ENVIRONMENTAL SCIENCE 312

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ENVIRONMENTAL SCIENCE
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UNIT1

Ecosystem:
An **ecosystem** is a biologicalenvironment consisting of all the living organisms or biotic component, in a particular area, and the nonliving, or abiotic component, with which the organisms interact, such as air, soil, water and sunlight. An ecosystem (short for "ecological system") is generally defined as a community of organisms living in a particular environment and the physical elements with which they interact. An ecosystem is an open functional unit that results from the interactions of abiotic (soil, water, light, inorganic nutrients and weather), biotic (plants, animals, and microorganisms usually categorized as either producers or consumers), and cultural (anthropogenic) components.
An ecosystem can be as small as a field or as large as the ocean. It is used to describe the world's major different habitat types. Terrestrial ecosystems include: arctic and alpine ecosystems, dominated by tundra with scarce vegetation; forest ecosystems, which can be subdivided into a whole range of types including tropical rainforests, Mediterranean evergreen forests, boreal forests, and temperate coniferous, deciduous and mixed forests; grasslands and savannas; and deserts and semi-arid ecosystems. Freshwater ecosystems include lakes, rivers, and marshlands. Marine ecosystems comprise an enormous range, from coral reefs, mangroves, sea-grass beds, and other shallow coastal water ecosystems, to open-water ones, including the mysterious, little-known ecosystems of the abyssal plains and trenches of the world's oceans.
Ecosystems sustain human societies and allow them to prosper, due to the nutritional, environmental, cultural, recreational and aesthetic resources they provide. We all depend directly or indirectly on the products and services of ecosystems, including crops, livestock, fish, wood, clean water, oxygen, and wildlife.

Kinds of Ecosystems;Ecosystem means **environment** of biology which consists all organisms that **live** in particular region and in environment's physical and **nonliving components** like air water sunlight and soil. The living organisms interact with the atmosphere's nonliving components. **Ecosystem,** basically, is of **2 types**: aquatic and terrestrial. Sub ecosystem comes under them.
Terrestrial-Ecosystem – It is found in every place except water-bodies. It is classified broadly into following sub-parts:
Forest-ecosystem – In this type of ecosystem we can see plenty of plants as well as numerous organisms. So life's density in it is quite high. Forest ecosystem is further divided into following forests:
Tropical-evergreen – It receives rainfall at an average varying from inches 80–400 yearly. Vegetation is very dense having trees of different lengths.
Tropical-deciduous – Has dense shrubs and bushes as well as trees with levels broad.
Temperature-evergreen – Have fewer trees with leaves spiked for minimizing transpiration.
Temperature-deciduous – Found in regions where temperature is moist with enough rainfall.

Desert-ecosystem – Is found in those regions which receives rainfall annually >25cm. almost 17% of planet's land is occupied by it. Plants have leaves having spines for conserving water. To xeric conditions, animals found here are also adapted. Trees are very rare here.
Grassland-ecosystem – We find it in regions both tropical and temperate of world. Comprises mainly grasses having trees and shrubs in small amount. It is of two types:
Savanna
Prairies
Mountain-ecosystem – Here wide variety of animals and plants are available. Higher slopes have treeless vegetation and lower region is covered of coniferous-forest.
Aquatic Ecosystem – It is situated inside water-bodies. It is of 2 types:
Marine-ecosystem – It covers about 71 percent of surface of Earth and has 97 percent of water of planet. Its various divisions are:
Oceanic
Inter-tidal
Salt-marshes
Estuaries
Coral-reefs
Freshwater-ecosystem – Covers only 0.8percent of surface of earth and 0.009percent of whole water. It is of 3 types:
Lentic
Wetlands
Lotic, the ecosystem of a river, stream or spring.
Artificial, ecosystems created by humans.Central to the ecosystem concept is the idea that living organisms interact with every other element in their local environment. Eugene Odum, a founder of ecology, stated: "Any unit that includes all of the organisms (ie: the "community") in a given area interacting with the physical environment so that a flow of energy leads to clearly defined trophic structure, biotic diversity, and material cycles (i.e.: exchange of materials between living and nonliving parts) within the system is an ecosystem.
Etymology:The term ecosystem was coined in 1930 by Roy Clapham to mean the combined physical and biological components of an environment. British ecologist Arthur Tansley later refined the term, describing it as "The whole system, … including not only the organism-complex, but also the whole complex of physical factors forming what we call the environment".[4] Tansley regarded ecosystems not simply as natural units, but as mental isolates.[4] Tansley later[5] defined the spatial extent of ecosystems using the term ecotope.
Examples of ecosystems
Agroecosystem
Aquatic ecosystem
Chaparral
Coral reef
Desert
Forest
Farm
Greater Yellowstone Ecosystem
Human ecosystem
Large marine ecosystem
Littoral zone
Lotic
Marine ecosystem

Pond ecosystem
Prairie
Rainforest
Riparian zone
Savanna
Steppe
Subsurface Lithoautotrophic Microbial Ecosystem
Taiga
Tundra
Urban ecosystem

Biodiversity &major issues:

The variety of life on Earth, its biological diversity is commonly referred to as biodiversity. The number of species of plants, animals, and microorganisms, the enormous diversity of genes in these species, the different ecosystems on the planet, such as deserts, rainforests and coral reefs are all part of a biologically diverse Earth. Appropriate conservation and sustainable development strategies attempt to recognize this as being integral to any approach. Almost all cultures have in some way or form recognized the importance that nature, and its biological diversity has had upon them and the need to maintain it. Yet, power, greed and politics have affected the precarious balance.

Why Is Biodiversity Important?

Biodiversity boosts ecosystem productivity where each species, no matter how small, all have an important role to play.

For example, a larger number of plant species means a greater variety of crops; greater species diversity ensures natural sustainability for all life forms; and healthy ecosystems can better withstand and recover from a variety of disasters.

And so, while we dominate this planet, we still need to preserve the diversity in wildlife

Biodiversity is the degree of variation of life forms within a given species, ecosystem, biome, or an entire planet. Biodiversity is a measure of the health of ecosystems. Biodiversity is in part a function of climate. In terrestrial habitats, tropical regions are typically rich whereas polar regions support fewer species.

The period since the emergence of humans has displayed an ongoing biodiversity reduction and an accompanying loss of genetic diversity. Named the Holocene extinction, the reduction is caused primarily by human impacts, particularly habitat destruction. Conversely, biodiversity impacts human health in a number of ways, both positively and negatively.[5]

Legal status;

Biodiversity is taken into account in some political and judicial decisions:

The relationship between law and ecosystems is very ancient and has consequences for biodiversity. It is related to private and public property rights. It can define protection for threatened ecosystems, but also some rights and duties (for example, fishing and hunting rights).

Law regarding species is more recent. It defines species that must be protected because they may be threatened by extinction. The U.S. Endangered Species Act is an example of an attempt to address the "law and species" issue.

Laws regarding gene pools are only about a century old.[citation needed] Domestication and plant breeding methods are not new, but advances in genetic engineering has led to tighter laws covering distribution of genetically modified organisms, gene patents and process patents.[129] Governments struggle to decide whether to focus on for example, genes, genomes, or organisms and species.[citation needed]

Global agreements such as the Convention on Biological Diversity, give "sovereign national rights over biological resources" (not property). The agreements commit countries to "conserve biodiversity", "develop resources for sustainability" and "share the benefits" resulting from their use. Biodiverse

countries that allow bioprospecting or collection of natural products, expect a share of the benefits rather than allowing the individual or institution that discovers/exploits the resource to capture them privately. Bioprospecting can become a type of biopiracy when such principles are not respected.

Biodiversity Conservation:

Conservation is the protection, preservation, management, or restoration of wildlife and natural resources such as forests and water. Through the conservation of biodiversity the survival of many species and habitats which are threatened due to human activities can be ensured. Other reasons for conserving biodiversity include securing valuable Natural Resources for future generations and protecting the well being of eco-system functions.

In-situ and ex-situ conservation

Conservation can broadly be divided into two types:

In-situ: Conservation of habitats, species and ecosystems where they naturally occur. This is in-situ conservation and the natural processes and interaction are conserved as well as the elements of biodiversity.

Ex-situ: The conservation of elements of biodiversity out of the context of their natural habitats is referred to as ex-situ conservation. Zoos, botanical gardens and seed banks are all example of ex-situ conservation.

In-situ conservation is not always possible as habitats may have been degraded and there may be competition for land which means species need to be removed from the area to save them.

In-situ and Ex-situ Conservation Methods:

In Situ Conservation Methods

In-situ conservation, the conservation of species in their natural habitats, is considered the most appropriate way of conserving biodiversity.

Conserving the areas where populations of species exist naturally is an underlying condition for the conservation of biodiversity. That's why protected areas form a central element of any national strategy to conserve biodiversity.

Ex Situ Conservation Methods

Ex-situ conservation is the preservation of components of biological diversity outside their natural habitats. This involves conservation of genetic resources, as well as wild and cultivated or species, and draws on a diverse body of techniques and facilities. Some of these include:

Gene banks, e.g. seed banks, sperm and ova banks, field banks;

In vitro plant tissue and microbial culture collections;

Captive breeding of animals and artificial propagation of plants, with possible reintroduction into the wild; and

Collecting living organisms for zoos, aquaria, and botanic gardens for research and public awareness.

Ex-situ conservation measures can be complementary to in-situ methods as they provide an "insurance policy" against extinction. These measures also have a valuable role to play in recovery programmes for endangered species. The Kew Seed Bank in England has 1.5 per cent of the world's flora - about 4,000 species - on deposit.

In agriculture, ex-situ conservation measures maintain domesticated plants which cannot survive in nature unaided.

Ex-situ conservation provides excellent research opportunities on the components of biological diversity. Some of these institutions also play a central role in public education and awareness raising by bringing members of the public into contact with plants and animals they may not normally come in contact with. It is estimated that worldwide, over 600 million people visit zoos every year.

Ex situ conservation measures should support in-situ conservation measures (in-situ conservation should be the primary objective).

Which areas to conserve?

Hotspots of biodiversity:A popular approach for selecting priority areas has been to select hotspots of diversity. Since it is not possible to conserve all biodiversity due to lack of resources and the need to use land for human activities, areas are prioritised to those which are most in need of conservation. 'Hotspot' a term used to define regions of high conservation priority combining high richness, high endemism and high threat.

Threatened Species: Over the last 200 years many species have become extinct and the extinction rate is on the increase due to the influence of human activity. The status of species has been assessed on a global scale by the World Conservation Union.

Threatened Habitats:Habitat destruction comes in many forms from clear felling of forests to simple changes in farming practices that change the overall surrounding habitat. If a habitat is degraded or disappears a species may also become threatened. The UK is in danger of losing diverse habitats ranging from lowland calcareous grassland to mudflats and wet woodland.

