# THE ENVIRONMENT MANAGEMENT

A Quarterly E- Magazine on Environment and Sustainable Development

SIES Indian Institute of Environment Management
RISE WITH EDUCATION

पर्यावरणो रक्षति रक्षिताः

**Vol.: I** **October - December 2015** **Issue: 1**


## Current Issue: Environmental Monitoring and Assessment for Pollution Control

**A View of Marine Pollution Monitoring**

Photo Courtesy: Mr. Sunil Belvekar, SIES- IIEM Alumni (PGDSEM 2013- 2014)

## CONTENTS



Earth provides enough to satisfy every man's need, but not every man's greed.

## From Director's Desk

### SUSTAIN ENVIRONMENT FOR SUSTENANCE

Urbanization and industrialization are prerequisite for economic development that inevitably increases the consumption of natural resources and the pressure to protect ecological environment. The environment and economy are two different perspectives, but affect each other positively as well as negatively. To address the paradox between economic growth and sustainability of the environment, we must find radical solutions for balance between development activities and utilization of natural resources. In this regard, environmental pollution monitoring and assessment play crucial role in the sustainable management of resources. A deliberation on current environmental monitoring and analytical techniques is necessary for their assessment and policy planning.

To commemorate the theme of the National Conference on 'Environmental Monitoring, Assessment and Pollution Control' SIES - Indian Institute of Environment Management is launching a quarterly magazine entitled 'The Environment Management' with a tag line 'पर्यावरणो रक्षति रक्षिताः' that signifies 'Sustain Environment for Sustenance'. The magazine aims to share latest knowledge, perspectives and news in the areas of environment and sustainable development to bridge gap between researchers, academicians, students and common people.

**Dr. Seema Mishra**

# Monitoring and Analysis of Pollutants for Sustainable Environment Management

**Seema Mishra**
**SIES - Indian Institute of Environment Management,**
**Plot- 1E, Sector- V, Nerul, Navi Mumbai, 400706**

Environmental pollution is not a recent phenomenon. During prehistoric times pollution was started with the first fire, metal forging and mining. However, due to less volume, it was easily assimilated in the system. Industrialization and urbanization have increased the exploitation of natural resources beyond their carrying capacity that intensified the magnitude of pollution in all the spheres of environment. Currently, level of pollutants over time decides the quality of life in any country. In abatement of environmental pollution, monitoring and analytical techniques have played important role and provided scope to researchers and engineers for research in the areas of pollution control and environment management.

Monitoring and analytical techniques are two powerful tools in environmental pollution control which can provide technology required for reliable evaluation of state of pollutants and their management. Pollution monitoring and assessment techniques have taken a new leap with the development of real time environmental monitoring systems. Current trends in environment monitoring systems in different spheres are discussed in this article.

## Water Pollution Monitoring

In water quality monitoring simply determining the presence of pollutants is often insufficient. Accurate determination of concentrations, speciation or sources can all be critical information to determine, for example, drinking water safety or identify the origin of pollution. Major pollutants in water include pathogens, organics and inorganics. In organic and inorganic pollutant hazard assessment, dose response assessment and exposure assessment are some of the qualitative and quantitative method that provide detail information on water quality. With the onset of molecular technology, monitoring of pathogens has become very easy. Computerization, automation and robotization of monitoring systems with biosensors and detectors have enhanced the detection limit of instruments used for monitoring and assessment.

## Air Pollution Monitoring

Air pollution can influence human health due to the fact that the atmosphere is a good carrier of pollutants, starting from gases, such as $SO_2$, $NO_x$, volatile and semi - volatile organic compounds, aerosols to particulate matter etc. It is related not only with geographical and meteorological conditions but also with their stability characterized by their lifetime. The different aims of analysis (real time or selective; indoor or outdoor) and the necessity of getting the desired information require the application of specific sampling techniques and methods for final determination.

## Soil Pollution Monitoring

Soil contamination by naturally occurring and anthropogenic organic and inorganic chemicals is a serious human and environmental health problem in many industrialized and agricultural lands. Several approaches to soil contamination monitoring include chemical, geophysical, and biological techniques. Chemical techniques are used to measure specific organic, inorganic, or radioactive contaminants in the soil using instruments such as a gas chromatograph, atomic absorption spectrometer, or mass spectrometer. Geophysical techniques examine changes in physical properties of the soil and the contaminants to address large areas of soil contamination. Biological techniques use organisms as indicators of soil contamination, or byproducts of contaminant biodegradation processes to monitor or predict changes in soil contaminant concentrations over time.

