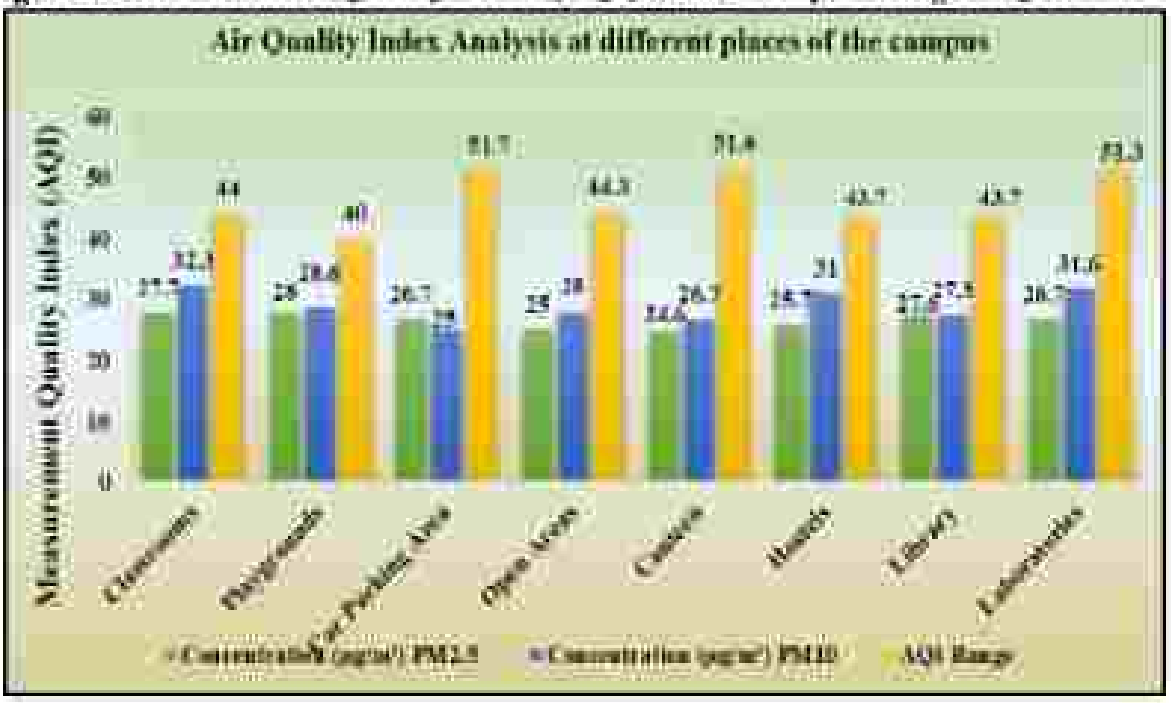
Table 10. AQI Scale, PM2.5 and PM10 Concentrations according to Central Pollution Control Board of India

AQI Scale Range	Concentration (µg/m³)		Category of Breathing Comfort	Health Implications & Possible actions for Indoors and Outdoor Units
	PM2.5	PM10		
0–50	0 – 30	0 – 50	Good	Air quality is satisfactory; safe for all for breathing
51–100	31 – 60	51 – 100	Satisfactory	Minor breathing discomfort for sensitive groups.
101–200	61 – 90	101 – 250	Moderate	Possible respiratory discomfort; limit strenuous outdoor activity.
201–300	91 – 120	251 – 350	Poor	Increased respiratory symptoms likely; reduce outdoor exposure.
301–400	121 – 250	351 – 430	Very Poor	Health effects to avoid the outdoor activity.
401–500	> 250	> 430	Severe	Serious health risks; stay indoors and consider closures.

Table 11. Air Quality Index Analysis at different places of the campus

S.No.	Places	Concentration (µg/m³)		AQI Range	Remarks
		PM2.5	PM10		
1.	Classrooms	27.7	32.3	44.0	Air quality is good with proper air circulation, safe for the stakeholders, well-ventilated learning environment.
2.	Playgrounds	28.0	28.6	40.0	
3.	Car Parking Area	26.7	25.0	51.7	
4.	Open Areas	25.0	28.0	44.3	
5.	Canteen	24.6	26.7	51.6	
6.	Hostels	25.7	31.0	43.7	
7.	Library	27.6	27.3	43.7	
8.	Laboratories	26.7	31.6	51.3	
	Mean	25.94	28.09	46.67	
	SEC ±	0.88	2.24	1.75	
	CD at P=0.05%	1.57	4.00	3.12	

Figure 7. Measurement Quality Index (AQI) in the Campus using a AQI Meter



Analysis of AQI concentration in the Campus

6. HYGIENE AUDIT

6.1. Introduction

A hygiene audit will provide an insight into how an organization operates in a sustainable manner in terms of hygiene environment to the stakeholders as per the International Standard for Occupational Health and Safety Management Systems (ISO HSMS). If an organization has a hygiene auditing process implemented already, then it should apply environmental context into a clean environment. Environmental audit is a natural management tool and it will become more effective when hygiene audit is added to it. It is an essential requirement to adopt an audit process for a sustained utilization of resources in a hygienic way in both developed and developing countries like India. Hygiene will be of different types such as personal hygiene, environmental hygiene, medical hygiene and public hygiene which are all interrelated between each other in terms of maintaining a hygienic atmosphere to the stakeholders.

