TECHNICAL AUDIT REPORT

[Green, Environment, Energy, Waste Management and Gender Audits]

Submitted to

SOKA IKEDA COLLEGE OF ARTS AND SCIENCE FOR WOMEN
MADHANANGKUPPAM, CHENNAI- 600 099
TAMIL NADU, INDIA

Date of Audit: 28.03.2023

Regd. No. 114 / 2017

Submitted by

NATURE SCIENCE FOUNDATION
(A Unique Research and Development Centre for Society Improvement)
[ISO Certified and Ministry of MSME Registered Organization]
No. 2669, LIG-II, Gandhi Managar, Peelamedu
Coimbatore 641 004, Tamil Nadu, India
Phone: 0422 2510006, Mobile: 9566777255, 9566777258
Email: director@nsfonline.org.in

SOKA IKEDA COLLEGE FOR WOMEN CHENNAI-99

PRINCIPAL
SOKA IKEDA COLLEGE OF ARTS AND SCIENCE FOR WOMEN
CHENNAI - 600 099

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(A Unique Research and Development Centre for Society Improvement)
ISO 9001:2015, 14001:2015, 45001:2018 & 50001:2018 Certified and Ministry of MSME Registered Organization
No. 2669, LIG - II, Gandhi Managar, Peelamedu, Coimbatore - 641 004, Tamil Nadu, India.
Email : directornsf@gmail.com, director@nsfonline.org.in, Website : www.nsfonline.org.in
Office : 0422 - 2510006, Mobile : 95667 77255, 95667 77258.

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

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 ***Soka Ikeda College of Arts and Science for Women, Madhanangkuppam, Chennai - 600 099, 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 till its validity.
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 and for whole hearted support extended at the time of onsite audit. Our sincere thanks to NAAC, IQAC Coordinator 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.

Date:
Place: Coimbatore

Authorized signatory
Nature Science Foundation

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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 (Aparajita, 1995). Green Campus Audit is a tool to evaluate environment management system which is systematically executed to protect and preserve the environment. Green campus audit 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 issues and offers solutions to various social and economic needs (APHA, 2017). 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

National Building Code of India has a set of rules and guidelines that regulates construction and as well as ecofriendly activities of the campus. In order to achieve the minimum standards of welfare and safety of stakeholders of a campus, the Governing body 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.

National building codes not only offer a standard benchmark that constructors 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. For instance, new and updated building codes put much emphasis on conservation as energy and the waste is the most expensive byproduct of older regions. This will not only offer environmental benefits to future generations but will also regulate indoor air pollution to protect the health.

Before the introduction of National Building Codes of India in the construction industry, building commercial and residential properties used a lot of energy which adversely affected the 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 and in this way National building code offers multiple environmental benefits to various stakeholders. While safety is the primary objective, new building codes are making significant contributions toward solving energy issues. National building codes contain provisions relating to the use of environmentally compatible construction techniques like planting trees, landscaping, rainwater harvesting and renewable and non-renewable energy sources. These provisions allow the constructors to use natural energy sources which in turn reduces the energy bills to a greater extent

1.3. Role of Educational Institutions in natural resource conservation

In view of providing eco-friendly atmosphere to the stakeholders, educational institutions are focused on establishing and maintenance of green and eco-friendly campus without harming the environment. A clean and healthy surrounding in an organization determine the effective learning/teaching and provides a favorable learning environment to the students. Educational institutions are insisted by both Central and State Governments toprovide green, healthier and eco-friendly atmosphere to the stakeholders. In addition, all the educational institutions are asked to save the environment for future generations and to solve the problems associated with environment through Environmental Education. Implementation of Swachh Bharath Abhiyan Scheme by the Indian Government through Educational Institutions imparted neat and clean environment at tribal, rural and urban areas across the country. Seminar, Conference, Workshop, training and awareness programmes on biodiversity conservation education, environmental awareness programmes, etc., may be conducted periodically by the Management and Administrative people of an organization for the benefit of the stakeholders.

1.4. Green Campus and Environment Policies

Green Campus Policy dealt with cleanliness of the campus maintained through proper disposal of wastes and steps to be followed to recycle the biodegradable wastes and utilization of eco-friendly supplies to maintain the campus free from hazardous wastes/pollutants. The concept of eco-friendly culture is disseminated among the students as well as rural community through various awareness programmes. Attempts are made to minimize the energy usage and substitute the non-renewable energy sources with renewable energy sources. Head of the Organization, Departmental Heads and Senior Managers/ Management Representatives are responsible for monitoring the "Go Green" initiatives of the Organisation and maintain a clean/green campus while each and every individual of the organization should adhere to the policy.

1.5. Environment Friendly Campus

As stated earlier, Organization is liable to provide an eco-friendly atmosphere along with good 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 Code 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 & Occupational Safety & 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.

Environmental auditing concerned with following aspects:

- ✓ Assessing compliance with pertinent constitutional and internal requirements
- ✓ Providing management control over environmental activities
- ✓ Endorsing good environmental management
- ✓ Maintaining credibility with the public
- ✓ Creating awareness among the staff on their commitment towards environmental policy
- ✓ Enduring improved opportunities and
- ✓ Establishing the performance baseline for developing an Environmental Management System (EMS).

1.6. About Nature Science Foundation (NSF)

NSF is an ISO QMS (9001:2015), EMS (14001:2015), OHSMS (45001:2018) & EnMS (50001:2018) Certified and registered with Ministry of Micro, Small and Medium Enterprise (MSME), Government of India Organization functioning energetically towards the noble cause of nature conservation and environmental protection. 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". NSF family iswide spread across India with over 115 State wise Lead Auditors to conduct Green Audit (Table 1).

NSF is functioning strenuously to conduct different awareness programmes and implement various schemes to public and school / college students towards the noble cause of nature protection. Some of the programmes are also being organized for the benefit of tribal communities to create the supply chain for biodiversity conservation studies. The objectives along with vision and mission are illustrated to promote educational and environmental awareness programmes through social activities for enhancing the quality of life and to conserve nature from environmental pollutants using traditional and modern technologies for sustainable land management. NSF is educating the tribal community children through social service and towards the upliftment of tribes as a whole and make them as entrepreneurs.

International Eco Club Student Chapter (IECSC) has been established for student volunteers and faculty members are encouraged to conduct National and International events pertinent to biodiversity and natural resource conservation. NSF is being released "Magazine" and "Quarterly Newsletter" to share the information about Environmental awareness programmes on biodiversity conservation in Western Ghats

of Southern India. In order to encourage the students, faculty members, academicians, scientists, entrepreneurs and industrial experts those who are involving in nature protection and biodiversity conservation activities across the world, NSF tributes the deserved meritorious candidates with various awards/honours and these awards will be conferred to them during the Annual Meet and Award Distribution Ceremony which will be conducted every year.

Apart from the "Green Audit", NSF has introduced various types of audits such as Hygienic Audit Water & Soil Audit, Plastic Waste Management Audit, Biomedical Waste Audit, Solid Waste Management Audit, E-Waste Management Audit, Academic & Administrative Audits including ISO certification process to 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 Checklist prepared by the NSF in compliance with ISO 17020 Criteria and Government Law and Environmental Legislations including World / Indian Green Building Council and the concept of Swachh Bharath Abhiyan under Clean India Mission.

Table 1. Audit processes are being conducted through the certified Auditors as per the following list

Audit	Certified Course	Lead Auditors/ Technical Experts/ Observers
Green Audit	• GBCRS - Green Building Code and Green Ratings Systems • GRIHA - Green Rating for Integrated Habitat Assessment • ISO Green Audit (17020:2012) • ISO QMS (9001:2015) • IGBC – Indian Green Building Council	Dr. S. Rajalakshmi (ILA) Dr. R. Mary Josephine (ILA) Dr. K. Suresh Babu (ELA) Dr. B. Mythili Gnanamangai (ILA) Er. N. Shanmugapriyan (ELA) Ms. V. Sri Santhya (ILA) Dr. Amzad Basha Kolar (ETE) Mr. B.S.C. Naveen Kumar (ETE) Mr. K. Sampath Kumar (ELA) Dr. Sreekala K Nair (Observer)
Environment Audit	• ASSOCHAM - Associated Chambers of Commerce and Industry • FSRS – Fire Safety & Rescue Services • ISO EMS (14001:2015)	Ar. N.M. Pradeep Kumar (ELA) Er. S. Srinivash (ELA) Er. A. Karthik (ELA) Dr. Helen Roselene Thomes (ETE) Dr. S.J. Veeresh (ETE) Dr. D. Vinoth Kumar (ILA) Dr. P.V. Sreenivasan (Observer)
Energy Audit	• BEE - Bureau of Energy Efficiency • LEED - Leadership in Energy and Environmental Design	Er. D. Dinesh Kumar (ELA) Er. P. Shanmugapriyan (ELA) Dr. D. Vinoth Kumar (ILA) Dr. N. Balasubramaniam (ELA) Ms. V. Sri Santhya (ILA) Dr. P. Thirumoorthi (ETE)
	• CII-GreenCo – GreenCo Rating System Felicitator • ISO EnMS (50001:2018)	Dr. G. Murugananth (ETE) Ms. T. Joys Ememmal (ITE) Dr. R. Raj Kumar (Observer)

Waste Management Audit	• Water & Soil Audit, Plastic Waste Management Audit, Biomedical Waste Audit, Solid Waste Management Audit, E- Waste Management Audit	Mrs. Gaanappriya Mohan (ELA) Ms. B. Vijayalakshmi (ELA) Dr. D. Vinoth Kumar (ILA) Er. A. Karthik (ELA) Ms. V. Sri Santhya (ILA) Dr. K.S. Vinayaka (ETE)
Hygiene Audit	• ISO FSMS (22000:2018) • SBICM - Swatch Bharath under India Clean Mission • ISO OHSMS (45001:2018)	Mrs. Gaanappriya Mohan (ELA) Ms. M. Nithya (ILA) Ms. R.S. Thulaja (ILA) Dr. N. Saranya (ETE)

Note:
ILA: Internal Lead Auditor, **ELA:** External Lead Auditor
ITE: Internal Technical Expert, **ETE:** External Technical Expert

1.7. About the Organization

Soka Ikeda College of Arts and Science for Women is named after a renowned Japanese poet and Buddhist philosopher Dr. Daisaku Ikeda and Soka Education System, which stresses on moral building. Dr. Daisaku Ikeda is the Honorary Founder and Mrs. Kaneko Ikeda is the Honorary Principal of the college.

