De-Polluting Indian Cities: Problems and Solution

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International Development Centre Foundation (IDC Foundation) has taken an initiative to organize a National conference on De-polluting Indian Cities, 18-19 September, 2015. Pollution in India, particularly the cities of India, is one of the most critical problems facing the public and concerned authorities. Environmental degradation is among the primary causes of disease leading to long term impact on well- being and livelihood. India has a long way to go to reach the environmental quality standards comparable with those enjoyed in developed economies. According to a WHO study last year 13 of the world's 20 most polluted cities were located in India.

The conference was attended by about 90 delegates/ Invites, more than 37 papers were presented by the experts working in the area of Pollution, Environment and from various Ministries, Pollution Control Boards, Municipalities, Delhi Jal Board, Meteorology and Atmospheric Sciences, Universities, Research and Teaching Institutes, Infrastructure Developers, Water Management Institutes, Medical and Health Departments. Finally Panel Discussion was conducted to adopt the conclusions and recommendations.

The Proceedings of the Conference was recorded by Dr. Sanjeet Panesar, Dr. Madhur Verma, Dr. Pallavi Boro, Dr. Bhushan Kamble, and Dr. Kriti Gangwar, all residents of department of Community Medicine Vardhman Mahavir Medical College & Safadrjung Hospital New Delhi.

Shri Paritosh Tyagi, Chairman & Managing Trustee, IDC foundation delivered his welcome address and program highlights. While welcoming all dignitaries at the dais and delegates participants, Mr. Tyagi briefly narrated the history of IDC Foundation along with its aims & objectives, besides explaining innovative approaches being supported by the IDC foundation in addressing environmental and socio-economic problems of the country. He further elaborated major challenges posed by ever growing environmental pollution in Indian cities and told that IDC is organizing its 29th National Conference on De-polluting Indian Cities on 18th & 19th September 2015 to deliberate upon various strategies for reduction & control of air, water, oil & odor pollution in Indian cities through general public, communities, administration and political diaspora. While expressing his sincere gratitude

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for support provided to the conference by Ministry of Science & Technology, Indian Council of Medical Research, Indian Space Research Organization, Grass Roots Research & Creation India Ltd, School of Planning & Architecture, Indian Council of Agriculture Research and International Roma Cultural University, Belgrade (Serbia), he also introduced respected dignitaries at the stage during the inaugural session and explained far reaching significance of their presence at this conference that will contribute significantly in achieving aims, objectives & outcomes of this crucial problem.

Dr. Ravindra Aggarwal, Additional Director, Health Services, Directorate of Health Services (DHS), Ministry of Health & Family Welfare, GNCT of Delhi addressed the delegates attending the conference as a guest of honor. Dr. Aggarwal expressed his serious concerns about the ever deteriorating air quality in Delhi and other cities of India, quoting WHO (2014) report that depicted Delhi as having worst air quality in the world. He also elaborated public health impacts of air pollution, increasing burden of diseases and high mortality occurring every year due to poor air quality in urban centers of India. Concluding his remarks, he drew attention towards the negligent attitude at different levels in de-pollution of Indian cities by giving famous quotation of Urdu poet Mirza Ghalib who said that a human being continue washing the mirror throughout his life, but remains ignorant to the fact that it was only his body that is dirty & not the mirror. With these words, Dr. Aggarwal wished great success to the conference.

Prof. J. M. Dave, Former Advisor (PH & EE) Government of India and Former Professor of School of Environmental Sciences, Jawaharlal Nehru University, New Delhi, delivered his special address. He discussed in detail about multiple factors affecting environmental quality, pollution control and the urgent need for carrying out holistic examination of issues affecting environmental quality in cities. He also explained growth pattern of Delhi since independence, evolution of DDA and huge industrial development. This rapid progress of industries required low skilled workers which resulted in unmanageable pressure on the infrastructure leads to pollution in all components of the environment. While worrying for environmental quality in Delhi, he gave examples of other cities of the world such as Brasilia (Brazil), Canberra (Australia) & Washington DC (USA) etc and explained approaches, strategies being adopted & implemented in these & several other cities for maintaining an envious state of cleanliness. He again stressed that Delhi city was planned without any due consideration to traffic potential and told that European cities are developing according to principles of green infrastructure, having harmony with surroundings of nature and vertical growth. Transports are becoming a fast reality because horizontal growth lead to heat islands effects which reduces the ventilation and problems of solid wastes & wastewater. He briefly explained the role of vertical developments in wastewater & solid-waste management because people have chutes through wastewaters & even solid wastes may be discarded even without segregation & treatments. He also recollected his past experiences as Chairman of National Ambient Air Quality long back in 1970 and members of several other high level committees of Government of India and told that Delhi used to receive a lot of dust before 1970 from nearby areas and only PM 20 measurements were

possible and PM10 measurements were not possible which began only after 1970 that too without characterization and he himself started measurements & characterization of PM 2.5 in Jawaharlal Nehru University. Finally, he spoke about approaches & methods being adopted in Air Quality Index (AQI) and suggested that Panic Air Quality Index should also be corrected besides the massive scale replication of wastewater treatment techniques in other parts of Delhi & other cities which were implemented first time in Vasant Kunj area of Delhi.

Shri R. S. Tyagi, Member (WS), Engineering Department, Delhi Jal Board, New Delhi delivered his keynote address. Shri Tyagi began his address by appreciating the theme of the conference as a very well thought theme and stressed on the need of wider level community participation in de-polluting cities including city of Delhi because even highly advanced technologies may not be very successful without having effective & meaningful community level participation.

He explained that significant role of community participation in solving city/ urban level issues by giving example of the city of Philadelphia where Dr. Benjamin Franklin used to stay and there was no electricity. Community level efforts kept one lantern in front of every household, thus the entire city of Philadelphia was brought in a very bright state of illumination.

He stressed upon need for self-discipline (good civic sense) for de-polluting cities and lack of appropriate civic sense as the main reasons behind increasing pollution and non-compliance with anti-pollution laws in cities. After talking about environmental pollution in cities, he kept explaining about the Mandate of Delhi Jal Board, infrastructure developed and treatment of 700 million gallons per day through operations of existing 37 sewage treatment plants (STPs).There is future requirements of STPs/ Pumping stations for treating sewage from unsewered areas because there are 6500 unplanned colonies in Delhi without any wastewater treatment facilities, leading the flow of sewage directly to River Yamuna.

He suggested application of Trenchless Technology in such areas of Delhi where laying of sewer lines is not possible While appreciating Prof. J.M. Dave's views regarding the application of Decentralized Sewage Treatment Systems, he explained in detail JAN-JAL PRABANDHAN YOJNA of DJB in which communities concerned will do the work of laying sewer lines, will use Decentralized STPs and entire technical knowledge and subsidies will be provided by DJB. Finally, he drew the attention of participants towards challenges being faced by DJB & other organizations in de-polluting Delhi, especially lack of political will, scarcity of funds, inadequate revenue generation and inadequate planning so far beyond achieving targets of wastewater treatments by DJB by 2016.