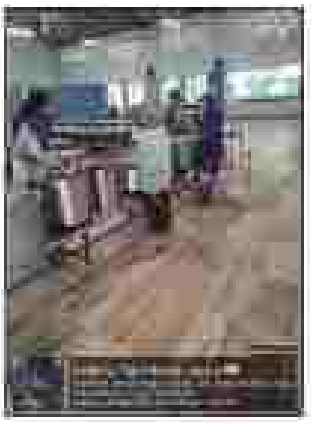
To ensure that the hygienic environmental management system, maintenance of environmental and personal hygiene, availability of clean resources, maintenance of water supply and hygiene, cleanliness ensured at the site of disposal of human waste materials and personal safety in the campus should be implemented effectively. Each year a plan for the hygiene audit should be prepared by the management of an organization. A committee of faculties and student representatives and social aware members appointed to take this plan forward in the beginning of every year will ensure that the entire hygienic environmental management system is implemented in the organization without any hindrance. An effective hygiene practice should be followed among the stakeholders which in turn useful to control a wide variety of disease outbreaks. Every organization should have applicable regulations, policies and standards with respect to hygienic environment.

A healthy population is the essential component of a country's wealth in terms of political, economic and environmental sustainability. In terms of population growth statistics, India is the fastest populating country to strike the second position in total population cover which is about 138 million and constitutes 17.25% of the total global population. Demographic status of India revealed that if the population increase continues to be at this rate, India is expected to be the most populated country by 2050. Along with the birth rate, social and environmental issues are also increasing and alarming now-a-days. As consequences of over population, social well-being of man and status of quality environment of the country get affected by the developing pressure on food, clothes, housing and other basic necessities, unemployment, loss of standard of living, decrease of forest cover, environmental pollution, energy crisis, ecological degradation and lack of hygienic condition-resulting in the distortion of well-being of a country. The hygiene audit is playing important role for both people and the environment of any organization in terms of safety. In order to achieve an effective ecofriendly hygiene by promoting the hygiene management practices and sanitization standards in the enterprise.

6.2. Hygiene audit observations

- No person is suffering from a disease or illness or with open wounds or burns among the students, teaching and non-teaching staff members including supportive staff and management people across the campuses observed during the hygiene audit.
- The sanitizing materials such as soap, liquid detergent, tissue paper role, hand gloves, hand towels, etc. to be placed nearby the washbasins and restrooms focusing towards the personal hygiene and sanitation related concerns to the stakeholders.
- Appropriate dustbins and eco-friendly covers are made available at laboratories, canteens, food courts, cafeteria and hostels across the campuses to control the spread of wastes and contaminants from one place to another place and without harming the environmental health.
- The laboratories, classrooms, hostels, canteens, food courts and toilets / restrooms are very neat and clean with proper ventilation and exhaust system.
- The pest management strategies, such as the insect trap, are ineffective and inappropriately located above the dining table.
- The kitchen requires thorough cleaning, particularly the walls. Additionally, the absence of insect nets has led to a presence of flies in the kitchen and dining areas.
- Maintenance of equipment and machinery items are very good and being carried out regularly as per the instructions of the manufacturer. They are neatly maintained without any dusts and covered with the appropriate covers. The management has signed a MoU to maintain Hygienic environment.
- Several first aid boxes in the laboratories have expired, with some dating back 3 to 6 years.
- Medical facilities are available for the laborers with physician to diagnose.

6.2.1. Observation on Personal Hygiene and Safety measures (NBC Checkpoint 12.3.6 and 12.3.7.)



As far as the stakeholders and employees are concerned, the safety and convenience of everyone working/access to the organization, the following safety rules should be observed at all times. Wearing a laboratory coat or apron along with hand gloves and caps before entering a working environment for protecting clothes from contamination or accidental discoloration by staining solutions are always mandatory in Organization's hygiene. The observation on providing hygiene environment to the stakeholders at campus revealed that sanitizing materials such as soap, liquid detergent, tissue paper role, hand gloves, hand towels to be placed nearby washbasins and restrooms focusing towards personal hygiene and sanitation related concerns. It is observed that working tables and benches are kept clean at laboratories across the Departments. Appropriate dustbins and eco-friendly covers are made available at laboratories, canteens, food courts, cafeteria and hostels across the campuses. At hostel dining halls and canteens, food suppliers are tied their long hairs properly and wear

disposable hand gloves, full cover aprons and caps to minimize contamination and fire hazards. Canteen is functioning hygienically and authorized by the management.

