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NESA

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APPLICATIONS ARE INVITED

FOR THE NESA AWARDS 2018

LAST DATE 30th SEPTEMBER 2018

(1) NESA FELLOWSHIP AWARD

ESSENTIAL

Professors/Scientist F and above

1. Research/Teaching experience of 15 Years or more.
2. Accomplished Research Work
3. Research publications in Journals with good impact factor.

DESIRABLE

1. At least 10 publications in journals with impact factor 3 or more.
2. Patents granted/Technology developed
3. Any award / recognition at National level.

AGE

45 and above.

The recipients shall get Citation, Certificate, Memento and a Gold plated medal, and can suffix F.N.E.S.A. after their names.

(2) NESA EMINENT SCIENTIST AWARD

ESSENTIAL

Professors/Scientist F and above or equivalent

1. Research/Teaching experience of 12 Years or more.
2. Accomplished Research Work
3. Research publications in Journals with good impact factor.

DESIRABLE

1. Atleast 10 publications in journals with impact factor 2 or more.
2. Patents granted/Technology developed
3. Any award / recognition at National level.

AGE

40 and above.

The recipient shall get Citation, Certificate, Memento and a Gold plated medal.

(3) NESA SCIENTIST OF THE YEAR AWARD

ESSENTIAL

Associate Professors/Dy. Director or equivalent

1. Research/Teaching experience of 10 Years or more.
2. Accomplished Research Work
3. Research publications in Journals with good impact factor.

DESIRABLE

1. At least 10 publications in journals with impact factor 1 or more with **proven record of achievement in that year**.
2. Any award / recognition at National level.

AGE

35 and above.

The recipient shall get Citation, Certificate, Memento and a Gold plated medal.

(4) NESA ENVIRONMENTALIST AWARD

ESSENTIAL

1. Associate Professors/Scientists/Professionals with significant contribution in the field of environment.

DESIRABLE

1. Any award / recognition in the area of environment at national level.

AGE

Up to 35 and above

The recipients shall get Citation, Certificate, Memento and a Gold plated medal.

(5) NESA GREEN TECHNOLOGY INNOVATIVE AWARD

ESSENTIAL

1. Scientists/Academicians/Social workers
2. Accomplished Research Work

DESIRABLE

1. Innovation in the area of green technology.

AGE

1. 35 and above
1. The recipients shall get Citation, Certificate, Memento and a Gold plated medal.

(6) NESA YOUNG SCIENTIST AWARD

ESSENTIAL

Assistant Professor/Research Associate/Research Fellows/any other PDF.

DESIRABLE

Active involvement in research with proven track record.

AGE : Up to 35.

The recipients shall get Citation, Certificate, Memento and a Gold plated medal.

PRESCRIBED APPLICATION FORMS

The application forms could be downloaded from **www.nesa-india.org**

Separate application form should be submitted for separate awards.

The application forms are non-transferable and it can also be obtained by sending sending a bank draft of Rs. 1000-00 / $40 only (per form). Drawn in favour of **NATIONAL ENVIRONMENTAL SCIENCE ACADEMY** payable at **NEW DELHI.**

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A CASE STUDY ON ENVIRONMENTAL DIOXIN INCREASE IN HARYANA: THREAT FOR HIGH CANCER RISK IN THE STATE

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Abstract
Strong evidences have emerged that food and environment are major causes of cancer in human population. Dioxins emitted from various industrial processes and Diesel combustion are proven human carcinogen, as per USEPA and ICRA. A case study of dioxin release from Auto-rickshaws, crude diesel generators, municipal plastic waste burning and industrial combustion was done in District Yamuna Nagar (having one million human population) of Haryana state in India. There is a regular incomplete combustion of 69,131,00 liters or 5599 Metric Tons (MT) of Diesel, annually, by Auto-Rickshaws & unapproved crude diesel generators used by the public and 15,330 MT of solid wastes and plastic burning every year, releasing total Dioxin emission more than 370 MT in the environment. Dioxin is such a dangerous carcinogen that 0.1 microgram per liter of air causes 10 cancer cases. What is more important that while smoke released by Industries is released above 30 feet but the smoke containing Dioxin released by auto-rickshaws, unapproved diesel generators, and municipal waste burning in open remains at lowest strata upto 10 feet where human population breaths more, thus inhaling even higher doses of dioxin per day. Out of approximate 400 cancer cases in the district, 209 cases are estimated to be due to dioxins alone! This district model of dioxin related carcinogenesis could be well extended to other cities of the state like Ambala, Kurukshetra, Panipat, Sonipat, Kaithal, Rohtak. Other cities viz. Varanasi, Lucknow, Ghaziabad, NOIDA, Bhopal, Agra, Kanpur, Puri, Dehradun etc., important either due to tourism, district Headquarters, mandies etc., where there are huge fleet of such polluting autos and stockpiles of unapproved gensets. The policy makers and pollution law enforcing agencies need to swing into action for absolute curb on emission of dreaded Dioxin in the environment. They need to realize that they also breath the same dioxin contaminated air that their fellow countrymen breath and Dioxin does not recognizes the rich or poor; powerful or week; very important person (VIP) or Common man!!

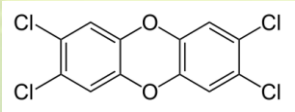
Key words: Dioxin, Environment, Cancer, Diesel, Plastic waste, Auto-rickshaw, Generators (Gensets), Industries, Municipal waste

INTRODUCTION:
5th June is celebrated as World Environment Day throughout the globe and United Nations has for the first time made India a global host for Environmental awareness throughout the country. This year's theme is "Forests: nature at your service" but the forests are ever decreasing. The national average forest cover percentage should be 33% of total land but is 19.47% and Haryana state has alarmingly low forest cover, just 6.83% !! On the other side, environmental pollution is fast on the rise creating a more vulnerable situation for the environment and public health. The trees those absorb CO2 by fixing into useful starch, are decreasing and in the air more and more toxic gases are released due to apathy of environmental law enforcing agencies- executive and legislature both.