Soka Ikeda College of Arts and Science for Women has gloriously embarked on the twenty fourth year with many accolades and achievements since its inception in the year 2000. Having emerged as a pioneer institution, in its neighbourhood, the college offers humanistic education. "The Institution of Excellence' award given by the Indian Council of Gandhian Studies, New Delhi adds glory to the success saga of the institution.

The college is an ISO 9001:2015 Certified Institution and is affiliated to the University of Madras and recognized by the Government of Tamilnadu (G.O.281). The college offers 12 courses at the U.G. level, 4 courses at P.G Level in Shift-I and 5 U.G. Courses, 3 P.G. courses in Shift-II

Vision

Soka Ikeda College of Arts and Science for Women aims to deliver university education to benefit and uplift the students and society through systematic knowledge assimilation and delivery, at all levels.

Mission

Soka Ikeda College of Arts and Science for Women aims to produce knowledgeable and competent graduates, postgraduates and researchers with wholesome leadership qualities, by systematic teaching and training with regular and path breaking programmes and strategies.

Quality Policy

We at Soka Ikeda College of Arts and Science for Women are committed to nurture and deliver continually enhanced, global quality education with leadership qualities.

Geographical location: The Soka Ikeda College of Arts and Science for Women located at Madhanangkuppam, Chennai, Tamil Nadu, India. At present, the campus is

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quite clean, green and with much less pollution when compared to the rest of the city. Dicot and monocot plants can be found on the campus considerably. In contrast, the campus is harboured a wide variety of birds and animals.

The campus occupies a total area of 9.154 acres in which total build area is estimated about 72426.14 Sq ft. (Table 2). Among the total built area, one sixth area has been installed with AC's. With regard to vegetation availability within the campus, 40% accounts for forest/natural vegetation while remaining 60% represents manmade, artificial vegetation (Table 2).

Table 2. Soka Ikeda College of Arts and Science for Women facility details

S.No.	Details of Area	Total area
1.	Total Campus area	9.154 acres
2.	Total Built up area	72426.14 Sq ft
3.	Forest vegetation	40%
4.	Planted vegetation	60%

1.8. Audit Team Details

Date / Day of Audit	:	**28.03.2023**
Venue of Audit	:	**Soka Ikeda College of Arts and Science for Women,** Madhanangkuppam, Chennai - 600 099, Tamil Nadu, India.
Audited by	:	**Nature Science Foundation** Coimbatore, Tamil Nadu, India
Audit type	:	**Green, Environment and Energy Audits**
Name of the Auditing Chairman	:	**Dr. S. Rajalakshmi** ISO QMS, EMS, OHSMS and EnMS Auditor Founder & Chairman of NSF
Name of the Auditing Team Leader	:	**Dr. D. Vinoth Kumar** ISO QMS, EMS and EnMS Auditor Joint Director, NSF.
Name of the Lead Auditor	:	**Er. D. Dinesh Kumar** Certified BEE, IGBC, ASSOCHEM, GRIHA & LEED Auditor
Name of the Green Auditor	:	**Dr. B. Mythili Gnanamangai** Indian Green Building Council Auditor
Name of the Environment Auditor	:	**Er. S. Srinivash** Tamil Nadu Fire and Rescue Services
Name of the Energy Auditor	:	**Dr. N. Balasubramanian** Bureau of Energy Efficiency Auditor
Name of the Waste Management Auditor		**Er. A. Karthick** Bureau of Energy Efficiency Auditor
Name of Technical Expert	:	**Mr. B.S.C. Naveen Kumar** Senior Faculty, Mahatma Gandhi National Council of Rural Education, Hyderabad Ministry of Higher Education, New Delhi
Name of the Green Audit Observer	:	**Dr. Sreekala K Nair** Research & Development, NSF
Name of the Environment Audit Observer	:	**Dr. R. Raj Kumar** Advisor, NSF
Name of the Energy Audit Observer	:	**Dr. P.V. Sreenivasan** Director, NSF
Name of the Waste Management Audit Observer		**Dr. B. Anirudhan** Executive member, NSF

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1.9. Procedures followed in auditing

Green audit is a structured process of documenting the credentials in terms of number of trees, herbs, shrubs, lawns, climbers and lianas reflected in reducingthe environmental pollution and soil erosion and useful for biodiversity conservation, landscape management, natural topography and vegetation. Green audit projects the best environmentalpractices and initiatives taken in the organization at the prescribed site of audit that brings added value to the organization in maintaining the eco-friendly campus to the stakeholders. First step of the audit is ensuring that the organization has a central role in building the green campus in order to validate the same (Adeniji, 2018).

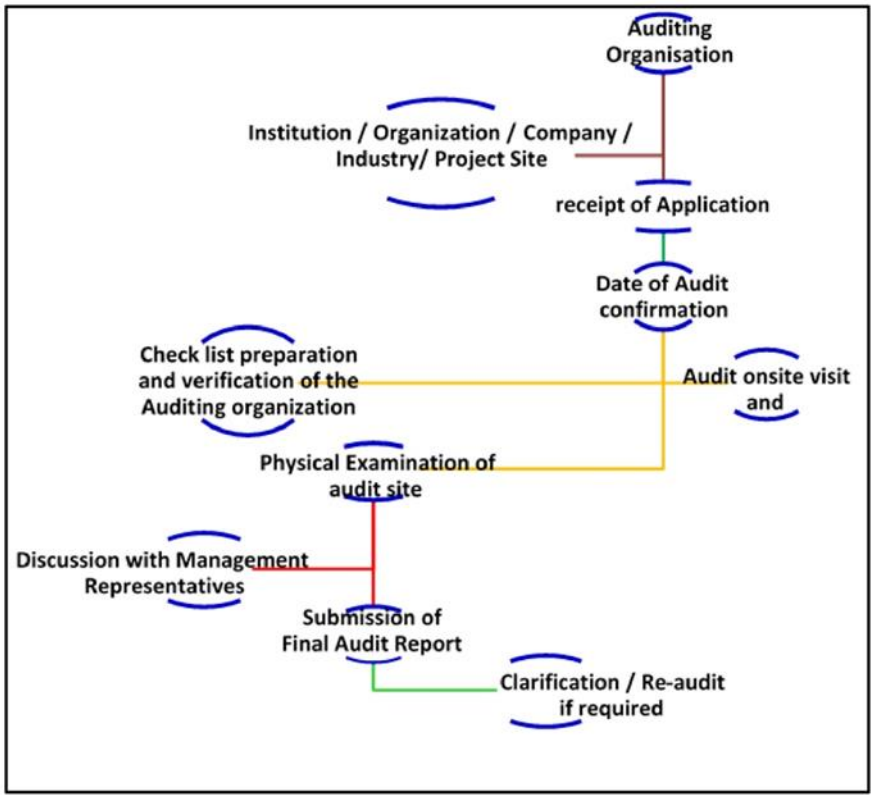
Green campus is not intended for the self-sustainability of the building alone, it also involves in propagation of the green campus initiatives so as to be adopted by any individuals and organization at a minimum cost. Green audit has been conducted as per the checklist based on National Building Code (NBC) Part 11 - Approach to Sustainability through the authenticated Professionals who have qualified to investigate and evaluate the campus for validating the best environmental practices.

During the audit, the nature of plants and animals / birds species thriving within the campus were recorded. Establishment of lawns, trees, herbs, shrubs and climbers and establishment of terrace / kitchen / herbal / zodiac / ornamental / medicinal gardens / aquarium and aquatic (hydrophytes) plants in the campus were documented. Labelling of common and botanical names of plants were observed. The operation of irrigation system, drip and sprinkler irrigation methods and utility of recycled water in the campus area were noted.

Attempts made for water scarcity during summer season towards the maintenance of plants and frequency of watering of plantations in the campus were recorded. Biodiversity conservation education, projects, awareness programmes, etc., through Indian Biodiversity Act and Ministry of Environment, Forests and Climate Change, Government of India and the conduct of outreach programmes for dissemination of Green campus motto among the students and staff members including public domain were gathered (Venkataraman, 2009) besides signing of MoU with Government and Non-Governmental Organizations to ensure green campus activities.

Projects, dissertations and thesis are the academic effort credentials that always fosters the innovative ideas on thinking and implementation of new approaches towards the green campus through presentations and publications in social media. These efforts taken by the students and staff were deliberated while conducting the green audit. Green audit processes are taking place as per the following flow-chart starting from the scrutinyof application forms from the auditee (organization) and ending upon the submission official report to the concerned organization (Leal Filho *et al.*, 2015). In addition, supporting activities of the scholars and staff with regard to "Vision and Mission" of the greenery activities of the Organization is also evaluated and reported.

Flow-chart of Audit Procedures



1.9.1. Pre-Audit stage activities

A pre-audit meeting (opening meeting) is conducted with Management and Administrative people along with staff coordinators with regard to green audit process, wherein audit protocol and audit plan were discussed in brief. The purpose of this meeting is to provide a chance to emphasize the scope and objectives of the audit and discussions held on the feasibilities associated with the audit (Marrone *et al*., 2018). Pre-audit stage activities are an essential prerequisite for the green audit to meet the auditee and to gather information about the campus and required documents were collected directly from the Organization before the start of the audit processes (Fachrudin *et al*. 2019).

1.9.2. Onsite audit activities

- Followed by opening meeting, onsite inspection will be conducted which is the second step in the audit where the audit team members visit different sites in the campus and required photographs were taken then and there for preparing the audit report.
- During the onsite visit, it is vivid how the various facilities made by the Management to the stakeholders without disturbing the landscape, natural topography and vegetation to ensure the green campus.