Shri Bhure Lal IAS (Retd) Former Chairman, Environmental Pollution Control Authority and the Member, Supreme Court Monitoring Committee and Former Member UPSC, delivered his Chief Guest address. Shri Bhure Lal began his address by talking that de-polluting cities is a micro-level issue, in fact, de-polluting Earth is required at Macrolevel. He quoted Ex-Honorable Vice President of USA & Nobel Laureate on Climate Change Mr. Al-Gore wordings that this earth is our home & God has given air, water, soil etc. and all these resources are to be conserved & protected for archiving aims, objectives & goals of sustainable development. Drawing the attention of participants towards the significance of deep ecological values in protecting the quality of environment around us, he emphasized that all religions of the world preach us for maintaining ecological balance and have accorded praise for each & every part of the nature and gave example of a prayer being recited everyday by Sikh religion which treat water like father and says that mother earth is great. After these initial remarks, he dealt in detail about changing pattern of consumption after industrialization leading to uncontrollable human greed, resulting in de-forestation & release of poisons (emissions) in the atmosphere, growth of population beyond carrying capacities of resources required for sustaining the same, resulting in natural calamities such as Tsunamis etc. He recited few stanzas of poems from Rig Veda regarding role & significance of maintain ecological balance in human survival. He further enlightened participants about Air Pollution issues, quoting WHO (2014) report which states Delhi as the most polluted city in the world, rising air pollution in Delhi due to rise in numbers of vehicles in comparison of other cities, pollution potential of home appliances being used in today's times and stressed upon the need of Clean Transport based Transportation system in cities so that public health impacts such as cancer, increased use of fossil fuels in transportation system may be prevented. He also drew attention of participants towards issues of water pollution & solid wastes management and told that sewage disposal due to lack of adequate treatment facilities is the key factor behind water pollution in Rivers like Yamuna, Ganga etc. As Ganga has become a Cancer Valley from Kanpur to Kolkata due to release of untreated domestic & industrial sewages. Finally, he explained issues & problems related with hazardous waste & solid waste management and emphasized that proper disposal & waste treatment facilities are still far from adequate in comparison of 13300 tons/ day garbage being generated in cities & adequate encouragements being provided to waste recycling especially composting and ended up elaborating the NGI's decision on 17th September 2015 regarding the removal of all garbage from all cities.

Once all addresses of Inaugural Address were over, the Souvenir of The Conference containing abstract was released by all dignitaries present on the dais and a copy of the released souvenir was circulated to each & every delegate & participant.

Dr. Ravindra Singh, Sr. Scientist ICMR, New Delhi and Associate IDC Foundation expressed Vote of Thanks to all dignitaries at the dais, delegates & participants as well as to all those who assisted & supported in making the conference a successful reality.

Technical Session–I: De-Polluting Indian Cities-Role of Planners and Policies

This session was chaired by Prof. A. K. Maitra, Former Director and the Chairman Governing Council, IDC foundation. There were lead speakers on highly significant issues related with environmental quality in Indian cities and approaches, methods, strategies, technologies to be adopted & implemented for de-polluting these cities. Prof. Maitra introduced all speakers to delegates & participants besides explaining the far reaching significance of the conference in times when quality of all components of the environment is consistently deteriorating due to lack of appropriate & adequate attention in all aspects, issues, urban planning and negligence of city/ other urban level authorities in bringing up meaningful civic sense based compliance to environmental laws & regulations.

Dr. A. L. Agarwal, a highly eminent Air Pollution Expert delivered his presentation on "The Status of Air Pollution & Its Sources in Urban Centers of India". Dr. Agarwal enlightened delegates & participants about the comparative cost-benefits perspectives being adopted in strategies & schematic framework for air pollution control in India & National Ambient air quality monitoring (NAAQM) in India. He explained in detail about global perspectives on all aspects & issues of Air pollution along with human toll due to air pollution as being reported by WHO resolution, resulting in increase of number of air quality monitoring stations till 31st December 2014 required for maintaining air quality standards for different categories of Indian cities as per WHO requirements. While explaining National Ambient air Quality Standards (NAAQS) for all air pollutants with special focus on Particulate matter, pollutants of serious concern among civic communities across the world, he presented a very critical view regarding the existing Air Quality Management Task Framework in India and revealed that there is no comprehensive air pollution inventory for any city and there are no adequate funds for carrying out fresh or even updating MoEF's apportionment study. Moreover Air Quality Index (AQI) has deficiencies in the measurement of Ozone due to the lack of its comprehensive program of monitoring especially during & after Dushera & Dipawali. He further explained trends of Annual Average Concentrations of air pollutants in Delhi, Chennai, Kolkata, Mumbai cities including Annual Air quality trends in Delhi from 2003-2013 where PM is on rise in Delhi besides SOX & NOX due to diesel and held ever growing population and number of vehicles in Delhi responsible for air quality problems. Besides explaining all key aspects of air pollutants, especially trends of heavy metal concentrations such as Pb, Ar, Ni in cities, he also explained equipments & instruments which was used for air quality monitoring for six cities while carrying out Source Apportionment Study for MoEF. At last, he explained his recollections when he was carrying out Source Apportionment Study and how did he understood PM 2.5 data, its sources at locations in Delhi (Pitampura, Ashram Chowk, SSI Industrial Area GTK & Dhaula Kuaon). Finally, he stressed upon the need for Quality Assurance (QA) / Quality Control (QC) for ensuring Ambient air quality data, felt need for setting strategies for

continuous network for air quality objectives besides suggesting that Public Dissemination from the best sources of air quality information should be made in a very careful manner and we should learn from past studies such as Source Apportionment, Suspended Aerosols & should develop comprehensive emission inventories.

Dr. P. B. Rastogi, Former Advisor to Ministry of environment, Forest & Climate Change (MoEFCC) Government of India delivered his presentation on" Abatement of Pollution through Smart & Environment Friendly Cities ". Dr. Rastogi began his presentation through a brief discussion about the concept of smart cities and said that there are several terms being used to define cities, resembling to smart cities, therefore there is lot confusion due to several definitions available regarding several perspectives of smart cities. While advancing further his presentation, he explained inadequacy of infrastructure in response to increased economic growth vis-a-vis population growth besides giving elaborated view of environmental sustainability aspects & issues of smart & environmental friendly cities and environmental sustainability potential of integrated townships. Further he explained about basics of smart cities with respect to mobility, economy, environment & society. He also briefed upon problems associated with the implementation of smart cities, especially related with the Land Acquisition, Pollution from construction projects, air pollution (PM10 & PM2.5), waste & water pollution, solid wastes & vehicular pollution besides explaining approaches/ methods of abatement of pollution, i.e. involvement of all stakeholders, sustainable architecture, eco-industrial parks, use of renewable energy, energy consumption reduction through energy conservation & energy efficiency (80% utilization of solar & other renewable energy sources) reduction in GHG emissions through energy conservation & efficiency measures etc and gave example of Indira Paryavaran Bhawan (new office of MoEFCC, govt of India) as an ideal case for energy efficiency & conservation besides explaining other features of Indira Paryavaran Bhwan-an environmental sustainable designed building. Finally, he stressed upon issues related with adequacy of digital infrastructure for key operation in smart cities, solid waste & hazardous waste management, walkable urbanism, Urban farming, agriculture and Renewable Energy Technologies etc. all related with the development of low carbon cities.