District Yamuna Nagar is already facing severe pollution problems of soil, water, air and food due to more than 2500 industries are discharging toxic wastes in water, soil and air; the problem is aggravated by burning of municipal solid wastes in the open and in dustbins turning air more toxic to breath. A recent ambient air quality test done last year in the district showed that PM2.5 and PM10 were 300 to 400% higher than the standard ! More polluted than Delhi !! These are directly linked with burning of Plastic and solid waste, plastic waste and incomplete combustion of diesel and industrial emissions.

Material & Methods
Extensive surveys were done in and around the districts of Yamuna Nagar, Ambala, Kurukshetra and Panipat covering air, soil, water ecosystems. The pollution emission rates in various districts were personally observed and trends were analyzed. Though the focus was on air pollution, other pollutions were also taken in ambit of the study. Various agencies like district pollution control Boards, Health departments were contacted directly and through reports of local news papers. The annual reports of municipal corporations and pollution boards were base data sources for predicting the amount of different polluting agents released in the environment. The various research papers published by some eminent scientists in the state were also taken into considerations. The personal observation and collected information were interpreted with respect to facts on pollution established by various national and international agencies including United States of Environment Protection Agency(USEPA), United Nation Environment Programs (UNEP), Bureau of Indian Standards (BIS), Central Pollution Control Board (CPCB) etc. The review and hypothesis was made according to broad issues of pollution that are prevalent in the country and the State environment (Air, Water and Soil ecosystems including agri-foods).

Results and Discussion
What is Dioxin: Dioxin is a group of toxic chemicals that include- 2,3,7,8 Tetra Chloro Dibenzo Dioxin (2,3,7,8 TCDD); PCDD furans; polychlorinated Biphenyl (PCB) and others. These are not industrial chemicals but are by-products of many combustion and industrial processes.



Structure of 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD): The name dioxin formally refers to the central dioxygenated ring, which is stabilized by the two flanking benzene rings

Source of Dioxin: Usually it is concentrated in air, soil and food products. From soil it reaches to water bodies like river, ponds and then to agri-foods. Its concentration is very high in towns as compared to villages. The burnt material reaches soil and water bodies via run-off rainwater and mixed with industrial waste. Accumulation of water of different places create adverse impact on all the living organism and environment. Industrial sludge is more dangerous than industrial solid waste. These industrial discharges, various pollutants from pulp and paper mills, sugar mills, distilleries, metal processing industries, starch mills, tanneries, textiles, fertilizers and pharmaceuticals pollute the water, air and soil in Yamuna Nagar and Jagadhari (Sharma *et al.*, 2011).
Major producers of Dioxins in Environment-

1. **Solid waste combustion of municipal wastes**
2. **Combustion of Biomedical wastes**
3. **Cement Plants**

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4. **Coal Based power plants**
5. **Paper mills**
6. **Burning of Backyard wastes**
7. **Copper Industries**

The plastic and plastic like material polymers like plastic bottles, polythene bags, thermocols, rubbers, tire-tubes are one of the major environmental nuisances. While polythene bags are being banned in almost all the states of the country under Environment Protection Act, 1986, yet the goal has not been achieved in its full perfection as it is still being used and forms a major part of local municipal solid wastes. In Yamuna Nagar district alone, there is about 250 metric tons (MT) solid waste generated every day as per sources and estimates. Of this, plastic makes about 12% of total solid waste generated every day. That means on average 30 MT of plastic and related material is being generated every day in one district alone. If we sum up this data for all 21 districts of Haryana State, approximately 630 MT plastic and related materials generated. If we take into account the plastic materials being picked up by local scavengers who pick about 20% of plastic wastes from municipal dustbins, the plastic waste that remains in municipal waste dustbin is about 504 MT per day or 1,83,960 MT per year. Due to lack of sufficient scavengers and pick up vehicles, the solid waste is burnt as a remedy of disposal because it is not removed on daily basis that over burdens the local scavengers. The people find it easy to reduce their waste burden by burning but unaware of increasing the burden on environment by virtue of high doses of toxic gases in the air.

The dustbin having plastic plates etc. near SD public school, model town, Yamuna Nagar is converted to like a furnace burning day and night. The school is having hundreds of tender age children who are forced to inhale toxic smoke making them vulnerable for lung diseases. Nearby Wrangler showroom owners Mr. Rishipal and Shivam told that the smoke and carbon is throat chocking and lungs spoiling. We are falling sick due to this heavy smoke released day and night. It keeps burning several days. Our only rescuer is God Indra who extinguishes it by pouring rain and again some one lit it up. Earlier there was old dustbin but now new dustbin is also used as furnace. It may be seen in the photograph the thermocol/plastic plates all those are dumped and burnt. The plot and dustbin near Tilakraj Chadda Institute of Management (TIMT) college in model town are ever emiting toxic smoke and students and public pass by. Every morning there are ever visible clouds of smoke on Jagadhari workshop road from Kamani chowk to Fountain chowk. As seen in photo the dustbin was dumped with thermocol, polythene bags are charred to black matter after releasing toxic gases like Dioxins. It is established fact, that the solid wastes having thermocol, plastic, polythene and other matter when burn they release highly poisonous gas that contain very high percentage of Dioxins which is a proven carcinogen as per various International agencies. The open grounds and dustbins nearby bus stands and other places in Ambala, Kurukshetra and Panipat were also seen under fumes during the studies. In general, it appears a general practice in the entire Haryana state to burn solid wastes those are supposed to be treated and disposed as per Environmental Laws. Traditionally, plastics are degraded by different techniques such as land filling and recycling. However, biodegradation is the method of choice for degradation of plastic, due to various limitations of traditional methods (Jain & Kumar, 2011). Green chemistry is the key of protecting the environment by man-made hazardous materials and the processes used to synthesize new chemical products. By taking multiple interests, twelve principles of Green Chemistry may be used to recognize the value of green chemistry in environmental and economic sustainability, for achieving benefits to public health, resource conservation, non-pollutant friendly environment, workers health and global warming (Bala et. al, 2011). The main focus of green chemistry is waste minimization, prevention of environmental pollution, organic synthesis in aqueous and solid phase (Bhasin, 2011). The fly ash released from thermal power plants may be used in environmental pollution control (Sharma et al, 2011). It is estimated that as many as two-thirds of all cancer cases are linked to environmental causes (Sodhi, 2011). While passing through different developmental stages, prior to conception till adolescence, a child is most vulnerable to environmental contaminants compared to adults (Vaswani, 2011). This has been recently demonstrated in combined research of two laboratory in Italy and three laboratories of US that perinatal exposure to low doses of Dioxin can permanently impair human semen quantity in the sexually matured stage later in life (Mocarelli et al., 2011).The children's environmental health filed has grey areas. In these cases it is important touse a “better to be safe than sorry” approach and adhere to precautionary principle. Health concerns are related to either known or suspected links to environmental exposures. Lead, methyl mercury, volatile organic compounds (like Dioxins), pesticides and herbicides, various plastics etc. are some common pollutants while bisphenol A (BPA), poly vinyl chloride, phthalates, pesticides, persistant organic pollutants POP), poly brominated diphenyl ethers are emerging substances of concern. When an activity raises threats harm to human health or the environment, precautionary measures should be taken even if some cause and effect relationship are not fully established scientifically (Vaswani, 2011)

