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SA	**ESC - book.docx** Document ESC - book.docx (D110527582)	22
W	URL: https://teresas.ac.in/wp-content/uploads/2020/06/CHAPTER-1-7-MULTIDISCIPLINARY-NATURE-OF-ENVIR... Fetched: 2022-03-11 09:15:16	19
SA	**Assam Don Bosco University / Environmental studies.pdf** Document Environmental studies.pdf (D165838221) Submitted by: mumtaz@code.dbuniversity.ac.in Receiver: mumtaz.dbuni@analysis.urkund.com	6
W	URL: https://onlyias.com/environmental-pollution/ Fetched: 2022-02-08 03:01:55	3
W	URL: https://www.vedantu.com/english/pollution-essay Fetched: 2021-01-20 14:15:03	1
SA	**ELMES-02 - Advances in EVS.docx** Document ELMES-02 - Advances in EVS.docx (D162886077)	2
W	URL: https://pdfcoffee.com/environmental-educationpdf-pdf-free.html Fetched: 2021-09-16 17:56:00	10
SA	**Chapters 1 - 7.docx** Document Chapters 1 - 7.docx (D19161985)	29
SA	**Industrial waste management.docx** Document Industrial waste management.docx (D138563744)	3
SA	**Dissertation for Plagiarism.pdf** Document Dissertation for Plagiarism.pdf (D135908508)	6

SA	**HAYAT DISSERTATION 1.pdf** Document HAYAT DISSERTATION 1.pdf (D110788320)	11
SA	**0_Dissertation(Rahul Kumar Singh).pdf** Document 0_Dissertation(Rahul Kumar Singh).pdf (D140073161)	19
W	URL: https://numerons.files.wordpress.com/2012/04/7environment-environmental-regulatory-mechanism-g... Fetched: 2022-11-12 07:27:54	6
SA	**Smita Barua.docx** Document Smita Barua.docx (D15085035)	11
SA	**Dissertation on Effects of Environmental Degradation in the Society A Study.docx** Document Dissertation on Effects of Environmental Degradation in the Society A Study.docx (D156794174)	8
SA	**dissertation_falak_LLM(HR).docx** Document dissertation_falak_LLM(HR).docx (D133844573)	15
SA	**pollution book.pdf** Document pollution book.pdf (D24327357)	2
SA	**Neelam- Dissertation.docx** Document Neelam- Dissertation.docx (D142205573)	1
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SA	**Jaspreet kaur.docx** Document Jaspreet kaur.docx (D113775418)	3
W	URL: https://www.ijlsi.com/wp-content/uploads/Hazardous-Waste-Management.pdf Fetched: 2022-01-06 12:20:31	1
W	URL: https://hrms.secab.org/resource/702_18CV642_Chethan_Kumar_Marol.pdf Fetched: 2023-03-16 12:19:35	3
W	URL: http://moef.gov.in/wp-content/uploads/report/0203/chap-05.htm Fetched: 2021-02-19 09:32:38	12

Entire Document

Unit: I Meaning, Nature and Scope of Environment In this unit, you will learn about, ? Definition, Scope and Importance ? Need for Public Awareness ? Institutions in Environment ? Pollution and its Effect on Environment ? Causes, effects and control measures on

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pollution ? Air Pollution ? Water Pollution ? Soil Pollution ? Marine Pollution ? Oil Pollution ? Noise Pollution ? Thermal Pollution ? Solid waste management: Causes effects and control measures

of urban and Industrial waste ? Role of an individual in prevention of pollution ? Disaster Management: Floods, Earthquakes, Cyclones, and Landslides ? Indian Constitutional Provisions for Sustainable development and Environment Protection ? Constitutional Provision for ecological preservation and Balanced Development ? Threats to the Environment Definition, Scope and Importance Definition

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Environmental studies deal with every issue that affects an organism. It is essentially a multidisciplinary approach that brings about an appreciation of our natural world and human impacts on its integrity. It is an applied science as it seeks practical answers to making human civilization sustainable on the earth's finite resources. Its components include biology, geology, chemistry, physics, engineering, sociology, health, anthropology, economics, statistics,

computers and philosophy. Scope
As we look around at the area in which we live, we see that our surroundings were originally a natural landscape such as a forest, a river, a mountain, a desert, or a combination of these elements. Most of us

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live in landscapes that have been heavily modified by human beings, in villages, towns or cities. But even those of us who live in cities get our food supply from surrounding villages and these in turn are dependent on natural landscapes such as forests, grasslands, rivers, seashores, for resources such as water for agriculture, fuel wood, fodder, and fish. Thus, our daily lives are linked with our surroundings and inevitably affects them. We use water to drink and for other day-to-day activities. We breathe air, we use resources from which food is made and we depend on the community of living plants and animals which form a web of life, of which we are also a part. Everything around us forms our environment and our lives depend on keeping its vital systems

as intact as possible. Our dependence on nature is so great that we cannot continue to live without protecting the earth's environmental resources. Thus, most traditions refer to our environment as 'Mother Nature'
and most traditional societies have learned that respecting nature is vital for their livelihoods. This has led to many cultural practices that helped traditional societies protect and preserve their natural resources. Respect for nature and all living creatures is not new to India. All our traditions are based on these values. Emperor Ashoka's edict proclaimed that all forms of life are important for our well being in Fourth Century BC. Over the past 200 years however, modern societies began to believe that easy answers to the question of producing more resources could be provided by means of technological innovations. For example, though growing more food by using fertilizers and pesticides, developing better strains of domestic animals and crops, irrigating farmland through mega dams and developing industry, led to rapid economic growth, the ill effects of this type of development, led to environmental degradation.

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The industrial development and intensive agriculture that provides the goods for our increasingly consumer oriented society uses up large amounts of natural resources such as water, minerals, petroleum products, wood, etc. 1 Non-renewable resources, such as minerals and oil are those which will be exhausted in the future if we continue to extract these without a thought for subsequent generations. Renewable resources, such as timber and water, are those which can be used but can be regenerated by natural processes such as regrowth or rainfall. But these too will be depleted if we continue to use them faster than nature can replace them.

For example, if the removal of timber and firewood from a forest is faster than the regrowth and regeneration of trees, it cannot replenish the supply. And loss of forest cover not only depletes the forest of its resources, such as timber and other non-wood products, but affect our water resources because an intact natural forest acts like a sponge which holds water and releases it slowly.

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Deforestation leads to floods in the monsoon and dry rivers once the rains are over.

Such multiple effects on the environment resulting from routine human activities must be appreciated by each one of us, if it is to provide us with the resources we need in the long-term. Our natural resources can be compared with money in a bank. If we use it rapidly, the capital will be reduced to zero. On the other hand, if we use only the interest, it can sustain us over the longer term. This is called sustainable utilisation or development. Importance Environment is not a single subject. It is an integration of several subjects that include both Science and Social Studies. To understand all the different aspects of our environment we need to understand biology, chemistry, physics, geography, resource management, economics and population issues. We live in a world in which natural resources are limited. Water, air, soil, minerals, oil, the products we get from forests, grasslands, oceans and from agriculture and livestock, are all a part of our life support systems. Without them, life itself would be impossible. As we keep increasing in numbers and the quantity of resources each of us uses also increases, the earth's resource base must inevitably shrink. The earth cannot be expected to sustain this expanding level of utilization of resources. Added to this is misuse of resources. We waste or pollute large amounts of nature's clean water; we create more and more material like plastic that we discard after a single use; and we waste colossal amounts of food, which is discarded as garbage. Manufacturing processes create solid waste by products that are discarded, as well as chemicals that flow out as liquid waste and pollute water, and gases that pollute the air. Increasing amounts of waste cannot be managed by natural processes. These accumulate in our environment, leading to a variety of diseases and other adverse environmental impacts now seriously affecting all our lives. Air pollution leads to respiratory diseases, water pollution to gastrointestinal diseases, and many pollutants are known to cause cancer. Improving this situation will only happen if each of us begins to take actions in our daily lives that will help preserve our environmental resources. We cannot expect Governments alone to manage the safeguarding of the environment, nor can we expect other people to prevent environmental damage. We need to do it ourselves. It is a responsibility that each of us must take on as ones own. ? Productive Value of Nature As scientists make new advances in fields such as biotechnology, we begin to understand that the world's species contain an incredible and uncountable number of complex chemicals. These are the raw materials that are used for developing new medicines and industrial products and are a storehouse from which to develop thousands of new products in the future. The flowering plants and insects that form the most species rich groups of living organisms are thus vital for the future development of man. If we degrade their habitat these species will become extinct. If one sees being sold or used, a product that comes from an illegally killed wild species, if we do not inform the authorities, we become party to its extinction. Once they are lost, man cannot bring them back. When we permit the destruction of a forest, wetland or other natural area and do not protest about it, future generations are being denied the use of these valuable resources and will blame us for these rash and negligent actions towards the environment. Thus, the urgent need to protect all living species is a concept that we need to understand and act upon. While individually, we perhaps cannot directly prevent the extinction of a species, creating a strong public opinion to protect the National Parks and Wildlife Sanctuaries in which wild species live is an importance aspect of sustainable living. There is a close link between agriculture and the forest, which illustrates its productive value. For crops to be successful, the flowers of fruit trees and vegetables must be pollinated by insects, bats and birds. Their life cycles however frequently require intact forests. ? Aesthetic/Recreational value of nature The aesthetic and recreational values that nature possesses enlivens our existence on earth. This is created by developing National Parks and Wildlife Sanctuaries in relatively undisturbed areas. A true wilderness experience has not only recreational value but is an incredible learning experience. It brings about an understanding of the oneness 2

of nature and the fact that we are entirely dependent upon the intricate functioning of ecosystems. The beauty of nature encompasses every aspect of the living and non-living part of our earth. One can appreciate the magnificence of a mountain, the power of the sea, the beauty of a forest, and the vast expanse of the desert. It is these natural vistas and their incredible diversity of plant and animal life that has led to the development of several philosophies of life. It has also inspired artists to develop visual arts and writers and poets to create their works that vitalize our lives. A wilderness experience has exceptional recreational value. This has been described as nature tourism, or wildlife tourism, and is also one aspect of adventure tourism. These recreational facilities not only provide a pleasurable experience but are intended to create a deep respect and love for nature. They are also key tools in educating people about the fragility of the environment and the need for sustainable lifestyles. In an urban setting, green spaces and gardens are vital to the psychological and physical health of city dwellers. It provides not only an aesthetic and visual appeal but the ability to ensure that each individual is able to access a certain amount of peace and tranquillity. Thus, urban environmental planners must ensure that these facilities are created in growing urban complexes. Another important conservation education facility in urban settings includes the need to set up well designed and properly managed zoological parks and aquariums. These have got great value in sensitizing school students to wildlife. Many young people who frequented zoos as young children grow up to love wildlife and become conservationists. In the absence of access to a Protected Area, a botanical garden or a zoo, one concept that can be developed is to create small nature awareness areas with interpretation facilities at district and taluka levels. These areas can be developed to mimic natural ecosystems even though they could be relatively small in size. Such nature trails are invaluable assets for creating conservation education and awareness. They can be developed in a small woodlot, a patch of grassland, a pond ecosystem, or be situated along an undisturbed river or coastal area. This would bring home to the visitor the importance of protecting our dwindling wilderness areas. ? The option value of nature While we utilise several goods and services of nature and enjoy its benefits, we must recognize that every activity that we do in our daily lives has an adverse impact on nature's integrity. Thus, if we use up all our resources, kill off and let species of plants and animals become extinct on earth, pollute our air and water, degrade land, and create enormous quantities of waste, we as a generation will leave nothing for future generations. Our present generation has developed its economies and lifestyles on unsustainable patterns of life. however, nature provides us with various options on how we utilize its goods and services. This is its option value. We can use up goods and services greedily and destroy its integrity and long term values, or we can use its resources sustainably and reduce our impacts on the environment. The option value allows us to use its resources sustainably and preserve its goods and services for the future. Need for Public Awareness

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As the earth's natural resources are dwindling and our environment is being increasingly degraded by human activities, it is evident that something needs to be done. We often feel that managing all this is something that the Government should do. But if we go on endangering our environment, there is no

way in

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which the Government can perform all these clean-up functions. It is the prevention of environment degradation in which we must all take part that must become a part of all our lives. Just as for any disease, prevention is better than cure. To prevent ill-effects on our environment by our actions, is economically more viable than cleaning up the environment once it is damaged. Individually we can play a major role in environment management. We can reduce wasting natural resources and we can act as watchdogs that inform the Government about sources that lead to pollution and degradation of our environment. This can only be made possible through mass public awareness. Mass media such as newspapers, radio, television, strongly influence public opinion. However, someone

must

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bring this about. If each of us feels strongly about the environment, the press and media will add to our efforts. Politicians in a democracy always respond positively to a strong publicly supported movement. Thus, if you join an NGO that supports conservation, politicians will make green policies. We are living on spaceship earth with a limited supply of resources.

Each of us

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is responsible for spreading this message to as many people as possible.

a) Institutions in Environment There have been several Government and Non-government organizations that have led to environmental protection in our country. They have led to a growing interest in environmental protection and conservation of nature and natural resources. The traditional conservation practices that were part of ancient India's culture have however gradually disappeared. Public awareness is thus a critical need to further environmental protection. Among the large 3

number of institutions that deal with environmental protection and conservation, a few well-known organizations include government organisations such as the BSI and ZSI, and NGOs such as BNHS, WWF-I, etc. ? Bombay Natural History Society (BNHS), Mumbai: The BNHS began as a small society of six members in 1883. It grew from a group of shikaris and people from all walks of life into a major research organisation that substantially influenced conservation policy in the country. The influence on wildlife policy building, research, popular publications and people's action have been unique features of the multifaceted society. Undoubtedly its major contribution has been in the field of wildlife research. It is India's oldest conservation research based NGO and one that has acted at the forefront of the battle for species and ecosystems. The BNHS publishes a popular magazine called Hornbill and also an internationally well-known Journal on Natural History. Its other publications include the Salim Ali Handbook on birds, JC Daniel's book of Indian Reptiles, SH Prater's book of Indian Mammals and PV Bole's book of Indian Trees. One of its greatest scientists was Dr. Salim Ali whose ornithological work on the birds of the Indian subcontinent is world famous. The BNHS has over the years helped Government to frame wildlife related laws and has taken up battles such as the 'Save the Silent Valley' campaign. ? World Wide Fund for Nature (WWF-I), New Delhi: The WWF-I was initiated in 1969 in Mumbai after which the headquarters were shifted to Delhi with several branch offices all over India. The early years focused attention on wildlife education and awareness. It runs several programs including the Nature Clubs of India program for school children and works as a think tank and lobby force for environment and development issues. ? Center for Science and Environment (CSE), New Delhi: Activities of this Center include organising campaigns, holding workshops and conferences, and producing environment related publications. It published a major document on the 'State of India's Environment', the first of its kind to be produced as a Citizen's Report on the Environment. The CSE also publishes a popular magazine, 'Down to Earth', which is a Science and Environment fortnightly. It is involved in the publication of material in the form of books, posters, video films and also conducts workshops and seminars on biodiversity related issues. ? CPR Environmental Education Centre, Madras: The CPR EEC was set up in 1988. It conducts a variety of programs to spread environmental awareness and creates an interest in conservation among the general public. It focussed attention on NGOs, teachers, women, youth and children to generally promote conservation of nature and natural resources. Its programs include components on wildlife and biodiversity issues. CPR EEC also produces a large number of publications. ? Centre for Environment Education (CEE), Ahmedabad: The Centre for Environment Education, Ahmedabad was initiated in 1989. It has a wide range of programs on the environment and produces a variety of educational material. CEE's Training in Environment Education {TEE} program has trained many environment educators. ? Bharati Vidyapeeth Institute of Environment Education and Research (BVIEER), Pune: This is part of the Bharati Vidyapeeth Deemed University. The Institute has a PhD, a Masters and Bachelors program in Environmental Sciences. It also offers an innovative Diploma in Environment Education for in-service teachers. It implements a large outreach programme that has covered over 135 schools in which it trains teachers and conducts fortnightly Environment Education Programs. Biodiversity Conservation is a major focus of its research initiatives. It develops low cost Interpretation Centres for Natural and Architectural sites that are highly locale specific as well as a large amount of innovative environment educational material for a variety of target groups. Its unique feature is that it conducts environment education from primary school level to the postgraduate level. The BVIEER has produced several EE aids. It has developed a teacher's handbook linked to school curriculum, a textbook for UGC for its undergraduate course on environment. Its Director has developed a CD ROM on India's biodiversity published by Mapin Publishers, Ahmedabad. ? Uttarkhand Seva Nidhi (UKSN), Almora: The Organisation is a Nodal Agency which supports NGOs in need of funds for their environment related activities. Its major program is organising and training school teachers to use its locale specific Environment Education Workbook 4

Program. The main targets are linked with sustainable resource use at the village level through training school children. Its environment education program covers about 500 schools. ? Kalpavriksh, Pune: This NGO, initially Delhi based, is now working from Pune and is active in several other parts of India. Kalpavriksh works on a variety of fronts: education and awareness; investigation and research; direct action and lobbying; and litigation with regard to environment and development issues. Its activities include talks and audio-visuals in schools and colleges, nature walks and outstation camps, organising student participation in ongoing campaigns including street demonstrations, pushing for consumer awareness regarding organic food, press statements, handling green alerts, and meetings with the city's administrators. It is involved with the preparation of site-specific, environmental manuals for school teachers. Kalpavriksh was responsible for developing India's National Biodiversity Strategy and Action Plan in 2003. ? Salim Ali Center for Ornithology and Natural History (SACON), Coimbatore: This institution was Dr. Salim Ali's dream that became a reality only after his demise. He wished to support a group of committed conservation scientists on a permanent basis. Initially conceived as being a wing of the Bombay Natural History Society (BNHS) it later evolved as an independent organisation based at Coimbatore in 1990. It has instituted a variety of field programs that have added to the country's information on our threatened biodiversity. ? Wildlife Institute of India (WII), Dehradun: This Institution was established in 1982, as a major training establishment for Forest Officials and Research in Wildlife Management. Its most significant publication has been 'Planning A Wildlife Protected Area Network for India' (Rodgers and Panwar, 1988). The organisation has over the years added an enormous amount of information on India's biological wealth. It has trained a large number of Forest Department Officials and Staff as Wildlife Managers. Its M.Sc. Program has trained excellent wildlife scientists. It also has an Environment Impact Assessment (EIA) cell. It trains personnel in eco development, wildlife biology, habitat management and Nature interpretation. ? Botanical Survey of India (BSI): The Botanical Survey of India (BSI) was established in 1890 at the Royal Botanic Gardens, Calcutta. However, it closed down for several years after 1939 and was reopened in 1954. In 1952 plans were made to reorganise the BSI and formulate its objectives. By 1955 the BSI had its headquarters in Calcutta with Circle Offices at Coimbatore, Shillong, Pune and Dehra Dun. Between 1962 and 1979, offices were established in Allahbad, Jodhpur, Port Blair, Itanagar and Gangtok. The BSI currently has nine regional centres. It carries out surveys of plant resources in different regions. ? Zoological Survey of India (ZSI): The ZSI was established in1916. Its mandate was to do a systematic survey of fauna in India. It has over the years collected 'type specimens' on the bases of which our animal life has been studied over the years. Its origins were collections based at the Indian Museum at Calcutta, which was established in 1875. Older collections of the Asiatic Society of Bengal, which were made between 1814 and 1875, as well as those of the Indian Museum made between 1875 and 1916 were then transferred to the ZSI. Today it has over a million specimens! This makes it one of the largest collections in Asia. It has done an enormous amount of work on taxonomy and ecology. It currently operates from 16 regional centers. b) People in Environment There are several internationally known environmental thinkers. Among those who have made landmarks, the names that are usually mentioned are Charles Darwin, Ralph Emerson, Henry Thoreau, John Muir, Aldo Leopald, Rachel Carson and EO Wilson. Each of these thinkers looked at the environment from a completely different perspective. Charles Darwin wrote the 'Origin of Species', which brought to light the close relationship between habitats and species. It brought about a new thinking of man's relationship with other species that was based on evolution. Alfred Wallace came to the same conclusions during his work. Ralph Emerson spoke of the dangers of commerce to our environment way back in the 1840s. Henry Thoreau in the 1860s wrote that the wilderness should be preserved after he lived in the wild for a year. He felt that most people did not care for nature and would sell it off for a small sum of money. John Muir is remembered as having saved the great ancient sequoia trees in California'a forests. 5

In the 1890s he formed the Sierra club, which is a major conservation NGO in the USA. Aldo Leopald was a forest official in the US in the 1920s. He designed the early policies on wilderness conservation and wildlife management. In the 1960s Rachel Carson published several articles that caused immediate worldwide concern on the effects of pesticides on nature and mankind. She wrote a well-known book called 'Silent Spring' which eventually led to a change in Government policy and public awareness. EO Wilson is an entomologist who envisioned that biological diversity was a key to human survival on earth. He wrote 'Diversity of Life' in 1993, which was awarded a prize for the best book published on environmental issues. His writings brought home to the world the risks to mankind due to manmade disturbances in natural ecosystems that are leading to the rapid extinction of species at the global level. There have been a number of individuals who have been instrumental in shaping the environmental history in our country. Some of the well-known names in the last century include environmentalists, scientists, administrators, legal experts, educationists and journalists. Salim Ali's name is synonymous with ornithology in India and with the Bombay Natural History Society (BNHS). He also wrote several great books including the famous 'Book of Indian Birds'. His autobiography, 'Fall of a Sparrow' should be read by every nature enthusiast. He was our country's leading conservation scientist and influenced environmental policies in our country for over 50 years. Indira Gandhi as PM has played a highly significant role in the preservation of India's wildlife. It was during her period as PM, that the network of PAs grew from 65 to 298! The Wildlife Protection Act was formulated during the period when she was PM and the Indian Board for Wildlife was extremely active as she personally chaired all its meetings. India gained a name for itself by being a major player in CITES and other International Environmental Treaties and Accords during her tenure. BNHS frequently used her good will to get conservation action initiated by the Government. S P Godrej was one of India's greatest supporters of wildlife conservation and nature awareness programs. Between 1975 and 1999, SP Godrej received 10 awards for his conservation activities. He was awarded the Padma Bhushan in 1999. His friendship with people in power combined with his deep commitment for conservation led to his playing a major advocacy role for wildlife in India. M S Swaminathan is one of India's foremost agricultural scientists and has also been concerned with various aspects of biodiversity conservation both of cultivars and wild biodiversity. He has founded the MS Swaminathan Research Foundation in Chennai, which does work on the conservation of biological diversity. Madhav Gadgil is a well-known ecologist in India. His interests range from broad ecological issues such as developing Community Biodiversity Registers and conserving sacred groves to studies on the behaviour of mammals, birds and insects. He has written several articles, published papers in journals and is the author of 6 books. M C Mehta is undoubtedly India's most famous environmental lawyer. Since 1984, he has filed several Public Interest Litigations for supporting the cause of environmental conservation. His most famous and long drawn battles supported by the Supreme Court include protecting the Taj Mahal, cleaning up the Ganges River, banning intensive shrimp farming on the coast, initiating Government to implement environmental education in schools and colleges, and a variety of other conservation issues. Anil Agarwal was a journalist who wrote the first report on the 'State of India's Environment' in 1982. He founded the Center for Science and Environment which is an active NGO that supports various environmental issues. Medha Patkar is known as one of India's champions who has supported the cause of downtrodden tribal people whose environment is being affected by the dams on the Narmada river. Sunderlal Bahugna's Chipko Movement has become an internationally well-known example of a highly successful conservation action program through the efforts of local people for guarding their forest resources. His fight to prevent the construction of the Tehri Dam in a fragile earthquake prone setting is a battle that he continues to wage. The Garhwal Hills will always remember his dedication to the cause for which he has walked over 20 thousand kilometers. Pollution and its Effects on Environment 'We spray our elms, and the following spring, trees are silent of robin song, not because we sprayed the robins directly but because the poison travelled step by step through the now familiar elm-earthworm-robin cycle' – Rachael Carson Definition Pollution is the effect of undesirable changes in our surroundings that have harmful effects on plants, animals and human beings. This occurs when only short-term economic gains are made at the cost of the long-term ecological benefits for humanity. No natural phenomenon has led to greater ecological changes than have been made by mankind. During the last few decades we have contaminated our air, water and land on which life itself depends with a variety of waste products. 6
Pollutants include

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solid, liquid or gaseous sub-stances present in greater than natural abundance produced due to human

activity, which have a detrimental effect on our environment. The nature and concentration of a pollutant determines the severity of detrimental effects on human health. An average human requires about 12 kg of air each day, which is nearly 12 to15 times greater than the amount of food we eat. Thus, even a small concentration of pollutants in the air becomes more significant in comparison to the similar levels present in food. Pollutants that enter water can spread to distant places especially in the marine ecosystem. From an ecological perspective pollutant can be classified as follows: ? Degradable or non-persistent pollutants: These can be rapidly broken down by natural pro-cesses. Eg: domestic sewage, discarded vegetables, etc. Slowly degradable or persistent pollutants: Pollutants that remain in the environment for many years in an unchanged condition and take de-cades or longer to degrade. Eg: DDT and most plastics. ? Non-degradable pollutants: These cannot be degraded by natural processes. Once they are released into the environment, they are difficult to eradicate and continue to accumulate. Eg: toxic elements like lead or mercury. Causes, Effects and control measures of Pollution 1) Air Pollution History of air pollution The origin of air pollution on the earth can be traced from the times when man started using firewood as a means of cooking and heating. Hippocrates has mentioned air pollution in 400 BC. With the discovery and increasing use of coal, air pollution became more pronounced especially in urban areas. It was recognized as a problem 700 years ago in London in the form of smoke pollution, which prompted King Edward I to make the first antipollution law to restrict people from using coal for domestic heating in the year 1273. In the year 1300 another Act banning the use of coal was passed. Defying the law led to imposition of capital punishment. Despite this air pollution became a serious problem in London during the industrial revolution due to the use of coal in industries. The earliest recorded major disaster was the 'London Smog' that occurred in 1952 that resulted in more than 4000 deaths due to the accumulation of air pollutants over the city for five days. In Europe, around the middle of the 19th century, a black form of the Peppered moth was noticed in industrial areas. Usually the normal Peppered moth is well camouflaged on a clean lichen covered tree. However, the peppered pat-tern was easily spotted and picked up by birds on the smoke blackened bark of trees in the industrial area, while the black form remained well camouflaged. Thus, while the peppered patterned moths were successful in surviving in clean non-industrial areas, the black coloured moths were successful in industrial areas. With the spread of industrialization, it has been observed that the black forms are not only see in Peppered moth, but also in many other moths. This is a classic case of pollution leading to adaptation. Air pollution began to increase in the beginning of the twentieth century with the development of the transportation systems and large-scale use of petrol and diesel. The severe air quality problems due to the formation of photochemical smog from the combustion residues of diesel and petrol engines were felt for the first time in Los Angeles. Pollution due to auto-exhaust re-mains a serious environmental issue in many developed and developing countries including India. The Air Pollution Control Act in India was passed in 1981 and the Motor Vehicle Act for control-ling the air pollution, very recently. These laws are intended to prevent air from being polluted. The greatest industrial disaster leading to serious air pollution took place in Bhopal where extremely poisonous methyl iso cyanide gas was accidentally released from the Union Carbide's pesticide manufacturing plant on the night of December 3 rd 1984. The effects of this disaster on human health and the soil are felt even to-day. Structure of the atmosphere The atmosphere is normally composed of 79 percent nitrogen, 20 percent oxygen and one percent as a mixture of carbon dioxide, water vapour and trace amounts of several other gases such as neon, helium, methane, krypton, hydrogen and xenon. The general structure of the atmosphere has several important features that have relevance to environmental problems. The atmosphere is divided into several layers. 7

The innermost layer the troposphere extends 17 kilometres above sea level at the equator and about 8 kilometres over the poles. It contains about 75 percent of the mass of the earth's air. The fragility of this layer is obvious from the fact that if the earth were an apple this particular layer would be no thicker than an apple's skin. Temperature declines with altitude in the troposphere. At the top of the troposphere temperature abruptly begin to rise. This boundary where this temperature reversal occurs is called the tropopause. The tropopause marks the end of the tropo-sphere and the beginning of the stratosphere, the second layer of the atmosphere. The stratosphere extends from 17 to 48 kilometres above the earth's surface. While the composition of the stratosphere is like that of the tropo-sphere it has two major differences. The volume of water vapour here is about 1000 times less while the volume of ozone is about 1000 times greater. The presence of ozone in the stratosphere prevents about 99 percent of the sun's harmful ultraviolet radiation from reaching the earth's surface thus protecting humans from cancer and damage to the immune system. This layer does not have clouds and hence airplanes fly in this layer as it creates less turbulence. Temperature rises with altitude in the stratosphere until there is another reversal. This point is called the stratopause and it marks the end of the stratosphere and the beginning of the atmosphere's next layer, the mesosphere. In the mesosphere the temperature decreases with altitude falling up to –110 degree Celsius at the top. Above this is a layer where ionization of the gases is a major phenomenon, thus increasing the temperature. This layer is called the thermosphere. Only the lower troposphere is routinely involved in our weather and hence air pollution. The other layers are not significant in determining the level of air pollution. Types and sources of Air Pollution What is

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Air pollution? Air pollution occurs due to the presence of

un-desirable solid or gaseous particles in the air in quantities that are harmful to human health and the environment. Air may get polluted by natural causes such as volcanoes, which release ash, dust, sulphur and other gases, or by forest fires that are occasionally naturally caused by lightning. However, unlike pollutants from human activity, naturally occurring pollutants tend to remain in the atmosphere for a short time and do not lead to permanent atmospheric change. Pollutants that are emitted directly from identifiable sources are produced both by natural events (for example, dust storms and volcanic eruptions) and human activities (emission from vehicles, industries, etc.). These are called primary pollutants. There are five primary pollutants that together contribute about 90 percent of the global air pollution. These are carbon oxides (CO and CO2), nitrogen oxides, sulphur oxides, volatile organic compounds (mostly hydrocarbons) and suspended particulate matter. Pollutants that are produced in the atmosphere when certain chemical reactions take place among the primary pollutants are called secondary pollutants. Eg: sulfuric acid, nitric acid, carbonic acid, etc. Carbon monoxide is a colourless, odourless and toxic gas produced when organic materials such as natural gas, coal or wood are incompletely burnt. Vehicular exhausts are the single largest source of carbon monoxide. The number of vehicles has been increasing over the years all over the world. Vehicles are also poorly maintained, and several have inadequate pollution control equipment resulting in release of greater amounts of carbon monoxide. Carbon monoxide is however not a persistent pollutant. Natural processes can convert carbon monoxide to other compounds that are not harmful. There-fore the air can be cleared of its carbon monoxide if no new carbon monoxide is introduced into the atmosphere. Sulphur oxides are produced when sulphur containing fossil fuels are burnt. Nitrogen oxides are found in vehicular exhausts. Nitrogen oxides are significant, as they are involved in the production of secondary air pollutants such as ozone. Hydrocarbons are a group of compounds consisting of carbon and hydrogen atoms. They either evaporate from fuel supplies or are remnants of fuel that did not burn completely. Hydrocarbons are washed out of the air when it rains and run into surface water. They cause an oily film on the surface and do not as such cause a serious issue until they react to form secondary pollutants. Using higher oxygen concentrations in the fuel-air mixture and using valves to prevent the escape of gases, fitting of catalytic converters in automobiles, are some of the modifications that can reduce the release of hydrocarbons into the atmosphere. Particulates are small pieces of solid material (for example, smoke particles from fires, bits of asbestos, dust particles and ash from industries) dispersed into the atmosphere. The effects of particulates range from soot to the carcinogenic (cancer causing) effects of asbestos, dust particles and ash from industrial plants that are dispersed into the atmosphere. Repeated exposure to particulates can cause them to accumulate in the lungs and interfere with the ability of the lungs to exchange gases. 8

Lead is a major air pollutant that remains largely unmonitored and is emitted by vehicles. High lead levels have been reported in the ambient air in metropolitan cities. Leaded petrol is the primary source of airborne lead emissions in Indian cities. Pollutants are also found indoors from infiltration of polluted outside air and from various chemicals used or produced inside buildings. Both indoor and outdoor air pollution are equally harmful. Types of Particulates Term Meaning Examples Aerosol General term for particles suspended in air Sprays from pressurized cans Mist Aerosol consisting of liquid droplets Sulfuric acid mist Dust Aerosol consisting of solid particles that are blown into the air or are produced from larger particles by grinding them down Dust storm Smoke Aerosol consisting of solid particles or a mixture of solid and liquid particles produced by chemical reaction such as fires Cigarette smoke, smoke from burning garbage Fume Generally, means the same as smoke but often applies specifically to aerosols produced by condensation of hot vapours of metals. Zinc/lead fumes Plume Geometrical shape or form of the smoke coming out of a chimney Fog Aerosol consisting of water droplets Smog Term used to describe a mixture of smoke and fog. What happens to pollutants in the atmosphere? Once pollutants enter the troposphere, they are transported downwind, diluted by the large volume of air, transformed through either physical or chemical changes or are removed from the atmosphere by rain during which they are attached to water vapour that subsequently forms rain or snow that falls to the earth's surface. The atmosphere normally disperses pollutants by mixing them in the very large volume of air that covers the earth. This dilutes the pollutants to acceptable levels. The rate of dispersion how-ever varies in relation to the following aspects: Topography Normally as the earth's surface becomes warmed by sunlight the layer of air in contact with the ground is also heated by convection. This warmer air is less dense than the cold air above it, so it rises. Thus, pollutants produced in the surface layer are effectively dispersed. However, on a still evening, the process is re-versed. An hour or two before sunset after a sunny day, the ground starts to lose heat and the air near the ground begins to cool rapidly. Due to the absence of wind, a static layer of cold air is produced as the ground cools. This in turn induces condensation of fog. The morning sun cannot initially penetrate this fog layer. The cold air being dense cannot rise and is trapped by the warm air above. It cannot move out of the area due to the surrounding hills. The topographic features resemble a closed chemical re-actor in which the pollutants are trapped. This condition often continues through the cool night and reaches its maximum intensity before sun-rise. When the morning sun warms the ground the air near the ground also warms up and rises within an hour or two. This may be broken up by strong winds. In cold regions this situation can persist for several days. Such a situation is known as smog (smoke + fog). The most well-known example is that of the 'London Smog' that occurred in 1952. The city used large quantities of sulphur containing coal for domestic heating that released smoke, along with smoke from thermal power plants and other industrial establishments. This used to lead to the generation of high levels of smoke containing sulphur oxides. Due to a sudden adverse meteorological condition air pollutant like smoke and sulphur oxides started to build-up in the atmosphere. The white fog accumulated over the city turned black forming a 'pea- soup' smog with almost zero visibility. Within two days of the formation of this smog, people started suffering from acute pulmonary disorders which caused irritation of bronchi, cough, nasal dis-charges, sore throat, vomiting and burning sensations in the eyes. This event lead to several deaths. 9
Meteorological Conditions The velocity of the wind affects the dispersal of pollutants. Strong winds mix polluted air more rapidly with the surrounding air diluting the pollutants rapidly. When wind velocity is low mixing takes place and the concentration of pollutants remains high. When sulphur dioxide and nitrogen oxides are transported by prevailing winds they form secondary pollutants such as nitric acid vapour, droplets of sulfuric acid and particles of sulphate and nitrate salts. These chemicals descend on the earth's surface in two forms: wet (as acidic rain, snow, fog and cloud vapour) and dry (as acidic particles). The resulting mixture is called acid deposition, commonly called acid rain. Acid deposition has many harmful effects especially when the pH falls below 5.1 for terrestrial systems and below 5.5 for aquatic systems. It contributes to human respiratory diseases such as bronchitis and asthma, which can cause pre-mature death. It also damages statues, buildings, metals and car finishes. Acid deposition can damage tree foliage directly but the most serious effect is weakening of trees so they be-come more susceptible to other types of dam-age. The nitric acid and the nitrate salts in acid deposition can lead to excessive soil nitrogen levels. This can over stimulate growth of other plants and intensify depletion of other important soil nutrients such as calcium and magnesium, which in turn can reduce tree growth and vigour. Effects of air pollution on living organisms 10

Our respiratory system has several mechanisms that help in protecting us from air pollution. The hair in our nose filters out large particles. The sticky mucus in the lining of the upper respiratory tract captures smaller particles and dissolves some gaseous pollutants. When the upper respiratory system is irritated by pollutants sneezing and coughing expel contaminated air and mucus. Prolonged smoking or exposure to air pollutants can overload or break- down these natural defences causing or contributing to diseases such as lung cancer, asthma, chronic bronchitis and emphysema. Elderly people, infants, pregnant women and people with heart disease, asthma or other respiratory diseases are especially vulnerable to air pollution. Cigarette smoking is responsible for the greatest exposure to carbon monoxide. Exposure to air containing even 0.001 percent of carbon monoxide for several hours can cause collapse, coma and even death. As carbon monoxide remains attached to haemoglobin in blood for a long time, it accumulates and reduces the oxy-gen carrying capacity of blood. This impairs perception and thinking, slows reflexes and causes headaches, drowsiness, dizziness and nausea. Carbon monoxide in heavy traffic causes head-aches, drowsiness and blurred vision. Sulphur dioxide irritates respiratory tissues. Chronic exposure causes a condition like bronchitis. It also reacts with water, oxygen and other material in the air to form sulphur-containing acids. The acids can become attached to particles which when inhaled are very corrosive to the lung. Nitrogen oxides especially NO2 can irritate the lungs, aggravate asthma or chronic bronchitis and increase susceptibility to respiratory infections such as influenza or common colds. Suspended particles aggravate bronchitis and asthma. Exposure to these particles over a long period of time damages lung tissue and con-tributes to the development of chronic respiratory disease and cancer. Many volatile organic compounds such as (benzene and formaldehyde) and toxic particulates (such as lead, cadmium) can cause mutations, reproductive problems or cancer. Inhaling ozone, a component of photochemical smog causes coughing, chest pain, breathlessness and irritation of the eye, nose and the throat. Effects on Plants When some gaseous pollutants enter leaf pores, they damage the leaves of crop plants. Chronic exposure of the leaves to air pollutants can break down the waxy coating that helps prevent excessive water loss and

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leads to damage from diseases, pests, drought and frost. Such expo-sure interferes with photosynthesis and plant growth, reduces nutrient uptake and causes leaves to turn yellow, brown or drop off altogether. At

a higher concentration of sulphur dioxide majority of the flower buds become stiff and hard. They eventually fall from the plants, as they are unable to flower. Prolonged exposure to high levels of several air pollutants from smelters, coal burning power plants and industrial units as well as from cars and trucks can damage trees and other plants. Effects of air pollution

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on materials Every year air pollutants cause damage worth billions of rupees. Air pollutants break down exterior paint

on cars and houses. All around the world air pollutants have discoloured irreplaceable monuments, historic buildings, marble statues, etc. Effects of air pollution on the stratosphere The upper stratosphere consists of considerable amounts of ozone, which works as an effective screen for ultraviolet light. This region called the ozone layer extends up to 60 kms above the surface of the earth. Though the ozone is present upto 60 kms its greatest density remains in the region between 20 to 25 kms. The ozone layer does not consist of solely ozone but a mixture of other common atmospheric gases. In the densest ozone layer there will be only one ozone molecule in 100,000 gas molecules. Therefore, even small changes in the ozone con- centration can produce dramatic effects on life on earth. The total amount of ozone in a 'column' of air from the earth's surface up to an altitude of 50 km is the total column ozone. This is recorded in Dobson Units (DU), a measure of the thick-ness of the ozone layer by an equivalent layer of pure ozone gas at normal temperature and pressure at sea level. This means that 100 DU=1mm of pure ozone gas at normal temperature and pressure at sea level. Ozone is a form of oxygen with three atoms instead of two. It is produced naturally from the photodissociation of oxygen gas molecules in the atmosphere. The ozone thus formed is constantly broken down by naturally occurring processes that maintain its balance in the ozone layer. In the absence of pollutants, the creation and breakdown of ozone are purely governed by natural forces, but the presence of certain pollutants can accelerate the breakdown of ozone. Though it was known earlier that ozone shows fluctuations in its concentrations which may be accompanied sometimes with a little ozone depletion, it was only in 1985 that the large scale destruction of the 11

ozone also called the Ozone Hole came into limelight when some British researchers published measurements about the ozone layer. Soon after these findings a greater impetus was given to research on the ozone layer, which convincingly established that CFC's were leading to its depletion. These CFCs (chloro-fluro-carbons) are extremely stable, non- flammable, non-toxic and harmless to handle. This makes them ideal for many industrial applications like aerosols, air conditioners, refrigerators and fire extinguishers. Many cans, which give out foams and sprays, use CFCs. (eg: perfumes, room fresheners, etc.) CFCs are also used in making foams for mattresses and cushions, disposable Styrofoam cups, glasses, packaging material for insulation, cold storage etc. However, their stability also gives them a long life span in the atmosphere. Halons are similar in structure to the CFCs but contain bromine atoms instead of chlorine. They are more dangerous to the ozone layer than CFCs. Halons are used as fire extinguishing agents as they do not pose a harm to people and equipment exposed to them during firefighting. The CFCs and the halons migrate into the up-per atmosphere after they are released. As they are heavier than air they have to be carried by air currents up to just above the lower atmosphere and then they slowly diffuse into the upper atmosphere. This is a slow process and can take as long as five to fifteen years. In the stratosphere unfiltered UV-radiation severs the chemical bonds releasing chlorine from the rest of the CFC. This attacks the ozone molecule resulting in its splitting into an oxygen molecule and an oxygen atom. Despite the fact that CFCs are evenly distribute over the globe, the ozone depletion is especially pronounced over the South Pole due to the extreme weather conditions in the Antarctic atmosphere. The presence of the ice crystals makes the Cl-O bonding easier. The ozone layer over countries like Australia, New Zealand, South Africa and parts of South America is also depleted. India has signed the Montreal Protocol in 1992, which aims to control the production and consumption of Ozone Depleting Substances. Ozone depletion - What does it do? Changes in the ozone layer have serious implications for mankind. ? Effects on Human Health:

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Sunburn, cataract, aging of the skin and skin cancer are caused by increased ultra-violet radiation. It weakens the immune system by suppressing the

resistance of the whole body

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to certain infections like measles, chicken pox and other viral diseases that elicit rash and parasitic diseases such as malaria introduced through

the skin. Food production: Ultra violet radiation

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affects the ability of plants to capture light energy during the process of photosynthesis. This reduces the nutrient content and the growth of plants. This is seen especially in legumes and cabbage. Plant and animal planktons are damaged by

ultra-violet radiation. In zooplanktons (microscopic animals) the breeding period is shortened by changes in radiation. As planktons form the basis of the marine food chain a change in their number and species composition influences fish and shell fish production. ? Effect on Materials: Increased UV radiation damages paints and fabrics, causing them to fade faster. ? Effect on Climate: Atmospheric changes induced by pollution contribute to global warming, a phenomenon which is caused due to the increase in concentration of certain gases like carbon dioxide, nitrogen oxides, methane and CFCs. Observations of the earth have shown beyond doubt that atmospheric constituents such as water vapour, carbon dioxide, methane, nitrogen oxides and Chloro Fluro Carbons trap heat in the form of infra-red radiation near the earth's surface. This is known as the 'Green-house Effect'. The phenomenon is similar to what happens in a greenhouse. The glass in a greenhouse allows solar radiation to enter which is absorbed by the objects inside. These objects radiate heat in the form of terrestrial radiation, which does not pass out through the glass. The heat is therefore trapped in the greenhouse in-creasing the temperature inside and ensuring the luxuriant growth of plants. 12

There could be several adverse effects of global warming. ? With a warmer earth the polar ice caps will melt causing a rise in ocean levels and flooding of coastal areas. ? In countries like Bangladesh or the Maldives this would be catastrophic. If the sea level rises by 3m., Maldives will disappear completely beneath the waves. ? The rise in temperature will bring about a fall in agricultural produce. ? Changes in the distribution of solar energy can bring about changes in habitats. A previously productive agricultural area will suffer severe droughts while rains will fall in locations that were once deserts. This could bring about changes in the species of natural plants, agricultural crops, insects, live-stock and micro- organisms. ? In the polar regions temperature rises caused by global warming would have disastrous effects. Vast quantities of methane are trapped beneath the frozen soil of Alaska. When the permafrost melts the methane that will be released can accelerate the process of global warming. Control measures for Air pollution Air pollution can be controlled by two fundamental approaches: preventive techniques and effluent control. One of the effective means of controlling air pollution is to have proper equipment in place. This includes devices for removal of pollutants from the flue gases though scrubbers, closed collection recovery systems through which it is possible to collect the pollutants before they escape, use of dry and wet collectors, filters, electrostatic precipitators, etc. Providing a greater height to the stacks can help in facilitating the discharge of pollutants as far away from the ground as possible. Indus-tries should be located in places so as to minimize the effects of pollution after considering the topography and the wind directions. Substitution of raw material that causes more pollution with those that cause less pollution can be done. 2) Water Pollution Our liquid planet glows like a soft blue sapphire in the hard-edged darkness of space. There is nothing else like it in the solar system. It is because of water. – John Todd Introduction Water is the essential element that makes life on earth possible. Without water there would be no life. We usually take water for granted. It flows from our taps when they are turned on. Most of us are able to bathe when we want to, swim when we choose and water our gardens. Like good health we ignore water when we have it. Although 71% of the earth's surface is covered by water only a tiny fraction of this water is avail-able to us as fresh water. About 97% of the total water available

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on earth is found in oceans and is too salty for drinking or irrigation. The remaining 3% is fresh water. Of this 2.997% is locked in ice caps

or glaciers. Thus only 0.003% of the earth' total volume of water is easily avail-able to us as soil moisture, groundwater, water vapour and water in lakes, streams, rivers and wetlands. In short if the world's water supply were only 100 litres our usable supply of fresh water would be only about 0.003 litres (one-half teaspoon). This makes water a very precious resource. The future wars in our world may well be fought over water. By the middle of this century, al-most twice as many people will be trying to share the same amount of fresh water the earth has today. As freshwater becomes more scarce access to water resources will be a major factor in determining the economic growth of several countries around the world. Water availability on the planet Water that is found in streams, rivers, lakes, wetlands and artificial reservoirs is called surface water. Water

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that percolates into the ground and fills the pores in soil and rock is called groundwater. Porous water-saturated 13 layers of

sand, gravel or bedrock through which ground water flows are called aquifers. Most aquifers are replenished naturally by rainfall that percolates down-ward through the soil and rock. This process is called natural recharge. If the withdrawal rate of an aquifer exceeds its natural recharge rate, the water table is lowered. Any pollutant that is discharged onto the land above is also pulled into the aquifer and pollutes the groundwater resulting in polluted water in the nearby wells. India receives most of her rainfall during the months of June to September due to the seasonal winds and the temperature differences between the land and the sea. These winds blow from the opposite directions in the different sea-sons. They blow into India from the surrounding oceans during the summer season and blow out from the subcontinent to the oceans during the winter. The monsoon in India is usually reasonably stable but varies geographically. In some years the commencement of the rains may be delayed considerably over the entire country or a part of it. The rains may also terminate earlier than usual. They may be heavier than usual over one part than over another. All these may cause local floods or drought. However, in India even areas that receive adequate rainfall during the monsoon suffer from water shortages in the post monsoon period due to lack of storage facilities. When the quality or composition of water changes directly or indirectly as a result of man's activities such that it becomes unfit for any purpose it is said to be polluted. Point sources of pollution When a source of pollution can be readily identified because it has a definite source and place where it enters the water it is said to come from a point source. Eg. Municipal and Industrial Discharge Pipes. When a source of pollution cannot be readily identified, such as agricultural runoff, acid rain, etc, they are said to be non-point sources of pollution. Causes of water pollution There are several classes of common water pollutants. These are disease-causing agents (pathogens) which include bacteria, viruses, protozoa and parasitic worms that enter water from domestic sewage and untreated human and animal wastes. Human wastes contain concentrated populations of coliform bacteria such as Escherichia coli and Streptococcus faecalis. These bacteria normally grow in the large intestine of humans where they are responsible for some food digestion and for the production of vitamin K. These bacteria are not harmful in low numbers. Large amounts of human waste in water, increases the number of these bacteria which cause gastrointestinal diseases. Other potentially harmful bacteria from human wastes may also be present in smaller numbers. Thus, the greater the amount of wastes in the water the greater are the chances of contracting diseases from them. Another category of water pollutant is oxygen depleting wastes. These are organic wastes that can be decomposed by aerobic (oxy-gen requiring) bacteria. Large populations of bacteria use up the oxygen present in water to degrade these wastes. In the process this de-grades water quality. The amount of oxygen required to break down a certain amount of organic matter is called the biological oxygen demand (BOD). The amount of BOD in the water is an indicator of the level of pollution. If too much organic matter is added to the water all the available oxygen is used up. This causes fish and other forms of oxygen dependent aquatic life to die. Thus, anaerobic bacteria (those that do not require oxygen) begin to break down the wastes. Their anaerobic respiration produces chemicals that have a foul odour and an un-pleasant taste that is harmful to human health. 14

A third class of pollutants are inorganic plant nutrients. These are water soluble nitrates and phosphates that cause excessive growth of algae and other aquatic plants. The excessive growth of algae and aquatic plants due to added nutrients is called eutrophication. They may interfere with the use of the water by clogging water intake pipes, changing the taste and odour of water and cause a build-up of organic matter. As the organic matter decays, oxygen levels decrease, and fish and other aquatic species die. The quantity of fertilizers applied in a field is often many times more than is actually required by the plants. The chemicals in fertilizers and pesticides pollute soil and water. While excess fertilizers cause eutrophication, pesticides cause bioaccumulation and biomagnification. Pesticides which enter water bodies are introduced into the aquatic food chain. They are then absorbed by the phytoplankton's and aquatic plants. These plants are eaten by the herbivorous fish which are in turn eaten by the carnivorous fish which are in turn eaten by the water birds. At each link in the food chain these chemicals which do not pass out of the body are ac-cumulated and increasingly concentrated resulting in biomagnification of these harmful substances. One of the effects of accumulation of high levels of pesticides such as DDT is that birds lay eggs with shells that are much thinner than normal. This results in the premature breaking of these eggs, killing the chicks inside. Birds of prey such as hawks, eagles and other fish eating birds are affected by such pollution. Al-though DDT has been banned in India for agricultural use and is to be used only for malaria eradication, it is still used in the fields as it is cheap. A fourth class of water pollutants is water soluble inorganic chemicals which are acids, salts and compounds of toxic metals such as mercury and lead. High levels of these chemicals can make the water unfit to drink, harm fish and other aquatic life, reduce crop yields and accelerate corrosion of equipment that use this water. Another cause of water pollution is a variety of organic chemicals, which include oil, gasoline, plastics, pesticides, cleaning solvents, detergent and many other chemicals. These are harmful to aquatic life and human health. They get into the water directly from industrial activity either from improper handling of the chemicals in industries and more often from improper and illegal disposal of chemical wastes. Sediment of suspended matter is another class of water pollutant. These are insoluble particles of soil and other solids that become suspended in water. This occurs when soil is eroded from the land. High levels of soil particles suspended in water, interferes with the penetration of sunlight. This reduces the photosynthetic activity of aquatic plants and algae disrupting the ecological balance of the aquatic bodies. When the velocity of water in streams and rivers decreases the suspended particles settle down at the bottom as sediments. Excessive sediments that settle down destroys feeding and spawning grounds of fish, clogs and fills lakes, artificial reservoirs etc. Water soluble radioactive isotopes are yet another source of water pollution. These can be concentrated in various tissues and organs as they pass through food chains and food webs. Ionizing radiation emitted by such isotopes can cause birth defects, cancer and genetic damage. Hot water let out by power plants and industries that use large volumes of water to cool the plant result in rise in temperature of the local water bodies. Thermal pollution occurs when industry returns the heated water to a water source. Power plants heat water to convert it into steam, to drive the turbines that generate electricity. For efficient functioning of the steam turbines, the steam is condensed into water after it leaves the turbines. This condensation is done by taking water from a water body to absorb the heat. This heated water, which is at least 15oC higher than the normal is discharged back into the water body. The warm water not only decreases the solubility of oxygen but changes the breeding cycles of various aquatic organisms. Oil is washed into surface water in run-off from roads and parking lots which also pollutes groundwater. Leakage from underground tanks is another source of pollution. Accidental oil spills from large transport tankers at sea have been causing significant environmental damage. Though accidents such as the Exxon Valdez get worldwide attention, much more oil is released as a result of small, regular releases from other less visible sources. Nearly two thirds of all marine oil pollution come from three sources: run-off from streets, improper discharge of lubricating oil from machines or automobile crankcases and intentional oil discharges that occur during the loading and unloading of tankers. Oil tankers often use sea water as ballast to stabilize the ship after they have discharged their oil. This oil contaminated water is then dis-charged back into the sea when the tanker is refilled. Groundwater Pollution: While oil spills are highly visible and often get a lot of media attention, a much greater threat to human life comes from our groundwater being polluted which is used for drinking and irrigation. While groundwater is easy to deplete and pollute it gets renewed very slowly and hence must be used judiciously. Groundwater flows are slow and not turbulent hence the contaminants are not effectively diluted and dispersed as 15

compared to surface water. Moreover, pumping groundwater and treating it is very slow and costly. Hence it is extremely essential to prevent the pollution of groundwater in the first place. Ground water is polluted due to: ? Urban run-off of untreated or poorly treated waste water and garbage ? Industrial waste storage located above or near aquifers ? Agricultural practices such as the application of large amounts of fertilizers and pesticides, animal feeding operations, etc. in the rural sector ? Leakage from underground storage tanks containing gasoline and other hazardous substances ? Leachate from landfills ? Poorly designed and inadequately maintained septic tanks ? Mining wastes Severe cases of arsenic poisoning from contaminated groundwater have been reported from West Bengal in what is known today as the worst case of groundwater pollution. The School of Environmental Sciences, Jadhavpur University, West Bengal has been involved in the task of surveying the magnitude of the arsenic problem in West Bengal for the last fourteen years. According to a report in the Down to Earth (Vol. 11, No.22), arsenic poisoning was first noticed by K C Saha, former professor of dermatology at the School of Tropical Medicine, Kolkata when he began to receive patients with skin lesions that resembled the symptoms of leprosy which was in reality not leprosy. Since all the patients were from the district of 24-Parganas, Saha along with others began to look for the cause and found it to be arsenic toxicity. Thus ground-water arsenic contamination in West Bengal was first reported in a local daily newspaper in December 1983 when 63 people from three villages located in different districts were identified by health officials as suffering from arsenic poisoning. There are two theories that have been put forth to explain this unusually high content of arsenic in groundwater. One group of researchers suggested that the cause is natural while the other stated that the cause is man-made. According to the first hypothesis, arsenic probably originates in the Himalayan headwaters of the Ganga and the Brahmaputra rivers and has been lying undisturbed beneath the surface of the region's deltas for thousands of years in the thick layers of fine alluvial mud across the banks of these rivers. Most of the arsenic affected areas of West Bengal lie in the alluvial plains formed in the quaternary period (last 1.6 million years). The Purulia district of West Bengal is part of the extensive area of the Precambrian era (last 570 million year) having metamorphic rocks and granites with widespread sulphide mineralisation. Researchers from the UK based British Geological Survey (BGS) suggested that their position close to where the river Ganga enters Bangladesh (geologically) may be the primary source of arsenic in the Bengal alluvium. According to David Kinniburgh project leader with BGS the main factor is time. The mud in these areas is thicker, wider and flatter than al-most anywhere else on earth. It can thus take hundreds or thousands of years for underground water to percolate through the mud before reaching the sea and thus it absorbs arsenic for a long period. Other researchers feel that the excess amount of arsenic in groundwater can be contributed to by the high rate of groundwater extraction. Their hypothesis called the pyrite oxidation the-sis describes how arsenic can get mobilized in the groundwater. In this hypothesis arsenic is assumed to be present in certain minerals (pyrites) that are deposited within the aquifer sediments. Due to the lowering of the water table below the deposits, arseno-pyrite which is oxidized in a zone of the aquifer called the Vadose zone releases arsenic as arsenic adsorbed on iron hydroxide. During the subsequent recharge period, iron hydroxide releases arsenic into ground-water. This theory is supported by two arguments. The first is the intensive irrigation development in West Bengal using deep tube wells and shallow tube wells. This method of extraction, which was exactly in the 20m to 100m below ground level ensured, increased contribution of groundwater to irrigation. The other argument that supports the pyrite oxidation theory is that prior to irrigation development and drinking water supply schemes based on groundwater there were no reported cases of arsenic poisoning. Arsenicosis or arsenic toxicity develops after two to five years of exposure to arsenic contaminated drinking water depending on the amount of water consumption and the arsenic concentration in water. Initially the skin begins to darken (called diffuse melanosis) which later leads to spotted melanosis when darkened sports begin to appear on the chest, back and limbs. At a later stage leucomelanosis sets in and the body begins to show black and white spots. In the middle stage of arsenicosis the skin in parts be-comes hard and fibrous. Rough, dry skin with nodules on hands or the soles of feet indicate severe toxicity. This can lead to the formation of gangrene and cancer. Arsenic poisoning brings with it other complications such as liver and spleen enlargement, cirrhosis of the liver, diabetes, goiter and skin cancers. Control measures for preventing water pollution 16

While the foremost necessity is prevention, set-ting up effluent treatment plants and treating waste through these can reduce the pollution load in the recipient water. The treated effluent can be reused for either gardening or cooling purposes wherever possible. A few years ago, a new technology called the Root Zone Process has been developed by Thermax. This system involves running contaminated water through the root zones of specially designed reed beds. The reeds, which are essentially wetland plants have the capacity to absorb oxygen from the surrounding air through their stomatal openings. The oxygen is pushed through the porous stem of the reeds into the hollow roots where it enters the root zone and creates conditions suit-able for the growth of numerous bacteria and fungi. These micro-organisms oxidize impurities in the wastewaters, so that the water which finally comes out is clean. 3) Soil Pollution Introduction We can no more manufacture a soil with a tank of chemicals than we can invent a rain forest or produce a single bird. We may enhance the soil by helping its processes along, but we can never recreate what we destroy. The soil is a resource for which there is no substitute. (Environmental historian Donald Worster reminds us that fertilizers are not a substitute for fertile soil). Soil is a thin covering over the land consisting of a mixture of minerals, organic material, living organisms, air and water that together support the growth of plant life. Several factors contribute to the formation of soil from the parent material. This includes mechanical weathering of rocks due to temperature changes and abrasion, wind, moving water, glaciers, chemical weathering activities and lichens.

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Climate and time are also important in the development of

soils. Extremely dry or cold climates develop soils very slowly while humid and warm climates develop them more rapidly. Under ideal climatic conditions soft parent material may develop into a centimetre of soil within 15 years. Under poor climatic conditions a hard parent material may require hundreds of years to develop into soil. Mature soils are arranged in a series of zones called soil horizons. Each horizon has a distinct texture and composition that varies with different types of soils. A cross sectional view of the horizons in a soil is called a soil profile. The top layer or the surface litter layer called the O horizon consists mostly of freshly fallen and partially decomposed

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leaves, twigs, animal waste, fungi and other organic materials. Normally it is brown or black.

The uppermost layer of the soil called the A horizon consists of partially decomposed organic matter (humus) and some inorganic mineral particles. It is usually darker and looser than the deeper layers. The roots of most plants are found in these two upper layers. As long as these layers are anchored by vegetation soil stores water and releases it in a trickle throughout the year instead of in a force like a flood. These two top layers also contain a large amount of bacteria, fungi, earthworms and other small insects that form complex food webs in the soil that help recycle soil nutrients and contribute to soil fertility. The B horizon often called the subsoil contains less organic material and fewer organisms than the A horizon. The area below the subsoil is called the C horizon and consists of weathered parent material. This parent material does not contain any organic materials. The chemical composition of the C-horizon helps to determine the pH of the soil and also influences the soil's rate of water absorption and retention. Soils vary in their content of clay (very fine particles), silt (fine particles), sand (medium size particles) and gravel (coarse to very coarse particles). The

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relative amounts of the different sizes and types of mineral particles determine soil

texture. Soils with approximately equal mixtures of clay, sand, silt and humus are called loams. Causes of Soil Degradation Erosion Soil erosion can be defined as the movement of surface litter and topsoil from one place to an-other. While erosion is a natural process often caused by wind and flowing water it is greatly accelerated by human activities such as farming, construction, overgrazing by livestock, burning of grass cover and deforestation. Loss of the topsoil makes a soil less fertile and reduces its water holding capacity. The topsoil, which is washed away, also contributes to water pollution clogging lakes, increasing turbidity of the water and also leads to loss of aquatic life. For one inch of topsoil to be formed it normally requires 200-1000 years depending upon the climate and soil type. Thus, if the topsoil erodes faster than it is formed the soil becomes a non-renewable resource. 17

Thus, it is essential that proper soil conservation measures are used to minimize the loss of top soil. There are several techniques that can protect soil from erosion. Today both water and soil are conserved through integrated treatment methods. Some of the most commonly employed methods include the two types of treatment that are generally used. ? Area treatment which involves treating the land ? Drainage line treatment which involves treating the natural water courses (nalas) Continuous contour trenches can be used to enhance infiltration of water reduce the run-off and check soil erosion. These are actually shallow trenches dug across the slope of the land and along the contour lines basically for the purpose of soil and water conservation. They are most effective on gentle slopes and in areas of low to medium rainfall. These bunds are stabilized by fast growing tree species and grasses. In areas of steep slopes where the bunds are not possible, continuous contour benches (CCBs) made of stones are used for the same purpose. Gratonites can also be used to convert waste-lands into agricultural lands. In this narrow trench with bunds on the downstream side are built along contours in the upper reaches of the catchment to collect run-off and to conserve moisture from the trees or tree crops. The area between the two bunds is use for cultivation of crops after development of fertile soil cover. Some of the ways in which this can be achieved are: Live check dams which barriers created by planting grass, shrubs and trees across the gullies can be used for this purpose. A bund constructed out of stones across the stream can also be used for conserving soil and water. Area Treatment Purpose Treatment Measure Effect Reduces the impact of rain drops on the soil Develop vegetative cover on the non- arable land Minimum disturbance and displacement of soil particles Infiltration of water where it falls Apply water infiltration measures on the area In situ soil and moisture conservation Minimum surface run off Store surplus rain water by constructing bunds, ponds in the area Increased soil moisture in the area, facilitate ground water recharge Ridge to valley sequencing Treat the upper catchment first and then proceed towards the outlet Economically viable, less risk of damage and longer life of structures of the lower catchments Drainage line treatment Purpose Treatment measure Effect Stop further deepening of gullies and retain sediment run-off Plug the gullies at formation Stops erosion, recharges groundwater at the upper level. Reduce run-off velocity, pass cleaner water to the downstream side Crate temporary barriers in nalas Delayed flow and increased groundwater recharge Minimum sedimentation in the storage basins Use various methods to treat the catchments Low construction cost Use local material and skills for constructing the structures Structures are locally maintained An Earthen checkbund is constructed out of local soil across the stream to check soil erosion and flow of water. A Gabion structure is a bund constructed of stone and wrapped in galvanized chain-link. 18

A Gabion structure with ferrocement impervious barrier has a one inch thick impervious wall of ferrocement at the centre of the structure which goes below the ground level up to the hard strata. This ferrocement partition supported by the gabion portion is able to retain the water and withstand the force of the runoff water. An Underground bandhara is an under-ground structure across a nalla bed to function as a barrier to check the ground water movement. Excess use of fertilizers: Approximately 25 percent of the world's crop yield is estimated to be directly attributed to the use of chemical fertilizers. The use of chemical fertilizes has in-creased significantly over the last few decades and is expected to rise even higher. Fertilizers are very valuable as they replace the soil nutrients used up by plants. The three primary soil nutrients often in short supply are potassium, phosphorus and nitrogen compounds. These are commonly referred to as macronutrients. Certain other elements like boron, zinc and manganese are necessary in extremely small amounts and are known as micronutrients. When crops are harvested a large amount of macronutrients and a small amount of micronutrients are re-moved with the crops. If the same crop is grown again depleted levels of thee nutrients can result in decreased yields. These necessary nutrients can be returned to the soil through the application of fertilizers. In addition to fertilizers a large amount of pesticides (chemicals used to kill or control populations of unwanted fungi, animals or plants often called pests) are also used to ensure a good yield. Pesticides can be subdivided into several categories based on the kinds of organisms they are used to control. Insecticides are used to control insect populations while fungicides are used to control unwanted fungal growth. Mice and rats are killed by rodenticides while plant pests are controlled by herbicides. Problems with pesticide use Pesticides not only kill the pests but also a large variety of living things including humans. They may be persistent or non-persistent. Persistent pesticides once applied are effective for a long time. However, as they do not break down easily they tend to accumulate in the soil and in the bodies of animals in the food chain. For example, DDT which was one of the first synthetic organic insecticide to be used was thought to be the perfect insecticide. During the first ten years of its use (1942-1952) DDT is estimated to have saved about five million lives primarily because of its use to control disease carrying mosquitoes. However, after a period of use many mosquitoes and insects became tolerant of DDT, thus making it lose its effectiveness. DDT in temperate regions of the world has a half-life (the amount of time required for half of the chemical to decompose) of 10 to 15 years. This means that if 100 kilograms of DDT were to be sprayed over an area, 50 kilograms would still be present in the area 10 to 15 years later. The half-life of DDT varies according to the soil type, temperature, kind of soil organ-isms present and other factors. In tropical parts of the world the half-life may be as short as six months. The use of DDT has been banned in some countries. India still however permits the use of DDT though for purposes of mosquito control only. Persistent pesticides become attached to small soil particles which are easily moved by wind and water to different parts thus affecting soils elsewhere. Persistent pesticides may also

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accumulate in the bodies of animals, and over a period of time increase in concentration if the animal is unable to flush

them out of its system thus leading to the phenomenon called bioaccumulation. When an affected ani-mal is eaten by another carnivore these pesticides are further concentrated in the body of the carnivore. This phenomenon of acquiring increasing levels of a substance in the bodies of higher trophic level organisms is known as biomagnification. This process especially in the case of insecticides like DDT have been proved to be disastrous. DDT is a well- known case of biomagnification in ecosystems. DDT interferes with the production of normal eggshells in birds making them fragile. Other problems associated with insecticides is the ability of insect populations to become resistant to them thus rendering them useless in a couple of generations. Most pesticides kill beneficial as well as pest species. They kill the predator as well as the parasitic insects that control the pests. Thus, the pest species increase rapidly following the use of a pesticide as there are no natural checks to their population growth. The short term and the

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long-term health effects to the persons using the pesticide and the public that consumes the food

grown by using the pesticides are also major concerns. Exposure to small quantities of pesticides over several years can cause mutations, produce cancers, etc. Thus, the question that comes to mind is that if pesticides have so many drawbacks then why been they used so extensively and what are the substitutes for them? There are three main rea-sons for the use of pesticides. Firstly, the use of pesticides in the short term has increased the amount of food that can be grown in many parts of the world as the damage by pests is de-creased. The second reason for its extensive use is based on an economic consideration. The in-creased yields more than compensates the farmer for cost of pesticides. Thirdly current health problems especially in developing countries due to mosquitoes are impossible to control without insecticides. 19

However, more and more farmers are increasingly opting to replace chemical fertilizers and use different methods of controlling pests with-out affecting their yield. Thus, several different approaches that have slightly varying and over-lapping goals have been developed. Alternative agriculture is the broadest term that is used that includes all non-traditional agricultural methods and encompasses sustainable agriculture, organic agriculture, alternative uses of traditional crops, alternative methods for raising crops, etc. Sustainable agriculture advocates the use of methods to produce adequate safe food in an economically viable manner while maintaining the state of the ecosystem. Organic agriculture advocates avoiding the use of chemical fertilizers and pesticides. A wide variety of techniques can be used to reduce this negative impact of agriculture. Leaving crop residue on the soil and incorporating it into the soil reduces erosion and increase soil organic matter. Introduction of organic matter into the soil also makes compaction less likely. Crop rotation is an effective way to enhance soil fertility, reduce erosion and control pests. There have been arguments both for and against organic farming. Critics argue that organic farming cannot produce the amount of food required for today's population and it is economically viable only in certain conditions. However, supporters for organic farming feel that of the hidden costs of soil erosion and pollution are taken into account it is a viable approach. Besides organic farmers do not have to spend on fertilizers and pesticides and also get a premium price for their products thus making it financially viable for them. Another way to reduce these impacts is through the use of integrated pest management. This is a technique that uses a complete understanding of all ecological aspects of a crop and the particular pests to which it is susceptible to establish pest control strategies that uses no or few pesticides. IPM promotes the use of biopesticides. Biopesticides are derived from three sources: microbial, botanical and bio-chemical. Microbial pesticides are micro-organ-isms such as bacteria, fungus, virus or protozoa that fight pests through a variety of ways. They produce toxins specific to the pests and produce diseases in them. Biochemical pesticides contain several chemicals that affect the reproductive and digestive mechanisms of the pests. The most commonly used biopesticides are Bacillus thuringiensis (Bt), neem (Azadirachta indica) and trichogramma. Although they are available in the market they are yet to become market favourites. Excess salts and water Irrigated lands can produce crop yields much higher than those that only use rainwater. How-ever this has its own set of ill effects. Irrigation water contains dissolved salts and in dry climates much of the water in the saline solution evaporates leaving its salts such as sodium chloride in the topsoil. The accumulation of these salts is called salinization, which can stunt plant growth, lower yields and eventually kill the crop and render the land useless for agriculture. These salts can be flushed out of the soil by using more water. This practice however increases the cost of crop production and also wastes enormous amounts of water. Flushing salts can also make the downstream irrigation water saltier. Another problem with irrigation is water logging. This occurs when large amounts of water is used to leach the salts deeper into the soil. However, if the drainage is poor this water accumulates underground gradually raising the water table. The roots of the plants then get enveloped in this saline water and eventually die. Thus, in the long run it is better for us to adopt sustainable farming practices so as to prevent the degradation of soil. 20

4) Marine Pollution Marine pollution can be defined as the introduction of substances to the

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marine environment directly or indirectly by man resulting in adverse effects such as hazards to human health, obstruction

of marine activities and lowering the quality of sea water. While the causes of marine pollution may be similar to that of general water pollution there are some very specific causes that pollute marine waters. ? The most obvious inputs of waste is through pipes directly discharging wastes into the sea. Very often municipal waste and sew-age from residences and hotels in coastal towns are directly discharged into the sea. ? Pesticides and fertilizers from agriculture which are washed off the land by rain, enter water courses and eventually reach the sea. ? Petroleum and oils washed off from the roads normally enter the sewage system but stormwater overflows carry these materials into rivers and eventually into the seas. ? Ships carry many toxic substances such as oil, liquefied natural gas, pesticides, industrial chemicals, etc. in huge quantities some-times to the capacity of 350,000 tonnes. Ship accidents and accidental spillages at sea therefore can be very damaging to the marine environment. Shipping channels in estuaries and at the entrances to ports of-ten require frequent dredging to keep them open. This dredged material that may contain heavy metals and other contaminants are often dumped out to sea. ? Offshore oil exploration and extraction also pollute the seawater to a large extent. Pollution due to organic wastes The amount of oxygen dissolved in the water is vital for the plants and animals living in it. Wastes, which directly or indirectly affect the oxygen concentration, play an important role in determining the quality of the water. Normally the greatest volume of waste discharged to watercourses, estuaries and the sea is sewage, which is primarily organic in nature and is de-graded by bacterial activity. Using the oxygen present in the water these wastes are broken down into stable inorganic compounds. How-ever as a result of this bacterial activity the oxy-gen concentration in the water is reduced. When the oxygen concentration falls below 1.5 mg/ lit, the rate of aerobic oxidation is reduced, and their place is taken over by the anaerobic bacteria that can oxidize the organic molecules with-out the use of oxygen. This results in end products such as hydrogen sulphide, ammonia and methane, which are toxic to many organ-isms. This process results in the formation of an anoxic zone which is low in its oxygen content from which most life disappears except for anaerobic bacteria, fungi, yeasts and some protozoa. This makes the water foul smelling. Control measures One way of reducing the pollution load on marine waters is through the introduction of sewage treatment plants. This will reduce the biological oxygen demand (BOD) of the final product before it is discharged to the receiving waters. Various stages of treatment such as primary, secondary or advanced can be used depending on the quality of the effluent that is required to be treated. ? Primary Treatment: These treatment plants use physical processes such as screening and sedimentation to remove pollutants that will settle, float or, that are too large to pass through simple screening devices. This includes, stones, sticks, rags, and all such material that can clog pipes. A screen consists of parallel bars spaced 2 to 7cms apart followed by a wire mesh with smaller openings. One way of avoiding the problem of disposal of materials collected on the screens is to use a device called a comminatory which grinds the coarse material into small pieces that can then be left in the waste water. After screening the wastewater passes into a grit chamber. The detention time is chosen to be long enough to allow lighter, organic material to settle. From the grit chamber the sewage passes into a primary settling tank (also called as sedimentation tank) where the flow speed is reduced sufficiently to allow most of the suspended solids to settle out by gravity. If the waste is to undergo only primary treatment it is then chlorinated to destroy bacteria and control odours after which the effluent is released. Primary treatment normally removes about 35 percent of the BOD and 60 percent of the suspended solids. ? Secondary Treatment: The main objective of secondary treatment is to remove most of the BOD. There are three commonly used approaches: trickling filters, activated sludge pro-cess and oxidation ponds. Secondary treatment can remove at least 85 percent of the BOD. 21

A trickling filter consists of a rotating distribution arm that sprays liquid wastewater over a circular bed of 'fist size' rocks or other coarse materials. The spaces between the rocks allow air to circulate easily so that aerobic conditions can be maintained. The individual rocks in the bed are covered with a layer of slime, which consists of bacteria, fungi, algae, etc. which degrade the waste trickling through the bed. This slime periodically slides off individual rocks and is collected at the bottom of the filter along with the treated wastewater and is then passed on to the secondary settling tank where it is removed. In the activated sludge process the sewage is pumped into a large tank and mixed for several hours with bacteria rich sludge and air bubbles to facilitate degradation by micro-organisms. The water then goes into a sedimentation tank where most of the microorganisms settle out as sludge. This sludge is then broken down in an anaerobic digester where methane-forming bacteria slowly convert the organic matter into carbon dioxide, methane and other stable end products. The gas produced in the digester is 60 percent methane, which is a valuable fuel and can be put to many uses within the treatment plant itself. The digested sludge, which is still liquid, is normally pumped out onto sludge drying beds where evaporation and seepage remove the water. This dried sludge is potentially a good source of manure. Activated sludge tanks use less land area than trickling filters with equivalent performance. They are also less expensive to construct than trickling filters and have fewer problems with flies and odour and can also achieve higher rates of BOD removal. Thus, although the operating costs are a little higher due to the expenses incurred on energy for running pumps and blowers they are preferred over trickling filters. Oxidation ponds are large shallow ponds approximately 1 to 2 metres deep where raw or partially treated sewage is decomposed by microorganisms. They are easy to build and man-age and accommodate large fluctuations in flow and can provide treatment at a much lower cost. They however require a large amount of land and hence can be used where land is not a limitation. ? Advanced sewage treatment: This involves a series of chemical and physical process that re-moves specific pollutants left in the water after primary and secondary treatment. Sewage treatment plant effluents contain nitrates and phosphates in large amounts. These contribute to eutrophication. Thus, advanced treatment plants are designed to specifically remove these contaminants. Advanced treatment plants are very expensive to build and operate and hence are rarely used. Effects of marine pollution Apart from causing eutrophication a large amount of organic wastes can also result in the development of red tides. These are phytoplankton blooms of such intensity that the area is discolored. Many important commercially important marine species are also killed due to clogging of gills or other structures. When liquid oil is spilled on the sea it spreads over the surface of the water to form a thin film called an oil slick. The rate of spreading and the thickness of the film depends on the sea temperature and the nature of the oil. Oil slicks damage marine life to a large extent. Salt marshes, mangrove swamps are likely to trap oil and the plants, which form the basis for these ecosystems thus suffer. For salt marsh plants, oil slicks can affect the flowering, fruiting and germination. If liquid oil contaminates a bird's plumage its water repellent properties are lost. Water thus penetrates the plumage and displaces the air trapped between the feathers and the skin. This air layer is necessary as it provides buoyancy and thermal insulation. With this loss the plumage becomes water logged and the birds may sink and drown. Even if this does not happen loss of thermal insulation results in exhaustion of food reserves in an attempt to maintain body temperature often followed by death. Birds often clean their plumage by preening and in the pro-cess consume oil which depending on its toxicity can lead to intestinal, renal or liver failure. Drill cuttings dumped on the seabed create anoxic conditions and result in the production of toxic sulphides in the bottom sediment thus eliminating the benthic fauna. Fish and shellfish production facilities can also be affected by oil slicks. The most important commercial damage can however also come from tainting which imparts an unpleasant flavour to fish and seafood and is detectable at extremely low levels of contamination. This reduces the market value of seafood. 5) Oil Pollution Pollution due to

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oil Oil pollution of the sea normally attracts the greatest attention because of its visibility.

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There are several sources though which the oil can reach the sea. ?

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Tanker operations: 22 Half the world production of crude oil which is close to three billion tones

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year is transported by sea. After a tanker has unloaded its cargo of oil it has to take on seawater as ballast for the return journey. This ballast water is stored in the cargo compartments that previously contained the oil. During the unloading

of the cargo a certain amount of

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oil remains clinging to the walls of the container and this may amount to 800 tonnes in a 200,000

tonne tanker.

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The ballast water thus becomes contaminated with this oil. When a fresh cargo of oil is to be loaded, these compartments are cleaned with water, which discharges the dirty ballast along with the oil into the sea. Two techniques have substantially reduced

this

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oil pollution. In the load-on- top system, the compartments are cleaned by high pressure jets of water. The oily water is retained in the compartment until the oil floats to the top. The water underneath that contains only a little oil is then discharged into the sea and the oil is transferred to a slop tank. At the loading terminal, fresh oil is loaded on top of the oil in the tank and hence the name of the technique. In the second method called 'crude oil washing', the clingage is removed by jets of crude oil while the cargo is being unloaded. Some modern tankers have segregated ballast where the ballast water does not come in contact with the oil. Thus with the introduction of these new methods of deballasting, the amount of oil entering the sea has been considerably reduced. ? Dry Docking: All ships need periodic dry docking for servicing, repairs, cleaning the hull, etc. During this period when the cargo compartments are to completely emptied, residual oil finds its way into the sea. ? Bilge and fuel oils: As ballast tanks take up valuable space, additional ballast is sometimes carried in empty fuel

tanks. While being pumped overboard it carries oil

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into the sea. Individually the quantity of oil released may be small but it becomes a considerable amount when all the shipping operations are taken into consideration. ? Tanker Accidents: A large number of oil tanker accidents happen every year. Sometimes this can result in major disasters such as that of

the Exxon Valdez de-scribed in the section on water pollution. ? Offshore oil production: Oil that is

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extracted from the seabed contains some water. Even after it is passed through oil separators the water that is discharged contains some oil, which adds to marine pollution. Drilling muds which are pumped down oil wells when

it is being drilled normally contain 70 to 80 percent

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of oil. They are dumped on the sea- bed beneath the platform thus heavily contaminating the water. Uncontrolled release of oil from the wells can be catastrophic events resulting in oil pollution.