Prof. V. K. Goswami Visiting Scientists UNIDO, ICTP-Italy & NCAR (USA) & Member Expert Panel of NOAA (NASA), ICAO (Canada) & Former Vice-Chancellor. Sangam university & Sunrise University, delivered his presentation on "Integrated City Specific Emission Inventories for De-polluting Air and Reducing Climate Change Impacts in Indian Cities: Potential Unrealized-Strategies to control Environmental Pollution through Detoxification of Toxic Gases through Chemical Process" Dr. Goswami elaborated in detail about spatial & temporal resolutions of atmospheric aerosols & de-toxification of GHG (CO, CH_4, NOX, CFC etc gases), by making use of the transition metal oxides catalysts viz CO_2 as selective catalyst beds MRT (Magnetic refrigeration techniques) to control global warning, including making increase in forest cover or through chemo-sorption, absorption of CO_2 by chlorophyll enriched transgenic plants besides stressing upon the need for computational Correlation Predicting Models (CCPM). Besides explaining adequately about these highly advanced technologies involved in detoxification of toxics & GHG gases, he also presented his serious concerns about the huge human toll happening i.e. 10000 to 30000 deaths per year due to air pollution related health impacts in Delhi, need for change in habits for managing solid waste management, quoted HUDCO report submitted for Clean Noida Plan & explained in detail Swachh Bharat Abhiyan (Clean India Mission) requiring more landfills creation & strict implementation of Environmental laws & regulations. He shared concerns raised by Dr. Brian P. Schimdt regarding impacts of climate change & London Report on Climate Change, the need for green courts, besides dwelling upon climate change effects on Himalayan glaciers which may disappear in next century as being predicted by Prof. Clarke, solar plane, generation of biofuels from liquors as being done by Scottish scientist community & use of solar & electricity cells for making fuel & water from asteroids.

Professor Meenakshi Dhote, Head, Department of environmental Planning & Architecture, School of Planning & Architecture, New Delhi made a presentation on "De-polluting Indian Cities-Role of Planners". Prof. Meenakshi started her presentation with trends of urbanization in India and associated increase of environmental pollution with the same and stressed upon the need for de-polluting cities. While advancing her presentation, she raised a question - Is there any baseline status of pollution around new cities that are growing and stressed

upon the need for the preparation of baseline pollution database of proposed 100 smart cities and further questioned participants-What should be regional sustainable planning & strategy for these 100 smart cities? And finally she suggested that besides bigger cities, small & medium cities should also be de-polluted

The Chair of the session, Prof. A. K. Maitra appreciated all speakers for sharing their well informed thoughts & views on various topics. There were three questions from participants i.) What will be your advice for controlling pollution in a village or mohalla? This question was raised to Prof. A. L. Agrawal who replied that there is a need for developing system based management at village level. ii.) What will be per unit cost solar energy. This question was raised by Prof. V. K. Goswami to Dr. PB Rastogi who answered that it is varying Rs 5.unit in Chhattisgarh, Rs 8/unit in West Bengal. This cost declines with increase in the use of solar energy. iii.) What is Lunar Cooling? This question was raised to Prof. VK Goswami who answered harnessing of lunar energy like solar energy for cooling purposes.

All delegates & participants break up for launch after the end of the Technical Session-I 12:00 PM to 1:30 PM.

Technical Session–II: Air, noise, Odor, Soil & Water Pollution

This session was chaired by Dr. Ajit Tyagi, Kotteswaram Professor (Retd.) from Ministry of Earth Sciences (DOD, Government of India) and co-chaired by Dr. Kamal Kishore, Professor of Pharmacology, All Indian Institute of Medical Sciences, New Delhi. This session comprised of four lead speakers & five delegate speakers.

Dr. Ajit Tyagi after introducing the themes/sub-themes of the session requested the co-chair of the session Dr. Kamal Kishore to introduce speakers and invite them for delivering their presentations.

Dr. S. K. Gupta, Honorary Secretary, Indian Association of Air Pollution Control (IAAPC) & Managing Director, Eco-Tech Services Ltd, delivered his presentation on, "Management of Air Quality in Delhi". Dr. Gupta during his presentation shared short-term & long-term recommendations made by IAAPC during his last workshop on Air Pollution Control in Delhi. While doing so, he dealt in detail about public perceptions of air quality scenarios in Delhi and provided a detailed view of short-term & long-term recommendations as opinion of experts. He discussed key short-term recommendations as enforce pollution control in industries, power plants, vehicles, construction activities etc. located in NCR Delhi, Ban burning of fossil fuels & agriculture residue, install vapor recovery systems at oil filling stations, improve green belts, ensure proper calibration of monitoring systems, methods for the management of road lifted dust (deploy vacuum cleaning systems & covering of exposed areas with greenery, setting of composting plants for biomass burning related waste products & incentivize composting by free distribution of compost to local residents. He also elaborated upon long-term recommendations mainly implementation of administrative controls rather finding engineering solutions, reduction of travel trips, distance & frequency by mandating that

children must attend neighborhood schools, focus/ augment intercity transport, develop smart city about 100 kilometers away that may connect Delhi by fast intercity trains and urban planning at self sufficient cluster basis.

Dr. S. K. Tyagi, Scientist E & Additional Director, Central Pollution Control Board delivered his presentation on "Air Quality Trends in Delhi during 2002-2014". Dr. Tyagi began his presentation while discussing air quality trends in Delhi deliberated in detail about premature mortality and held poor quality of fuels, poor vehicle design, uncontrolled vehicular growth etc. as main reasons behind poor air quality in NCR region. Explaining the figure of highest registered vehicles as 87% in Delhi, he explained in detail about issues related with vehicular pollution in Delhi i.e. high vehicle density, odor pollution, inadequate inspection and maintenance of vehicles, large number of two strokes/ two wheelers, adulteration of fuels, improper traffic management, road conditions & high population exodus. Coming back to air quality trends related issues, he explained through graphic analysis about rise & declines of PM in Delhi due to rapid increase in vehicles, decline in PM10 due to expansion of metro train system, EUR0_IV norms and further explained steps taken by CPCB for improving air quality in Delhi especially strict implementation of European Union implementation phases for EURO emission norms, implementation of emission norms. Implementation of the road map of BS-V and BS-VI & associated technological advancement, alternate fuels, Best Inspection & Maintenance Practices, roles to be played by Delhi citizens in improving air quality & CPCB instrumentation for Air Quality measurement and finally he shared and explained CPCB recommendations for the monitoring of air quality in Delhi NCR. A question was raised to Dr. SK Tyagi- What is the cost of calibration and air pollution measuring instruments in CPCB? Dr. Tyagi replied that cost is not a major issue, trained manpower etc is a significant issue.