Flagship and keystone species:Conservation efforts are often focused on a single species. This is usually for two reasons.

1) Some species are key to the functioning of a habitat and their loss would lead to greater than average change in other species populations or ecosystem processes. These are known as keystone species.

2) Humans will find the idea of conserving one species more appealing than conserving others. For example it would be easier to persuade people that it is necessary to conserve tigers that it is to persuade people to conserve the Zayante band-winged grasshopper. Using a flagship species such as a tiger will attract more resources for conservation which can be used to conserve areas of habitat.

Complementarity: Complementarity is a method used to select areas for conservation. These methods are used to find areas that in sum total have the highest representation of diversity. For example using complementarity methods, areas could be selected that would contain the most species between them but not necessarily be the most species rich areas individually and take into account pressures of development.

Distinguishing higher from lower priority areas for urgent conservation is the purpose of such area-selection methods. However, an acceptance of priorities must recognise that this idea also implies that some areas will be given lower priority. This is not to say that they have no conservation values rather that in relation to agreed goals the actions are not as urgent.

Sustainable Development:

Sustainable development, as defined by the Brundtland Commission (1987) is "development that meets the needs of the present without compromising the ability of future generations to meet their own needs".By definition, then, sustainable development is development that takes the impact on the environment into account and tries to minimize environmental damage.Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It contains within it two key concepts:

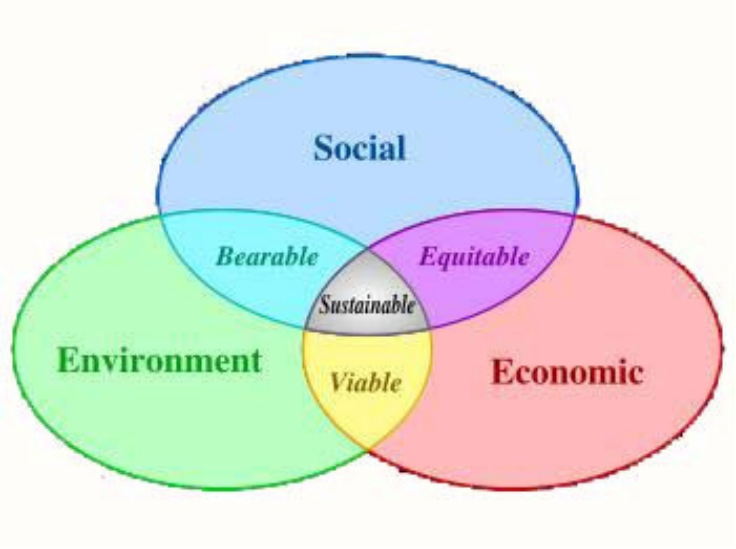
The concept of**needs**, in particular the essential needs of the world's poor, to which overriding priority should be given; and

The idea of**limitations**imposed by the state of technology and social organization on the environment's ability to meet present and future needs."

All definitions of sustainable development require that we see the world as a **system**—a system that connects **space**; and a system that connects **time.**When you think of the world as a system over space, you grow to understand that air pollution from North America affects air quality in Asia, and that pesticides sprayed in Argentina could harm fish stocks off the coast of Australia.And when you think of the world as a system over time, you start to realize that the decisions our grandparents made about how to farm the land continue to affect agricultural practice today; and the economic policies we endorse today will have an impact on urban poverty when our children are adults.

Literally, sustainable means 'that can be kept going or maintained'. Development means "the action or process of growing or cause of gradual growth. **Concept of sustainable development** is therefore, commonly understood as that development which meets the need of the present generation without compromising the needs of the future generations.

The world is not going to come to an end with us and hence we do not need to eat way all the resources in the name of development just because we can. Sustainable growth in context of environment means having common elements of covering the well-being of the society of human beings, the well-being of the environment and the well being of environment and sustainability over time



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1. **Equal:**Equality is essential for a sustainable development. This concept promotes equality between ages, genders, classes, races, continents and countries.
2. **Social Development:Concept of sustainable development** emphasizes on not only economic development, but also on social development and the need to conserve our environment and natural resources too.
3. **Inclusive approach**:Any growth that is exclusive is not right. Sustainable development has to be inclusive. It is based on the improved quality of life for everyone, mainly the deprived and the poverty-stricken people of the world.
4. **Human-Environment Harmony**:It understands that the needs of human beings and the requirements of the environment are interdependent and acknowledges this fact.
5. **Co-operation;**Sustainable development is possible only if the developed world and the developing worlds co-operate and the former support the latter in their endeavors whenever they can, through subsidies, for instance.

Why do we need sustainable development?

The human population is rising day by day. Their demands too are on rise. There is a need of natural resources to meet these demands. What we have done till now is followed an economic growth pattern that is short-term. In the process, we have misused the resources of nature and exploited them recklessly. As a result, we are short of these resources. The Earth that we live on is not capable of providing for the resources to meet our accelerating needs. We face the consequences if this imbalance in the form of climate changes in our everyday life. The magnitude of such challenges might just accelerate for our future generation. Hence we need a development plan that's long term, even if slow and gives us time to replace the resources we consume through measures like planting a tree, etc. This is not only for our own good; we also need this for the sake of our future generation as well as to maintain a healthy environment.

How can we go about sustainable development?

For meeting our present needs as well as saving for our future generation, we need a proper and need-based, not greed-based consumption pattern. The following aspects are essential for the same.

Sustainability:

This of course, is a priority and we should make sure that we are not mortgaging the choices of the future generation.

Strengthening:

We should build on human capacities to develop and conserve at the same time.

Sharing:

Equitable distribution of wealth and resources is vital for a sustainable development. Basic needs for all, without any discrimination should be ensured.

Social responsibility:

Our consumption patterns should be guided by a sense of social responsibility. We should strive for such a consumption that does not compromise the well-being of others.

We should, therefore, avoid all such development patterns that will ignite environmental degradation resulting from economic decisions we make today and which jeopardizes the situation for our posterity.

Agenda 21

•It is a programme run by the United Nations (UN) related to sustainabledevelopment. It is a comprehensive blueprint of action to be taken globally, nationally and locally by organisations of the UN, governments, and major groups in every area in which humans impact on the environment. The number 21 refers to the 21st century

•The full text of Agenda 21 was revealed at the 1992 United Nations Conference on Environment and Development (Earth Summit), held in Rio de Janeiro on June 14th where 179 governments voted to adopt the programme. The final text was the result of drafting, consultation and negotiation, beginning in 1989 and culminating at the two-week conference

Structure and Contents- Agenda 21 There are 40 chapters in Agenda 21, divided into four sections. All told the document was over 900 pages:

Section I: Social and Economic Dimensions

•including combating poverty, changing consumption patterns, population and demographic dynamics, promoting health, promoting sustainable settlement patterns and integrating environment and development into decision-making.

Section II: Conservation and Management of Resources for Development

•including atmospheric protection, combating deforestation, protecting fragile environments, conservation of biological diversity (biodiversity), and control of pollution.

Section III: Strengthening the Role of Major Groups

•including the roles of children and youth, women, NGOs, local authorities, business and workers.

Section IV: Means of Implementation

•including science, technology transfer, education, international institutions and mechanisms and financial mechanisms.

Agenda 21: Preamble

•Agenda 21 addresses the pressing problems of today and also aims at preparing the world for the challenges of the next century. It reflects a global consensus and political commitment at the highest level on development and environment cooperation. Its successful implementation is first and foremost the responsibility of Governments. National strategies, plans, policies and processes are crucial in achieving this. International cooperation should support and supplement such national efforts. In this context, the United Nations system has a key role to play. Other international, regional and sub regional organizations are also called upon to contribute to this effort. The broadest public participation and the active involvement of the non-governmental organizations and other groups should also be encouraged.

• The developmental and environmental objectives of Agenda 21 will require a substantial flow of new and additional financial resources to developing countries, in order to cover the incremental costs for the actions they have to undertake to deal with global environmental problems and to accelerate sustainable development. Financial resources are also required for strengthening the capacity of international institutions for the implementation of Agenda 21. An indicative order-of-magnitude assessment of costs is included in each of the programme areas. This assessment will need to be examined and refined by the relevant implementing agencies and organizations. Agenda 21 adopted at the conference, represents a global consensus and

political commitment at the highest level on socio-economic development and environmental cooperationa. The foremost responsibility for leading this change was placed on national governments. Each government was expected to design national strategies, plans, and policies for sustainable development — a national Agenda 21 — in consonance with the country's particular situation, capacity and priorities. This was to be done in partnership with international organizations, business, regional, state and local governments, non-government organizations and citizens groups. The Agenda also recognized the need for new assistance for developing countries to support the incremental cost of actions to deal with global environmental problems, and to accelerate sustainable development.

Kyoto Protocol•The Kyoto Protocol is a protocol to the international Framework Convention on Climate Change with the objective of reducing Greenhouse gases that cause climate change. It was agreed on 11 December 1997 at the 3rd Conference of the Parties to the treaty when they met in Kyoto, and entered into force on 16 February 2005.

•It is an agreement made under the United Nations Framework Convention on Climate Change (UNFCCC). Countries that ratify this protocol commit to reduce their emissions of carbon dioxide and five other greenhouse gases, or engage in emissions trading if they maintain or increase emissions of these gases.

Aim of Kyoto Protocol;Aim to reduce collective emission of green house gases and prevent global warming

•The Kyoto Protocol is an agreement under which industrialized countries will aim to reduce their collective emissions of greenhouse gases by 5.2% compared to the year 1990 (but note that, compared to the emissions levels that would be expected by 2010 without the Protocol, this limitation represents a 29% cut). The goal is to lower overall emissions of six greenhouse gases - carbon dioxide, methane,

nitrous oxide, sulfur hexafluoride, hydrofluorocarbons, and perfluorocarbons - averaged over the period of 2008-2012. National limitations range from 8% reductions for the European Union and some others to 7% for the US, 6% for Japan, 0% for Russia, and permitted increases of 8% for Australia and 10% for Iceland.

WTO & ENVIROMENT PROTECTION:

•The WTO has no specific agreement dealing with the environment. However, the WTO agreements confirm governments' right to protect the environment, provided certain conditions are met, and a number of them include provisions dealing with environmental concerns. The objectives of sustainable development and environmental protection are important enough to be stated in the preamble to the Agreement Establishing the WTO.

• The standing forum dedicated to dialogue between governments on the impact of trade policies on the environment, and of environment policies on trade.