Dioxin is the Cancer worry

In natural air, it is only found in extremely minute dose i.e. 0.1 part per Trillion (1PPT or 0.0001 microgram per liter of gas or liquid) but the way solid wastes, plastics etc. are burnt illegally in the town, it is suspected that its concentration might be in several PPT. Tests could be done by air sampling. According to International Cancer Research Agency (ICRA), 2,3,7,8 TCDD is a proven carcinogen. US Environment Protection Agency (USEPA) has also declared it a human carcinogen that increases the risk of cancer in human population. Under experimental conditions, when 0.1 μg per day Dioxin is given to rats increases their rate of tumors by 1%. People are 100 times more sensitive to dioxin than rats and it is concluded that there is a risk of 10 additional cancers in every million people consuming/inhaling 0.1 microgram a day from various sources.

There are more than 2500 industries, 3000 autos and about 4000-5000 unapproved diesel generators emitting tons of gases. One auto consumes about three liter petrol and all emit about 8 MT gases daily. Diesel generators emit about 12 MT gases daily putting more burden on environment and public health. Buses, tractors and trucks, also major polluting sources releasing diesel exhaust, are not included in the studies for want of data.

As most of above sources are located in Yamuna Nagar and if solid wastes are not disposed as per standards, then rate of increase of cancer is the towns of Haryana is inevitable.

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Table 1: Liquid Fuel.

Polluting sources	Autos Rickshaw	Diesel Gensets
Fuel Used	Diesel	Diesel
Units/Numbers/quantity	2980	5000
Average Fuel used /unit (L or Kg)	3	2
Average Fuel used/day (L)	8940	10000
Fuel used per day (MT)	7.2414	8.1
Fuel used per year (MT)	2643.111	2956.5
Estimated Dioxin emission rate (%)	2.4	2.4
Dioxin Emission (MT per year)	63.435	70.956
Dioxin in microgram(ug)#	$63.43*10^3*109$	70.95*103*109
Area Yamuna nagar (sq KM)	1756	1756
Area Yamuna nagar (sq M)	1756*106	1756*106
Volume Air Yamuna nagar (cub M)	1756*106 *103	17560*106
Volume Air Yamuna nagar (cub L)	1756*106*103*102	1756*106*103*102
Dioxin (ug/L of Air)	0.361218679	0.040404328
Oncogenesis per million population$ (10 cancers per 0.1ug Dioxin)	36 Cancer cases	40 Cancer cases
Predicted Cancer in Yamuna Nagar	36 Cancer cases	40 Cancer cases

1 kg= 109 ug; 1MT = 103 Kg
$ Yamuna Nagar Population= 1.2 million as per sources (Rounded off to 1 million)

Table 2: Solid fuel

Polluting sources	Municipal wastes	Industries
Units/Numbers/quantity (MT per day)	250	200
Plastic Percentage	12%	150
Total Plastic/waste (MT)	30	30
Plastic collected by scavengers (MT) 60 %	18	NA
Remaining Plastic in wastes (MT) 40%	12	NA
Plastic in MC waste (MT per year)	4380	10950
Estimated Dioxin emission rate (%)	2.40%	1.20%
Dioxin Emission (MT per year)	105.12	131.4
Dioxin in microgram(ug)#	105.12*103*109	131.4*103*109
Area Yamuna nagar (sq KM)	1756	1756
Area Yamuna nagar (sq M)	1756*106	1756*106
Volume Air Yamuna nagar (cub M)	17560*106	17560*106
Volume Air Yamuna nagar (cub L)	1756*106*103*102	1756*106*103*102
Dioxin (ug/L of Air)	0.598633257	0.748291572
Oncogenesis per million population$ (10 cancers per 0.1ug Dioxin)	59 Cancer Cases	74 Cancer Cases
	59 Cancer Cases	74 Cancer Cases

Table 3: Dioxin and Cancer Cases

	Autos	Gensets	MC Wastes	Industries
Dioxin Emission (MT per year)	63.435	70.956	105.12	131.4
Cancer Cases per million population	36	40	59	74

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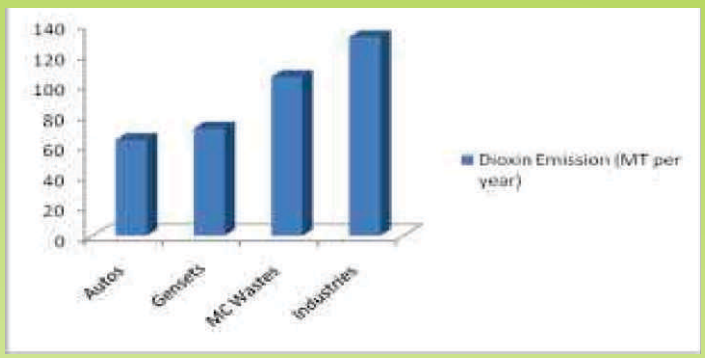

Fig. 1: Dioxin Emission (MT/year)

