

A CASE STUDY

Environmental auditing as a tool for evaluating solid waste management of a private group of institutions

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ABSTRACT

In recent years universities and colleges are approving environmentally sound course curriculum format by stressing the need for campus environmental audit programme. The main focus of the programme is their resource consumption and the need for improving campus environment on sustainable basis. Environmental auditing is a periodic, documented and systematic approach in the management of waste. Rusty Callier of the University of Wisconsin River-Falls defines a campus environmental audit as “a way to judge where resources are being used efficiently and where they are being used inefficiently”. Solid waste management is the collection, transport, processing, recycling or disposal, and monitoring of waste materials <http://en.wikipedia.org> The data collected for waste generation and study of various waste disposal mechanisms, collection and treatment helps us to have an approach for waste minimization and reduction.

Key Words : Environmental auditing, Solid waste management, Disposal mechanisms, Group of Institutions

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It is evident from the history of waste management and various case studies that before industrial revolution all the cities were having low population densities and thereafter the whole scenario changed by the large scale migration of people from rural areas to urban areas.

Solid waste management is not a new concept. Waste has played a tremendous role in history. Civilizations belonging to different countries in different eras used to invent and adopt various methods or technologies to dispose of the unwanted heaps of materials lying outside the cities, for example, The Maya civilization of Central America had dumps, which exploded occasionally and burned (<http://en.wikipedia.org>) those heaps of waste. Homemakers brought trash to local dumps, and monthly burnings would occur (<http://en.wikipedia.org>)

Background:

Even nowadays management of waste is a big issue since

it holds value for a disease free society and a clean environment. The waste coming out of factories, industries, agricultural farms, hospitals, and nursing homes, domestic and municipal waste is categorized on the basis of the source generation and the management and disposal of such waste has taken a systematic, periodic and well documented monitoring. The definition of environmental auditing adopted by International Chamber of Commerce is as follows: 'A management tool comprising a systematic, documented, periodic and objective evaluation of how well environmental organization, management systems and equipment are performing with the aim of facilitating management control of environmental practices and compliance with the company policies including meeting regulatory requirements.' Environmental auditing is a part of planning process of environmental management system of any organization. Environmental pollution is studied by analyzing the pollutant level of various types viz., air pollution, water pollution, noise

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pollution, solid waste and other integrated campus ecological problems supported by environment awareness education. A common audit programme is developed by studying and observing all the environmental factors. This audit programme includes pre-audit, onsite and post audit activities of any campus. The campus area of E-max College is found to be away from the main cities polluted areas and it is located well inside the village ecology. The ambient air quality was found to be lacking all the obnoxious gases and various air pollutants. The location of the campus away from any highway or from the main city makes it suitable for a noise pollution free zone except the localized and interrupted noises of construction works which is under progress. Thus, the main focus of our environment audit programme was the complete study on the management of solid waste in the campus ecology.

E-Max Group of Institution has taken a unique initiative in introducing solid waste management practices. These pioneer steps would help in making the environment more eco-friendly and help the campus go green and become the first group of institutions in the region to take environment friendly initiative, alongwith make the students environmentally aware.

The main advantages of performing audit on the campus are -

- Well planned and methodological process to reduce resource wastage.
- Students are attached with the survey and data collection teams inculcating team work and environmental awareness.
- By introducing various eco-friendly activities students get a chance in the decision making process.
- Students are sensitized about the fragile environment of the campus.

Objectives:

- To determine the solid waste management infrastructure on campus
- To determine how much solid waste the campus generates on a monthly basis
- To identify all programs and activities the group of colleges is engaged to reduce, reuse and recycle the materials and resources we use in the campus (www.calrecycle.ca.gov)

Information on solid waste generation and management, recycling efforts through the individuals involved in reuse and recycling projects in the campus

The methodology adopted for this audit was:

- Formation of audit groups including students
- Visual inspection and data collection
- Observations on the general condition of the facility and quantification details:

Biodegradable waste:

Solid waste generation points with types and quantities

of waste generated

- Canteen (food wastage, peels, tea leaves and other waste of natural origin)- 400 kg/day
- Juice corner (fruit waste, leaves etc)-20 kg/day

Non-biodegradable waste:

Plastic waste, cans, paper bags, polyethylene, disposable plates, spoons etc-200 kg/day.

Dumping sites:

- Paper/plastic waste → selling to knackers (kabaris)
- Paper waste → Backyard campus
- Disposable waste → Sewerage pits on the campus fringes
- Canteen food wastage → Sold for animal feed

Solution for bio-degradable waste:

- Organic waste pits and its construction (Details of technical data and const. cost attached)
- Segregation at the waste generation points by using different colored bins for biodegradable and non-biodegradable waste
- Campus greening steps by using organic manures for vegetable garden, plants and lawns in the campus
- Vermicomposting in the campus makes profit by reducing the fertilizer cost and multiplication of worms' means selling them at market price; alongwith producing organic manure.