Dr. Chakresh Jain, Assistant Professor, Department of Biotechnology, Jaypee Institute of Information Technology, Noida made his presentation on "Waste Management: Ecobalancing of Petroleum Products via Microbial Degradation". Dr. Jain during his presentation explained that certain chemicals such as cholorophenols, nitro-phenols BTEX (Benzene, ethyl benzene, toluene and xylene) polycyclic aromatic hydrocarbons (PAHs), polychlorinated Bi-phenyls and organic solvents present in the environment are highly carcinogenic and mutagenic and degrade at a very slower pace. Rapid removal of these pollutants can be achieved through bio-remediation technologies such as bioagumentation, phytoremediation & rhizoremediation. He further explained roles of few key micro-organisms such as Psuedomonas aeruginosa, pseudomonas fluresens, Mycobactrium spp, Hamephilus spp, Rhodococus spp, Paenibaciluss spp, Geobacilus thermodenitrificans, Burkhulderia, Gordonia spp. etc and finally discussed about few recent biotechnologies for maintaining ecological balance by applying such technologies for microbial degradation of Petroleum Products in the environment & thus preventing their adverse public health impacts.

Prof. Promila Goyal, distinguished Professor Emeritus, The North Cap University, Gurgaon delivered her presentation on "Status of Air Pollution in Indian Cities including Delhi". Prof. Promila during her deliberations explained that India is one of the worst performer ranked as 125 and ranked as 27 out of 100 most polluted countries of the world as per WHO (2011)Delhi the capital of India is reported as one of the most polluted city (WHO 2014) with respect to Particulate Matter of sizes 2.5 micrometers. She also explained air quality in Delhi due to different sources at different locations in Delhi in comparison with Beijing city of China which was earlier considered as world's most polluted city, now experiencing decline in air pollution levels. While advancing her presentation she expressed her serious concerns regarding 620,00 premature deaths occurring in India due to air pollution health impacts and told that her study confirms the already known fact that the road traffic is mainly responsible in most of cases for more than 70% of the concentrations of air pollutants & deterioration of air quality in Delhi and suggested that all air pollution abatement strategies should focus upon these sources of air pollution for reducing levels of air pollutants up to NAAQS.

Dr. N. Siva Siddaiah, School of Environmental Sciences, Jawaharlal Nehru University, delivered his presentation on "High-Tech Elements as Emerging Pollutants in Urban Environment: Strategies for Water Quality Protection". Dr. Siva during his presentation deliberated in detail about the enrichment of high tech elements (Rare earth Elements) such as Lanthanum (La), cerium (Ce),

Neodymium (Nd) & Gadolinum (Gd) in Yamuna waters due to urban storm water runoff and effluents from hospitals & wastewater treatment plants, automobile diesel (Ce), catalytic convertors (Ce & La) and hospital effluents (Gd as MRI contrast agent). He finally concluded that measuring & regular monitoring of these emerging pollutants in water bodies and their identification & characterization of their sources & pathways in urban environment should be warranted with sense of urgency for developing appropriate run-off treatments from various sources.

Barbie Hazarika, Centre for the Environment, IIT Guwahati-Assam, gave her presentation on "Secondary pollutants from VOCs in indoor air". Ms. Hazarika during her presentation explained that Volatile Organic Compounds (VOCs) are commonly occurring in indoor environments due to indoor sources.

She deliberated in greater details about all aspects & issues related with VOCs, especially sources, organic structures of VOCs, mechanism of VOCs reaction with Ozone, reactions of VOCs with Hydroxl process, reaction mechanism of Secondary Organic Aerosols (SOA) with VOCs, sizes of SOAs as reported by various researchers, mitigation measures for the control of VOCs & O3 sources. Finally she explained existing research & development gaps and future research areas related with aspects & issues of VOCs & SOAs mainly impacts of VOCs & SOAs in human health, all sources of VOCs except tarpaulin & aromatics, laboratory measurements & real world, comparison between SOA & Somg formation & importance VOCs & SOAs research for public health in India.

Dr. N. Kundu, Associate Professor, Teerthanker Mahaveer University, delivered his presentation on "Managing e- waste: an ocean of opportunities or a threat to survival". Dr. Kundu during his presentation delivered in detail about all aspects & issues related with E-Waste Management, especially about 60 elements present in E-wastes their valuabilities & hazardousness. Telling E-waste generation as a necessary evil of society progress which can not be stopped though full high resource consumption, health hazards, environmental pollution and threats to sustainability.

Proper management of E-waste is full of several possibilities & opportunities, especially if carried out through an auto efficient recovery and retrieval system and realization of all such wealth creation opportunities will not only bring environmentally sustainable benefits but will also minimize any threats to human survival up to a maximum possible extent. Further detailing about business potential of E-waste Management, he finally concluded that E-waste recycling in developing countries have the potential to generate decent employment, reductions in GHG emissions, enhancement in sustainability besides recovery of a wide range of valuable metals such as silver, gold, palladium, copper and indium etc.

Technical Session III: 03:45 AM-5:00 PM: Smart Cities and Climate Smart Cities

This session was chaired by Prof Usha Raghupathi, National Institute of Urban Affairs, New Delhi and co-chaired by Prof. Shyamala Mani, National Institute of Urban Affairs, New Delhi. The Chair of the session, Prof. Usha explained the theme/ sub-themes of the sessions by focusing upon climate change issues, low carbon development requirements in proposed smart cities/ future cities and requested Prof. Shayamala Mani to introduce speakers of the session while inviting them to deliver their presentations.

Prof. (Dr.) P. K. Joshi**,** School of Environmental Sciences, JNU delivered his presentation on "Urban Heat Island Effect". He began his presentation by deliberating upon essential aspects & issues related with 5 smart cities & related conceptual framework. Further he explained about approaches & methodologies being applied, especially geospatial technologies in the Evaluation of Surface Urban Heat Island Effects (SUHI) besides suggesting measures for mitigating SUHI such as cool roofs & green roofs, gave example of cool roof at ITC Green Center in Gurgaon and advised about other smart solutions such as integration of land use & urban systems, Park & ride, low impact development, floor management, SPV roof top systems, decentralized wastewater treatment systems & realization of benefits of geospatial tools for smart cities. Pallavi Sharma and Rohit Virmani & Mr. Nand Kishore, National Institute of Urban Affairs, delivered their combined presentation on "Planning for Climate Smart Cities". First Ms. Pallavi Sharma explained climate & urbanization issues through projections of urbanization & climate change, especially processes leading to impacts of urbanization on climate & vice-versa in terms of short-term & long-term impacts and co-related all such with core infrastructural elements of proposed smart cities besides comparing features of smart climate city and stressed upon the need for smart planning through a co-ordinated approach by explaining through example of Chemkal Choola city Mr. Rohit Virmani while continuing the second part of the presentation, explained challenges associated with Climate Smart Cities, such as lack of infrastructure, encroachments, unsewered areas, heat island stresses and concluded regarding the preparation of Master Plans in consistency with climate change threats, solid waste management requirement. Mr. Nand Kishore completed the remaining part of the presentation by focusing upon Smart Technologies and deliberated in detail about key aspects & issues related with Smart City Planning, especially climate responsive smart cities by explaining through example of New York City and finally stressed upon the need of collaborative Planning for addressing effectively challenges associated.