- It is also observe how the environment is protected in the campus and by what meansan eco-friendly atmosphere is being given to the stakeholders. Assessment reveals the strengths and weaknesses of the Auditees Management controls and risks associated with their failure in creating green campus facilities.
- Collecting audit proofs i.e. data collection and information from the auditee as per the audit protocol were carried out.
- An exit meeting was conducted to describe the findings of the audit. Representatives and staff members.

1.10. List of Instruments used in the Inspection Process

Nature Science Foundation conducts audits by using the listed instruments

- Oxygen Meter
- Carbon Dioxide Meter
- Light (LUX) Meter
- Sound Level Meter
- pH Meter
- TDS Meter
- GPS Meter
- Deluxe Water and Soil Analysis Kit

1.10.1. 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 % O2), 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 t 122 °F, temperature resolution is 0.1-degree, temperature accuracy is °C - ± 0.8 °C & °F –

1.10.2. 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 CO2 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-degree, temperature accuracy is °C – 0.8°C, °F – 1.5°F.

1.10.3. 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 (32 to 122 °F), 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.

1.10.4. 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.

1.10.5. 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)

1.10.6. 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.

1.10.7. GPS Meter

GPS meter is subjected to know the latitude and altitude, location, etc., Suitability of the GPS meter are, dimension is 2.1" x 4.0" x 1.3" (5.4 x 10.3 x 3.3 cm), Display resolution is 128 x 160 pixels an GPS Map features included in Continental Europe. It is calibrated six months once or after 20 times of the usage.

1.10.8. 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.

1.11. 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 and infection 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.,

1.11.1. 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.

1.11.2. 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.

1.11.3. 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.

1.11.4. 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.

1.11.5. 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.

1.11.6. 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, genets, generators, etc.,

1.12. Scope and Importance of National Building Code (Part -11 Approach to Sustainability)

The National Building Code of India (NBC), a comprehensive building code, is a national instrument providing guidelines for regulating the building construction activities across the country. It serves as a model code for the adoption of all agencies involved in building construction works. It includes Public Works Department, other Government construction departments, local bodies or private construction agencies. Scope 11 covers the parameter required to be considered for planning, design, construction, operation and maintenance of building and those relating to land development from sustainable point of view.

1.12.1. Campus Details

S.No.	Details / Descriptions	Quantity
1.	Total strength of Students	**1384**
2.	Total strength of Employees	**106**
3.	Total number of Buses in the campus	**07**
4.	Number of Cars entering in the campus	**05**
5.	Number of Motorcycles entering in the campus	**150**
6.	Number of other vehicles (Lorry, Ambulance, Jeep, Trucks, Cranes, Poclain, and etc. entering in the campus)	**01**
7.	Number of E-Vehicles	**02**
8.	Number of RO Water Plants	**01**
9.	Number of Borewells	**01**
10.	Number of Open wells	**Nil**
11.	Number of Percolation Ponds	**Nil**
12.	Number of Wastewater treatment facility	**Nil**
13.	Number of Solid waste management facility	**01**
14.	Number of Rain harvesting system	**01**
15.	Number of Water reservoirs in the campus	**04 Tanks**
16.	Number of Composting pits and Vermicompost units	**Nil**

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 theatmosphere. 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 (Maltby, 1995; Haahkim and Yunus, 2017). 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*., 2022).

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 (Ramachandra and Bachamanda, 2007). 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 (Conde and Sanchez, 2017). 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 (Aparajita, 1995; APHA, 2017). 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 (Gowri and Harikrishnan, 2014).

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 (Adeniji, 2018). 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 professional competence, d) sustenance activities without harming the environment and e) practicing the environmental conservation.

3.2. Environmental friendly campus

Literally, eco-friendly means earth-friendly/environment friendly or not hazardous to the environment. The term commonly refers to the products that contribute to green living or practices that help conserve the natural resources. Companies and educational institutions use the ambiguous terms to promote goods and services including working/ learning atmosphere conditions, at times with additional, more specific certifications (eco-labels). To ensure the successful meeting of sustainable development goals, companies and educational institutions are advised to implement environmental friendly processes in their production as well as providing good ambience to the stakeholders in their work place. The International Organization for Standardization has developed ISO 14001:2015, 14 020 and ISO 14024 to establish principles and procedures for environmental labels and declarations that certifies the environmentally friendly campus. Specifically, these standards communicate with avoidance of financial conflicts of interest, utility of sound scientific methods, accepted test procedures, honest and transparent setting ofstandards.

In order to provide efficient eco-friendly atmosphere to the stakeholders, the organization should take responsibility to provide good drinking water facility, use of the organic manure for manuring the plants, avoidance of non-compostable, single-use disposable plastics items/utensils and reduction in use of papers alternated with e-servicesand e-circulars, etc., besides proper disposal of wastes, recycling and suitable waste management system. These parameters should be considered while implementing the environmental friendly campus in an organization which in turn confine the environmental pollution.

3.3. Environmental policy

The environmental policy aims to afford an understanding on clean environment to the stakeholders in relation to environmental compliance. Scope of this policy applies to all employees and students of the Institution to establish and sustain an Eco-friendly atmosphere. Policy making dealt with cleanliness on the campus maintained through utilization of eco-friendly supplies, disseminating the concept of eco-friendly culture among the students and public through various awareness programmes. Head of the Organization, Departmental Heads and Senior Managers including Management Representatives are responsible for monitoring the eco-friendly initiatives of the Institution and maintain a clean campus. In addition, the staff and student volunteers from various functional clubs are committed to strictly follow the environmental policies of the Organization.

3.3.1. Environmental Management Plan (EMP)

A clean environment is required for progressive success of an organization to safeguard the upcoming generations to ensure in safe use of air, land and water resources. The management of any organization should attempt to continuously to improve the environmental performance and to prevent/minimize the pollution.

All the stakeholders of the organization are expected to support our environmental goals while providing clean and environmentally friendly work space. Main purpose of the EMP is to determine the environmental protection measures to be followed during in day-to-day's activities and confirm to minimize environmental ill-effects. It addresses the issues start from sanitation pertaining to human health and protection of plants, animals andmicroorganisms including wildlife habitats. EMP is an integrated document with various approvals, authorizations and specific components and/or activities that to be carried out in the campus without harming the environment (Table 14). EMP should provide a reference document as per the legislative requirements for employees when planning and/or performing specific activities in the campus surroundings.

Table 14. EMP and its execution in an organizational premises

S. No	Monitoring areas	Parameters monitored	Monitoring frequency	Reason for monitoring
1.	Dredging	Erosion, landscape, sedimentation, vegetation, disposal of dredging	Continuous	Dredging results in disturbance of Benthic community and causes soil erosion and sedimentation
2.	Marine Ecology	Biodiversity survey and conservation	Continuous	Unmitigated operations may result in loss of biodiversity as per the Indian Biodiversity Act
3.	Vegetation (Flora and Fauna)	Survey of macro and micro plants, animals (mammals, birds, moths, houseflies, reptiles, amphibians, termites) and soil and air microbial biodiversity	Continuous	Conservation of macro and micro plant, animals and soild and air microbial biodiversity conservation for future generations through modern technology
4.	Air Emission	O_2, CO, CO_2, SO_2, NO_2 level in the open, car parking and indoor areas	Monthly monitoring	Unmitigated operations may result in deterioration of air quality
5.	Solid Waste	Solid waste quality and quantity, waste disposal, reuse, solid waste treatment	Monthly monitoring	Compliance of Environmental Laws and Legislative policy
6.	Wastewater	Primary, secondary and tertiary pollutants and their recycling, wastewater minimization, storage	Monthly monitoring	Minimize the water pollution and to provide quality water as per the Central Pollution Control Board

		and handling, reuse, treatment before disposal		
7.	Soil	Soil contamination, soil edaphic parameters, soil, gravel and sand composition, water holding capacity, soil erosion	Half yearly	Soil surface and water pollution cause diseases as per the Compliance of Environmental Laws and Legislative policy
8.	Noise	Noise intensity, causes and impact, remedies, standard operating procedure	Monthly monitoring	Uncontrolled noise cause nuisance which affects the health
9.	Occupational Safety & Health	Safety, health and welfare of people at occupation, measures taken, Fire safety, First aid box, Safety protocol, Hospital facility	Continuous	Department of Occupational Safety & Health
10.	Land reclamation	Soil quality, soil micro and macro elements, soil composition	Half yearly	Legal obligation and structure protection, prevention of soil erosion and sedimentation to the port
11.	Restoration of the sites	Forest vegetation, plant vegetation, visual analysis, photographic records	Continuous	Maintain the soil fertility and soil original reclamation

3.3.2. Environmental health and safety management system

It is outlined the mitigate measures and the best management practices followed in the organization in terms of developing eco-friendly campus. It is suggested to perform complete assessment and control of entirely possible hazardous and risks arise in the organization (Rajalakshmi *et al*., 2021). The facility should be designed to include fire protection equipment/system including flame, multiple gas, smoke and low- and high temperature detectors/ alarms, automated and manual shut-down systems in terms of planning and implementing the best practices of environmental health and safetymanagement system.

High level of automation, periodical preventative maintenance and safeguards the environmental pollution besides the provision for safe emergency shut downs/exits should be maximized in the organization. Alarm signals may be used to begin evacuation of the facility in the organization if any unfavorable situation takes places like uncertain firing, etc. Internal facility alarms as well as communications systems, wherever applicable, to notify all facility personnel should be activated. Evacuation map and important phone numbers may be prominently displayed throughout the facility. Emergency equipment like fire extinguisher and first aid box should be placed in all the places to minimize the major environmental impact.

It should be developed and practiced a spill clean-up procedure where to find emergency equipment and how to use it properly should be trained to all the stakeholders. All the employees and management people should be trained properly about environmental health and safety measures which will be useful for protecting the environment.