Campus environmental activities:

Eco-clubs have been formed to carry on the environment friendly activities with the students, staff and faculty members involved in all these activities. It has been formed at the campus level for student and community participation in assessing and monitoring of environment parameters in the campus. The ecoclub activities have been formulated in the ecoclub annual calendar. These activities include campus greening drives and various afforestation programmes , plantation of fruits and vegetables in the campus organic garden and composting pits.

Eco club meet:

An eco-club meet was held with the inaugural speech on the topic causes and effects of noise pollution on human health and some measures to control or prevent them which was presided over by campus doctor making the students aware of various aspects of noise pollution and its ill effects on human health. Other activities of the club are as follows:

Energy conservation :

Listing 20 ways of conserving energy/preparing pamphlets, brochures on energy conservation.

Clean environment:

Planning a cleanliness drive in the campus/awareness on sanitation and hygienic conditions

Organic farming:

Starting organic gardens by kitchen/mess waste

Rainwater harvesting:

Preparation of a model of RWH for the campus/inviting a speaker on RWH

Procedures and techniques of activities with technical details for campus ecology:

Organic gardening and vermicomposting as measure for organic waste management:

There is lot of biodegradable waste and organic biomass in the campus from the mess, canteen, juice corner, garden area, lawns, campus backyard in the form of kitchen waste, leaf litter, dried grass etc. This waste can be recycled and used again as mulch in our campus area. This can be managed by a clean technology of vermicomposting and organic gardening.

Production process:

It can be prepared anywhere by using wooden boxes, earthen pits, ground pits, small plastic or cement drums etc. A brick masonry pit can be constructed in the ground with dimensions 12ftx5ftx3ft. PVC sheets are used to arrest the escape of earthworms in the soil sediments. Four layers are formed in the following way:

First layer: 2 inches, coconut fiber, rice husk, sugarcane bagasse.

Second layer: 2 inches, thick saw dust, rice or wheat straw. Water is sprinkled to moisten that matter.

Third layer: 6 to 8 inches, earthworm feed mixture of cowdung and organic waste (1:8). Organic waste is any green foliage, leaf litter, vegetable, fruit waste, waste of animals, pigs, cardboards, paper etc.

Fourth layer: Earthworms are spread in 1500-2000 no. Jute bags are spread and water is sprinkled to make it wet.

First week - Jute bags are turned upside down thrice a week

Second week - Jute bags are turned upside down twice a week

Third week - Jute bags are turned upside down once a week

Fourth to fifth week - By this time the decomposition process completes, heat production stops and if no warmth is felt on the top then the manure is ready for use.

Precautions:

- Protection of this area from the attack of rodents or ants

- A small shed is needed on the top of the pit as a protection from rain or excessive heat during summer season

Advantages:

- Reduction in use of inorganic fertilizers and cost saving
- Waste and biomass management both in rural and urban area.
- Compost is rich in potassium, phosphorus, calcium etc.
- Natural fertility of soil is maintained

Rainwater harvesting:

Till about thirty years back, the areas around our homes and offices used to be unpaved and the rain falling on these areas would percolate into the soil. These areas been paved and percolation of rainwater into the soil almost totally stopped, the withdrawal of water is more than its recharge back into the soil. A sincere attempt can be made to replenish the ground water table with rainwater during the monsoon and also some measures can be implemented to harvest rainwater in our houses and flat complexes and put it into the soil for our subsequent use.

Rainwater goes as a waste in drains and can be harvested in our homes, complexes and campus area to replenish the ground water table. Traditionally, *Johads* were used in Rajasthan for water harvesting. These are structures built of stones and mud barriers along the slopes Borthakur *et al.*, (2009)

Components of rainwater harvesting structure (www.aboutrainwaterharvesting.com) are-

Rainwater harvesting systems generally consist of four basic elements:

- a collection (catchment) area.
- a conveyance system consisting of pipes and gutters
- a storage facility, and
- a delivery system consisting of a tap or pump.

Applications:

- Rain water harvesting through pebble bed (Building complex).
- Rain water harvesting through well-cum canal-cum percolation method.
- Rain water harvesting through open wells.
- Rain water harvesting through service cum recharge well method.
- Rain water harvesting through broken brick method.
- Rain water harvesting through recharge wells and open ground.
- Bathing water and store water drains.
- Stopping rain water rushing out of the gate by the draft wall
- Roof top water collection and recharge

Rainwater harvesting for the campus area:

The common components of a rainwater harvesting system involved in these stages are illustrated here.

Catchments: The catchment of a water harvesting system is the surface which directly receives the rainfall and provides water to the system.