Control measures for oil pollution Cleaning oil from surface waters and contaminated beaches is a time consuming labour intensive process. The natural process of emulsification of oil in the water can be accelerated through the use of chemical dispersants which can be sprayed on the oil. A variety of slick-lickers in which a continuous belt of absorbent material dips through the oil slick and is passed through rollers to extract the oil have been designed. Rocks, harbour walls can be cleaned with high- pressure steam or dispersants after which the surface must be hosed down. 6) Noise Pollution Noise may not seem as harmful as the contamination of air or water but it is a pollution problem that affects human health and can contribute to a general deterioration of environmental quality. Noise is undesirable and unwanted sound. Not all sound is noise. What may be considered as music to one person may be noise to another.

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It is not a substance that can accumulate in the environment like most other pollutants.

Sound is measured in a unit called the 'Decibel'.

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There are several sources of noise pollution that contribute to both indoor and outdoor noise pollution.

Noise emanating from factories, vehicles, playing of loudspeakers during various festivals can contribute to outdoor noise pollution while loudly played radio or music systems, and other electronic gadgets can contribute to indoor noise pollution. A study conducted by researchers from the New Delhi based National Physical Laboratory show that noise generated by firecrackers (presently available in the market) is much higher than the prescribed levels. The permitted noise level is 125 decibels, as per the Environment (Protection) (second amendment) Rules, 1999. The differences between sound and noise is of-ten subjective and a matter of personal opinion. There are however some very harmful effects caused by exposure to high sound levels. These effects can range in severity from being extremely annoying to being extremely painful and hazardous. 23
Decibel levels of common sounds dB Environmental Condition 0 Threshold of hearing 10 Rustle of leaves 20 Broadcasting studio 30 Bedroom at night 40 Library 50 Quiet office 60 Conversational speech (at 1m) 70 Average radio 74 Light traffic noise 90 Subway Train 100 Symphony orchestra 110 Rock Band 120 Aircraft takeoff 146 Threshold of pain Effects of noise pollution on physical health

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The most direct harmful effect of excessive noise is physical damage to

the ear and the temporary or permanent hearing loss often called a temporary threshold shift (TTS). People suffering from this condition are unable to detect weak sounds. However, hearing ability is usually recovered within a month of exposure. In Maharashtra people living in close vicinity of Ganesh mandals that play blaring music for ten days of the Ganesh festival are usually known to suffer from this phenomenon. Permanent loss, usually called noise induced permanent threshold shift (NIPTS) represents a loss of hearing ability from which there is no recovery. Below a sound level of 80 dBA haring loss does not occur at all. However temporary effects are noticed at sound levels between 80 and 130 dBA. About 50 percent of the people exposed to 95 dBA sound levels at work will develop NIPTS and most people exposed to more than 105 dBA will experience permanent hearing loss to some degree. A sound level of 150 dBA or more can physically rupture the human eardrum. The degree of hearing loss depends on the du-ration as well as the intensity of the noise. For example, 1hour of exposure to a 100 dBA sound level can produce a TTS that may last for about one day. However, in factories with noisy machinery workers are subjected to high sound levels for several hours a day. Exposure to 95 dBA for 8 hours every day for over a period of 10 years may cause about 15 dBA of NIPTS. In addition to hearing losses excessive sound levels can cause harmful effects on the circulatory system by raising blood pressure and altering pulse rates. Effects of noise pollution on mental health Noise can also cause emotional or psychological effects such as irritability, anxiety and stress. Lack of concentration and mental fatigue are significant health effects of noise. It has been observed that the performance of school children is poor in comprehension tasks when schools are situated in busy areas of a city and suffer from noise pollution. As noise interferes with normal auditory communication, it may mask auditory warning signals and hence increases the rate of accidents especially in industries. It can also lead to lowered worker efficiency and productivity and higher accident rates on the job. Thus, noise is just more than a mere nuisance or annoyance. It

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definitely affects the quality of life. It is thus important to ensure mitigation or control of noise pollution.

Permitted noise levels Ambient Noise Levels dB Zone Day-time Night-time Silent Zone 50 40 Residential Zone 55 45 Commercial Zone 65 55 Industrial Zone 70 70 24

A standard safe time limit has been set for exposure to various noise levels. Beyond this 'safe' time continuing exposure over a period of a year will lead to hearing loss. Noise Control techniques There are four fundamental ways in which noise can be controlled: Reduce noise at the source, block the path of noise, increase the path length and protect the recipient. In general, the best control method is to reduce noise levels at the source. Source reduction can be done by effectively muffling vehicles and machinery to reduce the noise. In industries noise reduction can be done by using rigid sealed enclosures around machinery lined with acoustic absorbing material. Isolating machines and their enclosures from the floor using special spring mounts or absorbent mounts and pads and using flexible couplings for interior pipelines also contribute to reducing noise pollution at the source. However, one of the best methods of noise source reduction is regular and thorough maintenance of operating machinery. Noise levels at construction sites can be controlled using proper construction planning and scheduling techniques. Locating noisy air compressors and other equipment away from the site boundary along with creation of temporary barriers to physically block the noise can help contribute to reducing noise pollution. Most of the vehicular noise comes from movement of the vehicle tires on the pavement and wind resistance. However poorly maintained vehicles can add to the noise levels. Traffic volume and speed also have significant effects on the overall sound. For example doubling the speed increases the sound levels by about 9 dBA and doubling the traffic volume (number of vehicles per hour) increases sound levels by about 3 dBA. A smooth flow of traffic also causes less noise than does a stop-and-go traffic pattern. Proper highway planning and design are essential for controlling traffic noise. Establishing lower speed limits for highways that pass through residential areas, limiting traffic volume and providing alternative routes for truck traffic are effective noise control measures. The path of traffic noise can also be blocked by construction of vertical barriers alongside the high-way. Planting of trees around houses can also act as effective noise barriers. In industries different types of absorptive material can be used to control interior noise. Highly absorptive interior finish material for walls, ceilings and floors can decrease indoor noise levels significantly. Sound levels drop significantly with increasing distance from the noise source. Increasing the path length between the source and the recipient offers a passive means of control. Municipal land-use ordinances pertaining to the location of airports make use of the attenuating effect of distance on sound levels. Use of earplugs and earmuffs can protect individuals effectively from excessive noise levels. Specially designed earmuffs can reduce the sound level reaching the eardrum by as much as 40 dBA. However very often workers tend not to wear them on a regular basis despite company requirements for their use. 7) Thermal Pollution Sources: The discharge of warm water into a river is usually called a thermal pollution. It occurs when an industry removes water from a source, uses the water for cooling purposes and then returns the heated water to its source. Power plants heat water to convert it into steam, to drive the turbines that generate electricity. For efficient functioning of the steam turbines, the steam is condensed into water after it leaves the turbines. This condensation is done by taking water from a water body to absorb the heat. This heated water, which is at least 15oC higher than the normal is discharged back into the water body. 25 Duration dBA 8 hours 90 4 hours 93 2 hours 96 1 hour 99 30 minutes 102 15 minutes 105 7 minutes 108 4 minutes 111 2 minutes 114 1 minute 117 30 seconds 120 Instantaneous rupture of 150

Effects: The warmer temperature decreases the solubility of oxygen and increases the metabolism of fish. This changes the ecological balance of the river. Within certain limits thermal additions can promote the growth of certain fish and the fish catch may be high in the vicinity of a power plant. However sudden changes in temperature caused by periodic plant shutdowns both planned and unintentional can change result in death of these fish that are acclimatized to living in warmer waters. Tropical marine animals are generally unable to withstand a temperature increase of 2 to 30C and most sponges, mollusks and crustaceans are eliminated at temperatures above 370C. This results in a change in the diversity of fauna as only those species that can live in warmer water survive. Control Measures Thermal pollution can be controlled by passing the heated water through a cooling pond or a cooling tower after it leaves the condenser. The heat is dissipated into the air and the water can then be discharged into the river or pumped back to the plant for reuse as cooling water. There are several ways in which thermal pollution can be reduced. One method is to construct a large shallow pond.

A second method is to use a cooling tower. These structures take up less land area than the ponds. Here most of the heat transfer occurs through evaporation. Here warm waters coming from the condenser is sprayed down-ward over vertical sheets or baffles where the water flows in thin films. Cool air enters the tower through the water inlet that encircles the base of the tower and rises upwards causing evaporative cooling. A natural draft is maintained because of the density difference be-tween the cool air outside and the warmer air inside the tower. The waste heat is dissipated into the atmosphere about 100 m above the base of the tower. The cooled water is collected at the floor of the tower and recycled back to the power plant condensers. The disadvantage in both these methods is however that large amounts of water are lost by evaporation. Nuclear Hazards Nuclear energy can be

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both beneficial and harmful depending on the way in which it is used. We

routinely use X-rays to examine bones for fractures, treat cancer with radiation and diagnose diseases with the help of radioactive iso- topes. Approximately 17 % of the electrical energy

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generated in the world comes from nuclear power plants. However, on the other hand it is impossible to forget the

destruction that nuclear bombs caused the cities of Hiroshima and Nagasaki. The radioactive wastes from nuclear energy have caused serious environmental damage. Nuclear fission is the splitting of the nucleus of the atom. The resulting energy can be used for a variety of purposes. The first controlled fission of an atom was carried out in Germany in 1938. However, the United States was the first country to develop an atomic bomb which was subsequently dropped on the Japanese cities of Hiroshima and Nagasaki. The world's first electricity generating reactor was constructed in the United States in 1951 and the Soviet Union built its first reactor in 1954. In December 1953, President Dwight D. Eisenhower in his 'Atoms for Peace' speech made the following prediction: 'Nuclear reactors will produce electricity so cheaply that it will not be necessary to meter it. The users will pay a fee and use as much electricity as they want. Atoms will provide a safe, clean and dependable source of electricity.' Today however though nuclear power is being used as a reliable source of electricity the above statement sounds highly optimistic. Several serious accidents have caused worldwide concern about safety and disposal of radioactive wastes. In order to appreciate the consequences of using nuclear fuels to generate energy it is important to understand how the fuel is processed. Low-grade uranium ore, which contains 0.2 percent uranium by weight, is obtained by surface or underground mining. After it is mined the ore goes through a milling process where it is crushed and treated with a solvent to concentrate the uranium and produces yellow cake a material containing 70 to 90 percent uranium oxide. Naturally occurring uranium contains only 0.7 percent of fissionable U-235, which is not high enough for most types of reactors. Hence it is necessary to increase the amount of U-235 by enrichment though it is a difficult and ex-pensive process. The enrichment process in-creases the U-235 content from 0.7 to 3 percent. Fuel fabrication then converts the enriched material into a powder, which is then compacted into pellets. These pellets are sealed in metal fuel rods about 4 meters in length which is then loaded into the reactor. As fission occurs the concentration of U-235 atoms decreases. After about three years, a fuel rod does not have enough radioactive material to sustain a chain reaction and hence the spent fuel rods must be replaced by new ones. The spent rods are how-ever still very radioactive containing about one percent U-235 and one percent plutonium. These rods are a major source of radioactive waste material produced by a nuclear reactor. 26

Initially it was thought that spent fuel rods could be reprocessed to not only provide new fuel but also to reduce the amount of nuclear waste. However, the cost of producing fuel rods by re-processing was found to be greater than the cost of producing fuel rods from ore. Presently India does operate reprocessing plants to reprocess spent fuel as an alternative to storing them as nuclear waste. At each step in the cycle there is a danger of exposure and poses several health and environmental concerns. Although nuclear power has significant benefits an incident which changed people's attitudes towards nuclear power plants was the Chernobyl disaster that occurred in 1986. Chernobyl is a small city in Ukraine near the border with Belarus north of Kiev. At 1.00 am April 25, 1986 a test to measure the amount of electricity that the still spinning turbine would produce if steam were shut off was being con-ducted at the Chernobyl Nuclear Power Station. This was important information since the emergency core cooling system required energy for its operation and the coasting turbine could provide some of that energy until another source became available. The amount of steam being produced was reduced by lowering the control rods into the reactor. But the test was delayed because of a demand for electricity and a new shift of workers came on duty. The operators failed to program the computer to maintain power at 700 megawatts and the output dropped to 30 megawatts. This presented an immediate need to rapidly increase the power and many of the control rods were withdrawn. Meanwhile an inert gas (xenon) had accumulated on the fuel rods. The gas absorbed the neutrons and slowed the rate of power increase. In an attempt to obtain more power the opera-tors withdrew all the control rods. This was a second serious safety violation. At 1.00am, the operators shut off most of the emergency warning signals and turned on all the eight pumps to provide adequate cooling for the reactor following the completion of the test. Just as the final stages for the test were beginning a signal indicated excessive reaction in the reactor. In spite of the warning the operators blocked the automatic reactor shutdown and began the test. As the test continued the power output of the reactor rose beyond its normal level and continued to rise. The opera-tors activated the emergency system designed to put the control rods back into the reactor and stop the fission. But it was already too late. The core had already been deformed and the rods would not fit properly thus the reaction could not be stopped. In 4.5 seconds the energy level of the reactor increased two thou-sand times. The fuel rods ruptured the cooling water turned into steam and a steam explosion occurred. The lack of cooling water allowed the reactor to explode. The explosion blew the 1000 metric ton concrete roof from the reactor and the reactor caught fire. This resulted in the world's worst nuclear accident and it took ten days to bring the runaway reaction under control. There were of course immediate fatalities, but the long-term consequences were devastating. 116,000 people were evacuated of which 24,000 had received high doses of radiation. Even today many people suffer from illnesses they feel are related to their exposure to the fallout from Chernobyl. In 1996 ten years after the accident it was clear that one of the long-term effects was the increased frequency of thyroid cancer in children. The degree and the kind of damage from nuclear accidents vary with the kind of radiation, the amount

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of radiation, the duration of exposure and the types of cells irradiated. Radiation can

also cause mutations which are changes in the genetic makeup of the cells. Mutations can occur in the ovaries or the testes leading to the formation of mutated eggs or sperms which in turn can lead to abnormal off-spring. Mutations can also occur in the tissues of the body ad may manifest themselves as ab-normal tissue growths known as cancer. Two common cancers that are linked to increased radiation exposure are leukemia and breast cancer. Solid waste Management : Causes, effects and control measures of Urban and Industrial waste In ancient cities, food scraps and other wastes were simply thrown into the unpaved streets where they accumulated. Around 320 B.C. in Athens, the first known law forbidding this practice was established and a system of waste removal began to evolve in several eastern Mediterranean cities. Disposal methods were very crude and often were just open pits out-side the city walls. As populations increased, efforts were made to transport the wastes out further thus creating city dumps. Until recently the disposal of municipal solid waste did not attract much public attention. The favoured means of disposal was to dump solid wastes outside the city or village limits. Around most towns and cities in India the approach roads are littered with multi-coloured plastic bags and other garbage. Waste is also burnt to reduce its volume. Modern methods of disposal such as incineration and the development of sanitary landfills, etc. are now at-tempting to solve these problems. Lack of space for dumping solid waste has become a serious problem in several cities and towns all over the world. Dumping and burning wastes is not an acceptable practice today from either an environmental or a health perspective. Today disposal of solid waste should be part of an integrated waste management plan. The method of collection, processing, resource recovery and the final disposal should mesh with one another to achieve a common objective. Characteristics of municipal solid waste 27

Solid wastes are grouped or classified in several different ways. These different classifications are necessary to address the complex challenges of solid waste management in an effective manner. The term municipal solid waste (MSW) is generally used to describe most of the non-hazardous solid waste from a city, town or village that requires routine collection and transport to a processing or disposal site. Sources of MSW include private homes, commercial establishments and institutions as well as industrial facilities. However, MSW does not include wastes from industrial processes, construction and demolition debris, sewage sludge, mining wastes or agricultural wastes. Municipal solid waste contains a wide variety of materials. It can contain food waste such as vegetable and meat material, left over food, egg shells, etc which is classified as wet garbage as well as paper, plastic, tetra packs, plastic cans, newspaper, glass bottles, cardboard boxes, aluminum foil, metal items, wood pieces, etc. which is classified as dry garbage. Control measures of urban and industrial wastes: An integrated waste management strategy includes three main components: 1. Source reduction 2. Recycling 3. Disposal Source reduction is one of the fundamental ways to reduce waste. This can be done by using less material when making a product, reuse of products on site, designing products or pack-aging to reduce their quantity. On an individual level we can reduce the use of unnecessary items while shopping, buy items with minimal pack-aging, avoid buying disposable items and also avoid asking for plastic carry bags. Recycling is reusing some components of the waste that may have some economic value. Recycling has readily visible benefits such as conservation of resources reduction in energy used during manufacture and reducing pollution levels. Some materials such as aluminium and steel can be recycled many times. Metal, paper, glass and plastics are recyclable. Mining of new aluminium is expensive and hence recycled aluminium has a strong market and plays a significant role in the aluminium industry. Paper recycling can also help preserve forests as it takes about 17 trees to make one ton of paper. Crushed glass (cullet) reduces the energy required to manufacture new glass by 50 percent. Cullet lowers the temperature requirement of the glassmaking process thus conserving energy and reducing air pollution. However even if recycling is a viable alternative, it presents several problems. The problems associated with recycling are either technical or economical. Plastics are difficult to recycle because of the different types of polymer resins used in their production. Since each type has its own chemical makeup different plastics cannot be recycled together. Thus, separation of different plastics before recycling is necessary. Similarly in recycled paper the fibres are weakened and it is difficult to control the colour of the recycled product. Recycled paper is banned for use in food containers to prevent the possibility of contamination. It very often costs less to transport raw paper pulp than scrap paper. Collection, sorting and transport account for about 90 percent of the cost of paper recycling. The processes of pulping, deinking and screening wastepaper are generally more expensive than making paper from virgin wood or cellulose fibres. Very often thus recycled paper is more expensive than virgin paper. However, as technology improves the cost will come down. Disposal of solid waste is done most commonly through a sanitary landfill or through incineration. A modern sanitary landfill is a depression in an impermeable soil layer that is lined with an impermeable membrane. The three key characteristics of a municipal sanitary landfill that distinguish it from an open dump are: ? Solid waste is placed in a suitably selected and prepared landfill site in a carefully pre-scribed manner. ? The waste material is spread out and compacted with appropriate heavy machinery. ? The waste is covered each day with a layer of compacted soil. The problem with older landfills are

Today it is essential to have suitable bottom liners and leachate collection systems along with the installation of monitoring systems to detect groundwater pollution. The organic material in the buried solid waste will decompose due to the action of microorganisms. At first the waste decomposes aerobically until the oxygen that was present in the freshly placed fill is used up by the aerobic microorganisms. The anaerobes take over 28

producing methane which is poisonous and highly explosive when mixed with air in concentrations between 5 and 15 percent. The movement of gas can be controlled by providing impermeable barriers in the landfill. A venting system to collect the blocked gas and vent it to the surface where it can be safely diluted and dispersed into the atmosphere is thus a necessary component of the design of sanitary landfills. Even though landfilling is an economic alternative for solid waste disposal, it has become increasingly difficult to find suitable landfilling sites that are within economic hauling distance and very often citizens do not want landfills in their vicinity. Another reason is that no matter how well engineered the design and operation may be, there is always the danger of some environ-mental damage in the form of leakage of leachates. Incineration is the process of burning municipal solid waste in a properly designed furnace under suitable temperature and operating conditions. Incineration is a chemical process in which the combustible portion of the waste is combined with oxygen forming carbon dioxide and water, which are released into the atmosphere. This chemical reaction called oxidation results in the release of heat. For complete oxidation the waste must be mixed with appropriate volumes of air at a temperature of about 815o C for about one hour. Incineration can reduce the municipal solid waste by about 90 percent in volume and 75 percent in weight. The risks of incineration however involve air-quality problems and toxicity and disposal of the fly and bottom ash produced during the incineration process. Fly ash consists of finely divided particulate matter, including cinders, mineral dust and soot. Most of the incinerator ash is bottom ash while the remainder is fly ash. The possible presence of heavy metals in incinerator ash can be harmful. Thus, toxic products and materials containing heavy metals (for example batteries and plastics) should be segregated. Thus, extensive air pollution control equipment and high-level technical supervision and skilled employees for proper operation and maintenance is required. Thus while sanitary landfills and incinerators have their own advantages and disadvantages, the most effective method of solid waste management is source reduction and recycling. Vermi - Composting Nature has perfect solutions for managing the waste it creates, if left undisturbed. The bio-geochemical cycles are designed to clear the waste material produced by animals and plants. We can mimic the same methods that are present in nature. All dead and dry leaves and twigs decompose and are broken down by organisms such as worms and insects, and is finally broken down by bacteria and fungi, to form a dark rich soil-like material called compost. These organisms in the soil use the organic material as food, which provides them with nutrients for their growth and activities. These nutrients are returned to the soil to be used again by trees and other plants. This process recycles nutrients in nature. This soil can be used as a manure for farms and gardens. Steps for Vermi-Compost ? Dig a pit about half a meter square, one meter deep. ? Line it with straw or dried leaves and grass. ? Organize the disposal of organic waste into the pit as and when generated. ? Introduce a culture of worms that is now produced commercially. ? Ensure that the contents are covered with a sprinkling of dried leaves and soil every day. ? Water the pit once or twice a week to keep it moist. ? Turn over the contents of the pit every 15 days. ? In about 45 days the waste will be de-composed by the action of the microorganisms. ? The soil derived is fertile and rich in nutrients. Hazardous wastes Modern society produces large quantities of hazardous waste which are generated by chemical manufacturing companies, petroleum refineries, paper mills, smelters and other industries. Hazardous wastes are those that can cause harm to humans or the environment. Wastes are normally classified as
hazardous waste when

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they cause or significantly contribute to an increase in mortality or an increase in serious irreversible or incapacitating reversible illness or pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported or disposed of. 29

Characteristics of hazardous wastes A waste is classified as a hazardous waste if it

exhibits any of the four primary characteristics based on the physical or chemical properties of toxicity, reactivity, ignitability and corrosivity. In addition to this waste products that are either infectious or radioactive are also classified as hazardous. Toxic wastes are those substances that are poisonous even in very small or trace amounts. Some may have an acute or immediate effect on humans or animals causing death or violent illness. Others may have a chronic or long term effect slowly causing irreparable harm to ex-posed persons. Acute toxicity is readily apparent because organisms respond to the toxin shortly after being exposed. Chronic toxicity is much more difficult to determine because the effects may not be seen for years. Certain toxic wastes are known to be carcinogenic, causing cancer and others may be mutagenic causing biological changes in the children of exposed people and animals. Reactive wastes are those that have a tendency to react vigorously with air or water, are un-stable to shock or heat, generate toxic gases or explode during routine management. For ex-ample, gunpowder, nitro-glycerine, etc. Ignitable wastes are those that burn at relatively low temperatures (less than 60 C) and are capable of spontaneous combustion during storage, transport or disposal. For example, gasoline, paint thinners, and alcohol. Corrosive wastes are those that destroy materials and living tissue by chemical reaction. For example, acids and bases. Infectious wastes include human tissue from surgery, used bandages and hypodermic needles, microbiological materials, etc. Radioactive waste is basically an output from the nuclear power plants and can persist in the environment for thousands of years before it decays appreciably.

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Environmental problems and health risks caused by hazardous wastes As most of the hazardous wastes are disposed

of on or

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in land the most serious environmental effect is contaminated groundwater. Once groundwater is polluted with hazardous wastes it is very often not possible to reverse the damage. Pesticides are used increasingly to protect and increase food production. They form residues in the soil which are washed into streams which then carry them forwards. The residues may persist in the soil or in the bottom of lakes and rivers. Exposure can occur through ingestion, inhalation and skin contact resulting in acute or chronic poisoning.

Today we have an alternative to the excess use of pesticides through the use of Integrated Pest Management (IPM). The IPM system uses a wide variety of plants and insects to create a more natural process. The natural balance between climate, soil and insect populations can help to prevent an insect from overpopulating an area and destroying a particular crop.

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Lead, mercury and arsenic are hazardous sub-stances which are often referred to as heavy metals. Lead is an abundant heavy metal and is relatively easy to obtain. It is used in batteries, fuel, pesticides, paints, pipes and other places where resistance to corrosion is required. Most of the lead taken up by people and wildlife is stored in bones. Lead can affect red blood cells by reducing their ability to carry oxygen and shortening their life span. Lead may also dam-age nerve tissue which can result in brain disease. Mercury occurs in several different forms. Mercury is used in the production of chlorine. It is also used as a catalyst in the production of some plastics.

Industrial processes such as the production of chlorine and plastics are responsible for most of the environmental damage resulting from mercury.

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Our body has a limited ability to eliminate mercury. In the food web mercury becomes more concentrated as it is taken up by various organisms. In

an aquatic environment, mercury can be absorbed by the plankton which are then consumed by fish. In addition, fish take up mercury through their gills and by eating other fish contaminated with mercury. Generally older the fish greater is the mercury concentration in its body.

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Birds that eat the fish concentrate even more mercury in their bodies. It is a cumulative poison (it builds up in the body over long periods of time) and is known to cause brain damage.

Thousands of chemicals are used in industry every day. When used incorrectly or inappropriately they can become health hazards.
PCBs (

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Polychlorinated biphenyls) are resistant to fire and do not conduct electricity very well which makes them excellent materials for several industrial purposes. Rainwater can wash PCBs out of disposal areas in dumps and landfills thus contaminating water. PCBs do not break down very rapidly in the environment and thus retain their toxic characteristics. They cause long term exposure problems to both humans and

wild-life. PCBs

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are concentrated in the kidneys and liver and thus cause damage. They cause reproductive failure in birds and mammals.

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Vinyl chloride is a chemical that is widely used in the manufacture of plastic. Usually people are only exposed to high levels of vinyl chloride if they work with it or near it but exposure can also occur from vinyl chloride gas leaks. After a long continuous exposure (one to three years) in humans,

vinyl chloride

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can cause deafness, vision problems, circulation disorders and bone deformities. Vinyl chloride can also cause birth defects. 30

It is essential to substitute the use of PCBs and vinyl chloride with chemicals that are less toxic. Polyvinyl chloride use can be lowered by reducing our use of plastics. Thus, by reducing waste, encouraging recycling and using products that are well made and durable we can greatly reduce our consumption of these chemicals thus curtailing our exposure to these substances. We may not realize it but many household chemicals can be quite toxic to humans as well as wildlife. Most of the dangerous substances in our homes are found in various kinds of cleaners, solvents and products used in automotive care. When these products are used incorrectly, they have the potential to be harmful. Today the most common methods for disposing off hazardous wastes are land disposal and incineration. In countries where there is abundant land available for disposal for example, North America land disposal is the most widely used method. In countries like Europe and Japan where land is not readily available and is expensive, incineration is the preferred method for disposal. In spite of strong laws however illegal dumping of these wastes continues. Hazardous waste management must move beyond burying and burning. Industries need to be encouraged to generate less hazardous waste in their manufacturing processes. Although toxic wastes cannot be entirely eliminated, technologies are available for minimizing, recycling and treating wastes. An informed public can also contribute in a big way towards this end. It is essential for us to understand the ill effects of chemical substances so that we can make in- formed decisions about its use. We might decide that the benefits of the use of a toxic substance do not outweigh the risks and choose not to use it at all or we may decide that it is acceptable to use a substance under certain specific circumstances where it is adequately controlled and exposure to toxic levels is pre-vented. Role of an Individual in Prevention of Pollution There are a host of environmental problems caused by human actions on the environment. If we are to respond to these problems we have to recognize that each of us is individually responsible for the quality of the environment we live in. Our personal actions can either worsen or improve our environmental quality. Several people may feel that environmental problems can be solved with quick technological fixes. While a majority of individuals would want a cleaner environment, not many of them want to make major changes in their lifestyle that could contribute to a cleaner environment. Decisions and actions taken by individuals to a very large extent determine the quality of life for everyone. This necessitates that individuals should not only be aware of various environ-mental issues and the consequences of their actions on the environment but should also make a firm resolve to develop environmentally ethical lifestyles. With the help of solar energy, natural processes developed over billions of years can indefinitely renew the topsoil, water, air, forests, grasslands and wildlife on which all forms of life depend, but only as long as we do not use these potentially renewable resources faster than they are replenished. Some of our wastes can be diluted, decomposed and recycled by natural processes indefinitely as long as these processes are not overloaded. Natural processes also provide ser-vices of flood prevention, erosion control at no costs at all. We must therefore learn to value these resources and use them sustainably. Concepts that help individuals contribute towards a better quality of our environment and human life. ? Develop respect or reverence for all forms of life. ? Each individual must try to answer four basic questions: Where do the things that I consume come from? What do I know about the place where I live? How am I connected to the earth and other living things? What is my purpose and responsibility as a human being? ? Try to plant trees wherever you can and more importantly take care of them. They reduce air pollution. ? Reduce the use of wood and paper products wherever possible. Manufacturing paper leads to pollution and loss of forests which releases oxygen and takes up carbon dioxide. Try to recycle paper products and use recycled paper wherever possible. ? From the mail you receive reuse as many envelopes that you can. ? Do not buy furniture, doors, window frames made from tropical hardwoods such as teak and mahogany. These are forest based. ? Help in restoring a degraded area near your home or join in an afforestation program. ? Use pesticides in your home only when absolutely necessary and use them in as small amounts as necessary. Some insect species help to keep a check on the populations of pest species. ? Advocate organic farming by asking your grocery store to stock vegetables and fruits grown by an organic method. This will automatically help to reduce the use of pesticides. 31

? Reduce the use of fossil fuels by either walking up a short distance using a car pool, sharing a bike or using public transport. This reduces air pollution. ? Shut off the lights and fans when not needed. ? Don't use aerosol spray products and commercial room air fresheners. They damage the ozone layer. ? Do not pour pesticides, paints, solvents, oil or other products containing harmful chemicals down the drain or on the ground. ? Buy consumer goods that last, keep them as long as possible and have them repaired as far as possible instead of disposing them off. Such products end up in landfills that could pollute ground water. ? Buy consumer goods ages in refillable glass containers instead of cans or throwaway bottles. ? Use rechargeable batteries. ? Try to avoid asking for plastic carry bags when you buy groceries or vegetables or any other items. Use your own cloth bag instead. ? Use sponges and washable cloth napkins, dish towels and handkerchiefs instead of paper ones. ? Don't use throwaway paper and plastic plates and cups when reusable versions are available. ? Recycle all newspaper, glass, aluminum and other items accepted for recycling in your area. You might have to take a little trouble to locate such dealers. ? Set up a compost bin in your garden or terrace and use it to produce manure for your plants to reduce use of fertilizers. ? Try to lobby and push for setting up garbage separation and recycling programs in your localities. ? Choose items that have the least packaging or no packaging. ? Start individual or community composting or vermicomposting plants in your neighborhood and motivate people to join in. ? Do not litter the roads and surroundings just because the sweeper from the Municipal Corporation will clean it up. Take care to put trash into dustbins or bring it back home with you where it can be appropriately disposed. ? You must realize that you cannot do every-thing and have solutions for every problem in the world. You can however concentrate on issues that you feel strongly about and can do something about. Focusing your energy on a particular issue will help you get better results. ? You could join any of the several NGOs that exist in our country or become volunteers. Organize small local community meetings to discuss positive approaches of pollution prevention. ? Learn about the biodiversity of your own area. Understand the natural and cultural assets. This would help you to develop a sense of pride in your city/town/village and will also help you understand the problems facing their survival. ? You cannot improve your world by not voting. You have the option to make a choice rather than complain later on. ? It is important that you do not get discouraged at the first sign of trouble. Do not dwell on the negative aspects. But take positive actions wherever you can to make the world a better place to live in. ? When talking to elected officials always be courteous and reasonable. You may dis-agree with a particular position but be respectful in doing so as you will gain little by being hostile and brash. ? Take care to put into practice what you preach. Remember environment protection begins with YOU. Disaster Management: Floods, Earthquakes, cyclones and Landslides The Indian subcontinent is very vulnerable to droughts, floods, cyclones, earthquakes, land-slides, avalanches and forest fires. Among the 36 states and Union territories in the country, 22 are prone

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to disasters. Among all the disasters that occur in the country, floods are the most frequently occurring natural disasters, due to the irregularities of the Indian monsoon.

About 75 percent of the annual rainfall in India is concentrated in three to four months of the monsoon season. As a result there is a very heavy discharge from the rivers during this period causing widespread floods. Approximately 40 million hectares of land in the country has been identified as being prone to floods. Major floods are mainly caused in the Ganga-Brahmaputra-Meghna basin which carries 60 percent of the total river flow of our country. India has a long coastline of 5700 kms, which is exposed to tropical cyclones arising in the Bay of Bengal and the Arabian sea. The Indian Ocean is one of the six major cyclone prone regions of the world. In India, cyclones occur 32

usually be-tween April and May and also between October and December. The eastern coastline is more prone to cyclones as it is hit by about 80 per-cent of the total cyclones generated in the region. Droughts are a perennial feature in some states of India. Sixteen percent of the country's total area is drought prone. Drought is a significant environmental problem as it is caused by a lower than average rainfall over a long period of time. Most of the drought prone areas identified by the Government lie in the arid and semi-arid areas of the country. Earthquakes are considered to be one of the most destructive natural hazards. The impact of this phenomenon occurs with so little warning that it is almost impossible to make preparations against damages and collapse of buildings. About 50 to 60 percent of India is vulnerable to seismic activity of varying intensities. Most of the vulnerable areas are located in the Himalayan and sub-Himalayan regions. From management to mitigation of disasters Till very recently the approach towards dealing with natural disasters has been post disaster management involving problems such as evacuation, warnings, communications, search and rescue, fire-fighting, medical and psychiatric assistance, provision of relief, shelter, etc. After the initial trauma and the occurrence of the natural disaster is over and reconstruction and rehabilitation is done by people, NGOs and the Government, its memories are relegated to history. It is evident today that human activities are responsible for accelerating the frequency and severity of natural disasters. Natural occurrences such as floods, earthquakes, cyclones, etc. will always occur. They are a part of the environment that we live in. However, destruction from natural hazards can be minimized by the presence of a well-functioning warning system combined with preparedness on part of the community that will be affected. Thus though traditionally disaster management consisted primarily of reactive mechanisms, the past few years have witnessed a gradual shift towards a more proactive, mitigation based approach. Disaster management is a multidisciplinary area in which a wide range of issues that range from forecasting, warning, evacuation, search and rescue, relief, reconstruction and rehabilitation are included. It is also multi-sectoral as it involves administrators, scientists, planners, volunteers and communities. These roles and activities span the pre-disaster, during disaster and post disaster plans. Since their activities are complementary as well as supplementary to each other there is a critical need for coordinating these activities. In order to transfer the benefits of scientific re-search and development to the community's links must be developed between scientific com-munities and field agencies. Coordination be-tween Government agencies and NGOs needs to be built up so that overlap of activities may be avoided and linkages between the Government and communities are established. Today we have a range of early warning systems for a range of natural hazards. Although they are more accurate than before and can help in prediction it is not enough to ensure communities are safe from disasters. This is where disaster mitigation can play an important role. Mitigation means lessening the negative impact of the natural hazards. It is defined as sustained action taken to reduce long term vulnerability of human life and property to natural hazards. While the preparatory, response and the recovery phases of emergency management relate to specific events, mitigation activities have the potential to produce repetitive benefits over time. Certain guidelines if followed can result in an effective mitigation program. ? Pre-disaster mitigation can help in ensuring faster recovery from the impacts of disasters. ? Mitigation measures must ensure protection of the natural and cultural assets of the community. ? Hazard reduction methods must take into account the various hazards faced by the affected community and their desires and priorities. ? Any mitigation program must also ensure effective partnership between Government, scientific, private sector, NGOs and the community. The main elements of a mitigation strategy are as follows: ? Risk assessment and Vulnerability analysis This involves identification of hot spot areas of prime concern, collection of information on past natural hazards, information of the natural eco-systems and information on the population and infrastructure. Once this information is collected a risk assessment should be done to determine the frequency, intensity, impact and the time taken to return to normalcy after the disaster. The assessment of risk and vulnerabilities will need to be revised periodically. A regular mechanism will therefore have to be established for this. The use of Geographical Information Systems (GIS) 33

a computer program can be a valuable tool in this process as the primary data can be easily updated and the corresponding assessments can be made. ? Applied research and technology transfer There is a need to establish or upgrade observation equipment and networks, monitor the hazards properly, improve the quality of fore-casting and warning, disseminate information quickly through the warning systems and undertake disaster simulation exercises. Thus, space technologies such as remote sensing, satellite communications and Global Positioning Systems have a very important role to play. Government organizations like ISRO (Indian Space Research Organization) can play a vital role. Similarly, Government organizations the National Building Research Organization, the Meteorological Department, Irrigation Department, etc. can undertake applied research for devising locale specific mitigation strategies in collaboration with educational institutions or Universities. Such steps could lead to the formulation of locale specific mitigation measures. A combination of scientific knowledge and expertise with the community based mitigation measures would not only enhance the database but would also form the basis of a successful mitigation strategy. ? Public awareness and training One of the most critical components of a mitigation strategy is the training to be imparted to the officials and staff of the various departments involved at the state and the district level. This enables sharing of information and methodology. The success of a mitigation strategy will depend to a large extent on the inter-sectional, inter- departmental coordination and efficient teamwork. Thus, a training program that is de-signed after assessment of gaps in knowledge, skills and attitude with respect to the various tasks that need to be undertaken is a vital component. ? Institutional mechanisms The most important need at the National level is to strengthen or develop the capacity to undertake disaster mitigation strategies. There is a need to emphasize on proactive and pre-disaster measures rather than post disaster response. It is thus essential to have a permanent administrative structure which can monitor the developmental activities across departments and provides suggestions for necessary mitigation measures. The National Disaster Management Center (NDMC) can perform such a task. Professionals like architects, structural engineers, doctors, chemical engineers who are involved with management of hazardous chemicals can be asked to form groups that can design specific mitigation measures. ? Incentives and resources for mitigation To a very large extent the success of mitigation programs will depend upon the availability of continued funding. There is thus a need to develop mechanisms to provide stable sources of funding for all mitigation programs. This will include incentives for relocation of commercial and residential activities outside the disaster prone areas. Housing finance companies should make it mandatory for structures in such hazard prone areas to follow special building specifications. The introduction of disaster linked insurance should be explored and should cover not only life but also household goods, cattle, structures and crops. ? Landuse planning and regulations Long term disaster reduction efforts should aim at promoting appropriate land-use in the disaster prone areas. Separation of industrial areas from residential areas, maintaining wetlands as buffer zones for floods, creation of public awareness of proper land practices and formation of land-use policies for long term sustainable development is imperative. ? Hazard resistant design and construction In areas that are prone to disasters protection can be enhanced by careful selection of sites and the way the buildings are built. Thus it is essential to promote the knowledge of disaster resistant construction techniques and practices among engineers, architects and technical personnel. ? Structural and Constructional reinforcement of existing buildings It is also possible to reduce the vulnerability of existing buildings through minor adaptations or alterations thereby ensuring their safety. This can be done by insertion of walls on the outside of the building, buttresses, walls in the interior of the building, portico fill-in-walls, specially anchored frames, covering of columns and beams, construction 34

of new frame system, placing residential electrical equipment above flood level, designing water storage tanks to be able to with-stand cyclonic winds, earthquakes and floods, etc. Floods and mitigation measures The lower plain regions of India in particular Bihar, Uttar Pradesh and West Bengal in respect of the Ganga and Assam in respect of the Brahmaputra suffer from the adverse effects of floods every year. The Ganga Brahmaputra basin receives maximum run off within the three monsoon months. Based on hydrological studies carried out, it is estimated that only 18 per-cent of the rainwater can be stored in dams, reservoirs, etc. while 82 percent of the rainwater flows through rivers ultimately into the sea. Floods are therefore a recurring phenomenon in our country. Floods can be caused by natural, ecological or anthropogenic factors either individually or as a combined result. Anthropogenic activities such as deforestation and shifting cultivation can also contribute to floods. Forests on the hill slopes normally exert a sponge effect soaking up the abundant rainfall and storing it before releasing it in small amounts over a period of time. However, when the forests are cleared the rivers turn muddy and swollen during the wet monsoon season and run dry later on in the year during the drier periods. An increasing proportion of the rainfall is therefore released shortly after precipitation in the form of floods. The mitigation measures for floods include both structural and non-structural measures. The structural measures include: Reservoirs for impounding monsoon flows to be released in a regulated manner after the peak flood flow passes. ? Prevention of over-bank spilling by the construction of embankments and floodwalls. ? Improvement of flow conditions in the channel and anti-erosion measures. ? Improved drainage. The non-structural measures include: ? Flood plain management such as Flood Plain Zoning and Flood Proofing including Disaster Preparedness ? Maintaining wetlands ? Flood forecasting and warning services ? Disaster relief, flood fighting and public health measures ? Flood insurance ? Earthquakes and mitigation measures It has been several years since the earthquake struck Gujarat on January 26, 2001. In these years rehabilitation has been done on a massive scale. Gujarat's experience has taught that building shelters with less vulnerability to earthquakes should also take into consideration the specific needs of the victims instead of being a top down approach. The role of NGOs in this is very important. Their strength lies in their manpower, informality in operations and valuable human resources. Their ability to reach out to the community and sensitivity to local traditions is an asset in such situations. A report on the various initiatives in Gujarat reported in Down to Earth (Vol 12, No. 2) by Mihir Bhatt throws light on the various developments that have taken place after the earthquake. According to the report the initiatives of the International Fund for Agriculture Development in supporting the Self Employed Women's Association and the Government's initiative in community based livelihood security for earthquakes and drought victims have the potential to shape future disaster response and development projects in Gujarat. Similarly the Gujarat Woman's Economic Development Corporation initiative in reviving women's businesses after the calamity also provides many practical lessons in regenerating local economies and artisan markets. This project supported by the Asian Development Bank, puts premium on investments in income generation and asset building after a natural disaster. The farming kits provided to affected farmers by Gujarat's agriculture ministry is also showing promising results after two seasons. The author however states that coordination between Government, local NGOs and local community initiatives both for rescue as well as rehabilitation needs to be strengthened as this can cause delays, overlaps and waste of relief material and efforts. ? Cyclones and mitigation measures Tropical cyclones are the worst natural hazards in the tropics. They are large revolving vortices in the atmosphere extending horizontally from 150 to1000 km and vertically from the surface to 12 to 14 km. These are intense low- pressure areas. Strong winds spiraling anti clockwise in the Northern Hemisphere blow around the cyclone center at the lower level. At the higher levels the sense of rotation is just opposite to that at the lower level. They generally move 300 to 5000 km per day over the ocean. While moving over the ocean they pick up energy from the warm water of the ocean and some of them grow into a devastating intensity. On an average about 5 to 6 tropical cyclones form in 35
the Bay of Bengal and the Arabian Sea every year out of which 2 to 3 may be severe. More cyclones form in the Bay of Bengal than in the Arabian Sea.

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The main dangers from cyclones are very strong winds, torrential rains and high storm tides.

Most of the causalities are caused by coastal inundation by storm tides. This is of-ten followed by heavy rainfall and floods. Storm surges cause the greatest destruction. Although one cannot control cyclones, the effects of cyclones can be mitigated through effective and efficient mitigation policies and strategies. A brief description of the same is given below. Installation of early warning systems: Such systems fitted along the coastlines can greatly assist forecasting techniques thus helping in early evacuation of people in the storm surge areas. Developing communication infrastructure: Communication plays a vital role in cyclone disaster mitigation and yet this is one of the first services that gets disrupted during cyclones. Amateur Radio has today emerged as a second line unconventional communications systems and is an important tool for disaster mitigation. Developing shelter belts: Shelter belts with plantations of trees can act as effective wind and tide breakers. Apart from acting as effective windbreakers and protecting soil crops from being damaged they prevent soil erosion. Developing community cyclone shelters: Cyclone shelters at strategic locations can help minimizing the loss of human life. In the normal course these shelters can be used as public utility buildings. Construction of permanent houses: There is a need to build appropriately designed concrete houses that can withstand high winds and tidal waves. Training and education: Public awareness pro-grams that inform the population about their response to cyclone warnings and preparedness can go a long way in reducing causalities. Landuse control and settlement planning: No residential and industrial units should be ideally permitted in the coastal belt of 5 km from the sea as it is the most vulnerable belt. No further growth of settlements in this region should allowed. Major settlements and other important establishments should be located beyond 10 km from the sea. ? Landslides and mitigation measures Landslides are recurring phenomena in the Himalayan region. In the recent years however intensive construction activity and the destabilizing forces of nature have aggravated the problem. Landslides occur as a result of changes on a slope, sudden or gradual, either in its composition, structure, hydrology or vegetation. The changes can be due to geology, climate, weathering, land-use and earthquakes. A significant reduction in the hazards caused by landslides can be achieved by preventing the exposure of population and facilities to landslides and by physically controlling the landslides. Developmental programs that involve modification of the topography, exploitation of natural resources and change in the balance load on the ground should not be permitted. Some critical measures that could be undertaken to prevent further landslides are drainage measures, erosion control measures such a bamboo check dams, terracing, jute and coir netting and rock- fall control measures such as grass plantation, vegetated dry masonry wall, retaining wall and most importantly preventing deforestation and improving afforestation Disasters cannot be totally prevented. However early warning systems, careful planning and preparedness on part of the vulnerable community would help in minimizing the loss of life and property due to these disasters. Indian Constitutional Provisions for sustainable development and Environment Protection Introduction Environment protection and preservation is integral part of Indian religious practices and beliefs. It is belief of all Indian religions that to preserve the environment is one of the ways to serve the humanity and God. Undoubtedly, Indian Constitution implements the religious faith of Indian community on environment preservation by the insertion of various provisions concerning protection of natural resources like forests, lakes and wild life. Moreover, keen participation in various international conventions, conferences rather affirms that, most of the issues, which the humanity is facing today, are revolving around the human beings. Environmental pollution and 36

unsustainable pattern of development is such kind of issue. It is emphasized that these issues are not for single nation, therefore it is the obligations of the all nations whether developed or developing, rich or poor must concentrate to find out the solutions of these problems. Undoubtedly, various resolutions have been taken by world community through international conferences, conventions, declarations to resolve the above said issues. The first international conference for environment preservation and sustainable development is Stockholm Declaration on Human Environment, 1972, in which India participated and promised to implement the principles of Stockholm declaration in regional level. In other words, one can say that consciously, it was initial step of the Indian Government to fight against the problem of environment pollution and unsustainable development. Development that is environment friendly and meets the needs of people is the object set for governance by the modern welfare governments for themselves. Various laws passed by Parliament and numerous provisions inserted in Constitution regarding the protection of environment and sustainable development are an indication towards the ernest approach of the government in this direction. We have the satisfaction that our constitution is one of the longest and written constitutions of the world, having sufficient backing to the principles of environment protection and sustainable development. Articles 14, 19(1) (g), 21, 26, 32, 47, 48-A, 51 (A) (g), 226, 253, Seventh Schedule and Eleventh Schedule of Indian Constitution has relevance with the environment protection and sustainable development. When the people of India express their will for India to be an advanced nation, they primarily intend worthier provision of basic needs such as pure water, air, health and clean environment. To fulfill that desire, government of India at different times has always endeavoured to achieve the object. The Constitution of India being the highest law embodies in itself a greater national commitment to preserve and protect the clean and healthy environment. It guarantees right to life and personal liberty. They are further fortified by various pronouncements of Indian judiciary. To achieve the above said object, the Indian Constitution has imposed an obligations both on the State as well as the citizens to protect and preserve the natural environment. These provisions form the kernel of our constitutional mandate and highlight the national consensus on the importance of environmental protection and improvement, to lay the foundation for a jurisprudence of environmental protection. Moreover, from Stockholm Declaration, 1972 to Rio+20 Declaration, 2012 and BRICS Summit, 2014, India always has been a key player among the nations, which are committed for environment protection and sustainable development principles. Constitutional Provision for ecological preservation and Balanced Development At the time of Constituent Assembly debates, there was no particular provision regarding environment protection. At that time, environmental issues were left out. But on the other hand, judiciary was working very actively. Judicial consciousness in the sphere of environment protection and balanced progress makes government and people more conscious about the concept of sustainable development. Moreover, national environmental movements in India have also played a very important role to create environmental renaissance. The rise and development of environmental movements in India was considered since the later half of 1960's. The primary causes of these movements are undoubtedly the nature of development model adopted by India in the said period. Appiko Movement is one of the forest-based environmental movements in India, often looked at as a continuation of the Chipko Movement. The Movement took place in the Uttara Kannada District of Karnataka in the Western Ghats. It was for saving forests from destruction by felling trees. Further, Silent Valley Movement was led by Kerala Sastra Sahitya Parishad (KSSP) with the demand that the government should stop the execution of the project, because that particular project is harmful to environment and eco-system. It has 8,950 hectares of rainforest, one of the few remaining rainforests in India, with valuable flora and fauna. In 1973, the State Government of Kerala decided to build a dam across a valley in the Kunthipuzha River, which flows through the silent valley. The proposed project would generate 200 MW of electricity, and form the basis for regional economic development. However, the proposed project was not ecologically viable, as it would drown a chunk of the valuable rainforest of the valley and threaten the life of a host of endangered species of both flora and fauna. Hence, by 1979, students, rural school teachers, science forums, journalists, citizens, and voluntary organizations made a well-reasoned case against the project. Apart from above, Chilika Bachao Andolan, Baliapal Movement, The Movement against Tehri Dam, and Narmada Bachao Andolan are evidenced that modern Indian nation state favoured the development strategies based on the eco-friendly development. For balanced development, India is emerging as a role model for the other nations. Her performance could visualize at global level. International conventions, conferences, covenants and declarations like Stockholm declaration, 1972 (popularly known as Magna Carta of Environment), Rio declaration, 1992 (popularly known as Earth Summit), Kyoto Protocol, Johannesburg Declaration, 2002, Copenhagen Meet, 2009, Cancun, 2010, Durban Declaration, 2011, Rio+20, 2012, BRICS Summit, 2014 and G20 Leaders Summit, 2014 shows that Indian government has always sincere about environment protection and sustainable development. 37

Till 1976, the idea of ecological safety was set apart from legislative policies, but Articles like 14, 19, 21, 32, 39, 42, 47, 48, 49 etc. had an indirect impact on environment and reinforcing sustainable development which was hitherto an ignored objective. The constitution being a grundnorm of the land shall be binding not only on the citizens but on the non-citizens and the States itself. In pursuance of Stockholm Declaration, Constitution 42nd Amendment, 1976 was inserted in the constitution. It was a successful attempt of legislature to secure the protection of environment. Part-IV11 & IV-A of constitution is to realize the abatement of pollution for ecological safety. Above facts makes it clear that India has unique constitution with numerous provisions relating to environment preservation and sustainable development. These are listed and discussed as below: Preamble The public, fiscal and opinionated righteousness sembodied inside preamble comprises in itself the theme of environmental protection as well. The 42nd Amendment has inserted three words in the preamble i.e. secularism, socialism and integrity. These concepts are implicit in the Constitution. The amendment merely spells out clearly these concepts in the preamble. Now the preamble comprehends as thus: "We, the people of India, having solemnly resolved to constitute India into Sovereign, Socialist, Secular, Democratic, Republic and ....." Though India has always been following the ideal of socialistic society, yet it was for the first time that the ideal was given a constitutional recognition by the 42 nd Amendment Act, 1976. In this regard, S.K. Verma explains ecological infectivity is a common dilemma as it affects to all. The transformation from the laissez faire society to the socialistic pattern of the society raised works and responsibilities of the government and State are burdened with the weighty tasks like the assurance of societal justice and abolishment of community vulnerabilities. Continuous contamination of nature is most serious social problems that a nation may face. The developing countries must take a lesson from the enormity of the problem of environmental pollution that the developed countries are struggling . India was participant to the Stockholm Conference and consequently was under an obligation to give effects to the recommendations made by the said conference. So, the 42nd Amendment Act, 1976, has introduced towards the 'Social, Secular'. Term socialism stresses more attention towards the social problems than any individual problem, and the environmental conservation is one of them. Fundamental Rights Principle 1
of the Stockholm Declaration provides that: Man

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has the fundamental right to freedom, equality and adequate conditions of life, in an environment of a quality that permits a life of dignity and well-being, and he bears a solemn responsibility to protect and improve the environment for present and future generation .

Above given principle finds reflection in series of fundamental rights, which are explained as below: Article 14: Right to Equality To protect persons against arbitrary and unfair State actions is one of the agenda of equality clause. This Article being a general Article under Part III plays a very important role because it prohibits arbitrariness. It will not be wrong to say that coexistence of equality and arbitrariness is impossible. The new dimension of the right to equality which excludes arbitrariness is often used by judiciary for quashing the permission of construction granted arbitrarily by State without giving due importance to environmental concern. Arbitrary Sanction of Authorities in Environmental Matters The judiciary has on several occasions declared that the arbitrary sanction of the authorities in environmental matters as unconstitutional. Article 14 has been frequently invoked by Indian judiciary for environment protection. Its contents contain witnessed effectuation especially in cases involving mining and stone crushing activities. Arbitrary grant of lease and unwarranted operation of mines may lead to destruction of wild life and nature. When the mining activities resulted in pollution of Mussoorie Hill range forming part of Himalayas, then the issue of development and environment was brought into sharp focus for the first time. In 2010, the Communist Party of India (CPI) was urged to then Prime Minister Dr. Manmohan Singh to review the mega steel project awarded to South Korean Steel Gaint Posco in Orissa and urged him to immediately withdraw the arbitrary environmental clearance accorded to the project in light (Article 14) continued violence and atrocities against the local population. CPI has stated that the project did not provide any kind of direct benefit to the people of 38

the locality or the economy of the country or the state and was rather aimed at stripping the area of its rich mineral resources. Article 19(1) (a) Article 19(1) (a) assures to people of India the freedom of speech and expression subject to reasonable restrictions . Due to societies progress, new means for communication have been developed, which can be used for the purpose of speech and expression. Law prohibits us, to use these means violently, because public health demands control of the use of such appliance as produces loud noise by day or by night. Kerala High Court in P.A. Jacob v. Superintendent of Police, Kottayam, (AIR 1993 Ker 1), has also recognizes the above view and held that: the freedom of speech does not include freedom to use loud speakers or sound amplifiers to cause noise pollution and risk to human health . The Court has also made it very clear that operation of mechanical sound amplifying devices conflict with quite enjoyment of men in park and freedom of speech does not involve freedom to use sound amplifiers to drawn out natural speech of others . Article 19(1) (g) Satish Bhatia rightly explains that, "trade is not an end in itself but a means to an end the goal of sustainable development. Sustainable development aims at maximizing net welfare of economic activities, along with maintaining or increasing the stock of economic, ecological and socio-cultural assets overtime. It implies the role of many non-economic and non-material environmental factors and equity aspects also". Article 19(I) (g) confers right upon the citizens "to practice any profession or to carry any occupation, trade or business and this particular right carries certain reasonable limitations as given under Article 19(6), which may be compulsory for the welfare of common masses". By virtue of a range of judgments of Supreme Court as well as the High Courts, now it is well settled that the right to freedom of profession, occupation, trade or business is subject to the condition that it should not be a cause for environmental pollution. In Abhilash Textile v. Rajkot Municipal Corporation, AIR 1988 Gujarat 57, Court held that: Though a person has a right to carry on any business of his choice, but there is no right to carry on any business inherently dangerous to society, because the interests of society are to be balanced with the interests of citizens to carry on business". It is of common knowledge that now a day's tanneries, dye factories, acid factories and hotels are source of environmental pollution. Several times, the Indian judiciary directed that closure of certain industries which were not showing any progress towards setting up of air pollution control system in compliance with its earlier order. But it does not mean that State is against the concept of industrialization. It is true industrial development is essential for handling the problems like unemployment, poverty etc. but the preservation of ecological balance has a paramount place, because it is concerned with the life and health of the masses. Thus, no polluting industry can be permitted to run under the garb of development if it results in public nuisance and imbalance of the ecosystem. Generally environmental and trade issues can broadly be classified into two categories i.e. (a) Local or National pollution problems including problems like pollution of national soil, water and air resources. Mostly, the business activities are responsible for environmental degradation of such nature, which endanger the quality of life of its citizens. (b) Transboundary Pollution Problems have a global impact. This would include pollution of transnational water resources, air pollution, ozone layer depletion etc. No doubt industrial pollution contaminates environment. Trade or industrialization affects transnational water resources. When the harmful chemicals are released from the factories and mixed with the stream, rivers or ocean waters, there definitely affect the ground water. Moreover, today's world is suffering from transfrontier air pollution. Trail Smelter Arbitration is one of the best examples of transboundary air pollution. Ozone layer depletion is another effect of transboundary pollution. Thus it is very clear that any business or trade which is dangerous to flora and fauna can't be carried on in the name of fundamental right. Article 21 Out of the constitutional provisions regarding environment, Article 21 is remarkable which includes all the finer graces of human civilization and thus embraces environment also and thus the credit goes to Indian judiciary to incorporate the internationally recognized "Right to Environment" under domestic domain by its various 39
pronouncements. Article 21 emphasizes that every citizen can claim dignified life. Though it does not explicitly mention the word environment but courts have given a wider interpretation to the term life by including in it the right to congenial environment for human existence. This Article creates a new way for all the persons to approach the courts for appropriate relief when they are deprived of hygienic environment. In this context Gurdip Singh rightly explained that: "The right to clean environment is a fundamental right as well as a human right simply because it

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is the basic need for the survival of the human

race. The contaminated environment will kill human beings. Thus, right to pure and decent environment underlies the right to life supporting ecosystem which sustains life . In various countries

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the rights to healthy environment and to sustainable development are fundamental human rights implicit in the right to life.

Indian judiciary also recognized the idea of balanced progress as a part and parcel of Indian law in a series of cases and also elevated it to the status of a fundamental right implicit in Article 21 of the Indian Constitution. Moreover, numerous pronouncements have considerably widened the compass of Article 21. In Madhu Kishore v. State of Bihar court stated that: "There are two conflicting, yet complementary, aspects involved. These are the right to development and the right to clean and healthy environment. Both had been declared an integral part of the right to life under Article 21" . Clean wind is an Integral Part of Right to Life The term 'life' has broad meaning . To inhale clean air is the basic requirement of dignified life. Following the above view, the Supreme Court, directed for the closure of a factory which was creating air pollution28. Allahabad High
Court held that "

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right to life as a fundamental right under Article 21, which includes the right of enjoyment of pollution free water and air".

Again, Apex Court observed that "the emissions resulted in violation of the right of life of the people living in the Taz Trapezium (TTZ) and it has also damaged the prestigious monument like the Taj". Further, the Karnataka High Court observed that water and air pollution caused by stone crushing had adverse effects on human health, animals and vegetation, therefore, it violates the dignified life. The court also ordered crusher units to pay compensation to the victims of pollution31. Moreover, in CNG case, the Supreme Court treated air pollution in Delhi caused by vehicular emissions as violation of Article 21 and therefore, by keeping in view the concept of sustainable development directed all commercial vehicles operating in national capital to replace to CNG gas type for conserving the healthiness of the masses Thus, from the above discussion, it is very much obvious that Article 21 does not mean mere animal existence, it includes pollution free environment also. Article 32:- Writs as remedies for Environment Protection and Sustainable Development The importance of Article 32 can't be underestimated. Therefore, "Dr. B.R. Ambedkar" stated that: "If I was asked to name any particular article in this constitution as the most important an article without which this constitution would be a nullity I would not refer to any other article except this one. It is the very soul of the constitution and the very heart of it". The scope of these rights has been enlarged through judicial interpretations from time to time. Through various judicial announcements, it has been cleared that the right to life does not simply means an animal existence. The aggrieved person alleging complaints regarding environment pollution can move a petition for redressal of his grievances in the higher court of the land through Art. 32. In this context, the High Courts entertains much wider power for protection & improvement of environment under Art. 226. For elimination of water and atmospheric pollution, the Supreme Court has directed the erring parties not to discharge effluents into river water without adequate treatment. In the Taj Trapezium case, to protect and preserve the beauty of the Taj Mahal, certain industries affecting the nearby environment, were ordered to be closed down. In another writ petition, directions were sought to prevent the pollutions released by industries in Tamil Nadu. The Apex Court held that though such industries are of vital importance in the development process of our country, they could not be permitted to continue their operations unless they set up pollution control devices . The Court further held that such industries could not be permitted to destroy ecology, degrade the environment and pose health hazards. In this case, sustainable development principles were evolved. Justice Kuldip Singh (popularly known as Green Judge) maintained

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that Precautionary principle and the polluter pays principle are essential features of 'sustainable development'.

Apart from above cases, series of public interest litigations (Discussed in Chapter-V) have drawn the attention of Supreme Court in the direction of environmental pollution and Apex Court has issued necessary directions in such public interest litigations so that the people living in the area can lead the pollution free life. 40

Directives Principles of State Policy and Environment Protection and Sustainable Development No doubt, Part-IV is not judicially enforceable like basic rights provided under Part-III but according to Article 31-C No law giving effect to the policy of the State towards securing these principles contained in clause (b) or Clause (c) of Article 39 of the Constitution shall to be deemed void on the ground that it is inconsistent with or takes away and abridges any of the fundamental rights conferred by Article 14 and Article19 . Originally, no notable provision regarding ecological preservation was inserted in the Part-IV. But cautious studies of Constitution reveals that certain Articles are related to the nature conservation are in existence even prior to 42nd Amendment, 1976, which reads as under: "Article 42" "State to make provision for just and humane condition of work". "Article 43" "Securing living wage is not enough. State should endeavour to ensure decent standards of life". "Article 48" "

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The state shall endeavour to organize agricultural and animal husbandry on modern and scientific lines

and shall, in particular, take steps for the preserving and improving the breeds and prohibiting the slaughter of cows and claves and other milch and draught cattle". "Article 49" It shall be obligation of the state to protect every monument or place or object or artistic or historic interest, declared by or under law made by Parliament to be of national importance from spoliation, disfigurement, destruction, removal, disposal or export, as the case maybe". Post Forty Second Amendment (1977- 2006) Article 47 According to "Principle 1 of the Rio Declaration 1992" "

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Human beings are at the centre of concerns for sustainable development,

and that

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they are entitled to a healthy and protective life, in harmony with nature".

For balanced development, close linkage between environment, health and development is needed, because sustainable development is hardly possible without poverty eradication and healthy people. As per the Vision Statement on Environment and Human Health, July 2003: "There is an urgent need to address the causes of ill health, including environmental causes, and their impact on development, with particular emphasis on women and children, as well as vulnerable groups of society, such as people with disabilities, elderly persons and indigenous people and on development" Director General Emeritus, World Health Organization, Dr. Gro Harlem Brundtland, insists that Healthy life is an outcome of sustainable development as well as a powerful and undervalued means of achieving it. We need to see health both as precious asset in itself and as a means of stimulating economic growth and reducing poverty . Following the concept of sustainable development, Article 47 imposes a

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duty upon the State to raise the level of nutrition and the standard of living of its people and improve public health .

Accordingly, the State

Governments are primarily responsible to ensure formulation and enforcements of measures for raising the living standard of its public. As such individual State Governments have introduced various policies/programme aimed at providing adequate public health facilities. The Central Government has also been rendering assistance and when requested, particularly for eradication of vulnerable disuses, environmental pollution, drug control and prevention of food adulteration, etc. As per the report of Ministry of Health and Family Welfare government initiatives in public health sector have recorded some noteworthy successes overtime. Small Pox and Guinea worm disease have been eradicated from the country, Polio is on the verge of being eradicated; Leprosy, Kala Azar and Filariasis can be expected to be eliminated in the foreseeable future. There has been a substantial drop in the total fertility rate and infant mortality rate. According to National Health Policy, 2002: The figure on the health of Indian population indicates that during the period of 1981 to 2000 the life expectancy increased from 54 to 64.6; crude birth rate has come down from 33.9 to 26.1; Crude death rate has come 41
down from 12.5 to 8.7. Malaria cases (in Millions) decreased from 2.7 to 2.2, leprosy case per 10,000 population decreased from 57.3 to 3.7447. Apart from above, legislative efforts are also praiseworthy for the better health of the people. Keeping in view the fundamental right of health, The National Health Bill, 2009 was introduced into the Parliament. According to the Section 3 of the Bill, Government of India and the State Governments have under general obligations at all times, within the maximum limits of their available resources, towards the progressive realization of health and well being of every person in the country. In 2010, Assam has become the first State in the country to introduce an Assam Public Health Bill. As per Section 3 under Chapter II of the Bill, Government in the Health and Family Welfare Department has the general obligations at all times, within the limits of their available resources, towards the progressive realization of health and well-being of every person in the State 49. Article 47 thus, achieving its object i.e. progress of public health. because health is one of the outcome of balanced society. Above discussed achievements are impressive but are not enough as a large section of Indian population is still not benefitted by these well being measures. Under this situation, it is imperative that one is made aware of not only health hazards but also measures that exist for the protection of health, because economic development and healthy environment cannot be achieved without healthy life. Sustainable Development Sustainable development is a central concept for our age. It is both a way of understanding the world and a method for solving global problems. This book offers you an introduction to this fascinating and vital field of thought and action. Our starting point is our crowded planet. There are now 7.2 billion people on the planet, roughly 9 times the 800 million people estimated to have lived in 1750, at the start of the industrial revolution. The world population continues to rise rapidly, by around 75-80 million people per year. Soon enough there will be 8 billion by the 2020s, and perhaps 9 billion by the early 2040s. These billions of people are looking for their foothold in the world economy. The poor are struggling to find the food, safe water, health care, and shelter they need for mere survival. Those just above poverty are looking for improved prosperity and a brighter future for their children. Those in the high-income world are hoping that technological advances will offer them and their families even higher levels of wellbeing. It seems that the super-rich also jostle for their place on the world's rankings of richest people. In short, 7.2 billion people are looking for economic improvement. They are doing so in a world economy that is increasingly connected through trade, finance, technologies, production flows, migration, and social networks. The scale of the world economy, now estimated to produce $90 trillion of output per year (a sum called the Gross World Product, or GWP), is unprecedented. By crude statistics, the GWP measures at least 100 times larger than back in 1750. In truth, such a comparison is not all that meaningful, since most of the world economy today consists of goods and services that did not even exist 250 years ago. What we know is that the world economy is vast, growing rapidly (by 3-4 percent per year in scale), and highly unequal in the distribution of income within countries and between countries. Ours is a world of fabulous wealth and extreme poverty, of billions of people enjoying longevity and good health unimaginable in previous generations. Yet it is also a world in which at least 1 billion people live in such abject poverty that they struggle for mere survival every day. The poorest of the poor face the daily life-and-death challenges of insufficient nutrition, lack of health care, unsafe shelters, and the lack of safe drinking water and sanitation. The world economy is not only remarkably unequal, but also remarkably threatening to the planet itself. Like all living species, humanity depends on nature for the provision of food and water, materials for survival, and safety from dire environmental threats, such as disease epidemics or natural catastrophes. Yet for a species that depends on the beneficence of nature, or on what the scientists call "environmental services," we are doing a poor job of protecting the physical basis of our very survival. The gigantic world economy is creating a gigantic environmental crisis, one that threatens human wellbeing and even the survival of millions of other species on the planet, if not our own. The environmental threats, we shall learn, are arising on several fronts. Humanity is changing the Earth's climate; the availability of fresh water; the ocean chemistry; and the habitats of other species. These impacts are now so large that the Earth itself is undergoing unmistakable changes in the functioning of key processes – such as the cycles of water, nitrogen, and carbon – upon which life depends. We don't know the precise scaling, timing, and implications of these changes, but we do know enough to understand that they are extremely dangerous, and unprecedented in the span of humanity's 10,000 years of civilization. 42

Thus we arrive at sustainable development. As an intellectual pursuit, sustainable development tries to make sense of the interactions of three complex systems: the world economy, the global society, and the Earth's physical environment. How does an economy of 7.2 billion people, and $90 trillion Gross World Output, change over time? What causes economic growth? Why does poverty persist? What happens when billions of people are suddenly interconnected through markets, technology, finance, and social networks? How does a global society of such inequality of income, wealth, and power, function? Can the poor escape their fate? Can human trust and sympathy surmount the divisions of class and power? And what happens when the world economy is on a collision course with the physical environment? Is there a way to change course, a way to combine economic development with environmental sustainability? Sustainable Development is also a normative outlook on the world, meaning that it recommends a set of goals to which the world should aspire. In this normative (or ethical) sense, sustainable development calls for a world in which economic progress is widespread; extreme poverty is eliminated; social trust is encouraged through policies that strengthen the community; and the environment is protected from human-induced degradation. Notice that sustainable development recommends a holistic framework, in which society aims for economic, social, and environmental goals. Sometimes the following shorthand is used: sustainable development calls for socially inclusive and environmentally sustainable economic growth. To achieve the economic, social, and environmental objectives, a fourth objective must also be achieved: good governance. Governments must carry out many core functions to enable societies to prosper. Among these core functions of government are the provision of social services such as healthcare and education; the provision of infrastructure such as roads, ports, and power; the protection of individuals from crime and violence; the promotion of basic science and new technologies; and the implementation of regulations to protect the environment. Of course, this list is just a brief subset of what people around the world hope for from their governments. In fact, all too often they get the reverse: corruption, war, and an absence of public services. In our world today, good governance cannot refer only to governments. The world's multinational companies are often the most powerful actors. Our wellbeing depends on these powerful companies obeying the law, respecting the natural environment, and helping the communities in which they operate, especially to overcome extreme poverty. Yet as with governments, reality is often the reverse. Multinational companies are often the agents of public corruption, bribing officials to bend regulations or tax policies in their favor; tax evasion; money laundering; and reckless environmental damage. Thus, the normative side of sustainable development envisions four basic pillars of a good society: economic prosperity; social inclusion and cohesion; environmental sustainability; and good governance of major social actors, including governments and business. It's a lot to ask for, and there is no shortage of challenges to achieving sustainable development in practice. Yet the stakes are high. Achieving sustainable development on our crowded, unequal, and degraded planet is the most important challenge facing our generation. Embracing Complexity Sustainable development is a science of complex systems. A system is a group of interacting components, together with the rules for their interaction, constituting an interconnected whole. The brain is a system of interacting neurons; the human body is a system of some 10 trillion individual cells; the cell is a system of interacting organelles; and the economy is a system of millions of individuals and businesses, bound together through markets, contracts, laws, and regulations. We talk about these systems as complex because their interactions give rise to behaviors and patterns that are not discernible from the underlying components themselves. The conscious brain cannot be reduced to a list of its neurons and neurotransmitters. A living cell is more than the sum of the nucleus, ribosomes, and other components. A growing economy is more than the sum of its individual businesses and workers. Complexity scientists speak of the emergent properties of a complex system, meaning those characteristics that emerge from the interactions of the components to produce something that is "more than the sum of the parts." Complex systems have many unexpected characteristics. They often respond in a non-linear way to shocks or changes, meaning that even a modest change in the environment can cause a large, perhaps catastrophic, change in the performance of the system as a whole. A small change in the cell's chemistry can lead to its death; a small change in the physical environment may cause large and cascading changes to the relative abundance of the species in that environment. The failure of a single business can lead to a financial panic and a global downturn, such as occurred when the Lehman Brothers investment bank failed in September 2008. Sustainable development involves not just one but four complex systems. It deals with a global economy that now spans every part of the world; it focuses on social interactions of trust, inequality, and social support in 43

communities (including new global online communities made possible by the revolutions of information and communications technologies, or ICTs); it analyzes the changes to complex Earth processes such as climate and biodiversity; and it studies the problems of governance, regulation, and performance of governments and businesses. In each of these complex systems – economic, social, environmental, and political – the special phenomena of complex systems, such as emergent behavior and strong, non-linear dynamics (including booms and busts) are all too apparent. Complex systems require a certain complexity of thinking as well. It is a mistake to believe that the world's sustainable development problems can be boiled down to one idea or one solution. A complex phenomenon, such as poverty in the midst of plenty, has many causes that defy a single diagnosis or prescription; just as with environmental ills or communities torn asunder by mistrust and violence. Medical doctors are trained to understand and respond to the complex system known as the human body. Medical doctors know that a fever or a pain can have countless causes. Part of the job of a skilled medical doctor is to make a differential diagnosis of the specific cause of a fever in a particular patient. A skilled sustainable development practitioner needs to be a complex-systems expert in the same way, acknowledging the complexity of the issues and looking to make a specific diagnosis of each specific case. Sustainable Development as a Normative Approach Sustainable development is a way to understand the world, as the complex interaction of economic, social, environmental, and political systems. Yet is also a normative or ethical view of the world, a way to define the objectives of a well-functioning society, one that delivers wellbeing for its citizens today and in future generations. The basic point of sustainable development in that normative sense is that it urges us to have a holistic vision of what a good society should be. The easy answer for many people is that a good society is a rich society, where higher incomes are the ultimate purpose of economic and political life. Yet something is clearly too limited with such a view. Suppose that a society was rich on average because one person was super-rich while the rest were in fact very poor. Most people would not regard that as a very attractive society, one that is bringing wellbeing to the citizenry. People care not only about the average income, but about the income distribution as well: are some people exceedingly poor? Are the gaps between the rich and poor very wide? Can a poor person today hope to achieve economic success in the future, or are the practical barriers to advancement too high? Most of us would like to understand more about the social conditions in the country. Is economic wellbeing widely shared among different ethnic, religious, and racial groups, or is success limited to just a few of the many groups? Is prosperity shared between men and women, or is there a share difference between men and women in economic power and perhaps even in their legal rights? Is the economy fairly equal across regions of the country, or are there just few pockets of prosperity surrounded by a sea of poverty? And if the inequalities of income, wealth, and power are wide, is there deep distrust and even social unrest in the country, as we might guess? A third aspect of a good society is being a good steward of the natural environment. If we break the physical systems of water and biodiversity, if we destroy the oceans and the great rain forests, we will lose immeasurably. If we continue on a path that fundamentally changes the earth's climate, we are going to face grave dangers. Therefore from a normative perspective, environmental sustainability certainly seems right and compelling if we care, as we should, about the wellbeing of our children and our children's children and future generations. Most, if not all of us, also care about how our government functions. Massive corruption, lawlessness, untrustworthy politicians, unfair government services, significant discrimination, insider dealing and so forth create a lot of unhappiness. All over the world people feel happier and better when they can trust their government. Unfortunately in many places in the world, people do not trust their governments to be honest, fair and keep them basically secure. From a normative perspective then, we could say that a good society is not only an economically prosperous society (with high per-capita income), but also one that is also socially inclusive, environmentally sustainable and well governed. That is my working definition of the normative objectives of sustainable development. The fundamental question is how to take our knowledge of the interconnections of the economy, society, environment and governance to think through how to produce prosperous, inclusive, sustainable and well-governed societies. We shall see that there are indeed some powerful ways to achieve sustainable development as a shared set of goals for the planet. Threats to the Environment Introduction Atmosphere, water and soil are the most important components of environment in which we live. Atmospheric factors like rainfall, humidity, temperature, sunlight, etc. have a profound effect on living of various organisms. Proper environmental conditions are essential for survival of life on the Earth. In recent years with the development of 44

science and technology, industrialization, urbanization, development of transport & communication factors of environment are getting adversely affected and have created threat of destruction of environment. Thus human activities are considered as serious threats arising from environmental degradation. Number of plants and animals are getting extinct because of loss of their habitat by increasing population and generation of pollutants in the environment. Some scientists have estimated that 50 % of presently existing species of various plants and animals may become extinct by 2100. Threat to environment from extension of species The major threat to environment in the next century is mass extinction of plants and animals; Rapid disappearance of number of species is considered as one of the earth's environmental worries, which is more serious problem than pollution, global warming and depletion of ozone layer. Many biologists believe that the rate at which mass extinction is going on, 20 % of the living species are likely to disappear within thirty years by human activities such as deforestation and loss of habitat for animals. Extinction : In ecology & biology

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extinction is end of organism or group of organisms normally a species.

As species becomes extinct when the last extinct member dies. Today man has made tremendous progress in his standard of living, health, education, security and availability of quantity of food, comfort mobility, recreation & sports. But ill effects of these developments are often not seen because they happen slowly, unnoticeable and invisibly. Some of the threats to the Environment are as follows : Threats to atmosphere and water cycle are climatic changes, rise in sea level, atmospheric pollution. Threats to land and soil: soil erosion, species diversity and over exploitation of water. Threat to human : health, food, water, shelter, recreation etc. Habitat Destruction Habitat loss is the process by which natural habitat is damaged or destroyed to such an extent that it is no longer capable of supporting species and ecological communities which naturally occur there. Habitat loss in Terrestrial Ecosystem is because of following factors. ? Human Activities: Habitat loss may be directly by human activities which involve clearing of forest land for activities such as agriculture, mining, construction of dams for irrigation and hydro-electric power and urbanization and indirectly by certain human activities which are responsible for air and water pollution, climate change and introduction of invasive species. ? Natural Factors: Habitat loss also occurs because of some natural factors such as earthquakes, volcanic eruptions, flood and fluctuations in the climatic condition. Rapid growth of population : Habitat loss is increasing day by day with rapidly growing human population. As population increases man uses more land for agriculture & settlements which leads to encroachment on neighbouring forest and habitat loss of birds & animals. Habitat Loss in Aquatic Ecosystem : Coastal Development: With the development of tourism facilities causeways, construction of jetty there is a direct loss of marine habitat. The habitats most affected are salt marsh and mangroves. In additional to this development of ports, dredging and dumping etc are responsible for habitat loss in coastal areas. Impact on Mangroves: Mangroves are important habitat and food source for number of aquatic species. Today, mangroves are threatened for fire-wood being converted into shrimp farms and reclaimed for housing, development of industries. Pollution: Most of coastal coral reefs have degraded severely due to runoff pollution, water from the from the land. Oil spills: Oil from off share drilling storage tankers, pipeline, ships etc flow from the surface where it harms to species living within its reach. 45
Impact of Habitat Loss: a) Habitat loss and human population: The destruction of tropical rain forest is responsible to reduce the earth's ability by to produce oxygen and consume carbon dioxide. Thus there is increase of carbon dioxide levels which is one of the important factor responsible for global climate change. b) Due to destruction of habitat of birds & animals: Aesthetic uses such as birds watching. Recreational uses like hunting, eco-tourism etc are declining. Habitat destruction has altered carbon, sulphur and nitrogen cycle which has increased the frequency and severity of acid rain and killing of fish in lakes & rivers. Effect on rural population: All over the world poor people suffer worst when natural habitat gets destroyed as it results in availability of less natural habitat and less means of natural recourses per capita. The greatest threat to organisms and bio-diversity is the process of habitat loss . Today large number of bird species and animals species are significantly threatened by habitat loss. Protection of Habitat : To protect habitat of many plants, birds & animals government bodies at local, national & international level need to emphasize the following. Protecting remaining encroachment. Natural habitats from human Educating people about importance of natural habitat and bio-diversity. Implementing family planning programmes in areas where there is rapid growth of population. Developing technology to increase agricultural production than simply increasing fatal land under agriculture. Degradation of environment Degradation of environment

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is the deterioration of environment through depletion of resources such as air, water and soil, the destruction if ecosystems and extinction of

wild life.