The pest management strategies, such as the insect trap, are ineffective and inappropriately located above the dining table.The kitchen requires thorough cleaning, particularly the walls. Additionally, the absence of insect nets has led to a presence of flies in the kitchen and dining areas.

6.2.2. Napkin disposal facility

The campus has implemented safe practices for disposing of sanitary napkins using small-scale incinerators. The availability of incinerator facilities and properly designed disposal structures, along with efforts to address social stigmas surrounding menstruation, have positively influenced sanitary waste disposal habits among women on campus. Notably, the incineration facility, although available, is currently not in use, indicating a need for awareness and training on its proper utilization and benefits.

Napkin incinerator machine observed in the campus

6.3. Legal compliances

In this campus, they following legal appliances have been verified as per the National Building Code (Part 11 – Approach to Sustainability). Some of the documents are verified in onsite inspection are Building approval plan, canteen approval license to procure FSSAI certified food products and personal hygiene is evident from the management maintenance record.

FSSAI Certificate observed in the campus

7. SOIL AUDIT

7.1. Introduction

Soil is the inequitable natural resources and naturally occurring loose covering on the earth's surface. Weathering altered the rock particles of soil into mixtures of mineral and organic constituents. Soil is rich in microorganisms such as bacteria, fungi, actinomycetes, algae, protozoa and nematodes. The microorganism of the soil helps in enzymatic degradation of organic matter, energy storage and conversion of nutrients in available form in their biomass. In general, soil is the natural ecosystem of the organization that has to be structured, planned and developed from the point of entry to end users the stakeholders in such a way with contamination free soil without any chemical residues, sustainable use of land and suitable measures for their conservation.

Soil audit plays an important role to provide crucial data for sustainable agriculture, environmental management, and other fields by assessing soil health, nutrient levels, and contaminants. Environmentally, audits can identify contamination risks, track long-term soil health, and inform waste disposal practices. For construction and engineering, soil audits assess compaction and stability. Soil audit helps the educational institutions and industries to maintain eco-friendly environment, assures personal hygiene to various stakeholders and supports the nation; on the whole for the noble cause of environmental protection and nature conservation which in turn enhances the quality of life of all living beings. Most of the soil in India are well drained, deep, fairly loamy, slightly acidic to alkaline and lime-free soils and they are ideal for variety of plant cultivation. The Indian soils are mainly derived from gneiss rock containing large amount of mica with good behaviour of water holding capacity with abundance of micro and macro elements. Some of the soils are characterized by clay loam type, classified as latosols with good organic matter contents along with sufficient amount of nitrogen, potassium and phosphorous contents all tea soils are distinctly acidic, rich in nitrogen content.

7.2. Soil audit observations

1. The physic-chemical properties of soils revealed that the soil health is good towards the construction of building and the cultivation of various native and wild type plant species in large scale level.
2. By analyzing various nutrient levels, pH, texture and water holding capacity, it is suggested to select the right native plants species for cultivation in the organization with appropriate fertilizer applications in soil ecosystem.
3. Soil samples need to be checked six month once periodically, allowing for long-term management strategies that maintain productivity and prevent degradation.
4. It identifies issues like nutrient deficiencies, toxicities, or pH imbalances, enabling corrective actions before they impact plant species health.
5. By avoiding over-fertilization, soil audits reduce nutrient runoff into water bodies, which can cause eutrophication and other pollution.
6. Audits are used to detect contaminants such as heavy metals or organic pollutants, which is essential for environmental clean-up and risk assessment.
7. It is observed that Grey Water Contaminations in Bamboo Garden.

7.3. Geology, topography and soil condition (NBC Checkpoint 12.4.1)

Vallam is situated in the Thanjavur district, which has a geology of Cretaceous, Tertiary, and alluvial deposits, with a small patch of Cretaceous formations west and southwest of Vallam. These formations are primarily composed of clay, silt, impure limestone, and sandstone. Vallam is a town in the Thanjavur district of Tamil Nadu with an elevation of approximately 75 meters (246 feet). The local topography is generally flat, with a slight slope towards the north, and the terrain around the historic fort has variations in elevation. The area is part of the broader flat region of the Cauvery delta, though it is slightly elevated. The soil in and around Vallam, Thanjavur, is primarily a mix of alluvial and tertiary deposits, characteristic of the Thanjavur district.

7.4. Assessment of Physico-chemical property of soil samples

Soil physic-chemical properties influence the behaviour of soil and hence, knowledge of soil property is important. Soil testing is the only way to understand the soil health and to determine the available nutrient status in soil. The fertility of the soil depends on the concentration of N, P, K, organic and inorganic materials, conductivity. The results on soil samples analysis revealed that the pH, Electrical conductivity, total organic carbon, total nitrogen, available phosphorous and exchangeable potassium were found to be within the range and suitable for building constructions and cultivating the plants corresponding to the soil health. The soil samples were analysed with the help of ISO 17020 Accredited lab and correlated with the standard values referred from 'Soil Testing Methods in India' published by the Ministry of Agriculture, January 2011 Edition, Government of India.