3.4. Aims and objectives of environmental audit

Primary objective of an Environmental audit is to promote the environmental safety management and preservation of natural resources for future generations. Major objective of environmental audit confined to:

a. Protecting the environmental health and minimise the threats posed to human safety by the performance of the organization
b. To take steps to minimize the environmental pollution and degradation
c. To adopt measures to reduce water waste generation and waste water recycling
d. Evaluation and documentation of wastewater quality, its characteristics and their effects on living system
e. Maintenance of labour/occupational health & medicine followed by proper documentation of environmental compliance status
f. Annual environmental auditing will render educated to overcome existing issues and to conduct outreach programmes to the public.
g. To establish a baseline information about the eco-friendly environment in the campus and to create consciousness among the stakeholders about the requirementof clean environment and its conservation

3.5. Importance of environmental audit

Management of the Organization (Auditee) should be shown their inherent commitment towards making eco-friendly atmosphere through the environmental auditing and ready to encourage all types of environment related activities. Environmental audit may be beneficial to the campus in improving the greenery activities which in turn useful to save the planet for future generation. It is necessary to conduct environmental audit at least once in three years because students and staff members should aware of the advantages of environmental audit and help the institution to set a “bench- mark” (icon) to the community.

3.6. Role of environmental audit and environmental management system

A vital role of an environmental audit (EA) is to recognise the areas for development, but an audit does not itself, provide the methods to implement changes.

However, EA should set the agenda of an environmental management system while EMS provide a framework to 1) identify the environmental effectsand document regulatory documents requirements, 2) set the objectives/targets for ensuing environmental performance/programmes, 3) implement protocols and procedures for achieving the objectives/ targets and 4) undertake audits to measure environmental performance and its efficacy measures to attain the well-defined objectives/targets. All the events pertaining to environmental effects, regulations, objectives and targets and the procedures are usually documented. As far as stakeholders are concerned EMS usually rely heavily on documentation and verification.

3.7. Target areas of environment audit

Target areas of environment audit are a) auditing for water management, particularly, wastewater management, b) physico-chemical properties of water resources, c) water conservation measures, d) per capita water consumption, e) soil health and its sustenance, f) safety measures and conservation of green building code and g) auditing the stakeholders for their contribution and environmental education besides implementing Swachh Bharath Abhiyan Scheme.

a. Water conservation

In this component, the following aspects are considered: a) to document the water resource of the campus, b) monitoring the overhead tanks for periodical cleaning, c) reuse of treated water/recycling, d) corrective measures against leakages, e) irrigation facilities, f) water use efficiency and per capita utilization.

b. Rainwater harvesting

Under this title, the following criteria are monitored and documented: a) implementation of rainwater harvesting system, b) functioning status of rainwater harvesting system and c) connectivity between rainwater harvesting and open wells and bore wells/percolation ponds.

c. Soil health management

It is paramount importance to keep the soil health for nurturing the vegetation and enhance the soil borne microorganisms. In this context, physico-chemical parameters of the soils will be analyzed or secondary data obtained from the Management will be utilized for Technical Report preparation.

d. Sanitation and hygiene

Sanitation and hygiene is an important component of the environment audit where a) the water taps and sanitation plumbing, adequacy and efficiency, b) adequate clean drinking water facilities, c) kitchen staff apparel and hygiene, d) canteen and hostel hygiene maintenance, e) cutlery, crockery and utensils hygiene and f) dining hall hygiene were monitored and documented besides implementing Swachh Bharath Abhiyan Scheme.

3.8. Procedures followed in environment audit

Environment audit involves monitoring an organization concerning about the green campus, environment, sanitation and hygiene policies. It is a regular process that is conducted periodically by a regulated entity to check whether an organization meets the requirements of environmental compliance. The process of environment audit includes examining, collecting, evaluating, documenting the data and analysing various components related to environmental aspects and carried out as per the procedures mentioned of the Manual of Gnanamangai *et al*., (2021).

It is a customary stepwise process where it starts with opening meeting among the audit team and auditees and completed with closing meeting (Table 15) However, any specific parameter comes under this section will be highlighted hereunder.

- During onsite audit it has been monitored and documented the components as per the environment audit checklist.
- Monitoring the pH of the water sources (Tap-, Bore well-, RO- and Recycled-water, if any and turbidity/EC of above said samples with portable pH and TDS meters, respectively,as per the standard operating procedures.
- Identify the issues in the campus with respect to environment compliance and merits/demerits of the auditees Management controls. Collect information about Ecology and Environment studies, awareness programmes conducted and publications with respect to Environment.

Table 15 Qualitative measurements

S. No.	Part 11 clause as per the National Building Code	Audit Checklist / Parameters	Audit Findings (C / NC/ PC)
1.	3.7. Integrated water management system	Efforts taken for water conservation (Recycling, automatic water tap sensors, sign boards, prevention of leakage)	C
2.	7.1.2.2. Heat Island effect and parking design	Observation of open parking areas to reduce heat island effect (environmental parameters) (eg: parking vehicles under trees shade)	C
3.	7.2.1. Rainwater harvesting	Check on the availability and maintenance of the rainwater harvesting system	C
4.	7.3.2. Water conservation and irrigation practices	Availability of drip/sprinkler irrigation facilities	C
5.		Whether recycled water is used for irrigation purpose?	C
6.	9.1.2. Minimizing Green House Gas (GHG) Emission	Calculate carbon foot print using number of vehicles	C

7.	10.2.1. Planning and design of water supply system	Calculate the average daily demand of water based on the number of stakeholders	C
8.	10.2.1.1. Availability of water & water sourcing	Availability of water facilities in the campus [Data on Physico-chemical properties of drinking / RO / Borewell / Open well / Municipal or Corporation waters such as pH, TDS, turbidity, salinity, etc.,]	C
9.	10.2.4. Strategies for water efficiency	Observation on low flow fixtures for faucets, water closets and bath showers.	C
10.	10.3.1. Treated wastewater use for landscape and irrigation	Observation on the use of grey water (water used prior to recycling) for watering plants	C
11.	10.5. Process water requirements and effluent treatment	Availability of Sewage Treatment plant	C
12.	10.6.3. Solid waste system planning	Maintaining different coloured dust bins to segregate the organic and inorganic wastes.	C
13.	10.6.1-10.7 Planning and design of solid waste management system	Collection, segregation and disposal of solid, chemical, hazardous waste, bio-medical and e-wastes.	C
14.		Collection, segregation and disposal of construction & demolition waste	C
15.		Availability of Biogas facility	C
16.	Safety measures	Availability of fire extinguisher	C

3.9. Safety measures and green building conservation code

Environmental safety measures are very important in Institutional buildings as far as students, staff members and other stakeholders are concerned and it requires vigilance and awareness Organisation work to foster safe environments; however, students honestly share equal responsibility. Management should extend by issuing guidance and the best safety tools. The organization has have a police force, escort services, call boxes, first aid box, fire extinguishers, fire alarms, security systems and staffs towards the safety measures. Organisation 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.

Safety measures, CCTV Surveillance and Clinic Facilities in Soka Ikeda College of Arts and Science for Women, Chennai, Tamil Nadu

3.9.1. Ventilation, exhaust systems and lightening in buildings

Ventilation is necessary in the buildings and continuous air flow removes 'stale' air and replace it with 'fresh' air which facilitates to moderate internal temperatures, reduce the accumulation of moisture, odours and other gases. In addition, ventilation create air movement which improves the comfort of occupants. Mechanical ("forced") ventilation tends to be driven by exhaust fans to replace stable air with fresh air along with moderating the optimum temperature to the occupants. Natural ventilation is driven by pressure differences from one part of the building to another. Internal partitions may prevent the air paths, hence the creation of draughts adjacent to openings for adequate flow of air.

Ventilation facilities in Soka Ikeda College of Arts and Science for Women, Chennai, Tamil Nadu

If air quality is poor, natural ventilation by means of opening windows may be adopted to use in the building. It may also be useful to reduce the noise level to a greater extent. It has been recorded that the audited Organization has a large number of ventilators for effective air circulation.

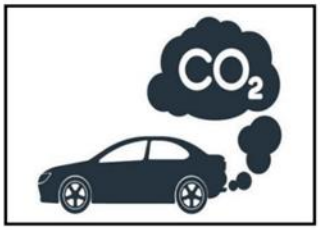
3.10. Public transport, low emitting vehicles and control of car smokes

Utility of public transportation (buses) reduces carbon emissions greatly and decreases the development of smog within the towns. This means that human beings have healthy air to respire. Comparing a bus travelling with a car transport for a person, it has been observed that buses are the most effective system by producing lower quantum of emission of carbon when compared to that of car transport. This will be a huge decrease in utility of natural resources per person. Public transportation is better for the surroundings which have been proven through research on emissions. Other than this, it also gives more benefits like less noise and traffic congestion. Whenever possible, try to take public transport in place of one's own vehicle.

E-Vehicles in Soka Ikeda College of Arts and Science for Women, Chennai, Tamil Nadu

The audited Organisation is provided two E- Vehicles to maintain eco-friendly environment in the campus and to reduce carbon dioxide emissions. Apart from the e-vehicles, students are encouraged to use bicycles.

3.10.1. Auditing carbon footprint



Carbon footprint means measuring/recording the greenhouse gases (GHG) emissions of an organization within its defined boundary. Burning fossil fuel emits carbon which accumulate in the atmosphere if there is not sufficient bio capacity dedicated to absorb the same. Commutation of stakeholders has an impact on the environment through the emission of greenhouse gases consequent to burning of fossil fuels. The most common greenhouse gases are carbon dioxide, methane, nitrous oxide and ozone; among them, carbon dioxide is the prominent one. An important aspect of doing an audit is to access

the impact within defined boundary which can helpful to derive better ways to minimise its impact. It is necessary to assess the carbon foot prints of an organisation to understand how far they contributing towards sustainable development. It is therefore essential that any environmentally responsible organizations should examine their carbon emission and subjected to calculate carbon footprint (Woo and Choi, 2013).

Observations on carbon dioxide and oxygen levels monitored in different parts of the campus are presented under Green 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.

3.11. Role of higher educational institutions with respect to water conservation

Periodical monitoring of existing water management system in the campus with participation and transparency. Development of a detailed guideline for conserving water within the campus is compulsorily adopted. Generate case studies on best water conservation practices adopted in the campus which will serve as models for other institutions and villages to adopt.