•Under the Doha Development Agenda, the regular committee is also looking at the effects of environmental measures on market access, the intellectual property agreement and biodiversity, and labeling for environmental purposes

•Moreover, the institutional machinery working under WTO for investigating the trade and environment interface, and making positive suggestions towards the objective of sustainable development, is the committee on Trade and Environment (CTE).

Stockholm conference:

The United Nations Conference on the Human Environment, having met at Stockholm from 5 to 16 June 1972,having considered the need for a common outlook and for common principles to inspire and guide the peoples of the world in the preservation and enhancement of the human environment,

Proclaims that:

1. Man is both creature and moulder of his environment, which gives him physical sustenance and affords him the opportunity for intellectual, moral, social and spiritual growth. In the long and tortuous evolution of the human race on this planet a stage has been reached when, through the rapid acceleration of science and technology, man has acquired the power to transform his environment in countless ways and on an unprecedented scale. Both aspects of man's environment, the natural and the man-made, are essential to his well-being and to the enjoyment of basic human rights the right to life itself.
2. The protection and improvement of the human environment is a major issue which affects the well-being of peoples and economic development throughout the world; it is the urgent desire of the peoples of the whole world and the duty of all Governments.
3. Man has constantly to sum up experience and go on discovering, inventing, creating and advancing. In our time, man's capability to transform his surroundings, if used wisely, can bring to all peoples the benefits of development and the opportunity to enhance the quality of life. Wrongly or heedlessly applied, the same power can do incalculable harm to human beings and the human environment. We see around us growing evidence of man-made harm in many regions of the earth: dangerous levels of pollution in water, air, earth and living beings; major and undesirable disturbances to the ecological balance of the biosphere; destruction and depletion of irreplaceable resources; and gross deficiencies, harmful to the physical, mental and social health of man, in the man-made environment, particularly in the living and working environment.
4. In the developing countries most of the environmental problems are caused by under-development. Millions continue to live far below the minimum levels required for a decent human existence, deprived of adequate food and clothing, shelter and education, health and sanitation. Therefore, the developing countries must direct their efforts to development, bearing in mind their priorities and the need to safeguard and improve the environment. For the same purpose, the industrialized countries should make

efforts to reduce the gap themselves and the developing countries. In the industrialized countries, environmental problems are generally related to industrialization and technological development.
5. The natural growth of population continuously presents problems for the preservation of the environment, and adequate policies and measures should be adopted, as appropriate, to face these problems. Of all things in the world, people are the most precious. It is the people that propel social progress, create social wealth, develop science and technology and, through their hard work, continuously transform the human environment. Along with social progress and the advance of production, science and technology, the capability of man to improve the environment increases with each passing day.
6. A point has been reached in history when we must shape our actions throughout the world with a more prudent care for their environmental consequences. Through ignorance or indifference we can do massive and irreversible harm to the earthly environment on which our life and well being depend. Conversely, through fuller knowledge and wiser action, we can achieve for ourselves and our posterity a better life in an environment more in keeping with human needs and hopes. There are broad vistas for the enhancement of environmental quality and the creation of a good life. What is needed is an enthusiastic but calm state of mind and intense but orderly work. For the purpose of attaining freedom in the world of nature, man must use knowledge to build, in collaboration with nature, a better environment. To defend and improve the human environment for present and future generations has become an imperative goal for mankind-a goal to be pursued together with, and in harmony with, the established and fundamental goals of peace and of worldwide economic and social development.
7. To achieve this environmental goal will demand the acceptance of responsibility by citizens and communities and by enterprises and institutions at every level, all sharing equitably in common efforts. Individuals in all walks of life as well as organizations in many fields, by their values and the sum of their actions, will shape the world environment of the future.
Local and national governments will bear the greatest burden for large-scale environmental policy and action within their jurisdictions. International cooperation is also needed in order to raise resources to support the developing countries in carrying out their responsibilities in this field. A growing class of environmental problems, because they are regional or global in extent or because they affect the common international realm, will require extensive cooperation among nations and action by international organizations in the common interest.
The Conference calls upon Governments and peoples to exert common efforts for the preservation and improvement of the human environment, for the benefit of all the people and for their posterity.

Principles of the conference:

Principle 1 :Man 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 generations. In this respect, policies promoting or perpetuating apartheid, racial segregation, discrimination, colonial and other forms of oppression and foreign domination stand condemned and must be eliminated.
Principle 2 :The natural resources of the earth, including the air, water, land, flora and fauna and especially representative samples of natural ecosystems, must be safeguarded for the benefit of present and future generations through careful planning or management, as appropriate.
Principle 3 :The capacity of the earth to produce vital renewable resources must be maintained and, wherever practicable, restored or improved.
Principle 4 :Man has a special responsibility to safeguard and wisely manage the heritage of wildlife and its habitat, which are now gravely imperilled by a combination of adverse factors. Nature conservation, including wildlife, must therefore receive importance in planning for economic development.
Principle 5 :The non-renewable resources of the earth must be employed in such a way as to guard against the danger of their future exhaustion and to ensure that benefits from such employment are shared by all mankind.

Principle 6 :The discharge of toxic substances or of other substances and the release of heat, in such quantities or concentrations as to exceed the capacity of the environment to render them harmless, must be halted in order to ensure that serious or irreversible damage is not inflicted upon ecosystems. The just struggle of the peoples of ill countries against pollution should be supported.
Principle 7 :States shall take all possible steps to prevent pollution of the seas by substances that are liable to create hazards to human health, to harm living resources and marine life, to damage amenities or to interfere with other legitimate uses of the sea.
Principle 8 :Economic and social development is essential for ensuring a favorable living and working environment for man and for creating conditions on earth that are necessary for the improvement of the quality of life.
Principle 9 :Environmental deficiencies generated by the conditions of under-development and natural disasters pose grave problems and can best be remedied by accelerated development through the transfer of substantial quantities of financial and technological assistance as a supplement to the domestic effort of the developing countries and such timely assistance as may be required.
Principle 10 :For the developing countries, stability of prices and adequate earnings for primary commodities and raw materials are essential to environmental management, since economic factors as well as ecological processes must be taken into account.
Principle 11 :The environmental policies of all States should enhance and not adversely affect the present or future development potential of developing countries, nor should they hamper the attainment of better living conditions for all, and 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.
Principle 12 :Resources should be made available to preserve and improve the environment, taking into account the circumstances and particular requirements of developing countries and any costs which may emanate- from their incorporating environmental safeguards into their development planning and the need for making available to them, upon their request, additional international technical and financial assistance for this purpose.
Principle 13 :In order to achieve a more rational management of resources and thus to improve the environment, States should adopt an integrated and coordinated approach to their development planning so as to ensure that development is compatible with the need to protect and improve environment for the benefit of their population.
Principle 14 :Rational planning constitutes an essential tool for reconciling any conflict between the needs of development and the need to protect and improve the environment.
Principle 15 :Planning must be applied to human settlements and urbanization with a view to avoiding adverse effects on the environment and obtaining maximum social, economic and environmental benefits for all. In this respect projects which arc designed for colonialist and racist domination must be abandoned.
Sustainable development: Experience has shown that sustainable development requires a commitment to sound economic policies and management, an effective and predictable public administration, the integration of environmental concerns into decision-making and progress towards democratic government, in the light of country-specific conditions, which allows for full participation of all parties concerned. These attributes are essential for the fulfilment of the policy directions and objectives listed below.
Objectives: In the years ahead, and taking into account the results of the Uruguay Round of multilateral trade negotiations, Governments should continue to strive to meet the following objectives:
(a) To promote an open, non-discriminatory and equitable multilateral trading system that will enable all countries - in particular, the developing countries - to improve their economic structures and improve the standard of living of their populations through sustained economic development;

(b) To improve access to markets for exports of developing countries;
(c) To improve the functioning of commodity markets and achieve sound, compatible and consistent commodity policies at national and international levels with a view to optimizing the contribution of the commodity sector to sustainable development, taking into account environmental considerations;
(d) To promote and support policies, domestic and international, that make economic growth and environmental protection mutually supportive.

International Issues :Multilateral Environmental Agreements

The need for international action:Most environmental problems have a transboundary nature and often a global scope, and they can only be addressed effectively through international co-operation. For this reason, the EC Treaty establishes that one of the key objectives of Community policy on the environment is to promote measures at international level to deal with regional or worldwide environmental problems. The Community takes an active part in the elaboration, ratification and implementation of multilateral environmental agreements. The EC Treaty explicitly foresees the possibility for the European Community to participate in international environmental agreements, together with its Member States.

International Agreements in the 6th Environment Action Programme:There is an essential international dimension to the four priority areas listed in the 6th Environment Action Programme of the EU: climate change, nature and biodiversity, environment and health and quality of life and natural resources and wastes. In all these cases, the EU's strategic objectives can only be achieved if a series of key international environmental agreements are actively supported and properly implemented, both at Community level and worldwide.

The Action Programme contains also a specific provision on international action, which recalls the objective of aiming for swift ratification, effective compliance and enforcement of all international conventions and agreements relating to the environment where the Community is a Party.

The EC is a Party to many International Environmental Agreements:The Community has already ratified many international environmental agreements, whether at global level (multilateral agreements negotiated under the auspices of the UN), at regional level (e.g. in the context of UN/ECE or the Council of Europe), and sub-regional level (for instance for the management of seas or transboundary rivers). Likewise, the matters addressed by these agreements are very wide, and include among other the following areas: biodiversity and nature protection, climate change, protection of the ozone layer, desertification, management of chemicals and waste, transboundary water and air pollution, environmental governance (including impact assessments, access to information and public participation), industrial accidents, maritime and river protection, environmental liability.

In all these fields, Europe is a leading proponent of international environmental action and co-operation, and an active player committed to promote worldwide the concept of sustainable development.