Finally the Chair of the session, Prof Usha Raghupathi quickly concluded the session by briefing that the session successfully brought out important features of smart cities & climate change.

Technical Session IV: 9:30 AM till 11:00 AM: Status of Soil and Water Pollution and Detoxification of Peri-urban agriculture

This session was chaired by Dr N K Tyagi, FINAE, FNAAS, FISAE, Former Member ASRB and co-chaired by Dr Vinay Mahajan, Principal Scientist & In Charge, Indian Institute of Maize Research, PAU, Campus, Ludhiana. The Chair of session Dr. Tyagi while introducing theme/ sub-themes of the session invited co-chair Dr. Mahajan to deliver his presentation.

Dr. Vinay Mahajan, Principal Scientist & In Charge, Indian Institute of Maize Research, PAU, Campus, Ludhiana delivered his presentation on, "Strategic Technologies for Peri-Urban Agriculture". He while explaining conceptual aspects of peri-urban agriculture and its significance in managing environmental pollution impacts especially related wastewater treatment, deliberated in detail about the ecological significance of peri-urban agriculture which is becoming vital for urban populations of many developing countries including India. Sharing UNDP estimates i.e. growing 15% of food worldwide in cities, he told that sewage water & urban industrial waste are major concerns in peri-urban agriculture & animal husbandry and all pollutants get easily recycled back to peri-urban agricultural practices especially horticulture production, small livestock and aquaculture. Finally he advised that a practical strategy need to planned & executed with direct & indirect support from the public sector so that the use of treated sewage water & industrial wastes for agriculture may increase in cities & areas around and made all participants aware regarding the availability of appropriate technology with Indian Council of Agricultural Research (ICAR) & other agricultural university in the country for the wide scale promotion of peri-urban agriculture.

S. K. Dubey, Indian Institute of Soil and Water Conservation, Research Centre, Chhalesar, Agra, India, delivered his presentation on "Using waste waters and solid wastes as resources in peri-urban agriculture for sustainable cities". He deliberated in detail regarding opportunities for wide scale utilization of treated urban sludge and industrial waste water for agricultural purposes because these waters are rich in organic matter and major & micro-nutrients required for enhancing soil fertility and crop productivities. He further shared findings of a survey carried out in Haryana for the evaluation of the impact of sludge and water on soil and told that it enhanced nutrient potential of 8100, 1200 and 11000 tonnes in terms of NPK., improvement in organic matter through the use of domestic sewage based irrigation. Finally, he shared findings of one of his experimental study carried out as analysis of effluents from Panipat town in Haryana and suggested that the major cause of concern in these water was PB and concluded that the sewage sludge & sewage water have been found as containing very high amount of micronutrients (NPK) besides having significant presence of heavy metals such as Pb, Ni and Cd in plants and groundwater which deserves to be strictly monitored on continuous basis.

Dr R. C. Yadav, Former Head, ICAR Soil and Water Conservation Research Centre Agra, delivered his presentation on "New strategic route for total de-polluting cities with emphasis on sewage and allied solid wastes, productive management". He deliberated in detail about a new & innovative design & installation of a piped system which can be regularly cleaned besides using solid wastes for the production of low cost involving manure for agriculture and irrigation for enhancing biodiversity and concluded that this proposed piped system can operate under the Public Scientific Partnerships (PSPs) as interdependent enterprise for de-polluting cities by creating varieties of sustainable employments.

Dr. Shakti Prakash, Consultant, Environmental and Social Sustainability, delivered his presentation on "Integrated City Specific Emission Inventories for De-Polluting Air & Reducing Climate Change Impacts in Indian Cities: Potential Unrealized". He deliberated in details about the Air Pollution Management (APM) and Greenhouse Gases (GHGs) Reductions which are key challenges being faced by humanity across the globe, whether it is urban area, rural and may be an area devoid of any human settlements such as forests etc. Besides other environmental contamination & pollution related public health impacts, Air Pollution, Climate change Adaptation& Mitigation issues are already seriously affecting the entire governance of all cities in India including those 100 cities, proposed to be developed as Smart Cities. Increasing air pollution & rising GHGs are having vice-versa type of relationships as far as deteriorating air quality, rising air temperatures and their adverse impacts on public health & other sectors of economy are

concerned. An effective APM & GHGs reduction programs requires integrated, accurate & reliable databases i.e. Integrated Emission Inventories (IEIs) along with widespread accessibility of the same to all stakeholders involved for taking & influencing well informed decisions regarding technological adoption, selection & monitoring of their performances conforming to required standards of APM and Kyoto Protocol (GHGs). IEIs have so far been a rarity in urban planning, development and implementation projects & programs in India. He concluded briefly providing an overview of the existing status of EIs for Indian cities, their role & significance in APM & GHGs reduction projects & programs besides exploring the enormous potential of city specific Integrated Emission Inventories (IEIs) in APM & GHG reduction programs, along with an objective to sensitize stakeholders involved, through examples from other cities of the world having IEIs i.e. how much sensitivities and seriousness & extent of work (projects & programs) are required to be carried out in India as far as de-polluting of Indian cities from poor air quality & GHGs emissions related threats are concerned.

Once, presentations of all four lead speakers were over, other speakers delivered their presentations.

Dr. Leena Singh, Department of ASH, Galgotias College of Engineering and Technology, Greater Noida, delivered her presentation on, "Status of Indian Rivers and de-polluting them". She while deliberating in details about aspects & issues of river pollution especially rivers Ganga & Yamuna enlightened the audience that the pollution of rivers is not a localized phenomenon and it exists today in transboundary manner and stressed upon the need for de-polluting Indian rivers with a sense of urgency and shared her critical & skeptical view regarding the success of steps taken so far the Governments at central & state levels and felt that all river cleaning programs & action plans for example Ganga action Plan etc need to strictly implemented for achieving desirable results.