## Human Biomonitoring for Environmental Pollutants

For epidemiologists to correlate environmental pollutants with health problems, they need to know who has been exposed and at what level. This knowledge is exceptionally difficult to gain when there is a lag between exposure and the manifestation of illness. Biomonitoring measures the actual levels of suspected environmental chemicals in human tissues and fluids, including saliva, semen, urine, sputum, hair, faeces, breast milk, and fingernails. Sensitive and specific biomarkers are available for many environmental chemicals, including metals, dioxins, furans, polychlorinated biphenyls, pesticides, volatile organic compounds, phthalates, phytoestrogens and environmental tobacco smoke.

Monitoring and analytical techniques indeed play crucial role in the pollution control and environment management especially at policy and planning level. The composition, concentration and complexity of pollutants vary in different media, phases and time. It is imperative to strengthen research and dissemination of new technologies for better management of pollution.

# A Perspective on Integrated Water Management in Indian Context

**V. Ramachandhran**
**Ex. Associate Director, SIES - Indian Institute of Environment Management**
**Plot- 1E, Sector- V, Nerul, Navi Mumbai, 400706**

Integrated Water Management involves a coordinated approach to the development and management of water, land and related resources in order to maximize economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems. India sustains nearly 16 % of the world's population with 2.5 % of land area and is endowed with just four percent of global water resources. About fifty percent of annual precipitation is received in just about fifteen days in a year. Most of this water is not being brought to productive use, due to limited storage capacity. The groundwater level is declining at the rate of 10 cms per year. Over 70% of surface water and ground water resources are contaminated. Wastage of water, overexploitation of sub surface water resources, increasing level of contamination of surface water bodies and inadequate sewage treatment in both urban and rural areas are the major issues that threaten our water security.

Drinking water quality is major issue that needs extensive research as well as awareness generation. An exploratory study was conducted by SIES- Indian Institute of Environment Management, Nerul in selected villages of District Raigad, Maharashtra to ascertain the availability and sources of drinking water, their physical, chemical and microbial quality and the existing/ prevalent domestic purification methods. The physico- chemical parameter of drinking water from bore well was found to have minor variations in different seasons pertaining. In rainy season microbial contamination was very high. Microbial contamination was observed very high even in stored water. It depicts that awareness on not only drinking water purification is required among consumers but also on the storage conditions.

The agricultural sector consumes over 80% of water resources. The irrigation efficiency in India is barely 35%. Only 16% of farmers are aware of irrigation efficiency techniques. Improvement in water use efficiency in the agriculture sector would result in huge overall water saving.

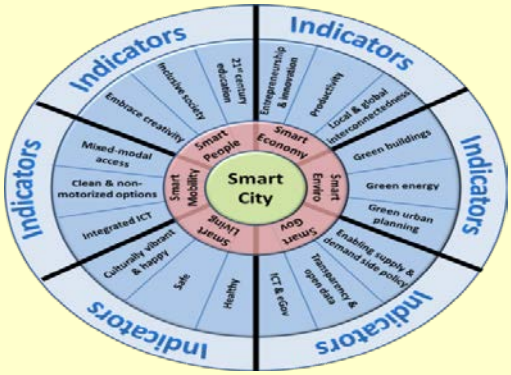
Water recycling is being practiced by various sectors in countries across the world, and to some extent in India, particularly in the industrial sector. However, we have to go a long way in the recycling and reuse of our municipal wastewaters. Storm water management is another serious issue in our country where heavy down pour is witnessed in coastal areas. Rain water harvesting, sewage recycling, desalination need to be promoted on a large scale. Water conservation is also an important issue which has potential application in all industrial operations.

Deployment of floating wetlands for remediation of surface water contamination is another interesting concept that requires extensive field study and engineering scale up. It is time India wakes up and takes a technological lead to ensure water security.