The team that would be involved in all aspects of water management (exploring, surveying, fact-finding, recording, planning, taking action and monitoring) will also include all relevant stakeholders' viz., citizens, student teams, their teachers, village leaders apart from administrative officials concerned in both campus and villages. A couple of environmentally concerned inclined faculty members or village community leaders may be given the responsibility to lead the water conservation movement in the respective realms. Water Conservation Initiative can be a successful only if the Head of the Institution ignites the spirit of everybody in the organization. She/he needs to direct the departments, pay attention to the findings of student teams and ensure that their valuable suggestions are followed in letter and spirit by all students, faculty members as well as administrative, non-teaching and support staff. A motivated leader can bring a sea-change in the system and therefore she/he is the cornerstone of this campaign. An advisory committee may be constituted to guide the initiative on water conservation.

3.11.1. Auditing for water management in the campus

Water is a natural resource which is an essential element for all living organisms. It has been reported that on earth only 3% is of fresh water and two-thirds of the same is locked up as ice caps and glaciers. Out of remaining one per cent, a fifth is available at remote areas and much seasonal rainfall and floods cannot easily be used. At present only about 0.08 per cent of all the world's fresh water is exploited by mankind (in terms of sanitation, drinking, manufacturing, leisure and agriculture). Water management is important since it helps to determine future irrigation expectations. Water is an abundant natural resource and becoming a more valuable commodity due to droughts and over exploitation. While freely available in many natural environments, in human settlements potable (drinkable) water is less readily available. At this juncture, it is time to use water wisely to ensure that drinkable water is available to all, at present and in the future.

3.11.2. Water management activities

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 (Rajalakshmi *et al* 2023).

The Organization is taking enough attempt to manage wastewater that are coming out from various Department laboratories, hostels and canteens. In general, water management activities are very important in terms of conserving water and its resources for future generations which in turn useful to reduce the land contamination.

R. O. Drinking plant and Units in Soka Ikeda College of Arts and Science for Women, Chennai, Tamil Nadu

3.11.3. Physical appearance and overall ambience on water conservation

Water conservation strategies broadly rely on a) adequacy of water, b) elaborate plumbing facilities with adequate, suitable water taps and sanitary fixtures, c) establishing water use efficient toilets with two levels of flushing facilities, d) well organised water usage, e) dedicated staff for water management including inspection, f) periodic service/repairs/corrective measure of leaks in taps and pipes, g) improved sanitization for cleanliness, h) use of carbonated water, i) planting and maintenance of indigenous variety of plants and less water consuming plants and j) organising water conservation workshops to the faculty and students and conducting awareness programme for the benefit of public.

Renovation of traditional and other water bodies/tanks

Renovation of tanks and water bodies include a) groundwater recharge and maintenance of water balance, b) reuse and recharge structures and preservation of existing water bodies, c) watershed development and biomass management and finally d) adopting land and water management protocols.

Leakages

Leakage accounts a largest share of wastage of available water resource as well as unauthorized water use. Each source meter required to be tested for its accuracy, either by reviewing available meter test results or retesting the meter. System valves mandatorily reviewed periodically to detect malfunction.

For instance, altitude control valves on storage tanks might be damaged or installed improperly, allowing the tank to overflow. These valves need periodic inspection, more so when there is observed leakage or overflow. Pressure relief valves set too low might cause spill when pressures reach the high range. These pressure relief valves need to be calibrated accordingly. When leakage problems are discovered during routine inspections, possible water lossesneed to be estimated and corrective action can be taken up immediately.

Other interventions

Other interferences are given attention on priority basis that include i) technological and sociological interventions, ii) planning, preparing and reporting mechanisms, iii) appropriate display, publicity and sharing of knowledge, iv) treating personnel/concerned staff with respect and considering their welfare, v) adhering to reporting mechanisms and vi) more importantly, monitoring and taking corrective measures with respect to water management by the enthusiastic designated staff.It has been observed that the audited organization adopted all the above said practiced in advance and meticulously. Rainwater harvesting system has been well planned and implemented in the campus. Rainwater harvesting pits are well connected with roof-top through proper pipe lines. At the time of audit nowhere leakage in the water supply system was observed. For drinking water facility RO purifying system was installed by the management.

3.11.4. 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.

3.11.5. Physico-chemical parameters of water quality

- 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.

Standards for physico-chemical properties of water

According to the Bureau of Indian Standards (BIS), the upper limit of TDS levels in water is 500 ppm. Long term exposure to high levels of salinity and turbidity could lead to bone issues in adults and also the fertilisation of nearby farm fields or sanitation facilities located too close to the well. In most cases, these compounds aren't a serious health risk. They are harmful to infants, however, causing blue baby syndrome, which can be lethal effects.

The water samples collected from various sources, i.e., RO water, tap water, bore well water, wastewater and treated water samples were subjected to analyzed for its physicochemical parameters. The results showed that all the parameters were found to be appreciable and no harmful effect was recorded (Table 16).These parameters were observed to be within the limit of Indian Standards of drinking water quality. Hence the direct consumption of these waters is recommended for drinking, irrigation and domestic usage purposes. If any water samples exceed the limitof ISI standards, it could be reduced significantly by adopting reverse osmosis technology. The observed pH values were found to be 6.5 - 8.5 ranges. 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 16. 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	7.3±0.1	73±1.0	305.0±4.6	4.5±0.2	6.4±0.2
2.	Tap water	7.8±0.1	123.7±2.0	309.3±2.5	4.6±0.2	6.7±0.3
3.	Bore well water	7.7±0.1	235.3±4.0	313.7±2.5	4.4±0.2	7.2±0.3
4.	Artificial pond water	8.2±0.1	267.0±4.6	318.0±3.0	5.0±0.2	7.6±0.2
5.	Waste water	8.4±0.1	277.7±3.5	326.3±2.5	5.1±0.2	8.5±0.2
6.	Treated water	8.0±0.1	354.7±2.1	334.3±2.5	4.7±0.1	8.5±0.2
Mean		7.96	248.6	321.4	4.82	7.65
SEC ±		0.07	2.32	2.51	0.15	0.13
CD at P = 0.05:		0.12	4.13	4.47	0.27	0.23

Standards for comparison

Acceptable Range of pH of different waters

Types of water	pH level
Tap water	Varies; typically, about 7.5
Distilled/Reverse osmosis water	5.0 to 7.0
Common bottled water	6.5 to 7.5
Bottled waters labeled as alkaline	8.0 to 9.0
Ocean water	About 8.0
Acid rain	5.0 to 5.5

Source: https://www.healthline.com/health/ph-of-drinking-water#acceptable-ph-levels

Acceptable Range of Total Dissolved Solids (TDS)

TDS Level (mg/L)	Remarks
Less than 50	Unacceptable as it lacks essential minerals
50-150	Acceptable for drinking.
150-350	Good. The water is ideal for people with cardiovascular disease
350-500	Fairly acceptable
500-900	Less acceptable
900-1200	Least acceptable. Avoid drinking water that has a TDS of 900
1200-2000	Water is not acceptable for drinking.
Above 2000	Unacceptable
Less than 50	Unacceptable as it lacks essential minerals

Source: https://www.kent.co.in/blog/what-are-total-dissolved-solids-tds-how-to-reduce-them/

Acceptable Range of Salinity level in water

Salinity of water (mg/L)	Quality
0-600	Good
600-900	Fair
900-1200	Poor
>1200	Unacceptable (unpalatable)

Source: https://www.researchgate.net/figure/The-range-of-salinity-according-to-Australian-Drinking-Water-Guidelines_tbl2_334786145

Acceptable Range of Turbidity in water

Water source	Turbidity level (NTU)
Water bodies with sparse plant and animal life	0
Drinking water	<0.5
Typical ground water	< 1.0
Water bodies with moderate plant and animal life	1.0- 8.0
Water bodies with large plumes of planktonic life	10.0 - 30.0
Muddy water or winter storm flows in rivers	20.0 - 50.0

Source: https://www.slideserve.com/oakes/turbidity

Acceptable Range of Dissolved Oxygen in water

Water Source	Dissolved Oxygen level (mg/L)
Not Acceptable	2-4
Moderately Acceptable	4-6
Acceptable	6-8

Source: https://www.researchgate.net/figure/Figure-2-1-Dissolved-oxygen-level-and-the-response-of-aquatic-life-forms-adapted-from_fig1_268030344

Figure 6 Physico-chemical properties of water samples

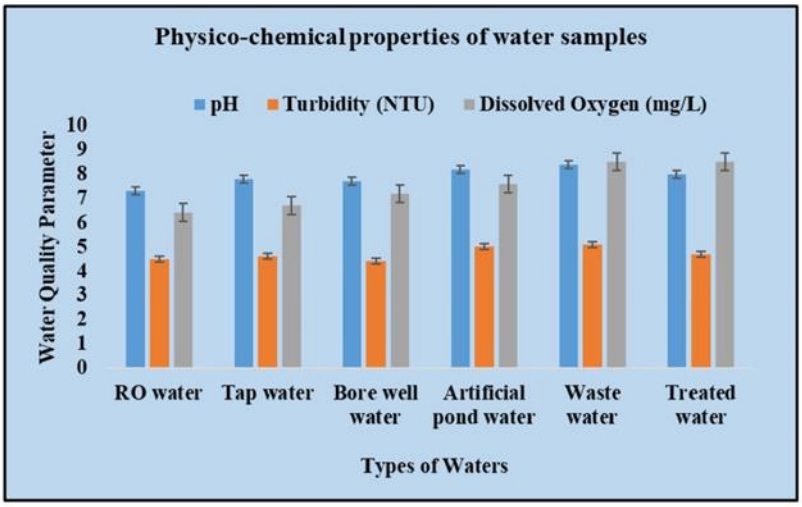
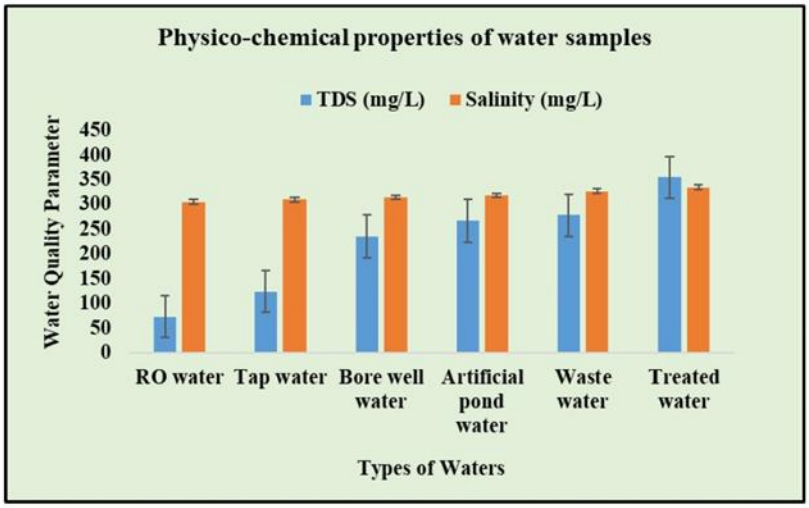


Figure 7 Physico-chemical properties of water samples



3.11.6. 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 required by various set-ups, which a city may have, is listed here under (Table 17).