Soil Sample Test Result:

S.No	Test Parameters	Value	Unit	Test Protocols	Comments
1.	pH @ 25 °C	7.94	-	IS 2720: (Part 26)	Sufficient
2.	Specific Electrical Conductivity	0.43	ms / cm	IS 14767	Sufficient
3.	Organic Carbon	0.10	%	IS 2720: (PART 22)	Sufficient
4.	Total Nitrogen	0.004	%	IS 14684	Sufficient
5.	Available Phosphorus as P	BDL(DL: 3.75)	mg / kg	ATL/SOIL/SOP – 03 Issue No / Date: 01/ 02.02.2018	Sufficient
6.	Soluble Potassium as K	103.1	mg / kg	ATL/SOIL/SOP – 05 Issue No / Date: 01/ 02.02.2018 (Based on FAO Manual)	Sufficient
7.	Moisture	58.5	%	IS 15106	Sufficient

Range of soil nutrients status:

S.No.	Soil Nutrients	Soil Fertility Ratings (%) *		
		Low	Medium	High
1.	Organic carbon as a measure of available Nitrogen (%)	< 0.5	0.5-0.75	>0.75
2.	Available N as per alkaline permanganate method (kg/ha)	<0.2	2.0 – 5.0	>5.0
3.	Available P by Olsen's method (kg/ha) in Alkaline soil	<5	5-10	>10
4.	Available K by Neutral N, ammonia acetate method (kg/ha)	<25	25-35	>35

Standards referred from 'Soil Testing Methods in India' published by the Ministry of Agriculture, Government of India and Methods of Analysis of Soils, Plants, Waters and Fertilizers by Fertilizer Development and Consultation Organization.

Soil Sample Test Report obtained from ISO 17025 certified lab

Soil Sample Collection in the Campus

7.5. Physico-chemical properties soil collected from of the Organization Campus

The physico-chemical properties of soil influence the behaviour of soil and hence, knowledge of soil property is important. Soil testing is the only way to determine the available nutrient status in soil and the only way we can develop specific fertilizer recommendations. Soil properties that are sensitive to changes can be used as indicators to improve soil quality. Analysis of soil is carried out for the studies of various parameters like total organic carbon, available nitrogen (N), phosphorus (P_2O5) and potassium [K_2O], pH, electrical conductivity, soil texture, bulk density, chloride, fluoride and % moisture content. The fertility of the soil depends on the concentration of N, P, K, organic and inorganic materials, conductivity. The physico-chemical properties such as moisture content, nitrogen, phosphorus and organic matter required for the growth of plant.

The soil profile and soil edaphic parameters of the campus observed is optimal in terms of essential nutrient analysis and soil fertility. Soil samples were collected from different places of the organization campus and then subjected to analyse for their fundamental soil edaphic parameters such as pH, electrical conductivity (Ec), total organic carbon, total nitrogen, available phosphorous, exchangeable potassium, total ferric and ferrous ion concentration, manganese, magnesium, zinc, copper. The results indicated that pH and Ec recorded values were found to be within the prescribed ranges. The soil macro-elements like the amount of total organic carbon, nitrogen, phosphorous and potassium were found to be optimal. Similarly, the micro-elements like total ferric and ferrous ion concentration, manganese, magnesium, zinc and copper recorded were within the prescribed range. The soil sample analysis report revealed that all the values are within the prescribed range according to the Indian soil health analysis report and guidelines and found to be suitable for building constructions and various native and wild plant species cultivation.

8. WATER AUDIT

8.1. Introduction

Water is one of the most essential natural resources, with around 97% existing as salt water and only 3% as fresh water accessible on land. The use of water is inevitable in our daily needs. Water is used in agriculture, industries, household, recreational and environmental activities every day. In general, the natural sources of fresh water are surface water and ground water. A water audit is a tool used to assess and improve the management of water resources, ensuring better quality for human and animal consumption, as well as efficient use in agriculture through irrigation. It creates awareness on environmental ethics, resolves environmental issues and offers solutions to various social and economic needs. It strengthens the concept of 'Jal Jeevan Mission' and 'Sustainable Land Management' among stakeholders of India for the protection of natural ecosystems for future prospects.

Water audit helps the educational institutions and industries to maintain eco-friendly environment, assures personal hygiene to various stakeholders and supports the nation; on the whole for the noble cause of environmental protection and nature conservation which in turn enhances the quality of life of all living beings. A water audit is a systematic process of analyzing water use to identify where water is consumed, lost, or wasted, with the goal of reducing consumption and improving efficiency. It involves measuring and tracking water from its entry point, through its use and potential leaks, to its discharge point. The process helps to pinpoint inefficiencies, suggest conservation measures, and can be applied to various scales, from a single building to an entire organization.

8.2. Key components and steps involved in the water audit

8.2.1. Water balance calculation: Determine the total amount of water entering the system and account for all uses and losses.

8.2.2. System mapping: Create a layout of the water supply system, including sources, the distribution network, and where water is used or discharged.