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The degradation of environment is defined as any change or disturbance to the environment perceived to be undesirable. The

United Nations International strategy for Disaster Reduction defined

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environmental degradation as “the reduction of the capacity of the environment to meet social and ecological objectives and needs” Degradation

of environment is basically because of pollution and climate change. 1) Pollution Water pollution and Air pollution is mainly responsibility for degradation of environment. Water Pollution One major component of degradation of environment is the depletion of the resources of fresh water on the Earth. Of the 6 billion people on the Earth, some 1.2 billion people lack access of safe drinking water because: Poisonous Rainwater: Water collected from rain has become poisonous particular in areas of high population densities and industry. Its nutrient components of nitrites, nitrates, sulphur dioxide and sulphates have become poisonous to humans. Poisonous Groundwater: Particularly in highly productive farming areas, where productivity is achieved by generous applications of fertilizers and agrichemicals for pest control, ground water, aquifers and rivers are becoming more and more polluted. It becomes more difficult to find drinking water. Salinated Water: In coastal areas, as aquifers become overexploits and their levels drop, it allows seawater to penetrate and to take its place. Safe Water: More than a billion to not have access to safe water, and their numbers are increasing. Water is unsafe for drinking, when mixed with surface run-off, human or animal excrement or when it is too muddy. Air Pollution In the 20th century, air pollution killed 25-40 million people, roughly equal to the combined kill of World War 1 and 2. Ultraviolet Radiation: Due to industrial gases like CFCs, the protective ozone layer has thinned, it causes more skin cancer. Air Rain: Most old buildings were built with limestone, cemented together with limestone cement. Acid rains of sulphuric acid and nitric acid dissolve both stone and mortar, resulting in irreparable damage. Energy: The burning of fossil fuels in power plants and industries causes major pollution to the atmosphere, causing acidification of lakes and dying forests. Transportation: The major sources of air pollutions are transportation 46

engines. The combustion of fuels in automobiles products number of primary air pollutions: nitrogen oxides, gaseous hydrocarbons and carbon monoxide, as well as, large quantities of particulates chiefly led. A recently discovered result of air pollution on increasing “hole” in the ozone layer in the atmosphere above Antarctica, coupled with growing evidence of global ozone depletion. This can increase the amount of ultraviolet radiation reaching the earth, which could damages crops and plants and can lead to skin cancer and cataracts. 2) Climate Change The recent phenomenon of global warming is also considered to be a major factor of degradation of environment. 1. Climate change and Temperature: Climate change affects the Earth’s water supply in large number of ways. It is predicted that the mean global temperature will rise in coming years due to a number of forces affecting the climate. The amount of CO2 will rise. Both of these will influence water resources, since evaporation strongly depends on temperature and moisture availability. ? Snow Season: Temperature increase can decrease the length of the snow season in winter and increase the intensity of snow melt in warmer season, leading to peak runoff of snow melt earlier in the season, affecting soil moisture, flood and drought risk etc. Thermal Expansion of Water: Thermal expansion of water and increased melting of oceanic of oceanic glacier melt from increase in temperature gives war to a rise in sea level. Impact on Ecosystem : Increase in water temperature can also affect ecosystems greatly because of a species sensitivity to temperature and also in inducting changes in a body of waters self purification from decreased amount of dissolved oxygen in the water due to rise in temperature. 2. Climate Change and Precipitation: While most of the attention about climate change is directed towards global warming and greenhouse effect, some of the most severe effects of climate change are likely to be from changes in precipitation, evapotranspiration, run-off, and soil moisture. It is generally expected that, on average, global precipitation will increase, with some areas receiving increases in precipitation and some decrease. 3. Floods and Droughts: Changes in precipitation affect the timing and magnitude of floods and droughts, shift in runoff processes, and alter groundwater rates. 4. Changes in Vegetation Pattern: Vegetation patterns and growth gates will be directly affected by the shift precipitation amount and distribution. It will also affect agriculture as well as natural ecosystems. 5. Monster Rains: Rainfall has become heavier almost everywhere in the world. In some areas a single rain may drop up to two tears of rainfall in a single day. Such monster rains destroy lowland infrastructure, while killing tens of thousands of people. For example, Bangladesh in 1991, Hurricane Andrew 1992 Cyclone Mitch 1998, Cloudburst in Mumbai in 2004 etc. Further Reading ? Balasubramanium, V., “Environment and Human Rights: A New Form of Imperialism”, Economic and Political Weekly, vol.33, no.8, 22-27 Feb. 1998, ? Birnie, Patricia and Allan Boyle, (1992) International Law and the Environment: Clarendon, Oxford ? Desai, Bharat, “Enforcement of the Right to Environmental Protection through Public InterestLitigation in India”, Indian Journal of International Law, vol.33, 1993, ? Finnies, J. (1987), Natural Law and Natural Rights, Clarendon Press, Oxford: ? Mahawal, S., “Right to Safe Environment”, World Focus, vol.13, no.2, March 1992 ? RLEK, (1997), Community Forestry Management in Protected Areas: A Van Gujjar Proposal, Natraj Publishers, New Delhi ? Sachs, Aaron, Eco-Justice: (1995) Linking Human Rights and the Environment, World watch Institute, Washington D.C. 47 ? Shelton, Dinah, “Human Rights, Environmental Rights and the Right to Environment”, Stanford Journal of International Law, vol.28, no.1, 1991, ? Singh, Nagendra, “Right to Environment and Sustainable Development as a Principle of International Law”, Journal of Indian Law Institute, 1987, ? Singh, Rajkumar Deepak, “Response of Indian Judiciary to Environmental Protection”, Indian Journal of International Law, vol.39, no.3, July-Sept. 1999, ? Trindade, A.C., (1998), “Human Rights and the Environment”, in Janusz Symonides, ed., Human Rights: New Dimensions and Challenges, UNESCO, Sydney. 48

Unit: II International and National Perspective In this unit, you will learn about, ? United nations declaration on Right to development ? Environmental Protection and Ecological development – Global and International ? Role of United Nations in protection of Environment ? UN Conferences on prospectives of developed, developing and Under developed Countries ? Globalization and its impact on Environment ? The debate on the social Clause: WTO, ILO, & Childlabor in India ? The Indian Constitution and Environmental Protection ? Environmental Protection and Preamble of the constitution ? Division of legislative powers in Environmental matters ? International environmental agreements and India's Obligations ? Duties of citizen towards environmental protection ? Duties of the state towards Environmental Protection ? Environmental Protection and Right to life ? Right to know and Environment ? Right to Equality and Environment ? Freedom of Speech & Expression and Environment ? Freedom of Trade & Commerce and Environment United Nations Declaration on Right to Development Article 1 1. The right to development is an inalienable human rightby virtue of which every human person and all peoples are entitled to participate in, contribute to, and enjoy economic, social, cultural and political development, in which all human rights and fundamental freedoms can be fully realized. 2. The human right to development also implies the full realization of the right of peoples to self-determination, which includes, subject to the relevant provisions of both International Covenants on Human Rights, the exercise of their inalienable right to full sovereignty over all their natural wealth and resources. Article 2 1. The human person is the central subject of development and should be the active participant and beneficiary of the right to development. 2. All human beings have a responsibility for development, individually and collectively, taking into account the need for full respect for their human rights and fundamental freedoms as well as their duties to the community, which alone can ensure the free and complete fulfilment of the human being, and they should therefore promote and protect an appropriate political, social and economic order for development. 3. States have the right and the duty to formulate appropriate national development policies that aim at the constant improvement of the well-being of the entire population and of all individuals, on the basis of their active, free and meaningful participation in development and in the fair distribution of the benefits resulting therefrom. Article 3 1. States have the primary responsibility for the creation of national and international conditions favourable to the realization of the right to development. 2. The realization of the right to development requires full respect for the principles of international law concerning friendly relations and cooperation among States in accordance with the Charter of the United Nations. 3. States have the duty to cooperate with each other in ensuring development and eliminating obstacles to development. States should realize their rights and fulfil their duties in such a manner as to promote a new 49
international economic order based on sovereign equality, interdependence, mutual interest and cooperation among all States, as well as to encourage the observance and realization of human rights. Article 4 1. States have the duty to take steps, individually and collectively, to formulate international development policies with a view to facilitating the full realization of the right to development. 2. Sustained action is required to promote more rapid development of developing countries. As a complement to the efforts of developing countries, effective international cooperation is essential in providing these countries with appropriate means and facilities to foster their comprehensive development. Article 5 States shall take resolute steps to eliminate the massive and flagrant violations of the human rights of peoples and human beings affected by situations such as those resulting from apartheid, all forms of racism and racial discrimination, colonialism, foreign domination and occupation, aggression, foreign interference and threats against national sovereignty, national unity and territorial integrity, threats of war and refusal to recognize the fundamental right of peoples to self-determination. Article 6 1. All States should co operate with a view to promoting, encouraging and strengthening universal respect for and observance of all

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human rights and fundamental freedoms for all without any distinction as

to race, sex, language or religion. 2. All human rights and fundamental freedoms are indivisible and interdependent; equal attention and urgent consideration should be given to the implementation, promotion and protection of civil, political, economic, social and cultural rights. 3. States should take steps to eliminate obstacles to development resulting from failure to observe civil and political rights, as well as economic, social and cultural rights. Article 7 All States should promote the establishment, maintenance and strengthening of international peace and security and, to that end, should do their utmost to achieve general and complete disarmament under effective international control, as well as to ensure that the resources released by effective disarmament measures are used for comprehensive development, in particular that of the developing countries. Article 8 1. States should undertake, at the national level, all necessary measures for the realization of the right to development and shall ensure, inter alia, equality of opportunity for all in their access to basic resources, education, health services, food, housing, employment and the fair distribution of income. Effective measures should be undertaken to ensure that women have an active role in the development process. Appropriate economic and social reforms should be carried out with a view to eradicating all social injustices. 2. States should encourage popular participation in all spheres as an important factor in development and in the full realization of all human rights. Article 9 1. All the aspects of the right to development set forth in the present Declaration are indivisible and interdependent and each of them should be considered in the context of the whole. 2. Nothing in the present Declaration shall be construed as being contrary to the purposes and principles of the United Nations, or as implying that any State, group or person has a

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right to engage in any activity or to perform any act aimed at the violation of the rights set forth

in the Universal Declaration of Human Rights and in the International Covenants on Human Rights. Article 10 Steps should be taken to ensure the full exercise and progressive enhancement of the right to development, including the formulation, adoption and implementation of policy, legislative and other measures at the national and international levels. 50

Environmental Protection and Ecological development – Global and International Introduction The environmental issues is a fundamental change in human perceptions of life on earth, caused or influenced by human activity, creating ill-effects, such problems commonly regarded as local, regional or national and may have international or global issues which need political action. The concepts of Globalization have brought the world in close proximity and transform the whole world into a global village. Though earth is geographically demarcated, Man with his scientific and technical might could not demarcate natural environment and is common to entire universe. The principles of International law are intended to regulate the conduct of state towards safeguarding the environment, peace and freedom of international communities. The function of international law is to promote creative peaceful and harmonious world order. The environment and its protection are common to international communities the sufferance is not confined to pollution originated country but spreads to neighboring countries. The biosphere is same to every one. Similarly the existence of man in the biosphere is global one. Thus global environmental regulation has assumed much significance. Environmental Protection and Ecological Development ? A Subject of Global Concern International environmental law is not just norms but an effective law accepted by most members. It is formed as an answer to fact growing industrialization and developed as a solution to environmental accidents. Though it has emerged as specific legal regime the domain of it relies on customs traditions, precedents and on good faith and as a moral obligation. Ecological security and safe guarding environment, is main phenomenon in International communities for this it is essential of developing environmental ethics among the countries. The growth of international concern to protect migratory wild life, marine animals and fisheries started during 1872 itself, i.e., century before Stockholm conference but due to absence of institutional machinery, treaties proved to be not so effective. The machinery that was chosen for international concern was a group of private citizens i.e., the non-governmental congress for protection of nature. A consultative commission at Berne was established for international protection of Nature. The activities of the commission were affected by 1 st World War. Thus it was never functioned but maintained the legal status during the period between two World Wars. So it was a first intergovernmental agency for protection of environment. After II World War the Intergovernmental organizations involved in environmental protection. In 1947, Swiss League sponsored conference at Brunnen for Protection of Nature attended by 24 countries and 9 International organizations were they adopted a draft constitution for establishment of International Union Protection of Nature followed by UNSECO conference, which framed basis for IUCN. Much other international institutional machinery has been evolved to protect the environment with the efforts of states. United Nations General assembly is a principal policy making body and the Secretariat provides administrative service. The U.N. works largely through committees, commissions, councils, and semi-autonomous special bodies out of three principal councils, only economic and social affairs is directly concerned with environmental policies . There are about 16 specialized agencies of the UN system half of them are directly involved in environment protection. The steps in the history of development of International concern has taken place after II world war with the establishment of the UN Educational, Scientific and Cultural Organization (UNESCO) in 1945 and

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the International Union for conservation of Nature and Natural Resources (IUCN)

in 1948.
The environment has always been critical to life but concerns over the balance between human life and the environment assumed international dimensions only during the 1950's. At the end of the 1960's, the voice of environmental concern was heard almost uniquely in the west. In the communist world the relentless destruction of the environment in the name of industrialization continued unabated. In developing countries, environmental concerns were regarded as western luxuries. In the early 1970's, attention was focused first on the biophysical environment. The 1970's was the foundation of modern environmentalism. The world of 1972 was very different from that of today. The cold war still divided many of the world' s most industrialized nation's, the period of colonization had yet ended and global warming had only just been mentioned for the first time and the threat to the ozone layer was seen as coming mainly from a large fleet of supersonic airliners that was never to materialize. The world of the early 1970's was thus fiercely polarized. Against this backdrop, it was surprising that the idea of an international conference on the environment should even be broached by Sweden, in 1968; it was even more surprising that one should actually take place (in Stockholm, in 1972); and it was astonishing that such a 51

conference could give rise to what later became known as the Stockholm Spirit of Compromise in which representatives of developed and developing countries found ways of accommodating each others strongly divergent views. The conference was hosted by Sweden following severe damage to thousands of Sweden's lakes from acid rain falling as a result of severe air pollution in Western Europe. The environmental law, in the perspective of International Policy can be best understood as the collective body of agreements among states regarding mutual rights and obligations affecting the environment, it is embodied as conventions and treaties and to a lesser extent in international declarations, principles, opinions of jurists and generally accepted practices among states. Thus nations are bound by treaties and conventions in international forums such as International court of justice. The states also evolve bilateral and multilateral binding agreements which in turn pave the way and guide their respective national legislation to a greater extent on a similar problem. Broader agreements pertaining to the oceans, the atmosphere, the global climate and endangered species will assume a greater role in the preservation of the earth's environment. The rules which would compose international environment law to bind the states are not different from the general international law. The sole objective of international environment law would be to co-ordinate the activities of the various nations on ecological considerations. The law relating to the environmental pollution reveals an extensive web, interwoven and archetypal. An overview of international environmental law is helpful in understanding the national legislation on the analogous problem. In fact, the protection of the environment from pollution is both national and international responsibility. International environmental agreements are the predominant legal method for addressing environmental problems that cross national boundaries. The need for international approach arises because all the components of the natural environment are interrelated. The interactions among all the components of the natural environment are numerous and important between air, soil, underground water, oceans, wild life and outer space. They can't be isolated from one another. It is well known that significant increase of heat produced by heavy air pollution will have consequences on all ages of life and even pollution of water. The pesticides affect not only the soil and living organisms but also the lakes and rivers. The trade effluents and hazardous substances introduced in rivers and sea waters. The sea water is not only essential for the food supply but also for maintenance of climatic balances but the considerable proportion of the world's waste and polluting substances goes to the sea. Thus the influence of a Denmark, Finland, Norway and Sweden basically reproduces the main provisions of the Bonn Agreement. Yet another convention on the protection of the marine environment of the Baltic Sea area, concluded at Helsinki on March 22, 1974 and Denmark, the Federal Republic of Germany, Finland, Poland, Sweden and the USSR. Article 3 of the convention imposes obligations on contracting parties to take appropriate legislative, administrative or vent measures to prevent pollution and to protect and enhance the marine environment of the Baltic Sea area. The convention prepared under the auspices of FAO (Food and Agriculture Organization) and signed in Barcelona on Feb 16, 1976 for the protection of the marine environment against pollution in the Mediterranean Sea is considered to be a comprehensive one covering the three main aspects of marine pollution i.e. discharge of oil, ocean dumping and land based pollution. The convention on the dumping of wastes at sea, adopted by an inter- governmental conference in London on 13 th November, 1972 constitutes a world wide regulation of the problem. Now it is important to discuss India's obligations in international environmental policy. International Conventions and Treaties India being a developing nation has obligations under numerous international treaties and agreements that relate to environmental issues. India supported faithfully all international decisions on safeguarding environment. India has carved out its national legislations on the problem to a large extent from international environmental policy guidelines framed by UNO and UNEP. International environmental policies are in the form of treaties, multilateral agreements, conventions and conferences. The treaty shall have force in international law, if it is ratified by requisite number of countries. India is a signatory to a number of multilateral agreements, treaties and conventions related to environment. An overview of some of the major multilateral agreements, treaties and conventions on environment and India's obligations are discussed. The following are the important International Conventions relating to
Environment. Stockholm Declaration 1972

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The United Nations Conference on the human environment held at Stockholm

from 5 th to 6 th June 1972, which is generally called as the —Stockholm Conference. It was the first declaration of international protection of the environment. In the conference 113 States were participated, including India and accepted such declaration. The Stockholm Declaration contains 26 principles. These principles provide the basis of an International Policy for the 52

Protection and improvement of the environment. The United Nations Environment Programme has been established by the United Nations General Assembly in pursuance of the Stockholm Conference. The Environmental Programme was set up in Geneva in June 1972. The UNEP worked as catalyst stimulator and coordinator among the member states on the environmental action. It worked very hard to implement the decisions of Stockholm Declaration into reality. The Stockholm Declaration influenced all the State Governments. Several governments have brought legislation on the environment. The object of the Stockholm Declaration was to pass the Mother Earth to the coming generations in clean and healthy conditions.

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Convention on International Trade in Endangered species of Wild flora and fauna (CITES) 1973

The
Conference aims to control or prevent international commercial trade in endangered species or products derived from them. The Convention does not seek to directly protect endangered species, rather it seeks to reduce the economic incentive to poach endangered species and destroy their habitat by closing off the international market. India became a party to the convention in 1976. International trade in all wild flora and fauna in general and species covered under convention is regulated jointly through the provisions of the Wild life (protection) Act 1972, the import/ export policy of government of India and the Customs Act 1962. Nairobi Declaration 1982 The Nairobi Declaration was adopted at Nairobi for celebrating

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the 10 th Anniversary of the Stockholm conference on human Environment

in 1972. This Conference was conducted from 10 th to 18 th May 1982. The Declaration envisaged the creation of a special commission to frame long term environment strategies for achieving sustainable developments upto the year 2000 and beyond. The Declaration was endorsed by the governing Council of United Nations Environment Programme (UNEP) in 1987 and also by the General Assembly of the United Nations Organisation. Main features of Nairobi Declaration 1982: ? The participating members found that the environmental problems remained the same as were in 1972. ? Nairobi Declaration aimed to continue the principles of the Stockholm Declaration. Further, it was stressed to refine those principles suited to present and the coming global environment. ? Nairobi Declaration reaffirmed its commitment of the Stockholm Declaration and the action plan as well as to further strengthen and expansion of national efforts and International Co-operation for the environmental protection. ? It requested all the Governments and peoples of the world to participate in the programmes to eradicate environmental pollution and to protect our mother earth. Vienna convention for the protection of ozone layer (1985) The convention was adopted on 22 nd March, 1985 by the conference of Plenipotentiaries which was organized by the UNEP. The convention came into force on sep 22, 1988. The main object of the convention was to provide to States the international legal framework for working together to protect the stratospheric ozone layer. The convention defines ozone layer under Article 1 which says that Ozone layer means the layer of atmospheric Ozone above the planetary boundary layer. Article 2 of the convention provides the general obligations of the parties which says that the parties shall take appropriate measures in accordance with the provisions of the convention and of those protocols in force in which they are parts

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to protect human health and the environment against adverse effects resulting

or likely to result from human activities which modify or are likely to modify the ozone layer. The Vienna convention of 1985 was the starting point of the global cooperation for protection of ozone layer. Later, adoption of Montreal protocol on substances that deplete ozone layer on 1987, the amendment in Montreal protocol in London (1990) and Vienna (1995). Montreal protocol on substances that deplete ozone layer, 1987 The Protocol came into force in 1989 as amended in 1990, 92 and 95 was adopted and by 2000, 173 states have become parties to Montreal protocol. The protocol set targets for reducing the consumption and production of a range of ozone depleting substances. In a major innovation the protocol recognized that all nations should not be treated equally. The agreement acknowledges that certain countries have contributed to ozone depletion more than others. It also recognizes that a nation's obligation to reduce current emissions should reflect its technological and financial ability to do so. Because of this, the agreement sets more stringent standards and accelerated phase-out timetables to countries that have contributed most to ozone depletion. India accepted this protocol along with its 53
London Amendment in September 1992. The Ministry of Environment and Forest has established an ozone cell and a steering committee on the protocol to facilitate implementation of the India country program, for phasing out ozone depleting substances production by 2010 to meet the commitments India has also taken policy decisions.

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The Ozone Depleting Substances (Regulation and Control) Rules 2000 were drafted under Environment (protection) Act, 1986.

Helsinki Declaration 1989: On protection of Ozone layer, phase out CFC Production and consumption by 2000. Basel convention on transboundary movement of hazardous wastes, 1989 The Convention came into force in 1992.

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The objectives of the convention are to reduce transboundary movements of hazardous wastes,

to
minimize the creation of such wastes and to prohibit their shipment to countries lacking the capacity to dispose hazardous wastes in an environmentally sound manner. India ratified the convention and enacted Hazardous Wastes Management Rules Act 1989, encompasses some of the Basal provisions related to the notification of import and export of hazardous wastes, illegal traffic and liability. Earth Summit 1992 In continuation of Stockholm Declaration, 1972 and the Nairobi Declaration, 1982 the third major Declaration was held in Rio-de-Janeiro in Brazil in the year 1992. Hence it is termed as Rio-Declaration and attended by over 150 countries. Hence, it is also well known as - Earth Summit. It discussed global and environmental problems very widely. It was the biggest International Conference in the history of International relations. The Rio-Declaration, a statement consisting of 27 principles on the environment and development. Maurice Strong, Secretary General of the Earth Summit remarked that the Earth Summit was a successful one. But the developed countries have exploited the natural resources abundantly and mercilessly, but did not come to assist the environmental recoupment the reserve of developing countries by rendering their technology and finance to achieve the goal of sustainable development. However, to the third world hoped that a road map was started from Rio with a better future for the world. At the Rio declaration it was resolved to adopt the Agenda 21. Two other conventions were adopted namely (1) the convention on Biodiversity and the convention on the reduction of green house gases. These aspects have to be explained before dealing with the UN framework convention on climate change 1992. U.N. Frame Work Convention on Climate Change (UNFCCC), 1992 The primary goals of the UNFCCC were to stabilize green house gas emissions at levels

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that would prevent dangerous anthropogenic interference with the global climate. The convention embraced the principle of common but differentiated responsibilities

which has

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guided the adoption of a regulatory structure. India signed the agreement in June 1992 which was ratified in November 1993. As per the convention the reduction/ limitation requirements apply only

to developed countries. The only reporting obligation for developing countries relates to the construction of a GHG inventory. Convention on Biological Diversity, 1992 This convention is a legally binding framework treaty that has been ratified by 180 countries. The areas that are dealt by convention are

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conservation of biodiversity, sustainable use of biological resources and equitable sharing of benefits arising from their sustainable use. The

convention came into force in 1993. Many biodiversity issues are addressed including habitat preservation, intellectual property rights, biosafety and indigenous people's rights. India's initiative under the convention on biodiversity includes the promulgation of the Wild life (protection) Act of 1972, amended in 1991 and participation in several international conventions. U.N. Convention on Desertification, 1994 An inter-governmental negotiating committee for the elaboration of an international convention to combat desertification in countries experiencing serious drought and/ or desertification was recommended in 1992 U.N. Conference on Environment and Development. The U.N. General Assembly established a committee in 1992 which helped formulation of the convention on desertification. The convention endorses and employs a bottom-up approach to international environmental cooperation. Under the terms of the convention, activities related to the control and alleviation of desertification and its effects are to be closely linked to the needs and participation of local land-users and non-governmental organizations. The convention aims at tackling desertification through national, regional and sub-regional action programmes. India hosts the network on agro forestry and soil conservation. 54

Johannesburg Declaration 2002 Yet, another Earth Summit was held at Johannesburg, South Africa, from 26 th August to 4 th September 2002. It was the consequential follow up action of the decision of the Earth Summit 1992. Johannesburg conference confirmed that significant progress has been made towards achieving a global consensus and partnership amongst all the people of our planet. Over 4000 delegates from about 100 countries participated in it. Stockholm Convention 2004: It was held on May 17 th aims at phasing out 12 dangerous pesticides and industrial pollutants. More than 150 countries have signed it and about 60 have ratified it. Motreal UN Summit 2005: World leaders decided to speed up the implementation of Kyoto Declaration. Global Warming Ozone Depletion The more dangerous effect on the environment is warming of the earth and depletion of Ozone layer. UNEP has chosen a slogan, - warming: Global warning, for environment day of the year 1989. Increased urbanization and Industrialization has increased the pollution of air, water and soil. Air emissions consist of carbon dioxide, nitrous oxide Ozone, methane etc called Greenhouse gases omitted from factories, Vehicles and other sources. These gases act like an insulating blanket, accumulate in the atmosphere and trap the heat re-radiated from the surface of the earth increasing the temperature of earth. Such an effect is called green house effect and increase in temperature of earth is global warming. Ozone present in stratosphere is important and vital to us for our survival, if not the harmful ultraviolet radiation from the sun reach the earth, harming the life forms and causes diseases to human. The other form of Ozone is formed in troposphere due to fossil fuel combustion, industrial activities causing respiratory and eye diseases in humans. Ozone the diatomic form of oxygen is volatile gas and the unstable third atom try to react with other chemicals particularly organic compounds especially chlorofluoro carbons are volatile organic compounds being light gases easily react with the third atom of ozone and destroy the ozone layer. To protect earth from this dangerous effect and to protect Ozone layer in 1985 Vienna convention for protection of Ozone layer was adopted. Convention on Climate Change This convention was adopted on Feb. 2005 for successfully achieving the challenges framed in Kyoto protocol 2005 i.e. reduction of global warming and protection from depletion of Ozone layer and other natural hazards. Regarding this convention International environment policy was adopted on 15 Nov. 2006 and many other conferences were held by the parties to the climate change convention to protect natural environment from climate change. The Inter Governmental panel on climate change, which will issue its fourth assessment report. Climate change 2007 brings together world wide expertise and has identified some clear steps towards mitigation of climate change. The Millennium Ecosystem Assessment similarly revealed the enormous and ecological processes and also pathways out of environmental danger. The year 2007 can and should be a time of great progress in sustainable development and environment protection. The treaties which are ratified by India are as follows: ? The Antarctic Treaty (Washington, 1959). ? Convention on wet lands of International importance, especially as water fowl Habit (Ramsar 1971). ?

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Convention concerning the protection of the world cultural and National heritage (Paris 1972). ? Convention on International Trade in Endangered species of wild fauna and

Flora (
Washington, 1973) ?
Protocol of 1978 relating

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to the International convention for the prevention of pollution from ships, 1973 (

MARFOL) (London 1978) ?

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Convention on the conservation of Migratory species of wild animals (Bonn, 1979) ? Convention

on the conservation of Antarctic Marine living Resources (Cantern a, 1980) ?

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United Nations convention on the Law of the Sea (Montego Bay; 1982) ?

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Convention for the protection of the Ozone Layer (Vienna, 1985) ? Protocol on substances that deplete the Ozone Layer (Montreal, 1987) ?

Amendments to the

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Montreal protocol on substance that Deplete the Ozone layer (London, 1990 ? Convention on the control of Trastoundary Movements of Hazardous wastes and their disposal (

Basel, 1989) ?
United Nations frame work convention on climate change (Rio de Janeiro, 1992) 55
? Convention on Biological Diversity (Rio de Janeiro, 1992) ? Convention to combat Desertification in those countries experiencing serious drought and or densification particularly in Africa (Paris, 1994) ? International tropical0inter Agreement (Geneva 1994) ? Protocol on Environmental protection to the Antarctica Treaty (Madrid, 1991) Until 1972, the environmental issues had been dealt with by international conventions in only a fragmentary manner, but since Stockholm conference the source of international law is found in resolutions and declarations and of major international conferences. Role of United Nations in Protection of Environment International concern for environment had made and is making the planet earth livable. U.N.O had taken lead and drives itself towards the universalization. It brought co-ordination between law of nature and human activities which are regulated with in nations by local statutes. Internationally UNO has been working on environment to ensure a good quality of life to every one in the world. A global policy requires consideration by all and for all. Thus with the co-operation of the states many conventions and conferences was adopted. These conventions have influenced all the states directly or indirectly. The resolutions under taken has been influenced the states to implement in their policies and programmes. The first international instrument which influenced the whole world which has been a land mark, the Stockholm conference has traced the origin of relationship between the man and nature and brought a world wide evolution with a manifesto -protect environment to save man kind. The U.N General Assembly on October 1982 World Charter for Nature' was reiterated the entire humanity is a part of nature, life depends on Nature. The UN charter proclaims that Nature shall be respected and must maintain the stability and quality of nature. The Rio Summit significantly determined that we cannot keep on developing unless we save the environment. Thus the Stockholm conference, Habitat conference, conference on desertification, Rio and Johannesburg conferences and several other conferences and conventions relating to environment as referred not only provide foundation for the development of international environmental law but a beginning also made to wards in the management of the world in which all of us would live happily in conducive environment. The objectives of international environmental agreements it implemented successfully and the goal of development would be achieved effectively. The relevant states become parties to them and rigorous implementation including monitoring of compliance could be ensured. India is one of the states which has been greatly influenced by international conferences and conventions. India is a signatory to many of the international conventions relating to environmental issues. From Stockholm to Johannesburg conferences India has played leading a role and so it is under obligation to contribute towards the realization of the goal has appealed to every nation to adopt measures constitutionally and legislatively to take adequate care for tackling environmental problems. Under Article 368, Indian constitution confers powers on the parliament to amend by way of addition, variation or repeal any provision of India constitution and also Art 51 (C). Thus to implement the decision of the Stockholm declaration and to capture the wave of the declaration. The Parliament resorted to Art 368 and introduced, 44 th Constitutional Amendment Bill, 1976. The bill added Art 48-A to protect and improve environment as a constitutional obligation for the state and citizens. Art 48-A provides
for protection and improvement of

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environment and to safeguard the forests and wild lie of the country. In Act 48A it is

used as the state shall endeavor, which is a wider connotation from any other term like to pass legislation which is also another effort of the government. The amendment further added a clause of fundamental duty on every citizen to how ever it may not be enforceable through court of law. The 42 nd Amendment Act, 1976 added part IV A dealing with fundamental duties. This part was added on the recommendations of the Swarn Singh committee bringing the constitution of India in line with Art 29 (1) of the universal declaration of Human rights. Art 51A (g) specifically deals with fundamental duty with respect to environment. Art 253 of the constitution specifically empowers the parliament to make any law. Entries No.13 and 1 of the Union list includes the subject matters over which the parliament can make laws. Thus Indian parliament can pass any law including law on environment protection and the same cannot be questioned and so parliament has made use of this power to enact

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Air (prevention and control of pollution) Act of 1981 and the Environment (protection) Act

of 1986. The preambles, of both these Acts were
enacted

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to implement the decisions reached at the United Nations conference on human environment held at Stockholm in 1972.

In People's Union for Civil Liberties Vs Union of India the SC held that the provision of the international covenant which elucidate and go to effectuate the fundamental rights guaranteed by our constitutions, can certainly be relied upon by courts as facets of those fundamental rights and hence, enforceable as such. In Vellore citizen's welfare forum Vs Union of India, the SC held that it is almost an accepted proposition of law that the rules of 56
customary international law which are not contrary to the municipal law shall be deemed to have been incorporated in the domestic law and shall be followed by the courts of law, India has implemented other decisions of any international conference, association or other body International Conferences like emission standards etc to protect and improve living conditions and quality of life. Stockholm Declaration finds its reflection in Articles 14, 19 and 21 of the Indian constitution. Thus, India being influenced by International decisions. The Indian Constitution puts an obligation and authorizes the parliament to implement provisions of International Conventions. Any laws is made for the people and it will surely influence the public. An environmental law is enacted with a view to protect and preserve the environment and save it for future generations. An environmental imperative is a matter of public and of legal rights and duties in the interest of future generations . Therefore, the people should essentially be aware of the adverse consequences of environmental pollution and should protect and improve the environment and their response is very much positive. Started Chipko and APPPIKO movement to save the forests from exploitation. The people have formed into groups and exerted influence on government to take decision on certain developmental projects only after proper environment impact assessment. UN Conferences on Prospectives of Developed – Developing and Under Developed Countries The environment entered on was brought much nearer the top of many regional and national agendas. Thus, the Preamble of the Stockholm Declaration states that most environmental problems of the developing states are caused by their underdevelopment problems of the developing states are caused by their underdevelopment whereas environmental problems of the developed countries are related to their industrialization and technological development. The Declaration even condemned the colonialism, racism and policies of apartheid all of which are sources of underdevelopment. The Declaration indicated an awareness that environmental standards that are valid for developed world might well inappropriate or even dysfunctional when applied to the developing world. The impact of the apprehensions expressed by the developing world is significant enough in that the Declaration has clearly maintained that

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the environmental policies of all states should enhance and not adversely affect the present or future developmental potential of

the

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developing countries, nor should they hamper the attainment of better living conditions for all,

and that appropriate steps should be taken by states and international organizations with a view to reaching agreement on meeting the possible national and international economic consequences resulting from the application of environmental measures. The principles contained in the Stockholm Declaration suggested various ways in which the advanced states are expected to show special considerations to the needs of the developing states. Rich states are to render financial support to the developing World, stable prices for primary commodities and raw materials is essential for effective environmental management by the developing states. The transfer of technology, not at any cost but on terms without constituting economic burden on the developing countries. So far as the issue of population control, left to the discretion of the individual governments. After setting forth the prescriptions by taking into account the apprehensions of the developing world, the Declaration proceeded further to present their aspirations also in its recommendations. Another contribution of the Stockholm conference is The Action plan for the Human Environment: It is divided into 3 parts: Frame work, Recommendations and Action Plan. The broad types of action that make up the plans are (1) global environmental assessment include evaluation and review (2) Environmental management activities covers comprehensive planning to protect and improve the quality the human environment and (3) International measures to support the national and international actions of assessment and management relate to first two categories and also education, training, public information, organizational arrangement s final and other forms of assistance. The resolutions recommended for the establishment of Governing Council, Environment secretariat, the environment fund, an environmental co-ordination board and observing 5 th June as world environment day. The resolution also condemned nuclear tests especially those came out in the atmosphere could contaminate the environment. The resolution recommended that the General Assembly should take initiative and decide to convene a second UN conference on environment at the appropriate time. The following are some of the Conferences conducted by United Nations Organization: 4. The United Nation's

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Conference on the Human Environment (UNCHE) 1972 The United Nations Conference on Human Environment,

held in 1972 on 5 th June at Stockholm marked a notable beginning of the endeavor of the international community to formulate international environmental policy. This is a major attempt made to solve the global environmental problem through an agreement at international level where international co-operation for environment protection is concentrated. It is a land mark beginning in the sense that it has set in a conceptual change of attitude towards the environmental concerns which were until then deprived of the 57

holistic approach which they desire. If underlined the recognition of the environment as a wholesome entity, the biosphere' to be protected in it's entirely by international law and the organizations. It generated keen interest in the world community to pay close attention to environmental problems exhibiting global ramifications. The Stockholm conference was different from the previous UN conferences because the preparations for the Stockholm conference were extensive and action oriented. It was widely represented by 114 governments and 130 NGOs also have attended. Accordingly, it was expected that the conference would result in solutions for the global ecological problems. The principal accomplishments of the Stockholm conference were two fold: the official recognition of the environment as a subject of general international concern and the institutionalization of the United Nations Environment Programme (UNEP) The fear which wildly ran through the developing world was that the adoption of a global policy of environmental protection adversely affects their developmental prospects. Their watchword, taken from the experience of the rich countries in the 1950s and 1960s was development first and environment later, when we think we can afford it. They were worried that incorporation of environmental standards results in increase of costs and also involves delay. In view of this, the developing world insisted that they cannot divert the financial resources which they require to meet the most immediate and basic needs of their people towards the payment of additional costs of incorporating the measures needed to ameliorate major global risks into their developmental policies and practices. Voicing out their concerns about the economic implications which arise out of the environmental measures, in particular, the possible effects of the measures on trade, development assistance, aid criteria, transfer of technology and location policies, the developing countries stood firm on their ground that they do not want to proceed with the environmental goals at the cost of their economic development. The arguments of the developing countries had significant impact on the output of the negotiations that had taken place during the conduct of the Stockholm Conference. They could succeed in accommodating their views in the final report approved by the conference. The Stockholm Conference produced a Declaration of 26 principles and an Action plan of 109 recommendations. A few specific targets were set a 10 year moratorium un commercial whaling, prevention of deliberate discharges at sea by 1975 and a report by 1975 on energy uses, the Stockholm Declaration on that Human Environment and principles constituted the first body of Soft law' in international environmental affairs. Stockholm articulated the right of people to live

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in an environment of a quality that permits a life of dignity and well-being.

Since then, a number of organizations and about 50 governments world wide, have adopted instruments on national constitutions that recognize the environment as a fundamental human right. Much national legislation on the environment followed Stockholm. During 1971-75, 31 major national environmental laws were passed in countries of the Organization for Economic Cooperation and Development (OECD). The integrated approach adopted during the Stockholm conference where the environmental issues are discussed together with developmental matters could set off to a large extent the initial apathy of the developing world towards the adoption of global environmental policy. The symposium advocated a strategy of satisfying first the basic needs of man, with the consideration for global environmental risks or so called outer limits. Thus, it may be noted that both the Stockholm Declaration on Human Environment and the Cocoyoc Declaration contained the ecological vision combined with the Third world demands for development and social justice'. Similarly the International Development Strategy for the Third Development. Decade adopted on 23 rd October, 1980 by the General Assembly also mentions explicitly the interrelationship between environment, development, population and natural resources as well as the environmental degradation A group of participants at a seminar organized by the International Development Center to consider the question of the Relationship between Environment and Development as such by the countries of the developing World' concluded, the environment (is) considered as harboring an enormous potential which it is necessary to take advantage of if an authentic and speedy development is to be attained'. ? United Nations Environmental Programme (UNEP) The United Nations Environmental Programme (UNEP) is the main institutional response most immediate to the Stockholm conference. The recommendations of the conference 1972, were implemented by General Assembly through resolution 2997 (XXVII) stressed the need to assist developing countries to implement environmental policies and programmes that are compatible with the development plants'.A 58 member Governing council for UNEP was set up and its first session was held in Geneva in June 1973. UNEP's Governing Council is also entrusted the duty to ensure that environmental programmes and projects shall be in conformity with the developmental plans and priorities' of the developing states. The conference deals with all kinds of human settlements and to improve peoples living environment. The Montevideo Programme Instituted by UNEP also stressed that particular attention should be paid to the interests and capabilities of the developing countries, especially their need for technical cooperation and 58

other assistance, in the process of codification of progressive development and implementation of environmental law. In the subsequent decade of the U.N. Conference on Human Environment, 1972, a series of strategic conferences related to the issues raised at Stockholm Conference were convened, most of which were organized and participated by UNEP in cooperation with other international bodies involved in the concerned subject matter. The various international treaties elaborated and adopted under the auspices of UNEP illustrate the growing legal response to the need for the integration of environmental and developmental concerns. All these developments culminated in the adoption of policy oriented declarations or recommendations. Although the Stockholm Declaration is not binding, it successfully awakened the governments to the dark side of the development. A series of treaties spawned within a span of two years to govern environment issues like ocean dumping and the protection of endangered species. There could be visible in the later agreements, a change for the better. Thus in the later agreements the need for integration of environment and development is stated in greater detail. But by the end of the first decade, it was assessed that the ambitious programme of fostering the United Nations Conference on Human Environment (UNCHE) principles was only partially achieved. ? Nairobi Declaration The 10 th anniversary of U.N. Conference on the Human environment was celebrated in Nairobi in 1982 by the world community of States . A declaration called Nairobi declaration was adopted. The declaration reaffirmed the commitment to the 1972 Stockholm declaration, which is as valid today as they were in 1972 and it provided a basic code of environmental conduct for the years to come further strengthening and expansion of national efforts and international cooperation in the filed of environmental protection urged all Governments and people of the world to protect environment collectively and individually, to ensure our planet earth is passed over to future generations in a condition which guarantees a life in human dignity for all. the Declaration adopted therein, while setting out reasons for the failure of UNCHE programme, directed particular attention to the problems of developing states, their need for more equitable - distribution of technical and economic resources and the use of appropriate technologies and environmentally sound methods of exploitation. ? World Conservation Strategy World Conservation Strategy (WCS) launched in 1980 by IUCN is one of the seminal documents which served to redefine environmentalism post-Stockholm. Human beings, in their quest for economic development and improvement of the quality of life, must come to terms with the reality of resource limitation and the carrying capacity of ecosystems, and must take account the needs of future generations', is the central theme of the World Conservation Strategy. The WCS envisaged governments in different parts of the world undertaking their own national conservation strategies, meeting one of the objectives of Stockholm to incorporate in environment in development planning. ? World's Charter of Nature The UN General Assembly adopted the World Charter of Nature, 1982 bringing attention to the intrinsic value of species and ecosystems. The World Charter of Nature, 1982 which could elicit the Third World's solidarity is indicative of the international support for sustainable development as a concept of universal significance The Charter is an important symbolic expression of the intent among nations to achieve a more harmonious and sustainable relationship between humanity and the rest of the biosphere – between mankind and earth. The acceptance of the Charter which declares the principle of sustainable development in a new binding form shows the positive change of attitude in the developing world towards the adoption of a global environmental policy. Yet, it also illustrates the widespread verbal acceptance of the principles enunciated at Stockholm and the practical difficulty of making these principles operational in a world of sovereign and antagonistic states. However, the concept of sustainable development helps immensely in generating a participative spirit of the developing community, at least in discussions, is evident in the Declaration of Brazilia on 31 st March and the Declaration of. Manaus, 6 th May adopted by two groups of Latin American and Caribbean states in 1989. Participants of the Declaration while emphasizing their sovereignty over the resources expressed simultaneously their willingness to take part in environmental protection measures only if linked to development. The significant shift of attitude of the developing countries within a period of 20 years since the Stockholm Conference is apparent from the invitation extended by Brazil to host

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the United Nations Conference on Environment and Development, at Rio.

Brazil, it may be recalled, is the country which led the opposition with regard to the imposition of environmental restrictions during the course of Stockholm Conference by either the developed or developing states. The problems 59

of environmental degradation like water contamination, water shortage, loss of forest cover, and biodiversity reached upto unhealthy proportions in developing countries also. The key environmental concerns discussed at Stockholm Conference moved from bad to worse. The understanding that environmental and developmental issues are better discussed than left ignored made the developing world to adopt a caution filled environmental diplomacy. ? The World Commission on Environment and Development (WCED) The United Nation's General Assembly established in 1983 the World Commission on Environment and Development, hereinafter referred to as WCED also known as Brundtland Commission. It was established to reexamine the issues of environment and development together. The Commission was headed by Mrs. Gro Harlem Brundtland, the Prime Minister of Norway. The Commission was called upon to design a global agenda for long term environmental strategies for achieving sustainable development by the year 2000 and beyond. Public meetings were held in both developed and developing regions, and the process empowered different groups to articulate their views on issues such as agriculture, forestry, water, energy, technology transfer and sustainable development in general. The meetings highlighted environmental problems such as global warming and ozone layer depletion. ?

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United Nations Conference on Environment and Development, 1992 Earth Summit was held at Rio de Janeiro

on June 1992.
It was the largest international conference in the history of international law as UNCED Chief described it as parliament of the planet'. The environmental experts felt it must be the last chance to save our planet. This conference was the culmination of a series of U.N. Conferences beginning with Stockholm conference 1972. The Rio Summit was different from the previous approaches in that every effort therein was made to tap the view point and input from all stakeholders. The Rio Conference inaugurated on 5 th June, 1992 was represented by 179 governments. The conference, popularity called as the Earth Summit' adopted various instruments trying to elaborate and prescribe general rights and obligations

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to meet developmental and environmental needs of the present and future generations'.

The formal process of UNCED culminated in the adoption of five documents, namely the Rio Declaration, a statement of broad principles to guide national conduct on environmental protection and development, Agenda-21, a massive document containing a detailed action-plan for sustainable development, Legally Non-Binding Principles of Forestry, Convention on Climate Change and the Convention on Biodiversity. ? The Rio Declaration The Rio Declaration was adopted in the conference recognizing the universal and integral nature of Earth and by establishing a global partnership among states and enlisting general rights and obligations on environmental protection. The Rio Declaration is a statement of 27 principles for the guidance of national environmental behavior and enlisting general rights and obligations on environmental protection. The text of the Rio Declaration and process which produced it provides a unique insight into the debates; compromises and achievements of UNCED. The 27 principles of the Rio Declaration embraced the entire gamut of concerns that the world has to urgently contend to protect the planet. Rio principles placed

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human beings at the centre of sustainable development concerns by stating that humans are entitled to a healthy and productive life in harmony with nature'.

It is intended to set the stage for

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international agreements which would respect and protect the integrity of the global environmental and development system.

Although not legally binding, the Rio Declaration is a considerable - political commitment for each country to merge environmental concerns with economic decision making. However, it falls short of the initial idea of drawing up an Earth Charter. The gist of those principles are happy and healthy life to all people in the world in order to achieve this goal, concept of sustainable development has been established. To achieve sustainable development, states shall reduce and eliminate unsustainable patterns of production and consumption, exchange of scientific and technological knowledge, compensation for adverse effects of environmental damager caused by activities with in their jurisdiction or control to areas beyond their jurisdiction, precautionary approach shall be widely applied by states polluter should bear the cost of pollution, Environmental impact assessment as an instrument to monitor the likely environmental effects. c) Agenda-21 It is a comprehensive action plan which gives a future plan in relation to environment and development. It sets out specific programmes to make long term changes in the developmental activities of al people to present ecological destruction and economic inequity. The Agenda emphasizes on issues like poverty, health consumption patterns, natural resource use, financial resources human settlements and technological transfer. It also includes energy, 60
climate and other wide range of issues concerning environment and development. Agenda-21 is a massive document running through 800 pages laying out 115 specific programmes, to put into effect all the major issues discussed at Rio. It is an Agreed Programme of Work by the International Community' addressing major Environment and Development Priorities' for the initial period 1993-2000 and leading into 21 st century. It is designed to facilitate the transition of economic growth of all nations into sustainable development. Agenda-21 is meant for Governments, United Nations' agencies, organizations and programmes, for constituency groups and for the public at large all of which must be involved in its implementation. These programmes are grouped around a series of themes each of which represent an important dimension of an overall strategy for global transition. Agenda-21 is not a binding document but it constitutes the key document of the Rio ? Earth summit plus five Five years after UNCED, the international community convened a review summit in June 1997 known as Rio+5 at New York. Nearly 160 Nations, environmentalists and NGO's participated in the conference. The conference renewed its commitments and set goals for future. According to summit chairman Razali Ismail, Malaysian diplomat, there was no improvement found, still the environment is in trouble. The great disappointment was on global warming. Concerns were expressed about the slow implementation of Agenda 21. The general conclusion was that while some progress had been made in terms of sustainable development, 'many of the targets of Agenda 21 are a long way from being met (UN 1997). The convention is distinctive as it endorses and employs a bottom-up approach to international environmental cooperation. Under the terms of the convention, activities related to the control and alleviation of desertification and its effects are to be closely linked to the needs and participation of local land users and non-governmental organizations. It employs detailed regional annexes and addresses the problem in specific region. Seven countries in South Asian region are signatories to the convention, which aims at tackling desertification through national, regional and sub-regional action programmes. The regional action programme has six Thematic Programme Networks for Asian region, each headed by a country host manager. India hosts the network on agro forestry and soil conservation. 6. Kyoto Conference 1997 UN Climate Conference on 11Dec 1997 was held in Kyoto and adopted in the form of a protocol, which requires the industrialized countries as a whole to reduce their average annual emissions of six green house gases like carbon dioxide, methane, CFC, etc., by 5.2 percent from 1990 levels between the year 2008 and 2012. As of Dec 2001, 84 parties signed and 46 parties ratified or acceded to the protocol. All developed countries were committed to cut gas emissions. Thus inspite of Kyoto protocol, it is difficult to say that the world would be safe from the green-house effect.Clean development mechanism is a key concept in Kyoto protocol. ? Millennium Conference The conference is entitled as on the Threshold of the New Millennium' held in Tokyo on January 2000. The conference examined key issues related to the themes of human development, environmental conservation, peace, governance and security at the global level. The issues discussed and recommendations arrived on issues like globalization and its impacts, challenges for human development and environmental conservation unpredictability and potentially critical developments. According to millennium conference Sustainable Development requires economic efficiency, social equity, human security and ecological stability, transfer of technology and financial resources are needed to promote. ? Stockholm convention on persistent organic pollutants (POPs) In December 2000 representatives of 122 governments finalized legally binding treaty for implementing international action on certain persistent organic pollutants. POPs has been opened for signatures in May 2001 and entered into force on May 2004. India became signatory to this convention on January 2006. The Convention sets out control measures covering 12 chemicals. The control provisions call for eliminating production and the use of intentionally and unintentionally produced POPs. The persistent organic pollutants (POPS) are chemical substances that persist in the environment, bio accumulate through the food web, and pause a risk of causing adverse effects to human health and environment. These POPs are present in pesticides, industrial chemicals and unwanted by-products of industrial processes. Thus actions are made to reduce and climate production, use and releases of thus substances are all far by International community. A health related exemption has been granted for DDT. The convention designates financial support from developed countries to developing world through GEF. 61

UN Secretary General Kofi Annan said in his final address that- Johannesburg is meant to find another way, a path that improves standards of living while protecting the environment, a path that works for all peoples. Today and tomorrow the relationship between human society and the natural environment is the core concern of Johannesburg, and is what sets Johannesburg apart from other UN conferences and Summits. The outcome of the 10-day summit saw nations pledge to halve the number of people without water and sanitation by 2015, and to seek renewable energy sources. However, the summit has been criticized for failing to set concrete targets and Oxfam says the agreement is "a triumph for greed and self-interest, a tragedy for poor people and the environment". The results of the Johannesburg Summit have been criticized in subsequent years as being too vague and for setting weaker goals than those agreed upon in previous summits. The resolutions passed at the summit also lack the provisions for substantial enforcement, making it difficult to assess what progress was actually made. ? United Nations World Summit The UN World Summit was held from 14-16 September 2005 in New York, USA in which 150 State heads were participated. The Summit discussed progress forwards the Millennium development Goals and a reform of the UN. It is the largest ever assemblage of world leaders, gathered at UN head quarters. The Summit had been originally conceived as a follow up to the anti-poverty goals of 2000 Millennium summit.The world has set a clear agenda of achievable goals for sustainable development; emphasis is also on poverty reduction and health care anti-Malaria efforts, education, all developing countries to adopt national plans 51 . In September 2005, the UN convened a World Summit that brought together the heads of most member states, calling the summit "a once-in-a-generation opportunity to take bold decisions in the areas of development, security, human rights and reform of the United Nations". Kofi Annan had proposed that the summit agree on a global "grand bargain" to reform the UN, revamping international systems for peace and security, human rights and development, to make them capable of addressing the extraordinary challenges facing the UN in the 21st century. World leaders agreed on a compromise text, including the following notable items: the creation of a Peace building Commission to provide a central mechanism to help countries emerging from conflict; an agreement that the international community has the right to step in when national governments fail to fulfill their responsibility to protect their citizens from atrocious crimes; A Human Rights Council (established in 2006); an agreement to devote more resources to UN's Office of Internal Oversight Services (OIOS); several agreements to spend billions more on achieving the Millennium Development Goals. ? The Kyoto Protocol The Kyoto Protocol which is entered into force on 16 th February 2005 is an important milestone in international actions to combat climate change. Under the protocol industrialized countries are legally bound to reduce their combined emissions of six major green house gases. The intentional carbon trading market will become legal and practical reality where the market based approach will improve the efficiency and cost-effectiveness emissions cuts. The clean Development Mechanism (CDM) will move from an early implementation phase to full operations. The protocols adaptation fund will start preparing itself for assisting developing countries to cope with the negative effects of climate change. India is also parts to the protocol but do not have emission reduction targets. Therefore, reducing the risks of global warming will require active engagement of entire International community. This protocol lead to the climate change convention to achieve new policies and approaches to meet the climate change challenges. ? United Nations Climate change conference 2005 The conference was held from 28 November to 10 December 2005 in Montreal, Canada, in which most of the instituted countries are bound by specific and legally finding emission reduction targets following this conference convention on climate change. ? United Nations Climate change conference at Bali 2007 The Government of Indonesia hosted the Conference at the Bali International Convention Centre and brought together more than 10,000 participants, including representatives of over 180 countries together with observers from intergovernmental and nongovernmental organizations

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and the media. The conference of the UN Framework Convention on climate change held in

Bali overcame considerable wrangling and produced the Bali Action Plan, a basic but promising road map to 2009, when major economies must decide on new actions to reduce greenhouse gas emissions. All countries will need bold initiatives on emission cuts beyond 2012 when existing Kyoto Protocol commitments expire. It may disappoint many that the UNFCCC dropped 62

from its conference resolution the quantified emission reduction targets sought by the European Union due to opposition, chiefly, from the United States. But the Bali resolution accepts the scientific evidence and emphasizes the-urgency for combating climate change. It is now incumbent on the big emitters to deliver on cuts and technology assistance, and for other countries to plan mitigation efforts. Developed countries must, as per the Bali plan, adopt-measurable, reportable and verifiable emission limits and reductions, while developing countries can emphasize mitigation rather than emission reduction. The U.S., which emits the most GHGs and is a Kyoto skeptic, obviously felt compelled to endorse the Bali plan under global moral pressure. India's intervention at the United Nations climate change talks to push through an amendment to a road map for the future fight against climate caused several adjournments and behind-the-scenes discussions, but in the end the entire G-77 and China, the largest negotiating bloc of developing countries, as well as the European Union expressed their support. After refusing to support the Indian amendment, the United States delegation faced a barrage of strong protests from a number of developing countries. The U.S. being isolated and forced to change later, agreed to join the consensus. The credit is given to the strong unity and initiative by the developing countries, the power of which he hoped could be carried over to other global negotiations. The Bali Action Plan provides opportunities for China and India to reduce their carbon footprint and to strive for mitigation without compromising on economic growth. The UNFCCC has agreed, as part of the road map, to help protect and expand forests through special funding. Rainforests in equatorial countries and some parts of India are seen as low-cost carbon sinks; they need only a small investment per tonne of avoided carbon dioxide (released by deforestation). This provision can fund forestry schemes and generate income for rural and tribal communities. India, which contributed to key Bali amendments on access to clean technologies, can also tap the Adaptation Fund under the Kyoto Protocol, the governance mechanism of which has been agreed upon, to cope with climate change. While pursing these options, India should not wait for obligatory requirements to launch far-sighted actions. It can easily leapfrog old technologies in high emission sectors - power, transport, lighting, and building. This it can do by calibrating policy and seeking out advanced technologies. The most promising of these appears to be carbon capture and storage at coal-fired power plants, the dominant national power source. Such national actions are within close reach, although a grand climate framework may still be two years away. The conference culminated in the adoption of the Bali roadmap, which charts the course for a new negotiating process to be concluded by 2009 that will ultimately lead to a post-2012 international agreement on climate change. Ground-breaking decisions were taken which form core elements of the roadmap. They include the launch of the Adaptation Fund as well as decisions on technology transfer and on reducing emissions and deforestation. These decisions represent various tracks that are essential to achieving a secure climate future. The Bali -roadmap calls for two years of negotiations that will end in 2009 on four key areas, mitigation, adaptation, technology and financing. It is hoped that the new agreement will be ratified by countries in time to take effect when the first commitment period of the Kyoto protocol expires in 2012. In addition to launching negotiations toward a future agreement, countries also agreed in Bali on a number of important measures that can begin immediately. This includes an agreement that will allow the Adaptation Fund to fund projects in developing countries that will help people cope with the impacts of climate change over the next four years. The Fund, currently worth over $30 million and which can grow by as much as $300 million by 2012, will get its resources from a two per cent levy on all transactions of the Clean Development Mechanism. The Bali Conference also agreed on a new programme to scale up investment for the transfer of clean technologies to developing countries. It was widely agreed in Bali that for poorer countries to avoid the same development mistakes of industrialized countries, they would need newer and cleaner technologies. Deforestation, which causes 20 per cent of all greenhouse gas emissions, also figured on the agenda in a major way for the first time in climate change discussions. Countries agreed on a range of measures to study and assess the issue - including finding out just how to calculate emissions from deforestation, as well as encouraging demonstration projects that can address the needs of local and indigenous communities. Despite of many other Environmental rights, the general policy of extending participatory rights has thus secured international support which is reflected in draft principles of human rights an the environment . The draft principles on human rights and the environment are guided by character of UN, UDHR, covenant on Economic, Social and cultural Rights, Covenant on Civil and Political Rights, Vienna Declaration and Action programme of the world conference of Human rights and other relevant international human rights instruments and relevant instruments of International environmental law (International Conference like Stockholm Declaration, Rio summit, Agenda 21) and also by fundamental principles of international humanitarian law. The procedural rights identified include right to information concerning environment, Right to participate in decision making including environmental impact assessment, right to freedom of association for the purpose of protecting the environment, right to effective remedies 63

and refresh for environmental harm in administrative and judicial proceedings. This is a comprehensive formulation which again draws heavily on existing human rights law and international environmental law. Globalization and It's Impact on Environment Meaning Broadly speaking, the term globalization' means integration of economies and societies through cross country flows of information, ideas, technologies, goods, services, capital, finance and people. Cross border integration can have several dimensions – cultural, social, political and economic. In fact, some people fear cultural and social integration even more than economic integration. The fear of - cultural hegemony haunts many. Limiting ourselves to economic integration, one can see this happen through the three channels of (a) trade in goods and services, (b) movement of capital and (c) flow of finance. Besides, there is also the channel through movement of people. Historical Development Globalization has been a historical process with ebbs and flows. During the Pre-World War I period of 1870 to 1914, there was rapid integration of the economies in terms of trade flows, movement of capital and migration of people. The growth of globalization was mainly led by the technological forces in the fields of transport and communication. There were less barriers to flow of trade and people across the geographical boundaries. Indeed there were no passports and visa requirements and very few non-tariff barriers and restrictions on fund flows. The pace of globalization, however, decelerated between the First and the Second World War. The inter-war period witnessed the erection of various barriers to restrict free movement of goods and services. Most economies thought that they could thrive better under high protective walls. After World War II, all the leading countries resolved not to repeat the mistakes they had committed previously by opting for isolation. Although after 1945, there was a drive to increased integration; it took a long time to reach the Pre-World War I level. In terms of percentage of exports and imports to total output, the US could reach the pre-World War level of 11 per cent only around 1970. Most of the developing countries which gained Independence from the colonial rule in the immediate Post-World War II period followed an import substitution industrialization regime. The Soviet bloc countries were also shielded from the process of global economic integration. However, times have changed. In the last two decades, the process of globalization has proceeded with greater vigour. The former Soviet bloc countries are getting integrated with the global economy. More and more developing countries are turning towards outward oriented policy of growth. Yet, studies point out that trade and capital markets are no more globalized today than they were at the end of the 19 th century. Nevertheless, there are more concerns about globalization now than before because of the nature and speed of transformation. What is striking in the current episode is not only the rapid pace but also the enormous impact of new information technologies on market integration, efficiency and industrial organization. Globalization of financial markets has far outpaced the integration of product markets. Globalization, in a fundamental sense, is not a new phenomenon. Its roots extend farther and deeper than the visible part of the plant. It is as old as history, starting with the great migrations of people across the great landmasses. Only recent developments in computer and communication technologies have accelerated the process of integration, with geographic distances becoming less of a factor. Is this 'end of geography' a boon or a bane? Borders have become porous and the sky is open. With modern technologies which do not recognize geography, it is not possible to hold back ideas either in the political, economic or cultural spheres. Each country must prepare itself to meet the new challenges so that it is not being bypassed by this huge wave of technological and institutional changes. Nothing is an unmixed blessing. Globalization in its present form though spurred by far reaching technological changes is not a pure technological phenomenon. It has many dimensions including ideological. To deal with this phenomenon, we must understand the gains and losses, the benefits as well as dangers. To be forewarned, as the saying goes, is to be forearmed. But we should not throw the baby with bath water. We should also resist the temptation to blame globalization for all our failures. Most often, as the poet said, the fault is in us. Risks of an open economy are well known. We must not, nevertheless, miss the opportunities that the global system can offer. As an eminent critic put it, the world cannot marginalize India. But India, if it chooses, can marginalize itself. We must guard ourselves against this danger. More than many other developing countries, India is in a position to wrest significant gains from globalization. However, we must voice our concerns and in cooperation with other developing countries modify the international trading arrangements to take care of the special needs of such countries. At the same time, we must identify and strengthen our comparative advantages. It is this two-fold 64

approach which will enable us to meet the challenges of globalization which may be the defining characteristic of the new millennium. Global change has become a popular word in scientific debates on long-range structural change in the earth's ecology. Globalization has in the past played a major role in the controversial environmental debates. Many problems resulted in this area of discussion, in regard to the intricate linkages between globalization, government, trade and transport, and environmental decay. The current debate on the environmental effects of globalization is particularly concerned with the question whether a worldwide liberalization of trade may provoke environmental collapse. Three major environmental concerns related to trade are the domestic environmental effects caused by the use of imported products, the foreign environmental effects caused by the production of exported goods, and the environmental effects caused by transport movements needed for international trade. The globalization brings with it potentially large benefits as well as risks. The challenge is to manage the process of globalization in such a way that it promotes environmental sustainability and equitable human development. In short, the more integrated environmental and trade policies are, the more sustainable economic growth will be and the more globalization can be harnessed for the benefit of the environment. The debate on Social Clause: WTO, ILO & ChildLabor in India Introduction Child labor is a universal phenomenon and it is revealed that there is a very weak link between economic development and existence of child labor 1 . However the magnanimity and depth of the problem is severe in developing countries like India. The intensity of the problem is enhanced by large unorganized labor markets and socio-economic factors like poverty, illiteracy and cost cutting by the employers etc. The economic compulsions of the poor families increase the complexity of the issue resulting into sending their children to the factories for earning their daily bread. The examples of Shivkashi Fire Works in Tamil Nadu or glass factories at Faridabad near Delhi or children working in hotels everywhere are rampant in India. The definition of child labor constitutes any act where children between the age of 5 and 14 are directly or indirectly forced to work at home or outside it . As a consequence, children are not only deprived of dignity and freedom to play but also scope for physical, mental and emotional development. These children are denied education which is their fundamental right. This paper attempts following objectives: 1. To explain the concept of social clause. 2. To understand the link between trade and labor with respect toWTO and ILO 3. To deliberate on the arguments in favor of and against the issue of social clause. 4. To know the Government of India's stand on social clause and child labor. 5. To summarize the measures taken by Government of India to ensure child rights. Social Clause – The Concept Core labor standards embody basic human rights, enshrined in Universal Declaration of Human Rights (UDHR) 1948. Article 23 to 25 confer decent living standards. Therefore, irrespective of country's level of development, this should apply. Moreover, Core labor standards represent a frame work in defense of worker rights or interest. The market system and trade liberalization in particular are fundamentally flawed under such condition and thus fail to maximize workers' welfare. Therefore Social clause stands for protecting labor standards, more specifically prohibition of employment of children in hazardous industries, providing adequate wages, healthy and hygienic conditions, and special social welfare protection for women, prescription of hours and rest and provision for efficacious remedies in case of default by employer to provide these conditions to his workers. The social clause merely aims at setting the "social rules of the game" in the international trading order, in particular by ensuring consultation among all parties; what agreement they reach and its specific content is up to them. Link between trade and Labor and Roles of WTO, ILO The first concerted effort to draw a link between trade and labor standards was made in 1880s when Kaiser Wilhelm of Germany invited other European Governments to Berlin Congress to negotiate on International Labor Laws 5 . In 1920, under the Treaty of Versailles Part XIII explicitly talked about International Labor Standards including Abolition of Child Labor and was followed by League of Nations in 1927. International Trade Organization 1947 also incorporated Havana Charter on trade and employment; however, there was never a consensus on the 65

issue of labor rights and unfair practices. The issue was raised again in Tokyo Round of negotiations in 1979 and also in 1986, 1987 and first half of 1990, however, Marrakesh Summit of April 1994 of WTO witnessed support of European Union Government (French) to US proposal on labor standards. The WTO was established at Marrakesh in 1994 as the conclusion of Uruguay Round to provide an institution to administer General Agreement on Tariffs and Trade (GATT). WTO is represented by governments of various countries. The Ministerial Conference of WTO meets every two years and it is the highest authority in WTO. The WTO provides an institutional base for the application and enforcement of multilaterally agreed trade of goods and services. In the globalized context WTO also takes note of matters incidental and ancillary to trade and investment such as employment standards, reduction in tariff rates, environment etc. for effective implementation of its provisions, WTO imposes sanctions in case of default by its member state. The WTO Summit of Singapore held in 1996, discussed among other issues; the implementation of social clause. The linking of trade and labor standards within WTO was urged most strongly by the United States, France and some other developed countries and opposed by a substantial number of developing economies and the United Kingdom. A compromise between proponents and opponents resulted into the inclusion of following paragraph in the final Ministerial Declaration: We renew our commitment to the observance of internationally recognized core labor standards. The International Labor Organization (ILO) is the competent body to set and deal with these standards, and we affirm our support for its work in promoting them. We believe that economic growth and development fostered by increased trade and further trade liberalization contribute to the promotion of these standards. We reject the use of labor standards for protectionist purposes, and agree that comparative advantage of the countries, particularly low wage developing countries, must in no way put into question. In this regard, we note that WTO and ILO secretariats will continue their existing collaboration. This declaration emphasizes following aspects: ? It promotes a link between labor standards and trade under WTO and vice versa ? It rejects the use of labor standards for protectionist purpose. ? It supports core labor standards of WTO for the members. ? However, it also emphasizes that ILO is the competent authority to set and deal with labor standards. The issue was not finally settled and WTO assigned the task to ILO to formulate the labor standards. The matter was again discussed in Doha Round in 2002 but without much conclusion. International Labor Organization is a tripartite authority formed by Governments of various nations, NGOs and representatives of trade unions and employers. ILO was established in 1919. Core labor standards are defined with reference to ILO convention. These conventions embody current International consensus and constitute the most comprehensive set of labor standards. The Copenhagen Declaration Commitment 3 made reference to 4 categories of fundamental rights as follows: Table 1 Right/Provision Convention Period Freedom of association & Right to bargain collectively C 87 and C 98 June 1999 and May 2000 Prohibition of Forced Labour C 29 and 105 May 2000 Prohibition of Child Labour C 138 and 182 May 2000 Non-Discrimination in Empoyment C 100 and 111 May 2000 Convention number 138 is related to establishing a minimum age for child labor. It is opposed by Less Developing Countries (LDCs) in particular because they feel that it is inadequate and premature. This would warrant the children not being compelled by circumstances to seek employment. But working children are usually orphans or from poor households, in female headed families, migrants or refugees. Even OECD acknowledged this criterion as ill – suited for less developed countries 8 . The minimum age criterion thus drives them into illegalities and put them at greater risk of exploitation and abuse. The core of 138 has to be giving children legal protection and to strictly regulate the conditions under which children may be permitted to work. 66

Again the minimum age of 15 or 18 for hazardous jobs remains unrealistic for developing countries, given low level elementary schooling. Further it does not distinguish work from exploitation. This implies that to eliminate child labor there needs to be a link established between schooling and child work. Eventually, ILO endorsed this view with its Convention No 182 providing a ban in hazardous industries, and thus, Convention 182 legalizes child labor in non-hazardous industries The Debate of Social Clause Keeping in mind foregoing discussion, it can be recapitulated that social clause refers to a legal provision in a trade agreement aimed at removing the most extreme forms of labor exploitation in exporting countries by allowing importing countries to take trade measures against the exporting countries which fail to conform to a set of internationally agreed minimum labor standards. The principle of non-discrimination among the trading partners of WTO member states does not allow deviation or otherwise permit prohibitive tax. The social clause debate comprises of an economic argument and a moral argument. The proponents of social clause often mix up economics and politics while the opponents hold the view that there is very weak link between trade, competition, growth and labor. From the beginning, the debate on the issue on social clause has North - South dimension. The proponents are industrialized nations while developing economies are flatly refusing it. Table 2: Arguments in favour of and against the social clause Sr.No. Arguments in Favour of Arguments Against 1. There has to be a definite link between trade and labour standards. According to Neo classical liberals, there is no link between trade and labour. 2. WTO must take a note of all trade related matters such as investment, employment and environment. ILO is the competent body to deal with labour standards. 3. Better labour standards throughout the world are recommended as lack of universal standards lead to exploitation and asymmetry in international trade. If uniform labour standards are accepted, it would cause the stagnation to growth. International labour standards do not cover unorganized sector where the majority of workforce is concentrated. 4. There is no scarcity of labour in developing countries; hence the factor price of labour is low. It is only the protectionist policy of developed nation inviting ban on child labour. 5. According to the developed nations' stand the employers paying wages below the labours if industrialized countries are guilty of 'Social Dumping' According to the developing economies repayment of higher interest debt need minimizing cost of production and one such way is hiring of child labour. 6. Political, moral, and human rights do not justify use of child labour. He economic reasons justify hiring the child labour. 7. The competitive advantage is due to low levels of wages and standards in developing countries and therefore, it's violation of human rights. The increased exports from south is not the result of low labour cost but due to competitive advantage of developing countries. Social Clause and Child Labor in India India is a house for more than 25 million child labors and approximately 90% of them are in rural areas. Initially India stressed that labor standard issue should not be referred to the Ministerial Conference of WTO (at Singapore); however, it silently accepted it too. From the Indian point of view, the matter of labor standards should be referred to ILO rather than WTO, which is a competent body to deal with it. The issue of labor is a concurrent subject in the Indian Constitution. Article 246(4) of the Constitution provides for joint legislation with regards to industrial disputes, trade union, and employment etc. The Constitution (Articles 24, 39 and 45) prohibits employment of children in hazardous industries and also has 8 legislations containing provisions for protecting children. Though, India has not ratified the ILO Convention No 138 and 182, it provides a ban on hazardous industries. The Child Labour Prohibition and Regulation Act 1986 is considered inadequate as it legally permits child labour in the „non – hazardous" sector 10 . The Act of 1986 incorporates 14 Conventions of the ILO. In addition, The National Human 67
Rights Commission (NHRC) in India has been monitoring the implementation of Government policies and programmes; on identification, release and rehabilitation of child labor in selected districts of the country. The other supportive measures to prevent the employment of child labor include Sarva Shiksha Abhiyan, Right to Education Act, National Skill Development Policy and National Child Labor Project, which offer education through non formal education centers. India has large and comprehensive laws on labor. However, extensive regulated system of labor protection is present only in case of organized sector for welfare of workers. Only a limited number of social security measures are available for workers in unorganized sector where most of the children are employed in. The Indian Constitution and Environmental Protection Introduction In India, the concern for environmental protection has not only been raised to the status of fundamental law of the land, but it is also wedded with human rights approach and it is now well established that, it is the basic human right of every individual to live in pollution free environment with full human dignity. In view of the various constitutional provisions and other statutory provisions contained in various laws relating to environment protection,

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the Supreme Court has held that the essential feature of "sustainable development" such as the "precautionary principle" and the "polluter pays principle" are

part of the environmental law of the country. When our constitution was drafted it did not contain any specific provisions on environment and even the word "Environment" did not find a place in the constitution; there are certain provisions which to great extent had direct bearing on the environment such as improvement of public health, organization of agricultural and animal husbandry on modern and scientific lines and protection of natural monuments from spoliation, disfigurement etc. Article 47 of the Constitution is considered to be more important, because it imposes the primary duty on the State to provide public with improved health, raised level of nutrition and ultimately improved standard of living. Public health can be assured to the public only by offering the safe and protected environment to live in. This enabled the framers of our Constitution to be more conscious on the environmental concern. The then Prime Minister Mrs. Indira Gandhi, in

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the first International Conference on Human Environment at Stockholm in 1972, voiced deep concern about the degradation of the environment and eco-

imbalances. She also emphasized that pollution, population and poverty are inter-related problems and there must be an integrated approach to deal with them.

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India was also one of the signatories of the Stockholm Declaration which is known as Magna Carta on human environment. Based upon the Stockholm conference, the Indian parliament passed the forty second amendment to the constitution in the year 1976 and incorporated specially two Articles relating to protection and improvement of environment

where
in the Constitution of India obligates

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the "State" as well as "Citizens" to "Protect and Improve" the environment.

Environmental Protection and Preamble of the Constitution The preamble of our Constitution provides that our country is based on "Socialistic" pattern of society, where the State pays more attention to the social problems than on any individual problems. Environmental pollution which has emerged as one of the biggest social problems is being regarded as a real problem affecting the society at large and thus state is under an obligation to fulfil the basic aim of socialism, that is, to provide decent standard of living to all which can be possible from a pollution free environment. The preamble further declares that, the great rights and freedoms which the people of India intended to secure all citizens include justice, social, economic and political. Justice also includes environmental justice. Although the particular word 'environment' does not find a place here, we can very well interpret this to include environmental justice. Environment as a subject matter has entered in our day to-day life in such a way that we cannot ignore deliberations on environmental matters when discussing about socio-economic or socio-political scene of the country. Environmental justice is also supported by the words of K.S. Dakshinamurty that, "Environment as a subject, environment as a concern and environment as part of socio-economic-political structure in the country seems to have taken of. In fact it has entered the structure in such a way that no intellectual, political or academic discourse is complete without it". The Preamble also declares India to be a "Democratic Republic". In a democratic set up, people have the right to participate in government decisions. They also have the right to know and access to information of government policies which is very important for the success of the environment policies. 68
Division of Legislative Powers in Environmental Matters Under Indian federal system, governmental power is shared

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between the Union and the State governments. Part XI of the Constitution governs the legislative and administrative relations between the union and the states. Parliament has the

power to legislate for the whole country, while the State Legislatures are empowered to make laws for their respective states. Article 246 of the Constitution divides the subject areas of legislation between the union and the states. The union list (List I) in the seventh schedule to the Constitution contains subjects over which parliament has exclusive power to legislate. This include defence, foreign affair, atomic energy, inter-state transportation, shipping, major ports, regulation of air traffic, regulation and development of oil fields, mines and mineral development and inter-state rivers. The State Legislatures have exclusive powers to legislate with respect to subjects in the State List (List II), such as public health and sanitation, agriculture, water supplies, irrigation and drainage and fisheries. Under the Concurrent list (List III) both Parliament and State Legislatures have overlapping and shared jurisdiction over some subject areas including forest, the protection of wild life, mines and mineral developments not covered in the union list, population control and family planning, minor ports and factories. Parliament has residual power to legislate on subjects not covered by the three lists. When a Central Law conflicts with a State Law on a concurrent subject the former prevails. A State Law passed subsequent to the Central Law will prevail, however, if it has received Presidential assent under Article 254. The parliament is also empowered to legislate in the 'national interest' on matters enumerated in the State List. In addition Parliament may enact Laws on State subjects, for States whose legislatures have consented to central legislatures. Thus, the Water (Prevention and Control of Pollution) Act of 1974 was enacted by the Parliament pursuant to consent resolution passed by the State Legislatures. The division of legislative powers shows that, there are ample provisions to make laws dealing with environmental problems at the local level as well as at the national level, but under the federal system, the Central Government controls the finances largely. It may happen that when an industrial project is allocated to a particular state, it may have some environmental impact in that state and thus it may be opposed by the environment and planning department of the state concerned. On the other hand the Central Government may threaten to withdraw the project from the State if its implementation is opposed and resulting into a conflict between development and environment. This conflict is being taken care of by the Environmental Impact Assessment (EIA) which is an effort to anticipate measure and weigh the socio-economic and eco system changes that may result from the proposed project. In India, the need for EIA has been recognized even by the planning commission by the Seventh Five Year Plan. However, existing system of administrative framework with its centralized environmental appraisal may lead to conflict between the project authorities and environmental authorities. International Environmental Agreements and India's Obligations The objectives of international environmental agreements would be effectively achieved if all relevant states become parties to them and rigorous implementation including monitoring of compliance was ensured. India is a contracting party or signatory to various international treaties and agreements relating to regional or global environmental issues. India is under an obligation to translate the contents and decisions of International Conferences, treaties and agreements into the stream of national law. Article 51(c) provides that "the State shall endeavour

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to foster respect for international law and treaty obligations in the dealings of organized people with one another". Article 253 of the

Constitution specifically empowers
the Parliament "

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to make any law for the whole or any part of the territory of India for implementing any treaty, agreement or convention with any other country or countries or any decision made at any international conference, association or other body".

The
subject matters over which the parliament can make laws are "participation in the

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international conferences, associations and other bodies and implementing of decisions made there at" and "entering into treaties and agreements with foreign countries and implementing of treaties, agreements and conventions with foreign countries".

In view of the broad language used in Article 253 as also in entries 13 and 14 in Union List, the parliament has very wide power of legislation including the subjects mentioned in the State List provided those issues are addressed at any international conferences, association or other body or it is the implementation of any international treaty, agreement or convention. The first consequence of the broad provisions on the environment protection in view of Article 253 read with Entries no. 13 and 14 of the Union List is that, the Parliament can pass any law on environment protection and the same cannot be questioned before the courts on the ground that the Parliament lacked legislative competence. Secondly, in India the Parliament has made use of this power to enact

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the Air (Prevention and Control of Pollution) Act of 1981 and the Environment (Protection) Act

of 1986.

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The Preamble of these laws state that these 69 Acts were enacted to implement the decisions reached at the United Nations Conference on Human Environment held at Stockholm in 1972.

In People's Union for Civil Liberties v. Union of India the Supreme Court held that the provisions of the International Covenant, which elucidates and go to effectuate the fundamental rights guaranteed by our constitution, can certainly be relied upon by courts as facets of those fundamental rights and hence, enforceable as such.

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In Vellore Citizens Welfare Forum v. Union of India the Supreme Court held that it is

almost an accepted proposition of law that the rules of customary International Law which are not contrary to the Municipal Law shall be deemed to have been incorporated in the domestic law and shall be followed by the courts of law. Duties of the Citizen Towards Environmental Protection Prior to the Forty-Second Amendment, the Fundamental Law of the land attached more importance on rights. The makers of the Constitution were concerned about the moral and natural rights. The intention behind it was that the citizens and the State would shoulder the responsibility to protect the Constitutional order as their moral duty. As the time passes the citizens became conscious about their rights and thereby neglected their duties. Rights and duties are very important elements of Law. They correlated to each other in such a way that one cannot be conceived without the other. A right is always against someone upon whom they correlative duty is imposed. The Constitution (Forty-Second Amendment) Act, 1976 added a new part IV-A dealing with "Fundamental Duties" in the Constitution of India Article 51-A (g) specially deals with fundamental duty with respect to environment
that: "

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It shall be the duty of every citizen of India to protect and improve the natural environment including forests, lakes, rivers and wild life and to have compassion for living creatures".

Article 51-
A (g) refers to

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the fundamental duty of every citizen to protect and improve "natural environment".