Air: Geneva Convention on Long-range Transboundary Air Pollution (CLRTAP)(1979) and its protocols

Biotechnology: Cartagena Biosafety Protocol (2000) to the Rio CBD Convention on Biological Diversity (1992)

Chemicals:

PIC Rotterdam Convention on Prior Informed Consent (1998)
POP Stockholm Convention on Persistent Organic Pollutants (2001)

Civil Protection and Environmental Accidents:

Helsinki Convention on Industrial Accidents (1992)
Barcelona Convention (1976) as amended and its protocols
Helsinki Convention on the Baltic Sea (1992)
OSPAR Convention(1992)

Bonn Agreement (1983)
Lisbon Agreement (1990)

Climate Change and Ozone Depletion:

UNFCCC Framework Convention on Climate Change (1992) and Kyoto protocol (1997)
Vienna Convention for the Protection of the Ozone Layer (1985) and Montreal protocol as amended

Governance

Aarhus Convention (1998) on access to environmental information
Espoo Convention on Environmental Impact Assessment (1991)

Industry:

Helsinki Convention on Industrial Accidents (1992)

Land use:

Alpine Convention (1991)

Nature and biodiversity:

Rio CBD Convention on Biological Diversity (1992) and Cartagena Biosafety Protocol (2000)
Bonn CMS Convention on the Conservation of Migratory Species (1979)
Bern Convention on European Wildlife and Habitats (1979)
Convention for the protection of Vertebrate Animals used for Experimental and other Scientific Purposes (1986)
Alpine Convention (1991) and its protocols
Convention on the Conservation of the marine fauna and flora of the Antartic (1980)

Soil:

UNCCD Convention to Combat Desertification in Africa (1994)

Waste:

Basel Convention on hazardous wastes (1989)

Water:

Helsinki Convention on Watercourses and International Lakes (1992)
River basin conventions (Danube (1987), Elbe (1990), Oder (1996), Rhine (1999))
Barcelona Convention (1976) as amended and its protocols
OSPAR Convention(1992) as amended
Bonn Agreement (1983)
Helsinki Convention on the Baltic Sea (1992)

UNIT -2

TheHydrologicalcycle Cycle

(also known as the water cycle) is the journey water takes as it circulates from the land to the sky and back again.

The sun's heat provides energy to evaporate water from the earth's surface (oceans, lakes, etc.). Plants also lose water to the transpiration. The water vapour eventually condenses, forming tiny droplets in clouds.

When the clouds meet cool air over land, precipitation (rain, sleet, or snow) is triggered, and water returns to the land (or s precipitation soaks into the ground. Some of the underground water is trapped between rock or clay layers - this is called g of the water flows downhill as runoff (above ground or underground), eventually returning to the seas as slightly salty wate

This Information page provides an understanding of the hydrological cycle. It describes the principal stages of the cycle, w of each stage. A diagram gives a clear visual explanation. The links between the hydrological cycle and the duties of a wa clean water and dispose of dirty water are also explained.

Links to other web pages allow the reader (particularly teachers and students) to supplement the information contained in t

What is the Hydrological Cycle?

The total amount of water on the earth and in its atmosphere does not change but the earth's water is always in movement. Oceans, rivers, clouds and rain, all of which contain water, are in a frequent state of change and the motion of rain and flowing rivers transfers water in a never-ending cycle. This circulation and conservation of earth's water as it circulates from the land to the sky and back again is called the 'hydrological cycle' or 'water cycle'.

How does the Hydrological Cycle work?

The stages of the cycle are:

Evaporation
Transport
Condensation
Precipitation
Groundwater
Run-off

Evaporation

Water is transferred from the surface to the atmosphere through evaporation, the process by which water changes from a liquid to a gas. The sun's heat provides energy to evaporate water from the earth's surface. Land, lakes, rivers and oceans send up a steady stream of water vapour and plants also lose water to the air (transpiration).

Approximately 80% of all evaporation is from the oceans, with the remaining 20% coming from inland water and vegetation.

Transport

The movement of water through the atmosphere, specifically from over the oceans to over land, is called transport. Some of the earth's moisture transport is visible as clouds, which themselves consist of ice crystals and/or tiny water droplets.

Clouds are propelled from one place to another by either the jet stream, surface-based circulations like land and sea breezes or other mechanisms. However, a typical cloud 1 km thick contains only enough

water for a millimetre of rainfall, whereas the amount of moisture in the atmosphere is usually 10-50 times greater than this.

Most water is transported in the form of water vapour, which is actually the third most abundant gas in the atmosphere. Water vapour may be invisible to us, but not to satellites which are capable of collecting data about moisture patterns in the atmosphere.

Condensation

The transported water vapour eventually condenses, forming tiny droplets in clouds.

Precipitation

The primary mechanism for transporting water from the atmosphere to the surface of the earth is precipitation.

When the clouds meet cool air over land, precipitation, in the form of rain, sleet or snow, is triggered and water returns to the land (or sea). A proportion of atmospheric precipitation evaporates.

Groundwater

Some of the precipitation soaks into the ground and this is the main source of the formation of the waters found on land - rivers, lakes, groundwater and glaciers.

Some of the underground water is trapped between rock or clay layers - this is called groundwater. Water that infiltrates the soil flows downward until it encounters impermeable rock and then travels laterally. The locations where water moves laterally are called 'aquifers'. Groundwater returns to the surface through these aquifers, which empty into lakes, rivers and the oceans.

Under special circumstances, groundwater can even flow upward in artesian wells. The flow of groundwater is much slower than run-off with speeds usually measured in centimetres per day, metres per year or even centimetres per year.

Run-off

Most of the water which returns to land flows downhill as run-off. Some of it penetrates and charges groundwater while the rest, as river flow, returns to the oceans where it evaporates. As the amount of groundwater increases or decreases, the water table rises or falls accordingly. When the entire area below the ground is saturated, flooding occurs because all subsequent precipitation is forced to remain on the surface.

Different surfaces hold different amounts of water and absorb water at different rates. As a surface becomes less permeable, an increasing amount of water remains on the surface, creating a greater potential for flooding. Flooding is very common during winter and early spring because frozen ground has no permeability, causing most rainwater and meltwater to become run-off.

Water conservation and management:

Introduction to water conservation
Importance of water
The water cycle rainfall, evaporation, infiltration, effective rainfall
Water sources and storage water quality
Facts on water uses water use at home, in primary and other industries
Why conserve water personal, regional and global significance
Water conservation at home
In Australia
In the United Kingdom
In the United States
Measures undertaken to save water in the home in the kitchen, bathroom and in the garden.
Water Saving Devices
Water conservation in the workplace
General principles
Implementing water saving strategies

Installing small appliances
Large water saving devices
Water management
Water quality maintaining water quality, salinity, chemical contaminants
Controlling Use and Quality of Water water flow measurement, water quality control, testing water salinity
Preserving Water Quality minimising evaporation, water sanitation
Water Audits
Water Management Plans
Water conservation in Primary Production I
Water Saving Measures
Water Wise Plants
Water Wise Procedures
Water Wise Irrigation systems
Water Wise Landscaping
Equipment, structures and tools to save water
Water conservation in Primary Production II
Use of water in primary production
Methods of water storage
Rainwater collection and storage
Bore water
Farm dams planning, lined ponds
Water Requirements livestock requirements, domestic requirements
Water Quality
Water Problems on Farms contamination and disposal of water, evaporation, seepage, runoff, overspray, scheduling
Using Farm Waste Water
Irrigation System Design
Maintenance Procedures and Scheduling
Surface/Flood Irrigation
Sprinkler Irrigation
Swales and Keylines
Water conservation in Services industries
Use of Water in Services Industry
Contamination and Disposal of Water
Reduce/Reuse/Recycle
Water conservation and Health
Hospitals, nursing homes, laundries, clinical laboratories, dental practices, human and animal research facilities
Uses of water in Health Industry control pathogens, general use
Water minimisation
Water efficiency
Water conservation in other sectors
Use of water in manufacturing, construction and heavy industry
Water use in the production process
Examples of water using activities in food facilities
Water holding
Benefits of cleaner production

Water treatment, reuse and recycling
Water Sanitation filtering and disinfection
Water Reuse and Recycling classification and composition of waste water.
Recycling Wastewater
Wastewater treatment
Suitable plants
Treating saline water

Explain the importance of water in the world and the reasons for its sustainable conservation and management.
Explain the importance of water conservation and methods to save water at the workplace.
Explain the importance of water conservation and methods to save water at home.
Explain water flow and quality control.
Explain water audits and water management plans.
Explain the importance of water conservation and methods to save water in Horticulture
Explain the importance of water conservation and methods to save water in Agriculture.
Explain the importance of water conservation and methods to save water in the Services Industry.
Explain the importance of water conservation and methods to save water in the Health Industry and allied services.
Explain the importance of water conservation and methods to save water in other occupations.
Explain water sanitation and wastewater treatment methods and the difference with water reuse and recycling

Water conservation

Our ancient religious texts and epics give a good insight into the water storage and conservation systems that prevailed in those days.

Over the years rising populations, growing industrialization, and expanding agriculture have pushed up the demand for water. Efforts have been made to collect water by building dams and reservoirs and digging wells; some countries have also tried to recycle and desalinate (remove salts) water. Water conservation has become the need of the day. The idea of ground water recharging by harvesting rainwater is gaining importance in many cities.

In the forests, water seeps gently into the ground as vegetation breaks the fall. This groundwater in turn feeds wells, lakes, and rivers. Protecting forests means protecting water 'catchments'. In ancient India, people believed that forests were the 'mothers' of rivers and worshipped the sources of these water bodies.

Some ancient Indian methods of water conservation

The Indus Valley Civilization, that flourished along the banks of the river Indus and other parts of western and northern India about 5,000 years ago, had one of the most sophisticated urban water supply and sewage systems in the world. The fact that the people were well acquainted with hygiene can be seen from the covered drains running beneath the streets of the ruins at both Mohenjodaro and Harappa. Another very good example is the well-planned city of Dholavira, on Khadir Bet, a low plateau in the Rann in Gujarat. One of the oldest water harvesting systems is found about 130 km from Pune along Naneghat in the Western Ghats. A large number of tanks were cut in the rocks to provide drinking water to tradesmen who used to travel along this ancient trade route. Each fort in the area had its own water harvesting and storage system in the form of

rock-cut cisterns, ponds, tanks and wells that are still in use today. A large number of forts like Raigad had tanks that supplied water.

- In ancient times, houses in parts of western Rajasthan were built so that each had a rooftop water harvesting system. Rainwater from these rooftops was directed into underground tanks. This system can be seen even today in all the forts, palaces and houses of the region.
- Underground baked earthen pipes and tunnels to maintain the flow of water and to transport it to distant places, are still functional at Burhanpur in Madhya Pradesh, Golkunda and Bijapur in Karnataka, and Aurangabad in Maharashtra.

Rainwater harvesting

In urban areas, the construction of houses, footpaths and roads has left little exposed earth for water to soak in. In parts of the rural areas of India, floodwater quickly flows to the rivers, which then dry up soon after the rains stop. If this water can be held back, it can seep into the ground and recharge the groundwater supply.

This has become a very popular method of conserving water especially in the urban areas. Rainwater harvesting essentially means collecting rainwater on the roofs of building and storing it underground for later use. Not only does this recharging arrest groundwater depletion, it also raises the declining water table and can help augment water supply. Rainwater harvesting and artificial recharging are becoming very important issues. It is essential to stop the decline in groundwater levels, arrest sea-water ingress, i.e. prevent sea-water from moving landward, and conserve surface water run-off during the rainy season.