8.2.3. Flow measurement: Install meters at strategic points to measure water flow, such as at the source, treatment plant, and distribution networks.

8.2.4. Leakage and waste identification: Systematically check for leaks, inefficient fixtures, and other forms of waste.

8.2.5. Consumption pattern analysis: Study how water is used and identify areas for improvement.

8.2.6. Recommendation development: Based on the findings, the audit report provides recommendations for water conservation, improved treatment, and waste reduction, often with cost-benefit analyses.

8.2.7. Record keeping: Establish a system for ongoing monitoring and record-keeping to maintain a history of water use and manage it effectively.

8.2.8. Physico-chemical property of Water: Colour, taste, odour, viscosity, pH, TDS, dissolved oxygen, micro and macro elements and etc. will be tested in water samples.

8.3. Water audit observations

1. The campus has well established rainwater harvesting models to recharge the bore wells by collecting rainwaters from the building roofs, open areas and playgrounds including unexplored areas which are maintained properly.
2. The physic-chemical properties of water revealed that water is good for human consumption and also useful for plant irrigation purpose.
3. The water quality parameters revealed that the quality of water is good in terms of domestic purposes.
4. A well-established rainwater harvesting system to recharge water ground status by collecting rainwaters from the campus coinciding with the contour of the terrain and natural drains.
5. Solar water heater is available to serve hot water for domestic purpose.
6. It is observed that few taps are leaked in the campus.
7. Grey water contamination in the bamboo garden, can implement proper grey water treatment and reuse systems.

8.4. Water management activities (NBC Checkpoint 7.3, 10.2 – 10.5 and 12.4.2.)

In order to conserve water resources, it is essential that any environmentally responsible institution should examine its water use practices. Water auditing is conducted for the appraisal of facilities of raw water intake and determining the facilities for water treatment and reuse. Auditor concerned investigates the relevant method that can be adopted and implemented to balance the demand and supply of water. The Organization is taking enough attempt to manage wastewater that are coming out from various Department laboratories, hostels and canteens as per the water management plan. Solar water heaters are available for the domestic use of water. Chemicals like bromine and chlorine are avoided to maintain the water quality and to maintain hygienic environment to the stakeholders. Low flow fitting are implemented in the recently constructed building to conserve water.

Water management activities observed in the campus

8.5. Operational water supply systems

Maintaining the green campus, water conservation mechanisms should be applied efficiently in the campus. Well planned water irrigation systems like sprinkler and drip should be implemented in the entire green area of the campus for an effective water management system. This can be implemented only when the plantations are well planned. Vegetative area of the audited organization has taken sufficient efforts to maintain the plants greenish and frequency of watering to the plants.

RO Units observed in the Campus

8.6. Rainwater harvesting system and percolation pond

Rainwater harvesting system is a traditional old practice not only in drought prone areas and also in areas having seasonal rainfall. Indian traditional rainwater harvesting systems are constructed based on three modes either direct pumped, indirect pumped or by both modes. In addition, lakes, ponds, water channels and any other water reservoir methods are considered as the rainwater harvesting system. During the audit it has been observed that the organization has developed storm water harvesting system.

Storm water harvesting system observed in the campus

8.7. Water quality

After air, water is the second most critical element for life to exist. As a result, the scientific literature has numerous descriptions of water quality. It is the physical, chemical and biological characteristics of water, is the most frequently used definition of water quality. Water quality is a measurement of the state of water in relation to the needs of one or more biotic species and/or to any human need or purpose.

- One of the most crucial aspects of water quality is pH. It is described as the hydrogen ion concentration's negative logarithm. It is an arbitrary number that expresses how acidic or basic a solution is. Actually, water's pH is a gauge of how acidic or basic it is. Both basic and acidic water have more hydrogen (H^+) and hydroxyl (OH^-) ions than usual.
- Total dissolved solids is referred to as TDS. It calculates the overall concentration

of soluble salts and minerals in water. One mg/L of dissolved minerals, for instance, means that the water pitcher contains one mg/L of TDS.

- The salinity of a body of water, commonly known as saline water (also see soil salinity), is the degree to which salt is present. It is often measured in grams per litre (g/L)..Water that is cloudy is referred to as turbid. It gauges how well light can travel through water. It is brought on by particulate matter suspended in water, including clay, silt, organic matter, plankton and other particles.
- One of the most crucial indicators of the water quality in streams, rivers and lakes is dissolved oxygen (DO) which is regarded as one of the factors. It isan important indicator of water pollution. The water quality improves as the dissolved oxygen concentration does.

8.8. Standards for physico-chemical properties of water

The water samples collected from various sources, i.e., RO water, tap water, bore well water, wastewater and treated water samples were subjected to analyze for its physico-chemical parameters. The results showed that all the parameters were found to be appreciable and no harmful effect was recorded (Table 12). These parameters were observed to be within the limit of Indian Standards of drinking water quality. The observed pH values were found to be 6.5 - 8.5 range. Similarly, observed TDS and salinity were 0 - 900 mg/L and 300 - 380 mg/L, respectively. Turbidity and dissolved oxygen were 4.5 – 5.5 NTU and 6.5 - 8.0 mg/L, respectively which are compliance with ISI standards.