But in the present days the pollution is caused not only by exploiting the "natural environment" but otherwise also. Nature has given us the gift of pollution free environment. The fundamental duty imposed on every citizen is not only to "protect" the environment from any kind of pollution but also to "improve" the environment quality if it has been polluted. So it is the duty of every citizen to preserve the environment in the same way as nature has gifted it to all of us.

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In Rural Litigation and Entitlement Kendra v. State of UP

Justice R.N. Mishra opined that "preservation

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of the environment and keeping the ecological balance unaffected is a task which not only the government but also

every citizen must undertake. It is a social obligation and let us remind every Indian

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citizen that it is his fundamental duty as enshrined in Article 51-A(g) of the Constitution".

In Kinkari Devi v. State Justice P.D. Desai remarked: "There is both a

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constitutional pointer to the state and a constitutional duty of the citizens not only to protect but also

to improve the environment

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and to preserve and safeguard the forest, the flora and fauna, the rivers and the lakes and all other water resources of the country. The neglect or failure to abide by the pointer or

to perform the duty is nothing short of betrayal of the fundamental law which the state and indeed the every Indian is bound to uphold

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and maintain". In L. K. Koolwal v. State of Rajasthan and Ors

Mr.L.K.Koolwal moved the High Court under Article 226 and highlighted that the Municipality has failed to discharge its "primary duty" resulting in

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the acute sanitation problem in Jaipur which is hazardous to the life of the citizens of Jaipur. The Court explained the

true scope of Article 51-A in the following words: "

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We can call Article 51-A ordinarily as the duty of the citizens, but in fact it is the right of the citizens as it creates the right in favour of the citizens to move to the court to see that the State performs its duties faithfully and the obligatory and primary duties are performed in accordance with the law of the land. Omissions or commissions are brought to the notice of the court by the citizen and thus, Article 51- A gives a right to the citizens to move the court for the enforcement of the duty caste on the state, instrumentalities, agencies, departments, local bodies and statutory authorities created under the particular law of the

state. The court pointed out that "right and duty co-exists. There cannot be any right without any duty and there cannot be any duty without any right". Insanitation leads to a slow poisoning and adversely affects the life of the citizens and hence it

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falls within the purview of Article 21 of the constitution. It is the duty of the

every citizen to see that rights which he has acquired under the constitution are fulfilled.

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The Court directed the Municipality to remove dirt, filth etc., from the city with in the period of six months.

The Court made it clear that it is not the duty of the court to see whether the funds are available or not. It is the duty of the administration and municipal council to see that primary duties are fulfilled. The Court concluded the judgment by observing that, "If the Legislature or the State government feels that the law enacted by them cannot be implemented then the Legislature has the liberty to scrap it, but which remains on the statutory books will have to be implemented, particularly when it relates to primary duty. 70
In Goa Foundation v. State of Goa the Bombay High Court examined the question of locus standi from the premises of the fundamental duties under the constitution of India. In this case
the

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petitioner was a society registered under the law relating to registration of societies and their members were citizens of India having fundamental duty

under

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Article 51-A to protect and improve the natural environment including forests, lakes, rivers and wild life and to have compassion for living creatures.

The
question before the Court was whether such a society also has the same duty. The Court answered this question in affirmative and held that such a society also has the same duty. On the basis of this the

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petitioner society was held to have a locus standi to move to the Court to prevent ecological degradation,

to formulate and implement programme for rehabilitation of environment and to restore ecological balance. In Sitaram Chhaparia v. State of Bihar public interest litigation was filed by five persons, residents of a locality seeking directions from the court for closure of tyre retreading plant in the residential area as the said industry was emitting carbon-di-oxide gas and other obnoxious gases from its furnaces causing harm to the environment of the locality. The Patna High Court held that protecting the environment is now a fundamental duty under Article 51-A of the Constitution and accordingly the respondents were directed to wind up their industry and the State respondents were obliged to ensure that. As regard the duty contained in Article 51-A(g) of the Constitution in Abhilash Textiles v. Rajkot Municipal Corporation has held that notices asking the petitioner to stop discharging the effluents from the factory on public road or drainage having natural environment on the pain of closing the factory will be valid. Duties of the State Towards Environmental Protection Article 47 of the Constitution which reads: "

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The State shall regard the raising of the level of nutrition and the standard of living of its people and the improvement of public health as among its primary duties and, in particular, the State shall endeavour to bring about prohibition of the consumption except for medical purposes of intoxicating drinks and drugs which are injurious to health".

The basic principle embodied in the Article very clearly denies the statement to some of the learned authors that initially our Constitution was environmentally blind and environment as a subject has been left out of the Constitution. Article 47 calls upon the State to perform the basic duty to look after the health of the citizen and also take necessary and effective steps to improve their standard of living and also raise the level of nutrition. Improvement of public health forms the core of environment because due to various environmental hazards it is the health of the general people which comes under severe threat. In order to protect the health the framers of the Constitution gave emphasis on the improvement of public health which is more vital for the existence of the mankind. In the present times several factors account for the pollution hazards which is going beyond control. The pollution of water and air spoils the nature very well and affect our health. Therefore, taking into consideration, the Constitution very aptly recognized the right to health and casts a responsibility upon the State making it obligatory to work for improving the health of the citizens. In Talcher Swasthya Surakshya Parishad v. Chairman-Cum-MD Mohanadi Coal Fields Ltd., and Others it was alleged that due to the operation of the collieries in the Talcher area, the people of Talcher town and nearby areas have been affected as there is no pure air to breathe and pure water to drink. They are forced to inhale such air being exposed to dust and effluent material and also are forced to take contaminated water which has become unsuitable for drinking purposes due to such dust and effluent articles. It was also alleged that due to extraction done from underneath the ground surface, land is becoming loose and there have been several instances of seepage of water and subsidence of earth, thereby endangering human life and property. In this case the High Court observed that: "It is needless to say that all concerned, i.e., the governments, the government agency like the Pollution Control Board, the coal-mines owners operating in the area have to ensure that at the altar of industrial development, environment and consequentially health of the people do not get sacrificed. It is the function of the Pollution Control Board to ensure that the rigid guidelines required to be followed in the matter of air and water pollution. Statistics may not always reflect the correct state of affairs. In the maze of figures, let welfare of people is not lost". The Pollution Control Board was directed to take strict steps after determining consequences of such pollution and see that there is no reoccurrence. It was further directed by the Court that, "for industrial development, the people should not become ill on account of collapse of buildings, surface erosion and water pollution. In Hamid Khan v. State of Madhyapradesh it was held that there was a gross negligence on the part of the state government in not taking proper measure before supplying drinking water from hand-pumps which has 71
resulted in colossal damage to the people, the Court held that the State was responsible and has failed to discharge its primary responsibility. With the objective of affording better protection to the environment, the Constitution was amended in the year 1976 and a new

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Article 48-A was inserted into the Constitution which reads: "The State shall endeavour to protect and improve the environment and safeguard the forests and wild life of the country".

This Article

used the word 'Environment' in a wider sense which affects all the living being and influences the conditions of their lives. Water and air are among such important factors which mould the life of the citizens. Billions of years have passed and the society is still dependant on water and also will continue to do so, thus proving the necessity and vitality of water for the existence of the mankind. Hence, it becomes the pious duty and responsibility of the State to protect the water and water resources as well as whole environment from all activities. So if we construe the Article, this necessarily requires the State not only to adopt the protectionist policy but also to provide for the improvement of the environment. Article 48- A further provides "to safeguard the forests and wild life". This is an important provision as the environment is greatly influenced by forests and wild life. The forests in particular has a direct relation with water pollution as the forest is responsible for natural rain which protects against pollution to a great extent and again by maintaining a balance, it constitutes an important safeguard against atmosphere pollution. In this way the forests contribute a lot in protecting the pollution of water. In India, the judicial attitude in protecting and improving the environment provides a testimony of the fact that, directive principles are not mere "guiding principles" of policy but they have to be given effect to.
In Shri.

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Sachidanand Pandey v. State of West Bengal the Supreme Court pointed out that whenever a problem of ecology is brought before the court, the court is bound to bear in mind Articles 48-A and 51-A (g)

of the Constitution, the Court further observed: "When the Court is called upon to give effect to the directive principles and the fundamental duty, the court is not to shrug its shoulders and say that priorities are a matter of policy. The least the Court may do is to examine whether appropriate consideration are borne in mind and irrelevancies excluded. In appropriate cases, the Court may go further, but how much further must depend on the circumstances of the case. The Court may always give necessary directions. However, the Court will not attempt to nicely balance relevant considerations. When the question involves nice balancing of relevant considerations, the court may feel justified in resigning itself to acceptance of the decision of the concerned authority". In T. Damodhar Rao. v. S. O Municipal Corporation, Hyderabad the court pointed out that in view of Articles 48-A and 51-A(g), it is clear that protection of environment is not only the duty of every citizen but it is also the "obligation" of the State and all other State organs including courts.

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In M.C. Mehta v. Union of India the court

observed that Articles-39(e), 47
and 48-A

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by themselves and collectively casts a duty on the State to secure the health of the people, improve public health and protect and improve environment.

The cumulative effect of Articles 48-A and 51-A(g) appears to be that the 'State' as much as the 'Citizens' both are now under a constitutional obligation to conserve, preserve, protect and improve the environment. Environmental Protection and
Right to Life

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Article 21 of the Constitution which reads: "No person shall be deprived of his life or personal liberty except according to procedure established by Law". The

right to life as guaranteed by Article 21 of the Constitution is basic human right and the concept of right to life and personal liberty have been transformed into positive rights by active judicial interpretation. A new era ushered in the post Maneka period the concept of right to life witnessed new developments and new dimensions were added to the interpretation of fundamental rights embodied in Article 21. Prior to this all the fundamental rights guaranteed in Part III of the Constitution were considered to negative in nature and imposing only negative obligation on the State. For the first time, thus Supreme Court transformed these rights into positive rights and imposed an affirmative duty on the State to enforce it. This view of the Supreme Court was also reflected in Francis Carolie Mulhin v. Administrator Union Territory of Delhi where Justice Bhagawati observed that "the right to life enshrined in Article 21 cannot be restricted to mere animal existence. It means something more than just physical survival". Further he added: "

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Right to life includes the right to life with human dignity and that goes along with it, namely, the bare necessities of life such as adequate nutrition, clothing and shelter over the head and facilities for writing and expressing oneself in diverse forms

with fellow human beings. Of course, the magnitude and contents of the components of this right would depend upon the extent of the economic development of the country but it must, in any view of the matter include the right to basic necessities of life". 72
Again the Apex Court in Chameli Singh v. State of UP held that the need for a decent and civilized life includes the right to food, water and a decent environment. In the same sentiment the Court was of the opinion that: "In any organized society, the right to live as human being is not ensured by meeting only the animal need of men. It is secured only when he is assured of all facilities to develop himself and is freed from restrictions which inhibit his growth. All human rights are designed to achieve this subject. The right to live guaranteed in any civilized society implies the right to food, water, decent environment, education, medical care and shelter. These are basic human rights known to any civilized society. All civil, political, social and cultural rights enshrined in the Universal Declaration on Human Rights or Convention or under the Constitution of India cannot be exercised without these human rights". Observing the stand taken by the Apex Court and considering the relation between fundamental rights and environmental protection, it was pointed out by Shyam Divan and Armin Rosencranz as: "Encouraged by an atmosphere of freedom and articulation in the after math of the emergency, Supreme Court entered one of its most creative periods. Specially,

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the court fortified and expanded the fundamental rights enshrined in Part III of the Constitution. In the process, the boundaries of the Fundamental right to life and personal liberty guaranteed in Article 21 were expanded to include environmental protection".

Right to Live in a Healthy Environment Article 21 guarantees the right to life, a life of dignity, to be lived in a proper environment, free of danger of disease and infection. It is an essential fact that there exists a close link between life and environment. Right to life would become meaningless if there is no healthy environment. The right to live in healthy environment as a part of Article 21 was evident from

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the case of Rural Litigation and Entitlement Kendra, Dehradun v. State of U.P. that the

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Rural Litigation and Entitlement Kendra, Dehradun and a group of citizens wrote to the Supreme Court against the progressive mining which denuded the Mussoori Hills of trees and forests

cover and accelerated soil erosion resulting in landslides and blockage of underground water channels which fed many rivers and springs in the valley. The Court ordered the registry
to treat this letter as writ petition under Article 32 of the Constitution. Initially

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the Court appointed an expert committee to advise the bench on technical issues. On the basis of the report of the committee, the Court ordered the closure of the lime-stone quarries. The Court

observed: "This is

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the first case of its kind in the country involving issues relating to environment and ecological balance

and the questions arising for consideration are of great moment and significance not only to the people residing in the Missouri Hill range but also in their implications to the welfare of the generality of people, living in the country". It is also stated that, the disturbance of ecology and pollution of water, air and environment by reason of quarrying operation definitely affects the life of the person and thus involves the violation

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of right to life and personal liberty under Article-21 of the Constitution.

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In M.C. Mehta v. Union of India the Supreme Court

once again impliedly treated the right to live in pollution- free environment as a part of fundamental right to life under Article-21
of the Constitution. In M.C. Mehta v. Union of India where a group of tanneries doing business on the banks of the river of Ganga were alleged to be polluting the river. Justice K.N. Singh remarked: "

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We are conscious that closure of tanneries may bring unemployment, loss of revenue but life, health and ecology have greater importance to the people".

In T.Damodhar Rao v. S.O. Municipal Corporation, Hyderabad the A.P. High Court observed that: "

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It would be reasonable to hold that the enjoyment of life and its attainment and fulfilment guaranteed by Article 21 of the Constitution embraces the protection and preservation of nature's gifts without which life cannot be enjoyed. There can be no reason why practice of violent extinguishment of life alone should be regarded as violative of Article 21 of the Constitution. The slow poisoning by the polluted atmosphere caused by environmental pollution and spoliation should also be regarded as amounting to violation of article 21 of the Constitution".

In
L.K. Koolwal v. State Rajasthan High Court held that the Maintenance of health, preservation of the

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sanitation and environment falls within the purview of Article 21 of the Constitution as it adversely affects the life of the citizen and it amounts to slow poisoning and reducing the life of the citizen because of the hazards created, if not checked.

In Charanlal

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Sahu v. Union of India the Supreme Court of India

held that, in the context of our national

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dimensions of human rights, right to life, liberty, pollution free air and water is guaranteed by

the Constitution under articles 21, 48 - A and 51 - A (g). It is the duty of the State to take effective steps to protect the guaranteed Constitutional rights. In F.K. Hussain v. Union of India the Kerala High Court pointed out that

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the right to sweet water and the right to free air is attributes of right to life, those are the basic elements which sustain life itself. 73

In Subash Kumar v. State of Bihar

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the Supreme Court observed: Right to live is a fundamental right under Article 21 of the Constitution and it includes the right of enjoyment of pollution - free water and air for full enjoyment of life. If anything endangers or impairs that quality of life in derogation of laws, a citizen has right to have recourse to Article 32 of the Constitution for removing the pollution of water or air which may be detrimental to the quality of life. In Rajiv Ranjan Singh v. State of Bihar

the Patna High Court

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held that failure to protect the inhabitants of the locality from

the poisonous and highly injurious effects of the distillery's effluents and fumes

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amounted to an infringement of the inhabitants' rights guaranteed under Articles 14, 21 read with Articles 47 and 48-A of the Constitution of India.

In M.C. Mehta v. Union of India
the Supreme Court
took note of environmental pollution due to stone crushing activities in and around Delhi. The court was conscious that environmental changes are the inevitable consequences of industrial development in our country, but at the same time the quality of environment cannot be permitted to be damaged by polluting the air, water and land to such an extent that it becomes a health hazard for the residents of the area. Showing deep concern to the environment, the Court observed that 'every citizen has a right to fresh air and to live in pollution- free environment'. In Obayya Pujari v. Member Secretary, KSPCB, Bangalore the stone crushing business was carried out by the units holding proper licenses and necessary permissions. They were causing environmental pollution and affecting health of the human beings, animals and vegetation. The Court held that

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the right to life is most fundamental right as enshrined in Article 21 of the Constitution of India and

such right
includes all attributes of life. Accordingly the Court directed the State Government, to immediately formulate a policy regulating carrying on stone crushing business and directed the state to identify safer zones for stone crushing within one year. In P.A. Jacob v. Superintendent of Police, Kottayam the Kerala High Court held that compulsory exposure of unwilling persons to dangerous and disastrous levels of noise, would amount to a clear infringement of their constitutional guarantee of right to life under Article 21. Right to life, comprehends right to a safe environment, including safe air quality, safe from noise. In K.C. Malhotra v. State the Madhya Pradesh High Court held that right to live with human dignity is the fundamental right of every Indian citizen and therefore, in the discharge of its responsibilities to people, State has to provide at least minimum conditions ensuring human dignity. Accordingly, the Court directed that there must be separate sewage line from which the filthy water may flow out. The drainage must be covered and there should be proper lavatories for public convenience which should be regularly cleaned. Public health and safety cannot suffer on any count and all steps to be taken as Article 47 makes it a paramount principle of government for the improvement of public health as its primary duties. In Law Society of India v. Fertilizers and Chemicals Travancore Ltd., the Kerala High Court held that deprivation of life under Article 21 of the Constitution of India comprehends certainly deprivations other than total deprivation. The guarantee to life is certainly more than immunity from annihilation

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of life. Right to healthy environment is part of the right to life.

In Kholamuhana Primary Fishermen Co-op. Society v. State the Orissa High

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Court held that the right to life conferred by Article 21 of the Constitution includes the right of enjoyment of pollution - free

atmosphere.

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In Virender Gaur v. State of Haryana the Supreme Court

observed: "Enjoyment of life and its attainment including their right to live with human dignity encompasses within its ambit, the protection and preservation of environment, ecological balance free from pollution of air and water, sanitation without which the life cannot be enjoyed. Environmental, ecological, air and water pollution etc., should be regarded as amounting to violation of Article 21. Therefore hygienic environment is an integral facet of right to healthy life and it would be impossible

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to live with human dignity without a human and healthy environment".

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In Indian Council for Enviro-Legal Action v. Union of India (

popularly known as H-Acid Case) a public interest litigation was field by an environmentalist organization,

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against the Union of India, State Government and State Pollution Board concerned to compel them to perform their statutory duties on

the ground that their failure to carry on such duties violated rights guaranteed under Article 21 of the residents of the affected area. In Dr.Ashok v. Union of India the Supreme Court held that by giving an extended meaning to the expression "life" in Article 21 of the Constitution, the Court had brought health hazard due to pollution within it and so also the health hazards from use of harmful drugs. In

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A.P. Pollution Control Board (II) v. Prof.M.V.

Nayadu the Supreme Court stated that

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the rights to healthy environment and to sustainable development are fundamental human rights implicit in the right to life.

Our Supreme Court was one of the first Courts to develop
the concept

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of "healthy environment" as part of right to "life" under Article 21 of the Constitution.

Thus from the perusal of all above mentioned cases it is evident that there has been a 74
new development in India and right to live in a healthy and pollution free environment is considered as the fundamental right under Article 21, without this, right to life and livelihood would become meaningless and it is evident that the judiciary has certainly prevented the flagrant violation of the right to safe environment. Right to Livelihood and Environment The judiciary

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has further broadened the scope and ambit of Article 21 and now "right to life" includes the "right to livelihood". The

right to earn livelihood is also considered

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as a part of right to life under Article 21 of the Constitution.

This
broad interpretation of the
right to life
is very helpful in checking the governmental action which has an environmental impact that threatens the poor people of their livelihood by dislocating them from their place of living or otherwise depriving them of their livelihood. The right to livelihood as a part of right to life under Article 21 was recognised by the Supreme Court in Sodan Singh v. N.D.M.C., Ahamadabad Municipal Corporation v. Nawab Khan Gulab Khan, Ramesh Chander v. Imtiaz Khan, and Olga Tellis v. Bombay Municipal Corporation in this case the petitioners, a journalist and two pavement dwellers challenged the governmental scheme by which the pavement dwellers were being removed from the Bombay pavements. The main argument advanced on behalf of the petitioners were that evicting a pavement dweller or slum dweller from his habitat amounts to depriving him of his right to livelihood. It was further argued

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that no person can be deprived of his life except according to the procedure established by law

which has to be “just, fair and reasonable”. The petitioners also contended that the State is under an obligation to provide citizens the necessities of life and in appropriate cases the Courts have the power to issue orders directing the State by affirmative action. The court observes: “

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If the right to livelihood is not treated as a part of the constitutional right to life, the easiest way of depriving a person of his right to life would be to deprive him of his means of livelihood to the point of abrogation.

Such deprivation would not only denude the life of its effective content and meaningfulness but it would make life impossible to live”. The court further directed the Municipal Corporation to provide alternate sites or accommodation to slum and pavement dwellers within reasonable distance of their original sites and to earnestly pursue housing scheme for the poor and to provide basic amenities to slum dwellers. In K.Chandru v. State of T.N the Supreme Court held that if the government plans the construction of a large dam or any other project without making proper environmental impact assessment and resulting in the displacement of persons from their habitat, thereby depriving them of their livelihood, then that action can be declared as unconstitutional being violative of Article 21 of the Constitution. The procedure of displacing the people from their habitat can be called “just, fair and reasonable” only when they are provided with suitable alternative sites with all basic amenities of life. When there is any conflict between environment and development, the question to be considered in the larger dimensions of national complexities is that, on the one hand for the national progress and growth, the construction of dams, thermal power plants and exploitation of natural resources are a must. On the other hand, these actions may infringe the fundamental rights of the people in the area where that project is undertaken. Judiciary in India has been very cautious in reconciling the environmental interests with the developmental process and avoiding any kind of conflict between the two. In Banwasi Seva Ashram v. State of U.P. the main grievance of the petitioner was that

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Adivasis and other backward people (tribal forest dweller) were using

forest

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as their habitat and means of livelihood. Part of the land was declared reserved forest and in respect of other part acquisition proceedings were initiated as the government had decided that a Super Thermal Plant of the National Thermal Power Corporation Ltd., (NTPC) was to be located there.

The
Supreme Court gave directions safeguarding and protecting the interests of the Adivasis and backward people who were being ousted from their forest land by NTPC. The Court permitted the acquisition of land only after NTPC agreed to provide certain facilities to the ousted forest dwellers. In this case the court impliedly treating the right of the Adivasis under Article 21 and observed that “it is common knowledge that Adivasis and other backward people living within the jungle used the forest area as their habitat and for generations. They had been using jungles around for collecting the requirements for their livelihood, fruits, vegetables, fodder, flowers, timber, animals by way of sport and fuel wood. At the same time the Court highlighted that for industrial growth as also for provisions of improved living facilities there is a great demand in this country for energy such as electricity”. In Karjan Jalasay Y.A.S.A.S. Samiti v. State of Gujarat the Supreme Court also passed the interim orders under Article 32 requiring the state agencies to resettle and rehabilitate the tribal people who were being displaced by dams. 75

In Pradeep Krishen v. Union of India the Madyapradesh Government issued an order permitting collection of tendu leaves from sanctuaries and national parks by villagers/tribal living around the boundaries thereof with the object of maintenance of their traditional rights including the right to livelihood. This order was challenged by public interest litigation for the protection of ecology, environment and wild life in sanctuaries and national parks. The Supreme Court in the circumstances of this case refused to squash the order and held that if one of the reasons for shrinkage of the forest cover is entry of these villagers/tribal urgent steps must be taken to prevent any destruction or damage to the environment, wild life, flora and fauna. The Supreme Court in the above case protected the right to livelihood of the tribal on the one hand and showed its concern for the protection of the ecology on the other hand. In Animal and Environmental Legal Defence Fund v. Union of India the petitioner, an association of lawyers and other persons who were concerned with the protection of environment, filed a public interest litigation challenging the order of the chief Wildlife Warden, Forest Department, granting 305 fishing permits to tribal villagers formerly residing within the National Park area for fishing in the reservoir situated in the heart of the National Park. The Supreme Court once again showed its concern for the right to livelihood of the tribal villagers and observed that it could have been more desirable, had the tribal's been provided with suitable fishing areas outside the National Park or if land had been given to them for cultivation. In M.C. Mehta v. Union of India public interest litigation was filed to protect Delhi from the environmental pollution caused by hazardous/noxious/heavy/ large industries operating in Delhi. The Court held that such industries are liable to be shifted /relocated to other towns of National Capital Region (NCR) as provided under the Master plan for Delhi Perspective 2001. The Court directed 168 industries, which were identified as such to stop functioning/operating in the city of Delhi and they could shift or relocate themselves to any other industrial estate in NCR. The Supreme Court in order to mitigate the hardship to the employees of such industries due to their closure/shifting/ relocation specified the rights and benefits to which workmen employed in these 168 industries were entitled on relocation/shifting of these industries. Subsequently, the Supreme Court has also issued the package of compensation for workmen employed in industries which are not relocating/ shifting or closing down as per earlier directions of the Supreme Court. Thus, the Supreme Court protected the right to livelihood of the workmen and tried to balance the industrial development and environment protection.

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In M.C.Mehta v. Union of India 8 (popularly known as

Tajmahal case) the Supreme Court once again followed the path of sustainable development and directed that the industries operating in Taj Trapezium Zone (TTZ) using coke/coal as industrial fuel must stop functioning and they could relocate to the alternate site provided under the Agra Master Plan. In this case also the Supreme Court specified the rights and benefits to which the workmen of such industries were entitled and thus, protected their right to livelihood and followed the guiding principle of sustainable development. From the various decisions of the Supreme Court it is evident that development is not antithetical to environment. However, thoughtless development can cause avoidable harm to the environment as well as it deprives the people of their right to livelihood. Right to Know and Environment The right to know is also implicit in Article 19(1) (a) and it has a close link with Article 21 of the Constitution particularly in environmental matters where the secret government decision may affect health, life and livelihood of the people. The right to know or access to information is the basic right for which the people of democratic country like India aspire for. Secrecy erodes the legitimacy of elected governments. On the other hand, the right to know strengthens the participatory democracy. The right to know plays a very important role in environmental matters. Any governmental plan of construction of dam or information of the proposed location of nuclear power stations or thermal power plants and hazardous industries, which directly affect the lives and health of the people of that area, must be widely published. The Judiciary has broadened

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the scope of the right to know in S. P. Gupta v. Union of India the Supreme Court recognized the right to

know to be implicit in the right to free speech and expression. The Supreme Court observed: "This is the new democratic culture of an open society towards which every liberal democracy is moving and our country should be no exception. The concept of open government is the direct emanation from the right to know which seems to be implicit in Article-19(1) (a). Therefore, disclosures of information in regard to the functioning of the government must be the rule and secrecy exception justified only where the strictest requirements of public interest so demands". In L.K. Koolwal v. State the Rajasthan High Court held that a citizen has a right to know about the activities of the State, the instrumentalities, the departments and agencies of the State. The Court further held that, "the State can impose and should impose reasonable restrictions in the matter like other fundamental rights where it affects the 76
national security and other matter affecting the nation's integrity. But this right is limited and particularly in the matter of sanitation and other allied matter every citizen has a right to know how the state is functioning and why the state is withholding such information in such matters". In R.P. Ltd., v. Proprietors, Indian Express Newspapers, Bombay Pvt. Ltd., the Supreme Court held that "we must remember that the people at large have a right to know in order to be able to take part in a participatory development in the industrial life and democracy. Right to know is a basic right to which citizen of a free country aspires in the broadening horizon on the right to life in this age on our land under Article 21 of the Constitution". In F.B. Taraporawala v. Bayer India Ltd., where the question before the court was regarding the relocation/shifting of chemical industries from the populated area of Thane in Mumbai, the Court felt that it has neither the expertise nor in possession of various information which was required to decide one way or the other so far as the question of relocation is concerned. The Court also directed the Constitution of an "authority" under section 3(3) of the Environment (Protection) Act, 1986, which was required to examine the entire matter. Such an authority would have power to examine and know various aspects of development and environment protection and take action accordingly.

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In Research Foundation for Science Technology and Natural Resource Policy v. Union of India

the Supreme Court has stated that

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the right to information and community participation necessary for protection of environment and human health

is an inalienable part of Article 21 and is governed by the accepted environment principles. Accordingly, the government and the authorities have to motivate the public participation by formulating necessary programmes. Right to Equality and Environment The Indian Constitution guarantees '

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right to equality' to all persons without any discrimination. This indicates that any action of the 'State' relating to environment must not infringe upon the right to equality as

mentioned in

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the Article 14 of the Constitution. The Stockholm Declaration, 1972, also recognized this principle of equality in environmental management and it called up all the worlds' nations to abide by this

principle. The judiciary, on various occasions, have struck down the arbitrary official sanction in environmental matters on the basis that it was violative of Article-14. The right to equality is generally resorted to in urban development where permission for construction is granted by the authorities arbitrarily under its discretionary powers without evaluating the public interest and without application of mind and considering the environmental impacts. In Bangalore Medical Trust v. B.S Muddappa the Supreme Court prevented an attempt to convert a public park site into nursing home. The City Improvement Board of Bangalore had prepared the Development scheme for the extension of the City of Bangalore. Under the scheme an area was kept for being developed as low Level Park. Subsequently, under the direction of the Chief Minister

a site for a hospital rather than a park is matter within the discretion of the development authority and thus, the diversion of the user of the land for that purpose is justified under the Act. The Supreme Court dismissed the appeal and highlighted the importance of public parks and open space in Urban Development as follows: "Protection of the environment, open spaces for recreation and fresh air, play grounds for children and other conveniences are matters of great public concern and are vital interest to be taken care of in a development scheme. The public interest in the reservation and preservation of open spaces for parks and playgrounds cannot be sacrificed by leasing or selling such sites to private persons for conversion to some other user; it would be in direct conflict with the Constitutional mandate". Judge R. M. Sahia in his judgment observed that public park as a place reserved for beauty and recreation is associated with growth of the concept of equality and recognition of importance of common man it is a, 'gift from people to themselves'. Its importance has multiplied with emphasis on environment and pollution. He further pointed that the "discretion is an effective tool of administration". When affecting public interest, it should be exercised objectively, rationally, intelligibly, fairly and authority cannot act whimsically or arbitrarily. It was held that the decision taken at the instance of the Chief Minister of the State to convert an open space reserved for public park into a site for constructing hospital and to allot the site to a private person was vitiated by non application of mind and was arbitrary, hence ultra vires and violation of Article 14 of the Constitution. In D.D. Vyas v. Ghaziabad Development Authority the grievance of the petitioner is that the respondents had not taken any steps to develop the area reserved for park. On the other hand, respondents were marking time to 77
carve out plots on such open space dedicated for Public Park in the plan and alienate the same with a view to earning huge profits. The Allahabad High Court followed the dictum of the Supreme Court in Bangalore Medical Trust case and held that the authority or the State cannot amend the plan in such a way so as to destroy its basic feature allowing the conversion of open spaces meant for Public Park. The Court was of the view that the respondents having failed to develop the park, have reminded grossly negligent in discharging their fundamental duty under Article 51-A (g) of the Constitution. In State of Himachal Pradesh v. Ganseh Wood Products the Supreme Court held that a decision making authority must give due weight and regard to ecological factors such as the environmental policy of the government and the sustainable use of natural resources. A government decision that fails to take into account relevant consideration affecting the environment is invalid. The Court also used Article 14 to justify the Government policy in certain cases. In Kholamuhana Primary Fisherman Cooperative Society v. State the government had framed a policy regarding fishing in Chilka Lake so as to protect the traditional rights of fisherman. The Court held that the said policy was neither arbitrary nor ambiguous and hence not violative of Article 14 of the Constitution. Further the Court pointed out that adoption of extensive and intensive prawn culture to earn "prawn dollars" in disregard to ecology was not proper. The Court has also struck down the action of the authorities if it was taken arbitrarily. In Mandu Distilleries Pvt. Ltd., v. M.P. Pradushan Niwaran Mandal the Pollution Control Board issued direction for stoppage of production by the industry on the ground that it was causing water pollution. However, the Court found that there was serious flaw in "decision making process". The decision was taken arbitrarily. The Court quashed the order passed by the board as violative Article 14 of the Constitution. In Ivory Traders and Manufacturers Association v. Union of India the Delhi High Court justified the ban on the business in animal species on verge of extinction. The Court held that the ban on trade in imported ivory and articles made there from is not violative of Article 14 of the Constitution. Article 14 can also be invoked to challenge the government action where permission for mining and other activities with high environmental impact is granted arbitrarily. Freedom of Speech and Expression and Environment Article 19(1) (a) guarantees every citizen a fundamental freedom of speech and expression. In India most of the environmental jurisprudence has developed by judicial activism. Most of the cases came before the Court as a result of public interest litigations (PILs) in which the people exercised their freedom of speech and expression sometimes by writing letters to the court or otherwise by filing petitions before it, highlighting the violation of

in one way or the other. Freedom of speech and expression under Article 19(1) (a) also includes freedom of press. In India the public opinion and media have played an important role in moulding the public perception of environmental issues. In Kerala Sastra Sahitya Parishad (KSSP) non governmetal organizations and influential environmentalists within and outside the government and the role of the media compelled the government to abandon "the Silent Valley Project". In this case legal battle played only a peripheral role. Again in the Tehri Dam project, the public opinion and media compelled the government to make proper Environment Impact Assessment (EIA) of the proposed dam and consider all the aspects of safety of the project. The decision of the government to construct Tehri Dam was scrutinized by the Supreme Court in Tehri Virodhi Sangarsh Samiti v. State of Uttar Pradesh in this case the main grievance of the petitioners was that safety aspect have not been taken into consideration by the government in the Tehri Dam Project. The Court on the perusal of the various recommendations of the committees and factual matrix came to the conclusion that the government has applied its mind and considered the relevant aspects of safety and finally dismissed the petition. In P.A.Jacob v. The Superintendent of Police, Kottayam the Kerala High Court held that freedom of speech under Article 19 (1) (a) does not include freedom to use loud speakers or sound amplifiers. Thus noise pollution caused by the loudspeakers can be controlled under Article 19(1) (a) of the Constitution. In Moulana Syed Md. Noorur Rehman Barkati v. State of West Bengal the Calcutta High Court observed that excessive noise is certainly pollution in the society. Under Article 19(1) (a) read with Article 21 of the Constitution of India, the citizens have a right of decent environment and they have a right to live peacefully, right to sleep at night and to have right to leisure which all are necessary ingredients of the right to life guaranteed under Article 21 of the Constitution. There are various other sources where the noise is created or generated but which offends citizen's right guaranteed under Articles 19(1) (a) and 21 of the Constitution. 78
Freedom of Trade and Commerce and Environment

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Article 19(1) (g) guarantees all citizens the right' to practice any profession or to carry on any occupation, trade

or business". This right of the citizens is not absolute. It is subject to Article 19(6) under which "reasonable restrictions" in the "interest of the general public" can be imposed. Thus, environmental interest from the hazards of any trade or business can be protected. he Gujarat High Court

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in Abhilash Textiles v. Rajkot Municipal Corporation made clear that, 'the petitioners cannot be allowed to reap profit at the cost of public health'. In this case

petitioners conducting the business of dyeing and printing works in rajkot area

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were discharging dirty water from the factory on the public road and in public drains without purifying the same, thereby causing damage to the public health.

The petitioners claimed that they were carrying on the business for the last 20 to 25 years and the industry was providing employment to twenty to thirty thousand families. Notice to close would be very harsh as they would be compelled to close down the factory and would also be violative of Article 19(1) (g). The Court held that one cannot carry on the

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business in the manner by which the business activity becomes

a

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health hazard to the entire society. By discharge of effluent water on public road or in public drainage system

the entire environment of the locality gets polluted. No citizen can assert his right to carry on business without any regard to the fundamental duty under

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Article 51-A (g) to protect and improve the natural environment.

The Court further directed that if the petitioners wish to carry on the business then they must provide for purification plant before discharging the effluents on public roads or in public drainage system. The petitioner had no right under Article 19(1) (g) to carry on business without complying with the Municipal Law and other environmental statutes. In M.C.

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Mehta v. Union of India where tanneries were discharging effluents from their factories in the holy river Ganga resulting in water pollution and not setting up a primary treatment plant in spite of being asked to do for several years.

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It was held that, an order directing them to stop working their tanneries should be passed as effluent discharge from tanneries is ten times noxious when compared with the domestic sewage water which

flow in to

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the river and the court passed the following order: "We are, therefore, issuing the directions for the closure of those tanneries which have failed to take minimum steps required for the primary treatment of industrial effluent. We are conscious that closure of tanneries may bring unemployment, loss of revenue, but life, health and ecology have greater importance to the people".

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In M.C. Mehta v. Union of India the Supreme Court

directed that certain industries which were not showing any progress regarding the installation of the air pollution controlling system in compliance with the Supreme Courts earlier order, should be closed. In this case the Supreme Court did not refer Article 19 (1) (g) however it is implied that while passing the order it had in its mind Article 19 (1) (g) read with Article 19 (6) and 21 of the Constitution. In S. Jagannath v. Union of India the Supreme Court held that, the sea beaches and sea coasts are gifts of nature and any activity polluting the same cannot be permitted. The intensified shrimp (prawn) farming culture industry by modern method in coastal area was causing degradation of mangrove eco system, depletion of plantation, discharge of highly polluting effluents and pollution of portable as well as ground water. Therefore it was held that the said activities of the industries are violative of Constitutional provisions and various other environmental legislations. While delivering the Judgment, Court had in mind that, before any shrimp industry is permitted to be installed in the ecologically fragile coastal area it must pass through a

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strict environmental test in other words "reasonable restriction" can be

put to regulate the right under Article 19(1) (g) of the Constitution. Accordingly, the Supreme Court suggested that there must be an Environmental Impact Assessment (EIA) before permission is granted to install commercial shrimp farms. It must take into consideration the inter-governmental equity and compensation for those who are affected and prejudiced. In Burrabazar Fire Works Dealers' Association v. Commissioner of Police, Calcutta the Court held that Article 19(1) (g) of the Constitution of India does not guarantee the fundamental right to carry on trade or business which creates pollution or which takes away that community's safety, health and peace. The Court of the view that there is no inherent or fundamental right in a citizen to manufacture, sell and deal with fireworks which will create sound beyond permissible limits and which will generate pollution which would endanger health and public order. A citizen or people cannot be made a captive listener to hear the tremendous sound caused by bursting out from noisy fireworks. In Ashwin Jajal v. Municipal Corporation of Greater Mumbai public interest litigation was filed by a resident against the municipal corporation seeking direction to prohibit the display of illuminated advertisements by use of neon lights in residential areas and also to revoke the permission granted to the respondents for display of advertisements on the buildings. It was argued that the neon light sign boards created environmental and health hazards and were of nuisance value as the bright light is deterrent to peaceful sleep. On the other hand, the respondents said that they have fundamental right under Article 19 (1) (g) to have free trade. The court held that keeping in view the environmental and health hazard and nuisance value it is always open to the authorities to 79
regulate the advertisement in a reasonable manner to the extent permissible and this does not result in the violation of fundamental right of free trade. In Baleshwar Singh v. State of U.P. the U.P. State rule prohibited the operation of a saw mill within 80 kilometres of any reserved or protected forests. This was challenged by the owners of the saw mill on the ground that it violates the fundamental freedom under Article 19 (1) (g) of the Constitution. The Allahabad High Court dismissed the petition and held that this is a reasonable restriction imposed to stop uncontrolled cutting of green trees resulting in disturbing ecological balance. The existence of saw mill in, near or around any forest is prohibited for the maintenance of the forest wealth and ecological balance and for the social and national interest. In Obayya Pujari v. Member Sectretary, K S P C B, Bangalore the Court held that a licence in favour of stone crushing units does not confer on them absolute rights to carry on commercial activities of trade or occupation without limitation. The rights are subject to reasonable restrictions and can be regulated by Court direction as are necessary for controlling pollution from such units. In A.P. Gunnies Merchants Association, Hyderabad v. Government of A.P. the High Court held that, the right to carry on business in old and used gunny bags is not absolute. The trade carried on involving activity of dusting and cleaning of gunny bags creates air and environmental pollution. Hence, the direction given by the State Government to shift the business from the thickly populated area to environmental safer place is valid and not violative of Article 19(1) (g) of the Constitution. Further Readings ? Balasubramanium, V., "Environment and Human Rights: A New Form of Imperialism", Economic and Political Weekly, vol.33, no.8, 22-27 Feb. 1998, ? Birnie, Patricia and Allan Boyle, (1992) International Law and the Environment: Clarendon, Oxford ? Desai, Bharat, "Enforcement of the Right to Environmental Protection through Public InterestLitigation in India", Indian Journal of International Law, vol.33, 1993, ? Finnies, J. (1987), Natural Law and Natural Rights, Clarendon Press, Oxford: ? Mahawal, S., "Right to Safe Environment", World Focus, vol.13, no.2, March 1992 ? RLEK, (1997), Community Forestry Management in Protected Areas: A Van Gujjar Proposal, Natraj Publishers, New Delhi ? Sachs, Aaron, Eco-Justice: (1995) Linking Human Rights and the Environment, World watch Institute, Washington D.C. ? Shelton, Dinah, "Human Rights, Environmental Rights and the Right to Environment", Stanford Journal of International Law, vol.28, no.1, 1991, ? Singh, Nagendra, "Right to Environment and Sustainable Development as a Principle of International Law", Journal of Indian Law Institute, 1987, 80

Unit: III Issues of Environmental Development In Developing Countries In this unit, you will learn about, ? Conservation and Use of Natural resources ? Water – A precious Resource ? Biodiversity ? Endangered Species ? Wildlife ? Energy Resources ? Forest and Tribal ▪ Classification of Tribes ▪ The major tribes in India ▪ Types of Tribals by occupation ▪ Socio-Economic development of Tribes ▪ Tribal Development Strategies in India ▪ Policies for tribal development ▪ Status of Tribal Women ▪ Empowerment of Tribal Women ? Hazardous Waste: Management and Treatment ? Pollution Prevention and Waste Minimisation ? Hazardous waste management in India ? Human, Social, and Environmental Impacts of Human Genetic Engineering Conservation and Use of Natural Resources Nature provides us the basic needs like food, shelter, clothes, etc. for our survival. We use air, water, soil, minerals, coal, petroleum, animals, plants etc. in our daily life. But do you ever think, how long these precious materials of the nature will be available for our use. The growing population, rapid industrialisation and urbanisation have created heavy demand on all these materials. It is feared that unless proper steps are taken to conserve them in time, we will face tremendous hardship in future. Natural Resources The term "resource" means any thing that we use from our environment to achieve our objective. For example, we require bricks, cement, iron, wood etc. to construct a building. All these items are called the resources for construction of building. A resource can be defined as 'any natural or artificial substance, energy or organism, which is used by human being for its welfare. These resources are of two types: (a) Natural resources and (b) Artificial resources. All that the nature has provided such as soil, air, water, minerals, coal, sunshine (sunlight), animals and plants, etc., are known as natural resources. Human being uses these directly or indirectly for survival and welfare. The resources, which have been developed by human being during the growth of civilization, are called artificial resources. For example, biogas, thermal electricity, plastics, etc are man-made resources. These man-made resources are generally derived from some other natural resources. For example, plastics and many other chemical products are ultimately derived from the natural resource of petroleum. Classification of Natural Resources The air we breathe and the light we get from the sun are available in unlimited quantity. But what about coal, forest, and petroleum? The stock of these resources is limited. The quantity of these resources is depleting day by day. 1) Inexhaustible Resources The resources which cannot be exhausted by human consumption and other uses, are called inexhaustible resources. These include energy sources like solar radiation, wind power, water power (flowing streams) and tidal power, and substances like sand, clay, air, water in oceans, etc. 81
2) Exhaustible Resources On the other hand, there are some resources, which are available in limited quantities and are going to be exhausted as a result of continus use. These are called exhaustible resources. For example, the stock of coal in the earth is limited and one day there will be no more coal available for our use. Petroleum is another important exhaustible resource. a) Renewable Resources Some of the exhaustible resources are naturally regenerated after consumption and are known as renewable resources. e.g. The living beings (both animals and plants) reproduce and can thus, replace the dying or killed individuals. However, if the consumption of these resources exceeds the rate of regeneration they may also get totally exhausted. Some examples are fresh water, fertile soil, forest (yielding wood and other products), vegetation, wildlife, etc. b) Non-renewable Resources The resources, which cannot be replaced after the use, are known as non-renewable Resources. These include minerals (copper, iron etc.) fossil fuels (coal, oil etc.). Even the wildlife species (rare plants and animals) belong to this category. Conservation of Natural Resources As the human population is continuously growing the consumption of natural resources is also increasing. With the increasing industrialisation and urbanisation of the modern human society, the use of all the resources is rising. If they are not properly used and well managed, a serious scarcity will result. Therefore we need to conserve the natural resources. This will also upset the ecological balance. Conservation is the proper management of a natural resource to prevent its exploitation, destruction or degradation. Conservation is the sum total of activities, which can derive benefits from natural resources

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but at the same time prevent excessive use leading to

destruction or degradation. 1. Need for Conservation of Natural Resources We know that nature provides us all our basic needs but we tend to overexploit it. If we go on exploiting the nature, there will be no more resources available in future. There is an urgent need to conserve the nature. Some of the needs are: ? to maintain ecological balance for supporting life. ? to preserve different kinds of species (biodiversity). ? to make the resources available for present and future generation. ? to ensure the survival of human race. 2. Conservation of Natural Resources and Traditions of India The need for conservation of natural resources was felt by our predecessors and in India, there was a tradition of respecting and preserving the nature and natural resources. Natural resources were conserved in the form of sacred groves/forests, sacred pools and lakes, sacred species etc. In our country the conservaton of natural forests is known from the time of Lord Ashoka. Sacred forests are forest patches of different dimensions dedicated by the tribal to their deities and ancestral spirits. Cutting down trees, hunting and other human interferences were strictly prohibited in these forests. This practice is wide spread particularly in peninsular, central and eastern India and has resulted in the protection of a large number of plants and animals and. Similarly, several water bodies, e.g., Khecheopalri lake in Sikkim was declared sacred by people, thus, protecting aquatic flora and fauna. Worshipping certain plants like banyan, peepal, tulsi etc. has not only preserved them 82
but also encouraged us for their plantation. History recalls numerous instances where people have laid down their lives in protecting the trees. Recent Chipko movement in India is one of the best examples. This movement was started by the women in Gopeshwar village in Garhwal in the Himalayas. They stopped the felling of trees by hugging them when the lumbermen arrived to cut them. This saved about 12000 square kilometers of the sensitive water catchment area. Similar movements also occurred in some other parts of the country. We discussed about the different types of natural resources and classified these. Now we will know about some of these resources in details. Let's begin with the 'soil' as a natural resource. Soil Soil is the uppermost layer of earth's crust, which supports growth of plants. It is a complex mixture of (i) mineral particles (formed from rocks), (ii) humus (organic material formed from decaying plant remains), (iii) mineral salts, (iv) water, (v) air, and (vi) living organisms (larger ones like earthworms and insects and microscopic ones like the bacteria and fungi). Soil is a renewable as well as non-renewable resource. ? Soil is renewable because its productivity can be maintained with fertilizers and manures rich in humus. ? If the soil has been removed from a certain place by erosion, it is practically non-renewable because formation of new soil may take hundreds and thousands of years. a) Soil Erosion Erosion literally means "to wear away". You might have noticed during the summer, when wind blows it carries away sand and soil particles from one place to another. Similarly flowing water removes some amount of soil along with it. This removal of top layers of soil by wind and water is called soil erosion. You know that top layers of soil contain humus and mineral salts, which are vital for the growth of plants. Thus, erosion causes a significant loss of humus and nutrients, and decreases the fertility of soil. b) Causes of soil Erosion Now we shall discuss the causes of soil erosion. There are several causes of soil erosion, these include: (a) Natural causes; and (b) Anthropogenic causes (human generated causes) 5. Natural Causes of Soil Erosion Erosion of soil takes places due to the effect of natural agents like wind and water. High velocity winds over lands, which have no vegetation, carry away the loose top soil. Similarly in areas with no or very little vegetation, the pouring raindrops carry away the soil. ? Anthropogenic Causes of Soil Erosion Besides the natural agents, there are some human activities, which cause soil erosion. Let us know about them. 1. Deforestation: If the forests are cut down for timber, or for farming purposes, then the soil is no longer protected from the effect of falling rains. Consequently, the top soil is washed away into the rivers and oceans. 2. Poor farming methods: Improper tillage and failure to replace humus after successive crops and burning the stubble of weeds reduce the water-holding capacity of the soil. So the soil becomes dry and can be blown away as dust. 3. Overgrazing: Overgrazing by flocks of cattle, buffaloes, goats and sheep leave very little plant-cover on the soil. Their hooves make the soil dry and soil can be blown away easily. c) Conservation of Soil In the previous section we learnt about the various causes of soil erosion. Soil loses its fertility due to erosion. So we need to conserve the soil. Soil conservation means checking soil erosion and improving soil fertility by adopting various methods. Let us know some of these methods. 1. Maintenance of soil fertility: The fertility can be maintained by adding manure and fertilizers regularly as well as by rotation of crop. 2. Control on grazing: Grazing should be allowed only on the areas meant for it and not on agricultural land. 3. Reforestation: Planting of trees and vegetation reduces soil erosion by both water and wind. 4. Terracing: Dividing a slope into several flat fields to control rapid run of water. It is practised mostly in hilly areas. 5. Contour Ploughing: Ploughing at right angles to the slope allows the furrows to trap water and check soil erosion by rain water. 83

Water – A Precious Resource Let us now discuss another most important natural resource, Water. You know it very well that water is essential for survival of all living organisms. It is the most important component of all life forms and necessary for sustaining life. It regulates climate, generates electricity and is also useful in agriculture and industries. About 97% of the water on earth is saline in nature, which is found in seas and oceans. The remaining 3% is fresh water, and most of which is stored in ice caps and glaciers, and just about 0.36% is distributed in lakes, rivers, ponds, etc. Sea water supports marine life and contributes to the production of fish and sea foods and several other commercial products (iodine, agar, coral, pearls, etc.). Fresh water is needed by humans for their personal use (drinking, cleaning, sewage disposal), It is also used by other animals, in agricultural, and for industrial purposes. Fresh water is a renewable resource as it is continuously being produced through hydrological cycle (evaporation, condensation and precipitation). Figure 1 – Hydrological Cycle 1) Degradation of Water Degradation of water is the decrease in quality and quantity of water on the earth surface. With increase in population and industrial growth, water is being degraded day by day. The main reasons for the degradation of water are: 1. to meet the need of increasing population, surface water (water from ponds, lakes, rivers, etc) and ground water are overdrawn. 2. sewage i.e., waste water from domestic and municipal use makes fresh water unfit for use by human beings and animals. 3. waste water, from all industries flow down the surface water bodies and ground water bodies and they get polluted. 4. agricultural wastes containing manures, fertilizers and pesticides enter the water bodies and degrade the quality of water. 5. the continuous decrease of ground water level along coastal regions often cause movement of saline sea water into freshwater wells, thus, spoiling their water quality. 2. Conservation of Water Conservation and management of water are essential for the survival of mankind, plants and animals. This can be achieved adopting the following methods: 1. Growing vegetation in the catchment areas, which will hold water in the soil and allow it to percolate into deeper layers and contribute to formation of ground water. 2. Constructing dams and reservoirs to regulate supply of water to the fields, as well as to enable generating hydroelectricity. 3. Sewage should be treated and only the clear water should be released into the rivers. 4. Industrial wastes (effluents) should be treated to prevent chemical and thermal pollution of fresh water. 5. Judicious use of water in our day-to-day life. 6. Rainwater harvesting should be done by storing rainwater and recharging groundwater. Biodiversity When we observe our surrounding, we find different types of plants, ranging from small green grasses to large trees. Large variety of animals, from tiny insect to human being and many other big animals. Besides these there are micro-organisms in the soil, air and water that we can’t see through our naked eyes. These varieties of plants, animals and microbes together form the biological diversity or biodiversity of your surrounding. 84

So biodiversity can be defined as the flora and fauna i.e. variety of all plants, animals and microbes of a region. 1. Importance of Biodiversity Biodiversity is essential for maintenance of ecosystem. It maintains gaseous composition of atmosphere, controls climate, helps in natural pest control, pollination of plants by insects and birds, soil formation and conservation, water purification and conservation, geochemical cycles etc. Some of the uses of biodiversity are given below: ? Food: All kind of food is derived from plants and animals. ? Drugs and Medicines: Around 25% of drugs are obtained from plants e.g. quinins used for treatment of malaria is obtained from Chinchona officinalis. All antibiotics are derived from microbes. ? Cultural and Aesthetic value: You enjoy watching butterflies, animals, birds and flowers. Ecotourism is a source of income. ? Religious values : Plants like tulsi, peepal, banyan and animals like cows, ox, elephant are worshiped. ? It is essential for maintenance of ecosystem. ? It is required for disposal and pollination in plants, formation and conservation of soil and purification and conservation of water. 2. Threat to Biodiversity Though biodiversity is so important for our survival, we are destroying it knowingly or unknowingly. It is under threat due to the following reasons: (i) Destruction of habitat by cutting down trees, filling up the wetland, ploughing of grassland or burning a forest. (ii) Population explosion has increased demand for food and shelter. It has lead to culture of single crop that will result in disappearance of some other crops. (iii) Industrialisation and urbanisation has changed and destroyed the natural habitat of plants and animals. (iv) Pollution of soil, air and water changes the habitat quality and may reduce or eliminate sensitive species. (v) Mining activities add to the pollution of air and water and threaten the survival of the animals in the nearby areas. (vi) Construction of dams, roads and railways destroys huge patches of forests, grassland etc. thus, disturb the biodiversity. (vii) Indiscriminate killing of animals for different purposes has resulted in their reduction. (viii) Introduction of exotic/foreign species in an area threaten the survival of existing natural biodiversity; e.g., water hyacinth clogs rivers and lakes and threatens the life of many aquatic species in our country. 3. Conservation of Biodiversity Now you have an idea of the importance of biodiversity for our survival and how it is destroyed. Let us know how to protect the biodiversity. There are two basic strategies for conservation of biodiversity: (i) In-situ conservation (ii) Ex-situ conservation (i) In-situ (on site) conservation includes the protection of plants and animals within their natural habitats or in protected areas. Protected areas are areas of land or sea dedicated to protection and maintenance of biodiversity. For example: e.g., National Parks, Wildlife Sanctuaries, Biosphere Reserves, etc. (ii) Ex-situ (off site) conservation is the conservation of plants and animals outside their natural habitats. These include Botanical Gardens, Zoo, Gene Banks, DNA Banks, Seed Banks, Pollen Banks, Seedling and Tissue Culture etc. Endangered Species You have already learnt about the various reasons due to which our biodiversity is under constant threat. You also learnt about the strategy to protect the biodiversity. Let us know about some of the plants and animals which have already become extinct or are going to be extinct from the earth surface. The species, which have already disappeared, are called the extinct species and the phenomenon of disappearance is known as the extinction. Another category of species called endangered species are those which have been reduced in number to a critical level and facing a high risk of extinction in the near future. The World Conservation Union, formerly

has enlisted endangered plants and animals in the Red Data Book. Few endangered plants and animals are listed below:
85

Endangered Animals 1. Asiatic Lion, 2. Green sea turtle, loggerhead turtle, 3. Tortoise 4. Marsh crocodile and gharial 5. Tiger 6. Rhinoceros 7. Asiatic Elephant, Indian Python 8. Great Indian Bustard, butterflies Endangered Plants 1. Pitcher plant 2. Indian belladonna 3. Orchids 4. Nilgiri Lilly 5. Ginkgo biloba (Maiden hair tree) Wildlife Now we shall know about an important resource of the nature called the wildlife. At home you may have a pet dog or a cat, even some may have cows, buffalos, sheeps, goats etc. In your garden you may grow different types of vegetables and flower plants. In addition to these, there are other plants and animals, which are not cultivated or reared by you. The plants, animals and microorganisms other than the cultivated plants and domesticated animals constitute the wildlife. Animals and plants living in their natural habitat constitute wildlife. The wildlife forms an important resource as it plays a major role in maintaining ecological balance. It is used in research as experimental material and also used for recreational purposes. Like other resources it is also facing severe threat. So it should be conserved and maintained for the use of future generation. 1. Need for Conservation of wildlife Wildlife needs to be conserved for : ? maintaining ecological balance for supporting life. ? preserving different kinds of species (biodiversity). ? preserving economically important plants and animals. ? conserving the endangered species. 2. Methods of Conservation of Wildlife After knowing the need for conservation of wildlife, let us discuss how to conserve it. We can protect it by adopting various means, like: ? Establishing biosphere reserves, national parks and sanctuaries. ? Afforestation (Tree planting programme). ? Special schemes for preservation of threatened species. ? Improvement of natural habitats of wildlife. ? Educating people about the need and methods of conservation of wildlife. ? Formulation of Acts and Regulations to prevent poaching (killing animals) for sports and money. 3. Wildlife Reserves in India Many National Parks and Sanctuaries have been established to preserve wildlife in their natural environment. Some of them are given below along with the important species found in these. ? Kaziranga sanctuary (Assam) – one-horned rhinoceros ? Manas sanctuary (Assam) – wild buffaloes ? Gir forest (Gujarat) – lions, chital, sambar, wild bears ? Kelameru bird sanctuary (Andhra) – pelicans and marine birds ? Dachigam sanctuary (Jammu and Kasmir) – Kashmir stags, Himalayan tahr, wild goats, sheep, antelopes ? Bandipur sanctuary (Karnataka) – Indian bison, elephants, langurs ? Periyar sanctuary (Kerala) – elephants, barking deer, sambar ? Kanha National Park (Madhya Pradesh) – tiger, leopards, wild dogs ? Similipal National Park (Orissa) – mangroves, marine turtles lay eggs ? Bharatpur bird sanctuary (Rajasthan) – ducks, herons ? Corbett National Park (Uttaranchal) – tigers, barking deer, sambar, wild bear, rhesus monkey ? Jaladpara sanctuary (West Bengal) – rhinoceros 86
4. Agencies Dealing with Conservation of Wildlife There are various agencies both at national and international levels which take care of conservation of wildlife. Some of them are given below: (i) Indian Board for Wildlife (IBWL) advises state government on wildlife protection. (ii) Constitution of India includes forest and wildlife protection. (iii) World Wildlife Fund for nature (WWF) : It is an international organisation formed in the year 1961 and is engaged in protection of wildlife. India became a member of it in 1969 and has its headquarter in Mumbai. It has supported the well-known “Project Tiger”. (iv)

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International Union for Conservation of Nature and Natural resources (IUCN),

World Conservation Union (WCU) is engaged in protection of wildlife and their habitats. (v) Convention of International Trade in Endangered Species (CITES) is an international organisation to check trade products from endangered animals. India became a party to CITES in 1976. Legislation for Conservation Various acts and laws have been passed in Indian constitution for conservation of natural resources. Some of them are: ? Environment Protection Act, 1986 ? Forest (Conservation) Act, 1980 ? National Forest Policy, 1988 ? Wildlife Protection Act, 1972 and amended in 1991 Sustainable Development Till now we discussed how we have manipulated the existing natural resources using the advanced science and technology to create our own environment. Thus, in the process of overexploitation of natural resources, we have not only changed the natural environment but in some cases, destroyed it. The modern industries, factories, cities, towns, roads, railways, dams etc. have replaced the natural habitats of plants and animals. Thus, the natural resources are depleting gradually and a day will come when most of these will not be available for our future generation. So it is high time to think about maintaining a balance between environment and development so that both present and future generations can derive proper benefits out of these resources. This can only be achieved by the process

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of sustainable development. Sustainable development is the development that meets the needs of the present

generation and conserves it for the future generation. So we should leave water, air, soil and other natural resources as pure and unpolluted as when it came on earth. Sustainable development should include: ? reducing excessive use of resources and enhancing resource conservation. ? recycling and reuse of waste materials. ? scientific management of renewable resources, especially bio-resources. ? plant more trees. ? green grassy patches to be interspersed between concrete buildings. ? use more environment friendly material or biodegradable material. ? use of technologies, which are environmental friendly and based on efficient use of resources. Energy Resources We have always been using different form of energy obtained from various sources for our daily activity like cooking, heating, ploughing, transportation, lighting, etc. For example, heat energy required for cooking purpose is obtained from firewood, kerosene oil, coal, electricity or cooking gas. LPG (liquefied petroleum gas) We use animal power (horse, bullock, etc.) for transportation and for running minor mechanical devices like the Persian wheel for irrigation or for running a "kolhu" for extracting oil from oilseeds. Different forms of these energies are obtained from various sources. We will discuss about them in detail. 1. Types of Energy Sources There are two main categories of energy sources: (i) Conventional Sources of Energy, which are easily available and have been in usage for a long time. (ii) Non-Conventional Sources of Energy, that are other than the usual, or that are different from those in common practice. The table 2 below summarises the list of both the above categories of energy resources. 87

Table 1 - Various types of Energy Sources 2. Conventional Sources of Energy Let's first discuss about the conventional sources of energy. These have been in use since ancient times. Most important among them are the fossil fuels. So we shall know details about the fossil fuels. Fossil Fuels Fossil fuels are the fossilised remains of plants and animals, which over millions of years have been transformed into coal, petroleum products and natural gas. Coal is the most abundant fossil fuel. It is widely used for combustion in cooking and industrial activities. There are different types of coal products such as coal gas, coal tar, benzene, toluene, etc., which are used for various purposes. Oil and Natural gases are formed from plants and animals which once lived in the tropical seas. Oil (or petroleum) is a source of countless products. Apart from petrol, diesel and other fuels, petroleum products include lubricants, waxes, solvents, dyes, etc. Petroleum reserves are supposed to last for another 100 years or so. Natural gas is often found with petroleum. The gas mainly contains methane. Apart from serving as fuel in several industries, it is being increasingly used as domestic fuel in many countries including India. United States of America is the largest producer as well as consumer of natural gas. Now a days in big cities and town it is being supplied through pipelines which is called Piped Natural Gas (PNG). The natural gas is also used as a fuel to run vehicles. It is known as Compressed Natural Gas (CNG). It is accepted as an economical and less polluting fuel for transport. The Liquefied Petroleum Gas (LPG) is the common cooking gas used in Indian homes. It is a mixture of propane and butane gases kept under pressure in liquid form, but they burn in gaseous form. This gas is made available in a specific container for domestic as well as industrial uses. It is a byproduct of petrolium refineries 3. Non-Conventional Sources of Energy We have already learnt known about conventional sources of energy, whether renewable or non-renewable (coal, oil, etc.), which are fast depleting and will not last long. Therefore, greater utilisation of non-conventional sources of energy (solar, wind, hydro, geothermal, etc) will have to be used. We will discuss about some of these energy sources. a) Solar Energy Solar energy is the ultimate source of all energies on earth. Firewood, coal, oil or natural gas are the products of plants and other organisms, which had used solar energy for the synthesis of organic molecules during photosynthesis. Even today it will turn out to be the most important answer to problems of energy except nuclear energy. The solar energy has the following advantages: (i) It is abundant (ii) It is everlasting (iii) It is available everywhere. almost (iv) It is free from political barriers. Various technologies in which solar energy can be, and is being utilised are as follows: (i) Solar cookers 88

(ii) Solar hot water systems (iii) Solar dryers (used for drying crop yields) (iv) Solar air heaters (v) Solar kilns (vi) Solar desalination systems (vii) Solar batteries b) Hydel /Hydro Energy The generation of electricity by using the force of falling water is called hydro- electricity or hydel power. It is cheaper than thermal or nuclear power. For its generation dams are built to store water, which is made to fall to rotate turbines that generate electricity. c) Wind Energy Wind as an energy can be utilised in our daily life by converting it into mechanical energy. This mechanical energy is used to generate electricity, raise water from wells and rivers for irrigation and other purposes. Windmills have been in use since early times to provide power for grinding grains. It is also used for grain cutting and shelling. In India a large number of windmills are being constructed on the sea beach and hilly areas. d) Tidal Energy Tidal energy is one that is produced by making the use of water movement from a high tide to a low tide. Ocean waves and tides can be made to turn a turbine and generate electricity. Areas where rivers flow into the sea experience waves and tides and electricity can be generated there. It has much potential. As you know we have a large coastline and major river systems in our country, electricity can be generated on a large scale from waves and tides. e) Nuclear Energy Radioactive elements like uranium and thorium disintegrate spontaneously releasing large quantities of energy. This energy can be trapped to produce electricity. 25% of world's thorium reserve is found in our country, which can be utilised to generate electricity. Most advanced countries have nuclear power stations. We too have some in India, for example, Tarapur (Maharashtra), Kalpakkam (Tamil Nadu), Narora (Uttar Pradesh), Kota (Rajasthan). Approximately 3% of India's electricity comes from nuclear power and about 25% is expected to come by 2050. Installation costs of nuclear power stations are very high, but maintenance costs are relatively low. If not carefully maintained, these also have an inherent risk of causing radioactive pollution. f) Hydrogen Energy Hydrogen is the primary fuel for the hydrogen based fuel cells and power plants. Power can be generated for industrial, residential and transport purposes by using hydrogen. g) Geothermal Energy This is the energy derived from the heat in the interior of the earth. In volcanic regions, springs and fountains of hot water called "geysers" are commonly found. These eruptions of hot steaming water can be used to turn turbines and produce electricity in geothermal power plants. In this method cold water is allowed to seep through the fissures in the rocks till it reaches the hot rocks in the lower layers. Water gets heated and gets converted into steam which forces out to the surface to be used in power generation. Besides the superheated steam of hot springs can also generate electricity. There are 46 hydrothermal areas in India where the water temperature normally exceeds 150 degree centigrade. Electricity can be generated from these hot springs. h) Biogas Another form of non-conventional energy is biogas. It is produced by the microbial activity on cattle dung in a specially designed tank called digester. A mixture of water and cattle dung is poured in this digester where anaerobic decomposition takes place and biogas is generated. This gas contains 55 – 70 percent methane, which is inflammable and it is generally used as cooking gas and for generation of electricity. The "waste" left in the tank after the generation of biogas is used as manures. Thus, biogas plant provides us both the fuel and the manure. Biogas plants are becoming very popular in rural India. There are two types of biogas plants: (a) Family type gas plants- These are small and are used individually by a family. (b) Community type gas plants- These are large and are used by larger rural populations. 89

i) Bio-fuel You know it very well that fossil fuels have been the main source of energy for transportation and industries for more than a century. Their rapid consumption has depleted the reserves of fossil fuels. Their fast depletion and non-renewable nature has sent an alarm to look for alternative fuel. Among the fuels, consumption of liquid fuels is the highest. So there are attempts to identify potential plant species as sources of liquid hydrocarbons, a substitute for liquid fossil fuels. The hydrocarbons present in such plants can be converted into petroleum hydrocarbons. This liquid hydrocarbon is the bio-fuel and the plants producing it are called petro- plants. These plants belong to families Euphorbiaceae, Asclepiadaceae, Apocyanaceae, Urticaceae, Convolvulaceae and Sapotaceae. The plant species, Jatropha curcus is the most suitable one, which yields bio-diesel. The Indian Oil Corporation is carrying out experiments for preparation of bio-diesel from various vegetable oils extracted from rice bran, palm, karanjia, sunflower etc. Advantages of Bio-diesel Bio-diesel has several advantages; some of them are given below: d) It is an agriculture based fuel substitute. e) It can be made from both vegetable oil and animal fats. f) It can be used without major modifications in engines. g) It does not need separate infrastructure for storage and delivery. h) Handling bio-diesel is safer. i) Planting of Jatropha curcus will utilise wasteland in our country. j) It's combustion emits less carbon monoxide, sulphates, unburnt hydrocarbons k) and particulate matters, thus reduces air pollution. 4. Conservation of Energy Sources We have already leant about the different types of sources of energy and how they are useful to us. Now you think about your daily activities and the types of energy you are using in each activity. Make a list of the sources, which produce these energies. Everyday you and your family members are using four to five sources of energy. Similarly other people, industries and different establishments are using energy everyday. The demand for energy is increasing day-by-day and exploitation of the energy sources is on the rise. Thus, energy sources are depleting gradually. There is an urgent need to conserve energy, else adequate energy will not be available in future. Some methods to conserve energy are: ? Minimise exploitation of non-renewable energy resources. ? Emphasis on use of renewable sources of energy. ? Stop wastage of energy. ? Creating awareness among people regarding wise and judicious use of energy. ? More use of bio-mass based energy. Forest and Tribal Introduction Forests are home to many peoples, including a substantial population of indigenous peoples. It provides the source and means of survival. Center for International Forestry Research (CIFOR) Director General David Kaimowitz says: "One hundred million people depend on forests to supply key elements needed for their survival, either goods and services or incomes. At least one third of the world's rural population depends on firewood, medicinal plants, food, and compost for agriculture that comes from forest. Forests are also a major source of income for large populations of the rural poor especially in Africa and Asia, and to a more limited extent in Latin America." In spite of such importance, the forests cover in India as per the present assessment is 63.73 million ha. consisting of only 19.36 per cent of the total geographical area. Out of this 37.74 million ha. (11.48 per cent) is dense forest, 25.50 million ha. (7.76 per cent) open forest and 049 per cent million ha. (0.15 per cent) constitutes mangroves. Forest areas in the vicinity of population centers/ villages have been reported to be degrading very fast due to collection of fuelwood, cattle grazing and other types of exploitation. According to Registrar General of India, a provisional number of villages in the country having forest land in the immediate vicinity is estimated at about 1,70,000, with a total population of 147 million. The purpose of this chapter is to explain the relationship between the forest and Tribals especially with special reference to Tribal women. Tribal communities live in forests, and therefore, in India they are called 'janjatis' (forest dwellers). Their socio-cultural life is mostly woven around nature. Forest trees and common 90

property resources are basic to tribal communities, directly benefit them like a foster mother and fulfill their biological, cultural, religious and emotional needs. For food, tribals are mostly dependent on forest by collecting nuts, wild fruits, vegetables, leaves, flowers, roots, stems, honey, wild animal and insects etc. (Malik, 2004). Therefore, for conceptual clarity and disciplinary requirement we need to see the flexible linkage between forest and tribals as well as the tribal women. Classification of Tribes The tribal groups can be classified into six types - mainly on the basis of occupation. Besides, their eco-system, traditional economy, their supernatural beliefs and practices and recent impacts are taken into consideration in the classification. These six types are: 1. Forest-Hunting Tribes: It includes the tribal groups which live in the forests and are exclusively dependent on forest for their livelihood. They live in the huts made by the materials found in the forests. Their life revolves round the forest with primitive technology, limited skills and deep traditional and ritual practices. The Raji, the Soka in the Cis-Himalayan region, the Kukis and a section of the Nagas in Bihar, the Hill Kharea, the Korwa, Juanga Hill, etc. in middle India come under this type. However, the major concentrations of this type of tribes are in Southern India. 2. The Primitive Hill Cultivation Tribes: The tribe of this category is distinguished by the techniques of shifting cultivation. Besides, they are also engaged in hunting and food gathering. In this, they chiefly subsist on slash and bum cultivation. The practice of hill cultivation continues to be widespread in India as tribals inhabiting the hill forests of Assam, Nagaland, Meghalaya, Arunachal Pradesh, Manipur, Tripura and Mizoram in the North-Eastern regions, Orissa, Bihar and Madhya Pradesh in the middle India and Andhra Pradesh in the South are dependent on hill areas, and practice shifting cultivation. 3. Plain Agricultural Tribes: Predominantly the bulk of tribal population is dependent on agriculture besides supplementing their economy with hunting, gathering and fishing. They raise only one crop during the monsoon. Their life is marked by spiritism and celebration of seasonal and agricultural festivals. 4. Simple Artisan Tribes: The tribe under this category makes crafts for livelihood such as basket making (bamboos), tool making (iron and wood), spinning and making metal articles, etc. The Kinnaur in Himachal Pradesh produce wood products, the Kanjar in Uttar Pradesh, and Machali in Bihar, Uttar Pradesh and Orissa are engaged in basket making, the Karmali in middle India in iron smithy, the Argur and Agaria in Bihar and Madhya Pradesh, in cloth making, etc. A number of tribes from South India are engaged in making bamboo mats and baskets. 5. The Pastoral and Cattle Breeder Tribes: The tribe of Nilgiri in South India is examples of this type. The Toda are purely a pastoral type and inspite of all efforts to make them agriculturist they continue to cling to Pastoralism. In the North-Eastern Himalayas, the Gujjars, the Bacarwals, the Goddis and the Jodhs are pastoral communities who roam with their flocks of sheep, goats and cattle in search of pastures on high altitudes. These tribal communities living in different ecological settings have adjusted themselves in many ways. 6. Urban Industrial Worker Tribes: The tribal areas in India in general and tribal area into middle India in particular are rich in mining and industrial resources which have remained unexplored before the British rule. These tribal areas began undergoing fast industrialization after First World War and especially after India's Independence followed by urbanization. The industrial urbanization in certain tribal areas of Bihar, Orissa, and Madhya Pradesh has adversely affected the tribal folk. Most of the tribals in these areas have shifted to urban areas and have become industrial workers. (Tirpude College of Social Work, Planning commission report) The Major Tribes in India There are 533 tribal communities living in India as per the notified Schedule under Article 342 of the Constitution of India. Some of the major tribes of different States are: 91

Table 2 – Major Tribes in India According to 2001 Census, the total population of Scheduled Tribes and their proportions to the total population of India is presented in the following table. 3. Table 3 - Total Population, Scheduled Tribes and their population to the total population 92