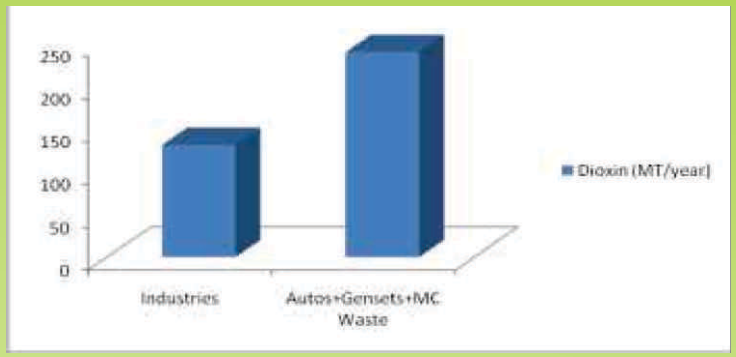

Fig. 2: Industries and other sources

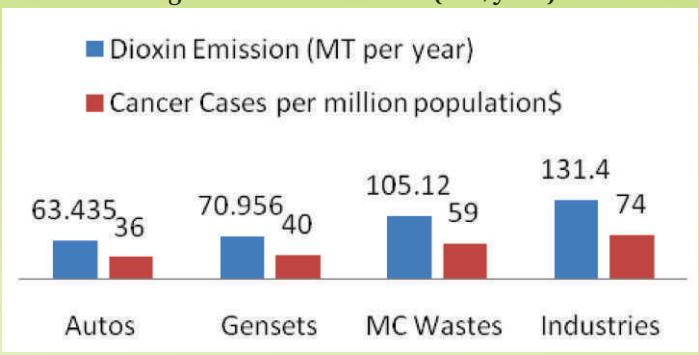

Fig. 3: Dioxin & Cancer cases

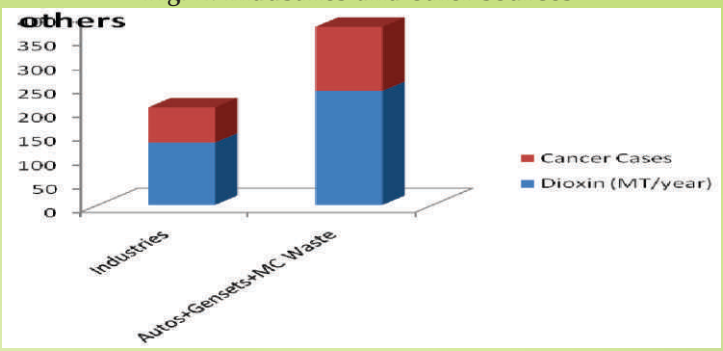

Fig. 4: Dioxin & Cancer: Industries Vs others

Other than dreaded cancer, it it also has found to cause hormonal imbalance (Mocarelli et al., 2008), disorders in children by birth, reduction in sexual efficiency, weak immune system etc (William Schiffmann, 2010). San Francisco Bay fish have dioxin and PCB levels "10 times more concentrated" than fish in the general food supply, according to a report released yesterday by Communities for a Better Environment. Dioxin, a byproduct of industrial chlorine use, can cause cancer, birth defects and other ailments, and the report found that people eating contaminated fish from the bay on a daily basis are exposed to "as much as 30 times more dioxin" than the general public. The top dioxin sources named in the report were Chevron Corp. and Tosco Corp. oil refineries and an Integrated Environmental Services medical waste incinerator. However, Chevron's Marielle Boortz said the company "is in legal compliance" and "for the last few years there have been no detectable emissions" of dioxin. And Robert Reed, a spokesperson for IES's parent company NorCal Waste Systems Inc., said medical waste incineration is only "a source of small amounts of dioxin," with diesel trucks, buses, generators and ships the main sources the pollution. CBE's report calls for completely eliminating chlorine use from the industrial process and eliminating the plastic polyvinyl chloride used in hospital operations (William Schiffmann, AP/San Francisco Chronicle/Examiner online, 9/10). In a published research work (Mocarelli et al., 2011), jointly by two labs of Italy and three American research labs, it is found that Dioxin exposure to embryo of five months in womb till one month of delivery, baby boy would have permanent impairment in sperm quality when reach to sexual maturity.

The lung is the major target organ for diesel exhaust. There are several toxic gaseous components in diesel exhaust. The primary one is formaldehyde, which makes up 65%-80% of the aldehyde emissions. The other main aldehydes present are acetaldehyde and acrolein. The gaseous portion also includes benzene, 1,3-butadiene, carbon monoxide, polyaromatic hydrocarbons (PAHs), and nitro-PAHs. Dioxin compounds have also been detected in trace quantities. Dioxins from diesel exhaust account for 1.2% of total annual dioxin emissions in the US. Diesel particulate matter and extracts of its organic components have induced gene mutations and chromosomal changes in a variety of bacterial and mammalian cell test systems. Both the particle core and the associated organic compounds have demonstrated carcinogenic properties. The particle component appears to contribute the most to carcinogenic effects, at least at high exposure levels. Approximately 80%-95% of the mass of particles in diesel exhaust is made up of fine particles (PM10) with an average diameter of about 0.2 microns size range (range from 0.05-1.0 microns). The particles in this range are composed of spherical elemental carbon cores on which are adsorbed organic compounds, sulphate, nitrate and trace elements. Their large surface area makes them excellent carriers for the adsorbed compounds, which can effectively reach the lowest parts of the lung. Many studies in both humans and animals have shown the potential for diesel exhaust to cause or contribute to the development of cancer in the lung. Increased lung cancer risk has been observed in many group of people exposed to diesel exhaust.

Conclusion: What to be done

Awareness among the public is the key and enforcement of Environmental rules is the Master Key. Awareness among municipal officers/workers, local administration, industries and local people would play a key role to stop emission of hazardous Dioxins in the town. Municipal Corporation should clearly instruct their workers not to burn waste in dustbins or in open and also should arrange fast disposal of wastes so that scavengers are not over burdened. Local administration and pollution control board should take strict action under various pollution laws against those flouting such laws by burning and not complying with standard emission norms. Local people should educate others and stop such activities. All industries /power plants must stick to standard combustions while using solid fuels for boilers/ electricity generation. The pollution enforcement machinery must be kept on toes for stringent control of dreaded Dioxin release in the atmosphere control deaths of innocents from polluting air. Tentacles of Dioxin reach up to 100 kilometers, so beware.