# Smart Cities: Sustainable Cities

**Devayani Savant**
**SIES - Indian Institute of Environment Management,**
**Plot 1- E, Sector V, Nerul (E), Navi Mumbai 400 706.**

The idea of a smart city dates back in 2008 when IBM started the Smart Planet Initiative. The vision is such a world where digital technology in sync with environmental friendly practices are harnessed to create smart sustainable cities with high quality living. A smart city includes its smart people, smart economy, smart mobility, smart living, smart government and smart environment. In short, smart cities pave way to efficient, eco-friendly and sustainable living.




**The Smart City Wheel (Source: Boyd, Cohen, 2011)**

The population of India is set to double in the next 70 years. We need at least 300 more cities to accommodate the increasing population. With this view, the government has launched the Smart Cities Programme this year. The government has declared the mission of creating 100 smart cities across the nation based on better technology, superior management and modern governance. A huge budget of 100,000 crores has been allocated to this project.

The indicators for smart environment are green buildings, green energy and green urban planning which includes good water management and waste management. Smart solutions for water management include introduction of smart meters and management, leakage identification and preventive maintenance and water quality monitoring. Smart solutions for waste management include waste to energy, waste to compost, treatment of wastewater and recycling and reduction of C &D waste. Relevant technologies have already been developed and implemented in some parts of the world. MK project is also trialling 'smart bins' which contain sensors that detect when public bins need emptying and send messages to the waste collection authority, with the intention of avoiding needless journeys. Sensors on public transport vehicles in Belgrade monitor a set of environmental parameters. A quality smart phone app – The AirProbe – is being used by hundreds of volunteers across Europe. IBM/AECOM's 'Smart Water Management System' which aggregates data from disparate sources, providing comprehensive, real-time, and system-wide views to improve detection of water leaks. In Glasgow, the remote control of street lighting to save energy has replaced 72,000 street lamps with LEDs and senses that has cut energy use by up to 60 %.These technologies are helping to create new policy tools by enabling policymakers to incorporate citizens' collective preferences as identified from social media data and then enabling citizens to directly influence city policy choices. For example Spacehive uses crowdsourcing and community engagement to identify and deliver investment in urban public spaces.

Despite all of these developments, however, there is little widespread evidence yet of smart initiatives making a significant impact on environmental problems as the environmental problems are not prioritized in Smart Initiatives. Without significantly increased incentives for investment in this direction the use of smart data and technology for solving environmental problems in cities will be eclipsed by the prospect of more money making and glamorous uses of such technologies concerned.

# Environmental Monitoring for Environmental Impact Assessment

**Sunil Belvekar**
**Goldfinch Engineering Systems Pvt. Ltd., Thane (M. S.)**

Environmental Impact Assessment (EIA) is an environment management tool used to evaluate and mitigate Environmental Impacts of any proposed project or development. Convention on Biological Diversity defines EIA as a process of evaluating the likely environmental impacts of a proposed project or development, taking into account inter-related socio-economic, cultural and human-health impacts, both beneficial and adverse. EIA study helps making project decisions to achieve environmental and socio-economic benefits.

In India EIA is a mandatory report for several projects to obtain prior Environmental Clearance from Ministry of Environment, Forest and Climate Change. EIA notification by MoEFCC gives guidelines for structure and content of EIA report. Based on these guidelines and Terms of Reference from Expert Appraisal Committee EIA report can be prepared.

One of the important aspects of the EIA report is Baseline data. It refers to analytical data generated after monitoring and analysis of Ground water, Surface water, Soil, Noise & Air environment in the surrounding region of the project site. Environmental impacts of the project can be estimated by studying technical aspects of the project such as Air emissions, Effluent quality, Noise, Soil quality etc. Baseline data presents current status of the environment in the study region which helps planning and designing the project to suit local environment and reduce adverse impacts on it. Moreover it also presents predictions and options to decision makers of the project.

Environmental monitoring for EIA involves sampling of Air, Water, Noise and Soil samples and its analysis. Sampling is done at various predefined and appropriate locations. In Air quality monitoring samples are analysed for estimation of level of pollutants such as Particulate matter, SOx, NOx, VOCs, $NH_3$, heavy metals etc. Monitoring of scrubber, incinerator and Boiler stack is done to determine emission contents. Air monitoring is done based on National Ambient Air Quality Standards notified by CPCB. Water monitoring is done to check various parameters such as pH, BOD, Salinity, Hardness, TSS, TDS, Sulphates, Nitrates, Heavy metals, Microbial study etc. are within acceptable limits. Soil monitoring gives an idea about quality of soil by analysing Texture, Porosity, pH, heavy metals etc. in it. Noise monitoring is essential to assess impact of noise arising from project activity on life in the surrounding region.

