THE ENVIRONMENT MANAGEMENT

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Leachate treatment for color

C&D Recycled products

Current Issue: Waste Management Technologies

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Waste management is one of the essential utility services underpinning society in the 21st century, particularly in urban areas. Waste management ranks alongside the provision of potable water, shelter, food, energy, transport and communications; all are essential to society and to the economy as a whole. Despite this, the public and political profile of waste management is often lower than other utility services. The initial focus of policy planners on waste management was on waste after it had been discarded, whereas now attention has moved upstream, addressing the problem at its source through, for example, designing out waste, preventing its generation, reducing both the quantities and the uses of hazardous substances, minimising and reusing, and, where residuals do occur, keeping them concentrated and separate to preserve their intrinsic value for recycling and recovery and preventing them from contaminating other waste that still has economic value for recovery.

Technological interventions have played vital role in the sustainable management of waste. The technologies on waste management should be tested at field level at multiple locations to ensure its suitability as well as application. Our institute has expertise and facilities for the identification of technological solutions and management of different type of wastes viz. fly ash, non incinerable hazardous waste, MSW, industrial waste water, oil sludge, leachate etc. The technologies generated by the institute are successfully transferred to the industries as well as society. The current issue of newsletter is focusing on the theme 'Waste Management Technologies' which is prerequisite to ensure cities and human settlement inclusive, safe, resilient and sustainable as per the Agenda 2030.

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Construction and Demolition Waste Management

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The construction industry has gained very fast growth in recent decades due to the increase in the population, increase in the IT sector and increase in the industrialization and also introduction of new infrastructure projects. This resulted in the increase of construction industry drastically due to which the demand for construction materials is huge for the construction activities.This results in the generation of huge amount of construction waste. Construction material wastage resulted in the huge financial setbacks to builders, contractors, regional authorities and also to the country

'Construction and demolition waste' means the waste comprising of building materials, debris and rubble resulting from construction, re-modeling, repair and demolition of any civil structure.

In India, at the beginning, it is said that there is no adequate or satisfactory data for accessing this issue. A report prepared by the MoEF (Ministry of Environment and Forest) in 2008 estimated that 0.53 million tonnes/day of waste is generated in the country. Table-1 shows the estimate prepared by central government of India.

Year	Authority	Estimate in Million Tonnes/year
2000	Ministry of Urban Development	10—12
2001	TIFAC	12—15
2010	Ministry of Environment and Forest	10—12

Table-1: Government of India Report

Earlier in India there was no separate framework for Construction and Demolition (C&D) waste management rules. It was covered under Municipal Solid Wastes (Management and Handling) Rules, 2000. On 29th March 2016, Ministry of Environment, Forest and Climate Change notified Construction and Demolition waste management rules.

The rules shall apply to every waste resulting from construction, re-modeling, repair and demolition of any civil structure of individual or organization or authority who generates construction and demolition waste such as building materials, debris, rubble.

As per Rules, C&D waste generators and Bulk Generators are defined as:

1. "waste generator" means any person or association of persons or institution, residential and commercial establishments including

Indian Railways, Airport, Port and Harbour and Defence establishments who undertake construction of or demolition of any civil structure which generate construction and demolition waste.

2. Bulk C&D waste generator" means those sources generating more than 20 tons or more in one day or 300 tons per project in a month of installed capacity.

As per C&D waste Management rules 2016, Under Rule 4 sub-rule (3) the segregation by bulk C & D waste generators shall be done into four streams such as:

- Concrete
- Soil
- Steel, wood and plastics
- Bricks & mortar

Typical composition of Indian C & D waste (TIFAC, 2001) is shown in table-2 below:

Soil, Sand & Gravel	36%
Brick and Masonry	31%
Concrete	23%
Metal	5%
Bitumen	2%
Wood	2 %
Others	1 %

Table-2: Typical Composition of C&D Waste in India

In these rules, duties of service providers and contractors are given. Central and Sate pollution control boards monitor the effective implementation of C&D waste management rules 2016.

In these rules, further criteria for storage, processing or recycling facilities for construction and demolition wasteland application of construction and demolition waste and its products are given. The Bureau of Indian Standards and Indian Roads Congress is responsible for preparation of code of practices and standards for use of recycled materials and products of construction and demolition waste in respect of construction activities.

Case Study of C&D waste management:

BURARI C&D Plant Processing:

The facility is currently operational on 2.5 acres of land and processes 500 metric tonnes of East Delhi waste. Around 700 metric tonnes of C & D waste is generated daily in East Delhi areas. The construction waste collected from 15 designated sites in East Delhi is brought to this place by the EDMC staff and afterwards the concessionaire processes it into bricks, which are used for the construction of Supreme court's building complex.

Photos: East Delhi Facility for C&D Waste Recycling

The concessionaire is using the 'wet processing technology' for treating the C & D waste that minimizes the residues to 5% and reduces dust and noise pollution. Till date, this plant has processed two lakh tonnes of waste.

The plant recovers and recycles about 95 per cent of incoming C&D waste. The plant has been developed through public-private-partnership (PPP) model, in collaboration with M/S IL&FS. The plant has been developed at a cost of Rs 20 crore.

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Call for Paper

Authors are requested to submit the abstract of their papers not exceeding 500 words in Times New Roman font, 12 size and with 1.5 line spacing in Windows 2007 on following e mail id: nationalconferenceiiem@sies.edu.in. The acceptance of the abstract for the oral or poster presentation will be communicated through e- mail. No abstract will be considered without registration fee. All the abstract and full paper for this conference should be submitted through e mail mentioned above.

Important Dates

Submission of Abstracts	25th October 2018
Acceptance of Abstract	30th October 2018
Full paper submission	10th November 2018
Acceptance of Full paper	15th November 2018
Registration Deadline	20th November 2018
Conference Date	1st December 2018

Registration

Participants are requested to register well in advance using the registration form (or Xerox copy).

Registration Fee

Category	Upto 15th Nov., 2018	After 15th Nov., 2018
Industries & Consultancies	Rs 5000/-	Rs. 5500/-
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National Conference on

Geoinformatics in Water Management

Date & Venue

1st December, 2018

SIES Educational Campus,

Nerul, Navi Mumbai

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Waste Composting Technologies

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All of us are very much aware how complicated it is getting to dispose the municipal solid waste. The tons of waste being generated in the cities are no less than a monster now.