Types of Tribals by Occupation a) Hunting, Collecting and Gathering Type They live by hunting, fishing, collecting roots, tubers, fruits, nuts and flowers. Leaves and fibers are used for making ropes while bamboo is used for making baskets and huts. Honey and wax are also collected by this category of tribals. b) Cattle - Herder Type The rearing of domestic animals is widely prevalent among tribals for their livelihood. Goats, bullocks and buffaloes are common while cows are few in number in tribal villages. Each of them has various uses. The goat is slaughtered for its meat on festive occasions and is even sold in case of contingencies like sickness, death etc. Many tribal people invest in cattle and their savings are 'mobile' though not very liquid. In times of need, cattle are sold in the cattle-markets. c) The Simple Artisan Type A number of tribes subsist on crafts and cottage industries like basket-making, tool-making (iron and wooden) and spinning and weaving, metal-work etc. There is crafts-wise specialization and the craftsman reside in the villages of other castes and communities. Handicrafts are a subsidiary occupation for most of the 'advanced tribals'. d) Hill and Shifting Cultivation Type The practice of hill and shifting cultivation is very common in many tribal areas. Shifting cultivation is essentially a regulated sequence of procedures designed to open up and bring under cultivation patches of forest lands, usually on hilly slopes. In shifting cultivation, the cultivators follow a pattern of cycle of activities which are as follows: ? Selection of a patch of hill slope or forest land and distribution of allotment of the same to the intended cultivators, ? worshipping of concerned deities and making sacrifices, ? cutting of trees, bushes, ferns etc., existing on the land before summer months, ? piling of logs, bushes and ferns on the land, ? burning of the withered logs, ferns, shrubs etc., to ashes on a suitable day, ? cleaning of the patch of land before the onset of monsoon and spreading of the ashes evenly on the land after a shower or two, ? sowing of seeds with regular commencement of rains, ? crude budding and weeding activities after sprouting of seeds, ? watching and protecting the crops, ? harvesting and collecting crops, ? threshing and storing of corns, grains, etc. ? merry-making and ? selling of crops. e) Settled Agricultural Type About 70 percent of the total tribal working population are cultivators, mostly of the subsistence variety. There are three types of land, upland, lowland and kitchen-garden varieties (mostly by women). There is total cooperation on a reciprocal basis during transplanting, sowing and harvesting of varieties of coarse grains as also rice, pulses and chillies. However, tribal communities practicing settled agriculture suffer from various problems, viz., (i) unproductive and uneconomical holdings, (ii) land alienation (iii) indebtedness, (iv) lack of irrigation facilities, (v) lack of power, absence of adequate roads and transport, (vii) lack of access to bank credit facilities, (viii) seasonal migration to other places for wages earning, (ix) lack of extension services and (x) lack of education and inadequate scope for modernization of their skills. f) Industrial Urban Worker Type A sizeable chunk of the tribal population in India have moved to mining industrial and urban areas for a secured living through wage-labour. In some instances, industrialization and mining operations have led to uprooting of tribal villages and the displaced have become industrial nomads. They have lost their traditional occupation, agricultural land, houses and immovable assets. They become unemployed and face unfair competition with 93

others in the Labour market. Their aspirations gradually escalated, although they invariably failed to achieve what they aspired for. Thus, the net result is frustration. Socio-Economic Development of Tribals 1. Tribes and Culture Tribals have their own culture and social life and thus important in India. With culture they also have own folklore, folksongs, dances etc., Almost all tribal communities posses rich mythologies, folk tales, stories which illustrate their affinity and relationship with tradition and traditional characters. With traditions they have their own general beliefs. They would like to derive the benefits of changing economic developments sweeping the country. They would like to share in the national mainstream. There is no doubt a problem is here and it is how to bring about socio-economic development and integration without sacrificing the cultural excellence that has marked many of these areas. It is essential to take into account the special characteristics of each of the tribes its level of socio-economic development, its system of values and the present stage of its material culture. 2. Languages and Dialects Linguistically tribes in Tamil Nadu speak Tamil, Malayalam, Kannada and old dialects of these languages. The isolation provided by the hills and inaccessible forests preserved some forms of old dialects of the Dravidian Language family. Malayali, Toda, Sholaga, Kurumbas, Kadar, Paniyan, Pulayan, Irular, Malai Malasar, Muduvans and Malaikuravans are a few such examples. A majority of the tribals in Tamil Nadu live on hilly ranges; viz., Eastern Ghats, Western Ghats and the discontinuous hill tracts adjoining the Tamil Nadu plains, and the areas adjoining the hills. Irular, the second important scheduled tribe, found in Chengalput district are scattered in large number on the plains. Only a small proportion of tribes (12.0 per cent) are found in urban areas compared to 34.15 per cent urban inhabitants for the whole population of Tamil Nadu state. Socio-economic and cultural complexities distinguish tribal groups in Tamil Nadu. The tribal communities have diverse subsistence patterns. Todas and Paniyans in Nilgiris are basically pastoral. Kadars, a food gathering tribe, have now taken to plantation work and agricultural labour. Kurumba, Urali, Pulayan and Malai Malasar depend on hunting, gathering forest produce including honey and also cultivate on a small scale. The tribals living on the hill ranges such as Malayali, Kota, Irulars are mainly dry land cultivators depending on monsoon with a few patches of irrigated land and coffee plots as well. Irulars are also expert snake-catchers and are employed by the neighbouring agricultural caste to catch the rodents destroying the crops. Forest plays a vital role in the economy of all the forest dwelling communities irrespective of their subsistence activity. Forest is utilized for grazing their cattle, wood for fuel, implements and huts, medicinal herbs for curing diseases, and to obtain minor forest produce satisfying various needs such as food, fibre and for sale. According to 2001 census 44.47 per cent of tribal workforces are cultivators. Similarly, the proportion of Scheduled Tribe agricultural labourers is 31.97 per cent, which is higher than the state average (29.89 per cent). A higher proportion of agricultural labourers indicate a bulk of tribals without land depending on others for their livelihood. This is a disturbing phenomenon emerging on the tribal scenario. Traditionally tribals owned the land, water and forest resources on a community basis. Till recently, and in some hill ranges of Tamil Nadu even now, no proper survey records are available. With the emergence of private ownership of land, forest restriction and intrusion of the non tribals, a gradual process of alienation of a section of the tribals started from the land and forest hitherto owned and operated by them. Intra-tribal difference inland ownership is also on the increase. The increase in population size and the limited land available leads to fragmentation and disputes within a lineage. All the tribal groups have their traditional political structure and are custom bound. The common rights over village precincts, grazing land, and the traditional village Panchayaths had regulated forest resources. The imposition of forestry laws and rules, formation of statutory Panchayats, and accessibility to courts have in some places diluted the authority of traditional functionaries in the recent years. Tribal Development Strategies in India Development has become an enemy of some tribal groups, particularly small tribal groups, which have remained outside national political systems. In their greed, the national majorities or the larger groups have been grabbing tribal land through legislation or even illegally, without even following the formalities for acquiring oil, mining and timber. Some tribal farmers elsewhere have to see their lands flooded by dams or other kinds of developmental activities with the help of administrators. When India attained independence, the new democratic state was made aware of its responsibility towards the welfare of the tribal people living in areas however remote and inaccessible they might be. The constituent assembly accepted this and the tribal problem at once become an integral part of the development of the Indian people as a whole. Thus, the constituent assembly passed some of the provisions, like article 46, which embodied the new policy, its message of hope for millions of our citizens hitherto neglected. Out of article 46 94

flow all safeguards for weaker sections including Scheduled Tribes. Thus, the goal set by the Constitution assures a progressive life to the members of these weaker sections of our community. The primary objective of the government policy in regard to tribal people and areas has been directed to preservation of tribal culture and social customs from erosion, safeguarding their traditional occupations, protection against exploitation by more sophisticated groups, and their economic and social development. Therefore, two prominent components of the national efforts for development of scheduled tribes and the scheduled areas are protection and development. This two-pronged approach has been necessitated because of the realization that elimination of exploitation, coupled with a rapid development alone could bring lasting benefits to these groups. Protection is afforded through various laws, regulations and government orders based on the provisions of the Constitution. Socio-economic development is undertaken as an integral part of national development planning. Problems of Tribals Tribal lands have been acquired by the Government for various development purposes. Land owners, contractors, moneylenders, missionaries etc., have also encroached the land of the tribals for their own benefits. As a result, the problem of landlessness has come into existence in tribal areas. The economy of tribals is subsistence oriented. The concept of saving is not known because they generally produce perishable things, which cannot be stored for a long period. The non-tribals and moneylenders have entered in the tribal areas that purchase the things produced by the tribals at low rate. They provide loan to the tribal at exorbitant rate of interest. Thus, they exploit the tribals on account of such practices, tribals have to face the problem of poverty. In hilly and forested areas, tribals build their houses with the help of mud, wood, grasses, leaves, bamboos, etc. These houses are easily destroyed by heavy rain, air and fire. They have to face the problem of housing. Previously, forest was the chief source of gainful employment of the tribals round the year. But the establishment of Government administration in the forest and enactment of forest acts snatching away the traditional rights of tribals over the forests has brought the problem of unemployment among the tribals. Now-a- days, reciprocal exchanges are in the way of vanishing. Tribals have to incur loan from the moneylenders. The moneylenders charge high rate of the interest on loan. Being unable to pay the loan and interest and to take more loans before the expiry of the first loan, forced the tribals to become bonded labour in the house of moneylenders. As bonded labour they loose all kind of freedom. They are paid very nominal wages and have to work at beck and call of the moneylenders. In this way, the lord of the forest has become the slave of the moneylenders. They are facing the problem associated with bonded labour system. The tribals have been practicing the shifting cultivation since time immemorial. But the establishments of government administration, a number of problems have come up before the tribals related to shifting cultivation. Fundamentally, livelihoods of the Tribals are poor. They have to struggle hard for their existence. They keep their children engaged in the household chores since very childhood. Although some government schools are situated in their areas, the importance of bread more than education forces them to make their children as child labour and earn little from their wages. As a result, the tribals have to face the problem of illiteracy. The tribals have to face the problems related to health also. They live in such a houses, which do not have access to air and light. They do not have drainage system. Their roads are made dirty. They drink water from dirty ponds. As a result they have to face a number of problems related to health and sanitation. The tribals have to face the problem related to malnutrition. Previously, tribals used to go for hunting and food gathering in the forests. They used to solve the problem of balanced diet from the practice of hunting and gathering in the forest. But now they are dependent only on small agriculture and wage earning. The income from agriculture and wage earning is not sufficient to meet the requirement of balanced diet. Majority of them are living below the poverty line and are also facing malnutrition. The tribals live in small settlements. A settlement is defined as any permanently occupied human dwelling place. Although an isolated occupied hut may be described as a settlement, the word more usually indicates a community of dwellings and associated buildings, ranging from a hamlet to a conurbation (Smith, 1984). A tribal settlement also refers to an organized habitation of the scattered tribals in individual families. Tribal families wandering from one place to another, those who are confined to the promises of their employers or families who already lived in other clusters or settlements, shift their residence individually or in small groups to settle down in a new habitation. They may shift their residence individually or in small groups to settle down in a new habitation. They may shift their residence out of their choice, upon suggestion or invitation by fellow tribals or out of compulsion from their employers or for any other reasons. A collection of such families who are concentrated in one place may be called a settlement. The areas which tribals live do not provide employment to the tribals round the year. During the agricultural season, they get employment in their own small lands. Those who do not have sufficient land, get employment as agriculture labour. After land, forest was another means of employment round the year. But decrease in forest areas due to illegal cutting of trees, the establishment of government administration and 95

policies have snatched away the employment opportunities of the tribals. Now, they have to migrate to other places for work. As migrant labour, they have to face a number of problems. Policies for Tribal Development Tribals are at the bottom of social and political ladder in India. Development projects have not only bypassed them, but have often harmed them by taking away their lands and other resources on which their livelihood was based. Unless the processes which result in their proletarianization are identified and corrective action taken to prevent it, chances are that new programmes will continue to ignore their interests as in the past. From the viewpoint of policy, it is important to understand that tribal communities are vulnerable not only because they are poor, asset less and illiterate compared to the general population; often their distinct vulnerability arises from their inability to negotiate and cope with the consequences of their forced integration with the mainstream economy, society, cultural and political system, from which they were historically protected as the result of their relative isolation. Post-independence, the requirements of planned development brought with them the specter of dams, mines, industries and roads on tribal lands. With these came the concomitant processes of displacement, both literal and metaphorical — as tribal institutions and practices were forced into uneasy existence with or gave way to market or formal state institutions (most significantly, in the legal sphere), tribal people found themselves at a profound disadvantage with respect to the influx of better-equipped outsiders into tribal areas. The repercussions for the already fragile socio-economic livelihood base of the tribals were devastating - ranging from loss of livelihoods, land alienation on a vast scale, to hereditary bondage. As tribal people in India perilously, sometimes hopelessly, grapple with these tragic consequences, the small clutch of bureaucratic programmes have done little to assist the precipitous pauperisation, exploitation and disintegration of tribal communities. Tribal people respond occasionally with anger and assertion, but often also in anomie and despair. However, that too is branded as a typical Taw and order' problem, ignoring its socio- economic dimensions. In nutshell, the following are the persistent problems that have by and large remained unattended which need immediate redressal (Saxena, 1998) ? Relation with forest officals; ? government monopoly over NTFPs; ? Land alienation and indebtedness; ? Involuntary displacement due to development projects and lack of proper rehabilitation; ? Ineffective implementation of Panchayats (Extension to the Scheduled Areas) Act of 1996 (PESA, 1996) for Schedule V areas; ? Shifting Cultivation; ? Weak governance, and poor programme delivery, especially in health and education; ? Insensitive reaction to upsurge of tribal anger against the exploitative system. Inter-Linkages between Forests and Tribals Tribal depend upon forests for their existence in several ways. The degree of dependence of tribals on forests depends upon the various factors. These factors include their socio-economic condition, distribution, cultural and religious norms, literacy etc. The primitive tribes, who live inside the dense forests are very poor and depend entirely on forests for meeting most of their needs. However, the tribal communities, which have gained access to the modem ways of life. (Nautiyal and Kaul, 2003). The dwindling of forest resources has also forced tribal people to look for alternative means of meeting their needs for consumption, income, employment, cultivation, pastoralism, and their cultural and religious needs. Forest helps to alleviate poverty through the creation of both on-farm and off-farm employment and income. Income is earned from wages or through sale of products. As indicated earlier, through forest-based growth centers, problems of backward and underdeveloped regions can be addressed. People can be involved and employed in a chain of activities such as seed collection, nursery operations, seedling sales, planting and maintenance of trees/plantations, tending, infrastructure development, logging and transportation, harvesting of NTFPs, primary and downstream processing of varying scales and sophistication, product distribution, and end use activities (e.g. Construction). Many of the forestry activities can be organised to benefit rural women and the landless. The forest-dwellers, mostly the different tribal communities, depend primarily on the Non-Timber Forest Products (NTFPs) for their subsistence, while the forest based industries depend on the commercially valuable wood. Besides the forest dwellers, to a vast majority of the tribal population, forest is one of the main sources of subsistence. They collect food from the forest, use the timber to construct their houses or make different types of implements, collect fuel-wood for cooking and different other objects from the forests required by them for a variety of purposes. A large number of tribals eke out through collection of non-timber forest products like sal and tendu leaves, mahua flowers, sal seeds, fruits, resins, lac, tassar cocoons etc. In Bihar, Orissa, Madhya Pradesh, and

Himachal Pradesh, it has been noted that more than 80% of the forest dwellers collect/ get 25% to 50% of their food from forests. Many people depend on wild fruits, timbers, leaves, wild animals and birds for food during lean months of the year. The tribals living at subsistence level largely depend on forest, particularly on non - timber forest produces. Forest and Fuelwood The dependence of the tribals on forest as a source of fuelwood is very conspicuous. There is no doubt that with the decrease of forest area, it has become extremely difficult for the tribals to collect the fuelwood. In some of author's studied areas, collection of fuelwood is practically a day's work which is usually done by the tribal women. A study on the Indian subcontinent showed that the situation is especially critical in the Himalayan foothills. Eckhlom (1976), who has done an extensive research in developing countries including India. In fact, the fuelwood crisis directly affects the poorer sections of the rural population in the 3rd world and possibly due to this reason, it has not attracted so much attention. In a study, it has been noted that about 95% of the fuelwood in the countryside comprises of firewood, cowdung and agricultural waste (Pant, 1978). Oil and electricity are not likely to meet the increasing demands in the rural areas to any appreciable extent. Naturally, the dependence, particularly on firewood and consequently on forest, will be there and is likely to increase in the future. Besides being the main source of fuelwood for cooking, the forest is also one of the main earning sources where the collected fuelwood is sold in the markets. This, no doubt, can be responsible for deforestation to a limited extent, but even then total restriction on the use of forest cannot be advocated and supported for the simple reason that this happens to be the one and the only source of income. Naturally, unless and until alternative sources or avenues are opened, this type of strategy can have a number of evil effects. On the other hand, if the tribals appreciate that by not cutting the trees, they would gain in future, they would always try to preserve it. In a number of cases where tassar production has been introduced under social forestry programme, this has definitely helped to preserve the forest area. (Chaudhuri, 1989) Forest and Tribal Socio Cultural Systems The tribal socio-cultural life is intimately connected with forest ecology. Forest is an inseparable part of tribal life. "Directly or indirectly in the tribal mind forest symbolises life in its manifold manifestations i.e. home, worship, food, employment, income and entire gamut. Tribes can, in fact, be regarded as children of the forest" (Burman; 1982). Among most of the tribal communities, the presence of sacred-grove is noticed. It is such a concept of tribals which ultimately manifests their world. "It is believed that the deities, representing various elements of nature such as sun, rain, fire etc. reside in these sacred groves." (Ramakrishna, 1989). The processes of socialization among the tribals inculcate the knowledge and importance of sacred groves. Young tribals are taught to respect nature through sacred groves. In the tribal society, communal hunting symbolises the cooperative motive of life. Most of the tribals in Chotanagpur region perform this ceremony on the day of Buddha Pumima (full moon day). It is not only a festival to have some games from the forest, but a systematic training of hunting methods also. Forest also plays an important role in the communication process among the tribals. The Santal system of Girabandha is an excellent means of mass communication. Symbolic use of Sal leaves in this practice may be considered as ritualistic; nevertheless, the dependence on forest cannot be ignored. The intimate relation of forest with many rituals performed by the tribals is also rejected, if the practices and items of rituals are examined. Different plants are often used for specific rituals. For example, Sal (Shorea robusta) is worshipped by the Santals during Sarhul worship. Many of the totem clans among the different tribal communities are derived from plants and animals that the concerned groups always try to protect. Thus many of the species in nature are protected from random exploitation as the tribals traditionally protect them. Forest Protection and Tribals There is no doubt that pressure on forest has increased considerably in the recent past which has resulted into gradual decrease of forest area. A number of afforestation programmes have been taken in many areas for the development of the forests and new trees have been planted. There is no doubt that more attention is given to develop trees having great commercial value, as the importance of forests as revenue earner has increasingly been emphasized. It has been noted that most of the trees having great commercial value, which are planted under the various afforestation programmes are of little use to the forest-dwellers or tribals. In fact, such varieties of trees are planted which are often required for industries, mostly located far from the forests. Thus, this type of development of forest cannot really help the tribals and forest dwellers either in the context of using the forest produce or through generating new employment opportunities locally. The situation has become more acute and critical where new plants are systematically planted replacing the earlier varieties, which were required or utilised by the tribals including the forest dwellers in a number of ways to meet their various 97

demands. Thus, the new afforestation programmes have not only affected and disturbed the existing tribal economy; it could not even provide an alternative. These types of forest policy in the context of afforestation programmes have already witnessed a number of tribal unrests and conflicts in different parts of India, particularly in the Chotonagpur region. There are many instances where the tribals, in a group, have uprooted the new such commercial trees planted earlier by the Forest Department (FD). In many areas, it has been noted that the tribals are so intimately connected with the forest that they are quite aware about the utility and usefulness of various trees which should be planted under afforestation programmes. Sometimes, this has developed through their close association with forest and keen observation of the forest-ecology. But unfortunately, this traditional knowledge is never utilised at the time of afforestation programmes. The weaker sections of the society, particularly the tribals, spend much time on collection of fuelwood from the forests. But often only a negligible portion of fuelwood is left for this in the context of new afforestation programmes even though one of the objectives of the social forestry programmes is to supply fuel to the people, particularly the tribals, in the shortest possible time. There is no doubt that in this type of afforestation programme, the involvement of the people will be minimum. Thus, the afforestation programmes have often failed to do justice to the goal of social forestry and even failed to bring the community to actively participate in the tree plantation programme. The observation of Fernandes (1989) that the new afforestation programmes have helped the strong and went against the interest of the weak is really applicable to many cases in India. It was never realized that there are many people who need forests for their survival. Again, when the tremendous ecological crisis was felt and huge raw materials were needed by the multinational companies, afforestation programmes were undertaken mostly funded by international organisations. Forest, Health and Nutrition of Tribals Health and nutrition, particularly in the tribal societies, is intimately connected with forest. It has been reported in various studies that the tribals who are living in remote areas have a better health status and more balanced food than those living in less remote and depleted forest areas. (Chaudhuri, 1986; Chaudhuri et.al.1989; Chaudhuri, 1991) In the Report of the Roy Burman Committee on Forest and Tribals, it has been noted, "It has been possible for the tribal ...community to subsist for generations with a reasonable standard of health because forest provided their food such as fruits, tubers, leafy vegetables, shoots, honey, flower juices, grass, game, fish, etc." Medicinal herbs and plants which they have been using for treatment of diseases and maintaining health are today the source of modem medicine. In two recently completed studies (Chaudhuri, 1991) related to tribal health, it has been noted the various roots and tubers available in the forest or small animals they can hunt supply a more balanced nutritional status of the tribals, but due to deforestation as most of the roots and tubers are not available in many area, the health and nutrition have been affected. Again, in many cases, it has been noted that certain diseases may be common in certain areas, but remained controlled due to certain food habits based on vegetation available locally. Forest helps to maintain a balanced ecosystem in nature and supplied sufficient food to the people who depend on it. So, any type of degradation in the forest environment is likely to affect the balance thereby adversely affecting the concerned population. Health and treatment among the tribals, particularly the forest-dwellers are also very much connected with the environment, particularly the forest ecology (Chaudhuri, 1991). "Since' the forest happens to be the main source of getting medicinal plants, the different Forest Acts restricting the use and exploitation of forest resources are adversely affecting the health and treatment in tribal societies. Thus apparently though there does not exist any relation between forest and health of an individual, in reality, the Forest Acts, deforestation and even certain types of afforestation programmes with commercially useful mono-plant forest may adversely affect the health and treatment of the tribals." (Chaudhuri, 1992). The tribals traditionally depend on forests for medicinal plants and also animals' parts of which are used for the treatment of diseases. Due to environmental degradation and deforestation, many of these medicinal plants or animals are not available. Again, due to various restrictions imposed by the Forest Department on the use and exploitation of forest resources, collections of medicinal plants have become difficult. Besides, due to the afforestation programmes often promoted by the Forest Department and since more emphasis is given on commercial trees, medicinal plants have become difficult to get affecting the health of the tribals. Forest Policy and Tribal Unrest Traditionally, the tribals enjoyed and exploited the forest resources. When the British came into power, they immediately realised the usefulness of the forest and promoted commercial exploitation of forests. The same process is still continuing. Declaration of 'Reserved' and 'Protected' forest has curtailed the rights of the tribals, particularly the forest dwellers. Forest and forest resources were earlier enjoyed and controlled by the forest dwellers and the tribals. Now it is largely controlled by the state. It is not unlikely that the forest policy of the 98

government can be influenced by the powerful industrial and commercial interest and often at the cost of poor tribals. It is also not always possible for the people to accept the faulty forest policy and bear the loss, both economically and ecologically. So they revolt against the policy of the government. In fact, many of the forestry programmes are often funded by the international agencies like the World Bank and the policies are often influenced by the fund giving agencies, who remain silent on the social relations, look after the interest of the developed countries or the industrial sector of the concerned country and help in widening the disparities. Apart from this, many of the so-called developed programmes have promoted displacement of the local population, particularly the tribals. Fernandes has conducted a very interesting study on the nature of displacement of tribal population due to various so-called development programmes. Unfortunately, the tribals have mostly suffered but they did not receive much benefit of these programmes. Status of Tribal Women Forests are vital for the healthy state of our global environment. And in the area of forests women play a major and critical role. They are intimately familiar with the forest like the nooks and crannies of their home. In many societies, women have for centuries been the gatherers of firewood and Non-Timber Forest Products and water-fetchers. They are the herbalists and ritualists. The women in the tribal community, as in other communities, constitute half of the tribal population. The well-being of the tribal community, as that of any other community, depends importantly on the status of their women. The popular image and perception of the tribal women is that of being better off than their non-tribal counterparts. There is no child marriage, no stigma on widowhood. She enjoys the right to decide about her marriage, etc. Instead of dowry there is bride price indicating high social status of the tribal woman. A tribal woman can divorce and remarry easily. She earns and is, therefore, to a great extent economically independent. However, there are many facts which indicate a low status for the tribal woman. For example, she does not have property rights except in a matrilineal society which is a small proportion of the tribal population. She is paid less as wages than her male counterpart for the same work. Several taboos discriminating against tribal women exist in certain tribal groups implying impurity and low status. The development projects have adversely affected the tribal women. With deforestation they have to travel a longer distance to gather forest products. Incidentally this has been one of the reasons for the participation of tribal women in Chipko movement to save the trees. There are evidences of sexual exploitation of tribal women by forest and mining contractors. The incidences of sexual assaults on tribal women have increased. Status is customarily defined by social scientists as a recognised social position or socially defined position of an individual or a community within a society. In recent times many attempts have been made to understand the status of women in the tribal society. Robert Lowie (1920) has suggested four different criteria to determine the status of women in a society i.e. (i) actual treatment, (ii) legal status, (iii) opportunity for social participation and (iv) character and extent of work. Empowerment of Tribal Women Among the tribal society, birth of a girl is not looked down upon because they are considered as economic assets. They participate in all agricultural operations (except ploughing), they work in all sectors of indigenous cottage industries, tribal arts and production of articrafts. Tribal women enjoy lot of freedom before and after marriage. The wife may divorce her husband on the grounds of cruelty, impotency, incompatibility, poverty, infidelity or negligence. Traditionally the institute of divorce exists and divorce is granted by the Village Panchayat. The tribal woman may just walk out of her husband's house with/without intimation to her husband. Though she enjoys full liberty to choose her life partner and also to break the marital bond and marry with another person, for the tribal men it is not possible to cause harm to the modesty of a married woman. Severe penalties and punishments are inflicted on the man in all such cases. The women thus enjoy an almost equal status with men except in the sphere of rituals. Cultural role The Cultural life of tribal communities is very rich. Music, dancing and singing occupy pivotal place in their culture. They have community entertainment with total village participating and the men, women, boys and girls all participate at equal level. They freely sing and dance with each other and joking, laughing and go on freely, especially on the occasion of marriages, and/on festivals like Holi, Dashera, etc. Men and women of all ages dance in ecstasy on the rhythm of the drums throughout the night. It is only in the tribal rituals connected with religious practices that the men folk get a priority over the women. Alcoholism among tribals also contributes towards the misery of the women in the house. (Deogankar, et. al, 1996). 99

Non- Agricultural Activites Only less than 10% of the tribal women are involved in activities other than agriculture. This is less than half the percentage of females in the general population in similar occupations. This category includes livestock, forestry mining/quarrying, manufacturing/processing/servicing and repairs in household as well as non-household industries, trade/commerce and services. Employment Status of Tribal Women A very large majority of the tribals (almost 90%) are engaged in agriculture; their other economic activities being food gathering (including hunting and fishing), pastoral, handicrafts, trade and commerce, and industrial labour. Rarely are they engaged in only one occupation. The employment status of tribal women may be considered in terms of their work participation, agriculture, forests, non-agricultural activities and impact of development programmes. Dependence of Women on Forests Women have always had a very crucial role to play in the preservation of forests because in India, since ages, women have looked after the food, fodder and water requirements of the family and they had been affected the most due to degradation of forests. For the rural women forests as common property resources provide the essential resources base for forest based livelihood strategies. Since long women folk have been actively engaged in using forest produce for their essential family needs. Collection of fuel and fodder from the forest has been the basic responsibility of rural women. However, depletion of forest cover in India over the last several decades has resulted in number of problems for women as, now they have to walk further and search harder to lop fodder for cattle and collect fuelwood. It is therefore natural that no other section of the society can be more interested in protecting, preserving and promoting forests than the women folk. It is therefore, quite befitting that the participation of women in forestry be made more meaningful through the identification of their role and planning for their maximum participation in the protection, management and development of forest resources. (Bourai, 2003). Women's role in forestry in developing countries is diverse, and women take active role in a variety of non-politicized instances. Unfortunately, the information based on these various roles tends to be very poor. As a result, many recommendations for program interventions and reports on the forestry sector have over looked a number of potential avenues for involving women. Moreover, there is a worrisome tendency to over generalize women's roles in forestry based on a few location specific examples. Literature forum and agencies, environmentalist and NGO flora instances, for instance, focuses on such dramatic examples as the chipko movement in northern India in which women become highly politized over the issue of forest depletion. While Chipko is an important movement, it reveals only one facet of the dynamics of women's involvement in forestry worldwide. It would be unrealistic to expect women everywhere to attempt to protect trees and forests as the chipko women have done-because of the strong position of women in that society. Perhaps due to the poor data base on the economic role of women now play and could play in the forestry sector - in forestry on public land as well as in tree cropping within the farming system on private land- women's issues have usually been regarded as welfare and equity concerns. As a result, concrete programs have centered on easing women's fuel and fodder collecting workload in the interest of their health and welfare. The status of women in tribal societies can be analysed by describing their condition or state, social position or standing in the family and community and comparing these indicators with respect to tribal women with those of other groups in tribal and non-tribal societies, (for example, tribal and non-tribal males, non-tribal females, etc.) In general, it is held that women in tribal societies enjoy a higher status than their non-tribal counterparts or even their own men folk mainly because of the leading role they play in production. As evidence of this phenomenon is cited the fact that among other things, in many tribal societies, a women can own property and has bride paid for her. While high lighting the loss of status of a tribal women in a non-traditional setting in which she is transplanted as a result of development, it must be remembered that her status has to be viewed in the proper context and her situation should not be isolated from that of other sections of society (including tribal men) which are exploited due to the onslaught of capitalist development. Most tribal women, like others in this larger group of the 'victims of development' become unequal partners, are marginalized and are left behind in the process of growth because they along with others like them, do not own the means of production in the new set up and do not or cannot adjust to the new circumstances. Yet, a tribal women's situation is in same ways unique which sets her apart from other exploited groups, both tribal and non-tribal. Her lack of education and skill and the absence of unionization among tribal women vis-a-vis tribal and non-tribal male workers and non-tribal female workers make her particularly vulnerable and accord her the lowest status among the exploited. She therefore suffers from the low wage, poor health, par working conditions nexus like all other exploited groups but probably does so even more acutely than her non-tribal sisters or non- 100

tribal brothers. There is not only a gender but an ethnic dimension to the exploitation of women in the work place. Then again, with the spread of "development", tribals in general seem to be moving in the direction of emulating the cultural and socio-economic patterns of caste Hindu groups and losing those features of their own society which had positive consequences for the status of women. So in the intra-tribal situation as well, tribal women have lost their traditional position vis-a-vis that of men as a result of their exposure to 'superior' cultures as a consequence to development. Thus, in many tribes which have now taken to settled cultivation, there are taboos against women touching the plough. From communal ownership and control of land many tribal societies have moved to a situation where legal ownership of land has been vested in the tribal male so that women have lost out to men. Violence against women, manifesting itself in practices like with hunting have developed or have become popular among tribals as extra-legal methods of depriving tribal women of their control over land. In situations where the tribals have been taken to non-agricultural occupations. Many tribal males have had to migrate to earn a living, leaving the women folk to fend for themselves and to provide for their children, imposing a double burden on them and making their condition worse. Where both tribal men and women have taken to non-agricultural occupations also, tribal women are generally at disadvantages as compared to their male counter parts because of their relatively low educational attainments, low levels of skill and non- involvement in the trade union movement. The main reasons behind the loss of status of women in tribal societies vis-a-vis their men folk in a non-traditional set-up is their subsidiary role in production in the new setting as compared to that of tribal males and the fact that their traditional skills have become redundant. Tribal Women and NTFPS NTFPs play a key role in the life and economy of rural and tribal communities living in and around forests. They provide 50 per cent of income for 20-30 per cent of the rural and tribal people in India (Theagarajan, 1994). Women are the collectors, head loaders, users and sellers of forest produce. It is women who collect fuelwood for cooking and wage earning purposes, as they do not have any other alternative sources of employment. The rural women take care of cattle grazing in the forests. Women have the capability of picking flowers, oil seeds, medicinally important plant parts, separating fibres, tapping gums and resins, making leaf plates, dyeing, tanning and many other jobs, forming a long list. Even today in many parts of the country women collect potable water from perennial jungle streams passing through forests. NTFP-based industries in which women can play a significant role are agarbatti making, lacquer work, tasar silk rearing, fruit preservation, myrobalan, bidi making and soap substitutes from ritha and shikakai fruits. These enterprises offer immense opportunities to women in employment and income generation. Thus NTFP enterprises reveal that women can be very suitably employed at various stages for the fulfillment of cottage and small scale industries. In addition to this, considerable employment and income can be generated to women who can help in ameliorating the quality of life and ensuring adequate socio-economic development. Women are the linch pin that connects the livelihood strategies of tribals households with forest wealth. Tribal women are largely responsible for collecting and processing many of the forest products. The goal is to explore the critical role that tribal women play in sustaining tribal households and the resulting implications for crafting and implanting forest co-management programs that are sensitive to the pivotal role played by women in extracting forest products. The Primary players in the collection, processing and marketing of NTFPs are women who gather the bulk of forest produce, including food and fuel- related forest products. Women also gather NTFPs that are primarily sold in the market, Men are mainly responsible for construction timber, poles and same collection of medicinal plants which are also gathered by women. Hazardous Waste: Management and Treatment

Hazardous Waste: Identification and Classification

Hazardous wastes refer to wastes that may, or tend to, cause adverse health effects on the ecosystem and human beings.

These wastes pose present or

potential risks to human health or living organisms, due to the fact that they ? are non-degradable or persistent in nature; ? can be biologically magnified; ? are highly toxic

and

even lethal at very low concentrations.

The above list relates only to the intrinsic hazard of the waste, under uncontrolled release, to the environment, regardless of quantity or pathways to humans or other critical organisms (

i.e., plants and animals). The criteria used to determine the nature of hazard include toxicity, phytotoxicity, genetic activity and bio-concentration. The threat to public health and

the environment of a given hazardous waste is dependent on the quantity

and characteristics of the waste involved.

Wastes are secondary materials, which are generally classified into six 101

categories as inherently waste: like materials, spent materials, sludges, by- products, commercial chemical products and scrap metals. Solid wastes form a subset of all secondary materials

and hazardous

wastes form a subset of solid waste. However, note that certain secondary materials are not regulated as wastes, as they are recycled
and reused.
Figure 2 illustrates the relationship among secondary materials, solid wastes and hazardous wastes.
Note that for a material to be classified as a hazardous waste, it must also meet the criteria specified in the regulatory definition of solid waste. 1.
Identification By using either or both of the following criteria, we can identify as to whether or not a waste is hazardous:
(i) The list provided by government agencies declaring that substance as hazardous. (
ii)
Characteristics such as ignitibility, corrosivity, reactivity and toxicity of the substance.
Let us now explain these two criteria. Listed hazardous wastes (priority chemicals) A specific list showing certain materials as hazardous wastes minimises the need to test wastes as well as simplifies waste determination. In other words, any waste that fits the definition of a listed waste is considered a hazardous waste. Four separate lists cover wastes from generic industrial processes, specific industrial sectors, unused pure chemical products and formulations that are either acutely toxic or toxic, and all hazardous waste regulations apply to these lists of wastes. We will describe these wastes, classified in the F, K, P, and U industrial waste codes, respectively, below F-list: The F-list contains hazardous wastes from non-specific sources, that is, various industrial processes that may have generated the waste. The list consists of solvents commonly used in degreasing, metal treatment baths and sludges,
waste waters
from metal plating operations and dioxin containing chemicals or their precursors. Examples of solvents that are F-listed hazardous wastes, along with their code numbers, include benzene (F005), carbon tetrachloride (F001), cresylic acid (F004), methyl ethyl ketone (F005), methylene chloride (F001), 1,1,1, trichloroethane (F001), toluene (F005) and trichloroethylene (F001). Solvent mixtures or blends, which contain greater than 10% of one or more of the solvents listed in F001, F002, F003, F004 and F005 are also considered F- listed wastes. K-list: The K-list contains hazardous wastes generated by specific industrial processes. Examples of industries, which generate K-listed wastes include wood preservation, pigment production, chemical production, petroleum refining, iron and steel production, explosive manufacturing and pesticide production. P and U lists: The P and U lists contain discarded commercial chemical products, off-specification chemicals, container residues and residues from the spillage of materials. These two lists include commercial pure grades of the chemical, any technical grades of the chemical that are produced or marketed, and all formulations in which the chemical is the sole active ingredient. An example of a P or U listed hazardous waste is a pesticide, which is not used during its shelf-life and requires to be disposed in bulk. The primary distinction between the two lists is the quantity at which the chemical is regulated. The P-list consists of acutely toxic wastes that are regulated 102
when the quantity generated per month, or accumulated at any time, exceeds one kilogram (2.2 pounds), while U-listed hazardous wastes are regulated when the quantity generated per month exceeds 25 kilograms (55 pounds). Examples of businesses that typically generate P or U listed wastes include pesticide applicators, laboratories and chemical formulators.
Characteristics of Hazardous Wastes The regulations define characteristic hazardous wastes as wastes that exhibit measurable properties posing sufficient threats to warrant regulation. For a waste to be deemed a characteristic hazardous waste, it must
cause, or significantly contribute to,
an
increased mortality or an increase in serious irreversible or incapacitating reversible illness, or pose a substantial hazard or
threat of a hazard to human health or
the environment, when it is improperly treated, stored, transported, disposed of, or otherwise mismanaged.
In other words, if the wastes generated at a facility are not listed in
the
F, K, P, or U lists, the final step to determine whether a waste is hazardous is to evaluate it against the following 4 hazardous characteristics: (
i)
Ignitability (EPA Waste Identification Number D001):
A waste is an ignitable hazardous waste, if it has a
flash point of less than 60 C; readily catches fire and
burns so vigorously as to create a hazard; or is an ignitable compressed gas or an oxidiser.

A simple method of determining the flash point of a waste is to review the material safety data sheet, which can be obtained from the manufacturer or distributor of the material. Naphtha, lacquer thinner, epoxy resins, adhesives and oil based paints are all examples of ignitable hazardous wastes. (ii) Corrosivity (
EPA Waste Identification Number D002):
A liquid waste which has a pH of
less than or equal to 2 or greater than or equal to 12.5
is considered to be a corrosive hazardous waste. Sodium hydroxide, a caustic solution with a high pH, is often used by many industries to clean
or degrease metal parts. Hydrochloric acid,
a solution with a low pH, is used by many industries to clean metal parts
prior to painting. When these caustic or acid solutions are disposed of, the waste is a corrosive hazardous waste. (
iii) Reactivity (EPA Waste Identification Number D003):
A material is considered a reactive hazardous waste, if it is unstable, reacts violently with water, generates toxic gases when exposed to water or corrosive materials, or if it is capable of
detonation or explosion when exposed to heat or a flame. Examples of reactive wastes would be waste gunpowder, sodium metal or wastes containing cyanides or sulphides. (iv) Toxicity (
EPA Waste Identification Number D004):
To determine if a waste is a toxic hazardous waste,
a representative sample of the material must be subjected to a test conducted in a certified laboratory. The toxic characteristic identifies wastes that are likely to leach dangerous concentrations of toxic chemicals into
ground water. 2. Classification
From a practical standpoint, there are far too many compounds, products and product combinations that fit within the broad definition of hazardous waste. For this reason, groups of waste are considered in the following five general categories: (i)
Radioactive substance: Substances that emit ionising radiation are radioactive. Such
substances are hazardous because prolonged exposure to radiation often results in damage to living organisms. Radioactive substances are of special concern because they persist for a long period.
The period in which radiation occurs is commonly measured
and
expressed as half-life, i.e., the time required for the radioactivity of a given amount of the substance to decay to half its initial value.
For example, uranium compounds have half-lives that range from 72 years for U 232 to 23,420,000 years for U 236 . The management of radioactive wastes is highly controlled by national and state regulatory agencies. Disposal sites that are used for the long-term storage of radioactive wastes are not used for the disposal of any other solid waste. (
ii)
Chemicals: Most hazardous chemical wastes can be classified into four groups: synthetic organics, inorganic metals, salts, acids and bases, and flammables
and explosives. Some of the chemicals are hazardous because they are highly toxic to most life forms. When such hazardous compounds are present in a waste stream at levels equal to, or greater than, their threshold levels, the entire waste stream is identified as
hazardous. (
iii)
Biomedical wastes: The principal sources of hazardous biological wastes are hospitals and biological research facilities. The ability to infect other living organisms
and the ability to produce toxins are the most significant characteristics
of hazardous biological wastes.
This group mainly includesmalignant tissues discarded during surgical procedures and contaminated materials, such as hypodermic needles, bandages and outdated drugs.
This waste can also be generated as a by-product
of industrial biological conversion processes. 103
(iv)
Flammable wastes: Most flammable
wastes are also identified as hazardous chemical wastes. This dual grouping is necessary because of the high potential hazard in storing, collecting and disposing of flammable wastes. These wastes may be liquid, gaseous or solid, but most often they are liquids.
Typical examples include organic solvents, oils, plasticisers and organic sludges. (v)

Explosives: Explosive hazardous wastes are mainly ordnance (artillery) materials, i.e., the wastes resulting from ordnance manufacturing
and
some industrial gases.
Similar to flammables, these wastes also have a high potential for hazard in storage, collection
and
disposal, and therefore, they should be considered separately in addition to being listed as hazardous chemicals.
These wastes may exist in solid, liquid or gaseous form.
vi)
Household hazardous wastes: Household wastes such as cleaning chemicals, batteries, nail polish etc in MSW constitute hazardous waste. Especially batteries contain mercury which are alkaline which is dangerous enough to kill people. Generic household hazardous material include non chlorinated organic, chlorinated organic, pesticides, latex paint, oil based paints, waste oil, automobile battery and household battery. We will discuss the management of hazardous waste, which is different from the management of other solid wastes due to hazardous nature of wastes, next.
Hazardous Waste Management Hazardous waste management, as is the case with non-hazardous solid waste management, which we studied earlier, consists of several functional elements. 1. Generation Hazardous wastes are generated in limited amounts in a community and very little information is available on the quantities of hazardous waste generated within a community and in various industries. Hazardous waste generation outside the industry is irregular and very less in amount, rendering the waste generation parameter meaningless. The only practical means to overcome these limitations is to conduct a detailed inventory and measurement studies at each potential source in a community. As a first step in developing a community inventory, potential sources of hazardous waste are to be identified. The total annual quantity of hazardous waste at any given source in a community must be established through data inventory completed during onsite visits. Table 4-
Common Hazardous Wastes: Community Source
In addition to the sources listed, the spillage of containerised hazardous waste must also be considered an important source. The quantities of hazardous wastes that are involved in spillage are usually not known. The effects of spillage are often spectacular and visible to the community. Because the occurrence of spillage cannot be predicted, the potential threat to human health and environment is greater than that from routinely generated hazardous wastes. 104
2.
Storage and collection nsite storage practices are a function of the types and amounts of hazardous wastes generated and the period over which generation occurs. Usually, when large quantities are generated, special facilities are used that have sufficient capacity to hold wastes accumulated over a period of several days. When only a small amount is generated, the waste can be containerised, and limited quantity may be stored. Containers and facilities used in hazardous waste storage and handling are selected on the basis of waste characteristics. For example, corrosive acids or caustic solutions are stored in fibreglass or glass-lined containers to prevent deterioration of metals in the container. Great care must also be exercised to avoid storing incompatible wastes in the same container or locations.
Figures 3 and 4 show
typical drum containers used for the storage of hazardous waste: Figure 3 Light- Gauge Closed Head Drum Figure 4 Light Gauge Open Head Drum The waste generator, or a specialised hauler, generally collects the hazardous waste for delivery to a treatment or disposal site. The loading of collection vehicles is completed in either of the following ways: (i) Wastes stored in large-capacity tanks are either drained or pumped into collection vehicles; (
ii
Wastes stored in sealed drums or sealed containers are loaded by hand or by mechanical equipment onto flatbed trucks. The stored containers are transported unopened to the treatment and disposal facility. To avoid accidents and the possible loss of life, two collectors should be assigned when hazardous wastes are to be collected. The equipment used for collection vary with the waste characteristics,
and the typical collection equipment are listed in Table 2 below: 105
Table 5- Equipment for collection of Hazardous waste
Note that for short-haul distances, drum storage and collection with a flatbed truck is often used. As hauling distances increase, the larger tank trucks, trailers and railroad tank cars are used. 3 Transfer and transport The economic benefits derived by transferring smaller vehicle loads to larger vehicles,
are equally

applicable to hazardous wastes. However, the facilities of a hazardous waste transfer station are quite different from solid waste transfer station. Typically, hazardous wastes are not compacted (i.e., mechanical volume reduction) or delivered by numerous community residents. Instead, liquid hazardous wastes are generally pumped from collection vehicles and sludge or solids are reloaded without removal from the collection containers for transport to processing and disposal facilities. It is unusual to find a hazardous waste transfer facility, where wastes are simply transferred to larger transport vehicles. Some processing and storage facilities are often part of the material handling sequence at a transfer station. For example, neutralisation of corrosive wastes might result in the use of a lower-cost holding tank on transport vehicles. As in the case of storage, great care must be exercised to avoid the danger of mixing incompatible wastes. 4. Processing Processing of hazardous waste is done for purposes of recovering useful materials and preparing the wastes for disposal. Processing can be accomplished on-site or off-site. The variables affecting the selection of processing site include the characteristics of wastes, the quantity of wastes, the technical, economical and environmental aspects of available on-site treatment processes and the availability of the nearest off-site treatment facility (e.g., haul distance, fees, and exclusions).
The treatment of hazardous waste can be accomplished by physical, chemical, thermal or biological means. Table 6 below gives the various individual processes in each category:
Functions: VR= volume reduction; Se = separation; De = detoxification; St = storage; Waste types: 1= inorganic chemical without heavy metals; 2 = inorganic chemical with heavy metal; 3 = organic chemical without heavy metal; 4 = organic chemical with heavy metal; 5= radiological; 6 = biological; 7= flammable and 8= explosive; # Waste forms: S=solid; L= liquid and G= gas 106
Table 6- Hazarduos Waste Treatment operations and Processes Note that in practice, the physical, chemical and thermal treatment operations are the most commonly used. (Biological treatment processes are used less often because of their sensitivity.) Depending on the type of wastes being treated, one or more of these methods may be used. 5.

100% **MATCHING BLOCK 188/202** W

Disposal Regardless of their form (i.e., solid, liquid, or gas), most hazardous waste is disposed off either near the surface or by deep burial.

Table 7 shows the various hazardous waste disposal methods: Table 7 – Hazaduos wastes disposal and storage methods
Functions: Di= disposal; St = storage; * Waste types: 1= inorganic chemical without heavy metals; 2 = inorganic chemical with heavy metal; 3 = organic chemical without heavy metal; 4 = organic chemical with heavy metal; 5= radiological; 6 = b iological; 7= flammab le and 8= explosive. # Waste form: S=solid; L= liquid and G= gas

100% **MATCHING BLOCK 189/202** W

Although, controlled landfill methods have been proved adequate for disposing of municipal solid waste and limited amounts of hazardous waste, they are not suitable enough for the disposal of a large quantity of hazardous waste, due to the following reasons: ? possible percolation of toxic liquid waste to the ground water; ? dissolution of solids followed by leaching and percolation to the ground water; 107 ?

dissolution of solid hazardous wastes by acid leachate from solid waste,

94% **MATCHING BLOCK 190/202** W

followed by leaching and percolation to the ground water; ? potential for undesirable reactions in the landfill that may lead to the development of explosive or toxic gases; ? volatilisation of

hazardous waste leading to the release of toxic or explosive vapours to the atmosphere; ? corrosion of containers with hazardous wastes. We must, therefore, take care both in the selection of a hazardous waste disposal site and its design. In general, disposal sites for hazardous wastes should be separate from those for municipal solid wastes. As hazardous wastes can exist in the form of liquids, sludges, solids and dusts, a correct approach for co-disposal for each of the hazardous wastes should be determined. To avoid the co-disposal of incompatible wastes, separate storage areas within the total landfill site should be designated for various classes of compatible wastes (Phelps, et al., 1995). Liquid wastes are usually stored in a tank near the site and can be introduced into the landfill by means of trenches or lagoons, injection or irrigation. Sludges are also placed in trenches. During disposal of lightweight wastes, the disposal area must be kept wet to prevent dust emissions. Hazardous solid waste characterised by a high degree of impermeability as such must not be disposed of over large areas. When containerised wastes are to be disposed of, precautions must be taken to avoid the rupturing of containers during the unloading operation and the placement of incompatible waste in the same location. To avoid rupturing, the containers are unloaded and placed in position individually. The covering of the containers with earth should be monitored and controlled carefully to ensure that a soil layer exists between each container and the equipment placing the soil does not crush or deform the container. While designing a landfill site for hazardous waste, provision should be made to prevent any leachate escaping from landfill site. This requires a clay liner, and in some cases, both clay and impermeable membrane liners are used. A layer of limestone is placed at the bottom of the landfill to neutralise the pH of leachate. A final soil cover of 25 cm or more should be placed over the liner. The completed site should be monitored continuously, both visually and with sample wells.

Hazardous

Waste Treatment Above, we discussed the various elements of hazardous waste management such as generation, storage and transport, transfer and transport, processing and disposal. Processing is mainly done to recover useful products and to prepare waste for disposal. But prior to disposal, hazardous wastes need appropriate treatment, depending on the type of

waste. The various options for hazardous waste treatment can be categorised under physical, chemical, thermal and biological treatments. 1.

Physical and chemical treatment Physical and

chemical treatments are an essential part of most hazardous waste treatment operations, and the treatments include the following (Freeman, 1988): (i)

Filtration and separation: Filtration is a method for separating solid particles from a liquid using a porous medium. The driving force in filtration is a pressure gradient, caused by gravity, centrifugal force, vacuum, or pressure greater than atmospheric pressure. The application of filtration for treatment of hazardous waste fall into the following categories: ? Clarification, in which suspended solid particles less than 100 ppm (parts per million) concentration are removed from an aqueous stream. This is usually accomplished by depth filtration and cross-flow filtration

and the primary aim is to produce a clear aqueous effluent, which can either be discharged directly, or further processed. The suspended solids are concentrated in a reject stream. ? Dewatering of slurries of typically 1% to 30 % solids by weight. Here, the aim is to concentrate the solids into a phase or solid form for disposal or further treatment. This is usually accomplished by cake filtration. The filtration treatment, for example, can be used for neutralisation of strong acid with lime or limestone, or precipitation of dissolved heavy metals as carbonates or sulphides followed by settling and thickening of the resulting precipitated solids as slurry. The slurry can be dewatered by cake filtration and the effluent from the settling step can be filtered by depth filtration prior to discharge. (ii) Chemical precipitation: This is a process by which the soluble substance is converted to an insoluble form either by a chemical reaction or by change in the composition of the solvent to diminish the solubility of the substance in it. Settling and/or filtration can then remove the precipitated solids. In the treatment of hazardous waste, the process has a wide applicability in the removal of toxic metal from aqueous wastes by converting them to an insoluble form. This includes wastes containing arsenic, barium, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, thallium and zinc. The sources of wastes containing metals are metal plating 108

and polishing, inorganic pigment, mining and the electronic industries. Hazardous wastes containing metals are also generated from cleanup of uncontrolled hazardous waste sites, e.g., leachate or contaminated ground water. (iii) Chemical oxidation and reduction (redox): In these reactions, the oxidation state of one reactant is raised, while that of the other reactant is lowered. When electrons are removed from an ion, atom, or molecule, the substance is oxidised and when electrons are added to a substance, it is reduced. Such reactions are used in treatment of metal-bearing wastes, sulphides, cyanides and chromium and in the treatment of many organic wastes such as phenols, pesticides and sulphur containing compounds. Since these treatment processes involve chemical reactions, both reactants are generally in solution. However, in some cases, a solution reacts with a slightly soluble solid or gas.

There are many chemicals, which are oxidising agents; but relatively few of them are used for waste treatment. Some of the commonly used oxidising agents are sodium hypochlorite, hydrogen peroxide, calcium hypochlorite, potassium permanganate and ozone. Reducing agents are used to treat wastes containing hexavalent chromium, mercury, organometallic compounds and chelated metals. Some of the compounds used as reducing agents are sulphur dioxide, sodium borohydride, etc. In general, chemical treatment costs are highly influenced by the chemical cost. This oxidation and reduction treatment tends to be more suitable for low concentration (i.e., less than 1%) in wastes (iv) Solidification and stabilisation: In hazardous waste management, solidification and stabilisation (S/S) is a term normally used to designate a technology employing activities to reduce the mobility of pollutants, thereby making the waste acceptable under current land disposal requirements. Solidification and stabilisation are treatment processes designed to improve waste handling and physical characteristics, decrease surface area across which pollutants can transfer or leach, limit the solubility or detoxify the hazardous constituent.

To understand this technology, it is important for us to understand the following terms: ? Solidification: This refers to a process in which materials are added to the waste to produce a solid. It may or may not involve a chemical bonding between the toxic contaminant and the additive. ? Stabilisation: This refers to a process by which a waste is converted to a more chemically stable form. Subsuming solidification, stabilisation represents the use of a chemical reaction to transform the toxic component to a new, non-toxic compound or substance. ? Chemical fixation: This implies the transformation of toxic contaminants to a new non-toxic compound. The term has been misused to describe processes, which do not involve chemical bonding of the contaminant to the binder. ? Encapsulation: This is a process involving the complete coating or enclosure of a toxic particle or waste agglomerate with a new substance (e.g., S/S additive or binder). The encapsulation of the individual particles is known as micro-encapsulation, while that of an agglomeration of waste particles or micro- encapsulated materials is known as macro-encapsulation. In S/S method, some wastes can be mixed with filling and binding agents to obtain a dischargeable product. This rather simple treatment can only be used for waste with chemical properties suitable for landfilling. With regard to wastes with physical properties, it changes only the physical properties, but is unsuitable for landfilling. The most important application of this technology, however, is the solidification of metal-containing waste. S/S technology could potentially be an important alternative technology with a major use being to treat wastes in order to make them acceptable for land disposal. Lower permeability, lower contaminant leaching rate and such similar characteristics may make hazardous wastes acceptable for land disposal after stabilisation. (

v)

Evaporation: Evaporation is defined as the conversion of a liquid from a solution or slurry into vapour. All evaporation systems require the transfer of sufficient heat from a heating medium to the process fluid to vaporise the volatile solvent. Evaporation is used in the treatment of hazardous waste and the process equipment is quite flexible and can handle waste in various forms – aqueous, slurries, sludges and tars. Evaporation is commonly used as a pre-treatment method to decrease quantities of material for final treatment. It is also used in cases where no other treatment method was found to be practical, such as in the concentration of trinitrotoluene (TNT) for subsequent incineration. (

vi) Ozonation: Ozone is a relatively unstable gas consisting of three oxygen atoms per molecule (O 3) and is one of the strongest oxidising agents known. It can be substituted for conventional oxidants such as chlorine, hydrogen peroxide and potassium permanganate. Ozone and UV radiations have been used to detoxify industrial organic wastes, containing aromatic and aliphatic polychlorinated compounds, ketones and alcohols. 2. Thermal treatment The two main thermal treatments used with regard to hazardous wastes are: 109

(i)

Incineration: Incineration can be regarded as either a pre-treatment of hazardous waste, prior to final disposal or as a means of valorising waste by recovering energy. It includes both the burning of mixed solid waste or burning of selected parts of the waste stream as a fuel. The concept of treating hazardous waste is similar to that of municipal solid waste. (

ii)

Pyrolysis: This is defined as the chemical decomposition or change brought about by heating in the absence of oxygen. This is a thermal process for transformation of solid and liquid carbonaceous materials into gaseous components and the solid residue containing fixed carbon and ash. The application of pyrolysis to hazardous waste treatment leads to a two-step process for disposal. In the first step, wastes are heated separating the volatile contents (e.g., combustible gases, water vapour, etc.) from non-volatile char and ash. In the second step volatile components are burned under proper conditions to assure incineration of all hazardous components (

Freeman, M. H. et al., 1988).

To elaborate, pyrolysis is applicable to hazardous waste treatment, as it provides a precise control of the combustion process. The first step of pyrolysis treatment is endothermic and generally done at 425 to 760 C. The heating chamber is called the pyrolyser. Hazardous organic compounds can be volatilised at this low temperature, leaving a clean residue. In the second step, the volatiles are burned in a fume incinerator to achieve destruction efficiency of more than 99%. Separating the process into two very controllable steps allows precise temperature control and makes it possible to build simpler equipment. The pyrolysis process can be applied to solids, sludges and liquid wastes.
Wastes with the following characteristics are especially amenable to pyrolysis: ? Sludge material that is either too viscous, too abrasive or varies too much in consistency to be atomised in an incinerator. ? Wastes such as plastic, which undergo partial or complete phase changes during thermal processing. ? High-residue materials such as high-ash liquid and sludges, with light, easily entrained solids that will generally require substantial stack gas clean up. ? Materials containing salts and metals, which melt and volatilise at normal incineration temperatures. Materials like sodium chloride (NaCl), zinc (Zn) and lead (Pb), when incinerated may cause refractory spalling and fouling of the heat-exchanger surface. 3. Biological treatment
On the basis of the fact that hazardous materials are toxic to living beings, it is not uncommon for some to assume that biological treatment is not possible for hazardous wastes. This assumption is untenable, and, in fact, we must aggressively seek biological treatment in order to exploit the full potential of hazardous wastes in terms of removal efficiency and cost (Freeman, et al., 1988).Against this background, let us now list some of the techniques used for biological treatment of hazardous waste: (i)
Land treatment: This is a waste treatment and disposal process, where a waste is mixed with or incorporated into the surface soil and is degraded, transformed or immobilised through proper management. The other terminologies used commonly include land cultivation, land farming, land application and sludge spreading. Compared to other land disposal options (e.g., landfill and surface impoundments), land treatment has lower long-
term monitoring, maintenance and potential clean up liabilities and because of this, it has received considerable attention as an ultimate disposal method. It is a dynamic, management-intensive process involving waste, site, soil, climate and biological activity as a system to degrade and immobilise waste constituents.
In land treatment, the organic fraction must be biodegradable at reasonable rates to minimise environmental problems associated with migration of hazardous waste constituents.
The various factors involved in the operation of the system are as follows: ?
Waste characteristics: Biodegradable wastes are suitable for land treatment. Radioactive wastes, highly volatile, reactive, flammable liquids and inorganic wastes such as heavy metals, acids and bases, cyanides and ammonia are not considered for land treatment. Land treatability of organic compound often follows a predictable pattern for similar type of compounds. Chemical structure, molecular weight, water solubility and vapour pressure are few of the characteristics that determine the ease of biodegradation. ? Soil characteristics: The rate of biodegradation and leaching of waste applied, the availability of nutrients and toxicants to microorganisms and the fate of hazardous waste constituents are determined largely by application rate as well as the soil's chemical and physical characteristics or reaction. Principal soil characteristics affecting land treatment processes are pH, salinity, aeration, moisture holding capacity, soil temperature, etc. Some of the characteristics can be improved through soil amendments (e.g., nutrients, lime, etc.), tillage or through adjustments of loading rate, frequency, etc., at the time of waste application. 110
? Microorganisms: Soil normally contains a large number of diverse microorganisms, consisting of several groups that are predominantly aerobic in well-drained soil. The types and population of microorganisms present in the waste-amended soil depend on the soil moisture content, available oxygen, nutrient composition and
other characteristics.
The key groups of the microorganisms present in the surface soil are bacteria, actinomycetes, fungi, algae and protozoa. In addition to these groups, other micro and macro fauna, such as nematodes and insects are often present. ? Waste degradation: Conditions favourable for plant growth are also favourable for the activity of soil microorganisms. The factors affecting waste degradation that (may be adjusted in the design and operation of a land treatment facility) are soil pH (near 7), soil moisture content (usually between 30 to 90 %), soil temperature (activity decreases below 10 C) and nutrients. (ii)
Enzymatic systems: Enzymes are complex proteins ubiquitous in nature. These proteins, composed of amino acids, are linked together via peptide bonds. Enzymes capable of transforming hazardous waste chemicals to non-toxic products can be harvested from microorganisms grown in mass culture. Such crude enzyme extracts derived from microorganisms have been shown to convert pesticides into less toxic and persistent products. The reaction of detoxifying enzymes are not limited to intracellular conditions but have been demonstrated through the use of immobilised enzyme extracts on several liquid waste streams. The factors of moisture, temperature, aeration, soil structure, organic matter content, seasonal variation and the availability of soil nutrients influence the presence and abundance of enzymes. (

iii) Composting: The principles involved in composting organic hazardous wastes are the same as those in the composting of all organic materials though with moderate modifications. The microbiology of hazardous wastes differs from that of composting in the use of inoculums. The reaction is that certain types of hazardous waste molecules can be degraded by only one or a very few microbial species, which may not be widely distributed or abundant in nature. The factors important in composting of hazardous wastes are those that govern all biological reactions.
The principal physical parameters are the shape and dimensions of the particles of the material to be composted and the environmental factors of interest in an operation are temperature, pH, available oxygen, moisture, and nutrient availability. The compost technology can be divided into two broad classes – windrow (open pile) and in-vessel (enclosed), and the former may be further subdivided into turned and forced aeration (static pile). Composting, by no means, is a panacea for the hazardous waste problem. When considering the future of hazardous waste composting needs, attention must be paid to the advantages and disadvantages inherent in composting as compared to those inherent in physical, chemical and thermal method of waste treatment. (
iv) Aerobic and anaerobic treatment: Hazardous materials are present in low to high concentration in waste waters, leachate and soil. These wastes are characterised by high organic content (e.g., up to 40,000 mg/l total organic carbon), low and high pH (2 to 12), elevated salt levels (sometimes, over 5%), and presence of heavy metals and hazardous organics. Hazardous wastes can be treated using either aerobic or anaerobic treatment methods.
In aerobic treatment, under proper conditions, microorganisms grow. They need a carbon and energy source, which many hazardous wastes satisfy, nutrients such as nitrogen, phosphorus and trace metals and a source of oxygen. Some organisms can use oxidised inorganic compounds (e.g. nitrate) as a substitute for oxygen. Care is to be taken such that all the required nutrients and substances are supplied in sufficient quantities. Temperature and pH must be controlled as needed and the substances that are toxic to the organisms (e.g., heavy metals) must be removed. Anaerobic treatment is a sequential biologically destructive process in which hydrocarbons are converted, in the absence of free oxygen, from complex to simpler molecules, and ultimately to carbon dioxide and methane. The process is mediated through enzyme catalysis and depends on maintaining a balance of population within a specific set of environmental conditions.
Hazardous waste streams often consist of hydrocarbons leading to higher concentrations of chemical oxygen demand (COD). Depending upon the nature of waste, the organic constituents may be derived from a single process stream or from a mixture of streams. The treatability of the waste depends upon the susceptibility of the hydrocarbon content to anaerobic biological degradation, and on the ability of the organisms to resist detrimental effect of biologically recalcitrant and toxic organic and inorganic chemicals. The metabolic interactions among the various groups of organisms are essential for the successful and complete mineralisation of the organic molecules. Various parameters such as the influent quality, the biological activity of the reactor and the quality of the reactor environment are monitored to maintain efficient operating conditions within the reactor. 111
Pollution Prevention and Waste Minimisation Pollution prevention is the use of materials, processes, or practices that reduce or eliminate the generation of pollutants or wastes at the source. It includes practices that reduce the use of hazardous and non-hazardous materials, energy, water or other resources as well as those that protect natural resources through conservation or more efficient use. Pollution prevention is the maximum

feasible reduction of all wastes generated at production sites. It involves the judicious use of resources through source reduction, energy efficiency, reuse of input materials and reduces water consumption. Waste minimisation means the feasible reduction of hazardous waste that is generated prior to treatment, storage and disposal. It is defined as any source reduction or recycling activity that results in the reduction of the total volume of hazardous waste, or toxicity of hazardous waste, or both. Practices that are considered in waste minimisation include recycling, source separation, product substitution, manufacturing process changes and the use of less toxic raw materials. Pollution prevention and waste minimisation provides us with an opportunity to be environmentally responsible. While pollution prevention reduces waste at its source, waste minimisation, including recycling and other methods, reduces the amount of waste. In what follows, we will look at some of the factors that can contribute to pollution prevention and waste minimisation. (i) Management support and employee participation: A clear commitment by management (through policy, communications and resources) for waste minimisation and pollution prevention is essential to earn the dedication of all employees. For this to happen, a formal policy statement must be drafted and adopted. The purpose of this statement is to reflect commitment and attitude towards protecting the environment, minimising or eliminating waste and reusing or recycling materials by the laboratories, departments and industries. Creative, progressive and responsible leadership will serve to develop an environmental policy. However, the total employee workforce will need to be involved to realise the fruits of the planning. (ii) Training: As with any activity, it is important for management to train employees so that they will have an understanding of what is expected of them and why they are being asked to change the way things are done. Employees must be provided with formal and on-the-job training to increase awareness of operating practices that reduce both solid and hazardous waste generation. The training programme should include the industries' compliance requirements, which may be found in the waste management policies, occupational health and safety requirements. Additionally, training on waste minimisation and pollution prevention is necessary. (iii) Waste audits: A programme of waste audits at the departmental level will provide a systematic and periodic survey of the industries designed to identify areas of potential waste reduction. The audit programme includes the identification of hazardous wastes and their sources, prioritisation of various waste reduction actions to be undertaken, evaluation of some technically, economically and ecologically feasible approaches to waste minimisation and pollution prevention, development of an economic comparison of waste minimisation and pollution prevention options and evaluation of their results. (iv) Good operating practices: These practices involve the procedural or organisational aspects of industry, research or teaching activities and, in some areas, changes in operating practices, in order to reduce the amount of waste generated. These practices would include, at a minimum, material handling improvements,
prevention, preventive
scheduling improvements, maintenance, corrective spill and leak maintenance, material/waste tracking or inventory control and waste stream segregation, according to the toxicity, type of contaminant and physical state. (v) Material substitution practices: The purpose of these practices is to find substitute materials, which are less hazardous than those currently utilised and which result in the generation of waste in smaller quantities and/or of less toxicity. (vi) Technological modification practices: These practices should be oriented towards process and equipment modifications to reduce waste generation. These can range from changes that can be implemented in a matter of days at low cost to the replacement of process equipment involving large capital expenditures. (vii) Recycling options: These options are characterised as use/reuse and resource recovery techniques. Use and reuse practices involve the return of a waste material either to the originating process or to another process as a substitute for an input material. Reclamation practices tender a waste to another company. 112
(viii) Surplus chemical waste exchange options: Inter- and intra-department chemical exchange is to be implemented and encouraged by employers/employees. Material exchanges not only reduce wastes but also save money – both are important considerations, during times of fiscal crisis. In addition, by auditing each department or section, a knowledge base of chemical purchase and usage can be developed, allowing each department to develop and implement controls on the purchase of chemicals, institute intra- departmental chemical sharing/swapping programmes and eliminate excessive purchase and usage. Research protocols should also be examined and modified in a manner similar to the above. Facility operations need to be examined to determine whether changes in practices and procedures will result in the generation of non- hazardous or less hazardous waste, or waste reduced in toxicity or volume. The specifics to be considered in this context include the substitution of non-toxic materials for toxic ones, distillation or evaporation of water-based chemical end- products, reclamation and reuse of common solvents, use of non- chromate cleaners as a standard part of doing business to generate non-hazardous end products. By implementing and adhering to the guidelines for handling and storing wastes at the point of generation, the costs associated with hazardous waste disposal will also be minimised.
Hazardous Waste

Management in India In the USA, more than 70% of the hazardous waste generated was produced from chemical and petrochemical industries. Of the remaining waste produced, 22% was generated by metal related industries. As industrialisation proceeds, the management of hazardous wastes is increasingly becoming a serious problem in India as well. The Indian chemical industry, which accounts for about 13% of the total industrial production and about 10% of the GNP valued at US $ 2.64 X 1011 (NNP is US $ 2.345 X 1011) per annum, employs about 6% of the nation's industrial workforce and is one of the major generators of toxic and hazardous wastes. There are 13,011 industrial units located in 340 districts, out of which 11,038 units have been granted authorization for multiple disposal practices encompassing incineration, storage land disposal and other disposal options. However, small and medium sized enterprises (SMEs) are the major sources of hazardous wastes. And, the States of Andhra Pradesh, Assam, Gujarat, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa, Rajasthan and Tamil Nadu generate the majority of all hazardous wastes. The total estimate of hazardous waste generated in India is 4,434,257 tonnes per annum. India is the first country that has made provisions for the protection and improvement of environment in its Constitution. The Directive Principles of State Policy
of the Constitution,
Article 48-A of Chapter IV enjoins the State to make endeavor for protection and improvement of the environment and for safeguarding the forest and wild life of the country.
In
Article 51 A (g) of the Constitution, one of
the Fundamental Duties
of
every citizen of India is
to protect and improve the
natural environment including forests, lakes, rivers and
wild life and to have compassion for living creatures.
India has
enacted the following laws, regulations and standards governing the country's environmental protection: (i)
The Water (
Prevention and Control of Pollution) Act, 1974 as amended
in 1988. (ii)
Water (
Prevention and Control of Pollution)
Rules, 1975. (
iii) The Water (Prevention and Control of Pollution) Cess Act, 1977,
as amended by Amendment
Act, 1991. (iv)
The Water (
Prevention and Control of Pollution) Cess Rules, 1978. (
v)
The Air (Prevention and Control of Pollution) Act, 1984,
as amended by Amendment
Act, 1987. (vi) The Air (Prevention and Control of Pollution) Rules 1982
and 1983. (
vii) The Environment (Protection) Act, 1986. (
viii) Hazardous Waste (Management and Handling) Rules, 1989
as amended in 2000. (ix) Management,
Storage and Import of Hazardous Chemical Rules, 1989. (x)
Manufacture, Use, Import, Export and Storage of Hazardous Microorganisms, Genetically Engineered Microorganisms or Cells Rules, 1989. (
xi) The Public Liability Insurance Act, 1991. (xii) The Public Liability Insurance Rules, 1991. (xiii) The Biomedical Wastes (Management and Handling) Rules, 1995. (xiv) Municipal Wastes (Management and Handling) Draft Rules, 1999. (xv) Hazardous Waste (Management and Handling) Amendment Rules 2000. Because of these amendments, the legal management of hazardous substances in India will now apply to 44 industrial processes, as specified in Schedule I of the Rules. The penal provisions for non-compliance under Hazardous Waste (Management and Handling) Amended Rules 2000 and Environment (Protection) Act, 1986 are: ? The State Pollution Control Board may cancel an authorisation issued under these rules or suspend it for such period as it thinks fit,
if, in its opinion, the authorised person has failed to comply with any of the 113

conditions of the authorisation or with any provisions of the Act of these rules, after giving the authorised person an opportunity to show cause and after recording reasons therefore. ? The occupier, transporter and operator of a facility shall be liable for damages caused to the environment resulting due to improper disposal of hazardous waste listed in Schedule 1, 2 and 3 of The Hazardous Waste (Management and Handling) Amendment Rules, 2000. The occupier and operator of a facility shall also be liable to reinstate or restore damaged or destroyed elements of the environment. The occupier and operator of a facility shall be liable to pay a fine as levied by the SPCB with the approval of the Central Pollution Control Board (CPCB) for any violation of the provisions under these rules. An appeal shall lie against any order of grantor refusal of an authorisation by the Member Secretary, SPCB, etc., to the Secretary, Department of Environment of the State. Besides the aforementioned provisions for non-compliance(s), the Penalty Provisions, delineated under Sections 15 (1,2) and 16 of the Environmental (Protection) Act, 1986 are also applicable. Furthermore, the Union Ministry of Environment and Forests, through the Gazette Notification of March 24, 1992, introduced Public Liability Insurance Act Policy, which is specially designed to protect any person, firm, association, or company who owns or has control over handling any hazardous substance at the time of accident. These include 179 hazardous substances along with three categories of inflammable substances. The term handling means manufacturing, processing, treatment, packaging, storing, transportation by vehicle, use, collection, destruction, conversion, offering for sale, transfer or any other similar form of dealing with hazardous substances. Hazardous waste (Management, Handling and transboundary movement) rules 2007. Hazardous Changes to the Hazardous waste Rules Existing Regulation The Ministry had notified the Hazardous Wastes (Management and Handling) Rules,1989 as amended in 2000 and 2003 for regulating management and handling of hazardous waste. Based on the experience gained in the implementation of these Rules, the Hazardous Waste (Management, Handling and Transboundary Movement) Rules, 2008 have been notified repealing the earlier Rules with a view to ensuring effective implementation. The Ministry has also provided financial assistance for strengthening the State Pollution Control Boards (SPCBs) for facilitating implementation of the Rules. Financial assistance has also been provided for setting up Common Treatment, Storage and Disposal Facilities for hazardous waste management.

In addition, the Ministry and the Central Pollution Control Board (CPCB) from time to time sponsor training programmes for creation of awareness about the provisions laid down in the Rules. The CPCB has also published guidelines on various aspects of the hazardous waste management for ensuring compliance of the Rules. In new rules, categories of wastes banned for export and import had also been defined, fulfilling the Basel Convention, ratified by India in 1992. The basic objectives of the Basel Convention are for the control and reduction of transboundary movements of hazardous and other wastes subject to the Convention, prevention and minimization of their generation, environmentally sound management of such wastes and for active promotion of the transfer and use of cleaner technologies. Current Scenario The hazardous waste generated in the country per annum currently is estimated to be around 8 million tonnes out of which 70% is being generated by five states, namely Gujarat, Maharashtra, Tamil Nadu, Karnataka and Andhra Pradesh. Only three States have developed common TSDF (Treatment, Storage, Disposal Facility), which are essential component of proper hazardous waste management activity for ultimate disposal of the hazardous wastes in an environmentally sound manner. These 10 facilities are currently operational only in Gujarat, Andhra Pradesh and Maharashtra. (Source: Central Pollution Control Board). Ground Reality Though the Hazardous Wastes (Management & Handling) Rules were notified in 1989, the implementation on the ground has left a lot to be desired. Lack of proper infrastructure and strict enforcement mechanism has led to hazardous waste still remaining a grave problem. New emerging wastes and loopholes in the current legislation have also contributed to this. There are still problems of hazardous waste not being managed in sound environmental conditions, improper dumping and lack of proper treatment and disposal facilities. However, the new draft claims to address sustainable development concerns and also enable the recovery and/or reuse of useful materials from hazardous materials generated from a process, thereby, reducing the hazardous wastes destined for final disposal and to ensure the environmentally sound management of all hazardous materials. 114 Prevention and Control of Pollution {Industrial Pollution Abatement through preventive strategies, Development and Promotion of Cleaner Technologies, Taj Protection Mission, Environmental Health, Noise Pollution, Air Pollution, Vehicular Pollution Control, Industrial Pollution Control, Common Effluent Treatment Plants, Zoning Atlas, Establishment of Environment Protection Authority, Central Pollution Control Board,

Hazardous Substances Management} The enhanced pace of developmental activities and rapid urbanization have resulted in stress on natural resources and quality of life. The trend of increasing pollution in various environmental media is evident from the deteriorating air and water quality, higher noise levels, increasing vehicular emission etc. Realising the urgent need for arresting the trend, Ministry adopted policy for Abatement of Pollution which provides for several mechanisms in the form of regulations, legislation, agreements, fiscal incentives and other measures to prevent and abate pollution. Further, realizing that conventional pollution control approach by treatment at the end of the pipe is not delivering the desired benefits in terms of resource conservation, the thrust has been shifted to pollution prevention and control through promotion of clean and low waste technology, re-use and recycling, natural resource accounting, Environmental Audit and Institutional and Human Resource Development. To give effect to various measures and policies on ground, multi-pronged approach is adopted which includes stringent regulations, Development of Environmental Standards, Control of Vehicular Pollution, preparation of Zoning Atlas for Spatial Environmental Planning including Industrial Estates etc. Major activities carried out under several programmes/schemes during the year are as follows: ? Industrial Pollution Abatement through preventive strategies This scheme is an amalgamation of the three on-going schemes viz. Environmental Audit, Adoption of Clean Technologies in Small Scale Industries and Environmental Statistics and Mapping, which have been continuing since eighth Five Year Plan. Due to encouraging results and benefits to various small scale units, these schemes are being continued during the 10 th Five Year Plan also: ? Environmental Statement (As a part of Environmental Audit) Environmental audit is a management tool and provides a structure and comprehensive mechanism for ensuring that the activities and products of an enterprise do no cause unacceptable effects on the environment. Submission of an Environmental Statement by polluting units seeking consent either under the Water (Prevention and Control of Pollution) Act, 1974 or the Air (Prevention and Control of Pollution) Act, 1981 or both and the Authorization under the Hazardous Wastes (Management and Handling) Rules, 1989 has been made mandatory through a Gazette Notification of April, 1993 under the Environment (Protection) Act, 1986. The Environmental Statement enables the units to undertake a comprehensive look at their industrial operations and facilities, understanding of material flows and focus on areas where waste reduction and consequently saving in-put cost if possible. The primary benefit of environmental audit is that it ensures cost effective compliance of laws, standards, regulations, company policies etc. During the year, action has been initiated to evolve model environmental statements in various sectors for facilitating comparison in use of raw material, water conservation, energy consumption etc. A project has been sponsored to Central Pollution Control Board for evolving model environmental statement in the eight sectors viz. Sugar, Thermal Power Projects, Cement, Paper and Pulp, Pesticides, Bulk Drugs, Tanneries and Textiles Activities. ? Waste Minimisation/Cleaner Production Waste minimization is one of the strategies adopted for minimizing the industrial pollution. The objective of the scheme is to assist the small and medium scale industry in adoption of cleaner production practices. A project has been sponsored to National Productivity Council on “Waste Minimisation in Small Scale Industries” for establishment and running of waste minimization circles in clusters of small scale industries, capacity building in areas of cleaner production, establishment of demonstration units in selected industrial sectors etc. So far 115 waste minimization circles have been established through out the country and a large number of Organizations and Institutions have been trained in waste minimization activities. The project was executed till November, 2002 under the World Bank project on Industrial Pollution Prevention (IPP) as Phase- I and Phase- II is now being continued with Ministry’s internal funds. Implementation of this project has helped in identification of more than 200 options for resource and energy conservation in various small scale industries. ? Environmental Statistics and Mapping For sound Environmental Management, reliable information base and the mapping of areas needing special attention for pollution prevention and control are a pre-requisite. As a step in the direction, projects and pilot 115 studies have been initiated through various research institutions and organizations. Under this program, following studies have been initiated and are in various stages of completion : ? GIS based Hydrological Modelling for Water Quality and Quantity in Cauvery River Basin by IIT, Delhi. ? Geochemical baseline Mapping for Environmental Management by National Geophysical Research Institute, Hyderabad. Development and Promotion of Cleaner Technologies Life Cycle Assessment (LCA) Life Cycle Assessment is a decision cum management tool which provides information on the environmental effects of various products and processes so as to arrive at necessary corrective measures to make the entire process efficient with optimal utilization of resources and minimal wastes generation. LCA studies have been initiated in various sectors namely; Steel, Pulp and Paper and Thermal Power. The study in the Steel Sector was completed earlier and the report is under preparation. The study relating to the Thermal Power Sector has been completed during the year while the study in the Pulp and Paper Sector is progressing as per schedule. Industrial Ecology Opportunities in Ankleshwar and Nandesari Industrial Estates, Gujarat A study was undertaken to develop and implement Industrial Ecology Opportunities in Ankleshwar and Nandesari Industrial Estates of Gujarat. The study has examined technologies used by

industries in this region and suggested possible approach to achieve eco-efficiency within the industrial estates to reuse and recycle wastes and effluents generated from different industrial units. The recommendations of the study have been discussed in a workshop with all stakeholders including State Government Agencies for their implementation and an Action Plan is being drawnup by them. Development of Market Based Instruments for Regional Environmental Management in the Kawas- Hazira Region in Gujarat The ongoing project on Development of Market Based Instruments for Kawas-Hazira Region of Gujarat has been completed. The study report has observed that the taxes and incentives based on efficiency improvements align the pollution control agencies better with the polluters than the Command and Control (CAC) regime. Such an instrument also facilitates prescribing incentives for achieving the triple bottom line, viz economic-efficiency, environment-responsibility, and social-relevance entitling the Corporate to Clean Development Mechanism (CDM) and other cleaner-production benefits. The recommendations of the study have been discussed in a workshop with all concerned. Field Demonstration and Development of Bamboo Based Composites/Panels The ongoing project on field demonstration and development of bamboo based composites/panels was continued during the year. Under this project, commercial production of horizontal and vertical laminates have been made using Bambusa bamboo Species. Construction of demonstration houses will be taken up during the current year. Recycling of Marble Slurry in Udaipur, Rajasthan A two years duration project has been sponsored for the manufacture of bricks and tiles from marble slurry in Udaipur, Rajasthan with the aim of utilizing wastes arising out of marble cutting and processing for the purpose of improving the local environment. Bio-remediation of Railadevi Lake in Thane, Maharashtra A project relating to cleaning of Railadevi Lake in Thane District in Maharashtra using bio-remediation technique has been sponsored to Thane Municipal Corporation. Development of Natural Dyes from Forest Wastes A three years duration project has been sponsored to Forest Research Institute, Dehradun for development of natural dyes from forest wastes. Taj Protection Mission As per the Hon'ble Supreme Court's Order the protection of the Taj Mahal is a National priority for the country. In order to implement various schemes for the protection of the monument, the Planning Commission decided to provide additional funds to the State Government. The Planning Commission approved Rs.600 crores on a 50:50 cost sharing basis with the concerned State Government to implement various schemes in the Taj Trapezium Zone in the context of environmental protection of the Taj Mahal. In the first phase during the Ninth Five Year Plan, 10 projects were approved and are being implemented. These are :- 116 ? Improvement in Electric Supply at Agra ? Improvement in Electric Supply in and around the rural areas of Agra and Fatehpur Sikri ? Water supply (Agra) ? Water Supply (Mathura-Vrindavan) ? Gokul Barrage ? Solid Waste Management ? Storm Water Drainage System (Agra) ? Construction of one part of Agra bye-pass ? Widening of Agra Bye-pass ? Improvement of Master Plan of Roads of Agra City The Mission Management Board of the Taj Protection Programme has approved another seven projects to be taken up during the Tenth Five Year Plan. These are: ? Taj Trapezium Zone Heritage Corridor covering the areas of Taj Mahal, Agra Fort, Ram Bagh, Emad-ud- Daula, Chinni-ka-Rauza and river Yamuna. ? Taj Trapezium Zone Authority Environmental Centre and Allied Schemes. ? Planning of Taj Trapezium Zone and Study of Taj Ecocity / Conceptual Plan / Master Plan. ? Automatic Air Monitoring Stations, Display Boards and Networking at Agra-Mathura and Firozabad. ? Hazardous Waste Secured Land-fill site for Agra and Mathura. ? Common Treatment Facility for Treatment of Bio-medical Wastes at Agra, and ? Public Awareness Programme in Taj Trapezium These projects have been reviewed and steps have been taken for clearance of the EFC Memo of these Projects. Environmental Health Environmental Health Cell of the Ministry has commissioned nine environmental health studies in the cities of Ludhiana, Delhi, Lucknow, Ahmedabad, Kolkata, Mumbai, Manali (Tamil Nadu), Bangalore and Trivandrum for documenting Environmental Health Profile so that necessary corrective measures could be evolved and addressed for pollution control and protection of public health. The Ministry in collaboration with the World Health Organisation, World Bank, the United States Environmental Protection Authority, United States AID and Confederation of Indian Industry organized a two-day Conference on Environmental Health at New Delhi on 20- 21 November, 2002 to sensitise the issues among the Central and State Government and other stakeholders in the country but also to come up with the consensus on the issues to act upon and to evolve strategies for the protection of public health. The recommendations have been finalized and are to be implemented depending on availability of resources and infrastructure. Noise Pollution An increasing trend of noise pollution has been observed in the major cities of the country. To regulate and control noise pollution, the Government has issued various notifications under the Environment (Protection) Act, 1986. During the year noise limits for diesel generator sets (upto 1000 KVA) manufactured on or after 1 st July, 2003, were notified on 17 th May, 2002. The maximum permissible sound pressure level for new diesel generator sets with rated capacity upto 1000 KVA shall not exceed 75 dB(A) at the distance of one metre from the enclosure surface. It has been made mandatory for the diesel generator sets to provide integral acoustic enclosure at the manufacturing stage itself. The State Pollution Control Boards and the Pollution Control Committees will regulate these limits. A Notification on Noise Pollution (Regulation and Control) Rules, 2000 was issued vide S.O. 123(E) on 14 th February, 2000 to curtail noise pollution in the country. Accordingly, the use of loudspeakers and public address systems were restricted during night between

10.00 p.m. and 6.00 a.m. except for the closed auditorium, banquet halls, etc. Owing to various representations received from State Governments, these rules have been amended vide Notification S.O. 1088(E) issued on 11 th October, 2002 to permit the use of loudspeakers or public address system during night hours (between 10.00 p.m. to 12.00 midnight) on or during any cultural or religious festival for a limited duration not exceeding 15 days in all during a calendar year. Noise limits for vehicles at manufacturing stage were notified vide GSR 7(E) on 25 th September, 2000 which would be effective from 1 st January, 2003. To make these standards commensurate with the emission standards for vehicles, the notified rules have been revised and are phased out in two stages. In the first phase, two wheelers, three wheelers, and passenger cars would comply with the notified norms from 1 st January, 2003. A relaxation of 3dB(A) has been given to passenger and commercial vehicles of various categories and would 117 become effective from 1 st July, 2003. In the second phase, noise limits for vehicles at manufacturing stage would be applicable on and from 1 st April, 2005 which would be at par with EC norms and based on engine power for various categories of vehicles. Hon'ble Supreme Court, in September, 2001 has passed an interim order to comply with the notification of the Ministry issued on 5 th October, 1999 to control noise from the bursting o fire crackers, which shall not exceed 125 dB(Al) and 145 dB(C) pk . The manufacture, sale and use of fire crackers should be restricted accordingly. While communicating this order to all State Governments and Union Territories, they have been requested to conduct the surveys to assess the noise pollution before and on Deepawali day. Some of the surveys have been conducted during the years of 2001 and 2002. The findings of the surveys indicate a decreasing trend of noise during the festive season. For creating awareness and for effective implementation of the rules and regulations for control of noise, a workshop was organized at West Bengal Pollution Control Board on 4 th and 5 th December, 2002 to train the officials of State Pollution Control Boards and the officials of Police Department of Eastern States. Air Pollution With a view to ascertain the ambient air quality at various locations, a monitoring network has been established comprising of 295 stations covering 98 cities/towns in 29 States and three Union Territories under the Air (Prevention and Control of Pollution) Act, 1981, as amended in 1988. Under this programme, four criteria air pollutants viz. Sulphur dioxide (SO 2), oxides of nitrogen (NO x), Suspended Particulate Matter (SPM) and Respirable Suspended Particulate Matter (RSPM) are regularly monitored at all the locations. Besides this, additional parameters such as respirable lead and other toxic trace matters and polycyclic aromatic hydrocarbons are also being monitored in 10 metro cities of the country. The ambient air quality is monitored by Central Pollution Control Board (CPCB) in coordination with the State Pollution Control Boards, Pollution Control Committees and some of the universities and research institutes. The data, thus generated, are transmitted to CPCB for scrutinisation, analysis, compilation and publication as a consolidated report. The monitoring results indicate that levels of Sulphur dioxide and Nitrogen dioxide are within the stipulated standards, whereas the levels of SPM and RSPM occasionally exceed, especially in Central and Northern parts of the country due to natural dust and vehicular emissions. The air quality of different cities/towns for three critical pollutants has been compared with the respective national ambient air quality standards and has been classified into four broad categories based on an Exceedence Factor (EF) as calculated by the following ratio: Observed Annual mean Concentration of criteria pollutant Exceedence Factor = Annual standard for the Respective pollutant and area class The four air quality categories are : Critical Pollution(C) When EF is more than 1.5 High Pollution (H) When EF is between 1.0 – 1.5 Moderate Pollution (M) With and EF between 0.5 – 1.0 Low Pollution(L) Where the EF is less than 0.5 Based upon the indicators stated above, a quarterly report is compiled by CPCB in some of the major cities. For real time data collection, automatic monitoring stations have also been established. Under the Male declaration, 11 automatic monitoring stations are also planned at strategic locations to measure the trans-boundary movement of pollutants among the South Asia Association of Region Co-operations (SAARC) Countries. CPCB has also initiated in-depth studies in the cities of Delhi and Kanpur to measures the level of PM 10 and PM 2.5 . To regulate and control air pollution, the source specific standards are notified from time to time. During the year 2002, emission standards for new diesel generator sets upto 800 KW were notified on 17 th May, 2002 vide GSR 371(E). These rules shall apply to all new diesel engines for Gensets manufactured in India or imported into India after the effective date. All engines upto 20 KV shall carry ISI mark and meet the relevant BIS specifications. Emission standards for diesel generator sets of more than 800 KW had also been notified on 9 th July, 2002 vide GSR 489(E). These standards shall be regulated by the State Pollution Control Boards or Pollution Control Committees as the case may be. It has also been made mandatory for all the diesel generator sets upto 118 800 KVA or more to use the liquid fuel specified for commercial. High Speed Diesel (HSD) applicable for diesel vehicles in the area from time to time. Vehicular Pollution Control The Ministry plays a coordinating role in the field of controlling of vehicular pollution with the concerned Ministries and its associated bodies/organizations including the Ministry of Surface Transport, the Ministry of Petroleum and Natural Gas and the Ministry of Industry for upgradation of automobile technology, improvement in fuel quality, expansion of urban public transport systems and promotion of integrated traffic management as the vehicular emissions is the major cause for deterioration of urban ambient air quality. The Gross Emission Standards for vehicles have been prescribed from time to time and a road map is prepared to improve the quality of the fuel. The Ministry of Petroleum and Natural Gas also

constituted an Expert Committee on Auto Fuel Policy under the Chairmanship of Dr. R. A. Mashelkar, Director General, Council of Scientific and Industrial Research (CSIR) to recommend an Auto Fuel Policy for the country together with a road map for its implementation. The Committee was represented by the Ministry and significant contribution was made in preparation of the Policy. The Committee has submitted its final report to the Government of India in August, 2002 and the recommendations of this Committee are under consideration for implementation. As per the directions of the Hon'ble Supreme Court in W.P. No. 13029 of 1985 by M.C. Mehta vs. Union of India and others, the Ministry coordinated the preparation of action plans for control of vehicular pollution for compulsory switch over to CNG/LPG in the cities of Ahmedabad, Kolkata, Pune and Kanpur which were found to be equally or more polluted than Delhi. The implementation of the plan submitted for these cities is being reviewed. Nine cities viz. Agra, Varanasi, Kanpur, Lucknow, Faridabad, Jharia, Jodhpur, Patna and Pune were also identified for improving air quality. Action plans for these cities are being coordinated by the Ministry. Promotion of the Ethanol Blended Petrol and Bio-diesel have also been taken up and Ethanol Blended Petrol has been introduced in the selective States as a first phase. Industrial Pollution Control Status of pollution control in 17 categories of Identified Polluting Industries The Central Pollution Control Board (CPCB) has identified 1551 large and medium industries in 17 categories of highly polluting industries, contributing maximum to the pollution load. They have been given time schedule to install necessary pollution control equipments to comply with the prescribed standards. The progress of compliance is monitored periodically and quarterly reports are given by CPCB based on the inputs received from the concerned State Pollution Control Boards (SPCBs). As on 31.12.2002, out of 1551 industries, 1351 industries have so far provided the necessary pollution control facilities, 178 industries have been closed down and the remaining 22 industries are defaulting. Legal action has been taken under the Environment (Protection) Act, 1986 in respect of all the defaulting units and in many cases, the matter is pending before the Hon'ble Supreme Court. Almost all the defaulting units are either in the advance stage of installing the pollution control measures or under legal action for default. A state-wise summary status of the pollution control in 17 categories of industries and a category-wise summary status are given in Table 8 and 9 respectively.