PROTECTING SOIL HEALTH THROUGH JUDICIOUS USE OF COVER CROPS

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The continued capacity of soil to function as a living ecosystem is important in maintaining proper soil health. Lack of proper soil management or in other words, lack of Best Management Practices (BMP) for soil health could negatively impact agricultural productivity as well as the stability and integrity of the delicate soil ecosystem. Hence for maintaining soil health we need to follow the four basic principles, such as: 1. Maximize continuous living roots in the soil zones, 2. Minimize soil disturbances, 3. Provide maximum soil cover throughout the year, and 4. Help in maximizing crop biodiversity for optimum soil management.

Scientific management of soil has multiple benefits such as effectively curbing soil erosion and conserving highly productive top soil, increasing the soil organic matter (SOM), improving soil structure, hydration and aeration, helping in conserving soil moisture, improving soil water infiltration and soil water retention capacity, capturing soil nutrients through nitrogen fixation and nitrogen scavenging, better mineral recycling, suppressing weeds and/or pests with special emphasis to Organic Agriculture (OA), reducing soil compaction, developing better feed sources for cattle and livestock and farmer friendly insects like natural insect pollinators (like bees, moths and butterflies, pollination friendly species of beetles and flies) that help in cross pollination of a large number of crops, and in increasing crop yields with less fluctuations over the years. Proper soil management also helps in preserving soil flora and fauna and in maintaining the natural physicochemical properties of the soil. Good BMP for soil conservation includes adopting suitable cover crops as an integral part of the local agri-production system.

It must be adapted within the cropping system used by local farmers/producers via suitable and sustainable, environment friendly cropping practices, appropriate rotational fit, soil nutrient management through use of plant (green) and/or animal manures, integrated pest management (IPM) and integrated weed management (IWM). The points to consider for adopting BMP for

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soil conservation includes appropriate selection of locally adapted cover crops, to better understand how does the current cropping/tillage system suit cover crops, proper timing, equipments and tools to be used, and taking into account the soil type, climatic variability, drought and flooding periods, judicious use of manures and herbicides during the production period, and any other necessary local considerations etc. The use of suitable cover crops has multiple benefits like N-Fixation, preventing soil erosion, better hydration and aeration of the soil, breaking up of hardpans, conserving soil moisture, scavenging soil micronutrients from deeper layers, phytoremediation, serving as forage for cattle and livestock, local wildlife, pollinators (including bees), in habitat restoration, reduced soil compaction, enriches soil with SOM, can serve as a biofumigant and help in insect pest control, nematode control and in efficient weed control; all of which cumulatively contributes towards efficient and effective long term, sustainable soil conservation.

Grasses used as cover crops provide shade and protection to the soil surface and prevents soil erosion and also help in phytoremediation while contributing to the SOM level. Legumes provide soil organic nitrogen as well as other essential macro and micro elements to the soil. While the brassicas help perverting soil borne diseases as well as aid towards better soil penetration, prevent soil compaction and help in phytoremediation. Choice of cover crops can vary depending upon the agro-climatic region; however, in general could include:

1. Grasses (including both Warm Season and Cool Season Grasses)
2. Brassicas (like collards, kale, radish, turnip, sugar beets, mustard etc)
3. Legumes (all pulses, beans, vetches, clovers, sweet clovers, fenugreek etc)
4. Suitable mixtures and blends developed for specific purposes and different agro-ecological environments:

A. Livestock feed: Grass/Legume mixtures enhancing existing cereal cropping
B. Catering to pollination/wildlife services: Specific mixtures planted in strips
C. Spring plant inter-seeded with annual grazing (mixture with cereal forage)
D. Graze/harvest (silage/green seed)
E. Fall regrowth for deferred/winter grazing
F. More complex systems can be used depending upon the need, experience and successful rotational system integrated into the production system
G. Multi-functionality with more diverse functions and benefits to the local agricultural ecosystems
H. Promote crop biodiversity to support and improve soil ecosystems

The top recommendations for successful incorporation of cover crops in rotational system are:

- Try Intercropping
- Consider establishing a grazing program
- Use post grain harvest and blend grazing
- Never leave soil exposed
- Consider planting a fall cover crop
- Avoid soil disturbances to the best of your efforts
- Think about crop biodiversity by using mix of multiple plants or crops for better soil management

Photo credit: **S. K. Basu**

Acknowledgements: Sikkim Express, Arunachal Times & Shillong Times

RADIOACTIVE WASTES AND THEIR MANAGEMENT

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Waste is any solid, liquid or gaseous substances that are ready to discard because of no further use. Waste that emits nuclear radiation is known as radioactive waste. Radioactive wastes are generally by-products of nuclear power generation and other applications of nuclear fission or nuclear technology, such as research and medicine. These wastes are hazardous to most forms of life and the environment, and is regulated by government agencies in order to protect human health and environment.

Radioactive waste comes from different sources. Radioactive waste naturally comprises of several radioisotopes, i.e. unstable nuclei that decay; emitting ionizing radiation harmful to humans and environment. Maximum waste originates from the nuclear fuel cycle and nuclear weapons reprocessing. Other sources are medical and industrial wastes, as well as naturally occurring radioactive materials (NORM) like at the time of processing or consumption of coal, oil and gas, and some minerals. As radioactivity naturally decays over time, so radioactive waste has to be isolated and confined in appropriate dumping site for a sufficient period of time until it no longer poses a hazard. The time period, radioactive waste must be stored depends on the type of radioactive isotopes present in the waste. It can range from a few days (very short-lived isotopes) to millions of years (spent nuclear fuel). Current major approaches to manage radioactive waste have been segregation and storage for short-lived waste, near-surface disposal for low and some intermediate level waste, and deep burial or partitioning/ transmutation for the high-level waste.

Classification of radioactive waste

Classifications of nuclear wastes varies in different countries. The IAEA, which publishes the Radioactive Waste Safety Standards (RADWASS), also plays a significant role in classifying the radioactive waste.

Uranium tailings

Uranium tailings are waste by-product of uranium bearing ore which are not significantly radioactive. Chemically dangerous heavy metal like lead and arsenic are naturally found in uranium mill tailings. Vast mounds of uranium mill tailings are found at many old mining sites, especially in Colorado, New Mexico, and Utah.