The solutions don't lie only with the municipal bodies.

If we carefully check the waste that is generated daily in our houses, we will notice that almost 40-50% of it is from the kitchen like fruit/vegetable peels, leftover food, flower offerings etc. We also notice that this part of waste gets converted into a smelly mass if kept for more time.

What is the reason?

Plants or their products which we consume are created mainly by the consumption of carbon dioxide using the sunlight and nitrogen and other minerals from the soil. The non vegetarian diet includes animals which consume the plants and plant produce. Any residue from agriculture processes or food processing is hence again a combination of nitrogen, carbon and other naturally occurring minerals.

Any food waste has inherent microorganisms that decay it over a period of time. Hence the smelly mass. However, if the same process is carried out in a systematic and controlled manner, we get a nutrient rich product called Compost, which can again be consumed by plants. This is a way to complete the carbon cycle.

Our ancestors have been doing this, though they may not have the technical know-how of the process. But many of us in today's times stay away from composting due to following assumptions:

1. Space constraints
2. Time constraints
3. Odour, flies, mosquito problems

But, none of these are true if we understand the science behind composting.

Composting in simple terms is breaking down of our kitchen waste/garden waste/agri waste, into a form which can be consumed by plants. There are two different ways of composting:

Aerobic: The organisms involved use free oxygen in the air. (Oxidation reaction)
Anaerobic (Bokashi): The organisms involved take oxygen from the food waste. (Reduction reaction)

The breaking down or decomposition process in a typical aerobic composting system, occurs due to three types of creatures:

1. Third level decomposers: These are generally referred as Macro organisms. These include Ants, beetles, centipedes,

"composting" worms, flies, millipedes, slugs, snails, spiders, and. woodlice (sow bugs). They break down the material by chewing, tearing etc.

2. Second level decomposers: These tend to be smaller and aren't visible with naked eye. Some examples are springtails, nematodes, beetle mites, mold mites and protozoa. They eat the organic matter and the organisms that make up the first level
3. decomposers.
4. First level decomposers: These are much smaller microorganisms e.g. bacteria, fungi actinomycetes. They play the major role in the composting process.

The first level and second level organisms generally change physical properties of the waste whereas microorganisms change chemical properties.

Of all these organisms, **aerobic bacteria** are the most important decomposers.

The bacteria consume Carbon from the waste pile for energy for sustenance and Nitrogen to grow and reproduce.

This oxidation process heats up the compost pile from ambient temperature. If proper conditions are present, the pile will heat up fairly rapidly (within days) due to bacteria consuming readily decomposable materials.

The bacteria also excrete plant nutrients such as nitrogen, phosphorus and magnesium.

There are different types of aerobic bacteria that work in composting piles. Their populations will vary according to the pile temperature.

Psychrophilic bacteria work in the lowest temperature range. They are most active at 55° F and will work in the pile if the initial pile temperature is less than 70º F. They give off a small amount of heat in comparison to other types of bacteria. The heat they produce is enough, however, to help build the pile temperature to the point where another set of bacteria, **mesophilic** bacteria start to take over.

Mesophilic bacteria rapidly decompose organic matter, producing acids, carbon dioxide and heat. Their working temperature range is generally between 70º to 100º F. When the pile temperature rises above 100º F, the mesophilic bacteria begin to die off or move to the outer part of the heap. They are replaced by heat-loving **thermophilic** bacteria.

Thermophilic bacteria thrive at temperatures ranging from 113º to 160º F. Thermophilic bacteria continue the decomposition process, raising the pile temperature 130º to 160º F, where it usually stabilizes. Unless a pile is constantly fed new materials and turned at strategic times, the high range temperatures typically last no more than three to five days. Thermophilic bacteria use up too much of the degradable materials to sustain their population for any length of time. As the thermophilic bacteria decline and the temperature of the pile gradually cools off, the mesophilic bacteria again become dominant. The mesophilic bacteria consume remaining organic material with the help of other organisms.

While the various types of bacteria are at work, other microorganisms also contribute to the degradation process. **Actinomycetes**, a higher-form bacteria similar to fungi and molds, are responsible for the pleasant earthy smell of compost. Greyish in appearance, actinomycetes work in the moderate heat zones of a compost pile. They decompose some of the more resistant materials in the pile such as lignin, cellulose, starches, and proteins. As they reduce materials, they liberate carbon,

nitrogen, and ammonia, making nutrients available for higher plants. Actinomycetes occur in large clusters and become most evident during the later stages of decomposition.

Like bacteria and actinomycetes, **fungi** are also responsible for organic matter decay in a compost pile. Fungi are primitive plants that can be either single celled or many celled and filamentous. They lack a photosynthetic pigment. Their main contribution to a compost pile is to break down cellulose and lignin, after faster acting bacteria make inroads on them. They prefer cooler temperatures (70 to 75º F) and easily digested food sources. As a result, they also tend to take over during the final stage of composting.

It can be concluded that proper functioning of the above microorganisms and hence proper composting, needs the favourable conditions for the organisms to be maintained. Those are:

1. Compost system temperature
2. Carbon to Nitrogen Ratio
3. Aeration i.e. Oxygen Levels
4. pH of the mixture
5. Moisture Levels

Any Aerobic Compost system is built considering all the above parameters.

Depending on the volume of waste to be handled, the form of the system can vary from a basket, drum to a raised bed, cement pit, cage or enclosed aerated bin. The volume of waste will also decide the requirement of additional equipment like waste shredder, which reduce the particle size for a faster decomposition.

There is another type of microorganisms which can survive in the absence of free atmospheric oxygen, like lactobacillus. They are responsible for another type of composting, '**anaerobic or Bokashi**'. (Bokashi means 'pickle' in Japanese language). They are lactobacillus bacteria, yeasts, some fungi.

The food waste is kept under airtight conditions with addition of the culture. The lactobacillus ferment and breakdown the food chains into simpler forms making a 'pickle'. These can be further digested in the form of nutrients by mesophilic bacteria when added to soil. This process of composting does not need shredding, churning of food waste. Milk products also can be decomposed in this method.

Irrespective of the type of composting system, it can be a pleasure if the steps are followed correctly.