Under

99% MATCHING BLOCK 200/202 W

Sectoral approach for prevention and control of pollution in different sectors, Action Plan by the Working Group on Tanneries is being implemented. State Pollution Control Boards have been advised to follow the suggestions given by the working Group while dealing with tannery units. As regards distillery, the industries have been advised to follow the protocol developed by Indian Agricultural Research Institute and take necessary measures to comply with the prescribed standards. At the request of All India Brick & Tiles Manufacturers' Federation, the duration of installation of fixed chimneys in place of moving chimneys kilns was extended upto June, 2002. This was subject to the units providing the necessary bank guarantee to the pollution control agencies and the undertakings by the Federation that the conversion would be completed by 30 th June, 2002. Despite several requests, no further extension has been granted for last date, i.e. 30 th June, 2002 for implementation of standards for brick kilns. As per the directions given by the Ministry, almost all States have started implementing the standards. 119 Table 8 Industrial Pollution Control The National River Conservation Authority (NRCA) in its meeting held on July 12, 1997 under the Chairmanship of the Prime Minister, decided that the polluting industries which are directly discharging their effluents into rivers and lakes, without requisite treatment, should be asked to install the requisite effluent treatment systems within three months, failing which closure notices should be issued. Accordingly, the State Pollution Control Board (SPCBs)/Pollution Control Committee (PCCs) in Union Territories, were asked by the Central Pollution Control Board (CPCB) on July 14, 1997 to take necessary action and send the list of defaulting units. The criteria defined for the National River Conservation Plan (NRCP) was followed, and the identified industries include those which (i) discharge their effluents into a water course including rivers and lakes, and (ii) are either involved of hazardous substances or discharge effluents with a BOD of 100 kg/day or more, or both. The information received from the SPCBs/PCCs in respect of such industries were compiled and the position was also reviewed by the Hon'ble MEF in a meeting taken by him with the Chairman/Senior Officers of the Pollution Control Boards/Committees at Ministry of Environment and Forests on August 19, 1997. This resulted into identification of a total of 2026 defaulting industries from 15 States/UTs which included 1657 defaulters in the State of Tamil Nadu. The programme was further intensified and four Regional Committees of experts were constituted to monitor the compliance of the directions issued by the CPCB to SPCBs/PCCs in this regard. A series of discussions have been held since then by the expert committees with the concerned SPCBs/PCCs to monitor the progress of implementation of the programme and to ensure issuance of appropriate directions to the defaulting industries by the concerned SPCBs/PCCs. The important decisions taken in these meetings are communicated to various Boards/Committees for implementation which include (i) the industries where the commissioning of ETPs are going on satisfactorily are to be given a reasonable time extension, (ii) the industries which have neither shown sufficient progress nor complying with the standards are to be issued closure notices, (iii) the industries which are closed are to be directed not to restart till they provide requisite ETPs, and (iv) the industries where there is no ETP are to be issued confirmed orders for their closure with immediate effect. The matter concerning the large number of defaulting industries i.e. 1657 in Tamil Nadu was also discussed in detail with the concerned SPCB to ensure whether these industries really conformed to the above mentioned criteria or not. It was confirmed that these industries are actually those which have been identified by the SPCB in obedience of an order of the Hon'ble High Court requiring inventorisation of the polluting units 120 located within one km of the water bodies in the State of Tamil Nadu. This inventory was, therefore, reviewed vis-à-vis the criteria fixed for the identification of the Grossly Polluting Industries discharging effluents into rivers/lakes. A total of 366 units out of the above mentioned 1657 units were accordingly found to be on conforming to this criteria. These 366 units have, therefore, been retained for further follow ups under the national programme and the remaining 1291 (1657-366) units through not polluting to the extend defined in the above criteria, still remains covered under implementation of the orders of the Hon'ble Court at the State level itself. Similar discussions in respect of the other States/UTs finally provided a total of 851 defaulters as on August 1997 instead of 2026 for reasons explained above. The status of these industries compiled on the basis of the discussions in the meetings of the Regional Committees and information received and from the SPCBs/PCCs till September 30, 2002 is given in Table-3. Accordingly, it can be summarized that the number of defaulters have reduced from 851 to five during the period of five years. This reduction is as a result of the closure of 238 industries and 608 industries having requisite Effluent Treatment Plants (ETPs). Table-9

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Common Effluent Treatment Plants (CETPs) The Ministry has undertaken a Centrally Sponsored Scheme for enabling the small scale industries (SSI) to set- up Common Effluent Treatment Plants in the country. Since some of the polluting SSIs are unable to afford installation of pollution control equipment. In order to encourage use of new technologies for CETPs for existing SSI clusters of units a scheme for financial assistance has been formulated. 121 The criteria for Consideration for Assistance 1) CETPs in industrial estates or in a cluster of Small Scale Industrial units are encouraged. 2) Central Assistance will be available only for clusters of SSIs. 3) Projects for assistance will be prioritized on the basis of : ? Toxicity of pollutants ? Pollution load being generated and to be treated; and ? Number of units covered 4) The CETPs are to be set up and managed by the State Industrial Infrastructure Corporation (by whatever name known) or through an appropriate institution including a cooperative body of the concerned units as may be decided by the State Governments/SPCBs concerned. 5) The project should be self-supporting for repayment of the loan and meeting operation and maintenance costs. 6) The project must formulate adequate institutional arrangements for cost sharing, recovery of dues and management and ensure observance of prescribed standards. 7) The scheme must have the technical recommendation of the State Pollution Control Boards. 8) The CETP project should have the conveyance system from the individual units to the CETP. 9) Sludge characteristics (i.e. hazardous Vs. non-hazardous) from the primary and secondary treatment of the CETP should be estimated. Therefore, the CETP should have a sludge management plan which should be prepared based on the sludge characterization and be documented in the feasibility report of the CETP project. 10)Possibility of recycling/reusing the treated effluent from the CETPs by the member units should be explored and be documented in the feasibility report of the CETP project. 11) An environmental management and monitoring plan/programme to be prepared for the CETP and be documented in the feasibility report of the CETP project. 12)A legal agreement between the CETP Co. and its member units to be executed be reflected in the feasibility report of the CETP project. 13)The cost recovery formula developed for the CETP project should be ratified by all members and be documented in the feasibility report of the CETP project. 14)Necessary clearance be obtained from the concerned State Pollution Control Board for discharging the treated effluent and be reflected in the feasibility report of the CETP project. 15)All hazardous waste facilities associated with these CETPs should obtain clearance from the concerned State Pollution Control Board and be documented in the feasibility report of the CETP project. 16)Pattern of Financial Assistance (

e.g. IDBI, ICICI or any other nationalised Banks, State Industrial Financial Corporation etc.) 17)If the CETP Co. does not desire to have loans from financial institutions/Banks they may augment the same out of their own resources/contributions, i.e. the entrepreneurs would then contribute 50% of the project cost 18)Central assistance upto 25% of the total cost of the CETP would be provided as a grant to the Common Effluent Treatment Plant(s) on the condition that a matching grant is sanctioned and released by the State Government. The CETP company should meet the remaining cost by equity contribution by the industries and loans from financial institutions. 19)Central assistance will be provided only for the capital costs. No assistance will be provided for recurring costs. The assistance will be released in four equal installments. The first installment of 25% of the assistance will be released when a body has been identified for the purpose of implementing the project, financial arrangements have been obtained from the State Pollution Control Board and State Government has committed its contribution. 20)The second installment of 25 per cent and the third installment of 25 per cent will be released after utilisation of the previous money released and adequate progress of work subject to release of their proportionate shares by the State Governments. 21)The fourth and the last installments will be released only when utilisation certificates for the previous installments have been submitted and duly verified by the State Pollution Control Boards. 22)It may be of advantage to combine some components of CETP with the municipal system. On such schemes, the municipalities have to pay their share of the cost. 23)An assessment may be made about the present physical & financial status of the CETPs. Funds released for the CETPs should be utilised for the CETP only and not for payment for debts/banks loans etc. 122 24)Large and medium scale industries other than 17 categories of heavily polluted industries may join the CETP after the primary treatment or as considered necessary by the State Pollution Control Board for the purpose of hydraulic load and for techno-economic viability of the CETP. The 17 categories of industries need to provide their own full-fledged effluent treatment facilities to confirm to the prescribed standards before the effluent is discharged. However, the large and medium scale industries would not be entitled for any subsidy meant for SSIs. During the current financial year, financial assistance has been provided to the on-going eight CETP Plant project and for new plants which have been approved by the Appraisal Committee. Common Effluent Treatment Plant at Kolkata A 30 mld (six modules of five mld capacity each) capacity CETP (Common Effluent Treatment Plant) for treating the wastewater from the cluster of tanneries has been approved for Calcutta Leather Complex (CLC) at Kolkata for an amount of Rs.65 crore. The cost of the project is to be shared on 50:50 basis between Centre and the State Government. The Central Government's share for the implementation of the project is interest free loan. The detailed project report for CETP (two modules of five mld capacity each) has been sanctioned at an estimated cost of Rs. 31.20 crore. In addition, the proposal for Effluent Transport System (ETS) for the CETP has also been sanctioned at an estimated cost of Rs. 11.59 crore. Central funds amounting to Rs. 17.985 crore have been released for execution of the scheme so far. The preliminary effluent treatment units of the CETP and ETS for CETP have been completed. The CETP is now equipped to offer the preliminary facilities to take care of the tannery wastes upto 10 mld as and when generated by the tanneries at CLC. None of the relocated tanneries or new tanneries have as yet started the tanning operation at CLC. The construction of the CETP is scheduled for completion by November, 2003. Spatial Environmental Planning Spatial planning is primarily used for land use plans, city planning, and is recently extended to regional planning as well. Environmental issues, generally, were not incorporated in the conventional town and country planning which has resulted in environmental degradation and deterioration of the urban landscape. The pollution load in ambient air, water and noise levels are also found to be higher in these areas. It is, therefore, imperative that the authorities should look into the remedial measures. In this context, spatial environmental planning has been initiated as a technique for conservation of the environmental resources and for achieving developmental targets in an environmentally sound manner. To start with a nation-wide environmental planning and mapping programme is being executed in the form of Zoning Atlas at the district level. It is followed by Industrial Estate Planning and Development of Eco Industrial Estates, Environmental Management Plans, Regional/State Planning Studies and Mapping of Environmentally Sensitive Zones. Urban Environmental Information System is also evolved for collecting information about the basic demographic profile of the urban area and a comprehensive human resource development programme for providing training to various target groups. It is proposed to establish a "Centre for Spatial Environmental Planning" at the existing premises of the Central Pollution Control Board. The details of these activities are given below: Zoning Atlas for Siting of Industries The project on Zoning Atlases for Siting of Industries has been initiated at District and Regional level for classifying the environmental status and to ascertain the pollution receiving potentials of various sites. The study also identifies the possible alternate sites for industries, through easy-to-be read maps (1:250,000 scale). Work for 63 districts was completed earlier. During the year, 73 districts covering 21 States and one Union Territory has been taken up. These include Andhra Pradesh, Assam, Bihar, Chhattisgarh, Gujarat, Himchal Pradesh, Jammu & Kashmir, Karnataka, Kerala, Madhya Pradesh, Manipur, Maharashtra, Meghalaya, Orissa, Punjab, Rajasthan, Tamil Nadu, Tripura, Uttar Pradesh, West

Bengal, Goa and UT of Pondicherry. Industrial Estate Planning & Development of Eco-Industrial Estates In continuation of the Zoning Atlas studies, the Industrial Estate Planning studies have been taken up at micro level (1:50,000 and lower) to identify environmentally suitable and acceptable sites for industrial estates. The study would also suggest infrastructure requirement for waste disposal systems and measures for controlling the surrounding land uses. Studies for nine sites have been completed and work for ten sites has been taken up. It is contemplated to develop Eco-industrial estates in the country in order to ensure proper siting of industrial estates, planning of the pollution abatement infrastructure and regulating development around these sites. In the pilot phase, technical support of German Technical Cooperation (GTZ) will be taken under the Indo- German Bilateral Programme for developing five sites as Eco-Industrial Estates. 123 Mapping of Environmental Sensitive Zones and Industrial Sites – State-wise The maps on Environmentally Sensitive Zones and Industrial Sites present the Information on National Parks, Reserved Forests, Protection Forests and Industrial Sites. These maps were earlier completed for 12 States and in the current year, work is in progress for Punjab, Maharashtra, Madhya Pradesh, Tamil Nadu, West Bengal, Uttar Pradesh and Rajasthan. Preparation of Environmental Management Plans The activities for preparation of Environmental Management Plans (EMPs) have been undertaken by urban areas, mining blocks, tourism sites and Environmentally fragile areas. As a priority project, EMP was initiated for Agra city during 2000-2001 and completed in January, 2002 at an investment of Rs. 350 crores. Outcome of the study suggests need for massive face-lift programme in the city of improving the physical infrastructure and urban management. The study for preparation of EMP for Panchmarhi Biophere Reserve located in Madhya Pradesh has also been completed and report is under finalization. Eco-cities Eco city is a city which is economically vibrant, socially equitable and environmentally supportive. Such cities ensure environmentally compatible and energy efficient development providing clean, pollution free surroundings and conservation of natural resources for higher quality living. An eco city project for Kottayam Kumarakom region was initiated, which was extended for the Taj Eco city covering an area of 30 sq. km. around Taj Mahal to achieve visible environmental improvement. Under the Tenth Plan, the project has been extended to small and medium towns in the country. The towns selected for coverage in the first phase of the Eco city programmes are Mathura (UP), Puri (Orissa), Vapi (Gujarat), Thanjavour (Tamil Nadu), Bharatpur (Rajasthan), Rishikesh (Uttaranchal), Tirupati (A.P.), Shillong (Meghalaya), Baidhyanath Dham (Deogarh, Jharkhand), Kottayam (Kerala) and Vrindavan (U.P.). The Minicipalities of these towns have submitted proposals for financial assistance. An Eco city Advisory Committee has been constituted for guiding the Programme and two meetings of the Committee have so far been held. Spatial Environmental Planning Network A comprehensive human resource development programme has been developed for providing training to various target groups in the field of spatial environmental planning. The training programmes are being conducted through a network of institutions, called SEP-NET (Spatial Environmental Planning Network). The institutes included in the SEP-NET are : Tata Energy Research Institute (TERI) - Delhi, Centre for Environment Planning & Technology – Ahmedabad, Environment Protection Training and Research Institute - Hyderabad, Environmental Training Institute – Chennai, National Productivity Council – Delhi, Disaster Management Institute – Bhopal, School of Planning & Architecture – New Delhi and Steel Authority of India Ltd. – Ranchi. The programme is supported by CDG with grants. In addition to a number of awareness programmes conducted at District level and hands-on-training to the pollution control board personnel the training programmes were also organized on themes such as Incorporation of EIA in Spatial Environmental Planning, Spatial Environmental Planning in Emergency Planning, Regional Watershed Management in Spatial Environmental Planning. Two overseas training programmes on “Spatial Environmental Planning:- Introduction and Curriculum Development” were held and a website of HRDP (www.cpcb -hrdp.com) has been launched. An evaluation manual has been finalized to achieve the quality assurance. The training institutes in the Spatial Environmental Planning Network (SEP-Net) and CPCB have started conducting training programmes. Urban Environmental Information System To provide information to the public in the form of a local environmental report to be prepared by the Municipalities on the status of socio-economics, development and environment of the towns and cities, “Urban Environmental Information System” is being introduced in a few volunteering towns. The Memorandum of Understanding has so far been signed in this regard with the municipalities of Agra, Kanpur, Patna and Bhubaneswar. Industrial Pollution Complaints During the year, Ministry has received more than 250 complaints regarding pollution caused by industries. The complaints were mostly related to pollution being caused in air, water, land and noise resulting in degradation of the eco-system. Some of the complaints were also related to discharge of untreated or partially treated effluent thereby contaminating water bodies, land and ground water. These complaints were attended to by calling reports along with the exact status and comments from the State Pollution Control Boards / Pollution Control Committees. 124 Establishment of Environment Protection Authorities National Environment Appellate Authority The National Environment Appellate Authority (NEAA) was established under the National Environment Appellate Authority Act, 1997 (22 of 1997) to hear appeals with respect to restriction of areas in which any industries, operations or processes of class of industries, operations or processes shall not be carried out or shall be carried out subject to certain safeguards under the Environment (Protection) Act, 1986 and for matters connected therewith or

accidental thereto. The NEAA was established vide Notification S.O. 311 (E) dated 9 th April, 1997. The Authority consists of a Chairperson (retired Judge of the Supreme Court or the Chief Justice of a High Court), a Vice-Chairperson and such other members not exceeding three as the Central Government deem fit. The loss of Ecology (Prevention and Payments of Compensation) Authority for the State of Tamil Nadu In compliance with Hon'ble Supreme Court's order dated 28.8.1996 in Writ Petition (Civil) No. 914 of 1991, namely, Vellore Citizens Welfare Forum versus Union of India and others, this Ministry had constituted vide Notification S.O. 671(E) dated 30.9.1996 the Loss of Ecology (Prevention and Payments of Compensation) Authority for the State of Tamil Nadu to deal with the situation created by the tanneries and other polluting industries in Tamil Nadu. The tenure of the Authority has been extended upto 30.9.2004 vide Notification S.O. 1044(E) dated 27.9.2002. The Authority consists of a retired Judge of the High Court and two members and one Member Secretary. Environment Pollution (Prevention and Control) Authority for the National Capital Region The Central Government had vide Notification S.O. 93(E) dated 29.1.1998 constituted the Environment Pollution (Prevention and Control) Authority for the National Capital Region. The Authority is headed by Shri Bhure Lal, Secretary to the Government of India with three other members and Chairman, CPCB as the convenor. The tenure of the authority has been extended by three years upto January, 2006 with inclusion of two additional members. The Authority is empowered to exercise the powers under Section 5 of Environment (Protection) Act, 1986 for issuing directions for compliance relating to violation of standards for quality of environment, emission or discharge of pollutants and to take all necessary steps to control vehicular pollution, restriction of industries causing environmental pollution and monitor the progress of action plan drawn up by the Ministry on Pollution in Delhi as contained in the "White Paper on Pollution in Delhi with an Action Plan". Central Pollution Control Board The Central Pollution Control Board (CPCB) is an autonomous body of the Ministry set up in September, 1974, under the provisions of the Water (Prevention and Control of Pollution) Act, 1974. It coordinates the activities of the State Pollution Control Boards (SPCBs) and Pollution Control Committees (PCCs), and also advises the Central Government on all matters concerning the prevention and control of environmental pollution. The CPCB, SPCBs and PCCs are responsible for implementing the legislation relating to prevention and control of pollution; they also develop rules and regulations which prescribe the standards for emissions and effluents of air and water pollutants and noise levels. The CPCB also provides technical services to the Ministry for implementing the provisions of the Environment (Protection) Act, 1986. During the year, special thrust was given to nation-wide pollution prevention plan, particularly with reference to combating vehicular pollution, pollution control in 17 categories of highly polluting industries, implementation of action plans for restoration of environmental quality in critically polluted areas, noise pollution control, municipal solid wastes and hazardous wastes. The Annual Action Plan (AAP) for 2002-2003 is an attempt towards the target set in the Coimbatore Charter on Environment and Forests and to observe the effects of implemented programs for development of environment. During the year, following activities received major emphasis in preparation of inventory of polluting sources, Preparation of State of Environment Reports of State/major cities, epidemiological studies, performance evaluation of CETP/STP, Solid Waste Management (municipal, Biomedical and hazardous), plastic waste management, Vehicular and noise pollution control, Prevention and control of pollution in small scale industries, augmentation of existing air and water quality monitoring, network monitoring of updating of Action Plan for identified problem areas. In addition, emphasis has been given for bio-monitoring of national aquatic resources, monitoring of specific pollutant in ambient air, updating of information on web-site, participation of NGOs/public in various pollution abatement programs and to effectively carryout mass awareness program. Proposals for strengthening of Zonal Offices with respect to building construction on acquired land have been made. 125 Water Quality Monitoring National Water Quality Monitoring Programme The water quality monitoring results obtained during 2001 indicated that faecal pollution, indicated by high BOD and high coliform density, continue to be the predominant source of pollution. This is mainly due to the large quantity of domestic wastewater being discharged. An attempt is made to classify the observations under different levels of pollution with respect to most critical parameters i.e. BOD, total & faecal Coliform. It is observed that 59% of the total 4119 observations taken on BOD during 2001 has BOD less than 3 mg/l, which is same as observed during the previous year. However, number of observations with BOD more than 6 mg/l has increased from 16% during the year 2000 to 18% during 2001 indicating that pollution load is on the increase and water bodies are further being polluted. This can be attributed to water scarcity due to over-abstraction, low rainfall in many parts of the country and increasing pollution load. However, the number of observations having high coliform density have somewhat reduced. State-wise number of observations falling under different BOD levels, total coliform and faecal coliform, the data indicate that Maharashtra has highest pollution level in terms of organic pollution which is mainly industrial in nature followed by Delhi, Uttar Pradesh, Gujarat, Andhra Pradesh and Tamil Nadu. Similarly, Coliform levels were found highest in Uttar Pradesh. The water quality trend based on Biochemical Oxygen Demand, total Coliform and faecal Coliform of past several years is presented in Fig 5 to Fig 7. Fig. 5. Water Quality Trend based on Bio-chemical Oxygen Demand Fig. 6. Water Quality Trend based on total Coliform 126 Fig. 7. Water Quality Trend based on Faecal Coliform Status of Wastewater Generation and Treatment It is estimated that 22,900 MLD of domestic wastewater is generated

from urban centres against 13000 MLD industrial wastewater. The treatment capacity available for domestic wastewater is only for 6,000 MLD, against 8,000 MLD of industrial wastewater. Thus, there is a big gap in treatment of domestic wastewater. Government of India is assisting the local bodies to establish sewage treatment plants under the Ganga Action Plan and subsequently under the National River Action Plan. Monitoring of Yamuna River for Assessment of Water Quality The Central Pollution Control Board is regularly monitoring Yamuna river on monthly basis in Delhi segment at three locations i.e. Palla, Nizamuddin barrage and Okhla barrage. In addition, monitoring of 22 drains, which are the major source of pollution in the river are also being undertaken regularly. The water quality of river Yamuna in Delhi stretch is depicted in The total calculated discharge of these 22 drains is approx. 46.30 m 3 /sec, which contributes 311.05 tonnes of BOD load per day. From the total discharge of these drains Yamuna receives more than 90% wastewater discharge and rest wastewaters contributed by two drains joining canals. Similarly out of 311.05 tonnes of BOD load, Yamuna receives 283.98 tonnes of BOD load per day and rest received by canals. The Delhi segment of river Yamuna has oligotrophic head with saprobic tail end, and characterized by high bacterial load (except at Palla) having high BOD with strong disagreeable odour. The anaerobic condition in river is frequently reflected by masses of gaseous sludge rising from the bottom and floating at the surface of water.

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Bio-monitoring of rivers/water bodies The importance and use of biological monitoring system, as a cost-effective tool, has been realized in recent past to maintain and restore the wholesomeness of water quality in terms of ecological sustainability of various designated best-uses of water bodies. It has been observed that the desired quality levels are quite often delinked with the observed water quality of water bodies for designated best uses due to number of integrated environmental management problems as a result of rapid industrialization and urbanization. On the basis of environmental status, twenty four problem areas have been identified in the country. The recipient water bodies of these problem areas are bearing the affect due to environmental degradation. The bio-monitoring studies in water bodies existing in problem areas have been undertaken at nineteen problem areas in the country in order to make an integrated approach toward environmental management. The identified nineteen problem areas are Ambedkar Nagar (Tamil Nadu), Angul, Talcher (Orissa), Ankleshwar (Gujarat) Bhadravathi (Karnataka), Dhanbad (Jharkhand), Durgapur (West Bengal), Howrah (West Bengal), Jodhpur (Rajasthan), Kochi (Kerala), Kala Amb (Himachal Pradesh), Manali (Tamil Nadu), Nagda, Ratlam (Madhya Pradesh), Najafgarh Drain Basin (Delhi) Pali (Rajasthan), Parwanoo (Himachal Pradesh) Singrauli (Uttar Pradesh and Madhya Pradesh) and Vapi (Gujarat). The main objective of the studies are : ? Biological assessment of water quality of surface water bodies existing in problem areas. ? To evaluate the improvement in water quality as a result of action taken for pollution control in problem areas. 127 Bio-mapping of River Ramganga Monthly monitoring of river Ramganga has been undertaken at ten locations during the year. From data, it is evident that as long as the river passes through the hills and reserve forests (Jim Corbett National Park) the deterioration of biological water quality is negligible. The deterioration of water quality starts in Bijnor district as some industries dispose their waste into the river. At downstream of Moradab, where drain and river Dhela joins the river, the river stretch is affected. The river itself a bit but sudden load from Rampur deteriorates its quality to class D. Further downstream, it slowly recovers its biota and maintains Class C till it joins the river Ganga. Air Quality Monitoring The air quality of different cities/towns with respect to three criteria pollutants has been compared with the respective National Ambient Air Quality Standards and categorized into four broad categories based on an Exceedence Factor The analysis contains the air quality assessment of 155 monitoring locations (in 64 cities/towns), out of which 81 are in residential, 71 in industrial and three in sensitive areas. At 49 locations (27 residential and 22 industrial), data are insufficient (> 50 monitoring days in the year) with respect to gaseous pollutants and at 56 locations (36 residential, 19 industrial and one sensitive) with respect to SPM. Such locations have not been considered for air quality assessment.

Table – 10 Respirable Suspended Particulate (RSPM) Monitoring

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RSPM levels were measured in various cities and towns in India Fig.47 and 48. RSPM levels exceeded the NAAQS (annual average) in residential areas of Hyderabad, Visakhapatnam, Delhi, Ahmedabad, Parwanoo, Bangalore, Cochin, Dehradun, Tiruvananthapuram, Mumbai, Nagpur. Pune, Solapur, Angul, Rourkela, Jaipur, 128 Chennai, Kanpur, Lucknow and Kolkata. RSPM levels also exceeded the NAAQS (annual average) in industrial areas of Ahmedabad, Dehradun, Thiruvananthapuram, Solapur, Jaipur, Kanpur and Kolkata. RSPM levels were within the NAAQS (annual average) in residential areas of Kozhikode and Shillong and industrial areas of Hyderabad, Visakhapatnam, Bangalore, Mysore, Cochin, Kotayam, Koshokode, Palakkad, Mumbai, Nagpur, Pune, Rourkela and Chennai. These results indicate that NAAQS (annual average) were not exceeded in above mentioned cities. Fig.49 and 50 shows number of cities with critical, high, moderates RSPM levels in residential and industrial areas.

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Air Quality Non-attainment Cities CPCB has identified list of cities in India based on ambient air quality data obtained under National Air Quality Monitoring Programme (NAMP) for the period 1995 to 2001.

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Fig. 8. RSPM Levels measured in Residential Areas during the year 2000 Fig. 9. RSPM Levels measured in Industrial Areas during the year 2000

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Ambient Noise Level and Air Pollution in Delhi during Deepawali Ambient noise level monitoring was carried out at various locations in Delhi, i.e. all India Institute of Medical Sciences (AIIMS), Lajpat Nagar, New Friends Colony, East Arjun Nagar, Connaught Place, India Gate, Mayur Vihar, Patel Nagar and Kamla Nagar on the occasion of Deepawali festival. At Kamla Nagar noise monitoring was conducted from 18.00 hrs to 24.00 hrs., while at other locations, short duration (half hourly) noise level monitoring was conducted between 18.00 hrs and 24.00 hrs. The average Leq noise level for short duration at 8 monitored locations ranged between 73 dB(A) and 80 dB(A). The minimum instantaneous value, 129 recorded at Kamla Nagar, was 47 dB(A) (between 18.30 hrs. and 19.00 hrs) and the maximum value, recorded was 101 dB(A) (between 19.30 hrs and 20 hrs.). The ambient noise levels were above the prescribed limit at all the locations but did not indicate much variation as compared to the previous year's data. Ambient air quality monitoring was also carried out at ITO Intersection and Ashok Vihar using manual monitoring techniques and at East Patel Nagar (Pusa Road) using the mobile monitoring van. The Respirable Suspended Particulate Matter (RSPM) were high in the evening hours on Deepawali day. The concentration of Sulphur dioxide (SO 2), Oxides of Nitrogen (NO x) and Carbon monoxide (CO) indicated a mixed trend which may be because of varying traffic density. Efficiency testing of Autoclaves used for hospital waste treatment by spore testing methodology Bio-medical waste generation and its safe disposal has become a matter of serious concern due to increasing health facilities & increase in number of hospitals, nursing homes in metropolitan cities. The Biomedical Waste (Management & Handling) Rules, 1998 notified by Government of India, has stipulated rules for proper collection, storage, transportation, treatment and disposal of bio-medical waste. As per Bio-medical Waste Rules, 1998 the hospitals have to install treatment facilities like incinerators, autoclaves, etc. for treatment of bio-medical wastes generated to ensure safe treatment & disposal of infectious hospital waste. These treatment facilities should operate at designed efficiency level. A project has been undertaken by Central Pollution Control Board for assessment of efficiency of autoclaves used in hospital waste treatment based on standardized spore testing methodology, for In-situ assessment of the efficiency of autoclaves installed at various hospitals within NCT-Delhi using biological indicator to ascertain 4 Log 10 reduction of Bacillus Stereothermophilus indicator. During first phase of the project, the standardization of spore testing methodology has been undertaken using Bacillus Stereothermophilus as biological indicator with a view for its application for efficiency testing of autoclaves used for hospital waste treatment. The standardized methodology has been used at autoclaves installed at various hospitals within NCT-Delhi for testing their efficiency during the reporting year. The results indicate that the Bio-medical waste treatment autoclaves installed at various hospitals are satisfactory with respect to sterilization of bio-medical waste undertaken at these autoclaves.

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Fig. 10. Number of Cities (Residential Areas) with Critical, High, and Moderate RSPM Levels during 2000

Development of Guidelines/Rational for Prescribing Location Specific Standards The Central Board is involved in developing Minimal National Standards (MINAS), which are applicable for entire nation considering techno-economic feasibility of control equipment. However, considering the location specific sensitivity, the State Pollution Control Boards can make the national standards stringent. For example, in critical areas, where single or cumulative effect of emissions/wastewater discharges exceed the ambient air/water quality requirement, a rational/structurised approach shall be followed in order to avoid bias in granting permit conditions to individual industries, which are often challenged on the basis. Under this programme, efforts have been made to set approach for assessment of assimilative capacity and fine tuning of the standards considering health protection, environment protection, availability of technology and economic feasibility. With the association of indigenous and expatriate consultants, an approach has been made which is being debated among the experts for finalization. Besides, the approach is being applied in selected study area for fine-tuning. These studies include inventorization of air and water pollution sources, existing level of control technologies, application of air quality models (ISCST3) and concepts of zone of initial dilution and mixing zones in respect of water quality in surface water bodies. 130 Control Technologies for Volatile Organic Compounds in Industrial Emissions One of the common air pollutants emanating from the chemical industries is volatile compounds. As it is well known that if emissions are emanating from a point source can very well be controlled absorption, condensation, adsorption, thermal destruction etc. whereas, due to volatile nature of various solvents and process fluids used in chemical sectors, the fugitive emissions will arise from valves, flanges, pumps, storing units, effluent treatment plants etc. In order to address the volatile organics, a project has been taken-up for studying oil refineries and petrochemical plants in India. Possibilities of application of general VOC's and hazardous air pollutants on the lines of developed countries is being discussed and their adoptability in terms of monitoring equipment, control equipment, investment on equipment modifications, establishing emission factors etc. are being studied. Review of Control Technologies for Total Dissolved Solids (TDS) in Industrial Effluents Feasible disposal specific TDS limits have been developed and same have been endorsed by the Expert Committee and are being considered by the Central Board. Under capacity building programme, five days training programme on "Management of TDS in Industrial Effluents" has been arranged through Environment Protection Training and Research Institute, Hyderabad for 15 States and Central Board officers. Pollution Control Implementation Industrial Pollution Control along the Rivers and Lakes 851 defaulting grossly polluting industries located along the rivers and lakes in the country have been identified for priority actions under this programme, which was started in August 1997. The follow-ups for the implementation of the programme, was intensified and this has resulted in reduction in the number of defaulting industries from 93 in March, 2000 to 5 in September, 2001. Environmental Surveillance Squad (ESS) Environmental Surveillance Squad in an important project undertaken by CPCB as per the direction of Hon'ble Supreme Court. The main objective of the squad is to identify the willful defaulter through surprise visits. Suitable action is also being taken against the erring industries either directly by CPCB or through State Pollution Control Board under various Environmental Acts. Under this project more than 50 industries have been visited and on the basis of the recommendations, the competent authority of CPCB has issued closure notice to the defaulters. Hazardous Substances Management The Hazardous Substances Management Division (HSMD) is the nodal point within the Ministry for management of chemical emergencies and hazardous substances. The main objective of the Division is to promote safe management and use of hazardous substances including hazardous chemicals and hazardous wastes, in order to avoid damage to health and environment. The activities of the division can be grouped under three main thrust areas, viz., Chemical Safety; Hazardous Wastes Management and Solid Waste Management. The Division is also the nodal point for the following three International Conventions. ? The Basel Convention on the Control of Transboundary Movement of Hazardous Wastes and their Disposal ? The Rotterdam Convention on the Prior Informed Consent (PIC) Procedure for Certain Hazardous Chemicals & Pesticides in International Trade. ? The Stockholm Convention on Persistent Organic Pollutants (POPs). Salient details of the programmes and activities carried out during the year are : Chemical Safety ? It has been decided to bring the entire gamut of activities relating to hazardous substances under the frame-work of a comprehensive National Chemical Profile, which is proposed to be prepared based on the UNITAR guidance document. The report will assess the existing institutional, administrative, technical and legal infrastructure vis-à-vis the requirement of safe handling of chemicals in the country. This activity is being supported under the Canada-India Environmental Institutional Strengthening Project. ? The Manufacture, Storage and Import of Hazardous Chemical (MSIHC) Rules, 1989 and the Chemical Accidents (Emergency Planning, Preparedness and Response) Rules, 1996 are the main instruments for ensuring chemical safety in the country. Implementation of both the Rules by the State/UTs governments is constantly pursued and monitored. As on date, there are 1460 Major Accident Hazard Units (MAH) in 19 states of the country. As per the latest reports, 1395 on-site Plans and 118 Off-site 131 plans have been prepared. All the states except Bihar and Jammu & Kashmir have constituted State Level Crisis Groups. ? A country report on "Status of

Emergency Preparedness and Response in MAH Districts in the Country" has been prepared. The study was undertaken to assess the Emergency Preparedness and Response Systems existing in the country. The study has observed that the status of Emergency Preparedness in the country needs improvement at different levels. Immediate upgradation of availability of information, availability of resources to respond to Fire Emergencies, availability of hospitals with poison treatment facilities and other responses has been recommended for those districts having maximum MAH units. ? A pilot study was initiated earlier to develop GIS based Emergency Planning and Response System in four identified States namely – Gujarat Maharashtra, Tamil Nadu and Andhra Pradesh. It has been decided to install the system consisting of a software package and database at the district level. Training will also be provided to enable the usage of this package along with district off-site emergency plans to improve emergency management at the district level. Districts with a large number of Major Accident Hazard Units namely-Bharuch, Valsad, Ahmedabad, Vadodara, Kutch and Surat in Gujarat; Thane, Mumbai, Nasik, Pune, Raigad and Ratanagiri in Maharashtra; Tiruvallur, Cheenai and Salem in Tamil Nadu; Rangareddy, Medak, East Godawari, West Godawari and Visakhapatnam in Andhra Pradesh have been included in this project so far. ? A Sub-Scheme entitled 'Industrial Pocket-wise Hazard Analysis' has been in operation since the Eighth Five Year Plan. Out of 180 Hazard prone industrial pockets, Hazard Analysis studies have been initiated for 75 pockets. Out of these 75 studies, 69 have been completed. Based on the recommendation of the study reports, preparation of off-site plan for Kota has been initiated. ? Several cases of chemical accidents involving isolated storages have come to light in the recent past. In this regard, lack of inventorization of such storages and poor enforcement of legal provisions have been identified as the major factors. An inventorisation study for the "Isolated Storage" in the country carried out last year has identified 347 Isolated Storages. The distribution of such storages is as follows: Gujarat (41), Uttar Pradesh (38), Tamil Nadu (32), Andhra Pradesh (31), Karnataka (25), West Bengal (24), Maharashtra (23), Orissa (22), Rajasthan (22), Madhya Pradesh and Punjab (17), Delhi (14), with the others being distributed all over the country. ? Under the Public Liability Insurance Act, 1991 as amended in 1992, all the MAH units handling chemicals in excess of the threshold quantities referred to in the Schedule, are mandated to take an insurance policy and deposit an equal amount in the Environment Relief Fund (ERF) to ensure immediate payment to the chemical accident victims. It has been decided to entrust the administration of the ERF to the United India Insurance Company. Modalities are being worked out regarding service charges payable to this company. ? During the year, Phase-I of the study entitled "Development and Demonstration of Process Technology for Remediation of Polychlorinated Biphenyls (PCBs) in Oils and Paints by Radiolysis" has been completed. The study has identified the types of PCBs, their concentrations in oils, capacitors and paints scrapings, collected from different sections of twenty seven ships and thirty plots/shipyards at Alang (Gujarat). Phase-II of the study has also been initiated during the current year to develop and optimize a radiolytic process for the decomposition of PCBs in oils, capacitors and paint scrapings. Hazardous Waste Management As per current assessment, 4.4 million tonnes of hazardous wastes are being generated by 13011 units spread over 373 districts of the country. The states of Maharashtra, Gujarat and Tamil Nadu account for over 63% of the total hazardous wastes generated in the country. This data, which is based on the waste categories indicated in the Hazardous Wastes (Management and Handling) Rules, 1989, is being revised in the light of the amendments carried out in January, 2000 and further amendments being carried out during the year. The legal instruments for management of hazardous wastes are the Hazardous Wastes (Management & Handling) Rules, 1989, as amended in 2000 and 2002, the Biomedical Wastes (Management & Handling) Rules, 1998/2000 and the Batteries (Management & Handling) Rules, 2001. Major responsibility for implementing these rules is with the Central Pollution Control Board and State Pollution Control Boards (SPCBs)/Pollution Control Committees (PCCs) and also with the State Departments of Environment. The status of implementation of all these rules is regularly monitored. The fifth meeting of the Steering Committee for the management of Biomedical Wastes was held during the year. It was decided that the Guidelines for Management and Handling of Bio -medical Wastes shall be finalized after incorporating the comments of the members of the Steering Committee. Certain amendments to the Bio-medical Rules are also proposed. The Batteries (Management & Handling) Rules, 2001 were notified in May, 2001 to regulate the collection, channelization and recycling as well as import of used lead acid batteries in the country. These rules 132 inter-alia make it mandatory for consumers to return used batteries. All manufacturers / assemblers / reconditioners / importers of lead acid batteries are responsible for collecting used batteries against new ones sold as per a schedule defined in the rules. Such used lead acid batteries can be auctioned/sold only to recyclers registered with the Ministry on the basis of their possessing environmentally sound facilities for recycling/recovery. During the year implementation of these rules was monitored which indicated that the status of implementation of these rules, especially relating to collection of old batteries needs improvement. Following steps have been taken during the year to ensure effective implementation of the Battery Rules 7. Creation of awareness among all stake holders about management of lead acid batteries through the print and electronic media. Issues relating to the management of lead acid batteries are proposed to be covered in one of the episodes of the environmental serial 'Bhoomi'. 8. 100% monitoring of all the lead acid battery recycling/reprocessing units registered with the MoEF has been launched. 9. Action is underway to put in place a mechanism for organized collection of used

lead acid batteries in the country. 10. Directions have been issued to all the SPCBs/PCCs to check and close down backyard lead smelters/fly-by-night operators. An Inquiry Committee was constituted during the year on the directions of the Hon'ble Supreme Court in the matter of Writ Petition No. 657 of 1995 filed by the Research Foundation for Science, Technology and Natural Resource Policy against the Union of India and others, to verify the inventory of hazardous wastes such as waste oil, lead acid batteries and other non-ferrous metal wastes lying in various ports and Inland Container Deports of the country. The Committee has submitted the final report and findings have been submitted to the Supreme Court. The W.P.No. 967/89 filed by Indian Council for Enviro Legal Action against UoI and Others on Groundwater Pollution and Soil Degradation in Bichhri Village, Udaipur (Rajasthan) due to indiscriminate disposal of Toxic Wastes, is being heard in the Supreme Court. The Final Report of the 'Remediation/Reclamation of Hazardous Waste Contaminated Areas in Bichhri Village, Rajasthan" has been submitted to the Ministry after incorporating the comments of the Advisory Technical Review Committee. As per the Hazardous Wastes (M&H) Rules, 1989 and 2000, all hazardous wastes are required to be treated and disposed off in the manner prescribed. In the absence of common disposal facilities in the country, permission has been granted to the hazardous waste generating units in the small scale sector, for storing their wastes temporarily in a secure, lined pit/facility within their premises. During the Tenth Plan Period it has been decided to focus on the setting up of common TSDFs in different parts of the country. While support would be provided for setting up two such common facilities in major hazardous waste generating states, one facility would be supported in other states. The Ministry has so far supported the setting up of common TSDFs at Maharashtra (TTC-Belapur) and Andhra Pradesh (RR District). During the year, financial support has been provided to three more TSDFs in the country – two in the state of Gujarat (Ankleshwar and Surat) and one in Maharashtra (Taloja). The scheme for "Registration of Recyclers/Reprocessors of Wastes as Actual Users having Environmentally Sound Management facilities" initiated in 1999, was continued during the year and two meetings of the Registration Committee were held. A total of 130 proposals were considered in these meetings. Registration was approved to 103 units, applications of 4 units were rejected and the rest were deferred. As on date, 234 units have been registered with the Ministry, out of which 78 are used/waste oil reprocessors, 71 are lead scrap processing units while the remaining 83 are non-ferrous metal waste processing units. During the year registration was also renewed in respect of 53 units whose registration had expired. The list of registered recyclers/reprocessors is posted on the web-site of the Ministry and is updated regularly. Rigorous monitoring of the registered units has been initiated during the year to ensure that all the conditions included in the Registration Letter are compiled with by the units. In case of lead acid battery recycling units 100% monitoring of registered units has been undertaken. The Regional Offices of the Ministry have been entrusted with the monitoring work. Solid Waste Management The Municipal Solid Wastes (Management & Handling) Rules, 2000, the Fly Ash Notification, 1999 and the Recycled Plastics (Manufacture & Usage) Rules 1999 constitute the regulatory frame work for the management of solid wastes in the country. ? Committee on Plastic Waste Disposal constituted under the Chairmanship of Shri Ranganath Mishra, former Chief Justice of the Hon'ble Supreme Court has submitted its report containing recommendations for the management of plastic wastes in the country. Draft amendments to the Recycled Plastics Manufacture and Usage Rules, 1999, have been issued 133 during the year. The proposed amendments include, inter-alia, a ban on manufacture of plastic carry bags less than 8 inches X 12 inches in size and a provision for registration of recyclers of plastic with the SPCBs/PCCs. Objections/comments/suggestions received in response to the draft amendments are being examined. ? During the year, guidelines for use of fly ash have been formulated and circulated to the State Governments. The guidelines cover use/disposal of fly ash by road and building construction agencies, local bodies, State Pollution Control Boards and Thermal Power Plants. ? A High Level Committee under the chairmanship of Secretary (E&F) has been constituted during the year with representatives from concerned Ministries, Technical Institutions and All India Brick and Tile Manufacturers Federation to review the implementation of the provisions of fly ash notification dated 14 th September, 1999. Besides monitoring the implementation of the provisions of the Notification, the Committee will also provide policy guidance on utilization of fly ash in various sectors/developmental activities including incentives/disincentives required therefore.

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International Conventions/Protocols Basel Convention on the Control of Transboundary Movement of Hazardous Wastes and their Disposal l) India is a signatory to the Basel Convention, which requires countries to ensure that hazardous wastes and hazardous recyclable materials are managed in an environmentally sound manner. m) During the year, the Ministry participated in the 5 th and 6 th meetings of the Expanded Bureau of Conference of Parties (COP) 5 and the 20 th meeting of the Technical Working Group, the Legal Working Group meeting etc. of the Basel Convention. The Ministry also participated in COP 6 of the convention held in Geneva in December, 2002. The four major issues discussed during COP 6 were the strategic plan for implementation of the Basel Convention, the establishment of Basel Convention Regional Centres, Mechanism for effective implementation of convention and partnership with industry and multilateral environmental agreements. Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals & Pesticides in International Trade. The Ministry participated in the 3rd Session of the Interim Chemical Review Committee Meetting under the Convention. Stockholm Convention on Persistent Organic Pollutants (POPs) India has signed the Stockholm Convention on POPs in May, 2002. The Convention seeks to eliminate production, use, import and export of 12 POPs wherever techno-economically feasible and in the interim period restrict the production and use of these chemicals. A project titled “Preliminary assessment to identify the requirements for developing a National Implementation Plan in India as a first step to implement the Stockholm Convention on POPs” has been initiated during the year with support from GEF. Legislations relating to Hazardous Substances Management ? One of the recommendations of the High Powered Committee constituted under the Chairmanship of Prof. MGK Menon in the mater of W.P.No.657 of 1995 being heard in the Hon’ble Supreme Court, was that the Hazardous Wastes (Management and Handling) Rules, 1989/2000 should be amended urgently based on waste prevention and clean production, waste minimization and recovery prior to consideration of options dealing with disposal of hazardous wastes. Accordingly, the Hazardous Wastes (Management & Handling) Amendment Rules, 2002 have been notified on 21 st May, 2002. A Technical Expert Committee constituted during the year to finalise the amendments has examined over 250 objections/comments/suggestions received from concerned institutions/organizations. Based on this and the inputs given by the CPCB and SPCBs, the amendments have been finalized and are expected to be notified shortly. ? During the year draft amendments to the fly-ash notification of 1999 have also been notified. Use of fly- ash in construction, laying of roads and reclamation of low lying areas has been made mandatory in the amendments. Objections/comments/suggestions received in response to the draft amendments are being examined. Institutional Strengthening The scheme for strengthening the manpower and infrastructure of the SPCBs/PCCs to ensure effective implementation of various Rules relating to Hazardous substances management, was continued during the year. 134

Waste Disposal Key Issues in Waste Disposal Let us first get one thing very clear: there is no option but to dispose of wastes. Disposal is the final element in the SWM system. It is the ultimate fate of all solid wastes, be they residential wastes collected and transported directly to a landfill site, semisolid waste (sludge) from municipal and industrial treatment plants, incinerator residue, compost or other substances from various solid waste processing plants that are of no further use to society. It is, therefore, imperative to have a proper plan in place for safe disposal of solid wastes, which involves appropriate handling of residual matter after solid wastes have been processed and the recovery of conversion products/energy has been achieved. It follows that an efficient SWM system must provide an environmentally sound disposal option for waste that cannot be reduced, recycled, composted, combusted, or processed further (Ali, et al 1999). However, in these days, indiscriminate disposal of wastes in many regions is very common, giving rise to such problems as: ? health hazards (e.g., residents in the vicinity of wastes inhale dust and smoke when the wastes are burnt; workers and rag pickers come into direct contact with wastes, etc.); ? pollution due to smoke; ? pollution from waste leachate and gas; ? blockage of open drains and sewers. Clearly, safe disposal of solid wastes is important for safeguarding both public health and the environment. Issues to be overcome To achieve effective waste disposal, we must overcome the following the constraints: i) Municipal Capacities: With the increasing volume of waste generation, collection of wastes gets more attention than disposal. Furthermore, in India, only a few municipalities seem to have the required experience or capacity for controlled disposal. Some municipalities may have identified disposal sites but still only few may actively manage them. In some places, contracting out waste disposal is seen as a solution. But, municipalities are not equipped to deal with the problems associated with it, such as issues of privatisation and monitoring of the contract. ii) Political commitment: SWM is more than a technical issue, as any successful programme needs effective political and governmental support. This is rarely a priority of government authorities, unless there is a strong and active public interest as well as international interventions. iii) Finance and cost recovery: Development of a sanitary landfill site represents a major investment and it generally receives less priority over other resource demands. And, even when establishment costs are secured for a disposal site, recurrent costs to maintain it always pose problems. (iv) Technical Guidelines: Standards established for waste disposal in one country need not necessarily be appropriate for another, due to reasons such as climatic conditions, resources availability, institutional infrastructure, socio- cultural values, etc. In the absence of adequate data and/or the means of collecting/acquiring it, officials often struggle to plan a safe and economically viable disposal option. v) Institutional role and responsibility: A disposal site may be located outside the boundary of a town and may serve more than one town. This necessitates the co-ordination of all authorities concerned, and the roles and responsibilities of different departments need to be clearly defined and accepted by all concerned. vi) Location: The accessibility of a disposal site, especially its distance from town, is an important factor in site selection, especially when staff and public do not have a strong incentive to use it, when compared to indiscriminate dumping. Site selection is perhaps the most difficult stage in the development of suitable disposal option. Disposal Options and Selection criteria The most common disposal option practised currently in many countries is either uncontrolled dumping or dumping with moderate control. The environmental costs of uncontrolled dumping include breeding of disease causing vectors (e.g., flies, mosquitoes and rodents), pollution, odour and smoke. However, it should be noted that the option selected for waste disposal must mesh with the existing socio-cultural milieu, infrastructure, etc., 1) Disposal Options In this Subsection, we will touch upon some the options available for waste disposal, and in that respect, we will consider the following: 135

i) Uncontrolled dumping or non-engineered disposal: As mentioned, this is the most common method being practised in many parts of the world, and India is no exception. In this method, wastes are dumped at a designated site without any environmental control. They tend to remain there for a long period of time, pose health risks and cause environmental degradation. Due to the adverse health and environmental impact associated with it, the non-engineered disposal is not considered a viable and safe option. ii) Sanitary landfill: Unlike the non-engineered disposal, sanitary landfill is a fully engineered disposal option in that the selected location or wasteland is carefully engineered in advance before it is pressed into service. Operators of sanitary landfills can minimise the effects of leachate (i.e., polluted water which flows from a landfill) and gas production through proper site selection, preparation and management. This particular option of waste disposal is suitable when the land is available at an affordable price, and adequate workforce and technical resources are available to operate and manage the site. iii) Composting: This is a biological process of decomposition in which organisms, under controlled conditions of ventilation, temperature and moisture, convert the organic portion of solid waste into humus-like material. If this process is carried out effectively, what we get as the final product is a stable, odour-free soil conditioner. Generally, the option of composting is considered, when a considerable amount of biodegradable waste is available in the waste stream and there is use or market for composts. Composting can be either centralised or small-scale. Centralised composting plants are possible, if adequate skilled workforce and equipments are available. And, small-scale composting practices can be effective at household level, but this needs public awareness. iv) Incineration: This refers to the controlled burning of wastes, at a high temperature (roughly 1200 – 1500 C), which sterilises and stabilises the waste in addition to reducing its volume. In the process, most of the combustible materials (i.e., self-sustaining combustible matter, which saves the energy needed to maintain the combustion) such as paper or plastics get converted into carbon dioxide and ash. Incineration may be used as a disposal option, when land filling is not possible and the waste composition is highly combustible. An appropriate technology, infrastructure and skilled workforce are required to operate and maintain the plant. v) Gasification: This is the partial combustion of carbonaceous material (through combustion) at high temperature (roughly 1000 C) forming a gas, comprising mainly carbon dioxide, carbon monoxide, nitrogen, hydrogen, water vapour and methane, which can be used as fuel. vi) Refuse-derived fuel (RDF): This is the combustible part of raw waste, separated for burning as fuel. Various physical processes such as screening, size reduction, magnetic separation, etc., are used to separate the combustibles vii) Pyrolysis: This is the thermal degradation of carbonaceous material to gaseous, liquid and solid fraction in the absence of oxygen. This occurs at a temperature between 200 and 900 C. The product of pyrolysis is a gas of relatively high calorific value of 20,000 joules per gram with oils, tars and solid burned residue (Ali, et al 1999). Relative merits of some options Having touched upon several disposal options, let us now present the merits and demerits of some of them in Table 11: Table 11 - Relative Merits of Disposal Options 2. Selection criteria With the help of proper frameworks and sub-frameworks, we can assess the effectiveness of each of the waste disposal options. While a framework represents an aid to decision-making and helps to ensure the key issues are considered, a sub-framework explains how and why the necessary information should be obtained (Ali, et al 1999). A framework contains a list of issues and questions pertaining to the technical, institutional, financial, social and environmental features of a waste disposal system to assess the capacity of a disposal option to meet the requirements. For example, an appraisal of waste disposal option must include the following: 136

i) Technical: This feature, involving efficient and effective operation of the technology being used, evaluates the following components of a SWM system: ? composition of wastes, e.g., type, characteristics and quantity. ? existing practices, e.g., collection, transport, and recycling process. ? siting, e.g., location of disposal site, engineering material, etc. ? technology, e.g., operation, maintenance, technical support, etc. ? impact, e.g., anticipated by-product, requirement for their treatment and disposal, etc. ii) Institutional: This involves the ability and willingness of responsible agencies to operate and manage the system by evaluating the following: ? structures, roles and responsibilities, e.g., current institutional frameworks. ? operational capacity, e.g., municipal capacities, local experience and staff training. ? incentives, e.g., management improvement and waste disposal practices. ? innovation and partnership. iii) Financial: This assesses the ability to finance the implementation, operation and maintenance of the system by evaluating the following: ? financing and cost recovery, e.g., willingness to raise finance for waste management. ? current revenue and expenditure on waste management. ? potential need for external finance for capital cost. iv) Social: This helps in avoiding adverse social impact by evaluating the following: ? waste picking, which has an impact on livelihood and access to waste pickers. ? health and income implication. ? public opinions on the existing and proposed system. v) Environmental: This means setting up an environment friendly disposal system by evaluating the following: ? initial environmental risks, i.e., impact of existing and proposed disposal option. ? long-term environmental risks, i.e., long-term implication (future impacts). We touched upon the various disposal options alongside the selection criteria for disposal options. One such option we mentioned is engineered disposal, often referred to as sanitary landfill. Although in several countries, uncontrolled dumping is still the most prevalent disposal option, sanitary landfill is gradually taking precedence as the ill effects of uncontrolled dumping are increasing. This being so, we will discuss the principle, processes, design, construction and monitoring aspects of sanitary landfill next. Sanitary Landfill The term landfill generally refers to an engineered deposit of wastes either in pits/trenches or on the surface. And, a sanitary landfill is essentially a landfill, where proper mechanisms are available to control the environmental risks associated with the disposal of wastes and to make available the land, subsequent to disposal, for other purposes. However, you must note that a landfill need not necessarily be an engineered site, when the waste is largely inert at final disposal, as in rural areas, where wastes contain a large proportion of soil and dirt. This practice is generally designated as non-engineered disposal method. When compared to uncontrolled dumping, engineered landfills are more likely to have pre-planned installations, environmental monitoring, and organised and trained workforce. Sanitary landfill implementation, therefore, requires careful site selection, preparation and management. The four minimum requirements you need to consider for a sanitary landfill are: (i) full or partial hydrological isolation; (ii) formal engineering preparation; (iii) permanent control; (iv) planned waste emplacement and covering. Against this background, let us now discuss the principles, processes anoperation of sanitary landfills. 1. Principle The purpose of land filling is to bury or alter the chemical composition of the wastes so that they do not pose any threat to the environment or public health. Landfills are not homogeneous and are usually made up of cells in which a discrete volume of waste is kept isolated from adjacent waste cells by a suitable barrier. The barriers 137
between cells generally consist of a layer of natural soil (i.e., clay), which restricts downward or lateral escape of the waste constituents or leachate. Land filling relies on containment rather than treatment (for control) of wastes. If properly executed, it is a safer and cheaper method than incineration An environmentally sound sanitary landfill comprises appropriate liners for protection of the groundwater (from contaminated leachate), run-off controls, leachate collection and treatment, monitoring wells and appropriate final cover design (Phelps, 1995). Figure 11 below gives a schematic layout of sanitary landfill along with its various components: Before we take up landfill processes, let us touch upon the phases in the life cycle of a landfill, and these are: ? Planning phase: This typically involves preliminary hydro-geological and geotechnical site investigations as a basis for actual design. ? Construction phase: This involves earthworks, road and facility construction and preparation (liners and drains) of the fill area. ? Operation phase (5 – 20 years): This phase has a high intensity of traffic, work at the front of the fill, operation of environmental installations and completion of finished sections. ? Completed phase (20 – 100 years): This phase involves the termination of the actual filling to the time when the environmental installations need no longer be operated. The emissions may have by then decreased to a level where they do not need any further treatment and can be discharged freely into the surroundings. ? Final storage phase: In this phase, the landfill is integrated into the surroundings for other purposes, and no longer needs special attention. 2. Landfill processes The feasibility of land disposal of solid wastes depends on factors such as the type, quantity and characteristics of wastes, the prevailing laws and regulations, and soil and site characteristics. Let us now explain some of these processes. (i) Site selection process and considerations: This requires the development of a working plan – a plan, or a series of plans, outlining the development and descriptions of site location, operation, engineering and site restoration. Considerations for site include public opinion, traffic patterns and congestion, climate, zoning requirements, availability of cover material and liner as well, high trees or buffer in the site perimeter, historic buildings, and endangered species, wetlands, and site land environmental factors, 138

speed limits, underpass limitations, load limits on roadways, bridge capacities, and proximity of major roadways, haul distance, hydrology and detours. (ii) Settling process: The waste body of a landfill undergoes different stages of settling or deformation. Figure 12 below illustrates these stages: The three stages shown in the figure above are described below: ? Primary consolidation: During this stage, a substantial amount of settling occurs. This settlement is caused by the weight of the waste layers. The movement of trucks, bulldozers or mechanical compactors will also enhance this process. After this primary consolidation, or short-term deformation stage, aerobic degradation processes occur. ? Secondary compression: During this stage, the rate of settling is much lower than that in the primary consolidation stage, as the settling occurs through compression, which cannot be enhanced. ? Decomposition: During the degradation processes, organic material is converted into gas and leachate. The settling rate during this stage increases compared to the secondary compression stage, and continues until all decomposable organic matter is degraded. The settling rate, however, gradually decreases with the passage of time. To appropriately design protective liners, and gas and leachate collection systems, it is, therefore, necessary to have a proper knowledge of the settling process of wastes. (iii) Microbial degradation process: The microbial degradation process is the most important biological process occurring in a landfill. These processes induce changes in the chemical and physical environment within the waste body, which determine the quality of leachate and both the quality and quantity of landfill gas. Assuming that landfills mostly receive organic wastes, microbial processes will dominate the stabilisation of the waste and therefore govern landfill gas generation and leachate composition. Soon after disposal, the predominant part of the wastes becomes anaerobic, and the bacteria will start degrading the solid organic carbon, eventually to produce carbon dioxide and methane. The anaerobic degradation process undergoes the following stages: ? Solid and complex dissolved organic compounds are hydrolysed and fermented by the fermenters primarily to volatile fatty acids, alcohols, hydrogen and carbon dioxide. ? An acidogenic group of bacteria converts the products of the first stage to acetic acid, hydrogen and carbon dioxide. ? Methanogenic bacteria convert acetic acid to methane and carbon dioxide and hydrogenophilic bacteria convert hydrogen and carbon dioxide to methane. The biotic factors that affect methane formation in the landfill are pH, alkalinity, nutrients, temperature, oxygen and moisture content. Enhancement of degradation Enhancement of the degradation processes in landfills will result in a faster stabilisation of the waste in the landfill, which enhances gas production, and we can achieve this by: 139

? Adding partly composted waste: As the readily degradable organic matter has already been decomposed aerobically, the rapid acid production phase is overcome, and the balance of acid and methane production bacteria can develop earlier and the consequent dilution effect lowers the organic acid concentration. ? Recirculating leachate: This may have positive effects since a slow increase in moisture will cause a long period of gas production. During warmer periods, recirculated leachate will evaporate, resulting in lower amounts of excess leachate. We mentioned earlier that microbial degradation of waste under anaerobic conditions induces gas emission and leachate formation. We will explain this further, next. Landfill gas and Leachate Leachate and landfill gas comprise the major hazards associated with a landfill. While leachate may contaminate the surrounding land and water, landfill gas can be toxic and lead to global warming and explosion leading to human catastrophe (Phelps, 1995). (Note that global warming, also known as greenhouse effect, refers to the warming of the earth's atmosphere by the accumulation of gases (e.g., methane, carbon dioxide and chlorofluorocarbons) that absorbs reflected solar radiation.) The factors, which affect the production of leachate and landfill gas, are the following: ? Nature of waste: The deposition of waste containing biodegradable matter invariably leads to the production of gas and leachate, and the amount depends on the content of biodegradable material in the waste. ? Moisture content: Most micro-organisms require a minimum of approximately 12% (by weight) moisture for growth, and thus the moisture content of landfill waste is an important factor in determining the amount and extent of leachate and gas production. ? pH: The methanogenic bacteria within a landfill produce methane gas, which will grow only at low pH range around neutrality. ? Particle size and density: The size of waste particle affects the density that can be achieved upon compaction and affects the surface area and hence volume. Both affect moisture absorption and therefore are potential for biological degradation. ? Temperature: An increase in temperature tends to increase gas production. The temperature affects the microbial activity to the extent that it is possible to segregate bacteria, according to their optimum temperature operating conditions. Note that the composition of waste, which varies with region and climate (season), determines the variation in pollution potential. Carbohydrates comprise a large percentage of biodegradable matter within municipal waste, the overall breakdown of which can be represented by the following equation: Let us now discuss landfill leachate and gas emission in detail along with their composition and adverse effects. Landfill Gas Emission Landfill gas contains a high percentage of methane due to the anaerobic decomposition of organic matter, which can be utilised as a source of energy. 1. Composition and properties We can predict the amount and composition of the gas generated for different substrates, depending on the general anaerobic decomposition of wastes added. Climatic and environmental conditions also influence gas composition. Due to the heterogeneous nature of the landfill, some acid-phase anaerobic decomposition occurs along with the methanogenic decomposition. Since aerobic and acid-phase degradation give rise to carbon dioxide and not methane, there may be a higher carbon dioxide content in the gas generated than whatwould otherwise be expected. Furthermore, depending on the moisture distribution, some carbon dioxide goes into solution. This may appear to increase (artificially) the methane content of the gas measured in the landfill. A typical landfill gas contains a number of components such as the following, which tend to occur within a characteristic range: 140

? Methane: This is a colourless, odourless and flammable gas with a density lighter than air, typically making up 50 – 60% of the landfill gas. ? Carbon dioxide: This is a colourless, odourless and non-inflammable gas that is denser than air, typically accounting for 30 – 40%. ? Oxygen: The flammability of methane depends on the percentage of oxygen. It is, therefore, important to control oxygen levels, where gas abstraction is undertaken. ? Nitrogen: This is essentially inert and will have little effect, except to modify the explosive range of methane. It is difficult to convert the amount of gas measured to the maximum landfill gas production value because gas is withdrawn from a small part of the landfill only, referred to as zone of influence during measurement. In other words, it is very difficult to determine this zone and relate it to the whole landfill area. 2. Hazards Landfill gas consists of a mixture of flammable, asphyxiating and noxious gases and may be hazardous to health and safety, and hence the need for precautions. Some of the major hazards are listed below: ? Explosion and fire: Methane is flammable in air within the range of 5 – 15% by volume, while hydrogen is flammable within the range of 4.1 – 7.5% (in the presence of oxygen) and potentially explosive. Fire, occurring within the waste, can be difficult to extinguish and can lead to unpredictable and uncontrolled subsidence as well as production of smoke and toxic fumes. ? Trace components: These comprise mostly alkanes and alkenes, and their oxidation products such as aldehydes, alcohols and esters. Many of them are recognised as toxicants, when present in air at concentrations above occupational exposure standards. ? Global warming: Known also as greenhouse effect, it is the warming of the earth's atmosphere by the accumulation of gases (methane, carbon dioxide and chlorofluorocarbons) that absorbs reflected solar radiation. 3. Migration During landfill development, most of the gas produced is vented to the atmosphere, provided the permeable intermediate cover has been used. While biological and chemical processes affect gas composition through methane oxidation, which converts methane to carbon dioxide, physical factors affect gas migration. The physical factors that affect gas migration include: ? Environmental conditions: These affect the rate of degradation and gas pressure build up. ? Geophysical conditions: These affect migration pathways. In the presence of fractured geological strata or a mineshaft, the gas may travel large distances, unless restricted by the water table. ? Climatic conditions: Falling atmospheric pressure, rainfall and water infiltration rate affect landfill gas migration. The proportion of void space in the ground, rather than permeability, determines the variability of gas emission. If the escape of landfill gas is controlled and proper extraction system is designed, this gas can be utilised as a source of energy. If landfill gas is not utilised, it should be burnt by means of flaring. However, landfill gas utilisation can save on the use of fossil fuels since its heating value is approximately 6 kWh/m and can be utilised in internal combustion engines for production of electricity and heat. It is important that landfill gas is extracted during the operation phase. It is extracted out of the landfill by means of gas wells, which are normally drilled by auger and are driven into the landfill at a spacing of 40 – 70 m. In addition, horizontal systems can be installed during operation of the landfill. The gas wells consist mainly of perforated plastic pipes surrounded by coarse gravel and are connected with the gas transportation pipe with flexible tubing. The vacuum necessary for gas extraction and transportation is created by means of a blower. The most important factors influencing planning and construction of landfill gas extraction systems are settling of waste, water tables in landfills and gas quality. 4. Control To control gas emission, it is necessary to control the following: ? waste inputs (i.e., restrict the amount of organic waste). ? processes within the waste (i.e., minimise moisture content to limit gas production) ? migration process (i.e., provide physical barriers or vents to remove the gas from the site and reduce gas pressure). Note that since gas migration cannot be easily prevented, removal is often the preferred option. This is done by using vents (extraction wells) within the waste or stone filled vents, which are often placed around the periphery of the landfill site. Some of the gas collection systems include impermeable cap, granular material, collection pipes and treatment systems. 141

Leachate Formation Leachate can pollute both groundwater and surface water supplies. The degree of pollution will depend on local geology and hydrogeology, nature of waste and the proximity of susceptible receptors. Once groundwater is contaminated, it is very costly to clean it up. Landfills, therefore, undergo siting, design and construction procedures that control leachate migration. 1. Composition and properties Leachate comprises soluble components of waste and its degradation products enter water, as it percolates through the landfill. The amount of leachate generated depends on: ? water availability; ? landfill surface condition; ? refuse state; ? condition of surrounding strata. The major factor, i.e., water availability, is affected by precipitation, surface runoff, waste decomposition and liquid waste disposal. The water balance equation for landfill requires negative or zero ("Lo") so that no excess leachate is produced. This is calculated using the following formula: Lo = I – E – aW i.e. I – E > aW where, Lo = free leachate retained at site (equivalent to leachate production minus leachate leaving the site); I = total liquid input; E = evapotranspiration losses; a = absorption capacity of waste; W = weight of waste disposed. Common toxic components in leachate are ammonia and heavy metals, which can be hazardous even at low levels, if they accumulate in the food chain. The presence of ammoniacal nitrogen means that leachate often has to be treated off-site before being discharged to a sewer, since there is no natural bio-chemical path for its removal (Ali, et al., 1995). Leachate composition varies with time and location. Table 12 shows a typical leachate properties and composition at various stages of waste decomposition: Table 12 Properties and Composition of Leachate at various stages of Decomposition 2. Leachate Migration It is generally difficult to predict the movement of escaped leachate accurately. The main controlling factors are the surrounding geology and hydrogeology. Escape to surface water may be relatively easy to control, but if it escapes to groundwater sources, it can be very difficult both to control and clean up. The degree of groundwater contamination is affected by physical, chemical and biological actions. The relative importance of each process may change, however, if the leachate moves from the landfill to the sub-surface region. 142