Dr. Inderpal Kaur, Associate Professor, Punjab School of Economics, Guru Nanak Dev University, Amritsar made her presentation on "Agricultural Degradation And Human Health In Punjab: An Inter-District Analysis". Dr. Inderpal Kaur elaborated in detail about her analysis of chemical fertilizers and pesticides as being applied in agricultural areas of Punjab and their adverse impacts on human health besides briefly discussing its policy implications & required appropriate policy interventions for addressing human health impacts of wide scale based use of chemical fertilizers & pesticides in the state of Punjab.

Dilip K. Markandey, Central Pollution Control Board, Parivesh Bhawan, East Arjun Nagar, Delhi, made his presentation on, "Removal-And Recovery of Heavy Metals from Industrial Effluents by Micro organisms". Dr. Dilip while discussing all key aspects & issues related with the bio-remediation told that it is the most cost-effective innovative technology involving micro-biological systems for treating hazardous metallic contaminants and further gave a comparative view of bioremediation technologies with conventional treatment technologies. Finally he explained the vast potential of applications of environmental biotechnologies, especially the suitability, type efficiency, operational proficiencies of biosorbents of different microbial origins and other non-conventional bio-sorbents for the removal of Cr.

Anindita Bhattacharya,[1] Department of Chemistry, Christ Church College, Kanpur, made her presentation on, "Formation of Atmospheric Sulfate under Elevated PM_{10} Concentration in Kanpur City: A Case Study." Dr. Anindita shared findings of her study that sulfate levels were considerably high (2.77-43.6 ug/ m^3) compared to levels in few cities in the US and further told that this high levels of SO2 provided a plausible explanation for low SO_2 concentration levels in the city of Kanpur. Finally she concluded that high levels of PM10 Ca acting as catalyst for SO_2 oxidation and high ph in atmospheric environment provide conductive environment for the oxidation of SO_2 and eventual formation of SO_4.

Finally, Dr. N. K. Tyagi summed up views of all lead & other speakers and advised not to read lines from power point presentations being shown, but to explain key aspects & issues involved and also advised that each speaker who have presented during the session should prepare at least one recommendation from his/ her area of work so that conference outcome may lead to fruitful directions by fulfilling its objectives of de-polluting Indian Cities.

Technical Session V: 11:15 AM-12:15 AM: Human Health in Indian Cities

This session was chaired by Dr. S. K. Rasania, Director Professor, Department of Community Medicine, Lady Harding Medical College and co-chaired by Prof. (Dr) Jugal Kishore, MBBS, PGCHFWM, PDGEE, MSc, MD, PhD, Head of Community Medicine, Vardhman Mahavir Medical College & Safdarjung Hospital, (under Ministry of Health & Family Welfare) New Delhi. The Chair of the session Dr. Rasania, after his brief overviewing of public health issues arising and taking heavy human toll due to environmental pollution in Delhi and other cities, requested the co-chair to continue the session by introducing& inviting other speakers.

Dr V. R. Singh, Fellow-IEEE, Formerly, National Physical Laboratory, New Delhi presently, PDM Educational Institutions, Bahadurgarh, Haryana, delivered his presentation on, "Pollutants Cause Cancer: Detection and Analysis". Dr. Singh during his presentation deliberated in detail about pollution & cancer related aspects & issues. He enlightened the participants through key findings of one of his research study by explaining about the detection and analysis of mechanisms involved in causing cancer & factors associated, due to pollution besides suggesting control mechanism the prevention as well as the control of pollution caused cancers through better health care systems & services.

Dr. Kamal Kishore, Professor, Department of Pharmacology, All India Institute of Medical Sciences New Delhi and Member GC, IDC Foundation delivered his presentation on "Impact of Pollution on Human Health." Dr. Kishore, during his presentation shared with participants that many scientific studies have established proven linkages between environmental pollution, especially air pollution and variety of public health problems such as lung disease, asthma, coughing or dyspnea. He further revealed that children are more vulnerable to these air pollution caused public health disorders and finally suggested that diesel car should comply with EURO-V emission norms, manual brooming of dust on roads should be stopped, ban on burning of dried leaves, plantation of more trees and strict regulation on industries for their pollutant related emission Dr. Manish Chaturvedi, Professor of Community Medicine, School of Medical Sciences & Research, Gr. Noida, delivered his presentation on, "Active Cities & Healthy Ageing". Dr. Chaturvedi, during his presentation deliberated in detail about the concept of a healthy city besides informing participants that around 30% of population lives in urban areas is facing double burden of diseases in the form of epidemics of communicable diseases and non-communicable diseases. He further elaborated upon socio-demographic, operational and administrative challenges in developing & managing active cities and finally suggested road map to be adopted & implemented in making active & health cities a reality i.e. reforms related with required administrative changes, strengthening of citizens charters, transformation of underserved population, innovations for inclusiveness, strengthening of primary health care delivery system and economic growth for national well-being.

Technical Session VI: Panel Discussion: De-Polluting Indian Cities: Vision 2020-30

This last session was chaired by Shri Paritosh Tyagi, Former Chairman, CPCB, Chairman & Managing Trustee, IDC Foundation and was attended by Dr. S K Rasania Director Professor, Department of Community Medicine, Lady Harding Medical College, Prof A K Maitra, Former Director, SPA, and Chairman Governing Council, IDC Foundation., Dr N K Tyagi, FINAE, FNAAS, FISAE, Former Member ASRB and Member GC IDC Foundation., Prof Shayamala Mani, National Institute of Urban Affairs., Dr V R Singh, Former Director-Grade-Scientist NPL, Director-PDMEI, Vice Chairman Governing Council, IDC Foundation, Dr N K Tyagi, FINAE, FNAAS, FISAE, Former Member ASRB and Member GC IDC Foundation. Each panellist were provided two minutes time for providing their conclusions & recommendations ahead for making de-polluting Indian cities a reality by setting right directions. All panellists expressed their positivism regarding the implementation of upcoming recommendations

Dr. Rasania during the panel discussion shared his brief remarks on aspects & issues related with urbanization & public health by drawing special attention of participants towards excessive growth of slums in the country and growth of urban population as well due to push & pull factors of population growth. He shared key findings of Krishnan Committee Report and finally appreciated Dr. Manish Chaturvedi, one of speakers, during the Technical Session-V for his thoughts & views about active healthy cities & smart aging etc.

Shri Paritosh Tyagi interacted with Dr. Inderpal Kaur, Associate Professor, Punjab School of Economics, Guru Nanak Dev University, Amritsar about issues raised by her during her presentation on "Agricultural Degradation And Human Health In Punjab: An Inter-District Analysis."

Dr. A. K. Maitra shared his very brief remarks that few industrial cities are heavily polluted and we must start working for de-polluting Indian cities.

Dr. Shayamala Mani stressed upon the need for serious works to be carried out regarding unplanned urbanization in India and its implication for environmental pollution & climate change issues. While humbly differing with Prof. A. K. Maitra's views that cities might become de-polluted, she expressed serious concerns with pollution and rising density of urban population and still a poor status of local level civic bodies lacking appropriate & adequate capacities & resources to tackle pollution, many of them are still having status of Gram Panchayat or Nagar Panchayats and still to be developed as proper urban Local Bodies. Finally, she told that even in JNURM (now AMRIT), planning of urban areas is not clear and pollution creating activities are going on as it is manner.