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- Mapping of resources and modelling
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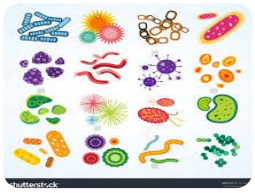

Microbial interventions in Environment Management

- Bioremediation and phytoremediation
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Environment Management

Designing of policies and plans as per agenda 2030 of Sustainable Development for industries and institutions

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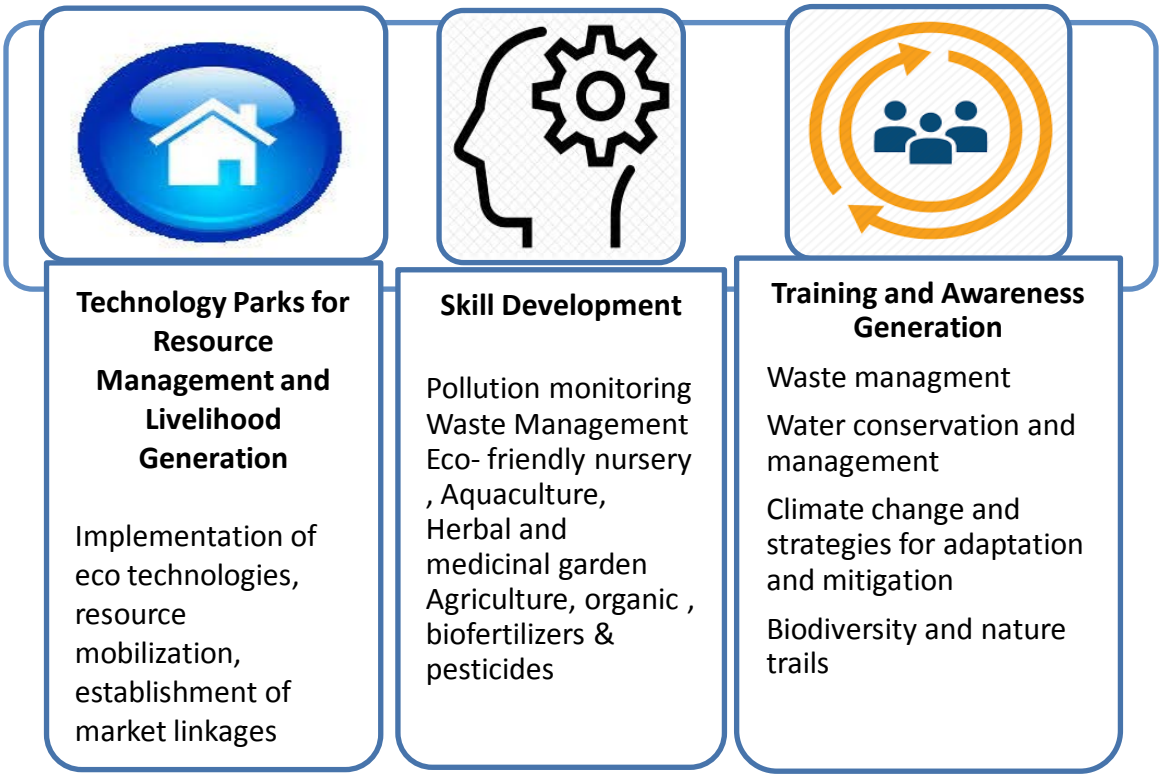

Technology Parks for Resource Management and Livelihood Generation

Implementation of eco technologies, resource mobilization, establishment of market linkages

Skill Development

Pollution monitoring
Waste Management
Eco- friendly nursery , Aquaculture, Herbal and medicinal garden
Agriculture, organic , biofertilizers & pesticides

Training and Awareness Generation

Waste managment

Water conservation and management

Climate change and strategies for adaptation and mitigation

Biodiversity and nature trails

e-Waste Management Technologies

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Introduction

The electronics industry is the world's largest and fastest growing manufacturing industry. Recent policy changes in India have led to an influx of leading multinational companies to set up electronics manufacturing facilities and R&D centres for hardware and software. This has no doubt helped the Indian economy to grow faster and fueled increase in the consumption rate of electronics products. The net effect is a higher rate of e-waste generation, which is leading to growing piles of e-waste. The aim of this article is to discuss about the technologies of e-waste management.

What is e-waste?

Electronic waste (e-waste) comprises waste electronics/electrical goods that are not fit for their originally intended use or have reached their end of life. This may include items such as computers, servers, mainframes, monitors, CDs, printers, scanners, copiers, calculators, fax machines, battery cells, cellular phones, transceivers, TVs, medical apparatus and electronic components besides white goods such as refrigerators and air-conditioners. E-waste contains valuable materials such as copper, silver, gold and platinum which could be processed for their recovery.

E-waste is not hazardous per se. However, the hazardous constituents present in the e-waste render it hazardous when such wastes are dismantled and processed, since it is only at this stage that they pose hazard to health and environment.

Electronics products like computers and cell phones contain a lot of different toxins.

For example, cathode ray tubes (CRTs) of computer monitors contain heavy metals such as lead, barium and cadmium, which can be very harmful to health if they enter the water system. These materials can cause damage to the human nervous and respiratory systems. Flame-retardant plastics, used in electronics casings, release particles that can damage human endocrine functions. These are the types of things that can happen when unprocessed e-waste is put directly in landfill.