Low-level waste

Low level waste (LLW) is generated from hospitals and industry, besides the nuclear fuel cycle. In low-level waste, the radioactivity and half-lives of radioactive isotopes are comparatively trivial. LLW include paper, rags, tools, clothing, filters, and other materials which contain small amounts of mostly short-lived radioactivity. Bulk quantities of waste polluted with small amounts of radionuclides, such as contaminated equipment (glove boxes, air filters, shielding materials and laboratory equipment) protective clothing, cleaning rags, etc. constitute LLW. Some high-activity LLW needs shielding in handling and transport but maximum LLW is appropriate for shallow land burial.

Intermediate-level waste

Intermediate-level waste (ILW) contains higher amounts of radioactivity and in some cases requires shielding. ILW includes resins, chemical sludge and metal reactor nuclear fuel cladding, as well as contaminated materials from reactor decommissioning. It may be solidified in concrete or bitumen for disposal. As a general rule, short-lived waste (mainly non-fuel materials from reactors) is buried in shallow repositories, while long-lived waste (from fuel and fuel reprocessing) is deposited in geological repository. U.S. regulations do not define this category of waste; the term is used in Europe and elsewhere.

High-level waste

High-level waste (HLW) is created by nuclear reactors. It contains fission products and transuranic elements produced in reactor core. It contains spent fuel and consist of uranium, plutonium and other highly radioactive elements created during fission, made up of fission fragments and transuranics. It is highly radioactive and often hot. They have tremendously long half-lives. HLW accounts for over 95 percent of the total radioactivity produced in the process of nuclear electricity generation.

Management of radioactive wastes

Two long-lived fission products, Tc-99 (half-life 220,000 years) and I-129 (half-life 15.7 million years), are of particular concern in nuclear waste management as they dominate spent fuel radioactivity after a few thousand years. The most troublesome transuranic elements in spent fuel are Np-237 (half-life two million years) and Pu-239 (half-life 24,000 years). Nuclear waste requires sophisticated treatment and management to successfully isolate it from interacting with the biosphere. This usually necessitates treatment, followed by a long-term management strategy involving storage, disposal or transformation of the waste into a non-toxic form. Governments around the world are considering a range of waste management and disposal options, though there has been limited progress toward long-term waste management solutions.

In second half of 20th century, several methods of disposal of radioactive waste were investigated by nuclear nations which are as follows:

- "Long term above ground storage", not implemented.
- "Disposal in outer space", not implemented.
- "Deep borehole disposal", not implemented.
- "Rock-melting", not implemented.
- "Disposal at subduction zones", not implemented.
- "Ocean disposal", done by USSR, UK, Switzerland, USA, Belgium, France, The Netherlands, Japan, Sweden, Russia, Germany, Italy and South Korea. (1954–93) . This is no longer permitted by international agreements.
- "Sub seabed disposal", not implemented, not permitted by international agreements.
- "Disposal in ice sheets", rejected in Antarctic Treaty
- "Direct injection", done by USSR and USA.

CHINA AGRICULTURAL MUSEUM

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The China Agricultural Museum known as CAM is assumed to be the only national agricultural museum in mainland China. It is situated in the National Agriculture Exhibition Hall at Dongsanhuan district in Beijing. This professional museum was firstly ratified by the State Council and then founded on July 1983. The main reason behind establishing CAM was to protect, collect and conduct research on Chinese agricultural heritage; as well as preserving the long history of agriculture in the country. The museum display of CAM comprises of four main parts: 1. Basic display demonstrating Chinese agricultural exhibition display and pottery; 2. Themed display highlighting Chinese traditional farming tools, Chinese soil specimen and teenager agricultural science popularization; 3. Outdoor exhibition gardens which including traditional and modern farming garden and traditional farming experience; and 4.Triplex Screen cinema for the visitors highlighting Chinese agricultural history and practices.

The main exhibition area utilizes three main halls with total acreage of 7,600 sq m. The China Ancient Agriculture Science and Technology History Exhibition, Agriculture Resource Area Division and Water Resource Exhibition are the main exhibits of Chinese Agriculture in CAM. The museum also exhibits large number of rich diversity of animal and bird specimens as well as rare specimens of the farmer's basic instruments and tools. The water resource series engulfs spectacular display of fresh water and marine fishing industries. It also introduces to the visitors the available water resource in China; and the approaches through which primitive humans utilized their abundant water resources. The CAM showcases gradual progress in planting, agricultural instruments, farming tools, irrigation, stock breeding and fishery industries, scientific development and some other remarkable achievements since the beginning of the foundation of the nation.

Guided tours are available. At the beginning visitors are introduced to an ancient statue of five popular persons who made significant great contribution to the Chinese agriculture; namely Hosi (invented fishing net), Shenon (invented farming and rising green), Fondi (legislation), Leizo (silk and waving cloth), and Daio (flood management). The visitors are made aware of the fact the history dated back to around 7000 years. In that era, women were in charge of cooking and weaving cloth and men were in charge of hunting for feeding their family. They also learned some indigenous techniques to construct wooden houses to live in. Ancient Chinese started to grow vegetables and to nurture and raise useful animals like dogs and pigs. There was a special bottle which could be used to take and hold water from river. It could be easily seen that there was a man holding a bow arrow to hunt fish and animals. Later, visitors are introduced to Shang dynasty (3000 years ago). The Emperor paid more attention to agricultural productions and in designing elementary tools like plowing tools. Farming tools were mostly made from bronze. During the Han dynasty (2000 years ago), cattle were starting to be used in farming. About 1400 years ago a man who was famous in agrotourism, in ancient China, worked on writing an agricultural book by hand (Jime Yao Sho). In the Song dynasty (1000 years ago), due to having a peaceful territory across China people moved from north regions to the southern parts of China and settled down which resulted in agricultural development in south of China with wet and warm