Town planners and civic authority in many cities in India are introducing bylaws making rainwater harvesting compulsory in all new structures. No water or sewage connection would be given if a new building did not have provisions for rainwater harvesting. Such rules should also be implemented in all the other cities to ensure a rise in the groundwater level.

Realizing the importance of recharging groundwater, the CGWB (Central Ground Water Board) is taking steps to encourage it through rainwater harvesting in the capital and elsewhere. A number of government buildings have been asked to go in for water harvesting in Delhi and other cities of India.

All you need for a water harvesting system is rain, and a place to collect it! Typically, rain is collected on rooftops and other surfaces, and the water is carried down to where it can be used immediately or stored. You can direct water run-off from this surface to plants, trees or lawns or even to the aquifer.

Some of the benefits of rainwater harvesting are as follows

- Increases water availability
- Checks the declining water table
- Is environmentally friendly
- Improves the quality of groundwater through the dilution of fluoride, nitrate, and salinity
- Prevents soil erosion and flooding especially in urban areas

Rainwater harvesting: a success story

Once Cherrapunji was famous because it received the largest volume of rainfall in the world It still does but ironically, experiences acute water shortages. This is mainly the result of extensive deforestation and because proper methods of

conserving rainwater are not used. There has been extensive soil erosion and often, despite the heavy rainfall and its location in the green hills of Meghalaya, one can see stretches of hillside devoid of trees and greenery. People have to walk long distances to collect water.
In the area surrounding the River Ruparel in Rajasthan, the story is different - this is an example of proper water conservation. The site does not receive even half the rainfall received by Cherrapunji, but proper management and conservation have meant that more water is available than in Cherrapunji.
The water level in the river began declining due to extensive deforestation and agricultural activities along the banks and, by the 1980s, a drought-like situation began to spread. Under the guidance of some NGOs (non-government organizations), the women living in the area were encouraged to take the initiative in building johads (round ponds) and dams to hold back rainwater. Gradually, water began coming back as proper methods of conserving and harvesting rainwater were followed. The revival of the river has transformed the ecology of the place and the lives of the people living along its banks. Their relationship with their natural environment has been strengthened. It has proved that humankind is not the master of the environment, but a part of it. If human beings put in an effort, the damage caused by us can be undone.

Agriculture

Conservation of water in the agricultural sector is essential since water is necessary for the growth of plants and crops. A depleting water table and a rise in salinity due to overuse of chemical fertilizers and pesticides has made matters serious. Various methods of water harvesting and recharging have been and are being applied all over the world to tackle the problem. In areas where rainfall is low and water is scarce, the local people have used simple techniques that are suited to their region and reduce the demand for water.

- In India's arid and semi-arid areas, the 'tank' system is traditionally the backbone of agricultural production. Tanks are constructed either by bunding or by excavating the ground and collecting rainwater.
- Rajasthan, located in the Great Indian Desert, receives hardly any rainfall, but people have adapted to the harsh conditions by collecting whatever rain falls. Large bunds to create reservoirs known as khadin, dams called johads, tanks, and other methods were applied to check water flow and accumulate run-off. At the end of the monsoon season, water from these structures was used to cultivate crops. Similar systems were developed in other parts of the country. These are known by various local names ¾ jal talais in Uttar Pradesh, the haveli system in Madhya Pradesh, ahar in Bihar, and so on.

Reducing water demand

Simple techniques can be used to reduce the demand for water. The underlying principle is that only part of the rainfall or irrigation water is taken up by plants, the rest percolates into the deep groundwater, or is lost by evaporation from the surface. Therefore, by improving the efficiency of water use, and by reducing its loss due to evaporation, we can reduce water demand.
There are numerous methods to reduce such losses and to improve soil moisture. Some of them are listed below.

- Mulching, i.e., the application of organic or inorganic material such as plant debris, compost, etc., slows down the surface run-off, improves the soil moisture, reduces

evaporation losses and improves soil fertility.

- Soil covered by crops, slows down run-off and minimizes evaporation losses. Hence, fields should not be left bare for long periods of time.
- Ploughing helps to move the soil around. As a consequence it retains more water thereby reducing evaporation.
- Shelter belts of trees and bushes along the edge of agricultural fields slow down the wind speed and reduce evaporation and erosion.
- Planting of trees, grass, and bushes breaks the force of rain and helps rainwater penetrate the soil.
- Fog and dew contain substantial amounts of water that can be used directly by adapted plant species. Artificial surfaces such as netting-surfaced traps or polyethylene sheets can be exposed to fog and dew. The resulting water can be used for crops.
- Contour farming is adopted in hilly areas and in lowland areas for paddy fields. Farmers recognize the efficiency of contour-based systems for conserving soil and water.
- Salt-resistant varieties of crops have also been developed recently. Because these grow in saline areas, overall agricultural productivity is increased without making additional demands on freshwater sources. Thus, this is a good water conservation strategy.
- Transfer of water from surplus areas to deficit areas by inter-linking water systems through canals, etc.
- Desalination technologies such as distillation, electro-dialysis and reverse osmosis are available.
- Use of efficient watering systems such as drip irrigation and sprinklers will reduce the water consumption by plants.

Water conservation

The most important step in the direction of finding solutions to issues of water and environmental conservation is to change people's attitudes and habits¾this includes each one of us. Conserve water because it is the right thing to do. We can follow some of the simple things that have been listed below and contribute to water conservation.

- Try to do one thing each day that will result in saving water. Don't worry if the savings are minimal¾every drop counts! You can make a difference.
- Remember to use only the amount you actually need.
- Form a group of water-conscious people and encourage your friends and neighbours to be part of this group. Promote water conservation in community newsletters and on bulletin boards. Encourage your friends, neighbours and co-workers to also contribute.
- Encourage your family to keep looking for new ways to conserve water in and around your home.
- Make sure that your home is leak-free. Many homes have leaking pipes that go unnoticed.
- Do not leave the tap running while you are brushing your teeth or soaping your face.
- See that there are no leaks in the toilet tank. You can check this by adding colour to the tank. If there is a leak, colour will appear in the toilet bowl within 30 minutes. (Flush as soon as the test is done, since food colouring may stain the tank.)
- Avoid flushing the toilet unnecessarily. Put a brick or any other device that occupies space to cut down on the amount of water needed for each flush.
- When washing the car, use water from a bucket and not a hosepipe.
- Do not throw away water that has been used for washing vegetables, rice or dals¾use it to water plants or to clean the floors, etc
- You can store water in a variety of ways. A simple method is to place a drum on a

raised platform directly under the rainwater collection source. You can also collect water in a bucket during the rainy season.

Rain Water Harvesting:

Introduction

Water is essential for all life and used in many different ways, It is also a part of the larger ecosystem in which the reproduction of the bio diversity depends. Fresh water scarcity is not limited to the arid climate regions only, but in areas with good supply the access of safe water is becoming critical problem. Lack of water is caused by low water storage capacity, low infiltration, larger inter annual and annual fluctuations of precipitation (due to monsoonic rains) and high evaporation demand. The term water harvesting was probably used first by Geddes of the University of Sydney. He defined as the collection and storage of any form of water either runoff or creek flow for irrigation use. Meyer's of USDA, USA has defined it as the practice of collecting water from an area treated to increase runoff from rainfall. Recently Currier ,USA has defined it as the process of collecting natural precipitation from prepared watershed for beneficial use. Now a days water harvesting has become a general term for collecting and storing runoff wateror creek flow ,resulting from rain in soil profile and reservoirs both over surface /under surface. Previously this was used for arid and semi arid areas, but recently their use has been extended to sub humid and humid regions too. In India water harvesting means utilizing the erratic monsoon rain for raising good crops in dry tracks and conserve the excess runoff water for drinking and for recharging purpose.

River Action Plans

The water quality data generated through National Water Monitoring Programme and River Basin Studies carried out since, 1980 indicated deterioration of water quality in riverine segments and other water bodies. The water bodies not meeting the desired water quality criteria are identified as polluted river stretches/water bodies. The deviation of water quality from the desired water quality criteria in the data generated for the river Ganga formed the basis for launching Ganga Action Plan (GAP). Subsequently, the river stretches not meeting the desired criteria are identified in all the major river basins. The identified polluted river stretches were intensively surveyed by State Pollution Control Boards (SPCBs) and Central Pollution Control Board (CPCB) to identify the sources of pollution such as Urban Centres and Industrial Units.

National River Conservation Directorate (NRCD) is implementing the River Action Plans for restoration of water quality based on the findings of survey reports submitted by CPCB/SPCBs. The thrust of NRCD is towards providing funds to state agencies for interception, diversion and treatment of sewage discharged to the water bodies from identified Urban Centers. At present NRCD is implementing the

Action Plans in 157 cities and towns located along 30 rivers. The name of the rivers are Adyar, Cooum, Betwa, Bhadra, Brahmani, Cauvery, Chambal, Damodar, Ganga, Godavari, Gomti, Khan, Krishna, Kshipra, Mahanadi, Mandovi, Narmada, Pennar, Sabarmati, Satluj, Subarnarekha, Tapti, Tunga, Tungbhadra, Tambiraparni, Vennar, Vaigai, Walnganga, Yamuna and Musi.

The schemes taken up by NRCD are related to Municipal Wastewater Treatment and are progressing in various stages. The component of Industrial Effluents contribution to polluted stretches is required to be addressed by SPCBs through consent management and surveillance. The SPCBs may compile information on Industrial Effluents being discharged in the polluted stretches in their respective states and come out with a time targeted plan to restore the water quality in the rivers. The SPCBs may also carry out performance study of functional Sewage Treatment Plant (STP) to evaluate the efficacy of treatment systems. This exercise shall be helpful in enforcement of treatment standards imposed by SPCBs and NRCD.

Ganga Action Plan (GAP)

Inertia in taking action to reduce the level of pollution stemmed largely from a widespread belief that the Ganga, as a holy river, had the ability to purify all that came into contact with it. Although there is some scientific evidence for the Ganga river's high capacity to assimilate (i.e. biodegrade) a large level of organic waste input, including pathogens, but no river can sustain its self-purifying power with this kind of over-use, misuse and abuse of its waters.

The Ganga Action Plan (GAP) originated from the personal intervention and interest of our late Prime Minister Mrs Indira Gandhi who had directed the Central Board for the Prevention and Control of Water Pollution, now Central Pollution Control Board (CPCB) to do a comprehensive survey of the situation in 1979. CPCB published two comprehensive reports which formed the base for GAP in Oct 1984 but was not presented to the nation formally due to assassination of Smt Indira Gandhi.