Table 12. Physico-chemical properties of various water sources

S.No.	Water source	pH	TDS (mg/L)	Salinity (mg/L)	Turbidity (NTU)	Dissolved Oxygen (mg/L)
1.	RO water	7.7	437	313.7	4.3	6.3
2.	Tap water	7.3	503	314.3	5.1	6.8
3.	Pond water	7.7	403	331.3	5.1	7.5
4.	Waste water	8.1	454	338.7	5.3	8.3
5.	Treated water	8.2	490	344.3	5.2	8.6
	Mean	7.84	457.53	328.47	5.07	7.48
	SEC ±	0.09	4.41	2.05	0.16	0.08
CD at P = 0.05:		0.15	7.87	3.65	0.29	0.15

Source: IS 10500: 2012

Water analysis by using pH and TDS Meters

8.9. Water consumption rate

Since several variables are influenced water consumption by various stakeholders of an organization; it is hard enough to precisely assess the water quantity demanded by the public. Water is an immense requirement of any living organism. Though it is a natural resource,we are exploiting water for various purposes in day-to-day activities. As an educational institution, water requirement for various activities may differ as shown in (Table 13). Per capita Domestic Consumption in Hostels combined with Canteen ranges between 90 - 125 litres. Industrial or laboratory demand for water is estimated ranges between 100 - 300 litres. Losses as leakages and routine consumption accounts approximately 30 - 50 litres (per capita) and other uses daily usage uses accounts another 50 litres.

Table 13. Water consumption for various purposes

S. No.	Types of consumption	Normal range (L/capita/day)	Average
1.	Per capita domestic consumption at hostel and canteen	93-126	112
2.	Industrial and commercial demand at laboratories	124 - 255	198
3.	Public uses including fire demand, transport washes	2378-3345	2434
4.	Losses and waste as routine consumption	37-53	43
5.	Daily use (day-to-day use)	64	37

9. WASTE MANAGEMENT AUDIT

9.1. Introduction

Waste management is a global environmental task but has always been neglected by the public. Improper waste management will create environmental issues viz., soil, water- and air-pollution which lead to health problems. Main reason for polluted environment is unawareness of consumers and improper or poor legitimate initiatives. Ever increasing population rate and the improved life style of the people results in generation of amplified amount of solid wastes, irrespective of urban and rural areas. Solid waste is defined as the unwanted substance which is generated by the society that does not have any economic value from the point of view of the user. Waste management is defined as the discipline associated with control of generation, storage, collection, transport/transfer, processing and disposal of solid waste materials in aesthetic way.

There is a daunting need of effective waste management in India as 62 million tons of municipal solid waste and 38 billion litres of sewage is generated annually only from urban areas. The solid waste increases at the rate of 1.0 - 1.3% annually and the maximum amount of municipal waste is left untreated (Rajalakshmi *et al.*, 2023). Primary reason for unclean surroundings in the nation is unawareness of individuals, in general, deprived institutional initiatives. While educating the environmental health and security, it has to be initiate from grass root level, primarily, educational institutions are the right forum to start with. Prior to teaching the students on waste management practices and prepare them to adopt strategic plan of waste management to material management, educational institutions should establish the physical facilities and follow the fundamental guidelines. The physical facilities established in the higher educational institutions and their utility through onsite auditing and to assess the implemented waste management practices with particular reference to recycling and generation of value added products.

9.2. Observations of the Waste Management Audit

- Recycling and reuse of waste materials are implemented in the campus through vermicomposting.
- Allocating specific areas for segregation is crucial to facilitate proper waste separation and minimize environmental impacts.
- Incinerator facilities are available for the disposal of napkins, required awareness among students.
- No usage of radioactive elements observed in the campus.
- Electrical and electronic wastes are collected and segregated properly.
- Records are available for e-waste disposal by the authorized agency.
- MoU signed with the authorized waste disposal agency as an effective practice of waste management.
- Observed the allotment of separate team to perform environmental impact assessment and environmental management plan.
- Training needs are identified and workforce training is carried out in regular basis.
- The bio-medical waste storage area needs a shelter, and immediate action is

required to address the open burning of waste and the contaminated open well in the hospital campus.