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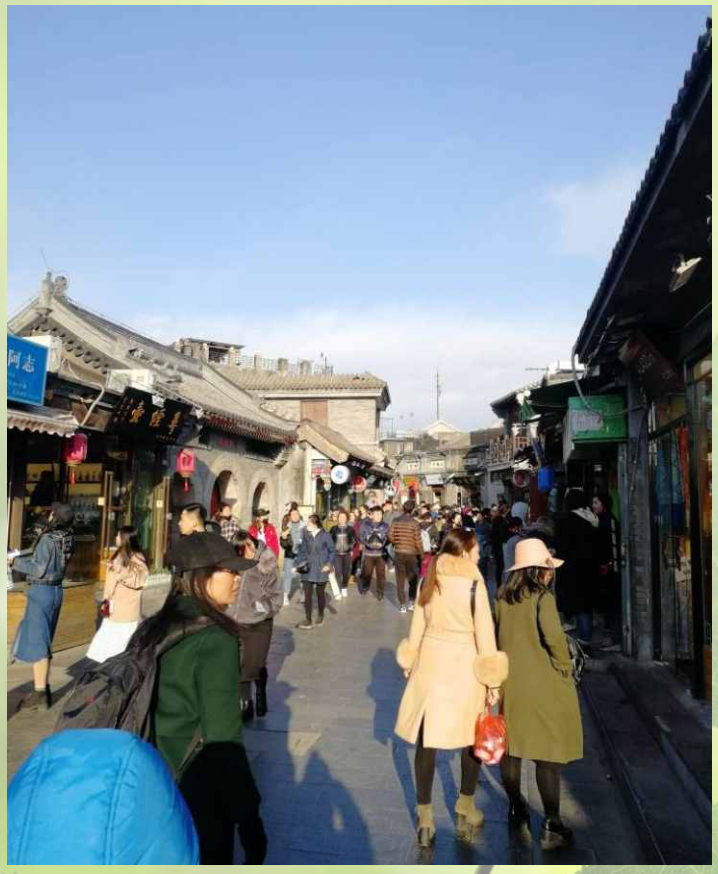

climate. This immigration tended to tea and crop plantation and since that time tea became Chinese national drink. There were some tools made from grass to protect their face and hands during cutting crops.

During the Ming dynasty (about 500 years ago) fishery and animal husbandry started to emerge and extend across China. Next section is related to the ancient irrigation system. Long years ago people were suffering from water disasters. Therefore the Chinese officials designed a national project to not only protect people and their farms from natural disasters; but to use it for an advance irrigation system. Underground irrigation system was developed during the Han dynasty. The animal husbandry gallery exhibit how people begun to re-domesticate animals like horses, goats, pigs, chicken etc. About 2000 years ago people also started to culture fish in their rice fields. Cotton industry in China dates back to 700 years ago. The Chinese women made significant contribution to the local cotton industry in terms of advancing weaving techniques and methods and invented related tools.

In 1895, people who were concerned about the agricultural future of China tried their best to influence people regarding the benefits of technological innovations in agriculture. They suggested the emperor to make an effort to start agricultural reforms in the country. Almost after three years , the government started to practically make huge reforms in agriculture. Innovative technology was thus slowly introduced to the Chinese agricultural industry and gradually traditional agriculture was replaced by modern agriculture. The museum nicely captures this progressive history of evolution of Chinese agriculture from the ancient time to the modern days through several gallery displays, images, models, display of instruments and tools and is an inspiration for other countries to capture their agricultural history. India with a long agricultural history since the time of Indus Valley Civilization should also look forward for establishing an exclusive Indian agricultural museum to capture the evolution of Indian agriculture from the ancient days to the modern times.

Photo credits: **P. Zandi**

WOMEN: THE KEY OF NATURE'S SUSTAINABILITY

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Women have always been considered close to nature. Both are identical in terms of nurturing and protecting qualities. Women sustain the security of food and nutrition for their houses, preserve biodiversity and retain traditional knowledge. They have a crucial role in the development of sustainable natural resource management. The present paper is an attempt to discuss the contribution of women in environmental sustainability worldwide. The paper will throw light on women like Amrita Devi, Rachel Carson, Vanadana Shiva, Beeja Devi, Wangari Maathai, Maria Cherkasova etc. who played significant role in environmental conservation and management. Amrita Devi actively participated in Chipko movement (1730 AD) and sacrificed her life for the protection of natural resources. Rachel Carson,a woman biologist, published a book in 1962 named as 'Silent Spring'. The book depicted the exposure of pesticide DDT on nature such as DDT contamination in food chain, loss of species, cancer and genetic disorders. Silent spring is a milestone and inspirational model book for environmental awareness in present time too. Wangari Mathai was the leader of green belt movement for restoration of environment. It is the need of the hour tolearn from these woman exemplars. Women can inculcate a sense of responsibility in their children to preserve natural resources. They should be allowed to actively participate in environmental issues and environmental decision-making at the local, regional, national, and international levels.

Keywords: Women, Environment, Sustainability, Women exemplar.

Introduction

Women's affinity to nature is old-aged. They have deep knowledge about the nature. Women have worked as farmers, water managers, traditional scientists as well as nature conservationists. Today, humans are facing various environmental problems worldwide such as climate change, waste generation, urbanization, deforestation, loss of biodiversity etc. Women are much concerned about preservation and protection of environment.

Moser (1991) broadly classifies three roles of women for environmental sustainability. These are as follows:

(i) Environmental managers- to maintain natural environment.

(ii) Environmental rehabilitators- to achieve sustainable development.

(iii) Environmental technologists- to use appropriate technology in the creation of new environment.

The present paper is an attempt to discuss the role of women in environmental sustainability in the world in general and in India in particular.

Women exemplars

There have been significant contributions by women environmentalists who paved the way for environmental sustainability. Worldwide, contribution of Rachel Carson, Wangari Mathai, Maria Charkosova, Vicki Buck, Rebecca Hosking, Masouhme Ebtekar and Marina Silva are known. In India, women who put effort for nature are Amrita Devi, Gaura Devi, Beeja Devi, Vandana Shiva, Indira Gandhi, Sunita Narain, Medha Patkar, Sugatha Kumari, Mayilamma and Meneka Gandhi etc.