These various environmental aspects are considered and monitored during Impact Assessment as **"the quality of surrounding environment determines health of an ecosystem and the life inhabiting it"**. Comparison of environment quality before existence of any project with that after commissioning of project aids in making crucial decisions in advance so as to suit and support the Environment of prime importance, Social improvement and achieve Economic benefits.

# Monitoring of Climate Change Impact on Environment and Flood Vulnerability by GIS

**Saumya Singh**
**SIES - Indian Institute of Environment Management,**
**Plot 1 - E, Sector V, Nerul (E), Navi Mumbai 400 706.**

There is strong evidence that the climate is changing and will continue to change. Climate change leads to increasing frequency of extreme weather events and poses a potentially serious impact on worldwide water resources, energy production and use, agriculture, forestry, coastal development and resources, flood control and public infrastructure. Many scientists and researchers agree that unusually high rain fall due to climate change is a significant cause of floods. Flood not only causes economic and social damages but also cause damage to natural environment. It causes destruction of biodiversity and wetlands. Also, it causes mixing of wastewater (domestic or industrial) with fresh water. It also severely affects the number of people and infrastructure located in flood risk zones. However, climate change is not the only cause of floods. Anthropogenic activities also play a key role. Changes in land use, such as building houses on flood plains and paving over natural surfaces, are making people more vulnerable to flooding. A relatively rapid increase in temperature has been documented during the past century, both at Earth's surface and in the oceans. The average surface temperature for Earth as a whole has risen some 1.3°Fahrenheit since 1850. According to the Intergovernmental Panel on Climate Change ( IPCC), the atmosphere is about 0.75 degrees warmer than it was at the start of the century, which means it can hold 5-6 per cent more moisture. Rising sea levels present a clear threat to flood coastal areas

Therefore, it becomes important to formulate a flood management strategy. Stopping deforestation and reforesting upstream areas, by halting wetland drainage and restoring damaged wetlands, impact of climate change on flooding can be reduced. For formulating any flood management strategy the first step is to identify the area most vulnerable to flooding.

For the last two decades advancement in the field of remote sensing and geographic information system (GIS) has greatly facilitated the operation of flood mapping and flood risk assessment. GIS is a computer-based system capable of assembling, storing, manipulation and displaying geographically referenced information. Flood management is a multi- disciplinary endeavor requiring many types of data with spatial and temporal attributes that should be available to district administrators in the right format for decision-making. The volume of information needed for flood management far exceeds the capacity to deal with them manually and thus there is a need for GIS- based information system. GIS tool can be beneficial for getting all the relevant information at the time of occurrence of the disaster, and can help in planning, preparedness and management of flood in the study area. Various researchers have worked on issues like delineation of flooded area using satellite data and image interpretation techniques and only limited work is done on flood management strategy. Therefore, creation of spatial database for delineation of flooded area as well as identification of the area having higher hazard potential is important. This database will help in flood management aspect. Flood hazard maps are required so that it can be used meaningfully by planners and decision makers to formulate strategies to combat this natural hazard.

# Radioactive Waste Management

**C. Srinivas**
**SIES - Indian Institute of Environment Management,**
**Plot 1 - E, Sector V, Nerul (E), Navi Mumbai 400 706.**

Recent global summit on climate change in Paris stressed the need for urgent remedial action to keep global warming under control to save the planet. Global warming occurs because of the increase in the concentration of green house gases like carbon dioxide in the atmosphere. Compared to pre-industrial revolution time, present carbon dioxide concentration in the earth's atmosphere has increased several fold. This increase is on account of the burning of huge quantities of fossil fuels for power generation purposes.

World focus on exploitation of clean sources of energy is the need of the hour. Besides solar energy, nuclear energy is a clean and sustainable energy option, especially, for India. It does not contribute to global warming. India is one of the few countries in the world to have mastered the highly complex technologies covering the entire spectrum of nuclear fuel cycle, viz., uranium mining down to radioactive waste management. This is a result of its self-reliant indigenous effort for the last 50 to 60 years. India is fortunate to have abundant natural thorium resources for sustainable nuclear energy production in the third stage of the country's nuclear energy programme.