Dr. M. P. Tyagi while sharing his brief remarks told participants that the retrofitting of old cities should not be carried out and multi-storeyed farming should be promoted.

At the end of the session, Shri O P Tyagi, Trustee, IDC Foundation, explained the significance of PANCHTATAVA in today's times of environmental pollution taking heavy human toll and finally expressed his deeply felt gratitude and sincere vote

of thanks to one & all, on behalf of IDC Foundation, for making the conference a successful reality.

Key Issues emerged & discussed during the two days Conference

- IDC's Innovative approaches in addressing environmental and socio-economic problems of the country were deliberated in detail by Shri Paritosh Tyagi, Managing Trustee, IC Foundation.
- There were serious deliberations on all aspects & issues pertaining to Environmental quality in cities, pollution control in cities.
- There has been ten-fold increase in automobiles in the decade 1999-2009. Changes in life style and consumerism are leading to health problems, environmental degradation and social disorder. Urban design and planning must provide for healthy lifestyle and reduction in consumerism.
- Population pressure resulting from industrial development and unmanageable pressures on the infrastructure are resulting in pollution in all components of the environment in cities.
- Strategies for reduction & control of pollution of air, water, soil, odor pollution in Indian cities need to revisited & reformulated in light of new guidelines issued in Swachh Bharat Abhiyan & Smart Cities program by giving special emphasis through general public, communities, administration.
- Deteriorating air quality in Delhi and other cities of India deserves urgent attention of all stakeholders to prevent heavy human toll occurring in cities due to poor air quality.
- There should be comprehensive survey & studies on all aspects & issues related with Public health impacts of air pollution and increasing burden of diseases and huge human toll.
- Working papers should be prepared regarding the replication of Approaches & strategies being adopted & implemented in cities such as Brasilia (Brazil), Canberra (Australia) & Washington DC (USA) etc. several other cities for maintaining cleanliness.
- Highly significant role of community participation in solving city/ urban level pollution management.
- Centralized system of sewage treatment is at the root of pollution of urban water bodies and absence of recycling treated sewage. Decentralized sewage treatment plants are absolutely necessary for ensuring recycling and reuse of treated sewage for flushing toilets, landscaping and cooling the condensers of centralized air-conditioning systems. There should be widespread awareness of The Mandate of Delhi Jal Board, infrastructure developed and being developed by DJB, especially treatment of 700 million gallons per day through operations of existing 37 sewage treatment plants (STPs), future requirements of STPs/ Pumping stations for treating sewage from unsewered areas because there are 6500 unplanned colonies in Delhi without any wastewater treatment facilities, leading the flow of sewage directly to River Yamuna, application of Trenchless Technology in such areas of Delhi where laying of sewer lines is not possible. Awareness & active participation all stakeholders should be ensured in evidentiary manner in DJB's programs such as JAN-JAL PRABANDHAN YOJNA of DJB in which communities concerned will do the work of laying sewer lines and use of Decentralized STPs
- There is a need to prepare comprehensive documentation on Macro & Micro-level De-polluting activities & programs.
- Data & information pertaining to water pollution in Ganga should be easily accessible public domain for all stakeholders because Ganga is being reported as a Cancer Valley from Kanpur to Kolkata due to release of untreated domestic & industrial sewages.
- Strategies & schematic framework for air pollution control in India & National Ambient air quality monitoring (NAAQM) in India, need to be revisited in the wake of WHO (2014) Report and heavy human toll occurring. There should be co-ordinated effort by MoEF and other ministries & departments including private sector industries in this direction.
- Comprehensive & Integrated air pollution & GHG Emissions inventories for cities should be developed. Besides revisiting the existing MoEF's apportionment study & the need for the development of comprehensive emission inventories.
- Rare earth elements enter storm water, groundwater and other water bodies because they are being increasingly used in automobile fuel and fertilizers. Norms need to be set for use of rare earth elements in various products considering their impact on water resources besides Heavy metal concentrations in surface,

groundwater & wastewater such as Pb, Ar, Ni in cities

- Environmental sustainability aspects & issues of smart & environmental friendly cities and environmental sustainability potential of integrated townships need to be studied & documented on urgent basis.
- There is a need for strict implementation of Approaches/ methods of abatement of pollution, i.e. involvement of all stakeholders, sustainable architecture, eco-industrial parks, use of renewable energy, energy consumption reduction through energy conservation & energy efficiency (80% utilization of solar & other renewable energy sources) reduction in GHG emissions through energy conservation & efficiency measures etc.
- Sustainable buildings such as Indira Paryavaran Bhawan (new office of MoEFCC, Govt. of India) as an ideal case for energy efficiency & conservation should be promoted by public & private sector real estate industry.
- Innovative ideas for research & development such as Spatial & temporal resolutions of atmospheric aerosols & de-toxification of GHG (CO, CH4, NOX, CFC etc. gases), by making use of the transition metal oxides catalysts viz. CO2 as selective catalyst beds MRT (Magnetic refrigeration techniques) to control global warning, need to be supported by the government.
- There is an urgent need for the preparation of the baseline status of pollution around new cities that are growing and also there is an urgent need for the preparation of baseline pollution database of proposed 100 smart cities.
- There has been ten-fold increase in automobiles in the decade 1999-2009. Changes in life style and consumerism are leading to health problems, environmental degradation and social disorder. Urban design and planning must provide for healthy lifestyle and reduction in consumerism. Management of Air Quality in Delhi deserves serious attention of all stakeholders especially policy planners.
- Air Quality Trends in Delhi as displayed for years 2002-2014 need to developed & updated regularly for all cities including the proposed 100 smart cities.
- Causes & reasons behind Rise & declines of PM in Delhi due to rapid increase in vehicles, decline in PM10 due to expansion of metro train system, should be regularly studied & reported. Particulate Matter of sizes 2.5 micrometers pollution in Delhi the capital of India which is being reported as one of the most polluted city (WHO 2014)
- There is a need for strict implementation of IAAPC's short-term recommendations for air pollution control & prevention in Delhi such as enforce pollution control in industries, power plants, vehicles, construction activities etc. located in NCR Delhi, Ban burning of fossil fuels & agriculture residue, install vapor recovery systems at oil filling stations, improve green belts, ensure proper calibration of monitoring systems, methods for the management of road lifted dust (deploy vacuum cleaning systems & covering of exposed areas with greenery, setting of composting plants for biomass burring related waste products & incentivize composting by free distribution of compost to local residents.
- There is a need for strict implementation of AAPC's long-term recommendations mainly-implementation of administrative controls rather finding engineering solutions, reducing of travel trips, distance & frequency by mandating that children must attend neighborhood schools, focus/ augment intercity transport. Develop smart city about 100 kilometers away that may connect Delhi by fast intercity trains and urban planning at self-sufficient cluster basis.
- Volatile Organic Compounds (VOCs) in indoor environments & their indoor sources are to studied in detail besides comprehensive R & D work on Organic structures of VOCs, Mechanism of VOCs reaction with Ozone, reactions of VOCs with Hydroxyl process, reaction mechanism of Secondary Organic Aerosols (SOA) with VOCs, sizes of SOAs as reported by various researchers, Mitigation measures for the control of VOCs & O3 sources. Research & development gaps and future research areas related with aspects & issues of VOCs & SOAs mainly impacts of VOCs & SOAs in human health, have been identified and deserves serious support from the government at all levels.
- Air Pollution & child health has remained a highly ignored area of work and deserves urgent attention of all stakeholders.
- All stakeholders should be encouraged to explore business opportunities in different areas of Waste Management for maintaining the required Eco balancing of Petroleum