In Feb 1985, the Central Ganga Authority (CGA) with the PM as Chairman was formed, with an initial budget of Rs 350 crore to administer the cleaning of the Ganga and to restore it to pristine condition by our late PM Sh Rajiv Gandhi. In June 1985, the Ganga Project Directorate (GPD) was established as a wing of the Department of Environment. GAP was launched on June 14, 1986 by Sh Rajiv Gandhi at Varanasi

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Water pollution: **Water pollution** is the contamination of water bodies (e.g. lakes, rivers, oceans, aquifers and groundwater). Water pollution occurs when pollutants are discharged directly or indirectly into water bodies without adequate treatment to remove harmful compounds.

Water pollution affects plants and organisms living in these bodies of water. In almost all cases the effect is damaging not only to individual species and populations, but also to the natural biological communities. Water pollution is a major global problem which requires ongoing evaluation and revision of water resource policy at all levels (international down to individual aquifers and wells). It has been suggested that it is the leading worldwide cause of deaths and diseases,[1][2] and that it accounts for the deaths of more than 14,000 people daily.[2] An estimated 700 million Indians have no access to a proper toilet, and 1,000 Indian children die of diarrheal sickness every day.[3] Some 90% of China's cities suffer from some degree of water pollution,[4] and nearly 500 million people lack access to safe drinking water.[5] In addition to the acute problems of water pollution in developing countries, developed countries continue to struggle with pollution problems as well. In the most recent national report on water quality in the United States, 45 percent of assessed stream miles, 47 percent of assessed lake acres, and 32 percent of assessed bay and estuarine square miles were classified as polluted.[6]

Water is typically referred to as polluted when it is impaired by anthropogenic contaminants and either does not support a human use, such as drinking water, and/or undergoes a marked shift in its ability to support its constituent biotic communities, such as fish. Natural phenomena such as volcanoes, algae blooms, storms, and earthquakes also cause major changes in water quality and the ecological status of water

Groundwater pollution: Interactions between groundwater and surface water are complex. Consequently, groundwater pollution, sometimes referred to as **groundwater contamination**, is not as easily classified as surface water pollution.[7] By its very nature, groundwater aquifers are susceptible to contamination from sources that may not directly affect surface water bodies, and the distinction of point vs. non-point source may be irrelevant. A spill or ongoing releases of chemical or radionuclide contaminants into soil (located away from a surface water body) may not create point source or non-point source pollution, but can contaminate the aquifer below, defined as a toxin plume. The movement of the plume, called a plume front, may be analyzed through a hydrological transport model or groundwater model. Analysis of groundwater contamination may focus on the soil characteristics and site geology, hydrogeology, hydrology, and the nature of the contaminants

Causes

The specific contaminants leading to pollution in water include a wide spectrum of chemicals, pathogens, and physical or sensory changes such as elevated temperature and discoloration. While many of the chemicals and substances that are regulated may be naturally occurring (calcium, sodium, iron, manganese, etc.) the concentration is often the key in determining what is a natural component of water, and what is a contaminant. High concentrations of naturally-occurring substances can have negative impacts on aquatic flora and fauna.

Oxygen-depleting substances may be natural materials, such as plant matter (e.g. leaves and grass) as well as man-made chemicals. Other natural and anthropogenic substances may cause turbidity (cloudiness) which blocks light and disrupts plant growth, and clogs the gills of some fish species.[10] Many of the chemical substances are toxic. Pathogens can produce waterborne diseases in either human or animal hosts.[11] Alteration of water's physical chemistry includes acidity (change in pH), electrical conductivity, temperature, and eutrophication. Eutrophication is an increase in the concentration of chemical nutrients in an ecosystem to an extent that increases in the primary productivity of the ecosystem. Depending on the degree of eutrophication, subsequent negative environmental effects such as anoxia (oxygen depletion) and severe reductions in water quality may occur, affecting fish and other animal populations

Thermal pollution:Thermal pollution is the rise or fall in the temperature of a natural body of water caused by human influence. Thermal pollution, unlike chemical pollution, results in a change in the physical properties of water. A common cause of thermal pollution is the use of water as a coolant by power plants and industrial manufacturers. Elevated water temperatures decreases oxygen levels (which can kill fish) and affects ecosystem composition, such as invasion by new thermophilic species. Urban runoff may also elevate temperature in surface waters.

Thermal pollution can also be caused by the release of very cold water from the base of reservoirs into warmer rivers

Wastewater Management

Wastewater management encompasses a broad range of efforts that promote effective and responsible water use, treatment, and disposal and encourage the protection and restoration of our nation's watersheds. EPA's Office of Wastewater Management oversees the regulatory and voluntary programs that help manage our nation's wastewater.

Under the Clean Water Act, EPA works in partnership with EPA Regions, states, local governments, tribes, the private sector, and non-governmental organizations to regulate discharges into surface waters. Other EPA initiatives include green infrastructure, energy management, effective municipal capital finance mechanisms, wastewater and stormwater infrastructure sustainability, and water efficiency

Domestic sewage:

Domestic sewage is 99.9 percent pure water, while the other 0.1 percent are pollutants. Although found in low concentrations, these pollutants pose risk on a large scale.[22] In urban areas, domestic sewage is typically treated by centralized sewage treatment plants. In the U.S., most of these plants are operated by local government agencies, frequently referred to as publicly owned treatment works (POTW). Municipal treatment plants are designed to control conventional pollutants: BOD and suspended solids. Well-designed and operated systems (i.e., secondary treatment or better) can remove 90 percent or more of these pollutants. Some plants have additional sub-systems to treat nutrients and pathogens. Most municipal plants are not designed to treat toxic pollutants found in industrial wastewater.[23]

Cities with sanitary sewer overflows or combined sewer overflows employ one or more engineering approaches to reduce discharges of untreated sewage, including:

utilizing a green infrastructure approach to improve stormwater management capacity throughout the system, and reduce the hydraulic overloading of the treatment plant[24]

repair and replacement of leaking and malfunctioning equipment[15]

increasing overall hydraulic capacity of the sewage collection system (often a very expensive option).

A household or business not served by a municipal treatment plant may have an individual septic tank, which treats the wastewater on site and discharges into the soil. Alternatively, domestic wastewater may be sent to a nearby privately owned treatment system (e.g. in a rural community).

Industrial wastewaterSome industrial facilities generate ordinary domestic sewage that can be treated by municipal facilities. Industries that generate wastewater with high concentrations of conventional pollutants (e.g. oil and grease), toxic pollutants (e.g. heavy metals, volatile organic compounds) or other nonconventional pollutants such as ammonia, need specialized treatment systems. Some of these facilities can install a pre-treatment system to remove the toxic components, and then send the partially-treated wastewater to the municipal system. Industries generating large volumes of wastewater typically operate their own complete on-site treatment systems.

Some industries have been successful at redesigning their manufacturing processes to reduce or eliminate pollutants, through a process called pollution prevention.

Heated water generated by power plants or manufacturing plants may be controlled with:

cooling ponds, man-made bodies of water designed for cooling by evaporation, convection, and radiation

cooling towers, which transfer waste heat to the atmosphere through evaporation and/or heat transfer

cogeneration, a process where waste heat is recycled for domestic and/or industrial heating purposes

Agricultural wastewater

Nonpoint source controls

Sediment (loose soil) washed off fields is the largest source of agricultural pollution in the United States.[10] Farmers may utilize erosion controls to reduce runoff flows and retain soil on their fields. Common techniques include contour plowing, crop mulching, crop rotation, planting perennial crops and installing riparian buffers.[26][27]:pp. 4-95–4-96

Nutrients (nitrogen and phosphorus) are typically applied to farmland as commercial fertilizer; animal manure; or spraying of municipal or industrial wastewater (effluent) or sludge. Nutrients may also enter runoff from crop residues, irrigation water, wildlife, and atmospheric deposition.[27]:p. 2-9 Farmers can

develop and implement nutrient management plans to reduce excess application of nutrients.[26][27]:pp. 4-37–4-38

To minimize pesticide impacts, farmers may use Integrated Pest Management (IPM) techniques (which can include biological pest control) to maintain control over pests, reduce reliance on chemical pesticides, and protect water quality.[28]

Point source wastewater treatment

Farms with large livestock and poultry operations, such as factory farms, are called concentrated animal feeding operations or feedlots in the US and are being subject to increasing government regulation.[29][30] Animal slurries are usually treated by containment in anaerobic lagoons before disposal by spray or trickle application to grassland. Constructed wetlands are sometimes used to facilitate treatment of animal wastes. Some animal slurries are treated by mixing with straw and composted at high temperature to produce a bacteriologically sterile and friable manure for soil improvement.

Air and its major pollutants:

One of the formal definitions of air pollution is as follows – 'The presence in the atmosphere of one or more contaminants in such quality and for such duration as is injurious, or tends to be injurious, to human health or welfare, animal or plant life.' It is the contamination of air by the discharge of harmful substances. Air pollution can cause health problems and it can also damage the environment and property. It has caused thinning of the protective ozone layer of the atmosphere, which is leading to climate change. Modernisation and progress have led to air getting more and more polluted over the years. Industries, vehicles, increase in the population, and urbanization are some of the major factors responsible for air pollution. The following industries are among those that emit a great deal of pollutants into the air: thermal power plants, cement, steel, refineries, petro chemicals, and mines.

Air pollution results from a variety of causes, not all of which are within human control. Dust storms in desert areas and smoke from forest fires and grass fires contribute to chemical and particulate pollution of the air. The source of pollution may be in one country but the impact of pollution may be felt elsewhere. The discovery of pesticides in Antarctica, where they have never been used, suggests the extent to which aerial transport can carry pollutants from one place to another. Probably the most important natural source of air pollution is volcanic activity, which at times pours great amounts of ash and toxic fumes into the atmosphere. The eruptions of such volcanoes as Krakatoa in Indonesia, Mt. St. Helens in Washington, USA and Katmai in Alaska, USA, have been related to measurable climatic changes.

Listed below are the major air pollutants and their sources:

- . Carbon monoxide (CO)is a colourless, odourless gas that is produced by the incomplete burning of carbon-based fuels including petrol, diesel, and wood. It is also produced from the combustion of natural and synthetic products such as cigarettes. It lowers the amount of oxygen that enters our blood . It can slow our reflexes and make us confused and sleepy.
- Carbon dioxide (CO_2)is the principle greenhouse gas emitted as a result of human activities such as the burning of coal, oil, and natural gases.
- Chloroflorocarbons (CFC) are gases that are released mainly from air-conditioning systems and refrigeration. When released into the air, CFCs rise to the stratosphere, where they come in contact with few other gases, which leads to a reduction of the ozone layer that protects the earth from the harmful ultraviolet rays ofthe sun**.**
- Leadis present in petrol, diesel, lead batteries, paints, hair dye products, etc. Lead affects children in particular. It can cause nervous system damage and digestive problems and, in some cases, cause cancer.