Table 17. 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	90 - 130	120
2.	Industrial and commercial demand at laboratories	140 - 250	195
3.	Public uses including fire demand, transport washes	2500 - 3200	2800
4.	Losses and waste as routine consumption	30 - 50	38
5.	Daily use (day-to-day use)	50	25

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 educationalinstitution, water requirement for various activities may differ. 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.

3.11.7. Estimation of water requirements for drinking and domestic use (Source: National Building Code 2016 BIS)

As a general rule, the following rates per capita per day may be considered for domestic and non-domestic needs. For communities with population 20,000 to 1,00,000 together with flushing the per capita per day rates may be considered for domestic and non-domestic ranges ~40 to 230 lphd, respectively (Table 18)

Table 18. Water requirements calculation

S. No	Educational Institutions water requirements	Domestic use (lphd)	Flushing (lphd)	Total use (lphd)
1.	Without boarding facility	20	50	70
2.	With boarding facility	150	30	180

3.11.8. Firefighting demand

The per capita fire protection demand is very less on an average basis but the quantum of water is required is very huge. The rate of fire demand is sometimes treated as a function of population and is worked out from following empirical formulae (Table 19).

Table 19. Per capita fire demand calculation

S. No	Authority	Formulae (P in thousand)	Q for 1 lakh Population)
1.	American Insurance Association	Q (L/min) =4637 □P (1-0.01 □P))	41760
2.	Kuchling's Formula: per capita fire demand	Q (L/min) =3182 □P	31800
3.	Freeman's Formula: per capita fire demand	Q (L/min) = 1136.5(P/5+10)	35050
4.	Ministry of Urban Development Manual Formula	Q (kilo litres/d) =100 □P for P>50000	31623

3.11.9. Factors affecting per capita demand of water consumption

As stated earlier, so many factors affecting the precise calculation of per capita demand of water consumption which include, a) size of the city: per capita demand for big cities is generally huge when compared to that of smaller towns where big cities have skewered houses. b) Existence of number of industries. c) Prevailing environmental conditions. d) Habits of people and their economic status. e) Quality of water plays an important role in water consumption rate. If water is aesthetically and medically safe, the consumption will increase as people will not resort to private wells, etc. f) Pressure in the distribution system. g) Efficiency of water works administration: Leaks in water mains and services and unauthorized use of water can be kept to a minimum by surveys. h) Cost of water and i) Policy of metering and charging method: Water tax is charged in two different ways: on the basis of meter reading and on the basis of certain fixed monthly rate. The above ethics are applicable to a campus of educational institution as well.

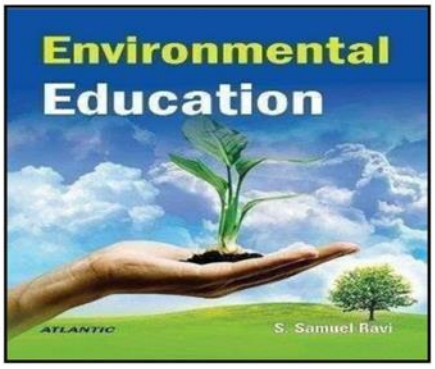
3.11.10. Fluctuations in rate of demand/consumption of water

- Average Daily per Capita Demand = Quantity required in 12 Months/(365 x Population); If this average demand is supplied at all the times, it will not be sufficient to meet the fluctuations.
- Seasonal variation: The demand peaks during summer. Firebreak outs are generally more in summer which increases the demand.
- Daily variation in water demand depends on human activities. People draw out more water on sundays and festival days, thus increasing demand on these days.
- Hourly variations in water demand is widely varied. During active household working hours i.e., from six to ten in the morning and four to eight in the evening, the bulk of the daily requirement is taken. During other hours the requirement is negligible.
- Adequate quantity of water must be available to meet the peak demand. To resolve all the fluctuation issues, the supply pipes, service reservoirs and distribution pipes must be properly proportioned. The water is supplied by pumping directly and the pumps and distribution system must be designed to meet the peak demand. Effect of monthly variation impacts the design of storage reservoirs and hourly variations influences the design of pumps and service reservoirs. It may be noted that as the population decreases, the fluctuation rate increases.

3.11.11. Climatic condition

The temperatures in Chennai during September are extremely high, between 27°C and hot as 33°C, drinking water regularly is advisable.

3.12. Environmental education



An environmental study is the learning principle of the ecosystem and how it will expand sustainable techniques to defend the surroundings. It enables people to develop an understanding of the environment in which we live and helps to overcome tough environmental troubles affecting nature. In addition, the physical aspects of the environment should be studied, it also emphasizes the need to conserve biodiversity and undertake an extra sustainable way of life and make use of sources in a responsible manner. To create attention amongst today's generation on pressing environmental troubles, the University Grants Commission (UGC) in India has made it mandatory for the Universities and Autonomous Colleges to introduce a course in 'Environmental studies' and teach to the students about the ecosystem, pollution and problems associated with the environment. Environmental education refers to structuredefforts to deliver how natural environments function, how human beings can manage toprotect the ecosystems in sustained manner (Breiting and Mogensen, 1999).

3.13. Waste management practices

Waste Management has a common mandate that the "Producer Owns the Responsibility". The community that generates waste should develop more responsibility in handling the waste with more care thus reducing negative impact on the environment. In a study conducted in 2013 by 'M/S Hand in Hand India Ltd.' In the Campus it had quantified a daily average of wastes in which food waste is about 37%, recyclable waste is about 27% and other organic waste is about 36%. The study revealed that the solid wastes need to be professionally handled. 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) sewage treatment plant and 3) disposal of e- waste.

3.14. Recycling of wastewaters

Wastewater recyclers are important features in any Organization. Once for all the implementations should follow the proper guidelines for wastewater treatment system discharge standards as per Central Pollution Control Board (CPCB). The main feature of these discharge standards is the treated water should not be harmful to the biodiversity, resources and the environment. 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. A typical wastewater treatment system should be based on the waste

characterization and the treatment of wastes which can be modified so as to fit into the motto of treating the wastewater which in turn to release of safe water. Rain water harvesting is implemented in our campus to collect and to recycle water to promote self-sufficiency and sustainability which is used or toilets. Wastewater treatment plant is installed in the campus and functioning well at the time of onsite audit. Treated water has been recycled for gardening / vehicle wash purposes within the campus.

3.15. Napkin disposal facility

Menstrual hygiene management (MHM) is an indispensable part of the Swachh Bharath Mission Guidelines (SBM-G) for adolescent girls and ladies. As in step with MHM hints, 'Safe disposal' method making sure that the process of destruction of used and dirty materials is performed without human touch and with minimum environmental pollutants and 'unsafe disposal' method throwing used material into ponds, rivers or inside the fields exposes others inside the vicinity to decaying material and must be averted. Some of the unsafe practices of napkins include throwing them unwrapped into fields and rooftops, wrapping them in paper/ plastic bags and throwing them outdoors or in dustbins, burying them for de- composting, throwing them in latrine / toilets or burning it. These unsafe practices are to be avoided and rather health practices can be adopted. The campus Management is implementing the safe practices of disposing of napkins using small scale incinerators in ladies' hostels. Incinerator's facility and disposal structures in the proper directions and other social stigmas connected to menstruation influences the sanitary waste disposal conduct of women within the campus is very much appreciated. The Organization is taking care of adolescent girls and women significantly in their personal hygiene. The management has installed napkin incinerators, wherever it is required

3.16. Compliances

1. In addition to natural ventilation and exhaust fans are made available in all buildings to replace 'stale' air with 'fresh' air which helps to create favourable microclimate during the occupied periods.
2. It is observed that the Organization is created massive facilities for wastewater treatment to purify the wastewaters using activated- sludge to manage the wastewaters effectively without harming the environment.
3. Dust bins and eco-friendly trashes are kept in different place across the campus to provide a dust free atmosphere to the stakeholders which are labelled properly
4. There is a Reverse Osmosis (RO) water unit to produce RO water which is periodically tested for the physico-chemical properties.
5. 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.
6. Swachh Bharath Abhiyan and National service schemes are implemented effectively towards sanitation and refining drinking water quality to promote cleanliness to rural and tribal people across the Chennai district.
7. Organization provide E- vehicles for campus students to maintain eco-friendly atmosphere in the campus and to reduce carbon dioxide foot prints.

8. "Club' along with NSS Units are functioning well and conducting a large number of awareness programmes related to nature conservation and environmental protection.

3.17. For further improvements

1. A proper step may be taken to minimize the environmental degradation by means of developing 'Sanitation and hygiene policy', 'Water conservation policy', in collaboration with Governmental and Non-Governmental Organizations.
2. The concept of eco-friendly culture and sensitize students to minimize the use of plastics, non-biodegradable materials and exploitation of natural resources which pose the environmental hazards may be carried out.
3. Policy on paper usage may be initiated with certain guidelines to reduce the numberof papers that are being used by the students for assignments, mini-projects and final year projects which in turn reduce 60% usage of paper as a commitment to curb the environmental damage.
4. Students may be taken to some industrial areas including the waste management sites to teach about the recycling of wastewaters, natural ecosystem, pollution-free environment and environmental education.