The scenario

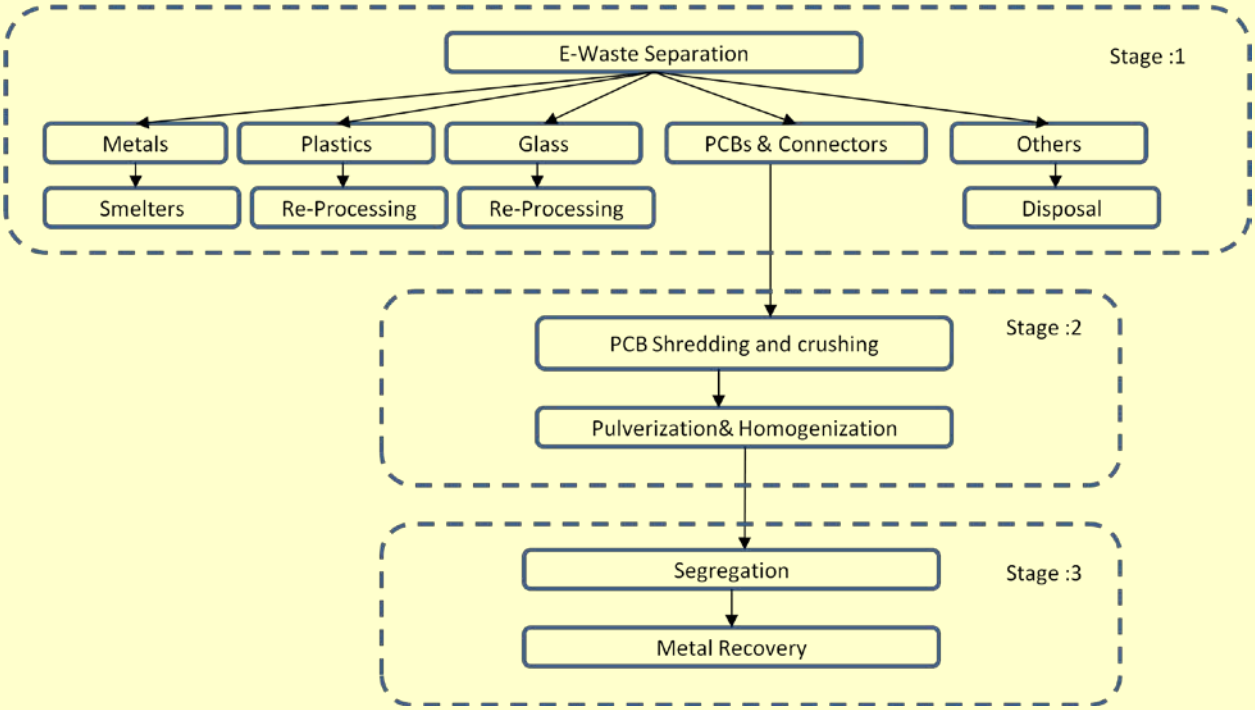
TABLE I
e-Waste Toxins and Affected Body Parts

Components	Constituents	Affected body parts
Printed circuit boards	Lead and cadmium	Nervous system, kidney, lever
Motherboards	Berillium	Lungs, skin
Cathode ray tubes (CRTs)	Lead oxide, barium and cadmium	Heart, lever, muscles
Switches and flat-screen monitors	Mercury	Brain, skin
Computer batteries	Cadmium	Kidney, lever
Capacitors and transformers	Polychlorinated biphenyls (PCBs)	
Printed circuit boards, plastic	Brominated flame-retardant casings cable	
Cable insulation/coating	Polyvinyl chloride (PVC)	Immune system
Plastic housing	Bromine	Endocrine

TABLE II
Discard Rate of Electronics Items

Item	Discard/replace rate
Mobile telephone	1 to 3 years
PC	Every 2 years
Camera	3 to 5 years
Television	10-15 years
Refrigerator	10-15 years
Washing Machine	10-15 years
IT accessories	Very fast

e-Waste Technologies-Typical Flow Chart



Plastics may be recycled if they are separated by type. They are mostly free of metals and other contaminants, and do not contain certain hazardous brominated flame retardants (BFRs), unless they can be removed or can legally continue to be used as flame retardants. Plastics can be used in smelting operations as fuel and as reducing agents, if the smelter emissions are well controlled, mainly for dioxins and furans.

Mechanized material recovery processes, using shredders, grinders and separation technology, are more likely to be high speed - high volume operations, with several shredding steps followed by very modern, sophisticated identification and separation of plastics and metals by optical and X-ray technology, ferrous metals by electromagnets, copper and aluminium by eddy current.

In case of concentrated streams of metals, they are usually further refined in metal-specific pyrometallurgical and/or hydrometallurgical processes. Scrap steel can be used in electric arc furnaces to produce new steel. Scrap aluminum can be used in secondary aluminum furnaces to produce new aluminum. Scrap copper, scrap precious metals, and some other non-ferrous metals are commonly recovered from computer circuit boards and other components/fractions in pyrometallurgical processing and/or by metal-specific hydrometallurgical refining. Informal recovery operations, such as acid leaching, on circuit boards and other precious metal-bearing materials are inefficient, and expose workers, communities and the environment to cyanides, strong acids, toxic gasses and other hazards. Batteries, derived from computing equipment, now almost always based on lithium and nickel metal hydride chemistry, should be evaluated for continued use as batteries, for which there is a good market. If a battery is no longer usable, it should be processed only in specialized facilities that are permitted to safely manage hazardous characteristics such as corrosivity or toxicity. The primary metals of interest are cobalt, nickel and copper, and lithium may also become a valuable target for recovery.

Management of Electronic Waste

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E-waste is commonly a name for disposable electronic products reaching their end of life or end of supported life as per manufacturer's determined expiry date. Electronics comprising computers, printers, televisions, CD-Players, mobiles, copiers, and fax machines are some of the common commercial electronic products. Electronic Waste products can be reused, refurbished, or recycled based on the condition in which they are disposed. Electronic equipment contains both valuable and harmful materials. Most of the valuable substances such as gold, silver, palladium and platinum are found in printed circuit boards, which occur in relevant quantities. (e. g. flat screens). It also contains heavy metals such as Lead, Cadmium, Arsenic, Antimony, Barium, Mercury, Nickel and Zinc apart from other toxic substances such as PCB (Polychlorinated Biphenyls) and Brominate flame retardants (BFR). It contains valuable material that can be recovered as secondary resource for conservation of energy and reduction in greenhouse gas emissions. These substances are not only harmful for the environment but also to the human health.

In the manufacturing of electronic equipment, simple substances are combined often to result in compounds which are hazardous. With new cheap devices, society has reaped tremendous benefits. When compared with traditional municipal wastes, e-waste is very different. The amounts of E-waste are growing rapidly, due to the wide use of this equipment, both in developed countries and in developing countries; E-waste in general can be classified as any equipment requiring either electricity or battery for its intended or unintended use. Population, urbanization and the rapid rate,

at which technological advancements are taking place, are key factors in the sudden sharp rise of the problem of e-waste.