One important concern in the public domain for nuclear energy programme is the *safe management of radioactive waste* arising from nuclear facility operations.

Radioactive waste contains some radioactive materials which emit radiation (alpha, beta and gamma) depending on the material present in the waste.

Radioactive waste management is based on three *universally-adopted* scientific approaches: 1)Delay and decay 2)Concentrate and Contain 3) Dilute and discharge.

The first method, **'Delay and Decay'** is an unique feature of radioactive waste. If the radioactive material in the waste has small half life, the waste becomes practically non-radioactive and harmless if it is stored for some specific time depending on the half life of the material. No special treatment is required in such a case.

In the second approach, the radioactive materials, especially from large volume water medium, are separated and ***concentrated*** by suitable treatment such as ion-exchange, precipitation, vitrification, membrane processes etc. ***contained*** and immobilized in a small volume of highly leach-resistant solid matrix. The method chosen is dependent on the type of radioactive waste.

The third approach, **'Dilute and discharge',** is adopted for very low levels of radioactive waste water. The Indian and international regulations are so stringent that this approach is used only after removal of almost all radioactive materials from the water.

In conclusion, radioactive waste management is a well-demonstrated scientific and industrial activity with universally agreed regulations and practices in place.

## Environment in News Headlines

### Rivers are turning blue in Meghalaya, India

The Lukha river in East Jaintia Hills district and certain sections of the Myntdu river in West Jaintia Hills district have changed their colour to a bright sky blue indicating a very high acid content, resulting in death of scores of fishes. Although the colouration was first detected way back in 2007, no one has been able to find out the reason for the colouration. The Meghalaya State Pollution Control Board (MSPCB) in its 2012 report blamed acid effluents from coal mines as the major probable causes of water pollution in the area. The Lukha river had been included in the National Water Monitoring Program, and water samples had been collected periodically to conduct various tests.

Source: The Times of India, Nov. 18, 2015

### Climate change is moving mountains

A strong relationship exists between global and local climate change and the mountain's internal tectonic plate shifts and topographic changes. Geologist Eva Enkelmann from University of Cincinnati in US found that the way mountain range moves and behaves topographically can also change and create its local climate by redirecting wind and precipitation. The global climate change triggers a change in rheology- the way material behaves. While the Earth was much warmer millions of years ago, glaciers still existed in the higher altitudes. However, 2.6million years ago the Earth experienced a shift to colder climate and glaciations intensified. In Gulf of Alaska glaciers are moving aggressively eroding material around and out due to tectonic forces and sediment is piling up.

Source: Free Press, Nov. 7, 2015

### Global warming is reducing polar bear population

According to a report by the International Union for the Conservation of Nature (IUCN) global warming is now the single biggest threat to the long-term survival of the polar bear as a species. Polar bears live, breed and hunt on sea ice, but it's disappearing even faster than predicted. The IUCN says Arctic sea ice has been retreating at a rate of 14% per decade, from 1979 to 2011. The longer the ice disappears for in the summer months, the longer the bears have to go without food. These extended fasts can cause reproductive problems and starvation. According to projections, some parts of the Arctic could be ice-free for up to five months of the year by the middle of the century.

Source: The Independent, Nov., 21, 2015

### Green cess on polluting vehicle

National Green Tribunal (NGT) imposed additional tax burden on commodity vehicles entering National Capital to combat air pollution during a hearing in the Supreme Court, supported a plea for a crackdown on such trucks. The central and Delhi governments told the Supreme Court they could impose an additional levy and also mull a ban on the entry of commercial vehicles which do not have to deliver goods in Delhi.

Source: Express News Service, Oct., 9th , 2015



### Forthcoming Events

- Training programme on water quality analysis
- Regional seminar cum Training programme on waste management

**Articles, photos etc. are invited for next issue (January - March 2016) of 'The Environment Management' on the theme 'Natural Resources and their Management'**


Published by-

**SIES - Indian Institute of Environment Management,**
**Sri. Chandrasekarendra Saraswathi Vidyapuram**
**Plot 1 E, Sector V, Nerul(E), Navi Mumbai 400 706**
**Tel.: 022 6119 6454 / 55/ 56 ; FAX: 022 27708360 | E- mail:iiemoffice@sies.edu.in; Website:http://siesiiem.net**