3.18. Conclusion

The Organisation is one among the well- established colleges adopting substantially the environmental protection initiatives. Campus has wastewater treatment facility to recycle the wastewaters. Swachh Bharath Abhiyan is implemented effectively by the campus to promote sanitation and cleanliness. Environmental audit is carried out to provide an indication to the management about how the environmental system and equipment are performing. As a result, the best practicable means can be applied to preserve air, water, soil, plant and animal life from the adverse effect.

7. References

Adeniji, A.A. 2018. *Audit and Assurance Services. Lagos: Value Analyst Concept of Green Audit*. New Age International, New Delhi, India.

Anirudhan, B., Saranya, N. and Sreekala K. Nair, 2023. *Environmental Science Research*. Integrated Publishers, New Delhi. 180 p. [ISBN 978-93-95118-34-7]

Aparajita, G. 1995. Environmental Audits- a Mean to Going Green. *Development Alternatives* **5** (4): 7-9.

APHA, 2017. *Standard Methods for the Estimation of Wastewaters*. Vol. II, 15th Edn, Washington, US.

Arora, D.P. 2017. Environmental Audit–need of the hour. *International Journal of Advanced Research in Engineering & Management* **3** (4): 25-31.

Aruninta, A., Kurazumi, Y., Fukagawa, K. and Ishii, J. 2017. The integration of human thermal comfort in an outdoor campus landscape in a tropical climate. *International Journal of GEOMATE* **14** (44): 26-32.

Asnani, J. and Bhawana, S. 2015. Study of awareness and habits among home makers during purchasing electrical household equipment. *International Journal of Applied Home Science***2** (7&8): 201-206.

Beebee, T.J.C. and Griffiths, R.A. 2000. Amphibians and Reptiles. A Natural History of the British Herpetofauna. The New Naturalist Library, London, UK.

Breiting, S. and Mogensen, F. 1999. Action competence and environmental education. *Cambridge Journal of Education* **29** (3): 349-353.

Cabrera, E., Pardo, M.A., Cobacho, R. and Cabrera, Jr, E. 2010. Energy audit of water networks. *Journal of Water Resources Planning and Management*. **136** (6): 669-677.

Carbon footprint calculation. www.carbonfootprint.com.

Conde, M.C. and Sanchez, J.S. 2017. The school curriculum and environmental education: A school environmental audit experience. *International Journal of Environmental & Science Education* **5** (4): 477-494.

Fachrudin, H.T., Fachrudin, K.A. and Utami, W. 2019. Education activities to realize green campus. *Asian Social Science* **15** (8): 18-27.

Ferenc, M., Sedlacek, O., Fuchs, R., Dinetti, M., Fraissinet, M. and D. Storch 2014. Are cities different?. Patterns of species richness and beta diversity of urban bird communities and regional species assemblages in Europe. *Global Ecology and Biogeography* **23**: 479-489.

Gamble, J.S. and Fischer, C..E.C 1972. *The Flora of the Presidency of Madras*. Vols. 1 - 3. Rep. Ed. 1957. Adlard and Sons Ltd., London, UK.

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. [ISBN 978-81-952088-4-5].

Gnanamangai, B.M., Rajalakshmi, S., Sri Santhya, V., Dinesh Kumar, D. and Lingeshwaran, P.K. 2022a. Implementation of environmental audit procedures for sustenance ecofriendly campus. *International Journal of Research in Engineering and Management* **6** (9): 1-9.

Gnanamangai, B.M., Rajalakshmi, S., Srivastava, A.K., Sudhakaran, R., Murugananth, G. and Thirumoorthi, P. 2022b. Energy audit procedures and energy savings opportunities in educational institutions and industrial sectors. *International Journal of Advanced Research*. **10** (5): 592-601.

Gowri, S. and Harikrishnan, V. 2014. Green computing: Analyzing power consumption using local cooling. *International Journal of Engineering Trends and Technology* **15** (3): 105-107.

Haahkim, W. and Yunus, A. 2017. Environmental audit as an Instrument for environmental protection and management. *The Business and Management Review* **9** (2): 228-232.

IGBC, 2021. Indian Green Building Council. https://igbc.in/igbc/

Ingle, A., Moezzi, M., Lutzenhiser, L. and Diamond, R. 2014. Better home energy audit modelling: incorporating inhabitant behaviours. *Building Research & Information* **42** (4): 409-421.

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

Jayson, E.A. and D.N. Mathew, 2000. Diversity and species-abundance distribution of birds in the tropical forests of Silent Valley, Coimbatore. *Journal of the Bombay Natural History Society* **97** (3): 390–399.

Leal Filho, W., Muthu, N., Edwin, G. and Sima, M. 2015. Implementing campus greening initiatives: approaches, methods and perspectives. Springer, London, UK.

Maltby, J. 1995. Environmental audit: theory and practices, *Managerial Auditing Journal*, **10** (8): 15-26.

Matthew, K.M. 1983. The flora of Tamil Nadu Carnatic. The Repinat Herbarium, Tiruchirapalli, Tamil Nadu, India.

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

Padmini, E. 2007. *Biocharacterization Calculations and Biostatistics*. Books and Allied (P) Ltd, Kolkata, India.

PIB GoI, 2016. Press Information Bureau, Government of India. 'Solid Waste Management Rules to Urban and Industrial Areas', Central Monitoring Committee Under Environment Secretary to Monitor Implementation. https://pib.gov.in/newsite/ printrelease. aspx?relid=138591.

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.

Rajalakshmi, S., Kavitha, G. and Vinoth Kuamr, D. 2021. *Energy and Environment Management Audit*. AkiNik Publishing, New Delhi, India. 232 p.

Rajalakshmi, S., Mythili Gnanamangai, B., Vinoth Kumar, D., Sri Santhya, V. and Deepa, M.A. Green campus Audit procedures and implementation to educational institutions and industries. *Nature Environment and Pollution Technology* **21** (4): 01-12.

Rajalakshmi, S., Sreekala K Nair, Sree Rohita Swati, S., Saranya, N and Anirudhan, B 2023. Implications of Soil and Water Audit at Nehru Arts and Science College, Coimbatore, Tamil Nadu, India for sustainable development. *Journal of Environmental Science and Food Technology* **17** (1): 69-75.

Ramachandra, T.V. and Bachamanda, S. 2007. Environmental audit of Municipal solid waste management. *International Journal Environmental Technology and Management* **7** (3/4): 369–391.F

Singh, M., Singh, G. and Singh, H. 2012. Energy Audit: A case study to reduce lighting cost. *Asian Journal of Computer Science and Information Technology* **2** (5): 119-122.

Sreekala K. Nair, Rajalakshmi, S., Vinoth kumar, D., Sri Santhya, V., Nithya, M. and Thulaja, R.S. 2023. An interdisciplinary approach of an ecofriendly environment at higher educational institutions. *International Journal of Scientific Research* **12** (1): 30-34.

Sri Santhya, V., Vinoth Kumar, D., Rajalakshmi, S., Lingeshwaran, P.K., Saranya, N. Anirudhan, B. 2022. An Environmental protecting approach through waste management practices at Nehru Arts and Science College, Coimbatore, Tamil Nadu, India. *International Journal of Science and Research* **11** (10): 223-228.

USEPA 2020. https://archive.epa.gov/epawaste/nonhaz/municipal/web/html/

Venkataraman, K. 2009. India's Biodiversity Act 2002 and its role in conservation. *Tropical Ecology* **50** (1): 23-30.

Vinothkumar, D., Pirathiba, S., Rajalakshmi, S., Sri Santhya, V., Saranya, N. and Anirudhan, B. 2022. A case study on water management strategies documented under environmental audit at Nehru Arts and Science College, Coimbatore, Tamil Nadu, India. *International Journal of Current Advanced Research* **11** (5): 960-964.

Vinothkumar, D., Sreenivasan, P.V., Rajalakshmi, S., and Gnanamangai, B.M. 2021. Environment and Green Campus Audits. AkiNik Publishing, New Delhi, India. 240 p.

WGBC, 2021. World Green Building Council. https://www.worldgbc.org.

Woo, J. and Choi, K.S. 2013. Analysis of potential reductions of greenhouse gas emissions on the college campus through the energy saving action programs. *Environmental Engineering Research* **18** (3): 191-197.

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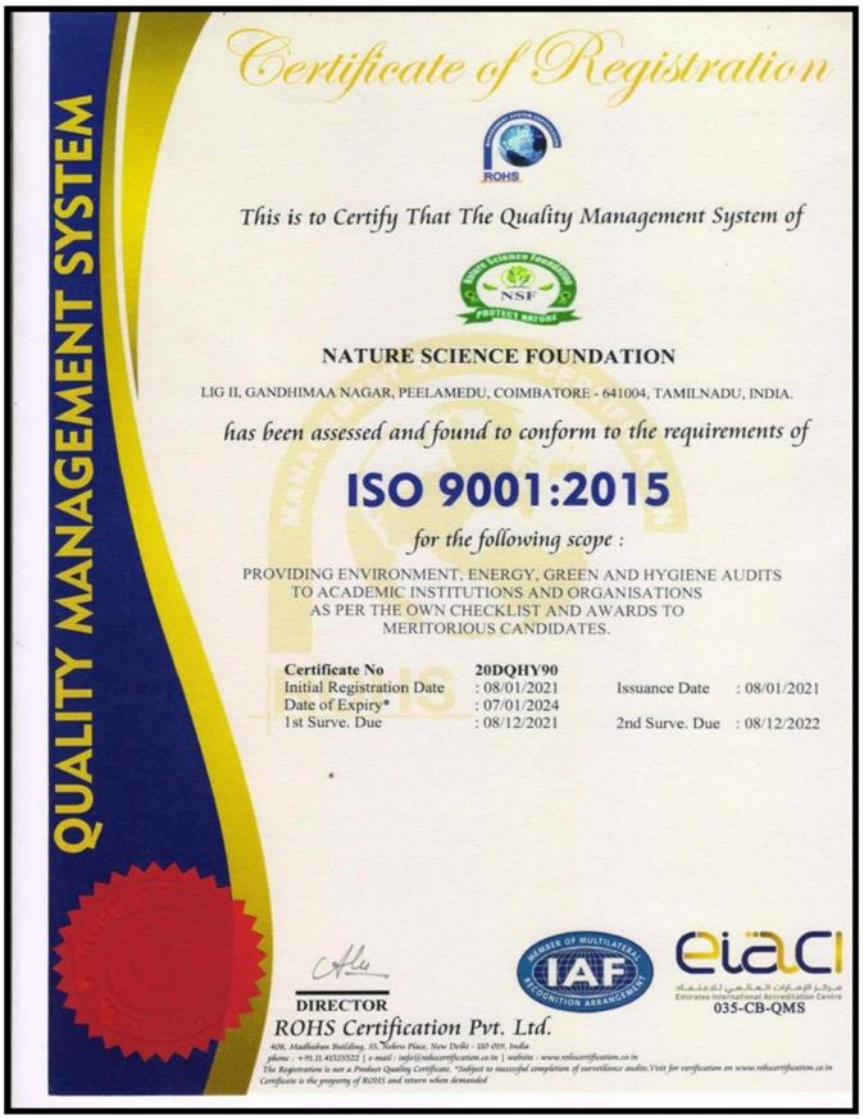