- Ozone occur naturally in the upper layers of the atmosphere. This important gas shields the earth from the harmful ultraviolet rays of the sun. However, at the ground level, it is a pollutant with highly toxic effects. Vehicles and industries are the major source of ground-level ozone emissions. Ozone makes our eyes itch, burn, and water. It lowers our resistance to colds and pneumonia.
- Nitrogen oxide (Nox) causes smog and acid rain. It is produced from burning fuels including petrol, diesel, and coal. Nitrogen oxides can make children susceptible to respiratory diseases in winters.
- Suspended particulate matter (SPM) consists of solids in the air in the form of smoke, dust, and vapour that can remain suspended for extended periods and is also the main source of haze which reduces visibility. The finer of these particles, when breathed in can lodge in our lungs and cause lung damage and respiratory problems.
- Sulphur dioxide (SO_2) is a gas produced from burning coal, mainly in thermal power plants. Some industrial processes, such as production of paper and smelting of metals, produce sulphur dioxide. It is a major contributor to smog and acid rain. Sulfur dioxide can lead to lung diseases.

Sources of Air pollution:

- Stationary Sources" include smoke stacks of power plants, manufacturing facilities (factories) and waste incinerators, as well as furnaces and other types of fuel-burning heating devices. In developing and poor countries, traditional biomass burning is the major source of air pollutants; traditional biomass includes wood, crop waste and dung.[6][7]
- "Mobile Sources" include motor vehicles, marine vessels, aircraft and the effect of sound etc.
- Chemicals, dust and controlled burn practices in agriculture and forestry management. Controlled or prescribed burning is a technique sometimes used in forest management, farming, prairie restoration or greenhouse gas abatement. Fire is a natural part of both forest and grassland ecology and controlled fire can be a tool for foresters. Controlled burning stimulates the germination of some desirable forest trees, thus renewing the forest.
- Fumes from paint, hair spray, varnish, aerosol sprays and other solvents
- Waste deposition in landfills, which generate methane. Methane is not toxic; however, it is highly flammable and may form explosive mixtures with air. Methane is also an asphyxiant and may displace oxygen in an enclosed space. Asphyxia or suffocation may result if the oxygen concentration is reduced to below 19.5% by displacement
- Military, such as nuclear weapons, toxic gases, germ warfare and rocketry
- Natural sources

- Dust from natural sources, usually large areas of land with little or no vegetation
- Methane, emitted by the digestion of food by animals, for example cattle
- Radon gas from radioactive decay within the Earth's crust. Radon is a colorless, odorless, naturally occurring, radioactive noble gas that is formed from the decay of radium. It is considered to be a health hazard. Radon gas from natural sources can accumulate in buildings, especially in confined areas such as the basement and it is the second most frequent cause of lung cancer, after cigarette smoking
- Smoke and carbon monoxide from wildfires
- Vegetation, in some regions, emits environmentally significant amounts of VOCs on warmer days. These VOCs react with primary anthropogenic pollutants—specifically, NOx, SO2, and

anthropogenic organic carbon compounds—to produce a seasonal haze of secondary pollutants.[8]
- Volcanic activity, which produce sulfur, chlorine, and ash particulates

Health effects:

Air pollution is a significant risk factor for multiple health conditions including respiratory infections, heart disease, and lung cancer, according to the WHO. The health effects caused by air pollution may include difficulty in breathing, wheezing, coughing and aggravation of existing respiratory and cardiac conditions. These effects can result in increased medication use, increased doctor or emergency room visits, more hospital admissions and premature death. The human health effects of poor air quality are far reaching, but principally affect the body's respiratory system and the cardiovascular system. Individual reactions to air pollutants depend on the type of pollutant a person is exposed to, the degree of exposure, the individual's health status and genetics.[citation needed]

The most common sources of air pollution include particulate matter, ozone, nitrogen dioxide, and sulfur dioxide. Both indoor and outdoor air pollution have caused approximately 3.3 million deaths worldwide. Children aged less than five years that live in developing countries are the most vulnerable population in terms of total deaths attributable to indoor and outdoor air pollution.[15]

The World Health Organization states that 2.4 million people die each year from causes directly attributable to air pollution, with 1.5 million of these deaths attributable to indoor air pollution.[16] "Epidemiological studies suggest that more than 500,000 Americans die each year from cardiopulmonary disease linked to breathing fine particle air pollution. . ."[17] A study by the University of Birmingham has shown a strong correlation between pneumonia related deaths and air pollution from motor vehicles.[18] Worldwide more deaths per year are linked to air pollution than to automobile accidents.[citation needed] Published in 2005 suggests that 310,000 Europeans die from air pollution annually.[citation needed] Causes of deaths include aggravated asthma, emphysema, lung and heart diseases, and respiratory allergies.[citation needed] The US EPA estimates that a proposed set of changes in diesel engine technology (Tier 2) could result in 12,000 fewer premature mortalities, 15,000 fewer heart attacks, 6,000 fewer emergency room visits by children with asthma, and 8,900 fewer respiratory-related hospital admissions each year in the United States.[citation needed]

The worst short term civilian pollution crisis in India was the 1984 Bhopal Disaster.[19] Leaked industrial vapours from the Union Carbide factory, belonging to Union Carbide, Inc., U.S.A., killed more than 25,000 people outright and injured anywhere from 150,000 to 600,000. The United Kingdom suffered its worst air pollution event when the December 4 Great Smog of 1952 formed over London. In six days more than 4,000 died, and 8,000 more died within the following months.[citation needed] An accidental leak of anthrax spores from a biological warfare laboratory in the former USSR in 1979 near Sverdlovsk is believed to have been the cause of hundreds of civilian deaths.[citation needed] The worst single incident of air pollution to occur in the United States of America occurred in Donora, Pennsylvania in late October, 1948, when 20 people died and over 7,000 were injured.[20]

A new economic study of the health impacts and associated costs of air pollution in the Los Angeles Basin and San Joaquin Valley of Southern California shows that more than 3800 people die prematurely (approximately 14 years earlier than normal) each year because air pollution levels violate federal standards. The number of annual premature deaths is considerably higher than the fatalities related to auto collisions in the same area, which average fewer than 2,000 per year.[21]

Diesel exhaust (DE) is a major contributor to combustion derived particulate matter air pollution. In several human experimental studies, using a well validated exposure chamber setup, DE has been linked to acute vascular dysfunction and increased thrombus formation.[22][23] This serves as a plausible mechanistic link between the previously described association between particulate matter air pollution and increased cardiovascular morbidity and mortality

Effects on COPD and AsthmaMain article: Chronic obstructive pulmonary disease
Chronic obstructive pulmonary disease (COPD) includes diseases such as chronic bronchitis and emphysema.:

Researches have demonstrated increased risk of developing asthma and COPDfrom increased exposure to traffic-related air pollution. Additionally, air pollution has been associated with increased hosptializations and mortality from asthma and COPD.[32][33]

A study conducted in 1960-1961 in the wake of the Great Smog of 1952 compared 293 London residents with 477 residents of Gloucester, Peterborough, and Norwich, three towns with low reported death rates from chronic bronchitis. All subjects were male postal truck drivers aged 40 to 59. Compared to the subjects from the outlying towns, the London subjects exhibited more severe respiratory symptoms (including cough, phlegm, and dyspnea), reduced lung function (FEV1 and peak flow rate), and increased sputum production and purulence. The differences were more pronounced for subjects aged 50 to 59. The study controlled for age and smoking habits, so concluded that air pollution was the most likely cause of the observed differences.

It is believed that much like cystic fibrosis, by living in a more urban environment serious health hazards become more apparent. Studies have shown that in urban areas patients suffer mucus hypersecretion, lower levels of lung function, and more self diagnosis of chronic bronchitis and emphysema.

Possible links to cancerA large Danish epidemiological study found an increased risk of lung cancer for patients who lived in areas with high nitrogen oxide concentrations. In this study, the association was higher for non-smokers than smokersThere are also possible associations between air pollution and other forms of cancer, including cervical cancer and brain cancer.

Impacts of Air Pollution & Acid Rain on Vegetation
Introduction:

"Acid rain" is a general name for many phenomena including acid fog, acid sleet, and acid snow. Although we associate the acid threat with rainy days, acid deposition occurs all the time, even on sunny days.

Sulphur dioxide and nitrogen oxides both combine with water in the atmosphere to create acid rain. Acid rain acidifies the soils and waters where it falls, killing off plants. Many industrial processes produce large quantities of pollutants including sulphur dioxide and nitrous oxide. These are also produced by car engines and are emitted in the exhaust. When sulphur dioxide and nitrous oxide react with water vapour in the atmosphere, acids are produced. The result is what is termed acid rain, which causes serious damage to plants.

In addition, other gaseous pollutants, such as ozone, can also harm vegetation directly.

How Acid Rain Harms Trees

Acid rain does not usually kill trees directly. Instead, it is more likely to weaken the trees by damaging their leaves, limiting the nutrients available to them, or poisoning them with toxic substances slowly released from the soil. The main atmospheric pollutants that affect trees are nitrates and sulphates. Forest decline is often the first sign that trees are in trouble due to air pollution.

Scientists believe that acidic water dissolves the nutrients and helpful minerals in the soil and then washes them away before the trees and other plants can use them to grow. At the same time, the acid rain causes the release of toxic substances such as aluminium into the soil. These are very harmful to trees and plants, even if contact is limited. Toxic substances also wash away in the runoff that carries the substances into streams, rivers, and lakes. Fewer of these toxic substances are released when the rainfall is cleaner.

Even if the soil is well buffered, there can be damage from acid rain. Forests in high mountain regions receive additional acid from the acidic clouds and fog that often surround them. These clouds and fog are often more acidic than rainfall. When leaves are frequently bathed in this acid fog, their protective waxy coating can wear away. The loss of the coating damages the leaves and creates brown spots. Leaves turn the energy in sunlight into food for growth. This process is called photosynthesis. When leaves are damaged, they cannot produce enough food energy for the tree to remain healthy.

Once trees are weak, diseases or insects that ultimately kill them can more easily attack them. Weakened trees may also become injured more easily by cold weather.

How Air Pollution Harms Trees

Whilst acid rain is a major cause of damage to vegetation, air pollutants which can also be harmful directly. These include sulphur dioxide and ozone.

Sulphur Dioxide:
Sulphur dioxide, one of the main components of acid rain, has direct effects on vegetation. Changes in the physical appearance of vegetation are an indication that the plants' metabolism is impaired by the concentration of sulphur dioxide. Harm caused by sulphur dioxide is first noticeable on the leaves of the plants. For some plants injury can occur within hours or days of being exposed to high levels of sulphur dioxide. It is the leaves in mid-growth that are the most vulnerable, while the older and younger leaves are more resistant. You can see the damage to coniferous needles by observing the extreme colour difference between the green base and the bright orange-red tips.