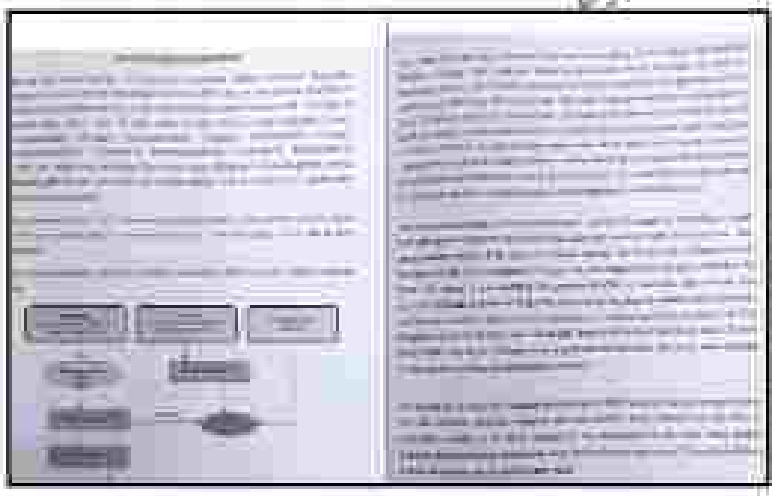
- Grey water directly discharged in open pond and bamboo gardens, consider alternative methods to minimize contamination risks.
- Sewage treatment plant is not available in the campus.
- There is no designated area allocated for scrap yard purposes.
- Some of the construction wastes are reused for constructing cement roads inside the campus.
- Biogas plant is available in the campus but not functioning.

9.2.1. Technology Options (NBC Checkpoint 3.3 and 3.4.)

As per the guidelines to Architect and Civil contractors for existing buildings, traditional materials are used in the construction, environment friendly and cost-effective technologies are made available in the campus as per the building code.

9.2.2. Waste Management Practices (NBC Checkpoint 10.6, 10.7 and 12)

Waste Management has a common mandate that the 'Producer Owns the Responsibility'. The solid wastes are collected from different places of campus and segregated based on biodegradable and non-degradable materials subsequently subjected for recycling and degradation processes like composting. Details of the waste management practices in the Organization are 1) bio-degradable waste handling, 2) disposal of e-waste. Waste management is performed based on the waste management plan, separate committee is formed and monitored accordingly.



Waste Management plan observed in the campus

i) Solid waste management practices at the campus

The term, solid waste control refers to the method of accumulating and treating solid wastes by following ecofriendly methods. It is also a solution for recycling objects that do not belong to garbage. In the solid waste management, the wastes are accumulated from different parts and are disposed based on degradability materials like paper and non- degradability materials like glasses, plastics and metals. Organization has a very good solid waste recycling unit which operates a few vehicles to collect wastes using compostable bags across the campus. Both degradable and non-degradable items are being collected from canteens, stationary shops and hostels and disposed through the Corporation facility.

ii) Bio-degradable and non-degradable waste materials management practice

For segregation of waste (Organic, Recyclable, Non-recyclable and E-waste) at source and collecting the same 'Waste Bins' are placed at designated locations in the Campus viz. Students Hostels and Staff rooms, Students Service Centre, Sports Complex and Guest rooms. A Contractor is engaged for the collection and further process of waste generated within the campus where biodegradable wastes subjected to preparation of organic compost.

Vermicomposting pit observed in the campus

iii) Use of biofertilizers, organic and green manures

Natural or eco-friendly methods should be used to grow plants vigorously in thecampus which could reduce the environmental pollution. The plant waste such as fallen leaves, stems, fruits, nuts, seeds and other plant parts are used to make green manures. Minimal use of chemical fertilizers as part of integrated nutrient management system is acceptable but 'zero use' of chemical fertilizers is highly appreciable. Biofertilizers, farm yard manure and dried cow dung manure are extensively used in the audited organization to cultivate plants ensured to keep the campus organic. These practices are very well appreciated because air, water and soil pollution due to use of agrochemicals is eradicated which in turn to improve the soil health significantly. Biogas plant observed in the campus currently non-operational.

iv) Disposal of E-Waste

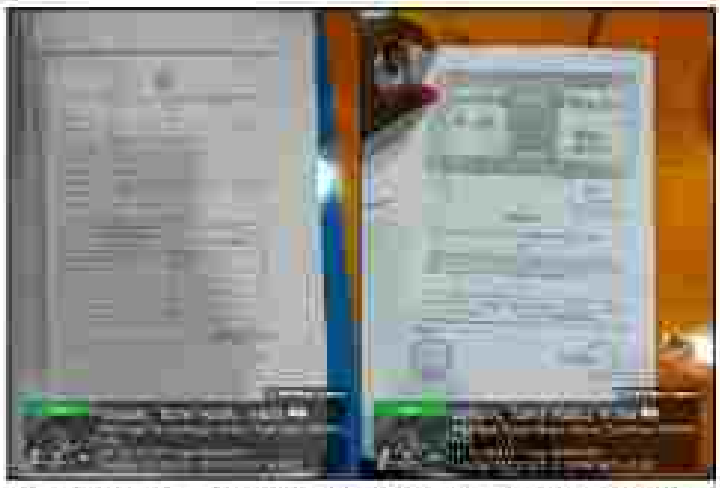
According to E-Waste Management Rules, 2016 (Ministry of Environment, Forest and Climate Change, Government of India), electronic waste or e-waste includes old and non-functional electrical and electronic appliances. The e-waste materials were collected from the Organization are being segregated and then given to authorized agencies for handling e-waste. Due to this e-waste activity disposal, the e-waste pollution is significantly reduced in the Campus. Organization has produced lesser quantity of e-waste and the same has been disposed through the Corporation facilities.