3. Control The best way to control leachate is through prevention, which should be integral to the site design. In most cases, it is necessary to control liquid access, collection and treatment, all of which can be done using the following landfill liners: Natural liners: These refer to compacted clay or shale, bitumen or soil sealants, etc., and are generally less permeable, resistant to chemical attack and have good sorption properties. They generally do not act as true containment barriers, because sometimes leachate migrates through them. Synthetic (geo-membrane) liners: These are typically made up of high or medium density polyethylene and are generally less permeable, easy to install, relatively strong and have good deformation characteristics. They sometimes expand or shrink according to temperature and age. Note that natural and geo-membrane liners are often combined to enhance the overall efficiency of the containment system. Some of the leachate collection systems include impermeable liner, granular material, collection piping, leachate storage tank; leachate is trucked to a wastewater treatment facility. 4. Treatment Concentrations of various substances occurring in leachate are too high to be discharged to surface water or into a sewer system. These concentrations, therefore, have to be reduced by removal, treatment or both. The various treatments of leachate include: ? Leachate recirculation: It is one of the simplest forms of treatment. Recirculation of leachate reduces the hazardous nature of leachate and helps wet the waste, increasing its potential for biological degradation. ? Biological treatment: This removes BOD, ammonia and suspended solids. Leachate from land filled waste can be readily degraded by biological means, due to high content of volatile fatty acids (VFAs). The common methods are aerated lagoons (i.e., special devices which enhance the aerobic process es of degradation of organic substances over the entire depth of the tank) andactivated sludge process, which differs from aerated lagoons in that discharged sludge is recirculated and is often used for BOD and ammonia removal. While under conditions of low COD, rotating biological contactors (i.e., biomass is brought into contact with circular blades fixed to a common axle which is rotated) are very effective in removing ammonia. In an anaerobic treatment system, complex organic molecules are fermented in filter. The common types are anaerobic filters, anaerobic lagoon and digesters. ? Physicochemical treatment: After biological degradation, effluents still contain significant concentrations of different substances. Physicochemical treatment processes could be installed to improve the leachate effluent quality. Some of these processes are flocculation-precipitation. (Note that addition of chemicals to the water attracts the metal by floc formation). Separation of the floc from water takes place by sedimentation, adsorption and reverse osmosis. Environmental Effects of Landfill The environmental effects of a landfill include wind-blown litter and dust, noise, obnoxious odour, vermin and insects attracted by the waste, surface run off and inaesthetic conditions. Gas and leachate problems also arise during the operation phase and require significant environmental controls. In what follows, we will describe some of the major environmental effects below: (i) Wind-blown litter and dust are continuous problems of the ongoing landfill operation and a nuisance to the neighbourhood. Covering the waste cells with soil and spraying water on dirt roads and waste in dry periods, in combination with fencing and movable screens, may minimise the problem of wind-blown litter and dust. However, note that the problem will remain at the tipping front of the landfill. (ii) Movement of waste collection vehicles, emptying of wastes from them, compactors, earthmoving equipment, etc., produce noise. Improving the technical capability of the equipment, surrounding the fill area with soil embankments and plantations, limiting the working hours and appropriately training the workforce will help minimise noise pollution. (iii) Birds (e.g., scavengers), vermin, insects and animals are attracted to the landfill for feeding and breeding. Since many of these may act as disease vectors, their presence is a potential health problem. (iv) Surface run-off, which has been in contact with the land filled waste, may be a problem in areas of intense rainfall. If not controlled, heavily polluted run-off may enter directly into creeks and streams. Careful design and 143

maintenance of surface drains and ditches, together with a final soil cover on completed landfill sections, can help eliminate this problem. An operating landfill, where equipment and waste are exposed, appears inaesthetic. This problem may be reduced by careful design of screening soil embankments, plantings, rapid covering and re- vegetation of filled sections. (vi) Gas released, as a result of degradation or volatilisation of waste components, causes odour, flammability, health problems and damage of the vegetation (due to oxygen depletion in the root zone). The measures to control this include liners, soil covers, passive venting or active extraction of gas for treatment before discharge into the atmosphere. (vii) Polluted leachate appears shortly after disposal of the waste. This may cause groundwater pollution and pollution of streams through sub-surface migration. Liners, drainage collection, treatment of leachate, and groundwater and downstream water quality monitoring are necessary to control this problem. Figure 13 gives a summary of the environmental emissions from a sanitary landfill: Figure 13 - Environmental Emissions from a Sanitary Landfill Besides the emissions shown in Figure 3, incidental events such as flooding, fires, landslides and earthquakes result in severe environmental impacts, and may require preventive measures with respect to landfill site selection, design and operation. In the main, to minimise adverse environmental impacts due to sanitary landfill, proper attention must be paid to the environmental aspects at all stages and phases of landfill management, viz., site selection, design, construction, operation and maintenance (Ali, et al., 1995). Regulations for Landfills Regulations include restrictions on distances from airports, flood plains, and fault areas, as well as limitations on construction in wetlands and others. Prevention of contamination of groundwater and land resources requires synthetic liner. (Hutzler, 2004). Adequate buffer with the restricted activities around the landfill. Landfill Operation Issues Once a potential site has been identified/selected, an assessment of design aspects, including costs for civil works, begins. Important issues to be looked into in this regard are land requirements, types of wastes that are handled, evaluation of seepage potential, design of drainage and seepage control facilities, development of a general operation plan, design of solid waste filling plan and determination of equipment requirements. With this in view, we will discuss some important factors required for successful implementation and operation of a sanitary landfill. 1. Design and construction The design and construction process involves site infrastructure, i.e., the position of the buildings, roads and facilities that are necessary to the efficient running of the site and site engineering, i.e., the basic engineering 144

works needed to shape the site for the reception of wastes and to meet the technical requirements of the working plan (Phelps, 1995). At the outset, however, the potential operator and the licensing authority should agree upon a working plan for the landfill. The disposal license includes the design, earthworks and procedures in the working plan. What are the processes involved in design and construction? We will study these below: i) Site infrastructure: The size, type and number of buildings required at a landfill depend on factors such as the level of waste input, the expected life of the site and environmental factors. Depending on the size and complexity of the landfill, buildings range from single portable cabins to big complexes. However, certain aspects such as the following are common: ? need to comply with planning, building, fire, health and safety regulations and controls; ? security and resistance to vandalism; ? durability of service and the possible need to relocate accommodation during the lifetime of the site operations; ? ease of cleaning and maintenance; ? availability of services such as electricity, water, drainage and telecommunication. Paying some attention to the appearance of the site entrance is necessary, as it influences the perception of the public about the landfill site. All landfill sites need to control and keep records of vehicles entering and leaving the site, and have a weighbridge to record waste input data, which can be analysed by a site control office. Note that at small sites, the site control office can be accommodated at the site itself. ii) Earthworks: Various features of landfill operations may require substantial earthworks, and therefore, the working plan must include earthworks to be carried out before wastes can be deposited. Details about earthworks gain significance, if artificial liners are to be installed, which involves grading the base and sides of the site (including construction of 25 slopes to drain leachate to the collection areas) and the formation of embankments. Material may also have to be placed in stockpiles for later use at the site. The cell method of operation requires the construction of cell walls. At some sites, it may be necessary to construct earth banks around the site perimeter to screen the landfill operations from the public. Trees or shrubs may then be planted on the banks to enhance the screening effect. The construction of roads leading to disposal sites also involves earthworks. iii) Lining landfill sites: Where the use of a liner is envisaged, the suitability of a site for lining should be evaluated at the site investigation stage. However, they should not be installed, until the site has been properly prepared. The area to be lined should be free of objects likely to cause physical damage to the liner, such as vegetation and hard rocks. If synthetic liner materials are used, a binding layer of suitable fine-grained material should be laid to support the liner. However, if the supporting layer consists of low permeable material (e.g., clay), the synthetic liner must be placed on top of this layer. A layer of similar fine- grained material with the thickness of 25 – 30 cm should also be laid above the liner to protect it from subsequent mechanical and environmental damage. During the early phase of operation, particular care should be taken to ensure that the traffic does not damage the liner. Monitoring the quality of groundwater close to the site is necessary to get the feedback on the performance of a liner. (iv) Leachate and landfill gas management: The basic elements of the leachate collection system (i.e., drain pipes, drainage layers, collection pipes, sumps, etc.) must be installed immediately above the liner, before any waste is deposited. Particular care must also be taken to prevent the drain and collection pipes from settling. During landfill operations, waste cells are covered with soil to avoid additional contact between waste and the environment. The soil layers have to be sufficiently permeable to allow downward leachate transport. Landfill gas is not extracted before completion, which includes construction of final cover, of the waste body. Extraction wells (diameter 0.3 to 1.0 m) may be constructed during or after operation. (v) Landfill capping: Capping is required to control and minimise leachate generation (by minimising water ingress into the landfill) and facilitate landfill gas control or collection (by installing a low permeability cap over the whole site). A cap may consist of natural (e.g., clay) or synthetic (e.g., poly-ethylene) material with thickness of at least 1 m. An uneven settlement of the waste may be a major cause of cap failure. Designs for capping should, therefore, include consideration of leachate and landfill gas collection wells or vents. For the cap to remain effective, it must be protected from agricultural machinery, drying and cracking, plant root penetration, burrowing animals and erosion. 145

2. Operation To secure public acceptability, landfill operations require careful planning and determination of the extent of environmental effects. The basic factor influencing the planning of site operations is the nature and quantity of incoming wastes. The various aspects of this include the following: (i) Methods of filling: The following variations in land filling techniques are available (Burner and Kelly, 1972): ? Trench method: This involves the excavation of a trench into which waste is deposited, and the excavated material is then used as cover. Area method: Wastes may be deposited in layers and so form terraces over the available area. However, with this type of operation, excessive leachate generation may occur, which may render the control difficult. ? Cell method: This method involves the deposition of wastes within pre-constructed bounded area. It is now the preferred method in the industrialised world, since it encourages the concept of progressive filling and restoration. Operating a cellular method of filling enables wastes to be deposited in a tidy manner, as the cells serve both to conceal the tipping operation and trap much of the litter that has been generated. ? Canyon/depression: This method refers to the placing of suitable wastes against lined canyon or ravine slide slopes. (Slope stability and leachate gas emission control are critical issues for this type of waste placement.) Figure 14 illustrates the land filling methods touched upon above: Figure 14- Commonly Used Land Filling Methods ii) Refuse placement: The working space should be sufficiently extensive to permit vehicles to manoeuvre and unload quickly and safely without impeding refuse spreading, and allow easy operation of the site equipment. Depositing waste in thin layers and using a compactor enables a high waste density to be achieved. Each progressive layer should not be more than 30 cm thick. The number of passes by a machine over the waste determines the level of compaction. iii) Covering of waste: At the end of each working day, all exposed surfaces, including the flanks and working space, should be covered with a suitable inert material to a depth of at least 15 cm. This daily cover is considered essential, as it minimises windblown litter and helps reduce odours. Cover material may be obtained from on- site excavations or inert waste material scoming to the site. Pulverised fuel ash or sewage sludge can also be used for this purpose. iv) Site equipment and workforce orientation: The equipment most commonly used on landfill sites includes steel wheeled compactors, tracked dozers, loaders, earth movers and hydraulic excavators. Scrapers are used for excavating and moving cover materials. In addition to appropriate equipment, proper training must be ensured for the workforce. They should be competent, and adequately supervised; training should include site safety and first aid. Since a landfill site may pose dangers to both site operators and users, it is necessary to lay down emergency plans and test them from time to time (Phelps,1995). 3. Monitoring Landfill represents a complex process of transforming polluting wastes into environmentally acceptable deposits. Because of the complexity of these processes and their potential environmental effects, it is imperative to monitor and confirm that the landfill works, as expected. A monitoring scheme, for example, is required for 146

collecting detailed information on the development of leachate and landfill gas within and beyond a landfill. The scheme should be site specific, drawn at the site investigation stage and implemented. Monitoring is generally done for the following: i) Leachate/gas: Monitoring of leachate/gas plays a vital role in the management of landfills. Data on the volume of leachate/gas and their composition are essential for proper control of leachate/gas generation and its treatment. Knowledge of the chemical composition of leachate/gas is also required to confirm that attenuation processes within the landfill are proceeding as expected. Various systems for monitoring the leachate level are in use, and are mostly based on pipes installed prior to land filling. Note that small bore perforated plastic pipes are relatively cheaper and easier to install, but have the disadvantage of getting damaged faster during infilling. Placing pipes within a column or tyres may, however, offer some protection. ii) Groundwater: A continued groundwater-monitoring programme for confirming the integrity of the liner system is essential. At an early stage of site preparation, therefore, a number of monitoring boreholes need to be provided around the site. However, the location, design and number of boreholes depend on the size of the landfill, proximity to an aquifer, geology of the site and types of wastes deposited. Installation of a double liner system can make the monitoring exercise more accurate and easier to perform. Water should be regularly flushed through the secondary leachate collection system. In case this water is polluted, the primary leachate barrier will be damaged, and if repair is not considered possible, the leachate collected must be transported to the leachate treatment facility. Waste Disposal: A case study of Bangalore One of the critical concerns of a municipal corporation is planning for a proper waste disposal in response to the increasing volume and hazardous nature of urban wastes. When wastes are disposed unhygienically, they do spoil the aesthetic value of the city as well as create problems such as breeding of pathogenic organisms, which serve as carriers of diseases (Attarwalla, 1993, Areivala, 1971). Some of the principal problems associated with disposal of solid wastes can be categorised as under: ? Diseases, i.e., rats, flies and other pests feed on the wastes and carry diseases. ? Air/noise pollution, e.g., increase in vehicular traffic, smoke, fly ash and odours. ? Ground and surface water pollution, e.g., runoff during the monsoon season causes surface water pollution, while percolation often causes groundwater contamination. ? Unaesthetic appearance because of litter (Gotoh, 1989). However, we can minimise or satisfactorily deal with these problems through competent engineering and planning, selecting appropriate waste disposal sites and methods of operation, and making SWM strategies essentially local. Against this backdrop, let us now assess the scenario in Bangalore. About two-thirds of the waste (about 1600 tonnes/day) in the Bangalore city is getting dumped in the outskirts of the city. As there are no sanitary landfills in the city for proper dumping of waste, it is merely transported to the outskirts and disposed of in any abandoned open land, usually along public highways (Vagale, 1997). The Bangalore Mahanagara Palike (BMP) along with the Karnataka State Pollution Control Board (KSPCB) has, however, identified 9 abandoned quarries around the city for sanitary landfills. Table 3 contains the list of these sites: Table 13 - Solid Waste Disposal Sites Identified by the BMP 147

Of the sites listed in Table 3, only 3 have been selected after an assessment of suitability, viz. B. Narayanpura (situated about 10 km northeast of the city in Krishnarajapura hobli), Hennur (situated at a distance of about 9 km north of the city) and Devanachikkanahalli (situated about 10 km to the southeast of the city). These sites were selected on the basis of the geo-technical assessment carried out after a site visit and review of data. However, a periodical assessment of ground water and air quality, before and during the process of land filling, is necessary. Human, Social, and Environmental Impacts of Human Genetic Engineering Introduction Human genetic engineering relies heavily on science and technology. It was developed to help end the spread of diseases. With the advent of genetic engineering, scientists can now change the way genomes are constructed to terminate certain diseases that occur as a result of genetic mutation. Today genetic engineering is used in fighting problems such as cystic fibrosis, diabetes, and several other diseases. Another deadly disease now being treated with genetic engineering is the "bubble boy" disease (Severe Combined Immunodeficiency). This is a clear indication that genetic engineering has the potential to improve the quality of life and allow for longer life span. Clearly, one of the greatest benefits of this field is the prospect of helping cure illness and diseases in unborn children. Having a genetic screening with a fetus can allow for treatment of the unborn. Overtime this can impact the growing spread of diseases in future generations. However, these benefits are not without peril. Human genetic engineering is a development that people are either very passionate about or opposed to completely. This article gives a brief account on the effect of this principle on the biosphere together with several controversial issues that accompany the acceptance of this technology. The manuscript has been prepared by using information from peer reviewed journals indexed in pubmed in the period of 2000 to 2015. Effects on the Environment Although the positive impacts of this field could be enormous, there are many questions raised that needs to be answered. New organisms created by genetic engineering could present an ecological problem. One cannot predict the changes that a genetically engineered species would make on the environment. The release of a new genetically engineered species would also have the possibility of causing an imbalance in the ecology of a region just exotic species would do. An accident or an unknown result could cause several problems. An accident in engineering the genetics of a virus or bacteria for example could result in a stronger type, which could cause a serious epidemic when released. This could be fatal in human genetic engineering creating problems ranging from minor medical problems, to death. Effects on Human Looking at the fact that genetic engineering employs viral vector that carries functional gene inside the human body; the repercussion are still unknown. There are no clues as to where functional genes are being placed. They may even replace the important genes, instead of mutated genes. Thus, this may lead to another health condition or disease to human. Also, as defective genes are replaced with functional gene, then it is expected that there will be a reduction in genetic diversity and if human beings will have identical genomes, the population as a whole will be susceptible to virus or any form of diseases. Genetic engineering could also create unknown side effects or outcomes. Certain changes in a plant or animal could cause unpredicted allergic reactions in some people which, in its original form, did not occur. Other changes could result into the toxicity of an organism to humans or other organisms. Antibiotic Resistance Genetic engineering often uses genes for antibiotic resistance as "selectable markers." Early in the engineering process, these markers help identify cells that have taken up foreign genes. Although they have no further use, the genes continue to be expressed in plant tissues. Most genetically engineered plant foods carry fully functioning antibiotic-resistance genes. The presence of antibiotic-resistance genes in foods could have lethal effects. Therefore, eating these foods could reduce the effectiveness of antibiotics to fight disease when these antibiotics are taken with meals. More so, the resistance genes could be transferred to human or animal pathogens, making them impervious to antibiotics. If transfer were to occur, it could aggravate the already serious health problem of antibiotic- resistant disease organisms. 148

Ethical and Social Issues "Playing God" has become a strong argument against genetic engineering. Several issues have also been raised as regards the acceptance of this technology. These concerns range from ethical issues to lack of knowledge on the effects genetic engineering may have. One major concern is that once an altered gene is placed in an organism, the process cannot be reversed. Public reaction to the use of rDNA in genetic engineering has been mixed. The production of medicines through the use of genetically altered organisms has generally been welcomed. However, critics of rDNA fear that disease-producing, organisms used in some rDNA experiments might develop extremely infectious forms that could cause worldwide epidemics. As more human genes are being used in non-human organisms to create new forms of life that are genetically partly human, new ethical questions arise. For instance, what percentage of human genes does an organism have to contain before it is considered human and how many human genes would a green pepper for example have to contain before it can be eaten without qualms. Human genes are now being inserted into tomatoes and peppers to make them grow faster. This suggests that one can now be a vegetarian and a cannibal at the same time. For meat- eaters, the same question could be posed about eating pork with human genes. What about the mice that have been genetically engineered to produce human sperm. The question is 'what psychological effect would it pose on the offspring? Critics have questioned the safety of genetically engineered bovine somatotropin (BST) to increase the milk yield of dairy cows (BST) for both the cows that are injected with it and the humans who drink the resulting milk; owing to the fact that it increases a cow's likelihood of developing mastitis, or infection of the udder, and it also makes cows more susceptible to infertility and lameness. Transgenic plants also present controversial issues. Allergens can be transferred from one food crop to another through genetic engineering. Another concern is that pregnant women eating genetically modified products may endanger their offspring by harming normal fetal development and altering gene expression. In 2002 the National Academy of Sciences released a report calling for a legal ban on human cloning. The report concluded that the high rate of health problems in cloned animals suggests that such an effort in humans would be highly dangerous for the mother and developing embryo and is likely to fail. Beyond safety, the possibility of cloning humans also raises a variety of social issues like the psychological issues that would result for a cloned child who is the identical twin of his or her parent. Another frightening scenario is the destructive use of genetic engineering. Terrorist groups or armies could develop more powerful biological weaponry. These weapons could be resistant to medicines, or even targeted at people who carry certain genes. Genetically engineered organisms used for biological weapons might also reproduce faster, which would create larger quantities in shorter periods of time, increasing the level of devastation. Further Readings ? Balasubramanium, V., "Environment and Human Rights: A New Form of Imperialism", Economic and Political Weekly, vol.33, no.8, 22-27 Feb. 1998, ? Birnie, Patricia and Allan Boyle, (1992) International Law and the Environment: Clarendon, Oxford ? Desai, Bharat, "Enforcement of the Right to Environmental Protection through Public Interest Litigation in India", Indian Journal of International Law, vol.33, 1993, ? Finnies, J. (1987), Natural Law and Natural Rights, Clarendon Press, Oxford: ? Mahawal, S., "Right to Safe Environment", World Focus, vol.13, no.2, March 1992 ? RLEK, (1997), Community Forestry Management in Protected Areas: A Van Gujjar Proposal, Natraj Publishers, New Delhi ? Sachs, Aaron, Eco-Justice: (1995) Linking Human Rights and the Environment, World watch Institute, Washington D.C. ? Shelton, Dinah, "Human Rights, Environmental Rights and the Right to Environment", Stanford Journal of International Law, vol.28, no.1, 1991, ? Singh, Nagendra, "Right to Environment and Sustainable Development as a Principle of International Law", Journal of Indian Law Institute, 1987, 149

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pollution ? Air Pollution ? Water Pollution ? Soil Pollution ? Marine Pollution ? Oil Pollution ? Noise Pollution ? Thermal Pollution ? Solid waste management: Causes effects and control measures			Pollution • Air Pollution • Water Pollution • Soil Pollution • Noise Pollution Types of Pollution, Causes, Effects and Control Measures		

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2/202	SUBMITTED TEXT	61 WORDS	97%	MATCHING TEXT	61 WORDS

Environmental studies deal with every issue that affects an organism. It is essentially a multidisciplinary approach that brings about an appreciation of our natural world and human impacts on its integrity. It is an applied science as it seeks practical answers to making human civilization sustainable on the earth's finite resources. Its components include biology, geology, chemistry, physics, engineering, sociology, health, anthropology, economics, statistics,

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3/202	SUBMITTED TEXT	126 WORDS	98%	MATCHING TEXT	126 WORDS

live in landscapes that have been heavily modified by human beings, in villages, towns or cities. But even those of us who live in cities get our food supply from surrounding villages and these in turn are dependent on natural landscapes such as forests, grasslands, rivers, seashores, for resources such as water for agriculture, fuel wood, fodder, and fish. Thus, our daily lives are linked with our surroundings and inevitably affects them. We use water to drink and for other day-to-day activities. We breathe air, we use resources from which food is made and we depend on the community of living plants and animals which form a web of life, of which we are also a part. Everything around us forms our environment and our lives depend on keeping its vital systems

live in landscapes that have been heavily modified by human beings, in villages, towns or cities. But even those of us who live in cities get our food supply from surrounding villages and these in turn are dependent on natural landscapes such as forests, grasslands, rivers, seashores, for resources such as water for agriculture, fuel wood, fodder, and fish. Thus, our daily lives are linked with our surroundings and inevitably affects them. We use water to drink and for other day-to-day activities. We breathe air, we use resources from which food is made and we depend on the community of living plants and animals which form a web of life, of which we are also a part. Everything around us forms our environment and our lives depend on sustaining its vital systems.

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Deforestation leads to floods in the monsoon and dry rivers once the rains are over.

Deforestation leads to floods in the monsoon and dry rivers once the rains are over

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5/202	SUBMITTED TEXT	99 WORDS	96%	MATCHING TEXT	99 WORDS

The industrial development and intensive agriculture that provides the goods for our increasingly consumer oriented society uses up large amounts of natural resources such as water, minerals, petroleum products, wood, etc. 1 Non-renewable resources, such as minerals and oil are those which will be exhausted in the future if we continue to extract these without a thought for subsequent generations. Renewable resources, such as timber and water, are those which can be used but can be regenerated by natural processes such as regrowth or rainfall. But these too will be depleted if we continue to use them faster than nature can replace them.

The industrial development and intensive agriculture that provides the goods for our increasingly consumer oriented society uses up large amounts of natural resources such as water, minerals, petroleum products, wood, etc. Non renewable resources, such as minerals and oil are those which will be exhausted in the future if we continue to extract these without a thought for subsequent generations. Renewable resources, such as timber and water, are those which can be used but can be regenerated by natural processes such as re growth or rainfall. However, these too will be depleted if we continue to use them faster than nature can replace them.

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As the earth's natural resources are dwindling and our environment is being increasingly degraded by human activities, it is evident that something needs to be done. We often feel that managing all this is something that the Government should do. But if we go on endangering our environment, there is no

As the earth's natural resources are deteriorating and our environment is being largely ruined by human activities, it is clear that something required to be Unit 1 - Nature of Environmental Studies Notes 23 done. We usually realise that managing all this is something that the Government should perform. But if we go on degrading our environment, there is no

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which the Government can perform all these clean-up functions. It is the prevention of environment degradation in which we must all take part that must become a part of all our lives. Just as for any disease, prevention is better than cure. To prevent ill-effects on our environment by our actions, is economically more viable than cleaning up the environment once it is damaged. Individually we can play a major role in environment management. We can reduce wasting natural resources and we can act as watchdogs that inform the Government about sources that lead to pollution and degradation of our environment. This can only be made possible through mass public awareness. Mass media such as newspapers, radio, television, strongly influence public opinion. However, someone

which the Government may do all these clean-up functions. It is the prevention of environment degradation in which we all must take part that must become a part of all our lives. Just as for any disease, prevention is better than cure. To prevent ill-effects on our environment by our actions is economically more viable than cleaning up the environment once it is damaged. Individually we can play a major role in environment management. We can reduce wasting natural resources and we can act as watchdogs that inform the Government about sources that lead to pollution and degradation of our environment. It is important for you to note that this can only be made possible through mass public awareness. Mass media such as newspapers, radio, television, strongly influence public opinion. However, someone

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is responsible for spreading this message to as many people as possible.

is responsible for exposing this message to as many people as possible.

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bring this about. If each of us feels strongly about the environment, the press and media will add to our efforts. Politicians in a democracy always respond positively to a strong publicly supported movement. Thus, if you join an NGO that supports conservation, politicians will make green policies. We are living on spaceship earth with a limited supply of resources.

bring this about. If each of us feels strongly about the environment, the press and media will add to our efforts. Politicians in a democracy always respond positively to a strong publicly supported movement. Thus if you join an NGO that supports conservation, politicians will make green policies. We are living on spaceship earth with a limited supply of resources.

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solid, liquid or gaseous sub-stances present in greater than natural abundance produced due to human

solid, liquid or gaseous substances present in greater concentration than in natural abundance and are produced due to human

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Air pollution? Air pollution occurs due to the presence of

Air Pollution: Air Pollution occurs due to the presence of

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leads to damage from diseases, pests, drought and frost. Such expo-sure interferes with photosynthesis and plant growth, reduces nutrient uptake and causes leaves to turn yellow, brown or drop off altogether. At

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on materials Every year air pollutants cause damage worth billions of rupees. Air pollutants break down exterior paint

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Sunburn, cataract, aging of the skin and skin cancer are caused by increased ultra-violet radiation. It weakens the immune system by suppressing the

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to certain infections like measles, chicken pox and other viral diseases that elicit rash and parasitic diseases such as malaria introduced through

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affects the ability of plants to capture light energy during the process of photosynthesis. This reduces the nutrient content and the growth of plants. This is seen especially in legumes and cabbage. Plant and animal planktons are damaged by

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on earth is found in oceans and is too salty for drinking or irrigation. The remaining 3% is fresh water. Of this 2.997% is locked in ice caps

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Climate and time are also important in the development of

Climate and time are also important in the development of

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leaves, twigs, animal waste, fungi and other organic materials. Normally it is brown or black.

leaves, twigs, animal waste, fungi and other organic wastes. Normally it is brown or black

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that percolates into the ground and fills the pores in soil and rock is called groundwater. Porous water-saturated 13 layers of

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relative amounts of the different sizes and types of mineral particles determine soil

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marine environment directly or indirectly by man resulting in adverse effects such as hazards to human health, obstruction

marine environment directly or indirectly by man resulting in adverse effects such as hazards to human health, obstruction

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accumulate in the bodies of animals, and over a period of time increase in concentration if the animal is unable to flush

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long-term health effects to the persons using the pesticide and the public that consumes the food

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oil Oil pollution of the sea normally attracts the greatest attention because of its visibility.

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There are several sources though which the oil can reach the sea. ?

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Tanker operations: 22 Half the world production of crude oil which is close to three billion tones

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year is transported by sea. After a tanker has unloaded its cargo of oil it has to take on seawater as ballast for the return journey. This ballast water is stored in the cargo compartments that previously contained the oil. During the unloading

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29/202	SUBMITTED TEXT	19 WORDS	100%	MATCHING TEXT	19 WORDS

oil remains clinging to the walls of the container and this may amount to 800 tonnes in a 200,000

SA ESC - book.docx (D110527582)

30/202	SUBMITTED TEXT	184 WORDS	87%	MATCHING TEXT	184 WORDS

oil pollution. In the load-on- top system, the compartments are cleaned by high pressure jets of water. The oily water is retained in the compartment until the oil floats to the top. The water underneath that contains only a little oil is then discharged into the sea and the oil is transferred to a slop tank. At the loading terminal, fresh oil is loaded on top of the oil in the tank and hence the name of the technique. In the second method called 'crude oil washing', the clingage is removed by jets of crude oil while the cargo is being unloaded. Some modern tankers have segregated ballast where the ballast water does not come in contact with the oil. Thus with the introduction of these new methods of deballasting, the amount of oil entering the sea has been considerably reduced. ? Dry Docking: All ships need periodic dry docking for servicing, repairs, cleaning the hull, etc. During this period when the cargo compartments are to completely emptied, residual oil finds its way into the sea. ? Bilge and fuel oils: As ballast tanks take up valuable space, additional ballast is sometimes carried in empty fuel

SA ESC - book.docx (D110527582)

31/202	SUBMITTED TEXT	41 WORDS	100%	MATCHING TEXT	41 WORDS

The ballast water thus becomes contaminated with this oil. When a fresh cargo of oil is to be loaded, these compartments are cleaned with water, which discharges the dirty ballast along with the oil into the sea. Two techniques have substantially reduced

SA ESC - book.docx (D110527582)

32/202	SUBMITTED TEXT	48 WORDS	99%	MATCHING TEXT	48 WORDS

into the sea. Individually the quantity of oil released may be small but it becomes a considerable amount when all the shipping operations are taken into consideration. ? Tanker Accidents: A large number of oil tanker accidents happen every year. Sometimes this can result in major disasters such as that of

SA ESC - book.docx (D110527582)

33/202	SUBMITTED TEXT	36 WORDS	90%	MATCHING TEXT	36 WORDS

extracted from the seabed contains some water. Even after it is passed through oil separators the water that is discharged contains some oil, which adds to marine pollution. Drilling muds which are pumped down oil wells when

SA ESC - book.docx (D110527582)

34/202	SUBMITTED TEXT	16 WORDS	90%	MATCHING TEXT	16 WORDS

There are several sources of noise pollution that contribute to both indoor and outdoor noise pollution.

There are several sources of noise that contribute to both indoor and outdoor noise pollution. •

W https://teresas.ac.in/wp-content/uploads/2020/06/CHAPTER-1-7-MULTIDISCIPLINARY-NATURE-OF-ENVIRONM ...

35/202	SUBMITTED TEXT	13 WORDS	95%	MATCHING TEXT	13 WORDS

The most direct harmful effect of excessive noise is physical damage to

The most direct harmful effect of excessive noise is the physical damage to

W https://teresas.ac.in/wp-content/uploads/2020/06/CHAPTER-1-7-MULTIDISCIPLINARY-NATURE-OF-ENVIRONM ...

36/202	SUBMITTED TEXT	30 WORDS	89%	MATCHING TEXT	30 WORDS

of oil. They are dumped on the sea- bed beneath the platform thus heavily contaminating the water. Uncontrolled release of oil from the wells can be catastrophic events resulting in oil pollution.

SA ESC - book.docx (D110527582)

37/202	SUBMITTED TEXT	15 WORDS	100%	MATCHING TEXT	15 WORDS

It is not a substance that can accumulate in the environment like most other pollutants.

SA ESC - book.docx (D110527582)

38/202	SUBMITTED TEXT	15 WORDS	100%	MATCHING TEXT	15 WORDS

both beneficial and harmful depending on the way in which it is used. We

both beneficial and harmful depending on the way in which it is used. We

W https://teresas.ac.in/wp-content/uploads/2020/06/CHAPTER-1-7-MULTIDISCIPLINARY-NATURE-OF-ENVIRONM ...

39/202	SUBMITTED TEXT	20 WORDS	100%	MATCHING TEXT	20 WORDS

generated in the world comes from nuclear power plants. However, on the other hand it is impossible to forget the

generated in the world comes from nuclear power plants. However, on the other hand, it is impossible to forget the

W https://teresas.ac.in/wp-content/uploads/2020/06/CHAPTER-1-7-MULTIDISCIPLINARY-NATURE-OF-ENVIRONM ...

40/202	SUBMITTED TEXT	17 WORDS	88%	MATCHING TEXT	17 WORDS

definitely affects the quality of life. It is thus important to ensure mitigation or control of noise pollution.

SA ESC - book.docx (D110527582)

41/202	SUBMITTED TEXT	29 WORDS	100%	MATCHING TEXT	29 WORDS

Hot water is pumped into one end of the pond and cooler water is removed from the other end. The heat gets dissipated from the pond into the atmosphere.

SA ESC - book.docx (D110527582)

42/202	SUBMITTED TEXT	14 WORDS	75%	MATCHING TEXT	14 WORDS

of radiation, the duration of exposure and the types of cells irradiated. Radiation can

of radiation, duration of exposure and types of cells irradiated. Radiation effects can

W https://pdfcoffee.com/environmental-educationpdf-pdf-free.html

43/202	SUBMITTED TEXT	30 WORDS	80%	MATCHING TEXT	30 WORDS

associated with groundwater pollution. Pollutants seeping out from the bottom of a sanitary landfill (leachates) very often percolate down to the groundwater aquifer no matter how thick the underlying soil layer.

SA Chapters 1 - 7.docx (D19161985)

44/202	SUBMITTED TEXT	40 WORDS	96%	MATCHING TEXT	40 WORDS

they cause or significantly contribute to an increase in mortality or an increase in serious irreversible or incapacitating reversible illness or pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported or disposed of. 29

SA Chapters 1 - 7.docx (D19161985)

45/202	SUBMITTED TEXT	17 WORDS	100%	MATCHING TEXT	17 WORDS

Environmental problems and health risks caused by hazardous wastes As most of the hazardous wastes are disposed

SA Industrial waste management.docx (D138563744)

46/202	SUBMITTED TEXT	78 WORDS	100%	MATCHING TEXT	78 WORDS

in land the most serious environmental effect is contaminated groundwater. Once groundwater is polluted with hazardous wastes it is very often not possible to reverse the damage. Pesticides are used increasingly to protect and increase food production. They form residues in the soil which are washed into streams which then carry them forwards. The residues may persist in the soil or in the bottom of lakes and rivers. Exposure can occur through ingestion, inhalation and skin contact resulting in acute or chronic poisoning.

SA Industrial waste management.docx (D138563744)

47/202	SUBMITTED TEXT	111 WORDS	94%	MATCHING TEXT	111 WORDS

Lead, mercury and arsenic are hazardous sub-stances which are often referred to as heavy metals. Lead is an abundant heavy metal and is relatively easy to obtain. It is used in batteries, fuel, pesticides, paints, pipes and other places where resistance to corrosion is required. Most of the lead taken up by people and wildlife is stored in bones. Lead can affect red blood cells by reducing their ability to carry oxygen and shortening their life span. Lead may also dam-age nerve tissue which can result in brain disease. Mercury occurs in several different forms. Mercury is used in the production of chlorine. It is also used as a catalyst in the production of some plastics.

SA Industrial waste management.docx (D138563744)

48/202	SUBMITTED TEXT	26 WORDS	100%	MATCHING TEXT	26 WORDS

Our body has a limited ability to eliminate mercury. In the food web mercury becomes more concentrated as it is taken up by various organisms. In

SA Chapters 1 - 7.docx (D19161985)

49/202	SUBMITTED TEXT	34 WORDS	100%	MATCHING TEXT	34 WORDS

Birds that eat the fish concentrate even more mercury in their bodies. It is a cumulative poison (it builds up in the body over long periods of time) and is known to cause brain damage.

SA Chapters 1 - 7.docx (D19161985)

50/202	SUBMITTED TEXT	61 WORDS	99%	MATCHING TEXT	61 WORDS

Polychlorinated biphenyls) are resistant to fire and do not conduct electricity very well which makes them excellent materials for several industrial purposes. Rainwater can wash PCBs out of disposal areas in dumps and landfills thus contaminating water. PCBs do not break down very rapidly in the environment and thus retain their toxic characteristics. They cause long term exposure problems to both humans and

SA Chapters 1 - 7.docx (D19161985)

51/202	SUBMITTED TEXT	18 WORDS	92%	MATCHING TEXT	18 WORDS

are concentrated in the kidneys and liver and thus cause damage. They cause reproductive failure in birds and mammals.

SA Chapters 1 - 7.docx (D19161985)

52/202	SUBMITTED TEXT	26 WORDS	88%	MATCHING TEXT	26 WORDS

to disasters. Among all the disasters that occur in the country, floods are the most frequently occurring natural disasters, due to the irregularities of the Indian monsoon.

to drought. Among all the disasters that occur in the country, floods are the most frequently occurring natural disaster due to the irregularities of the Indian Monsoon.

W https://teresas.ac.in/wp-content/uploads/2020/06/CHAPTER-1-7-MULTIDISCIPLINARY-NATURE-OF-ENVIRONM ...

53/202	SUBMITTED TEXT	15 WORDS	100%	MATCHING TEXT	15 WORDS

The main dangers from cyclones are very strong winds, torrential rains and high storm tides.

The main dangers from cyclones are very strong winds, torrential rains and high storm tides.

W https://teresas.ac.in/wp-content/uploads/2020/06/CHAPTER-1-7-MULTIDISCIPLINARY-NATURE-OF-ENVIRONM ...

54/202	SUBMITTED TEXT	53 WORDS	97%	MATCHING TEXT	53 WORDS

Vinyl chloride is a chemical that is widely used in the manufacture of plastic. Usually people are only exposed to high levels of vinyl chloride if they work with it or near it but exposure can also occur from vinyl chloride gas leaks. After a long continuous exposure (one to three years) in humans,

SA Chapters 1 - 7.docx (D19161985)

55/202	SUBMITTED TEXT	17 WORDS	100%	MATCHING TEXT	17 WORDS

can cause deafness, vision problems, circulation disorders and bone deformities. Vinyl chloride can also cause birth defects. 30

SA Chapters 1 - 7.docx (D19161985)

56/202	SUBMITTED TEXT	43 WORDS	100%	MATCHING TEXT	43 WORDS

has the fundamental right to freedom, equality and adequate conditions of life, in an environment of a quality that permits a life of dignity and well-being, and he bears a solemn responsibility to protect and improve the environment for present and future generation .

SA Dissertation for Plagiarism.pdf (D135908508)

57/202	SUBMITTED TEXT	10 WORDS	100%	MATCHING TEXT	10 WORDS

is the basic need for the survival of the human

SA HAYAT DISSERTATION 1.pdf (D110788320)

58/202	SUBMITTED TEXT	19 WORDS	92%	MATCHING TEXT	19 WORDS

the rights to healthy environment and to sustainable development are fundamental human rights implicit in the right to life.

SA HAYAT DISSERTATION 1.pdf (D110788320)

59/202	SUBMITTED TEXT	16 WORDS	66%	MATCHING TEXT	16 WORDS

The state shall endeavour to organize agricultural and animal husbandry on modern and scientific lines

the State to take steps to organize agriculture and animal husbandry on modern and scientific lines.

W https://teresas.ac.in/wp-content/uploads/2020/06/CHAPTER-1-7-MULTIDISCIPLINARY-NATURE-OF-ENVIRONM ...

60/202	SUBMITTED TEXT	22 WORDS	70%	MATCHING TEXT	22 WORDS

right to life as a fundamental right under Article 21, which includes the right of enjoyment of pollution free water and air".

SA Chapters 1 - 7.docx (D19161985)

61/202	SUBMITTED TEXT	13 WORDS	96%	MATCHING TEXT	13 WORDS

that Precautionary principle and the polluter pays principle are essential features of 'sustainable development'.

SA 0_Dissertation(Rahul Kumar Singh).pdf (D140073161)

62/202	SUBMITTED TEXT	12 WORDS	95%	MATCHING TEXT	12 WORDS

Human beings are at the centre of concerns for sustainable development,

Human beings are at the centre of the concerns for sustainable development.

W https://numerons.files.wordpress.com/2012/04/7environment-environmental-regulatory-mechanism-govt ...

63/202	SUBMITTED TEXT	23 WORDS	90%	MATCHING TEXT	23 WORDS

duty upon the State to raise the level of nutrition and the standard of living of its people and improve public health .

duty of the State to raise the level of nutrition and the standard of living of its people to improve public health -

W https://teresas.ac.in/wp-content/uploads/2020/06/CHAPTER-1-7-MULTIDISCIPLINARY-NATURE-OF-ENVIRONM ...

64/202	SUBMITTED TEXT	13 WORDS	83%	MATCHING TEXT	13 WORDS

extinction is end of organism or group of organisms normally a species.

extinction is the end of an organism or of a group of organisms, normally a species.

W https://pdfcoffee.com/environmental-educationpdf-pdf-free.html

65/202	SUBMITTED TEXT	12 WORDS	88%	MATCHING TEXT	12 WORDS

they are entitled to a healthy and protective life, in harmony with nature".

They are entitled to a healthy and productive life in harmony with nature.

W https://numerons.files.wordpress.com/2012/04/7environment-environmental-regulatory-mechanism-govt ...

66/202	SUBMITTED TEXT	22 WORDS	75%	MATCHING TEXT	22 WORDS

is the deterioration of environment through depletion of resources such as air, water and soil, the destruction if ecosystems and extinction of

SA Smita Barua.docx (D15085035)

67/202	SUBMITTED TEXT	19 WORDS	73%	MATCHING TEXT	19 WORDS

The degradation of environment is defined as any change or disturbance to the environment perceived to be undesirable. The

SA Smita Barua.docx (D15085035)

68/202	SUBMITTED TEXT	12 WORDS	95%	MATCHING TEXT	12 WORDS

human rights and fundamental freedoms for all without any distinction as

human rights and fundamental 140 freedoms for all without any distinction such as

W https://teresas.ac.in/wp-content/uploads/2020/06/CHAPTER-1-7-MULTIDISCIPLINARY-NATURE-OF-ENVIRONM ...

69/202	SUBMITTED TEXT	20 WORDS	82%	MATCHING TEXT	20 WORDS

right to engage in any activity or to perform any act aimed at the violation of the rights set forth

right to engage in any activity or to perform any act aimed at the destruction of any of the rights and freedoms set forth

W https://teresas.ac.in/wp-content/uploads/2020/06/CHAPTER-1-7-MULTIDISCIPLINARY-NATURE-OF-ENVIRONM ...

70/202	SUBMITTED TEXT	20 WORDS	97%	MATCHING TEXT	20 WORDS

environmental degradation as “the reduction of the capacity of the environment to meet social and ecological objectives and needs” Degradation

SA Dissertation on Effects of Environmental Degradation in the Society A Study.docx (D156794174)

71/202	SUBMITTED TEXT	11 WORDS	100%	MATCHING TEXT	11 WORDS

the International Union for conservation of Nature and Natural Resources (IUCN)

SA dissertation_falak_LLM(HR).docx (D133844573)

72/202	SUBMITTED TEXT	14 WORDS	96%	MATCHING TEXT	14 WORDS

Convention on International Trade in Endangered species of Wild flora and fauna (CITES) 1973

Convention on the International Trade in Endangered Species of Wild Flora and Fauna, (CITES),

W https://pdfcoffee.com/environmental-educationpdf-pdf-free.html

73/202	SUBMITTED TEXT	11 WORDS	95%	MATCHING TEXT	11 WORDS

to protect human health and the environment against adverse effects resulting

to protect human health and the environment against the adverse effects resulting

W https://onlyias.com/environmental-pollution/

74/202	SUBMITTED TEXT	15 WORDS	76%	MATCHING TEXT	15 WORDS

The Ozone Depleting Substances (Regulation and Control) Rules 2000 were drafted under Environment (protection) Act, 1986.

the Ozone Depleting Substances (Regulation and Control), rules, 2000 under the Environment Protection Act.

W https://pdfcoffee.com/environmental-educationpdf-pdf-free.html

75/202	SUBMITTED TEXT	12 WORDS	100%	MATCHING TEXT	12 WORDS

The United Nations Conference on the human environment held at Stockholm

SA pollution book.pdf (D24327357)

76/202	SUBMITTED TEXT	13 WORDS	100%	MATCHING TEXT	13 WORDS

the 10 th Anniversary of the Stockholm conference on human Environment

SA Smita Barua.docx (D15085035)

77/202	SUBMITTED TEXT	19 WORDS	67%	MATCHING TEXT	19 WORDS

that would prevent dangerous anthropogenic interference with the global climate. The convention embraced the principle of common but differentiated responsibilities

that would prevent dangerous anthropogenic interference with the climate system" (Art. 2). The Protocol is based on the principle of common but differentiated responsibilities:

W https://pdfcoffee.com/environmental-educationpdf-pdf-free.html

78/202	SUBMITTED TEXT	13 WORDS	96%	MATCHING TEXT	13 WORDS

The objectives of the convention are to reduce transboundary movements of hazardous wastes,

SA HAYAT DISSERTATION 1.pdf (D110788320)

79/202	SUBMITTED TEXT	19 WORDS	92%	MATCHING TEXT	19 WORDS

conservation of biodiversity, sustainable use of biological resources and equitable sharing of benefits arising from their sustainable use. The

conservation of biodiversity, sustainable use of biological resources, and equitable sharing of benefits arising from its sustainable use. The

SA Environmental studies.pdf (D165838221)

80/202	SUBMITTED TEXT	25 WORDS	84%	MATCHING TEXT	25 WORDS

Convention concerning the protection of the world cultural and National heritage (Paris 1972). ? Convention on International Trade in Endangered species of wild fauna and

Convention Concerning the Protection of the World Cultural and Natural Heritage, Paris, 1972. Convention on the International Trade in Endangered Species of Wild Flora and

W https://pdfcoffee.com/environmental-educationpdf-pdf-free.html

81/202	SUBMITTED TEXT	12 WORDS	100%	MATCHING TEXT	12 WORDS

to the International convention for the prevention of pollution from ships, 1973 (

to the International Convention for the Prevention of Pollution from Ships (

W https://onlyias.com/environmental-pollution/

82/202	SUBMITTED TEXT	15 WORDS	91%	MATCHING TEXT	15 WORDS

Convention on the conservation of Migratory species of wild animals (Bonn, 1979) ? Convention

Convention on the Conservation of Migratory Species of Wild Animals (CMS), International Convention

W https://pdfcoffee.com/environmental-educationpdf-pdf-free.html

83/202	SUBMITTED TEXT	14 WORDS	90%	MATCHING TEXT	14 WORDS

United Nations convention on the Law of the Sea (Montego Bay; 1982) ?

United Nations Convention on the Law of the Sea LOS Convention, Montego Bay, 1982. (

W https://pdfcoffee.com/environmental-educationpdf-pdf-free.html

84/202	SUBMITTED TEXT	22 WORDS	91%	MATCHING TEXT	22 WORDS

Convention for the protection of the Ozone Layer (Vienna, 1985) ? Protocol on substances that deplete the Ozone Layer (Montreal, 1987) ?

Convention for the Protection of the Ozone Layer, Vienna, 1985, including the Montreal Protocol on Substances that Deplete the Ozone Layer, Montreal 1987.

W https://pdfcoffee.com/environmental-educationpdf-pdf-free.html

85/202	SUBMITTED TEXT	29 WORDS	35%	MATCHING TEXT	29 WORDS

guided the adoption of a regulatory structure. India signed the agreement in June 1992 which was ratified in November 1993. As per the convention the reduction/ limitation requirements apply only

SA Neelam- Dissertation.docx (D142205573)

86/202	SUBMITTED TEXT	17 WORDS	70%	MATCHING TEXT	17 WORDS

environment and to safeguard the forests and wild lie of the country. In Act 48A it is

SA critical analysis.docx (D41891205)

87/202	SUBMITTED TEXT	25 WORDS	78%	MATCHING TEXT	25 WORDS

Montreal protocol on substance that Deplete the Ozone layer (London, 1990 ? Convention on the control of Trastoundary Movements of Hazardous wastes and their disposal (

SA dissertation_falak_LLM(HR).docx (D133844573)

88/202	SUBMITTED TEXT	14 WORDS	80%	MATCHING TEXT	14 WORDS

Air (prevention and control of pollution) Act of 1981 and the Environment (protection) Act

SA 0_Dissertation(Rahul Kumar Singh).pdf (D140073161)

89/202	SUBMITTED TEXT	14 WORDS	84%	MATCHING TEXT	14 WORDS

Conference on the Human Environment (UNCHE) 1972 The United Nations Conference on Human Environment,

Conference on the Human Environment – Stockholm 1972. The United Nations Conference on the Human Environment,

W https://numerons.files.wordpress.com/2012/04/7environment-environmental-regulatory-mechanism-govt ...

90/202	SUBMITTED TEXT	17 WORDS	88%	MATCHING TEXT	17 WORDS

to implement the decisions reached at the United Nations conference on human environment held at Stockholm in 1972.

SA pollution book.pdf (D24327357)

91/202	SUBMITTED TEXT	19 WORDS	92%	MATCHING TEXT	19 WORDS

the environmental policies of all states should enhance and not adversely affect the present or future developmental potential of

SA Dissertation for Plagiarism.pdf (D135908508)

92/202	SUBMITTED TEXT	11 WORDS	100%	MATCHING TEXT	11 WORDS

the United Nations Conference on Environment and Development, at Rio.

The 1992, United Nations Conference on Environment and Development at Rio

SA Environmental studies.pdf (D165838221)

93/202	SUBMITTED TEXT	14 WORDS	89%	MATCHING TEXT	14 WORDS

developing countries, nor should they hamper the attainment of better living conditions for all,

SA Dissertation for Plagiarism.pdf (D135908508)

94/202	SUBMITTED TEXT	14 WORDS	100%	MATCHING TEXT	14 WORDS

in an environment of a quality that permits a life of dignity and well-being.

SA Dissertation for Plagiarism.pdf (D135908508)

95/202	SUBMITTED TEXT	12 WORDS	95%	MATCHING TEXT	12 WORDS

to meet developmental and environmental needs of the present and future generations'.

to equitably meet developmental and environmental needs of the present and future generations.

W https://numerons.files.wordpress.com/2012/04/7environment-environmental-regulatory-mechanism-govt ...

96/202	SUBMITTED TEXT	25 WORDS	62%	MATCHING TEXT	25 WORDS

human beings at the centre of sustainable development concerns by stating that humans are entitled to a healthy and productive life in harmony with nature'.

Human beings are at the centre of the concerns for sustainable development. are entitled to a healthy and productive life in harmony with nature.

W https://numerons.files.wordpress.com/2012/04/7environment-environmental-regulatory-mechanism-govt ...

97/202	SUBMITTED TEXT	16 WORDS	78%	MATCHING TEXT	16 WORDS

international agreements which would respect and protect the integrity of the global environmental and development system.

international agreements which respect the interests of all and protect the integrity of the global environmental and development system,

W https://numerons.files.wordpress.com/2012/04/7environment-environmental-regulatory-mechanism-govt ...

98/202	SUBMITTED TEXT	15 WORDS	66%	MATCHING TEXT	15 WORDS

and the media. The conference of the UN Framework Convention on climate change held in

and ecosystem 126 The Conference of the Parties (COP) of the UN Framework Convention on Climate Change (UNFCCC) held in

W https://teresas.ac.in/wp-content/uploads/2020/06/CHAPTER-1-7-MULTIDISCIPLINARY-NATURE-OF-ENVIRONM ...

99/202	SUBMITTED TEXT	16 WORDS	78%	MATCHING TEXT	16 WORDS

United Nations Conference on Environment and Development, 1992 Earth Summit was held at Rio de Janeiro

SA rofiulalom47@gmail.com.docx (D153756935)

100/202	SUBMITTED TEXT	22 WORDS	50%	MATCHING TEXT	22 WORDS

the Supreme Court has held that the essential feature of "sustainable development" such as the "precautionary principle" and the "polluter pays principle" are

SA 0_Dissertation(Rahul Kumar Singh).pdf (D140073161)

101/202	SUBMITTED TEXT	21 WORDS	97%	MATCHING TEXT	21 WORDS

the first International Conference on Human Environment at Stockholm in 1972, voiced deep concern about the degradation of the environment and eco-

SA Smita Barua.docx (D15085035)

102/202	SUBMITTED TEXT	52 WORDS	78%	MATCHING TEXT	52 WORDS

India was also one of the signatories of the Stockholm Declaration which is known as Magna Carta on human environment. Based upon the Stockholm conference, the Indian parliament passed the forty second amendment to the constitution in the year 1976 and incorporated specially two Articles relating to protection and improvement of environment

SA Smita Barua.docx (D15085035)

103/202	SUBMITTED TEXT	11 WORDS	91%	MATCHING TEXT	11 WORDS

the "State" as well as "Citizens" to "Protect and Improve" the environment.

SA 0_Dissertation(Rahul Kumar Singh).pdf (D140073161)

104/202	SUBMITTED TEXT	26 WORDS	66%	MATCHING TEXT	26 WORDS

between the Union and the State governments. Part XI of the Constitution governs the legislative and administrative relations between the union and the states. Parliament has the

SA Smita Barua.docx (D15085035)

105/202	SUBMITTED TEXT	21 WORDS	73%	MATCHING TEXT	21 WORDS

to foster respect for international law and treaty obligations in the dealings of organized people with one another". Article 253 of the

SA Smita Barua.docx (D15085035)

106/202	SUBMITTED TEXT	39 WORDS	100%	MATCHING TEXT	39 WORDS

to make any law for the whole or any part of the territory of India for implementing any treaty, agreement or convention with any other country or countries or any decision made at any international conference, association or other body".

SA HAYAT DISSERTATION 1.pdf (D110788320)

107/202	SUBMITTED TEXT	31 WORDS	85%	MATCHING TEXT	31 WORDS

international conferences, associations and other bodies and implementing of decisions made there at" and "entering into treaties and agreements with foreign countries and implementing of treaties, agreements and conventions with foreign countries".

SA Chapters 1 - 7.docx (D19161985)

108/202	SUBMITTED TEXT	15 WORDS	82%	MATCHING TEXT	15 WORDS

the Air (Prevention and Control of Pollution) Act of 1981 and the Environment (Protection) Act

SA 0_Dissertation(Rahul Kumar Singh).pdf (D140073161)

109/202	SUBMITTED TEXT	28 WORDS	57%	MATCHING TEXT	28 WORDS

The Preamble of these laws state that these 69 Acts were enacted to implement the decisions reached at the United Nations Conference on Human Environment held at Stockholm in 1972.

SA Dissertation on Effects of Environmental Degradation in the Society A Study.docx (D156794174)

110/202	SUBMITTED TEXT	19 WORDS	100%	MATCHING TEXT	19 WORDS

In Vellore Citizens Welfare Forum v. Union of India the Supreme Court held that it is

SA Dissertation on Effects of Environmental Degradation in the Society A Study.docx (D156794174)

111/202	SUBMITTED TEXT	12 WORDS	100%	MATCHING TEXT	12 WORDS

the fundamental duty of every citizen to protect and improve "natural environment".

the fundamental duty of every citizen to protect and improve natural environment

W https://teresas.ac.in/wp-content/uploads/2020/06/CHAPTER-1-7-MULTIDISCIPLINARY-NATURE-OF-ENVIRONM ...

112/202	SUBMITTED TEXT	30 WORDS	95%	MATCHING TEXT	30 WORDS

It shall be the duty of every citizen of India to protect and improve the natural environment including forests, lakes, rivers and wild life and to have compassion for living creatures".

SA Smita Barua.docx (D15085035)

113/202	SUBMITTED TEXT	13 WORDS	100%	MATCHING TEXT	13 WORDS

In Rural Litigation and Entitlement Kendra v. State of UP

SA 0_Dissertation(Rahul Kumar Singh).pdf (D140073161)

114/202	SUBMITTED TEXT	19 WORDS	55%	MATCHING TEXT	19 WORDS

of the environment and keeping the ecological balance unaffected is a task which not only the government but also

SA For_Plagiarism.doc (D34239379)

115/202	SUBMITTED TEXT	14 WORDS	65%	MATCHING TEXT	14 WORDS

citizen that it is his fundamental duty as enshrined in Article 51-A(g) of the Constitution".

SA For_Plagiarism.doc (D34239379)

116/202	SUBMITTED TEXT	18 WORDS	77%	MATCHING TEXT	18 WORDS

constitutional pointer to the state and a constitutional duty of the citizens not only to protect but also

SA Dissertation on Effects of Environmental Degradation in the Society A Study.docx (D156794174)

117/202	SUBMITTED TEXT	33 WORDS	80%	MATCHING TEXT	33 WORDS

and to preserve and safeguard the forest, the flora and fauna, the rivers and the lakes and all other water resources of the country. The neglect or failure to abide by the pointer or

SA Dissertation on Effects of Environmental Degradation in the Society A Study.docx (D156794174)

118/202	SUBMITTED TEXT	14 WORDS	87%	MATCHING TEXT	14 WORDS

and maintain". In L. K. Koolwal v. State of Rajasthan and Ors

SA Dissertation on Effects of Environmental Degradation in the Society A Study.docx (D156794174)

119/202	SUBMITTED TEXT	21 WORDS	76%	MATCHING TEXT	21 WORDS

the acute sanitation problem in Jaipur which is hazardous to the life of the citizens of Jaipur. The Court explained the

SA Chapters 1 - 7.docx (D19161985)

120/202	SUBMITTED TEXT	112 WORDS	89%	MATCHING TEXT	112 WORDS

We can call Article 51-A ordinarily as the duty of the citizens, but in fact it is the right of the citizens as it creates the right in favour of the citizens to move to the court to see that the State performs its duties faithfully and the obligatory and primary duties are performed in accordance with the law of the land. Omissions or commissions are brought to the notice of the court by the citizen and thus, Article 51- A gives a right to the citizens to move the court for the enforcement of the duty caste on the state, instrumentalities, agencies, departments, local bodies and statutory authorities created under the particular law of the

SA Smita Barua.docx (D15085035)

121/202	SUBMITTED TEXT	17 WORDS	73%	MATCHING TEXT	17 WORDS

falls within the purview of Article 21 of the constitution. It is the duty of the

SA Chapters 1 - 7.docx (D19161985)

122/202	SUBMITTED TEXT	20 WORDS	85%	MATCHING TEXT	20 WORDS

The Court directed the Municipality to remove dirt, filth etc., from the city with in the period of six months.

SA Chapters 1 - 7.docx (D19161985)

123/202	SUBMITTED TEXT	22 WORDS	72%	MATCHING TEXT	22 WORDS

petitioner was a society registered under the law relating to registration of societies and their members were citizens of India having fundamental duty

SA 0_Dissertation(Rahul Kumar Singh).pdf (D140073161)

124/202	SUBMITTED TEXT	23 WORDS	97%	MATCHING TEXT	23 WORDS

Article 51-A to protect and improve the natural environment including forests, lakes, rivers and wild life and to have compassion for living creatures.

SA HAYAT DISSERTATION 1.pdf (D110788320)

125/202	SUBMITTED TEXT	18 WORDS	77%	MATCHING TEXT	18 WORDS

petitioner society was held to have a locus standi to move to the Court to prevent ecological degradation,

SA Dissertation on Effects of Environmental Degradation in the Society A Study.docx (D156794174)

126/202	SUBMITTED TEXT	29 WORDS	72%	MATCHING TEXT	29 WORDS

Article 48-A was inserted into the Constitution which reads: "The State shall endeavour to protect and improve the environment and safeguard the forests and wild life of the country".

Article 48 -A of the constitution says the state shall endeavour to protect and improve the and to safeguard the forests and wild life of the country".

W https://teresas.ac.in/wp-content/uploads/2020/06/CHAPTER-1-7-MULTIDISCIPLINARY-NATURE-OF-ENVIRONM ...

127/202	SUBMITTED TEXT	55 WORDS	94%	MATCHING TEXT	55 WORDS

The State shall regard the raising of the level of nutrition and the standard of living of its people and the improvement of public health as among its primary duties and, in particular, the State shall endeavour to bring about prohibition of the consumption except for medical purposes of intoxicating drinks and drugs which are injurious to health".

SA HAYAT DISSERTATION 1.pdf (D110788320)

128/202	SUBMITTED TEXT	36 WORDS	81%	MATCHING TEXT	36 WORDS

Sachidanand Pandey v. State of West Bengal the Supreme Court pointed out that whenever a problem of ecology is brought before the court, the court is bound to bear in mind Articles 48-A and 51-A (g)

SA HAYAT DISSERTATION 1.pdf (D110788320)

129/202	SUBMITTED TEXT	10 WORDS	100%	MATCHING TEXT	10 WORDS

In M.C. Mehta v. Union of India the court

SA 0_Dissertation(Rahul Kumar Singh).pdf (D140073161)

130/202	SUBMITTED TEXT	24 WORDS	92%	MATCHING TEXT	24 WORDS

by themselves and collectively casts a duty on the State to secure the health of the people, improve public health and protect and improve environment.

SA Smita Barua.docx (D15085035)

131/202	SUBMITTED TEXT	25 WORDS	84%	MATCHING TEXT	25 WORDS

Article 21 of the Constitution which reads: “No person shall be deprived of his life or personal liberty except according to procedure established by Law”. The

SA 0_Dissertation(Rahul Kumar Singh).pdf (D140073161)

132/202	SUBMITTED TEXT	42 WORDS	90%	MATCHING TEXT	42 WORDS

Right to life includes the right to life with human dignity and that goes along with it, namely, the bare necessities of life such as adequate nutrition, clothing and shelter over the head and facilities for writing and expressing oneself in diverse forms

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133/202	SUBMITTED TEXT	37 WORDS	100%	MATCHING TEXT	37 WORDS

the court fortified and expanded the fundamental rights enshrined in Part III of the Constitution. In the process, the boundaries of the Fundamental right to life and personal liberty guaranteed in Article 21 were expanded to include environmental protection”.

SA 0_Dissertation(Rahul Kumar Singh).pdf (D140073161)

134/202	SUBMITTED TEXT	17 WORDS	81%	MATCHING TEXT	17 WORDS

the case of Rural Litigation and Entitlement Kendra, Dehradun v. State of U.P. that the

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135/202	SUBMITTED TEXT	28 WORDS	58%	MATCHING TEXT	28 WORDS

Rural Litigation and Entitlement Kendra, Dehradun and a group of citizens wrote to the Supreme Court against the progressive mining which denuded the Mussoori Hills of trees and forests

SA Dissertation on Effects of Environmental Degradation in the Society A Study.docx (D156794174)

136/202	SUBMITTED TEXT	17 WORDS	100%	MATCHING TEXT	17 WORDS

the first case of its kind in the country involving issues relating to environment and ecological balance

SA 0_Dissertation(Rahul Kumar Singh).pdf (D140073161)

137/202	SUBMITTED TEXT	32 WORDS	51%	MATCHING TEXT	32 WORDS

the Court appointed an expert committee to advise the bench on technical issues. On the basis of the report of the committee, the Court ordered the closure of the lime-stone quarries. The Court

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138/202	SUBMITTED TEXT	12 WORDS	95%	MATCHING TEXT	12 WORDS

of right to life and personal liberty under Article-21 of the Constitution.

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139/202	SUBMITTED TEXT	13 WORDS	100%	MATCHING TEXT	13 WORDS

In M.C. Mehta v. Union of India the Supreme Court

SA For_Plagiarism.doc (D34239379)

140/202	SUBMITTED TEXT	24 WORDS	100%	MATCHING TEXT	24 WORDS

We are conscious that closure of tanneries may bring unemployment, loss of revenue but life, health and ecology have greater importance to the people".

SA Chapters 1 - 7.docx (D19161985)

141/202	SUBMITTED TEXT	84 WORDS	96%	MATCHING TEXT	84 WORDS

It would be reasonable to hold that the enjoyment of life and its attainment and fulfilment guaranteed by Article 21 of the Constitution embraces the protection and preservation of nature's gifts without which life cannot be enjoyed. There can be no reason why practice of violent extinguishment of life alone should be regarded as violative of Article 21 of the Constitution. The slow poisoning by the polluted atmosphere caused by environmental pollution and spoliation should also be regarded as amounting to violation of article 21 of the Constitution".

SA Chapters 1 - 7.docx (D19161985)

142/202	SUBMITTED TEXT	41 WORDS	100%	MATCHING TEXT	41 WORDS

sanitation and environment falls within the purview of Article 21 of the Constitution as it adversely affects the life of the citizen and it amounts to slow poisoning and reducing the life of the citizen because of the hazards created, if not checked.

SA Chapters 1 - 7.docx (D19161985)

143/202	SUBMITTED TEXT	13 WORDS	100%	MATCHING TEXT	13 WORDS

Sahu v. Union of India the Supreme Court of India

SA dissertation_falak_LLM(HR).docx (D133844573)

144/202	SUBMITTED TEXT	17 WORDS	78%	MATCHING TEXT	17 WORDS

dimensions of human rights, right to life, liberty, pollution free air and water is guaranteed by

SA dissertation_falak_LLM(HR).docx (D133844573)

145/202	SUBMITTED TEXT	26 WORDS	84%	MATCHING TEXT	26 WORDS

the right to sweet water and the right to free air is attributes of right to life, those are the basic elements which sustain life itself. 73

SA dissertation_falak_LLM(HR).docx (D133844573)

146/202	SUBMITTED TEXT	83 WORDS	94%	MATCHING TEXT	83 WORDS

the Supreme Court observed: Right to live is a fundamental right under Article 21 of the Constitution and it includes the right of enjoyment of pollution - free water and air for full enjoyment of life. If anything endangers or impairs that quality of life in derogation of laws, a citizen has right to have recourse to Article 32 of the Constitution for removing the pollution of water or air which may be detrimental to the quality of life. In Rajiv Ranjan Singh v. State of Bihar

SA Chapters 1 - 7.docx (D19161985)

147/202	SUBMITTED TEXT	11 WORDS	100%	MATCHING TEXT	11 WORDS

held that failure to protect the inhabitants of the locality from

SA Chapters 1 - 7.docx (D19161985)

148/202	SUBMITTED TEXT	22 WORDS	77%	MATCHING TEXT	22 WORDS

amounted to an infringement of the inhabitants' rights guaranteed under Articles 14, 21 read with Articles 47 and 48-A of the Constitution of India.

SA Chapters 1 - 7.docx (D19161985)

149/202	SUBMITTED TEXT	19 WORDS	75%	MATCHING TEXT	19 WORDS

the right to life is most fundamental right as enshrined in Article 21 of the Constitution of India and

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150/202	SUBMITTED TEXT	12 WORDS	76%	MATCHING TEXT	12 WORDS

of life. Right to healthy environment is part of the right to life.

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151/202	SUBMITTED TEXT	22 WORDS	85%	MATCHING TEXT	22 WORDS

Court held that the right to life conferred by Article 21 of the Constitution includes the right of enjoyment of pollution -free

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152/202	SUBMITTED TEXT	14 WORDS	100%	MATCHING TEXT	14 WORDS

In Virender Gaur v. State of Haryana the Supreme Court

SA Jaspreet kaur.docx (D113775418)

153/202	SUBMITTED TEXT	11 WORDS	100%	MATCHING TEXT	11 WORDS

to live with human dignity without a human and healthy environment".

SA Smita Barua.docx (D15085035)

154/202	SUBMITTED TEXT	11 WORDS	100%	MATCHING TEXT	11 WORDS

In Indian Council for Enviro-Legal Action v. Union of India (

SA 0_Dissertation(Rahul Kumar Singh).pdf (D140073161)

155/202	SUBMITTED TEXT	21 WORDS	100%	MATCHING TEXT	21 WORDS

against the Union of India, State Government and State Pollution Board concerned to compel them to perform their statutory duties on

SA 0_Dissertation(Rahul Kumar Singh).pdf (D140073161)

156/202	SUBMITTED TEXT	7 WORDS	100%	MATCHING TEXT	7 WORDS

A.P. Pollution Control Board (II) v. Prof.M.V.

SA dissertation_falak_LLM(HR).docx (D133844573)

157/202	SUBMITTED TEXT	19 WORDS	92%	MATCHING TEXT	19 WORDS

the rights to healthy environment and to sustainable development are fundamental human rights implicit in the right to life.

SA HAYAT DISSERTATION 1.pdf (D110788320)

158/202	SUBMITTED TEXT	15 WORDS	80%	MATCHING TEXT	15 WORDS

of "healthy environment" as part of right to "life" under Article 21 of the Constitution.

SA Chapters 1 - 7.docx (D19161985)

159/202	SUBMITTED TEXT	21 WORDS	97%	MATCHING TEXT	21 WORDS

has further broadened the scope and ambit of Article 21 and now “right to life” includes the “right to livelihood”. The

SA Chapters 1 - 7.docx (D19161985)

160/202	SUBMITTED TEXT	13 WORDS	95%	MATCHING TEXT	13 WORDS

as a part of right to life under Article 21 of the Constitution.

SA Chapters 1 - 7.docx (D19161985)

161/202	SUBMITTED TEXT	17 WORDS	82%	MATCHING TEXT	17 WORDS

that no person can be deprived of his life except according to the procedure established by law

SA Chapters 1 - 7.docx (D19161985)

162/202	SUBMITTED TEXT	44 WORDS	100%	MATCHING TEXT	44 WORDS

If the right to livelihood is not treated as a part of the constitutional right to life, the easiest way of depriving a person of his right to life would be to deprive him of his means of livelihood to the point of abrogation.

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163/202	SUBMITTED TEXT	11 WORDS	100%	MATCHING TEXT	11 WORDS

Adivasis and other backward people (tribal forest dweller) were using

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164/202	SUBMITTED TEXT	46 WORDS	97%	MATCHING TEXT	46 WORDS

as their habitat and means of livelihood. Part of the land was declared reserved forest and in respect of other part acquisition proceedings were initiated as the government had decided that a Super Thermal Plant of the National Thermal Power Corporation Ltd., (NTPC) was to be located there.

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165/202	SUBMITTED TEXT	13 WORDS	100%	MATCHING TEXT	13 WORDS

In M.C.Mehta v. Union of India 8 (popularly known as

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166/202	SUBMITTED TEXT	22 WORDS	47%	MATCHING TEXT	22 WORDS

the scope of the right to know in S. P. Gupta v. Union of India the Supreme Court recognized the right to

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167/202	SUBMITTED TEXT	15 WORDS	89%	MATCHING TEXT	15 WORDS

In Research Foundation for Science Technology and Natural Resource Policy v. Union of India

SA Dissertation for Plagiarism.pdf (D135908508)

168/202	SUBMITTED TEXT	15 WORDS	80%	MATCHING TEXT	15 WORDS

the right to information and community participation necessary for protection of environment and human health

The rights to information and community participation for protection of environment and human health

W https://www.ijlsi.com/wp-content/uploads/Hazardous-Waste-Management.pdf

169/202	SUBMITTED TEXT	29 WORDS	55%	MATCHING TEXT	29 WORDS

right to equality' to all persons without any discrimination. This indicates that any action of the 'State' relating to environment must not infringe upon the right to equality as

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170/202	SUBMITTED TEXT	33 WORDS	62%	MATCHING TEXT	33 WORDS

the Article 14 of the Constitution. The Stockholm Declaration, 1972, also recognized this principle of equality in environmental management and it called up all the worlds' nations to abide by this

SA Jaspreet kaur.docx (D113775418)

171/202	SUBMITTED TEXT	58 WORDS	25%	MATCHING TEXT	58 WORDS

of the State the area kept for laying a park was converted to a civic amenity site where hospital was to be constructed by the appellant. When the construction activity was noticed, the resident of the area approached the High Court which allowed the petition. The Appellant came in appeal before the Supreme Court contenting that the decision to allot

SA Dissertation for Plagiarism.pdf (D135908508)

172/202	SUBMITTED TEXT	19 WORDS	58%	MATCHING TEXT	19 WORDS

Article 19(1) (g) guarantees all citizens the right' to practice any profession or to carry on any occupation, trade

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173/202	SUBMITTED TEXT	10 WORDS	100%	MATCHING TEXT	10 WORDS

the rights of the people to live in healthy environment

SA HAYAT DISSERTATION 1.pdf (D110788320)

174/202	SUBMITTED TEXT	27 WORDS	72%	MATCHING TEXT	27 WORDS

in Abhilash Textiles v. Rajkot Municipal Corporation made clear that, 'the petitioners cannot be allowed to reap profit at the cost of public health'. In this case

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175/202	SUBMITTED TEXT	26 WORDS	94%	MATCHING TEXT	26 WORDS

were discharging dirty water from the factory on the public road and in public drains without purifying the same, thereby causing damage to the public health.

SA Chapters 1 - 7.docx (D19161985)

176/202	SUBMITTED TEXT	10 WORDS	100%	MATCHING TEXT	10 WORDS

business in the manner by which the business activity becomes

SA Chapters 1 - 7.docx (D19161985)

177/202	SUBMITTED TEXT	20 WORDS	97%	MATCHING TEXT	20 WORDS

health hazard to the entire society. By discharge of effluent water on public road or in public drainage system

SA Chapters 1 - 7.docx (D19161985)

178/202	SUBMITTED TEXT	11 WORDS	100%	MATCHING TEXT	11 WORDS

Article 51-A (g) to protect and improve the natural environment.

SA HAYAT DISSERTATION 1.pdf (D110788320)

179/202	SUBMITTED TEXT	41 WORDS	100%	MATCHING TEXT	41 WORDS

Mehta v. Union of India where tanneries were discharging effluents from their factories in the holy river Ganga resulting in water pollution and not setting up a primary treatment plant in spite of being asked to do for several years.

SA Chapters 1 - 7.docx (D19161985)

180/202	SUBMITTED TEXT	33 WORDS	84%	MATCHING TEXT	33 WORDS

It was held that, an order directing them to stop working their tanneries should be passed as effluent discharge from tanneries is ten times noxious when compared with the domestic sewage water which

SA Chapters 1 - 7.docx (D19161985)

181/202	SUBMITTED TEXT	56 WORDS	97%	MATCHING TEXT	56 WORDS

the river and the court passed the following order: "We are, therefore, issuing the directions for the closure of those tanneries which have failed to take minimum steps required for the primary treatment of industrial effluent. We are conscious that closure of tanneries may bring unemployment, loss of revenue, but life, health and ecology have greater importance to the people".

SA Chapters 1 - 7.docx (D19161985)

182/202	SUBMITTED TEXT	13 WORDS	100%	MATCHING TEXT	13 WORDS

In M.C. Mehta v. Union of India the Supreme Court

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183/202	SUBMITTED TEXT	10 WORDS	100%	MATCHING TEXT	10 WORDS

but at the same time prevent excessive use leading to

but at the same time, prevent excessive use leading to

W https://pdfcoffee.com/environmental-educationpdf-pdf-free.html

184/202	SUBMITTED TEXT	10 WORDS	100%	MATCHING TEXT	10 WORDS

strict environmental test in other words “reasonable restriction” can be

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185/202	SUBMITTED TEXT	12 WORDS	100%	MATCHING TEXT	12 WORDS

International Union for the Conservation of Nature and Natural Resources (IUCN)

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186/202	SUBMITTED TEXT	11 WORDS	100%	MATCHING TEXT	11 WORDS

International Union for Conservation of Nature and Natural resources (IUCN),

SA dissertation_falak_LLM(HR).docx (D133844573)

187/202	SUBMITTED TEXT	15 WORDS	80%	MATCHING TEXT	15 WORDS

of sustainable development. Sustainable development is the development that meets the needs of the present

SA dissertation_falak_LLM(HR).docx (D133844573)

188/202	SUBMITTED TEXT	23 WORDS	100%	MATCHING TEXT	23 WORDS

Disposal Regardless of their form (i.e., solid, liquid, or gas), most hazardous waste is disposed off either near the surface or by deep burial.

Disposal Regardless of their form (i.e., solid, liquid, or gas), most hazardous waste is disposed off either near the surface or by deep burial.

W https://hrms.secab.org/resource/702_18CV642_Chethan_Kumar_Marol.pdf

189/202	SUBMITTED TEXT	62 WORDS	100%	MATCHING TEXT	62 WORDS

Although, controlled landfill methods have been proved adequate for disposing of municipal solid waste and limited amounts of hazardous waste, they are not suitable enough for the disposal of a large quantity of hazardous waste, due to the following reasons: ? possible percolation of toxic liquid waste to the ground water; ? dissolution of solids followed by leaching and percolation to the ground water; 107 ?

Although, controlled landfill methods have been proved adequate for disposing of municipal solid waste and limited amounts of hazardous waste, they are not suitable enough for the disposal of a large quantity of hazardous waste, due to the following reasons: ? possible percolation of toxic liquid waste to the ground water; ? dissolution of solids followed by leaching and percolation to the ground water; ?