With the country already struggling to dispose the 1 lakh MT of municipal solid waste every day, the ever increasing e-waste adds to this burden. Over the past decade, small and large e-waste processing facilities have sprung all over the country. There are two significant recycling technologies of e-waste - hazardous and non-hazardous technologies. The informal ways of disposal which result in exposing environment to the hazardous substances is appropriately named as hazardous Technologies or methods. The technologies which safeguard the environment and do not release harmful substances to the environment are named as non-hazardous technologies. With the colossal and indispensable usage of lead acid batteries in power supply units, industries, automobiles and various other sectors, the production of lead acid batteries has also increased. Lead being a heavy metal, it poses health hazard to communities residing near facilities handling lead. Both formal and informal recycling methods are available and have been practiced all over the world. However, cheap and informal techniques are more prevalent in developing or under developed countries. Recovery of these materials depends on the specific equipment that these materials are present in. The specific recycling technique to be adopted depends on the materials of interest for recovery. In general, the recovery process usually follows three steps namely pretreatment, followed by a physical treatment and ends with a chemical treatment process. Pyrolysis and gasification are typical examples of chemical treatment of e-waste.

Recycling Techniques

The process of recycling e-waste is a mix of pretreatment and physical processes. The incoming material is firstly sorted according to their category and then dismantled manually into separate components such as cables, PCBs, plastics etc. This forms the pre-treatment part of the process. The dismantled material is then passed over a conveyer belt to a shredder. The pieces are reduced to a size of 2-3 inches. This is then granulated to get pieces which are about 0.5mm in diameter. The output is fed to a cyclone separator which is used to trap light dust particles while the heavy particles settle down. Lighter particles are passed to a dust collector which uses his dust collector is capable of trapping dust as small as 100 microns and comprises. Residual dust is collected and sent for land filling at regular intervals. The last process is that of an air classifier which is used to separate particles with greater density from the lighter density particles like plastics. The heavy particles are then subjected to a gravity separator which is based on the principle of specific density of different metals. Materials are separated based on their relative movement in response to gravity. The separation is also based on their size. The output of this process are separated Aluminum, Copper and mixed metals. The mixed metals are

leached by pyrometallurgy process. The precious metals like Gold, Silver, Palladium and Platinum are extracted from this process. The purity of metals recovered is 99.9%..

Economic globalisation, innovative and easy access to technology has changed our lifestyle by providing us with electronic products which are used limitlessly to make our daily life more communicable and comforting. But, this unrestrained usage of electronic products has to lead to the huge generation of e-waste. People, even today, are unaware of what exactly should be done with this e-waste. So, at the same time, awareness and right management are needed.

A Brief look into use of Wetlands for Waste Water Treatment

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&

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Use of wetlands for wastewater treatment offers a low cost alternative to conventional treatment methods. Natural wetlands are areas covered by either salt water or fresh water either seasonally or perennially containing plants and vegetation and microbial activity which thrive in submerged or partially submerged conditions. The plants act as sieves for the water flow and in a way act like kidneys of the landscape and have the capacity to purify the water before it enters the receiving water ways. Constructed wetlands(CWs) on the other hand are artificial systems created for waste water treatment and a variety of engineered systems are used throughout the world. They are classified according to the flow regime into either free surface flow or sub surface flow systems. Sub surface constructed wetlands are designed to keep the water level below the surface of the filter bed. Subsurface flow CWs do not have open water bodies; therefore they do not encourage mosquito breeding. Subsurface flow CWs produce clear water, whereas ponds have a high algae production which influences the effluent quality. Due to their open water surface, mosquitoes and odour, ponds are much more difficult to integrate in an urban neighborhood. Constructed wetlands are often referred to as simple and low technology systems, but the biological physical and chemical treatment processes involved are far from simple. These systems utilize the capabilities of plants, soils and the associated microbial populations to degrade and immobilize waste water contaminants. Removal of contaminants takes place by plant uptake, microbial degradation, filtration, chemical precipitation and sedimentation.

Wetland systems are designed around emergent aquatic plants and are of two types namely, floating aquatic plants or submerged aquatic plants involving either subsurface flow or free water surface flow. Floating aquatic macrophytes have their photosynthetic parts at or above the water surface with their roots extending down into the water column. They draw carbon dioxide and oxygen from the air but depend on the dissolved constituents of water for all of other nutritional requirements. Under anaerobic conditions they transport oxygen to their roots for metabolic purposes. Excess oxygen is then available to the surrounding media. When the roots are within the water column they act as living substrates for the attached aerobic bacteria which use the excess oxygen to degrade the dissolved organic matter.

Primary goal of an aquatic plant system is to protect the public health and to prevent damage to environment at affordable sustainable cost. The ability of various plant systems to meet these requirements will determine whether they are practical as components in a treatment facility. Several aquatic plants are studied and used in waste water treatment systems and the most common are water hyacinths or duckweeds. Water Hyacinth is the largest of the known highly productive aquatic macrophytes,characterized by a very fast growth rate, eminently suited for waste water treatment. It has a high eavapotranspiration loss, almost three to four times the evaporation rate of exposed surface e water. It is difficult to control and is generally considered a costly pest. Its growth rate could be even higher in nutrient rich waters. The size and density of roots of this plant are of interest because they provide majority of absorption sites for dissolved constituents and act as a living substrates for aerobic microbial population which provide degradation of organics in the treatment scheme. It can grow in waters of pH 4 to 10. Apart from water hyacinth, water lettuce, pennywort, duckweed and water fern are some of the aquatic plants studied for waste water treatment. In general plants which are considered noxious weeds in natural waters are usually worth considering as plants for waste water treatment because they are already acclimatized to the local conditions. Water hyacinth systems are capable of removing high levels of BOD, suspended solids (SS), nitrogen and refractory trace organic matter and phosphorus to some extent. The macrophytes used in such systems act like algae in oxidation ponds by transferring oxygen to the bacteria performing the degradation or they may also provide removal of contaminants by incorporating them in plant tissues.

Some plants are also capable of absorbing substantial amounts of metals and dissolved organics. The organics are destroyed by the plant's metabolic activities while the metals are not degraded but are usually stored within the plant tissues. Aquatic plants have the same nutritional requirements like terrestrial plants but they have adopted their metabolisms to the aquatic environment. They not only provide treatment by taking nutrients and dissolved constituents into their systems but also provide a growing surface for the aerobic microorganisms which contribute to treatment. Constructed wet land systems could be used for a variety of applications such as municipal waste water treatment, treatment of household waste waters or grey waters, tertiary treatment of effluents from conventional waste treatment plants and similar other applications.