Products via Microbial Degradation as well as High-Tech Elements as Emerging Pollutants in Urban Environment: Strategies for Water Quality Protection. Similar types of efforts are required to be carried out in the area of e-waste: management related business opportunities & ecological balance because E-waste is a threat to environmental quality as also an ocean of opportunities for recovery of precious metals. The opportunities need to be explored.

- Heat Island Effect is a result of unplanned urban development and depletion of vegetation in urban areas. Heat island is created both at land surface and in the atmosphere. It is forecast that nights may be hotter than the day if the subject is neglected for long. Heat Island Effect has to be addressed by major changes in urban design to reduce retention of heat in urban infrastructure and energy requirement in various buildings. There should be widespread application of already proven approaches & methodologies being applied, especially geospatial technologies in the Evaluation of Surface Urban Heat Island Effects (SUHI) besides suggesting measures for mitigating SUHI such as cool roofs & green roofs.
- There are formidable challenges associated with Climate Smart Cities, such as Lack of infrastructure, encroachments, unsewered areas, heat island stresses and there are seriously felt needs for the preparation of Master Plans in consistency with climate change threats, solid waste management requirements.
- Peri-urban areas remain neglected until they are included within the area to be developed. Peri-urban agriculture has the potential for not only meeting the need of vegetables for urban dwellers but also disposing of the treated wastewater in a scientific and safe manner. Managing Environmental pollution especially wastewater & sludge treatment through peri-urban agriculture should be promoted on wider scales.
- Opportunities for wide scale utilization of treated urban sludge and industrial waste water for agricultural purposes, have been identified because these waters are rich in organic matter and major & micro-nutrients required for enhancing soil fertility and crop productivities.
- Urban planning for cities should incorporate new & innovative design & installation of a piped system which can be regularly cleaned besides using solid wastes for the production of lowest cost involving manure for agriculture and irrigation for enhancing biodiversity.
- Chemical methods have great potential in detoxification of environment. New studies and applications are highly recommended in this subject R & D efforts regarding all aspects & issues of river pollution need to be intensified.
- Agricultural Degradation and Human Health in Punjab, human health impacts of wide scale based use of chemical fertilizers & pesticides in the state of Punjab has attracted serious attention of all stakeholders & meaningful action plans are required to be prepared and implemented strictly.
- Applications of environmental biotechnologies such as Removal and Recovery of Heavy Metals from Industrial Effluents by Microorganisms, should be promoted on wider scales besides exploring the potential of applications of environmental biotechnologies, especially the suitability, type efficiency, operational proficiencies of bio-sorbents of different microbial origins and other non-conventional bio-sorbents for the removal of Cr.
- Technologies involved in detecting environmental pollution, cancer, detection & measuring instrumentations and prevention & control measures should be popularized on wide scales in the society.
- Road map to be developed and adopted & implemented in making active & health cities a reality i.e. reforms related with required administrative changes, strengthening of citizens charters, transformation of underserved population, innovations for inclusiveness, strengthening of primary health care delivery system and economic growth for national well-being.
- Immigration to urban areas shall continue and lead to extend slum areas unless well-directed policies take care of urban immigration. Unplanned urban growth is similar to growth of cancer in human body. Prevention is always better than cure. Efforts for depolluting should start at avoiding pollution rather than have focus on mitigating the effects of pollution. An integrated planning considering social and environmental impacts of proposed developments in urban areas must be done.

- There is a need for strengthening of infrastructure & related facilities in cities having pollution and rising density of urban population and still a poor status of local level civic bodies lacking appropriate & adequate capacities & resources to tackle pollution problems in urban areas.

IDC Foundation: National Conference held on Depolluting Indian Cities, 18-19 September 2015

Salient Observations and Recommendations

1. Urban dwellers are stakeholders in depolluting their city and are, to a significant measure, the contributors to pollution. *Society in general and the community-based organizations in particular should be involved in the proposals and efforts for depolluting the cities. Jan Jal Prabandhan Yojana of Delhi Jal Board presents a model for replication.*
2. Immigration to urban areas shall continue and lead to extend slum areas unless well-directed policies take care of urban immigration. Unplanned urban growth is similar to growth of cancer in human body. *Prevention is always better than cure. Efforts for depolluting should start at avoiding pollution rather than have focus on mitigating the effects of pollution. An integrated planning considering social and environmental impacts of proposed developments in urban areas must be done.*
3. Heat Island Effect is a result of unplanned urban development and depletion of vegetation in urban areas. Heat island is created both at land surface and in the atmosphere. It is forecast that nights may be hotter than the day if the subject is neglected for long. *Heat Island Effect has to be addressed by major changes in urban design to reduce retention of heat in urban infrastructure and energy requirement in various buildings.*
4. Centralized system of sewage treatment is at the root of pollution of urban water bodies and absence of recycling treated sewage. *Decentralized sewage treatment plants are absolutely necessary for ensuring recycling and reuse of treated sewage for flushing toilets, landscaping and cooling the condensers of centralized air-conditioning systems.*
5. There has been ten-fold increase in automobiles in the decade 1999-2009. Changes in life style and consumerism are leading to health problems, environmental degradation and social disorder. *Urban design and planning must provide for healthy lifestyle and reduction in consumerism.*
6. Rare earth elements enter storm water, groundwater and other water bodies because they are being increasingly used in automobile fuel and fertilizers. *Norms need to be set for use of rare earth elements in various products considering their impact on water resources.*
7. E-waste is a threat to environmental quality as also an ocean of opportunities for recovery of precious metals. *The opportunities need to be explored.*
8. Peri-urban areas remain neglected until they are included within the area to be developed. *Peri-urban agriculture has the potential for not only meeting the need of vegetables for urban dwellers but also disposing of the treated wastewater in a scientific and safe manner.*
9. Air quality has become a major health concern. *For managing urban air quality, source apportionment and dispersion modeling have to done to be able to address the problem where it is needed.*
10. Chemical methods have great potential in detoxification of environment. *New studies and applications are highly recommended in this subject.*