v) Construction and Demolition waste management

The Ministry of Environment, Forest and Climate Change, Government of India has notified the Construction and Demolition Waste Management Rules, 2016 exclusively to manage waste (building materials, debris and rubble) from construction activities like new construction, re-modelling, repair and demolition. One of the best waste management practices is rebuilding of construction waste into pillars, pathway road and etc. The construction waste inside the campus is found to be very low.

vi) Hazardous and biomedical wastes management

The Organization have taken pioneering efforts to dispose the hazardous as well as biomedical wastes properly that are generated from various Department laboratories. Acids, solvents, salts, reagents and cancer-causing substances (carcinogens) will cause cancer to the stakeholders those who doing research and/or experiments. Most of these kinds of wastes are disposed of safely without affecting the environment, soil health and water quality as per the directions of World Hazardous Waste Programme. Hazardous chemical and biomedical wastes are not abundantly used in the campus. The bio-medical waste storage area needs a shelter, and immediate action is required to address the open burning of waste and the contaminated open well in the hospital campus.



MoU signed documents for biomedical wastes verified in the campus

vii) Recycling of wastewaters

The main feature of the treated water should not be harmful to the biodiversity, resources and the environment especially in soil ecosystem. If an industry or Organization has the wastewater treatment plan, proper records on the analysis of water input and output parameters including the running time of the wastewater treatment plant, its operation cost, its maintenance and the reuse records of the treated water should be well accounted.

10. Conclusion

Considering the fact that the organization is a well-established academic institution and there is significant scope for conserving green, environment, energy, air quality, hygiene, soil, water and waste management, which in turn make the campus as self-sustained. The organization has taken enormous efforts to maintain green campus in a sustainable manner. It has conducting a large number of activities for the benefit of rural and tribal community people without disturbing the natural environment. The installation of a rainwater harvesting system and irrigation system to conserve rainwater and improve the ground water levels are noteworthy. The Organization has created Herbal and Bamboo gardens at small scale level for establishing a massive reforestation / afforestation programme in which a large number of trees and shrubs species were planted together for providing an eco-friendly atmosphere to the stakeholders in a sustainable manner.

The energy conservation initiatives taken by the organization are substantial. Water and Soil conservation activities are also implemented and practiced. Proper facilities and procedures are followed for waste collection, segregation, disposal, recycle and reuse. Quality of soil and water observed to be good. Hygienic practices are monitored and maintained considering the health and sustainability of the stakeholders at canteen and hostel premises. Tree plantation at appropriate locations are maintained to resist the indoor climate and conserve energy as per the National Building Code (Part 11 – Approach to Sustainability). The organization has made significant progressive contributions with respect to teaching learning, research and consultancy, innovation and transfer of technology, community service and value education, in toto. It imparts quality education to rural, tribal and urban people across the nation which is excellent in terms of academic activities and providing an eco-friendly atmosphere to the stakeholders.

11. References

BIS, Code for Practice of Industrial Lighting (IS: 6665-1972). Bureau of Indian Standards, New Delhi, India.

BEE, 2015. Bureau of Energy Efficiency, A statutory Body Under Ministry of Power, Government of India.

Carbon footprint calculation. www.carbonfootprint.com.

Code for Practice of Industrial Lighting (IS: 6665-1972). Bureau of Indian Standards, New Delhi, India.

Gnanamangai, B.M., Murugananth, G. and Rajalakshmi, S. 2021. *A Manual on Environmental Management Audits to Educational Institutions and Industrial Sectors*. Laser Park Publishing House, Coimbatore, Tamil Nadu, India. 366 p.

ISO, 2021. International Organization for Standardization. https://www.iso.org/home.html.com.

NBC, 2016. National Building Code of India 2016, Volume 2. Bureau of Indian Standards, New Delhi, India.

NCP, 2016. *National Environmental Policy-2006*, Government of India, Ministry of Environment and Forest, New Delhi, India.

Permissible Limits of Noise Levels for Rotating Electrical Machines (IS: 12065 - 1987). Bureau of Indian Standards, New Delhi, India.

Rajalakshmi, S., Amzad Basha, K. and Asif Jamal, G.A. 2023. *A Manual on Waste Management Audit*. Laser Park Publish House, Coimbatore, Tamil Nadu, India. 163p.

Soil Test Methods, 2011. Methods Manual - Soil Testing in India, Department of Agriculture & Co- operation. January 2011 Edition, Ministry of Agriculture Govt. of India. New Delhi.

Soil Test Methods, 2016. Methods of Test for soils (IS 1270-1984). Indian Standards Institution, New Delhi, India.

Water Test Methods 2016. Drinking Water – Specification (IS 10500: 2012). Bureau of Indian Standards. New Delhi, India.