The operator of the aquatic plant based waste water systems must be familiar with not only waste water treatment but also of the plants used. He should be knowledgeable about the needs of the plants to do what is required of them, the pests they are susceptible to and how to control them. Most of the plants used in treatment may indulge in luxury uptake of nutrients such as iron. Because of this, addition of limiting nutrients may be required in lagoons that are third or fourth in a series of aquatic plant lagoons. In systems where phosphorus and metal removals are expected, harvesting is the only pathway for permanent removal of these constituents.

Harvesting is also desirable to ensure healthy vigorous population and to control pests. Systems using water hyacinth or water ferns would become eventually crowded forming suds. Sud is a floating mat of partially decayed plant matter. Once this happens, all the nutrients and contaminants would return back to water. Complete removal of suds is required. Depending upon the design of the system, such units require periodic draining and removal of benthic sludge. Unprotected aquatic plants are limited in their range of year around operation They do not survive extreme cold climates. From public health and environmental view point, natural treatment systems suffer the drawback of exposing the public to waste water contaminants as compared to conventional mechanical or chemical treatment systems. But such systems need to be fenced and protected from encroachments. The capital costs of subsurface flow CWs are highly dependent on the costs of sand since the bed has to be filled with sand. Secondly the capital costs are also dependent on the cost of land. They have significantly lower operation and maintenance costs compared to high-rate aerobic processes for energy use and operator time.

SMART ENVIRONMENTAL AND WASTE MANAGEMENT

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In the present day global scenario, environment and waste are frequently used words be it the boardroom of a company or the kitchen of a house. The growing

awareness towards waste handling and waste management has resulted in scientific approaches being implemented at all levels. Household and corporates struggle to achieve their environmental goals.

Waste and assets are two sides of the same coin. Both come at a cost. Companies, factories and households all work towards reducing certain type of wastes as they directly are related to costs/ savings but largely the companies reduce or manage their waste due to regulatory mechanisms. Reducing waste / costs saves the environment too. In some projects, waste reduction or waste recycling is inbuilt into their system design and operations, while in some it is a standalone system. The former integrated approach is more preferred and usually is less labor intensive. The waste or pollution can be tackled by either the Primary Abatement principle (do not allow to form/ reduction at source) or Secondary Abatement principle (treat the effluent). Let us shift our focus on Corporate strategy towards Environmentally Acceptable Sustainable development and operations.

The concept of waste management can be broadly categorized at Micro level (people related/ actions) and Macro level (companies / decisions). Any management revolves around the Plan-Do-Check-Act (PDCA) cycle and so is in waste management. The first step is to clearly define the objectives of waste management. The objective must be SMART.

The organization has a choice of selecting one or many of the **Specific** pollutants and quantify the same (**Measurable**). Then a goal must be set to minimize it or eliminate it and the job must be **Assigned** to a team or individual, empower them with resources. The targeted aspect must be **Realistic / Relevant** to the business and must have a positive environmental impact. Lastly the goals set must be achieved within a specific time frame i.e. **Time Based**.

Choice is to first choose the low hanging fruits: Easy targets. Once set goals are achieved, then slowly escalate the

challenge. Another approach is to target the smaller issues. Whichever be the method used, the organization must evolve and identify all aspects and put in a plan to mitigate negative impacts over a time period. The approach of the company is not only complying with the regulations (compliance) but create proactive and SMART goals and work on Beyond Compliance. It must train and educate its employees and make them believe in the EMS. Active participation of all employees: top to bottom is required to set and achieve the target. Only then the true GREEN approach can be seen and sustainable development can be achieved.

SMART Case Study:- Anglo-Eastern Maritime Academy is a Maritime Academy training 440 cadets in the outskirts of Mumbai. It started with education and training of staff followed by Waste segregation.

SPECIFIC: -With an intention to reduce plastic waste and move towards the Zero Waste campus, the initiative was taken to reduce and eliminate plastic. The job was easier said than done.

MEASURABLE: - The first task undertaken was to scan the dustbin (bottoms up approach) and categorize the plastic waste and their sources. Another approach was to scan the requisitions and find the items that have been ordered by the campus. (Top down approach). From the analysis, two items are picked up.

bigger issues first and then focus on

- Pens ordered in stationary were numbering 1600 against refills 200 units.
- Canteen dustbins generated 0.4 m^3 of plastic waste every day (Tetra Packs and Wafers and biscuits wraps)
- Vendor supplying Clothes and other items used the Plastic wrapping on them

Both the identified items were targeted in different ways meeting the SMART objectives.

ASSIGNED:- The persons who were operating in the concerned area with maximum influence on the process were briefed and the responsibility given to them. Target was set and the plan to achieve the target was discussed.

REALISTIC:- The target has to be realistic and total ban on the product was not feasible till alternates were found. Hence the objective was set to realistic value for the first phase.

TIMEBOUND:- An initial plan was drawn up and three months were decided to be enough to meet the set targets based on the resources available at that point of time.

We are glad to inform that the targets have been met and the PDCA CYCLE has taken its course as the feedback gained from experience upto July is instrumental in deciding our goals/targets for next phase. Target for second half of 2018 is shortlisted as e-waste and batteries.

Stage 1 :- Easier goals set

Specific	Measurable	Assigned	Relevant /Realistic	Time bound	Remarks / Action Point
PENS	1600 TO BE REDUCED TO 100	Stationary in charge and Purchase Manager	Being an educational institution, the pens are useful commodity and it cannot be banned. Hence a realistic target is set.	By 1st July 2018	Order refills. Finds alternates to Pens. Educate the public on plan to reduce.
PLASTIC WASTE IN CANTEEN	0.4 M3 TO BE REDUCED TO 0.1 M3	Canteen Manager and House Keeping	The stage wise approach was both on Primary and Secondary abetment as more vendors who supply in plastics are to be also targeted.	By 1st July 2018	Stock Glass bottle drinks instead of Tetra Pack. Reduce plastic wrapped products. Minimize generation first to 0.1m2 per day. The collected waste plastics to be sent to identified plastic recycler.
PLASTIC COVERS ON DRESS AND CLOTHES	3600 WRAPS PER YEAR MINIMUM	STORE IN CHARGE	New supplies to be wrapped in paper and not plastic	By 1st June 2018	Vendor briefed not to bring new clothes delivery in plastic and store keeper to check before accepting delivery

Swachhata Hi Seva

Cleanliness drive and Rally Event on 26-09-2018 From SIES, Nerul Campus

Students and Faculty/non-Teaching staff of South Indian Education Society Indian Institute of Environmental Management (SIES IIEM) contributed actively to the 'Swachhata Hi Seva' campaign on 26th of September 2018. This has been initiated by Honourable Prime Minister of India, Mr.Narendra Modi to create awareness on cleanliness in the country- fond dream of Mahatma Gandhi. This event was jointly organized with Navi Mumbai Municipal Corporation. It was sponsored by Novvo Craze and Trendz.