W https://hrms.secab.org/resource/702_18CV642_Chethan_Kumar_Marol.pdf

190/202	SUBMITTED TEXT	28 WORDS	94%	MATCHING TEXT	28 WORDS

followed by leaching and percolation to the ground water; ? potential for undesirable reactions in the landfill that may lead to the development of explosive or toxic gases; ? volatilisation of

followed by leaching and percolation to the ground water; ? potential for undesirable reactions in the landfill that may lead to the development of explosive or toxic gases; ? Corrosion of

W https://hrms.secab.org/resource/702_18CV642_Chethan_Kumar_Marol.pdf

191/202	SUBMITTED TEXT	418 WORDS	100%	MATCHING TEXT	418 WORDS

Common Effluent Treatment Plants (CETPs) The Ministry has undertaken a Centrally Sponsored Scheme for enabling the small scale industries (SSI) to set- up Common Effluent Treatment Plants in the country. Since some of the polluting SSIs are unable to afford installation of pollution control equipment. In order to encourage use of new technologies for CETPs for existing SSI clusters of units a scheme for financial assistance has been formulated. 121 The criteria for Consideration for Assistance 1) CETPs in industrial estates or in a cluster of Small Scale Industrial units are encouraged. 2) Central Assistance will be available only for clusters of SSIs. 3) Projects for assistance will be prioritized on the basis of : ? Toxicity of pollutants ? Pollution load being generated and to be treated; and ? Number of units covered 4) The CETPs are to be set up and managed by the State Industrial Infrastructure Corporation (by whatever name known) or through an appropriate institution including a cooperative body of the concerned units as may be decided by the State Governments/SPCBs concerned. 5) The project should be self-supporting for repayment of the loan and meeting operation and maintenance costs. 6) The project must formulate adequate institutional arrangements for cost sharing, recovery of dues and management and ensure observance of prescribed standards. 7) The scheme must have the technical recommendation of the State Pollution Control Boards. 8) The CETP project should have the conveyance system from the individual units to the CETP. 9) Sludge characteristics (i.e. hazardous Vs. non-hazardous) from the primary and secondary treatment of the CETP should be estimated. Therefore, the CETP should have a sludge management plan which should be prepared based on the sludge characterization and be documented in the feasibility report of the CETP project. 10)Possibility of recycling/reusing the treated effluent from the CETPs by the member units should be explored and be documented in the feasibility report of the CETP project. 11) An environmental management and monitoring plan/programme to be prepared for the CETP and be documented in the feasibility report of the CETP project. 12)A legal agreement between the CETP Co. and its member units to be executed be reflected in the feasibility report of the CETP project. 13)The cost recovery formula developed for the CETP project should be ratified by all members and be documented in the feasibility report of the CETP project. 14)Necessary clearance be obtained from the concerned State Pollution Control Board for discharging the treated effluent and be reflected in the feasibility report of the CETP project. 15)All hazardous waste facilities associated with these CETPs should obtain clearance from the concerned State Pollution Control Board and be

Common Effluent Treatment Plants (CETPs) The Ministry has undertaken a Centrally Sponsored Scheme for enabling the small scale industries (SSI) to set-up Common Effluent Treatment Plants in the country. Since some of the polluting SSIs are unable to afford installation of pollution control equipment. In order to encourage use of new technologies for CETPs for existing SSI clusters of units a scheme for financial assistance has been formulated. The criteria for Consideration for Assistance - CETPs in industrial estates or in a cluster of Small Scale Industrial units are encouraged. - Central Assistance will be available only for clusters of SSIs. - Projects for assistance will be prioritized on the basis of : - Toxicity of pollutants - Pollution load being generated and to be treated; and - Number of units covered - The CETPs are to be set up and managed by the State Industrial Infrastructure Corporation (by whatever name known) or through an appropriate institution including a cooperative body of the concerned units as may be decided by the State Governments/SPCBs concerned. - The project should be self-supporting for repayment of the loan and meeting operation and maintenance costs. - The project must formulate adequate institutional arrangements for cost sharing, recovery of dues and management and ensure observance of prescribed standards. - The scheme must have the technical recommendation of the State Pollution Control Boards. - The CETP project should have the conveyance system from the individual units to the CETP. - Sludge characteristics (i.e. hazardous Vs. non-hazardous) from the primary and secondary treatment of the CETP should be estimated. Therefore, the CETP should have a sludge management plan which should be prepared based on the sludge characterization and be documented in the feasibility report of the CETP project. - Possibility of recycling/reusing the treated effluent from the CETPs by the member units should be explored and be documented in the feasibility report of the CETP project. - An environmental management and monitoring plan/programme to be prepared for the CETP and be documented in the feasibility report of the CETP project. - A legal agreement between the CETP Co. and its member units to be executed be reflected in the feasibility report of the CETP project. - The cost recovery formula developed for the CETP project should be ratified by all members and be documented in the feasibility report of the CETP project. - Necessary clearance be obtained from the concerned State Pollution Control Board for discharging the treated effluent and be reflected in the feasibility report of the CETP project. - All hazardous waste facilities associated with these CETPs should obtain clearance from the concerned State Pollution Control Board and be documented in the

documented in the feasibility report of the CETP project. 16)Pattern of Financial Assistance (

feasibility report of the CETP project. - Pattern of Financial Assistance -

W http://moef.gov.in/wp-content/uploads/report/0203/chap-05.htm

Hazardous Substances Management} The enhanced pace of developmental activities and rapid urbanization have resulted in stress on natural resources and quality of life. The trend of increasing pollution in various environmental media is evident from the deteriorating air and water quality, higher noise levels, increasing vehicular emission etc. Realising the urgent need for arresting the trend, Ministry adopted policy for Abatement of Pollution which provides for several mechanisms in the form of regulations, legislation, agreements, fiscal incentives and other measures to prevent and abate pollution. Further, realizing that conventional pollution control approach by treatment at the end of the pipe is not delivering the desired benefits in terms of resource conservation, the thrust has been shifted to pollution prevention and control through promotion of clean and low waste technology, re-use and recycling, natural resource accounting, Environmental Audit and Institutional and Human Resource Development. To give effect to various measures and policies on ground, multi-pronged approach is adopted which includes stringent regulations, Development of Environmental Standards, Control of Vehicular Pollution, preparation of Zoning Atlas for Spatial Environmental Planning including Industrial Estates etc. Major activities carried out under several programmes/schemes during the year are as follows: ? Industrial Pollution Abatement through preventive strategies This scheme is an amalgamation of the three on-going schemes viz. Environmental Audit, Adoption of Clean Technologies in Small Scale Industries and Environmental Statistics and Mapping, which have been continuing since eighth Five Year Plan. Due to encouraging results and benefits to various small scale units, these schemes are being continued during the 10 th Five Year Plan also: ? Environmental Statement (As a part of Environmental Audit) Environmental audit is a management tool and provides a structure and comprehensive mechanism for ensuring that the activities and products of an enterprise do no cause unacceptable effects on the environment. Submission of an Environmental Statement by polluting units seeking consent either under the Water (Prevention and Control of Pollution) Act, 1974 or the Air (Prevention and Control of Pollution) Act, 1981 or both and the Authorization under the Hazardous Wastes (Management and Handling) Rules, 1989 has been made mandatory through a Gazette Notification of April, 1993 under the Environment (Protection) Act, 1986. The Environmental Statement enables the units to undertake a comprehensive look at their industrial operations and facilities, understanding of material flows and focus on areas where waste reduction and consequently saving in-put cost if possible. The primary benefit of environmental audit is that it ensures cost effective compliance of laws, standards, regulations,

Hazardous Substances Institutional Strengthening The enhanced pace of developmental activities and rapid urbanization have resulted in stress on natural resources and quality of life. The trend of increasing pollution in various environmental media is evident from the deteriorating air and water quality, higher noise levels, increasing vehicular emission etc. Realising the urgent need for arresting the trend, Ministry adopted policy for Abatement of Pollution which provides for several mechanisms in the form of regulations, legislation, agreements, fiscal incentives and other measures to prevent and abate pollution. Further, realizing that conventional pollution control approach by treatment at the end of the pipe is not delivering the desired benefits in terms of resource conservation, the thrust has been shifted to pollution prevention and control through promotion of clean and low waste technology, re-use and recycling, natural resource accounting, Environmental Audit and Institutional and Human Resource Development. To give effect to various measures and policies on ground, multi-pronged approach is adopted which includes stringent regulations, Development of Environmental Standards, Control of Vehicular Pollution, preparation of Zoning Atlas for Spatial Environmental Planning including Industrial Estates etc. Major activities carried out under several programmes/schemes during the year are as follows : Industrial Pollution Abatement through preventive strategies This scheme is an amalgamation of the three on-going schemes viz. Environmental Audit, Adoption of Clean Technologies in Small Scale Industries and Environmental Statistics and Mapping, which have been continuing since eighth Five Year Plan. Due to encouraging results and benefits to various small scale units, these schemes are being continued during the 10th Five Year Plan also: Environmental Statement (As a part of Environmental Audit) Environmental audit is a management tool and provides a structure and comprehensive mechanism for ensuring that the activities and products of an enterprise do no cause unacceptable effects on the environment. Submission of an Environmental Statement by polluting units seeking consent either under the Prevention and Control of Pollution) Act, 1974 or the Air (Prevention and Control of Pollution) Act, 1981 or both and the Authorization under the Hazardous Wastes (Management and Handling) Rules, 1989 has been made mandatory through a Gazette Notification of April, 1993 under the Environment (Protection) Act, 1986. The Environmental Statement enables the units to undertake a comprehensive look at their industrial operations and facilities, understanding of material flows and focus on areas where waste reduction and consequently saving in-put cost if possible. The primary benefit of environmental audit is that it ensures

company policies etc. During the year, action has been initiated to evolve model environmental statements in various sectors for facilitating comparison in use of raw material, water conservation, energy consumption etc. A project has been sponsored to Central Pollution Control Board for evolving model environmental statement in the eight sectors viz. Sugar, Thermal Power Projects, Cement, Paper and Pulp, Pesticides, Bulk Drugs, Tanneries and Textiles Activities. ? Waste Minimisation/Cleaner Production Waste minimization is one of the strategies adopted for minimizing the industrial pollution. The objective of the scheme is to assist the small and medium scale industry in adoption of cleaner production practices. A project has been sponsored to National Productivity Council on “Waste Minimisation in Small Scale Industries” for establishment and running of waste minimization circles in clusters of small scale industries, capacity building in areas of cleaner production, establishment of demonstration units in selected industrial sectors etc. So far 115 waste minimization circles have been established through out the country and a large number of Organizations and Institutions have been trained in waste minimization activities. The project was executed till November, 2002 under the World Bank project on Industrial Pollution Prevention (IPP) as Phase- I and Phase- II is now being continued with Ministry’s internal funds. Implementation of this project has helped in identification of more than 200 options for resource and energy conservation in various small scale industries. ? Environmental Statistics and Mapping For sound Environmental Management, reliable information base and the mapping of areas needing special attention for pollution prevention and control are a pre-requisite. As a step in the direction, projects and pilot 115 studies have been initiated through various research institutions and organizations. Under this program, following studies have been initiated and are in various stages of completion : ? GIS based Hydrological Modelling for Water Quality and Quantity in Cauvery River Basin by IIT, Delhi. ? Geochemical baseline Mapping for Environmental Management by National Geophysical Research Institute, Hyderabad. Development and Promotion of Cleaner Technologies Life Cycle Assessment (LCA) Life Cycle Assessment is a decision cum management tool which provides information on the environmental effects of various products and processes so as to arrive at necessary corrective measures to make the entire process efficient with optimal utilization of resources and minimal wastes generation. LCA studies have been initiated in various sectors namely; Steel, Pulp and Paper and Thermal Power. The study in the Steel Sector was completed earlier and the report is under preparation. The study relating to the Thermal Power Sector has been completed during the year while the study in the Pulp and Paper Sector is progressing as per schedule.

cost effective compliance of laws, standards, regulations, company policies etc. During the year, action has been initiated to evolve model environmental statements in various sectors for facilitating comparison in use of raw material, water conservation, energy consumption etc. A project has been sponsored to Central Pollution Control Board for evolving model environmental statement in the eight sectors viz. Sugar, Thermal Power Projects, Cement, Paper and Pulp, Pesticides, Bulk Drugs, Tanneries and Textiles Activities. Waste Minimisation/Cleaner Production Waste minimization is one of the strategies adopted for minimizing the industrial pollution. The objective of the scheme is to assist the small and medium scale industry in adoption of cleaner production practices. A project has been sponsored to National Productivity Council on "Waste Minimisation in Small Scale Industries" for establishment and running of waste minimization circles in clusters of small scale industries, capacity building in areas of cleaner production, establishment of demonstration units in selected industrial sectors etc. So far 115 waste minimization circles have been established through out the country and a large number of Organizations and Institutions have been trained in waste minimization activities. The project was executed till November, 2002 under the World Bank project on Industrial Pollution Prevention (IPP) as Phase-I and Phase-II is now being continued with Ministry’s internal funds. Implementation of this project has helped in identification of more than 200 options for resource and energy conservation in various small scale industries. Environmental Statistics and Mapping For sound Environmental Management, reliable information base and the mapping of areas needing special attention for pollution prevention and control are a pre-requisite. As a step in the direction, projects and pilot studies have been initiated through various research institutions and organizations. Under this program, following studies have been initiated and are in various stages of completion : - GIS based Hydrological Modelling for Water Quality and Quantity in Cauvery River Basin by IIT, Delhi. - Geochemical baseline Mapping for Environmental Management by National Geophysical Research Institute, Hyderabad. Index Development and Promotion of Cleaner Technologies Life Cycle Assessment (LCA) Life Cycle Assessment is a decision cum management tool which provides information on the environmental effects of various products and processes so as to arrive at necessary corrective measures to make the entire process efficient with optimal utilization of resources and minimal wastes generation. LCA studies have been initiated in various sectors namely; Steel, Pulp and Paper and Thermal Power. The study in the Steel Sector was completed earlier and the report is under preparation. The study relating to the Thermal Power Sector has been completed during the year while the study in the Pulp and Paper Sector is progressing as per schedule.

Industrial Ecology Opportunities in Ankleshwar and Nandesari Industrial Estates, Gujarat A study was undertaken to develop and implement Industrial Ecology Opportunities in Ankleshwar and Nandesari Industrial Estates of Gujarat. The study has examined technologies used by industries in this region and suggested possible approach to achieve eco-efficiency within the industrial estates to reuse and recycle wastes and effluents generated from different industrial units. The recommendations of the study have been discussed in a workshop with all stakeholders including State Government Agencies for their implementation and an Action Plan is being drawnup by them. Development of Market Based Instruments for Regional Environmental Management in the Kawas- Hazira Region in Gujarat The ongoing project on Development of Market Based Instruments for Kawas-Hazira Region of Gujarat has been completed. The study report has observed that the taxes and incentives based on efficiency improvements align the pollution control agencies better with the polluters than the Command and Control (CAC) regime. Such an instrument also facilitates prescribing incentives for achieving the triple bottom line, viz economic-efficiency, environment-responsibility, and social-relevance entitling the Corporate to Clean Development Mechanism (CDM) and other cleaner-production benefits. The recommendations of the study have been discussed in a workshop with all concerned. Field Demonstration and Development of Bamboo Based Composites/Panels The ongoing project on field demonstration and development of bamboo based composites/panels was continued during the year. Under this project, commercial production of horizontal and vertical laminates have been made using Bambusa bamboo Species. Construction of demonstration houses will be taken up during the current year. Recycling of Marble Slurry in Udaipur, Rajasthan A two years duration project has been sponsored for the manufacture of bricks and tiles from marble slurry in Udaipur, Rajasthan with the aim of utilizing wastes arising out of marble cutting and processing for the purpose of improving the local environment. Bio-remediation of Railadevi Lake in Thane, Maharashtra A project relating to cleaning of Railadevi Lake in Thane District in Maharashtra using bio-remediation technique has been sponsored to Thane Municipal Corporation. Development of Natural Dyes from Forest Wastes A three years duration project has been sponsored to Forest Research Institute, Dehradun for development of natural dyes from forest wastes. Taj Protection Mission As per the Hon'ble Supreme Court's Order the protection of the Taj Mahal is a National priority for the country. In order to implement various schemes for the protection of the monument, the Planning Commission decided to provide additional funds to the State Government. The Planning Commission approved Rs.600 crores on a 50:50 cost sharing basis with the concerned State Government to

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implement various schemes in the Taj Trapezium Zone in the context of environmental protection of the Taj Mahal. In the first phase during the Ninth Five Year Plan, 10 projects were approved and are being implemented. These are :- 116 ? Improvement in Electric Supply at Agra ? Improvement in Electric Supply in and around the rural areas of Agra and Fatehpur Sikri ? Water supply (Agra) ? Water Supply (Mathura-Vrindavan) ? Gokul Barrage ? Solid Waste Management ? Storm Water Drainage System (Agra) ? Construction of one part of Agra bye-pass ? Widening of Agra Bye-pass ? Improvement of Master Plan of Roads of Agra City The Mission Management Board of the Taj Protection Programme has approved another seven projects to be taken up during the Tenth Five Year Plan. These are: ? Taj Trapezium Zone Heritage Corridor covering the areas of Taj Mahal, Agra Fort, Ram Bagh, Emad-ud- Daula, Chinni-ka-Rauza and river Yamuna. ? Taj Trapezium Zone Authority Environmental Centre and Allied Schemes. ? Planning of Taj Trapezium Zone and Study of Taj Ecocity / Conceptual Plan / Master Plan. ? Automatic Air Monitoring Stations, Display Boards and Networking at Agra-Mathura and Firozabad. ? Hazardous Waste Secured Land-fill site for Agra and Mathura. ? Common Treatment Facility for Treatment of Bio-medical Wastes at Agra, and ? Public Awareness Programme in Taj Trapezium These projects have been reviewed and steps have been taken for clearance of the EFC Memo of these Projects. Environmental Health Environmental Health Cell of the Ministry has commissioned nine environmental health studies in the cities of Ludhiana, Delhi, Lucknow, Ahmedabad, Kolkata, Mumbai, Manali (Tamil Nadu), Bangalore and Trivandrum for documenting Environmental Health Profile so that necessary corrective measures could be evolved and addressed for pollution control and protection of public health. The Ministry in collaboration with the World Health Organisation, World Bank, the United States Environmental Protection Authority, United States AID and Confederation of Indian Industry organized a two-day Conference on Environmental Health at New Delhi on 20- 21 November, 2002 to sensitise the issues among the Central and State Government and other stakeholders in the country but also to come up with the consensus on the issues to act upon and to evolve strategies for the protection of public health. The recommendations have been finalized and are to be implemented depending on availability of resources and infrastructure. Noise Pollution An increasing trend of noise pollution has been observed in the major cities of the country. To regulate and control noise pollution, the Government has issued various notifications under the Environment (Protection) Act, 1986. During the year noise limits for diesel generator sets (upto 1000 KVA) manufactured on or after 1 st July, 2003, were notified on 17 th May, 2002. The maximum permissible sound pressure level for new diesel generator sets with rated capacity upto 1000 KVA shall not exceed

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75 dB(A) at the distance of one metre from the enclosure surface. It has been made mandatory for the diesel generator sets to provide integral acoustic enclosure at the manufacturing stage itself. The State Pollution Control Boards and the Pollution Control Committees will regulate these limits. A Notification on Noise Pollution (Regulation and Control) Rules, 2000 was issued vide S.O. 123(E) on 14 th February, 2000 to curtail noise pollution in the country. Accordingly, the use of loudspeakers and public address systems were restricted during night between 10.00 p.m. and 6.00 a.m. except for the closed auditorium, banquet halls, etc. Owing to various representations received from State Governments, these rules have been amended vide Notification S.O. 1088(E) issued on 11 th October, 2002 to permit the use of loudspeakers or public address system during night hours (between 10.00 p.m. to 12.00 midnight) on or during any cultural or religious festival for a limited duration not exceeding 15 days in all during a calendar year. Noise limits for vehicles at manufacturing stage were notified vide GSR 7(E) on 25 th September, 2000 which would be effective from 1 st January, 2003. To make these standards commensurate with the emission standards for vehicles, the notified rules have been revised and are phased out in two stages. In the first phase, two wheelers, three wheelers, and passenger cars would comply with the notified norms from 1 st January, 2003. A relaxation of 3dB(A) has been given to passenger and commercial vehicles of various categories and would 117 become effective from 1 st July, 2003. In the second phase, noise limits for vehicles at manufacturing stage would be applicable on and from 1 st April, 2005 which would be at par with EC norms and based on engine power for various categories of vehicles. Hon'ble Supreme Court, in September, 2001 has passed an interim order to comply with the notification of the Ministry issued on 5 th October, 1999 to control noise from the bursting o fire crackers, which shall not exceed 125 dB(Al) and 145 dB(C) pk . The manufacture, sale and use of fire crackers should be restricted accordingly. While communicating this order to all State Governments and Union Territories, they have been requested to conduct the surveys to assess the noise pollution before and on Deepawali day. Some of the surveys have been conducted during the years of 2001 and 2002. The findings of the surveys indicate a decreasing trend of noise during the festive season. For creating awareness and for effective implementation of the rules and regulations for control of noise, a workshop was organized at West Bengal Pollution Control Board on 4 th and 5 th December, 2002 to train the officials of State Pollution Control Boards and the officials of Police Department of Eastern States. Air Pollution With a view to ascertain the ambient air quality at various locations, a monitoring network has been established comprising of 295 stations covering 98 cities/towns in 29 States and

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three Union Territories under the Air (Prevention and Control of Pollution) Act, 1981, as amended in 1988. Under this programme, four criteria air pollutants viz. Sulphur dioxide (SO 2), oxides of nitrogen (NO x), Suspended Particulate Matter (SPM) and Respirable Suspended Particulate Matter (RSPM) are regularly monitored at all the locations. Besides this, additional parameters such as respirable lead and other toxic trace matters and polycyclic aromatic hydrocarbons are also being monitored in 10 metro cities of the country. The ambient air quality is monitored by Central Pollution Control Board (CPCB) in coordination with the State Pollution Control Boards, Pollution Control Committees and some of the universities and research institutes. The data, thus generated, are transmitted to CPCB for scrutinisation, analysis, compilation and publication as a consolidated report. The monitoring results indicate that levels of Sulphur dioxide and Nitrogen dioxide are within the stipulated standards, whereas the levels of SPM and RSPM occasionally exceed, especially in Central and Northern parts of the country due to natural dust and vehicular emissions. The air quality of different cities/towns for three critical pollutants has been compared with the respective national ambient air quality standards and has been classified into four broad categories based on an Exceedence Factor (EF) as calculated by the following ratio: Observed Annual mean Concentration of criteria pollutant Exceedence Factor = Annual standard for the Respective pollutant and area class The four air quality categories are : Critical Pollution(C) When EF is more than 1.5 High Pollution (H) When EF is between 1.0 – 1.5 Moderate Pollution (M) With and EF between 0.5 – 1.0 Low Pollution(L) Where the EF is less than 0.5 Based upon the indicators stated above, a quarterly report is compiled by CPCB in some of the major cities. For real time data collection, automatic monitoring stations have also been established. Under the Male declaration, 11 automatic monitoring stations are also planned at strategic locations to measure the trans-boundary movement of pollutants among the South Asia Association of Region Co-operations (SAARC) Countries. CPCB has also initiated in-depth studies in the cities of Delhi and Kanpur to measures the level of PM 10 and PM 2.5 . To regulate and control air pollution, the source specific standards are notified from time to time. During the year 2002, emission standards for new diesel generator sets upto 800 KW were notified on 17 th May, 2002 vide GSR 371(E). These rules shall apply to all new diesel engines for Gensets manufactured in India or imported into India after the effective date. All engines upto 20 KV shall carry ISI mark and meet the relevant BIS specifications. Emission standards for diesel generator sets of more than 800 KW had also been notified on 9 th July, 2002 vide GSR 489(E). These standards shall be regulated by the State Pollution Control Boards or Pollution Control Committees as the case may be. It has

States and three Union Territories under the Air (Prevention and Control of Pollution) Act, 1981, as amended in 1988. Under this programme, four criteria air pollutants viz. Sulphur dioxide (SO2), oxides of nitrogen (NOx), Suspended Particulate Matter (SPM) and Respirable Suspended Particulate Matter (RSPM) are regularly monitored at all the locations. Besides this, additional parameters such as respirable lead and other toxic trace matters and polycyclic aromatic hydrocarbons are also being monitored in 10 metro cities of the country. The ambient air quality is monitored by Central Pollution Control Board (CPCB) in coordination with the State Pollution Control Boards, Pollution Control Committees and some of the universities and research institutes. The data, thus generated, are transmitted to CPCB for scrutinisation, analysis, compilation and publication as a consolidated report. The monitoring results indicate that levels of Sulphur dioxide and Nitrogen dioxide are within the stipulated standards, whereas the levels of SPM and RSPM occasionally exceed, especially in Central and Northern parts of the country due to natural dust and vehicular emissions. The air quality of different cities/towns for three critical pollutants has been compared with the respective national ambient air quality standards and has been classified into four broad categories based on an Exceedence Factor (EF) as calculated by the following ratio: Observed Annual mean Concentration of criteria pollutant Exceedence Factor = Annual standard for the Respective pollutant and area class The four air quality categories are : Critical pollution (C) : When EF is more than 1.5 High pollution (H) : When the EF is between 1.0-1.5 Moderate pollution (M) : With and EF between 0.5-1.0 Low pollution (L) : Where the EF is less than 0.5 Based upon the indicators stated above, a quarterly report is compiled by CPCB in some of the major cities. For real time data collection, automatic monitoring stations have also been established. Under the Male declaration, 11 automatic monitoring stations are also planned at strategic locations to measure the trans-boundary movement of pollutants among the South Asia Association of Region Co-operations (SAARC) Countries. CPCB has also initiated in-depth studies in the cities of Delhi and Kanpur to measures the level of PM10 and PM2.5. To regulate and control air pollution, the source specific standards are notified from time to time. During the year 2002, emission standards for new diesel generator sets upto 800 KW were notified on 17th May, 2002 vide GSR 371(E). These rules shall apply to all new diesel engines for Gensets manufactured in India or imported into India after the effective date. All engines upto 20 KV shall carry ISI mark and meet the relevant BIS specifications. Emission standards for diesel generator sets of more than 800 KW had also been notified on 9th July, 2002 vide GSR 489(E). These standards shall be regulated by the State Pollution Control Boards or Pollution Control Committees as the case may be. It has

also been made mandatory for all the diesel generator sets upto 118 800 KVA or more to use the liquid fuel specified for commercial. High Speed Diesel (HSD) applicable for diesel vehicles in the area from time to time. Vehicular Pollution Control The Ministry plays a coordinating role in the field of controlling of vehicular pollution with the concerned Ministries and its associated bodies/organizations including the Ministry of Surface Transport, the Ministry of Petroleum and Natural Gas and the Ministry of Industry for upgradation of automobile technology, improvement in fuel quality, expansion of urban public transport systems and promotion of integrated traffic management as the vehicular emissions is the major cause for deterioration of urban ambient air quality. The Gross Emission Standards for vehicles have been prescribed from time to time and a road map is prepared to improve the quality of the fuel. The Ministry of Petroleum and Natural Gas also constituted an Expert Committee on Auto Fuel Policy under the Chairmanship of Dr. R. A. Mashelkar, Director General, Council of Scientific and Industrial Research (CSIR) to recommend an Auto Fuel Policy for the country together with a road map for its implementation. The Committee was represented by the Ministry and significant contribution was made in preparation of the Policy. The Committee has submitted its final report to the Government of India in August, 2002 and the recommendations of this Committee are under consideration for implementation. As per the directions of the Hon'ble Supreme Court in W.P. No. 13029 of 1985 by M.C. Mehta vs. Union of India and others, the Ministry coordinated the preparation of action plans for control of vehicular pollution for compulsory switch over to CNG/LPG in the cities of Ahmedabad, Kolkata, Pune and Kanpur which were found to be equally or more polluted than Delhi. The implementation of the plan submitted for these cities is being reviewed. Nine cities viz. Agra, Varanasi, Kanpur, Lucknow, Faridabad, Jharia, Jodhpur, Patna and Pune were also identified for improving air quality. Action plans for these cities are being coordinated by the Ministry. Promotion of the Ethanol Blended Petrol and Bio-diesel have also been taken up and Ethanol Blended Petrol has been introduced in the selective States as a first phase. Industrial Pollution Control Status of pollution control in 17 categories of Identified Polluting Industries The Central Pollution Control Board (CPCB) has identified 1551 large and medium industries in 17 categories of highly polluting industries, contributing maximum to the pollution load. They have been given time schedule to install necessary pollution control equipments to comply with the prescribed standards. The progress of compliance is monitored periodically and quarterly reports are given by CPCB based on the inputs received from the concerned State Pollution Control Boards (SPCBs). As on 31.12.2002, out of 1551 industries, 1351 industries have so far provided the necessary pollution control facilities, 178

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industries have been closed down and the remaining 22 industries are defaulting. Legal action has been taken under the Environment (Protection) Act, 1986 in respect of all the defaulting units and in many cases, the matter is pending before the Hon'ble Supreme Court. Almost all the defaulting units are either in the advance stage of installing the pollution control measures or under legal action for default. A state-wise summary status of the pollution control in 17 categories of industries and a category-wise summary status are given in Table 8 and 9 respectively.

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W http://moef.gov.in/wp-content/uploads/report/0203/chap-05.htm

e.g. IDBI, ICICI or any other nationalised Banks, State Industrial Financial Corporation etc.) 17)If the CETP Co. does not desire to have loans from financial institutions/Banks they may augment the same out of their own resources/contributions, i.e. the entrepreneurs would then contribute 50% of the project cost 18)Central assistance upto 25% of the total cost of the CETP would be provided as a grant to the Common Effluent Treatment Plant(s) on the condition that a matching grant is sanctioned and released by the State Government. The CETP company should meet the remaining cost by equity contribution by the industries and loans from financial institutions. 19)Central assistance will be provided only for the capital costs. No assistance will be provided for recurring costs. The assistance will be released in four equal installments. The first installment of 25% of the assistance will be released when a body has been identified for the purpose of implementing the project, financial arrangements have been obtained from the State Pollution Control Board and State Government has committed its contribution. 20)The second installment of 25 per cent and the third installment of 25 per cent will be released after utilisation of the previous money released and adequate progress of work subject to release of their proportionate shares by the State Governments. 21)The fourth and the last installments will be released only when utilisation certificates for the previous installments have been submitted and duly verified by the State Pollution Control Boards. 22)It may be of advantage to combine some components of CETP with the municipal system. On such schemes, the municipalities have to pay their share of the cost. 23)An assessment may be made about the present physical & financial status of the CETPs. Funds released for the CETPs should be utilised for the CETP only and not for payment for debts/banks loans etc. 122 24)Large and medium scale industries other than 17 categories of heavily polluted industries may join the CETP after the primary treatment or as considered necessary by the State Pollution Control Board for the purpose of hydraulic load and for techno-economic viability of the CETP. The 17 categories of industries need to provide their own full-fledged effluent treatment facilities to confirm to the prescribed standards before the effluent is discharged. However, the large and medium scale industries would not be entitled for any subsidy meant for SSIs. During the current financial year, financial assistance has been provided to the on-going eight CETP Plant project and for new plants which have been approved by the Appraisal Committee. Common Effluent Treatment Plant at Kolkata A 30 mld (six modules of five mld capacity each) capacity CETP (Common Effluent Treatment Plant) for treating the wastewater from the cluster of tanneries has been approved for Calcutta Leather Complex (CLC)

e.g. IDBI, ICICI or any other nationalised Banks, State Industrial Financial Corporation etc.) - If the CETP Co. does not desire to have loans from financial institutions/Banks they may augment the same out of their own resources/contributions, i.e. the entrepreneurs would then contribute 50% of the project cost. - Central assistance upto 25% of the total cost of the CETP would be provided as a grant to the Common Effluent Treatment Plant(s) on the condition that a matching grant is sanctioned and released by the State Government. The CETP company should meet the remaining cost by equity contribution by the industries and loans from financial institutions. - Central assistance will be provided only for the capital costs. No assistance will be provided for recurring costs. The assistance will be released in four equal installments. The first installment of 25% of the assistance will be released when a body has been identified for the purpose of implementing the project, financial arrangements have been obtained from the State Pollution Control Board and State Government has committed its contribution. - The second installment of 25 per cent and the third installment of 25 per cent will be released after utilisation of the previous money released and adequate progress of work subject to release of their proportionate shares by the State Governments. - The fourth and the last installments will be released only when utilisation certificates for the previous installments have been submitted and duly verified by the State Pollution Control Boards. - It may be of advantage to combine some components of CETP with the municipal system. On such schemes, the municipalities have to pay their share of the cost. - An assessment may be made about the present physical & financial status of the CETPs. Funds released for the CETPs should be utilised for the CETP only and not for payment for debts/banks loans etc. - Large and medium scale industries other than 17 categories of heavily polluted industries may join the CETP after the primary treatment or as considered necessary by the State Pollution Control Board for the purpose of hydraulic load and for techno-economic viability of the CETP. The 17 categories of industries need to provide their own full-fledged effluent treatment facilities to confirm to the prescribed standards before the effluent is discharged. However, the large and medium scale industries would not be entitled for any subsidy meant for SSIs. During the current financial year, financial assistance has been provided to the on-going eight CETP Plant project and for new plants which have been approved by the Appraisal Committee. Index Common Effluent Treatment Plant at Kolkata A 30 mld (six modules of five mld capacity each) capacity CETP (Common Effluent Treatment Plant) for treating the wastewater from the cluster of tanneries has been approved for Calcutta

at Kolkata for an amount of Rs.65 crore. The cost of the project is to be shared on 50:50 basis between Centre and the State Government. The Central Government's share for the implementation of the project is interest free loan. The detailed project report for CETP (two modules of five mld capacity each) has been sanctioned at an estimated cost of Rs. 31.20 crore. In addition, the proposal for Effluent Transport System (ETS) for the CETP has also been sanctioned at an estimated cost of Rs. 11.59 crore. Central funds amounting to Rs. 17.985 crore have been released for execution of the scheme so far. The preliminary effluent treatment units of the CETP and ETS for CETP have been completed. The CETP is now equipped to offer the preliminary facilities to take care of the tannery wastes upto 10 mld as and when generated by the tanneries at CLC. None of the relocated tanneries or new tanneries have as yet started the tanning operation at CLC. The construction of the CETP is scheduled for completion by November, 2003. Spatial Environmental Planning Spatial planning is primarily used for land use plans, city planning, and is recently extended to regional planning as well. Environmental issues, generally, were not incorporated in the conventional town and country planning which has resulted in environmental degradation and deterioration of the urban landscape. The pollution load in ambient air, water and noise levels are also found to be higher in these areas. It is, therefore, imperative that the authorities should look into the remedial measures. In this context, spatial environmental planning has been initiated as a technique for conservation of the environmental resources and for achieving developmental targets in an environmentally sound manner. To start with a nation-wide environmental planning and mapping programme is being executed in the form of Zoning Atlas at the district level. It is followed by Industrial Estate Planning and Development of Eco Industrial Estates, Environmental Management Plans, Regional/State Planning Studies and Mapping of Environmentally Sensitive Zones. Urban Environmental Information System is also evolved for collecting information about the basic demographic profile of the urban area and a comprehensive human resource development programme for providing training to various target groups. It is proposed to establish a "Centre for Spatial Environmental Planning" at the existing premises of the Central Pollution Control Board. The details of these activities are given below: Zoning Atlas for Siting of Industries The project on Zoning Atlases for Siting of Industries has been initiated at District and Regional level for classifying the environmental status and to ascertain the pollution receiving potentials of various sites. The study also identifies the possible alternate sites for industries, through easy-to-be read maps (1:250,000 scale). Work for 63 districts was completed earlier. During the year, 73 districts covering 21 States and one Union Territory has been taken up. These include Andhra

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Pradesh, Assam, Bihar, Chhattisgarh, Gujarat, Himchal Pradesh, Jammu & Kashmir, Karnataka, Kerala, Madhya Pradesh, Manipur, Maharashtra, Meghalaya, Orissa, Punjab, Rajasthan, Tamil Nadu, Tripura, Uttar Pradesh, West Bengal, Goa and UT of Pondicherry. Industrial Estate Planning & Development of Eco-Industrial Estates In continuation of the Zoning Atlas studies, the Industrial Estate Planning studies have been taken up at micro level (1:50,000 and lower) to identify environmentally suitable and acceptable sites for industrial estates. The study would also suggest infrastructure requirement for waste disposal systems and measures for controlling the surrounding land uses. Studies for nine sites have been completed and work for ten sites has been taken up. It is contemplated to develop Eco-industrial estates in the country in order to ensure proper siting of industrial estates, planning of the pollution abatement infrastructure and regulating development around these sites. In the pilot phase, technical support of German Technical Cooperation (GTZ) will be taken under the Indo- German Bilateral Programme for developing five sites as Eco-Industrial Estates. 123 Mapping of Environmental Sensitive Zones and Industrial Sites – State-wise The maps on Environmentally Sensitive Zones and Industrial Sites present the Information on National Parks, Reserved Forests, Protection Forests and Industrial Sites. These maps were earlier completed for 12 States and in the current year, work is in progress for Punjab, Maharashtra, Madhya Pradesh, Tamil Nadu, West Bengal, Uttar Pradesh and Rajasthan. Preparation of Environmental Management Plans The activities for preparation of Environmental Management Plans (EMPs) have been undertaken by urban areas, mining blocks, tourism sites and Environmentally fragile areas. As a priority project, EMP was initiated for Agra city during 2000-2001 and completed in January, 2002 at an investment of Rs. 350 crores. Outcome of the study suggests need for massive face-lift programme in the city of improving the physical infrastructure and urban management. The study for preparation of EMP for Panchmarhi Biophere Reserve located in Madhya Pradesh has also been completed and report is under finalization. Eco-cities Eco city is a city which is economically vibrant, socially equitable and environmentally supportive. Such cities ensure environmentally compatible and energy efficient development providing clean, pollution free surroundings and conservation of natural resources for higher quality living. An eco city project for Kottayam Kumarakom region was initiated, which was extended for the Taj Eco city covering an area of 30 sq. km. around Taj Mahal to achieve visible environmental improvement. Under the Tenth Plan, the project has been extended to small and medium towns in the country. The towns selected for coverage in the first phase of the Eco city programmes are Mathura (UP), Puri (Orissa), Vapi (Gujarat), Thanjavour (Tamil Nadu), Bharatpur (Rajasthan),

Territory has been taken up. These include Andhra Pradesh, Assam, Bihar, Chhattisgarh, Gujarat, Himchal Pradesh, Jammu & Kashmir, Karnataka, Kerala, Madhya Pradesh, Manipur, Maharashtra, Meghalaya, Orissa, Punjab, Rajasthan, Tamil Nadu, Tripura, Uttar Pradesh, West Bengal, Goa and UT of Pondicherry. Industrial Estate Planning & Development of Eco-Industrial Estates In continuation of the Zoning Atlas studies, the Industrial Estate Planning studies have been taken up at micro level (1:50,000 and lower) to identify environmentally suitable and acceptable sites for industrial estates. The study would also suggest infrastructure requirement for waste disposal systems and measures for controlling the surrounding land uses. Studies for nine sites have been completed and work for ten sites has been taken up. It is contemplated to develop Eco-industrial estates in the country in order to ensure proper siting of industrial estates, planning of the pollution abatement infrastructure and regulating development around these sites. In the pilot phase, technical support of German Technical Cooperation (GTZ) will be taken under the Indo-German Bilateral Programme for developing five sites as Eco-Industrial Estates. Mapping of Environmental Sensitive Zones and Industrial Sites – State-wise The maps on Environmentally Sensitive Zones and Industrial Sites present the Information on National Parks, Reserved Forests, Protection Forests and Industrial Sites. These maps were earlier completed for 12 States and in the current year, work is in progress for Punjab, Maharashtra, Madhya Pradesh, Tamil Nadu, West Bengal, Uttar Pradesh and Rajasthan. Preparation of Environmental Management Plans The activities for preparation of Environmental Management Plans (EMPs) have been undertaken by urban areas, mining blocks, tourism sites and Environmentally fragile areas. As a priority project, EMP was initiated for Agra city during 2000-2001 and completed in January, 2002 at an investment of Rs. 350 crores. Outcome of the study suggests need for massive face-lift programme in the city of improving the physical infrastructure and urban management. The study for preparation of EMP for Panchmarhi Biophere Reserve located in Madhya Pradesh has also been completed and report is under finalization. Index Eco-cities Eco city is a city which is economically vibrant, socially equitable and environmentally supportive. Such cities ensure environmentally compatible and energy efficient development providing clean, pollution free surroundings and conservation of natural resources for higher quality living. An eco city project for Kottayam Kumarakom region was initiated, which was extended for the Taj Eco city covering an area of 30 sq. km. around Taj Mahal to achieve visible environmental improvement. Under the Tenth Plan, the project has been extended to small and medium towns in the country. The towns selected for coverage in the first phase of the Eco city programmes are Mathura (UP), Puri (Orissa), Vapi (Gujarat), Thanjavour

Rishikesh (Uttaranchal), Tirupati (A.P.), Shillong (Meghalaya), Baidhyanath Dham (Deogarh, Jharkhand), Kottayam (Kerala) and Vrindavan (U.P.). The Minicipalities of these towns have submitted proposals for financial assistance. An Eco city Advisory Committee has been constituted for guiding the Programme and two meetings of the Committee have so far been held. Spatial Environmental Planning Network A comprehensive human resource development programme has been developed for providing training to various target groups in the field of spatial environmental planning. The training programmes are being conducted through a network of institutions, called SEP-NET (Spatial Environmental Planning Network). The institutes included in the SEP-NET are : Tata Energy Research Institute (TERI) - Delhi, Centre for Environment Planning & Technology – Ahmedabad, Environment Protection Training and Research Institute - Hyderabad, Environmental Training Institute – Chennai, National Productivity Council – Delhi, Disaster Management Institute – Bhopal, School of Planning & Architecture – New Delhi and Steel Authority of India Ltd. – Ranchi. The programme is supported by CDG with grants. In addition to a number of awareness programmes conducted at District level and hands-on-training to the pollution control board personnel the training programmes were also organized on themes such as Incorporation of EIA in Spatial Environmental Planning, Spatial Environmental Planning in Emergency Planning, Regional Watershed Management in Spatial Environmental Planning. Two overseas training programmes on “Spatial Environmental Planning:- Introduction and Curriculum Development” were held and a website of HRDP (www.cpcb -hrdp.com) has been launched. An evaluation manual has been finalized to achieve the quality assurance. The training institutes in the Spatial Environmental Planning Network (SEP-Net) and CPCB have started conducting training programmes. Urban Environmental Information System To provide information to the public in the form of a local environmental report to be prepared by the Municipalities on the status of socio-economics, development and environment of the towns and cities, “Urban Environmental Information System” is being introduced in a few volunteering towns. The Memorandum of Understanding has so far been signed in this regard with the municipalities of Agra, Kanpur, Patna and Bhubaneswar. Industrial Pollution Complaints During the year, Ministry has received more than 250 complaints regarding pollution caused by industries. The complaints were mostly related to pollution being caused in air, water, land and noise resulting in degradation of the eco-system. Some of the complaints were also related to discharge of untreated or partially treated effluent thereby contaminating water bodies, land and ground water. These complaints were attended to by calling reports along with the exact status and comments from

(Tamil Nadu), Bharatpur (Rajasthan), Rishikesh (Uttaranchal), Tirupati (A.P.), Shillong (Meghalaya), Baidhyanath Dham (Deogarh, Jharkhand), Kottayam (Kerala) and Vrindavan (U.P.). The Minicipalities of these towns have submitted proposals for financial assistance. An Eco city Advisory Committee has been constituted for guiding the Programme and two meetings of the Committee have so far been held. Index Spatial Environmental Planning Network A comprehensive human resource development programme has been developed for providing training to various target groups in the field of spatial environmental planning. The training programmes are being conducted through a network of institutions, called SEP-NET (Spatial Environmental Planning Network). The institutes included in the SEP-NET are : Tata Energy Research Institute (TERI) - Delhi, Centre for Environment Planning & Technology – Ahmedabad, Environment Protection Training and Research Institute - Hyderabad, Environmental Training Institute – Chennai, National Productivity Council – Delhi, Disaster Management Institute – Bhopal, School of Planning & Architecture – New Delhi and Steel Authority of India Ltd. – Ranchi. The programme is supported by CDG with grants. In addition to a number of awareness programmes conducted at District level and hands-on-training to the pollution control board personnel the training programmes were also organized on themes such as Incorporation of EIA in Spatial Environmental Planning, Spatial Environmental Planning in Emergency Planning, Regional Watershed Management in Spatial Environmental Planning. Two overseas training programmes on "Spatial Environmental Planning:- Introduction and Curriculum Development" were held and a website of HRDP (www.cpcb-hrdp.com) has been launched. An evaluation manual has been finalized to achieve the quality assurance. The training institutes in the Spatial Environmental Planning Network (SEP-Net) and CPCB have started conducting training programmes. Index Urban Environmental Information System To provide information to the public in the form of a local environmental report to be prepared by the Municipalities on the status of socio-economics, development and environment of the towns and cities, "Urban Environmental Information System" is being introduced in a few volunteering towns. The Memorandum of Understanding has so far been signed in this regard with the municipalities of Agra, Kanpur, Patna and Bhubaneswar. Index Industrial Pollution Complaints During the year, Ministry has received more than 250 complaints regarding pollution caused by industries. The complaints were mostly related to pollution being caused in air, water, land and noise resulting in degradation of the eco-system. Some of the complaints were also related to discharge of untreated or partially treated effluent thereby contaminating water bodies, land and ground water. These complaints were attended to by calling

the State Pollution Control Boards / Pollution Control Committees. 124 Establishment of Environment Protection Authorities National Environment Appellate Authority The National Environment Appellate Authority (NEAA) was established under the National Environment Appellate Authority Act, 1997 (22 of 1997) to hear appeals with respect to restriction of areas in which any industries, operations or processes of class of industries, operations or processes shall not be carried out or shall be carried out subject to certain safeguards under the Environment (Protection) Act, 1986 and for matters connected therewith or accidental thereto. The NEAA was established vide Notification S.O. 311 (E) dated 9 th April, 1997. The Authority consists of a Chairperson (retired Judge of the Supreme Court or the Chief Justice of a High Court), a Vice-Chairperson and such other members not exceeding three as the Central Government deem fit. The loss of Ecology (Prevention and Payments of Compensation) Authority for the State of Tamil Nadu In compliance with Hon'ble Supreme Court's order dated 28.8.1996 in Writ Petition (Civil) No. 914 of 1991, namely, Vellore Citizens Welfare Forum versus Union of India and others, this Ministry had constituted vide Notification S.O. 671(E) dated 30.9.1996 the Loss of Ecology (Prevention and Payments of Compensation) Authority for the State of Tamil Nadu to deal with the situation created by the tanneries and other polluting industries in Tamil Nadu. The tenure of the Authority has been extended upto 30.9.2004 vide Notification S.O. 1044(E) dated 27.9.2002. The Authority consists of a retired Judge of the High Court and two members and one Member Secretary. Environment Pollution (Prevention and Control) Authority for the National Capital Region The Central Government had vide Notification S.O. 93(E) dated 29.1.1998 constituted the Environment Pollution (Prevention and Control) Authority for the National Capital Region. The Authority is headed by Shri Bhure Lal, Secretary to the Government of India with three other members and Chairman, CPCB as the convenor. The tenure of the authority has been extended by three years upto January, 2006 with inclusion of two additional members. The Authority is empowered to exercise the powers under Section 5 of Environment (Protection) Act, 1986 for issuing directions for compliance relating to violation of standards for quality of environment, emission or discharge of pollutants and to take all necessary steps to control vehicular pollution, restriction of industries causing environmental pollution and monitor the progress of action plan drawn up by the Ministry on Pollution in Delhi as contained in the "White Paper on Pollution in Delhi with an Action Plan". Central Pollution Control Board The Central Pollution Control Board (CPCB) is an autonomous body of the Ministry set up in September, 1974, under the provisions of the Water (Prevention and Control of Pollution) Act, 1974. It coordinates the

reports along with the exact status and comments from the State Pollution Control Boards / Pollution Control Committees. Establishment of Environment Protection Authorities National Environment Appellate Authority The National Environment Appellate Authority (NEAA) was established under the National Environment Appellate Authority Act, 1997 (22 of 1997) to hear appeals with respect to restriction of areas in which any industries, operations or processes of class of industries, operations or processes shall not be carried out or shall be carried out subject to certain safeguards under the Environment (Protection) Act, 1986 and for matters connected therewith or accidental thereto. The NEAA was established vide Notification S.O. 311 (E) dated 9th April, 1997. The Authority consists of a Chairperson (retired Judge of the Supreme Court or the Chief Justice of a High Court), a Vice-Chairperson and such other members not exceeding three as the Central Government deem fit. Index loss of Ecology (Prevention and Payments of Compensation) Authority for the State of Tamil Nadu In compliance with Hon'ble Supreme Court's order dated 28.8.1996 in Writ Petition (Civil) No. 914 of 1991, namely, Vellore Citizens Welfare Forum versus Union of India and others, this Ministry had constituted vide Notification S.O. 671(E) dated 30.9.1996 the Loss of Ecology (Prevention and Payments of Compensation) Authority for the State of Tamil Nadu to deal with the situation created by the tanneries and other polluting industries in Tamil Nadu. The tenure of the Authority has been extended upto 30.9.2004 vide Notification S.O. 1044(E) dated 27.9.2002. The Authority consists of a retired Judge of the High Court and two members and one Member Secretary. Environment Pollution (Prevention and Control) Authority for the National Capital Region The Central Government had vide Notification S.O. 93(E) dated 29.1.1998 constituted the Environment Pollution (Prevention and Control) Authority for the National Capital Region. The Authority is headed by Shri Bhure Lal, Secretary to the Government of India with three other members and Chairman, CPCB as the convenor. The tenure of the authority has been extended by three years upto January, 2006 with inclusion of two additional members. The Authority is empowered to exercise the powers under Section 5 of Environment (Protection) Act, 1986 for issuing directions for compliance relating to violation of standards for quality of environment, emission or discharge of pollutants and to take all necessary steps to control vehicular pollution, restriction of industries causing environmental pollution and monitor the progress of action plan drawn up by the Ministry on Pollution in Delhi as contained in the "White Paper on Pollution in Delhi with an Action Plan". Central Pollution Control Board The Central Pollution Control Board (CPCB) is an autonomous body of the Ministry set up in September, 1974, under the provisions of the Water (Prevention and

activities of the State Pollution Control Boards (SPCBs) and Pollution Control Committees (PCCs), and also advises the Central Government on all matters concerning the prevention and control of environmental pollution. The CPCB, SPCBs and PCCs are responsible for implementing the legislation relating to prevention and control of pollution; they also develop rules and regulations which prescribe the standards for emissions and effluents of air and water pollutants and noise levels. The CPCB also provides technical services to the Ministry for implementing the provisions of the Environment (Protection) Act, 1986. During the year, special thrust was given to nation-wide pollution prevention plan, particularly with reference to combating vehicular pollution, pollution control in 17 categories of highly polluting industries, implementation of action plans for restoration of environmental quality in critically polluted areas, noise pollution control, municipal solid wastes and hazardous wastes. The Annual Action Plan (AAP) for 2002-2003 is an attempt towards the target set in the Coimbatore Charter on Environment and Forests and to observe the effects of implemented programs for development of environment. During the year, following activities received major emphasis in preparation of inventory of polluting sources, Preparation of State of Environment Reports of State/major cities, epidemiological studies, performance evaluation of CETP/STP, Solid Waste Management (municipal, Biomedical and hazardous), plastic waste management, Vehicular and noise pollution control, Prevention and control of pollution in small scale industries, augmentation of existing air and water quality monitoring, network monitoring of updating of Action Plan for identified problem areas. In addition, emphasis has been given for bio-monitoring of national aquatic resources, monitoring of specific pollutant in ambient air, updating of information on web-site, participation of NGOs/public in various pollution abatement programs and to effectively carryout mass awareness program. Proposals for strengthening of Zonal Offices with respect to building construction on acquired land have been made. 125 Water Quality Monitoring National Water Quality Monitoring Programme The water quality monitoring results obtained during 2001 indicated that faecal pollution, indicated by high BOD and high coliform density, continue to be the predominant source of pollution. This is mainly due to the large quantity of domestic wastewater being discharged. An attempt is made to classify the observations under different levels of pollution with respect to most critical parameters i.e. BOD, total & faecal Coliform. It is observed that 59% of the total 4119 observations taken on BOD during 2001 has BOD less than 3 mg/l, which is same as observed during the previous year. However, number of observations with BOD more than 6 mg/l has increased from 16% during the year 2000 to 18% during 2001

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indicating that pollution load is on the increase and water bodies are further being polluted. This can be attributed to water scarcity due to over-abstraction, low rainfall in many parts of the country and increasing pollution load. However, the number of observations having high coliform density have somewhat reduced. State-wise number of observations falling under different BOD levels, total coliform and faecal coliform, the data indicate that Maharashtra has highest pollution level in terms of organic pollution which is mainly industrial in nature followed by Delhi, Uttar Pradesh, Gujarat, Andhra Pradesh and Tamil Nadu. Similarly, Coliform levels were found highest in Uttar Pradesh. The water quality trend based on Biochemical Oxygen Demand, total Coliform and faecal Coliform of past several years is presented in Fig 5 to Fig 7. Fig. 5. Water Quality Trend based on Bio-chemical Oxygen Demand Fig. 6. Water Quality Trend based on total Coliform 126 Fig. 7. Water Quality Trend based on Faecal Coliform Status of Wastewater Generation and Treatment It is estimated that 22,900 MLD of domestic wastewater is generated from urban centres against 13000 MLD industrial wastewater. The treatment capacity available for domestic wastewater is only for 6,000 MLD, against 8,000 MLD of industrial wastewater. Thus, there is a big gap in treatment of domestic wastewater. Government of India is assisting the local bodies to establish sewage treatment plants under the Ganga Action Plan and subsequently under the National River Action Plan. Monitoring of Yamuna River for Assessment of Water Quality The Central Pollution Control Board is regularly monitoring Yamuna river on monthly basis in Delhi segment at three locations i.e. Palla, Nizamuddin barrage and Okhla barrage. In addition, monitoring of 22 drains, which are the major source of pollution in the river are also being undertaken regularly. The water quality of river Yamuna in Delhi stretch is depicted in The total calculated discharge of these 22 drains is approx. 46.30 m 3 /sec, which contributes 311.05 tonnes of BOD load per day. From the total discharge of these drains Yamuna receives more than 90% wastewater discharge and rest wastewaters contributed by two drains joining canals. Similarly out of 311.05 tonnes of BOD load, Yamuna receives 283.98 tonnes of BOD load per day and rest received by canals. The Delhi segment of river Yamuna has oligotrophic head with saprobic tail end, and characterized by high bacterial load (except at Palla) having high BOD with strong disagreeable odour. The anaerobic condition in river is frequently reflected by masses of gaseous sludge rising from the bottom and floating at the surface of water.

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Bio-monitoring of rivers/water bodies The importance and use of biological monitoring system, as a cost-effective tool, has been realized in recent past to maintain and restore the wholesomeness of water quality in terms of ecological sustainability of various designated best-uses of water bodies. It has been observed that the desired quality levels are quite often delinked with the observed water quality of water bodies for designated best uses due to number of integrated environmental management problems as a result of rapid industrialization and urbanization. On the basis of environmental status, twenty four problem areas have been identified in the country. The recipient water bodies of these problem areas are bearing the affect due to environmental degradation. The bio-monitoring studies in water bodies existing in problem areas have been undertaken at nineteen problem areas in the country in order to make an integrated approach toward environmental management. The identified nineteen problem areas are Ambedkar Nagar (Tamil Nadu), Angul, Talcher (Orissa), Ankleshwar (Gujarat) Bhadravathi (Karnataka), Dhanbad (Jharkhand), Durgapur (West Bengal), Howrah (West Bengal), Jodhpur (Rajasthan), Kochi (Kerala), Kala Amb (Himachal Pradesh), Manali (Tamil Nadu), Nagda, Ratlam (Madhya Pradesh), Najafgarh Drain Basin (Delhi) Pali (Rajasthan), Parwanoo (Himachal Pradesh) Singrauli (Uttar Pradesh and Madhya Pradesh) and Vapi (Gujarat). The main objective of the studies are : ? Biological assessment of water quality of surface water bodies existing in problem areas. ? To evaluate the improvement in water quality as a result of action taken for pollution control in problem areas. 127 Bio-mapping of River Ramganga Monthly monitoring of river Ramganga has been undertaken at ten locations during the year. From data, it is evident that as long as the river passes through the hills and reserve forests (Jim Corbett National Park) the deterioration of biological water quality is negligible. The deterioration of water quality starts in Bijnor district as some industries dispose their waste into the river. At downstream of Moradab, where drain and river Dhela joins the river, the river stretch is affected. The river itself a bit but sudden load from Rampur deteriorates its quality to class D. Further downstream, it slowly recovers its biota and maintains Class C till it joins the river Ganga. Air Quality Monitoring The air quality of different cities/towns with respect to three criteria pollutants has been compared with the respective National Ambient Air Quality Standards and categorized into four broad categories based on an Exceedence Factor The analysis contains the air quality assessment of 155 monitoring locations (in 64 cities/towns), out of which 81 are in residential, 71 in industrial and three in sensitive areas. At 49 locations (27 residential and 22 industrial), data are insufficient (> 50 monitoring days

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RSPM levels were measured in various cities and towns in India Fig.47 and 48. RSPM levels exceeded the NAAQS (annual average) in residential areas of Hyderabad, Visakhapatnam, Delhi, Ahmedabad, Parwanoo, Bangalore, Cochin, Dehradun, Tiruvananthapuram, Mumbai, Nagpur. Pune, Solapur, Angul, Rourkela, Jaipur, 128 Chennai, Kanpur, Lucknow and Kolkata. RSPM levels also exceeded the NAAQS (annual average) in industrial areas of Ahmedabad, Dehradun, Thiruvananthapuram, Solapur, Jaipur, Kanpur and Kolkata. RSPM levels were within the NAAQS (annual average) in residential areas of Kozhikode and Shillong and industrial areas of Hyderabad, Visakhapatnam, Bangalore, Mysore, Cochin, Kotayam, Koshokode, Palakkad, Mumbai, Nagpur, Pune, Rourkela and Chennai. These results indicate that NAAQS (annual average) were not exceeded in above mentioned cities. Fig.49 and 50 shows number of cities with critical, high, moderates RSPM levels in residential and industrial areas.	RSPM levels were measured in various cities and towns in India Fig.47 and 48. RSPM levels exceeded the NAAQS (annual average) in residential areas of Hyderabad, Visakhapatnam, Delhi, Ahmedabad, Parwanoo, Bangalore, Cochin, Dehradun, Tiruvananthapuram, Mumbai, Nagpur. Pune, Solapur, Angul, Rourkela, Jaipur, Chennai, Kanpur, Lucknow and Kolkata. RSPM levels also exceeded the NAAQS (annual average) in industrial areas of Ahmedabad, Dehradun, Thiruvananthapuram, Solapur, Jaipur, Kanpur and Kolkata. RSPM levels were within the NAAQS (annual average) in residential areas of Kozhikode and Shillong and industrial areas of Hyderabad, Visakhapatnam, Bangalore, Mysore, Cochin, Kotayam, Koshokode, Palakkad, Mumbai, Nagpur, Pune, Rourkela and Chennai. These results indicate that NAAQS (annual average) were not exceeded in above mentioned cities. Fig.49 and 50 shows number of cities with critical, high, moderates RSPM levels in residential and industrial areas.

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Air Quality Non-attainment Cities CPCB has identified list of cities in India based on ambient air quality data obtained under National Air Quality Monitoring Programme (NAMP) for the period 1995 to 2001.	Air Quality Non-attainment Cities CPCB has identified list of cities in India based on ambient air quality data obtained under National Air Quality Monitoring Programme (NAMP) for the period 1995 to 2001.

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Fig. 8. RSPM Levels measured in Residential Areas during the year 2000 Fig. 9. RSPM Levels measured in Industrial Areas during the year 2000	Fig. 47. RSPM Levels measured in Residential Areas during the year 2000 Fig. 48. RSPM Levels measured in Industrial Areas during the year 2000

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Ambient Noise Level and Air Pollution in Delhi during Deepawali Ambient noise level monitoring was carried out at various locations in Delhi, i.e. all India Institute of Medical Sciences (AIIMS), Lajpat Nagar, New Friends Colony, East Arjun Nagar, Connaught Place, India Gate, Mayur Vihar, Patel Nagar and Kamla Nagar on the occasion of Deepawali festival. At Kamla Nagar noise monitoring was conducted from 18.00 hrs to 24.00 hrs., while at other locations, short duration (half hourly) noise level monitoring was conducted between 18.00 hrs and 24.00 hrs. The average Leq noise level for short duration at 8 monitored locations ranged between 73 dB(A) and 80 dB(A). The minimum instantaneous value, 129 recorded at Kamla Nagar, was 47 dB(A) (between 18.30 hrs. and 19.00 hrs) and the maximum value, recorded was 101 dB(A) (between 19.30 hrs and 20 hrs.). The ambient noise levels were above the prescribed limit at all the locations but did not indicate much variation as compared to the previous year's data. Ambient air quality monitoring was also carried out at ITO Intersection and Ashok Vihar using manual monitoring techniques and at East Patel Nagar (Pusa Road) using the mobile monitoring van. The Respirable Suspended Particulate Matter (RSPM) were high in the evening hours on Deepawali day. The concentration of Sulphur dioxide (SO 2), Oxides of Nitrogen (NO x) and Carbon monoxide (CO) indicated a mixed trend which may be because of varying traffic density. Efficiency testing of Autoclaves used for hospital waste treatment by spore testing methodology Bio-medical waste generation and its safe disposal has become a matter of serious concern due to increasing health facilities & increase in number of hospitals, nursing homes in metropolitan cities. The Biomedical Waste (Management & Handling) Rules, 1998 notified by Government of India, has stipulated rules for proper collection, storage, transportation, treatment and disposal of bio-medical waste. As per Bio-medical Waste Rules, 1998 the hospitals have to install treatment facilities like incinerators, autoclaves, etc. for treatment of bio-medical wastes generated to ensure safe treatment & disposal of infectious hospital waste. These treatment facilities should operate at designed efficiency level. A project has been undertaken by Central Pollution Control Board for assessment of efficiency of autoclaves used in hospital waste treatment based on standardized spore testing methodology, for In-situ assessment of the efficiency of autoclaves installed at various hospitals within NCT-Delhi using biological indicator to ascertain 4 Log 10 reduction of Bacillus Stereothermophilus indicator. During first phase of the project, the standardization of spore testing methodology has been undertaken using Bacillus Stereothermophilus as biological indicator with a view for its application for efficiency testing of autoclaves used for hospital waste treatment. The standardized methodology

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Fig. 10. Number of Cities (Residential Areas) with Critical, High, and Moderate RSPM Levels during 2000

Fig. 49. Number of Cities (Residential Areas) with Critical, High, and Moderate RSPM Levels during 2000

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200/202	SUBMITTED TEXT	795 WORDS	99%	MATCHING TEXT	795 WORDS

Sectoral approach for prevention and control of pollution in different sectors, Action Plan by the Working Group on Tanneries is being implemented. State Pollution Control Boards have been advised to follow the suggestions given by the working Group while dealing with tannery units. As regards distillery, the industries have been advised to follow the protocol developed by Indian Agricultural Research Institute and take necessary measures to comply with the prescribed standards. At the request of All India Brick & Tiles Manufacturers' Federation, the duration of installation of fixed chimneys in place of moving chimneys kilns was extended upto June, 2002. This was subject to the units providing the necessary bank guarantee to the pollution control agencies and the undertakings by the Federation that the conversion would be completed by 30 th June, 2002. Despite several requests, no further extension has been granted for last date, i.e. 30 th June, 2002 for implementation of standards for brick kilns. As per the directions given by the Ministry, almost all States have started implementing the standards. 119 Table 8 Industrial Pollution Control The National River Conservation Authority (NRCA) in its meeting held on July 12, 1997 under the Chairmanship of the Prime Minister, decided that the polluting industries which are directly discharging their effluents into rivers and lakes, without requisite treatment, should be asked to install the requisite effluent treatment systems within three months, failing which closure notices should be issued. Accordingly, the State Pollution Control Board (SPCBs)/Pollution Control Committee (PCCs) in Union Territories, were asked by the Central Pollution Control Board (CPCB) on July 14, 1997 to take necessary action and send the list of defaulting units. The criteria defined for the National River Conservation Plan (NRCP) was followed, and the identified industries include those which (i) discharge their effluents into a water course including rivers and lakes, and (ii) are either involved of hazardous substances or discharge effluents with a BOD of 100 kg/day or more, or both. The information received from the SPCBs/PCCs in respect of such industries were compiled and the position was also reviewed by the Hon'ble MEF in a meeting taken by him with the Chairman/Senior Officers of the Pollution Control Boards/Committees at Ministry of Environment and Forests on August 19, 1997. This resulted into identification of a total of 2026 defaulting industries from 15 States/UTs which included 1657 defaulters in the State of Tamil Nadu. The programme was further intensified and four Regional Committees of experts were constituted to monitor the compliance of the directions issued by the CPCB to SPCBs/PCCs in this regard. A series of discussions have been held since then by the expert committees with the concerned SPCBs/PCCs to monitor the progress of implementation of the

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programme and to ensure issuance of appropriate directions to the defaulting industries by the concerned SPCBs/PCCs. The important decisions taken in these meetings are communicated to various Boards/Committees for implementation which include (i) the industries where the commissioning of ETPs are going on satisfactorily are to be given a reasonable time extension, (ii) the industries which have neither shown sufficient progress nor complying with the standards are to be issued closure notices, (iii) the industries which are closed are to be directed not to restart till they provide requisite ETPs, and (iv) the industries where there is no ETP are to be issued confirmed orders for their closure with immediate effect. The matter concerning the large number of defaulting industries i.e. 1657 in Tamil Nadu was also discussed in detail with the concerned SPCB to ensure whether these industries really conformed to the above mentioned criteria or not. It was confirmed that these industries are actually those which have been identified by the SPCB in obedience of an order of the Hon'ble High Court requiring inventorisation of the polluting units 120 located within one km of the water bodies in the State of Tamil Nadu. This inventory was, therefore, reviewed vis-à-vis the criteria fixed for the identification of the Grossly Polluting Industries discharging effluents into rivers/lakes. A total of 366 units out of the above mentioned 1657 units were accordingly found to be on conforming to this criteria. These 366 units have, therefore, been retained for further follow ups under the national programme and the remaining 1291 (1657-366) units through not polluting to the extend defined in the above criteria, still remains covered under implementation of the orders of the Hon'ble Court at the State level itself. Similar discussions in respect of the other States/UTs finally provided a total of 851 defaulters as on August 1997 instead of 2026 for reasons explained above. The status of these industries compiled on the basis of the discussions in the meetings of the Regional Committees and information received and from the SPCBs/PCCs till September 30, 2002 is given in Table-3. Accordingly, it can be summarized that the number of defaulters have reduced from 851 to five during the period of five years. This reduction is as a result of the closure of 238 industries and 608 industries having requisite Effluent Treatment Plants (ETPs). Table-9

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W http://moef.gov.in/wp-content/uploads/report/0203/chap-05.htm

Development of Guidelines/Rational for Prescribing Location Specific Standards The Central Board is involved in developing Minimal National Standards (MINAS), which are applicable for entire nation considering techno-economic feasibility of control equipment. However, considering the location specific sensitivity, the State Pollution Control Boards can make the national standards stringent. For example, in critical areas, where single or cumulative effect of emissions/wastewater discharges exceed the ambient air/water quality requirement, a rational/structurised approach shall be followed in order to avoid bias in granting permit conditions to individual industries, which are often challenged on the basis. Under this programme, efforts have been made to set approach for assessment of assimilative capacity and fine tuning of the standards considering health protection, environment protection, availability of technology and economic feasibility. With the association of indigenous and expatriate consultants, an approach has been made which is being debated among the experts for finalization. Besides, the approach is being applied in selected study area for fine-tuning. These studies include inventorization of air and water pollution sources, existing level of control technologies, application of air quality models (ISCST3) and concepts of zone of initial dilution and mixing zones in respect of water quality in surface water bodies. 130 Control Technologies for Volatile Organic Compounds in Industrial Emissions One of the common air pollutants emanating from the chemical industries is volatile compounds. As it is well known that if emissions are emanating from a point source can very well be controlled absorption, condensation, adsorption, thermal destruction etc. whereas, due to volatile nature of various solvents and process fluids used in chemical sectors, the fugitive emissions will arise from valves, flanges, pumps, storing units, effluent treatment plants etc. In order to address the volatile organics, a project has been taken-up for studying oil refineries and petrochemical plants in India. Possibilities of application of general VOC's and hazardous air pollutants on the lines of developed countries is being discussed and their adoptability in terms of monitoring equipment, control equipment, investment on equipment modifications, establishing emission factors etc. are being studied. Review of Control Technologies for Total Dissolved Solids (TDS) in Industrial Effluents Feasible disposal specific TDS limits have been developed and same have been endorsed by the Expert Committee and are being considered by the Central Board. Under capacity building programme, five days training programme on "Management of TDS in Industrial Effluents" has been arranged through Environment Protection Training and Research Institute, Hyderabad for 15 States and Central Board officers. Pollution Control Implementation

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Industrial Pollution Control along the Rivers and Lakes 851 defaulting grossly polluting industries located along the rivers and lakes in the country have been identified for priority actions under this programme, which was started in August 1997. The follow-ups for the implementation of the programme, was intensified and this has resulted in reduction in the number of defaulting industries from 93 in March, 2000 to 5 in September, 2001. Environmental Surveillance Squad (ESS) Environmental Surveillance Squad in an important project undertaken by CPCB as per the direction of Hon'ble Supreme Court. The main objective of the squad is to identify the willful defaulter through surprise visits. Suitable action is also being taken against the erring industries either directly by CPCB or through State Pollution Control Board under various Environmental Acts. Under this project more than 50 industries have been visited and on the basis of the recommendations, the competent authority of CPCB has issued closure notice to the defaulters. Hazardous Substances Management The Hazardous Substances Management Division (HSMD) is the nodal point within the Ministry for management of chemical emergencies and hazardous substances. The main objective of the Division is to promote safe management and use of hazardous substances including hazardous chemicals and hazardous wastes, in order to avoid damage to health and environment. The activities of the division can be grouped under three main thrust areas, viz., Chemical Safety; Hazardous Wastes Management and Solid Waste Management. The Division is also the nodal point for the following three International Conventions. ? The Basel Convention on the Control of Transboundary Movement of Hazardous Wastes and their Disposal ? The Rotterdam Convention on the Prior Informed Consent (PIC) Procedure for Certain Hazardous Chemicals & Pesticides in International Trade. ? The Stockholm Convention on Persistent Organic Pollutants (POPs). Salient details of the programmes and activities carried out during the year are : Chemical Safety ? It has been decided to bring the entire gamut of activities relating to hazardous substances under the frame-work of a comprehensive National Chemical Profile, which is proposed to be prepared based on the UNITAR guidance document. The report will assess the existing institutional, administrative, technical and legal infrastructure vis-à-vis the requirement of safe handling of chemicals in the country. This activity is being supported under the Canada-India Environmental Institutional Strengthening Project. ? The Manufacture, Storage and Import of Hazardous Chemical (MSIHC) Rules, 1989 and the Chemical Accidents (Emergency Planning, Preparedness and Response) Rules, 1996 are the main instruments for ensuring chemical safety in the country. Implementation of both the Rules by the State/UTs governments is constantly pursued and monitored. As on date, there are 1460 Major Accident Hazard Units (MAH) in 19 states of the country. As per the

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latest reports, 1395 on-site Plans and 118 Off-site 131 plans have been prepared. All the states except Bihar and Jammu & Kashmir have constituted State Level Crisis Groups. ? A country report on “Status of Emergency Preparedness and Response in MAH Districts in the Country” has been prepared. The study was undertaken to assess the Emergency Preparedness and Response Systems existing in the country. The study has observed that the status of Emergency Preparedness in the country needs improvement at different levels. Immediate upgradation of availability of information, availability of resources to respond to Fire Emergencies, availability of hospitals with poison treatment facilities and other responses has been recommended for those districts having maximum MAH units. ? A pilot study was initiated earlier to develop GIS based Emergency Planning and Response System in four identified States namely – Gujarat Maharashtra, Tamil Nadu and Andhra Pradesh. It has been decided to install the system consisting of a software package and database at the district level. Training will also be provided to enable the usage of this package along with district off-site emergency plans to improve emergency management at the district level. Districts with a large number of Major Accident Hazard Units namely-Bharuch, Valsad, Ahmedabad, Vadodara, Kutch and Surat in Gujarat; Thane, Mumbai, Nasik, Pune, Raigad and Ratanagiri in Maharashtra; Tiruvallur, Cheenai and Salem in Tamil Nadu; Rangareddy, Medak, East Godawari, West Godawari and Visakhapatnam in Andhra Pradesh have been included in this project so far. ? A Sub-Scheme entitled ‘Industrial Pocket-wise Hazard Analysis’ has been in operation since the Eighth Five Year Plan. Out of 180 Hazard prone industrial pockets, Hazard Analysis studies have been initiated for 75 pockets. Out of these 75 studies, 69 have been completed. Based on the recommendation of the study reports, preparation of off-site plan for Kota has been initiated. ? Several cases of chemical accidents involving isolated storages have come to light in the recent past. In this regard, lack of inventorization of such storages and poor enforcement of legal provisions have been identified as the major factors. An inventorisation study for the “Isolated Storage” in the country carried out last year has identified 347 Isolated Storages. The distribution of such storages is as follows: Gujarat (41), Uttar Pradesh (38), Tamil Nadu (32), Andhra Pradesh (31), Karnataka (25), West Bengal (24), Maharashtra (23), Orissa (22), Rajasthan (22), Madhya Pradesh and Punjab (17), Delhi (14), with the others being distributed all over the country. ? Under the Public Liability Insurance Act, 1991 as amended in 1992, all the MAH units handling chemicals in excess of the threshold quantities referred to in the Schedule, are mandated to take an insurance policy and deposit an equal amount in the Environment Relief Fund (ERF) to ensure immediate payment to the chemical accident victims. It has been decided to entrust the administration of the ERF to the

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United India Insurance Company. Modalities are being worked out regarding service charges payable to this company. ? During the year, Phase-I of the study entitled “Development and Demonstration of Process Technology for Remediation of Polychlorinated Biphenyls (PCBs) in Oils and Paints by Radiolysis” has been completed. The study has identified the types of PCBs, their concentrations in oils, capacitors and paints scrapings, collected from different sections of twenty seven ships and thirty plots/shipyards at Alang (Gujarat). Phase-II of the study has also been initiated during the current year to develop and optimize a radiolytic process for the decomposition of PCBs in oils, capacitors and paint scrapings. Hazardous Waste Management As per current assessment, 4.4 million tonnes of hazardous wastes are being generated by 13011 units spread over 373 districts of the country. The states of Maharashtra, Gujarat and Tamil Nadu account for over 63% of the total hazardous wastes generated in the country. This data, which is based on the waste categories indicated in the Hazardous Wastes (Management and Handling) Rules, 1989, is being revised in the light of the amendments carried out in January, 2000 and further amendments being carried out during the year. The legal instruments for management of hazardous wastes are the Hazardous Wastes (Management & Handling) Rules, 1989, as amended in 2000 and 2002, the Biomedical Wastes (Management & Handling) Rules, 1998/2000 and the Batteries (Management & Handling) Rules, 2001. Major responsibility for implementing these rules is with the Central Pollution Control Board and State Pollution Control Boards (SPCBs)/Pollution Control Committees (PCCs) and also with the State Departments of Environment. The status of implementation of all these rules is regularly monitored. The fifth meeting of the Steering Committee for the management of Biomedical Wastes was held during the year. It was decided that the Guidelines for Management and Handling of Bio -medical Wastes shall be finalized after incorporating the comments of the members of the Steering Committee. Certain amendments to the Bio-medical Rules are also proposed. The Batteries (Management & Handling) Rules, 2001 were notified in May, 2001 to regulate the collection, channelization and recycling as well as import of used lead acid batteries in the country. These rules 132 inter-alia make it mandatory for consumers to return used batteries. All manufacturers / assemblers / reconditioners / importers of lead acid batteries are responsible for collecting used batteries against new ones sold as per a schedule defined in the rules. Such used lead acid batteries can be auctioned/sold only to recyclers registered with the Ministry on the basis of their possessing environmentally sound facilities for recycling/recovery. During the year implementation of these rules was monitored which indicated that the status of implementation of these rules, especially relating to

United India Insurance Company. Modalities are being worked out regarding service charges payable to this company. - During the year, Phase-I of the study entitled "Development and Demonstration of Process Technology for Remediation of Polychlorinated Biphenyls (PCBs) in Oils and Paints by Radiolysis" has been completed. The study has identified the types of PCBs, their concentrations in oils, capacitors and paints scrapings, collected from different sections of twenty seven ships and thirty plots/shipyards at Alang (Gujarat). Phase-II of the study has also been initiated during the current year to develop and optimize a radiolytic process for the decomposition of PCBs in oils, capacitors and paint scrapings. Index Hazardous Waste Management As per current assessment, 4.4 million tonnes of hazardous wastes are being generated by 13011 units spread over 373 districts of the country. The states of Maharashtra, Gujarat and Tamil Nadu account for over 63% of the total hazardous wastes generated in the country. This data, which is based on the waste categories indicated in the Hazardous Wastes (Management and Handling) Rules, 1989, is being revised in the light of the amendments carried out in January, 2000 and further amendments being carried out during the year. The legal instruments for management of hazardous wastes are the Hazardous Wastes (Management & Handling) Rules, 1989, as amended in 2000 and 2002, the Biomedical Wastes (Management & Handling) Rules, 1998/2000 and the Batteries (Management & Handling) Rules, 2001. Major responsibility for implementing these rules is with the Central Pollution Control Board and State Pollution Control Boards (SPCBs)/Pollution Control Committees (PCCs) and also with the State Departments of Environment. The status of implementation of all these rules is regularly monitored. The fifth meeting of the Steering Committee for the management of Biomedical Wastes was held during the year. It was decided that the Guidelines for Management and Handling of Bio-medical Wastes shall be finalized after incorporating the comments of the members of the Steering Committee. Certain amendments to the Bio-medical Rules are also proposed. The Batteries (Management & Handling) Rules, 2001 were notified in May, 2001 to regulate the collection, channelization and recycling as well as import of used lead acid batteries in the country. These rules inter-alia make it mandatory for consumers to return used batteries. All manufacturers / assemblers / reconditioners / importers of lead acid batteries are responsible for collecting used batteries against new ones sold as per a schedule defined in the rules. Such used lead acid batteries can be auctioned/sold only to recyclers registered with the Ministry on the basis of their possessing environmentally sound facilities for recycling/recovery. During the year implementation of these rules was monitored which indicated that the status of implementation of these rules, especially relating to

collection of old batteries needs improvement. Following steps have been taken during the year to ensure effective implementation of the Battery Rules 7. Creation of awareness among all stake holders about management of lead acid batteries through the print and electronic media. Issues relating to the management of lead acid batteries are proposed to be covered in one of the episodes of the environmental serial 'Bhoomi'. 8. 100% monitoring of all the lead acid battery recycling/reprocessing units registered with the MoEF has been launched. 9. Action is underway to put in place a mechanism for organized collection of used lead acid batteries in the country. 10. Directions have been issued to all the SPCBs/PCCs to check and close down backyard lead smelters/fly-by-night operators. An Inquiry Committee was constituted during the year on the directions of the Hon'ble Supreme Court in the matter of Writ Petition No. 657 of 1995 filed by the Research Foundation for Science, Technology and Natural Resource Policy against the Union of India and others, to verify the inventory of hazardous wastes such as waste oil, lead acid batteries and other non-ferrous metal wastes lying in various ports and Inland Container Deports of the country. The Committee has submitted the final report and findings have been submitted to the Supreme Court. The W.P.No. 967/89 filed by Indian Council for Enviro Legal Action against UoI and Others on Groundwater Pollution and Soil Degradation in Bichhri Village, Udaipur (Rajasthan) due to indiscriminate disposal of Toxic Wastes, is being heard in the Supreme Court. The Final Report of the 'Remediation/Reclamation of Hazardous Waste Contaminated Areas in Bichhri Village, Rajasthan" has been submitted to the Ministry after incorporating the comments of the Advisory Technical Review Committee. As per the Hazardous Wastes (M&H) Rules, 1989 and 2000, all hazardous wastes are required to be treated and disposed off in the manner prescribed. In the absence of common disposal facilities in the country, permission has been granted to the hazardous waste generating units in the small scale sector, for storing their wastes temporarily in a secure, lined pit/facility within their premises. During the Tenth Plan Period it has been decided to focus on the setting up of common TSDFs in different parts of the country. While support would be provided for setting up two such common facilities in major hazardous waste generating states, one facility would be supported in other states. The Ministry has so far supported the setting up of common TSDFs at Maharashtra (TTC-Belapur) and Andhra Pradesh (RR District). During the year, financial support has been provided to three more TSDFs in the country – two in the state of Gujarat (Ankleshwar and Surat) and one in Maharashtra (Taloja). The scheme for "Registration of Recyclers/Reprocessors of Wastes as Actual Users having Environmentally Sound Management facilities" initiated in 1999, was continued during the year

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and two meetings of the Registration Committee were held. A total of 130 proposals were considered in these meetings. Registration was approved to 103 units, applications of 4 units were rejected and the rest were deferred. As on date, 234 units have been registered with the Ministry, out of which 78 are used/waste oil reprocessors, 71 are lead scrap processing units while the remaining 83 are non-ferrous metal waste processing units. During the year registration was also renewed in respect of 53 units whose registration had expired. The list of registered recyclers/reprocessors is posted on the web-site of the Ministry and is updated regularly. Rigorous monitoring of the registered units has been initiated during the year to ensure that all the conditions included in the Registration Letter are compiled with by the units. In case of lead acid battery recycling units 100% monitoring of registered units has been undertaken. The Regional Offices of the Ministry have been entrusted with the monitoring work. Solid Waste Management The Municipal Solid Wastes (Management & Handling) Rules, 2000, the Fly Ash Notification, 1999 and the Recycled Plastics (Manufacture & Usage) Rules 1999 constitute the regulatory frame work for the management of solid wastes in the country. ? Committee on Plastic Waste Disposal constituted under the Chairmanship of Shri Ranganath Mishra, former Chief Justice of the Hon'ble Supreme Court has submitted its report containing recommendations for the management of plastic wastes in the country. Draft amendments to the Recycled Plastics Manufacture and Usage Rules, 1999, have been issued 133 during the year. The proposed amendments include, inter-alia, a ban on manufacture of plastic carry bags less than 8 inches X 12 inches in size and a provision for registration of recyclers of plastic with the SPCBs/PCCs. Objections/comments/suggestions received in response to the draft amendments are being examined. ? During the year, guidelines for use of fly ash have been formulated and circulated to the State Governments. The guidelines cover use/disposal of fly ash by road and building construction agencies, local bodies, State Pollution Control Boards and Thermal Power Plants. ? A High Level Committee under the chairmanship of Secretary (E&F) has been constituted during the year with representatives from concerned Ministries, Technical Institutions and All India Brick and Tile Manufacturers Federation to review the implementation of the provisions of fly ash notification dated 14 th September, 1999. Besides monitoring the implementation of the provisions of the Notification, the Committee will also provide policy guidance on utilization of fly ash in various sectors/developmental activities including incentives/disincentives required therefore.

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202/202	SUBMITTED TEXT	451 WORDS	99%	MATCHING TEXT	451 WORDS

International Conventions/Protocols Basel Convention on the Control of Transboundary Movement of Hazardous Wastes and their Disposal l) India is a signatory to the Basel Convention, which requires countries to ensure that hazardous wastes and hazardous recyclable materials are managed in an environmentally sound manner. m) During the year, the Ministry participated in the 5 th and 6 th meetings of the Expanded Bureau of Conference of Parties (COP) 5 and the 20 th meeting of the Technical Working Group, the Legal Working Group meeting etc. of the Basel Convention. The Ministry also participated in COP 6 of the convention held in Geneva in December, 2002. The four major issues discussed during COP 6 were the strategic plan for implementation of the Basel Convention, the establishment of Basel Convention Regional Centres, Mechanism for effective implementation of convention and partnership with industry and multilateral environmental agreements. Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals & Pesticides in International Trade. The Ministry participated in the 3rd Session of the Interim Chemical Review Committee Meetting under the Convention. Stockholm Convention on Persistent Organic Pollutants (POPs) India has signed the Stockholm Convention on POPs in May, 2002. The Convention seeks to eliminate production, use, import and export of 12 POPs wherever techno-economically feasible and in the interim period restrict the production and use of these chemicals. A project titled “Preliminary assessment to identify the requirements for developing a National Implementation Plan in India as a first step to implement the Stockholm Convention on POPs” has been initiated during the year with support from GEF. Legislations relating to Hazardous Substances Management ? One of the recommendations of the High Powered Committee constituted under the Chairmanship of Prof. MGK Menon in the mater of W.P.No.657 of 1995 being heard in the Hon’ble Supreme Court, was that the Hazardous Wastes (Management and Handling) Rules, 1989/2000 should be amended urgently based on waste prevention and clean production, waste minimization and recovery prior to consideration of options dealing with disposal of hazardous wastes. Accordingly, the Hazardous Wastes (Management & Handling) Amendment Rules, 2002 have been notified on 21 st May, 2002. A Technical Expert Committee constituted during the year to finalise the amendments has examined over 250 objections/comments/suggestions received from concerned institutions/organizations. Based on this and the inputs given by the CPCB and SPCBs, the amendments have been finalized and are expected to be notified shortly. ? During the year draft amendments to the fly-ash notification of 1999 have also been notified. Use of fly- ash in construction, laying of roads and

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