Coarse: Mesh at the roof to prevent the passage of debris.

Gutters: Channels all around the edge of a sloping roof to collect and transport rainwater to the storage tank.

Gutters can be semi-circular or rectangular and could be made using:

Locally available material such as plain galvanized iron sheet (20 to 22 gauge), folded to required shapes.

Semi-circular gutters of PVC material can be readily prepared by cutting those pipes into two equal semi-circular channels.

Bamboo or betel trunks cut vertically in half.

Conduits: are pipelines or drains that carry rainwater from the catchment or rooftop area to the harvesting system. Conduits can be of any material like polyvinyl chloride (PVC) or galvanized iron (GI), materials that are commonly available.

First-flushing : A first flush device is a valve that ensures that runoff from the first spell of rain is flushed out and does not enter the system.

Filter : The filter is used to remove suspended pollutants from rainwater collected over roof. A filter unit is a chamber filled with filtering media such as fibre, coarse sand and gravel layers to remove debris and dirt from water before it enters the storage tank or recharge structure.

Filter for large rooftops:

When rainwater is harvested in a large rooftop area, the filtering system should accommodate the excess flow. A system is designed with three concentric circular chambers in which the outer chamber is filled with sand, the middle one with coarse aggregate and the inner-most layer with pebble.

Storage facility : There are various options available for the construction of these tanks with respect to the shape, size and the material of construction.

Recharge structures : Rainwater may be charged into the groundwater aquifers through any suitable structures like dug wells, bore wells, recharge trenches and recharge pits.

Advantages-

- Storage of rainwater in containers.
- Recharging of rainwater in the ground water table

Resource use for future trends:

Waste:

The group of institutions will aim to improve its

management of both general and hazardous waste produced on campus by:

- Minimizing (reducing and /or recycling) wherever possible its biodegradable solid waste (by adopting organic farming and vermicomposting).
- Minimizing liquid waste streams at all discharge points on campus and constructing sewage treatment plants (STP) having tertiary treatment facility for the waste such that the effluent can be recycled for irrigation purpose.
- Using recycled products wherever feasible.
- Adopting a purchasing policy sensitive to environmental concerns.
- Identifying and minimizing hazardous wastes on campus.
- Ensuring satisfactory disposal of wastes (hazardous and general) that cannot be re-used or recycled.
- Conducting a regular waste audit to assess improvement of waste management strategies on campus and to communicate these results to relevant parties.

Energy:

The group will aim to maximize campus energy efficiency by:

- Minimizing and monitoring the total energy consumption.
- Implementing wherever possible to best available energy technology for all new buildings and in existing structures where possible.
- By performing regular energy audit programmes

Water:

The groups will aim to manage its water resources efficiently:

- Minimizing and monitoring the total water consumption.
- Ensuring that water systems on campus are not wasteful.
- Encouraging the planting of indigenous flora to reduce water usage.
- Construction of rain water harvesting structures

Conclusion:

Recommendations for future use:

3 R's need to be followed strictly—Reduce, Reuse and Recycle

Reduce:

Reduce needless consumption and the generation of waste.

- Reduction of waste generation by less use of disposable plates, glasses, spoons etc in the canteen and saving disposal cost by making nearby area more hygienic and clean.

Autopia to be achieved and it would be reducing the generation of waste and its recycling.

– More use of steel or unbreakable utensils means one time investment and reduction of waste at generation site

Reuse:

– Computer items from comp. Labs
– Demolition waste from construction sites of the buildings

– Electronic items from various sources
– Substitute reusable items for consumables
– Use cloth napkins in the kitchens, mess and canteen areas

– Invest in a set of reusable shopping bags rather than using plastic bags or polythene.

Recycle:

– Recyclable material waste paper, plastic, broken glass, metal, packaging material etc.,

– Bathrooms can generate a fair amount of recyclable waste, shampoo bottles, empty facial tissue boxes, and empty toilet paper tubes.

– It is easier to toss recyclable waste in a separate container

Recycling pickup can collect the following items

– Steel and aluminum cans—Beverage cans, food cans, aerosol cans.

– Clean aluminum food packaging—Pie plates, dinner trays, foil.

– Paper — newspaper, magazines, catalogs, phone books, bulk mail, office paper, computer paper, envelopes, gift wrapping paper, cardboard, food boxes, shoeboxes, paper towel and toilet paper tubes, paper egg cartons.

– Plastic—Plastic that bears plastic recycling symbol

Recycle on your own:

Food waste/yard waste-compost, vermicomposting

Proposed energy audit:

– Objective of the study
– Present energy scenario
– Audit methodology

– Preaudit activities
– Onsite activities
– Post audit activities

– Quantification
– Benchmarking
– Energy efficiency

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