The event 'Swachhata Hi Seva' started with a meet of participants at AV Hall of Arts, Science and Commerce College of SIES, Nerul campus. Welcome address was given by Dr.Seema Mishra, Director of SIES IIEM followed by the Principal of SIES Arts, Science and Commerce College, Dr.Milind Vaidya. Students of M.Sc. (1st semester), Ms.Zaara Hasnain and Ms.Nikita Ubbu gave a presentation on the importance of waste management and cleanliness. Everyone present took the Cleanliness Pledge read by Dr. Devayani Savant for spending two hours per week for activities related to cleanliness at personal, society, community and city level.

After the meeting, a rally was organized from SIES, Nerul campus to Palm Beach Road entry point at sector-6 covering two kilometers distance. In this rally, SIES IIEM faculty/non-teaching staff and students from NSS and Rotoract club of SIES Arts, Science and Commerce, Nerul, PGDPM,PGDBM, students of SIESCOMS had joined enthusiastically. There were a total of 66 participants in the event. Mrs. Jayashri Adhal from NMMC also joined the rally. The participants in the rally carried placards and banners about cleanliness.

Ms.Shweta Waghpanje, student of SIES IIEM along with some volunteers approached shops on the way and sensitized the owners about waste management and cleanliness.

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NMMC had arranged dustbins for waste collection along the route.

As Gandhiji rightly said “You should be the change you wish to see in the world”. **It is our duty to keep our country clean!**

VALUE LAB

SIES is aiming for achieving ‘One of the Most Admired Institutions’ status in the country and formulated Mission Document for achieving the same. As a part of it, it has created ‘Value Lab’ for discussion and debate on different values to be imbibed by all the members of the Institution, especially students. At SIES IIEM also, we have already conducted two debates under VALUE LAB in the last few months. They were on the themes ‘Punctuality and Time Sense’ and ‘Education and its Significance’. Students and all members of SIES IIEM participated actively in the debates.

Report on International Conference on Plastic Recycling & Waste Management, Opportunities & Challenges

The students of SIES IIEM participated in the 1st one day International Conference on Plastic Recycling & Waste Management Opportunities & Challenges, organized by Indian Centre for Plastic in the Environment (ICPE) at the Hall of Culture, Nehru Centre, Worli, Mumbai on Thursday, 27th September, 2018.

In his keynote address, Mr. Vipul Shah, COO, Petrochemicals, Reliance Industries Ltd. spoke on Circular economy in Plastic waste management and innovations at Reliance Industries such as plastic waste to fabric. He stressed on "segregation being the need of the hour", and that "we should use technology to cleanup what is already created in terms of waste."

In the first technical session on 'Innovative ideas for Plastic Recycling', Mr. Edward Kosior, MD , Nextek Ltd. addressed on meeting the challenges of plastic waste management and the European strategies and technologies to reduce the use of water, energy and human error in plastic waste management and recycling.

"Plastic Man of India", Padmashri Dr. R. Vasudevan, citing his own innovations, said that no plastic is waste and can be used for different applications such as road making. building materials, roofing materials and corrosion resistant rods. Mr. A. P Singhal from JB Ecotex talked about the recycling of packaged drinking water bottles for making polyester textile material.

Mr. Ulhas Parlikar, ACC Ltd., talked about the use of non-recyclable waste plastics and other combustible non-hazardous waste as supplementary fuel in ACC Ltd. furnace operations.

In the second technical session on successful models of plastic waste management, Mr Sandeep Patil, from NEPRA spoke about Value Chain Management in waste management, especially plastic waste and Extended producer Responsibility (EPR). Mr. Thomas Berlingen, EREMA talked about EREMA's technology development for plastic waste recycling and reuse that includes machines for making odour free recycled product for reuse, preconditioners, cutter compactor, pelletisation, biopacks, etc.

Mr. Milind Chavan and Mr. Shashibhushan Mishra from Dow chemicals presented on the initiatives towards sustainable management of waste and circular economy. They stressed on the company's policy in decrease of food waste and material use, increase in the recyclability of flex packaging and value recovery from the materials. They explained what they call the Dow Packaging Redesign Toolbox model to compartmentalize waste and create recycle ready technology.

TECHNICAL SESSION IN PROGRESS

In the panel discussion, Mr. Ravi Jashnani, from Maharashtra Plastics Manufacture Association, talked about the unfairness of the abrupt ban and its consequences to the manufacturers, factories and their labour and the inconveniences to the general public. He echoed the opinion of other panelists about the need for managing plastic waste and not banning plastic production. Mr. Rahul Podar from Shakti recycling spoke about his decades old recycling business and its evolution in terms of efficiency, effectiveness, job creation and their latest venture on waste to product development.

SIES IIEM STUDENTS WITH 'PLASTIC MAN OF INDIA' –Dr. RAJAGOPALAN VASUDEVAN

Report on Documentary film screening on Marine Plastic Pollution at US Consulate, Mumbai

On Saturday, 29th September 2018, U.S.Consulate General, Mumbai organised a documentary film screening on the topic "A Plastic Ocean: We need a wave of change". Around 50-60 people from different colleges and backgrounds including SIES IIEM students actively participated in the screening.

The movie focused on the hot topic of 2018 i.e. Plastic. It showed all the harmful effects of pollution on marine animals and also migratory birds. Emphasis was given to Marine pollution. The heart wrenching video displayed the scenario of plastic pollution and its manifestation upon us since ages. Unknown types of plastics like toxic Micro plastics, Plastic pellets were discussed in detail in the screening. Inside of a dead bird, around 234 pieces of plastic were found which weighed around 6-8 kg. Not only birds but also marine organisms consumed plastic and were found with plastic inside their body. Fishes got entangled in the plastic which led to their death. Various scenarios where plastic was mistakenly consumed as jelly fish by turtles were shown. Apart from them even humans were shown with adverse effects of plastic by inhaling or consuming microplastics. Hormonal changes, endocrine disruptions, pulmonary diseases, emphysema and also adverse effects were seen on pregnant women ultimately also causing cancer .