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NATIONAL INDUSTRY CLASSIFICATION CODE(S)

SNo.	NIC 2 Digit	NIC 4 Digit	NIC 5 Digit	Activity
1	69 - Legal and accounting activities	6920 - Accounting, bookkeeping and auditing activities; tax consultancy	69201 - Accounting, bookkeeping and auditing activities	Services
2	85 - Education	8542 - Cultural education	85420 - Cultural education	Services
3	85 - Education	8549 - Other education n.e.c.	85499 - Other educational services n.e.c.	Services

DATE OF UDYAM REGISTRATION	26/02/2022

* In case of graduation (upward/reverse) of status of an enterprise, the benefit of the Government Schemes will be availed as per the provisions of Notification No. S.O. 2119(E) dated 26.06.2020 issued by the M/o MSME.

Disclaimer: This is computer generated statement, no signature required. Printed from https://udyamregistration.gov.in & Date of printing - 26/02/2022

For any assistance, you may contact:

1. District Industries Centre: COIMBATORE (TAMIL NADU)
2. MSME-DI: CHENNAI (TAMIL NADU)

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9. Certificates of Lead Auditors

1. Bureau of Energy Efficiency (BEE), LEED AP and GRIHA Certificates of Er. D. Dineshkumar, Energy and Environment Auditor of NSF.

2. Indian Green Building Council (IGBC AP) Accredited Professional of Dr. B. Mythili Gnanamangai, Vice-Chairman of NSF.

3. Tamil Nadu Fire and Rescue Service Certificate of Er. S. Srinivash, Energy Auditors of NSF.

4. Energy Management System ISO 50001:2018 Certificate of Dr. D. Vinoth Kumar, Joint Director of NSF.

5. ISO 17020:2012 certificate of Ms. V. Sri Santhya, Assistant Director of NSF.

BUREAU OF ENERGY EFFICIENCY

Examination Registration No. : EA-14056 Serial Number: 9176

Certificate Registration No. : 9176

Certificate For Certified Energy Manager

This is to certify that Mr./Mrs./Ms. Dinesh Kumar D Son/Daughter of Mr./Mrs. R M Dhanasekaran who has passed the National Examination for certification of energy manager held in the month of October 2011 is qualified as certified energy manager subject to the provisions of Bureau of Energy Efficiency (Certification Procedures for Energy Managers) Regulations, 2010.

This certificate shall be valid for five years with effect from the date of award of this certificate and shall be renewable subject to attending the prescribed refresher training course once in every five years.

His /Her name has been entered in the Register of certified energy manager at Serial Number 9176 being maintained by the Bureau of Energy Efficiency under the aforesaid regulations.

Mr./Mrs./Ms. Dinesh Kumar D is deemed to have qualified for appointment or designation as energy manager under clause (/) of Section 14 of the Energy Conservation Act, 2001 (Act No.52 of 2001).

Given under the seal of the Bureau of Energy Efficiency, this 7th day of February, 2013

Digitally Signed: RAKESH KUMAR RAI
Sun Mar 01 10:58:55 IST 2020
Secretary, BEE New Delhi

Secretary
Bureau of Energy Efficiency
New Delhi

Dates of attending the refresher course	Secretary's Signature	Dates of attending the refresher course	Secretary's Signature
22.12.2019			

SOKA IKEDA COLLEGE FOR WOMEN * CHENNAI-99 *

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AND SCIENCE FOR WOMEN
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ENERGY IS LIFE
CONSERVE IT

ऊर्जा दक्षता ब्यूरो
BUREAU OF ENERGY EFFICIENCY

विद्युत मंत्रालय, भारत सरकार
MINISTRY OF POWER, GOVERNMENT OF INDIA

प्रमाणित किया जाता है कि

श्री/श्रीमती दिनेश कुमार ने ऊर्जा संरक्षण भवन निर्माण संहिता के लिए 7 दिसंबर '16 से 8 दिसंबर '16 तक ~~एमएनआईटी~~ / ~~सीईपीटी~~ /आईआईआईटी द्वारा आयोजित मास्टर ट्रेनर सर्टिफिकेट कार्यक्रम को सफलता पूर्वक सम्पन्न कर लिया है।

This is to certify that

Shri/Smt. Dinesh Kumar has successfully completed the Master Trainer Certificate Programme conducted by ~~MNIT~~ / ~~CEPT~~ / IIIT from 7 December '16 to 8 December '16 for the Energy Conservation Building Code.

नई दिल्ली, 11 JAN 2017
New Delhi,

महानिदेशक
Director General

TAMILNADU FIRE & RESCUE SERVICES
THIRUVALLUR DISTRICT
THIRUVALLUR

CERTIFICATE

This is to certify that Mrs. / Mr. S. SRINIVASH S/o B. SWAMIYAPPAN H/855, ST. Xavier's Street, Pannur, Thiruvallur District has under gone the "Basic Fire Fighting & Rescue Operation" Training course conducted from 11.08.2016 to 20.08.2016 by Tamil Nadu Fire & Rescue Services Department at Thiruvallur District, Thiruvallur as per G.O.M.S. No.713, dated 17.08.2005 Home (Police XVII) Department, Government of Tamil Nadu.

Station : Thiruvallur.
Date : 20.9.16

District Officer 20.9.16
Fire & Rescue Services
Thiruvallur District
Thiruvallur

GEM Certificate

ASSOCHAM

ASSOCHAM hereby certifies that

Dr. B. Mythili Gnanamangai

has successfully passed the

Green and Eco-friendly Movement Certified Professional Test (GEM CP)

with

"Excellent Performance"

on

16 July, 2021

He/she is now eligible to execute the GEM Sustainability Certification Projects.
ASSOCHAM feels proud to award the GEM Certified Professional title to him/her.

Pankaj R. Dharkar
Chairman, GEM

GEM CP 20/649

Deepak Sood
Secretary General, ASSOCHAM

IGBC

CII
Confederation of Indian Industry

The Indian Green Building Council

hereby certifies that

B Mythili Gnanamangai

has successfully demonstrated knowledge on the Green Building Design & Construction, Building Standards & Codes, IGBC Resources & Processes and Green Design Strategies & their Impacts, required to be awarded the title of

IGBC Accredited Professional

K S Venkatagiri
Executive Director
CII-Godrej GBC

V Suresh
Chairmar
Indian Green Building Council

Gurmit Singh Arora
Vice-Chairman
Indian Green Building Council

210122

17 April 2021

TAMILNADU FIRE & RESCUE SERVICES

THIRUVALLUR DISTRICT

THIRUVALLUR

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Station: Thiruvallur.
Date: 20.9.16

District Officer 20.9.16
Fire & Rescue Services
Thiruvallur District,
Thiruvallur

GRIHA

GREEN RATING FOR INTEGRATED HABITAT ASSESSMENT

GRIHA CERTIFIED PROFESSIONAL CERTIFICATE

This is to certify that

Dinesh Kumar Dhanasekaran

has qualified as a **GRIHA** Certified Professional For V. 2015

Date of issue: 19th June 2020

Note : This certification is valid only for GRIHA version 2015.

Chief Executive Officer
GRIHA Council

LEED AP BD+C

GREEN BUSINESS CERTIFICATION INC. CERTIFIES THAT

DINESH KUMAR D

HAS ATTAINED THE DESIGNATION OF

LEED AP® Building Design + Construction

by demonstrating the knowledge and understanding of green building practices and principles needed to support the use of the LEED® green building program.

10531234-AP-BD+C
CREDENTIAL ID

26 DEC 2016
ISSUED

25 DEC 2022
VALID THROUGH

Mahesh Ramanujam

MAHESH RAMANUJAM
PRESIDENT & CEO, U.S. GREEN BUILDING COUNCIL
PRESIDENT & CEO, GREEN BUSINESS CERTIFICATION INC.

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organized by

Training and Capacity Building (TCB) Cell, Quality Council of India

on

10-11 August 2023

Alok Jain
Director & Head, TCB

Cert No. TCB/QCI/110823/06-012

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The CPD Accreditation Office

Certificate of Successful Attainment

This is to certify that

DR. D. VINOTH KUMAR

HAS SUCCESSFULLY COMPLETED THE FIVE DAYS (40 HOURS)

LEAD AUDITOR COURSE

BY PASSING THE WRITTEN EXAMINATION BASED ON

ISO 50001:2018

ENERGY MANAGEMENT SYSTEMS

Examination Date: 15/07/2022
Certificate issue Date: 22/07/2022
Certificate registration number: QCS/TR/C/0056
Total Course duration: 40 hours CPD Credits Earned: 32

Remarks: Roughly one hour of study time equals to 1 CPD Credit.

This certificate can be validated online from the industry wide Global Professional Register at www.qcspl.com.

Partha Bagchi
(Managing Director)

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