Amrita Devi and Gaura Devi: Tree huggers

Amrita Devi was the first woman leader to save natural resources. She saved Khejri (Prosopis cineraria) trees in 1730 AD when the ruler of Marwar state Maharaja Abhay Singh directed his soldiers to get the woods for the building of his new palace. His soldiers came to Khejadli but when Amrita Devi and local villagers came to know about it, they protested the king's men. She considered it against her religion and she believed to give away her life to save the green trees. . She said:

"Sar sāntey rūkh rahe to bhī sasto jān"

(If a tree is saved even at the cost of one's head, it's worth it)

Amrita Devi offered her head first and sacrificed her life. She demonstrated a mother's love for Khejri tree. After Amrita Devi, her three daughters (Asu, Ratni and Bhagu) also followed the same path of death by hugging the trees. 363 Bishnoi men, women and children died in this movement. They sacrificed their lives while protecting trees by hugging to them. The regretful king ordered protecting trees and animals in Bishnoi dominant areas. This is still remembered as the great Khejarli sacrifice (Kaur, 2017).

Amrita Devi inspired Gaura Devi to lead a band of brave women to protect trees in Reni village of Chamoli (Uttarakhand) in 1974 giving rise to the famous Chipko movement. Thus, Amrita Devi and Gaura Devi are the pioneers of the environmental conservation movement in India.

Rachel Carson

Rachel Carson (27 May 1907 – 14 April 1964) was nature writer, marine biologist and environmentalist. She is renowned for her book 'Silent Spring'which waspublished in 1962. The bookexposed the hazards of the pesticide DDT. The book explains well the entry of DDT in food chain and accumulation in the fatty tissues of animals, including human beings, and then caused cancer and genetic damage. Carson concluded that DDT and other pesticides had irrevocably harmed crops, insects and animals and had contaminated the world's food supply. The book's most haunting and famous chapter, "A Fable for Tomorrow," depicted a nameless American town where all life—from fish to birds to apple blossoms to human children—had been "silenced" by the insidious effects of DDT.

Henceforth, the most important bequest of Silent Spring was a new public awareness about vulnerability of nature due to to human intervention. This revolutionary book's message reverberates vociferously in 20th century.Rachel Carson and her book 'Silent Spring' are inspirations for us (NRDC, 2015).

Marjory Stoneman Douglas

Marjory Stoneman Douglas (7 April, 1890 to 14 May, 1998) was an environmental activist, renowned writer and journalist from United States of America. She is renowned for her activism to save the fragile wetland ecosystem of Everglades through her book "The Everglades: River of grass" which was published in 1947. The book highlighted the intricate relation Everglades shared with the people and its cultural importance for South Florida. She spent 29 major years of her life towards the restoration and preservation of South Florida's rich natural reserves. She worked persistently for the war refugees and women rights. She was bestowed in 1993 with the prestigious Presidential Medal. Her contribution for welfare of human and environment was recognized all over the world (Anushua, 2015).

contd. in next issue July 2018

EVENT / CONFERENCES

Following are the details of some important conferences:

1. **National Conference on Advances in Science, Agriculture, Environmental & Biotechnology (NCASAEB) in Chennai, India on 16th June, 2018**
   http://nationalconferences.org/Conference2018/6/Chennai/NCASAEB/

2. **7th Edition of GreenCo Summit 2018 ITC GRAND CHOLA, CHENNAI on 28th - 29th June, 2018**
   http://www.greenco.in/site/grncosummit/index.jsp

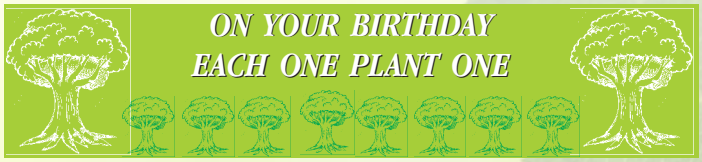
3. **The ASAR-International Conference on Renewable Energy, Green technology & Environmental Science (ICREGTES), New Delhi, India on 1st July, 2018**
   http://www.asar.org.in/Conference2018/7/NewDelhi/ICREGTES/

4. **2018 INTERNATIONAL CONFERENCE ON PHARMACEUTICAL, MEDICAL & ENVIRONMENTAL HEALTH SCIENCES (ICPharME-2018) organized by Institute for Global Research Forum (IGRForum). The conference will be held in Bangalore, India on 1st July, 2018.**
   http://irfconference.org/Conference2018/7/Bangalore/ICPharME/

5. **ISER-399th International Conference on Chemical and Environmental Science (ICCES), New Delhi, India on 15th - 16th July, 2018.**
   http://iser.co/Conference2018/India/1/ICCES/

6. **ISERD – 414th International Conference on Environment and Natural Science (ICENS) on 16th - 17th July, 2018 in Boston, USA**
   http://iserd.co/Conference2018/USA/13/ICENS/

7. **IASTEM- 440th International Conference on Environment and Natural Science (ICENS) on 15th - 16th August, 2018 at New Delhi, India**
   http://iastem.org/Conference2018/India/3/ICENS/



APPEAL TO LIFE MEMBERS

NESA Life Members are requested to submit short articles for the NESA e-Newsletter that are consistent with NESA's objectives to improve environment. The articles should focus on topics related to environment and facilitate communication and discussion among researchers, academicians and students. The articles for July edition can be submitted to **nesapublications@gmail.com** before 20th June, 2018.

Dr. Shefali Gola
Editor, NESA E-newsletter

To,

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INVITATION OF RESEARCH ARTICLES for PUBLICATION in NESA Journals

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BULLETIN ON CHEMICAL SCIENCES
ISSN NO. 0973-8134 | UGC Approved Journal No. 9701

BULLETIN ON ENVIRONMENTAL SCIENCES
ISSN NO. 0971-1732 | UGC Approved Journal No. 9702

BULLETIN ON PHYSICAL SCIENCES
ISSN NO. 0973-8150 | UGC Approved Journal No. 9705

INTERNATIONAL JOURNAL ON AGRICULTURAL SCIENCES
ISSN NO. 0976-450X | NAAS RATING 2.60

INTERNATIONAL JOURNAL ON ENVIRONMENTAL SCIENCES
ISSN NO. 0976-4534 | NAAS RATING 3.06

INTERNATIONAL JOURNAL ON BIOLOGICAL SCIENCES
ISSN NO. 0976-4534 | NAAS RATING 3.14

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