The movie also showed how 1500 tonnes of garbage, mainly plastic, was collected daily. Rapid production of plastic and its heavy usage has caused huge deposition of plastic all over the planet. This plastic takes 1000s of years to degrade and is getting accumulated largely whereby it was estimated that by 2050 we may by weight have more plastics than fishes in the world's oceans. To get rid of this plastic, many people were shown burning plastics which also releases harmful and very toxic chemicals into the environment like nitrogen oxides, sulphur dioxide, volatile organic chemicals, etc.

SIES IIEM DEDICATED TO ENVIRONMENT MANAGEMENT THROUGH R & D AND OUTREACH ACTIVITIES

ABOUT SIES IIEM

- SIES IIEM was established in 1999. It has been contributing in the fields of R&D activities and Academics in the areas of Environment Management and Biotechnology.
- IIEM is recognized by Department of Scientific and Industrial Research for research activities and has successfully completed various research projects with funding from DST, BRNS, DBT, ICMR, MOEFCC, MMREIS and several other agencies.
- IIEM also conducts consultancy services, organizing seminars, workshop and providing community service through research and creating awareness.




INFRASTRUCTURE AND FACILITIES

State of Art Facilities to conduct R & D and consultancy in the areas of Environmental Science and Management. Laboratories are equipped with the advanced equipments (HPLC, AAS, GC, HVS etc.)

CONSULTANCY SERVICES

GREEN MANAGEMENT

Environmental Monitoring and Analysis

- Water, Soil, Air, Waste
- Eco-toxicity studies

Conservation of Resources and Biodiversity

- Eco restoration of Resources
- Biodiversity mapping and indexing

Waste Management

- Wastewater management for zero discharge
- Solid waste management
- Industrial sludge management
- E- waste management

Expertise in:

- Advanced oxidation processes
- Aerobic and anaerobic processes
- Bio- and phyto- remediation

EIA and Sustainability Solutions for Mitigation of Climate Change Vulnerability

GIS based Environmental Planning and Management

- Natural resource mapping
- Groundwater recharge study
- Site selection
- Database management

GREEN COMMUNICATION

Providing CSR Solutions for Environment and Society

- Environmental Education
- Training and Awareness programme
- Water audit and energy audit
- Carbon footprint mapping
- Capacity building
- R&D proposals and report writing
- Events – workshops, seminars and conferences

Areas of Research	Specific Areas
1. Total Water Management	1. Purification of drinking water by using low cost techniques. 2. Management of nitrite contaminated wastewater 3. Textile wastewater management. 4. Phytoremediation. 5. Oil spill management by biosurfactants. 6. Management of brine generated from water purification technologies. 7. Assessment and management of marine pollution
2. Solid Waste Management	1. Management of industrial waste. 2. Management of MSW and other solid wastes. 3. Management of agro- residue.
3. Applied Biotechnology	1. Utilization of biofertilizers and biopesticides in soil fertility management and agriculture. 2. Exploitation of beneficial microorganisms in remediation of heavy metals, oil pollution etc.
3. Management of Natural Resources	1. Pollution monitoring and management 2. Ecorestoration. 3. Studies on Climate Change. 4. Biodiversity Studies. 5. GIS & Remote Sensing

MAJOR FUNDING AGENCIES

- Ministry of Environment Forest and Climate Change
- Department of Science and Technology
- Department of Biotechnology
- Board of Research in Nuclear Sciences
- Indian Council of Medical Research
- Mumbai- Metropolitan Region- Environment Improvement Society

OUTREACH ACTIVITIES

Disclaimer:

Editors have taken utmost care to provide quality in this compilation. However, they are not responsible for the representation of facts, adaptation of material, and the personal views of the authors with respect to their compilation.

Climate and growth Economists win Nobel

William Nordhaus and Paul Romer of USA win this year's Nobel Prize in Economics for research on how climate and technology affect the economy. The Royal Swedish Academy of Sciences said they had addressed some of our time's most pressing questions on how to achieve sustainable growth.

Source: BBC News, 8 October 2018

Champion of the Earth Award to Prime Minister of India

United Nations conferred the Champion of Earth Award to Prime Minister Mr. Narendra Modi for his pro-active steps to arrest climate change in the region and world.

Source: United Nations 03 October, 2018

'Year of extremes' for shrinking Swiss glaciers in 2018: study

Despite an exceptionally snow-filled winter, Swiss glaciers have lost 2.5% of their volume this year according to a report which dubbed 2018 a year of extremes. This year's record-breaking temperatures have greatly contributed to the loss of " a fifth of (the glaciers) volume over the past decade", according to annual study on the state of the glaciers, published by Swiss Academies of Science.

Source: The Economic Times, October 16, 2018

2018 Is Shaping Up to Be the Fourth-Hottest Year: Yet We're Still Not Prepared for Global Warming

This summer of fire and swelter looks a lot like the future that scientists have been warning about in the era of climate change, and it is revealing in real time how unprepared much of the world remains for life on a hotter planet.

Source: The New York Times, August 9, 2018

Worst yet to come? Kerala rains match climate change forecasts

Once- a-century rains that have pounded Kerala and displaced 1.3 million people are in line with the predictions of climate scientists, who warn that worse is to come if global warming continues unabated.

Source: AFP, August 25, 2018

Parties to Montreal Protocol take up urgent responses to CFC-11 emissions

Delegates, representatives,civil society groups, implementing agencies and industry stakeholders gathered in Vienna in July, 2018 for the 40th Open-Ended Working Group of the Montreal Protocol. Addressing reports of a persistent rise in ozone depleting CFC-11 emissions, Executive Secretary of UN Environment's Ozone Secretariat, opened the meeting with a reminder that the world now looks to the Montreal Protocol for answers and action. We cannot relax our vigilance for a second. Any illegal consumption and production of CFC-11 demands decisive action"- said UN Executive Secretary.

Source: UN Environment 16 July, 2018

Forthcoming Events

Students' Fest 'PRAKKATHAN' on 26-10-2018 and National Conference on Geoinformatics in Water Management on 01-12-2018(Details in the Newsletter)

Articles, photos etc. are invited for next issue (October-December, 2018) of the Newsletter on the theme ''Geo-spatial Technologies for Environment Management"

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