The effects of sulphur dioxide are influenced by other biological and environmental factors such as plant type, age, sunlight levels, temperature, humidity and the presence of other pollutants (ozone and nitrogen oxides). Thus, even though sulphur dioxide levels may be extremely high, the levels may not affect vegetation because of the surrounding environmental conditions. It is also possible that the plants and soils may temporarily store pollutants. By storing the pollutants they are preventing the pollutants from reacting with other substances in the plants or soil.

Ozone:

The effects of ozone on plants have been investigated intensively for almost two decades. Studies made in controlled environment (CE) chambers, glasshouses and in the field, using open-topped chambers, have all contributed to the understanding of the mechanisms underlying ozone effects and their ultimate impact on vegetation. The biochemical mechanisms by which ozone interacts with plants have been intensively studied and, although the relative significance of different initial reactions remains unclear, there is a consensus that the key event in plant responses is oxidative damage to cell membranes. This primary oxidative damage results in the loss of membrane integrity and function, and in turn to inhibition of essential biochemical and physiological processes. A key target is photosynthesis, although ozone may also affect stomatal function and so modify plant responses to other factors, such as drought and elevated carbon dioxide. These changes result in reduced growth and yield in many plants. However, it is clear that such responses vary in magnitude between species and also between different cultivars within species. The mechanisms by which some species and genotypes are protected from ozone injury are not clear, but may include differences in uptake into the leaf or in the various components of antioxidant metabolism. Ozone may also increase the severity of many fungal diseases, while virus infections reduce the effects of ozone in some plants.

Past and Present Pollution:
Acid deposition and ozone exposure have increased considerably in the past 50 years in Asia, Europe and the US, with many reports of tree/forest decline and increased mortality. In general, the more highly polluted forests have the higher rate of decline and mortality. However, there has been no recent chronic deterioration in the UK of tree condition. Since the early 1990s, peak concentrations of ozone have been falling, whilst the large reduction in sulphur dioxide emissions since the 1970s has provided an opportunity for recovery of many plant species. By 2010, atmospheric sulphur dioxide concentrations in the UK should pose little or no threat to vegetation.

Acidification by Forestry:
While forestry has long been considered to be adversely affected by air pollution and acid rain, recent studies show it to be part of the acidifying process. The rough canopies of mature evergreen forests are efficient scavengers of particulate and gaseous contaminants in polluted air. This results in a more acidic deposition under the forest canopies than in open land. Chemical processes at the roots of trees, evergreens in particular, further acidify the soil and soil water in forest catchments. When the forests are located on poorly buffered soils, these processes can lead to a significant acidification of the run-off water and consequent damage to associated streams and lakes.

What is the greenhouse effect?

There are two meanings of the term "greenhouse effect". There is a "natural" greenhouse effect that keeps the Earth's climate warm and habitable. There is also the "man-made" greenhouse effect, which is the enhancement of Earth's natural greenhouse effect by the addition of greenhouse gases from the burning of fossil fuels (mainly petroleum, coal, and natural gas).

In order to understand how the greenhouse effect operates, we need to first understand "infrared radiation". Greenhouse gases trap some of the infrared radiation that escapes from the Earth, making the Earth warmer that it would otherwise be. You can think of greenhouse gases as sort of a "blanket" for infrared radiation-- it keeps the lower layers of the atmosphere warmer, and the upper layers colder, than if the greenhouse gases were not there.

About 80-90% of the Earth's natural greenhouse effect is due to water vapor, a strong greenhouse gas. The remainder is due to carbon dioxide, methane, and a few other minor gases.

It is the carbon dioxide concentration that is increasing, due to the burning of fossil fuels (as well as from some rainforest burning). This is the man-made portion of the greenhouse effect, and it is believed by many scientists to be responsible for the global warming of the last 150 years.

Also, the concentration of methane, although small, has also increased in recent decades. The reasons for this increase, though, are uncertain.

Interesting facts:

DOES THE GREENHOUSE EFFECT EVEN EXIST?The greenhouse warming of the Earth's surface is believed by some people to be physically impossible. They claim it would violate the 2nd Law of Thermodynamics, which basically states that energy must flow from where there is more to where there is less.

The reason for this apparent violation is that the existence of greenhouse gases in the COLDER layers of the atmosphere make the surface WARMER, which would suggest energy flow from colder to warmer, which would seem to violate the 2nd Law. But the greenhouse effect is kind of like adding a lid to cover a pot of water on the stove...even though the lid is colder than the water, its presence actually makes the water warmer.

It's the TOTAL (net) flow of energy which must be from warmer to colder, which is indeed the case in both the greenhouse effect, and adding a lid to the pot of water on the stove.

Greenhouse gases

By their percentage contribution to the greenhouse effect on Earth the four major gases are:[16][17]

water vapor, 36–70%
carbon dioxide, 9–26%
methane, 4–9%
ozone, 3–7%
The major non-gas contributor to the Earth's greenhouse effect, clouds, also absorb and emit infrared radiation and thus have an effect on radiative properties of the atmosphere.[17]

Role in climate change:

The Keeling Curve of atmospheric CO2 concentrations measured at Mauna Loa Observatory.Strengthening of the greenhouse effect through human activities is known as the enhanced (or anthropogenic) greenhouse effect.[18] This increase in radiative forcing from human activity is attributable mainly to increased atmospheric carbon dioxide levels.[19]

CO2 is produced by fossil fuel burning and other activities such as cement production and tropical deforestation.[20] Measurements of CO2 from the Mauna Loa observatory show that concentrations have increased from about 313 ppm [21] in 1960 to about 389 ppm in 2010. The current observed amount of CO2 exceeds the geological record maxima (~300 ppm) from ice core data.[22] The effect of combustion-produced carbon dioxide on the global climate, a special case of the greenhouse effect first described in 1896 by Svante Arrhenius, has also been called the Callendar effect.

Because it is a greenhouse gas, elevated CO2 levels contribute to additional absorption and emission of thermal infrared in the atmosphere, which produce net warming. According to the latest Assessment Report from the Intergovernmental Panel on Climate Change, "most of the observed increase in globally averaged temperatures since the mid-20th century is very likely due to the observed increase in anthropogenic greenhouse gas concentrations".[23]

Over the past 800,000 years,[24] ice core data shows that carbon dioxide has varied from values as low as 180 parts per million (ppm) to the pre-industrial level of 270ppm.[25] Paleoclimatologists consider variations in carbon dioxide concentration to be a fundamental factor influencing climate variations over this time scale.[26][27]

Real greenhouses

A modern Greenhouse in RHS WisleyThe "greenhouse effect" is named by analogy to greenhouses. The greenhouse effect and a real greenhouse are similar in that they both limit the rate of thermal energy flowing out of the system, but the mechanisms by which heat is retained are different.[28] A greenhouse works primarily by preventing absorbed heat from leaving the structure through convection, i.e. sensible heat transport. The greenhouse effect heats the earth because greenhouse gases absorb outgoing radiative energy and re-emit some of it back towards earth.

A greenhouse is built of any material that passes sunlight, usually glass, or plastic. It mainly heats up because the Sun warms the ground inside, which then warms the air in the greenhouse. The air continues to heat because it is confined within the greenhouse, unlike the environment outside the greenhouse where warm air near the surface rises and mixes with cooler air aloft. This can be demonstrated by opening a small window near the roof of a greenhouse: the temperature will drop considerably. It has also been demonstrated experimentally (R. W. Wood, 1909) that a "greenhouse" with a cover of rock salt (which is transparent to infra red) heats up an enclosure similarly to one with a glass cover.[3] Thus greenhouses work primarily by preventing convective cooling.[4][29]

In the greenhouse effect, rather than retaining (sensible) heat by physically preventing movement of the air, greenhouse gases act to warm the Earth by re-radiating some of the energy back towards the surface. This process may exist in real greenhouses, but is comparatively unimportant there.

Bodies other than Earth

In our solar system, Mars, Venus, and the moon Titan also exhibit greenhouse effects.[30] Titan has an anti-greenhouse effect, in that its atmosphere absorbs solar radiation but is relatively transparent to infrared radiation. Pluto also exhibits behavior superficially similar to the anti-greenhouse effect.[31][32]

A runaway greenhouse effect occurs if positive feedbacks lead to the evaporation of all greenhouse gases into the atmosphere.[33] A runaway greenhouse effect involving carbon dioxide and water vapor is thought to have occurred on Venus

The Biggest Danger

This effect moderated temperature on the Earth long before humans began changing the chemistry of the atmosphere. Like a well managed greenhouse, the Earth's surface remained warm, but not too hot, and thus allowed the growth of the lush ecosystems we have inherited. The increase in heat-trapping gases in the Earth's atmosphere caused by human activity means the greenhouse effect could, like a poorly

managed greenhouse that is left closed up on a hot summer day, overheat and do great damage to all the living creatures on the Earth.

The Main Causes: Human Emissions

The primary greenhouse gases include:

■carbon■methane
■nitrogen oxides, and
■fluorinated gases

These make up only one percent or less of the Earth's atmosphere, but they are almost entirely responsible for all of it's heat trapping capacity.

Greenhouse gas levels have increased dramatically since the start of the industrial revolution. Based on scientific study of the Earth's past, it is believed that the atmosphere of the Earth contained about 280 parts per million (ppm) of carbon dioxide before the industrial revolution began, and about .72 ppm of methane. Now the Earth's atmosphere has about 385 ppm of carbon dioxide and about 1.8 ppm of methane.

Impacts of Different Greenhouse Gases:

Carbon dioxide is the largest contributor to global warming, and occurs in relatively high concentrations. On the other hand, methane occurs in low concentrations, but it has a much higher heat-trapping capacity than carbon dioxide per unit volume. In fact, methane is 20 times more potent per unit as a greenhouse gas than carbon dioxide measured on a 100 year scale, and 100 times more potent measured on a 10 year scale. (Methane breaks down relatively quickly in the atmosphere to simpler molecules.)

Other trace gases, like nitrogen oxides, and other human-created fluorinated gases have heat trapping capacities 200-300 times more potent than carbon dioxide.

Humans Are Enhancing the Effect

We have initiated a new geological age: the Anthropocene — the age created by humans. We are brining this new geological era into being by radically increasing the impact of the greenhouse effect.

Carbon levels have increased in the atmosphere as a result of our burning large volumes of fossil fuels that have been trapped underground for millions of years. We have cut down millions of acres of forest and every tree contains carbon, and as a tree is burned or decomposes, that carbon is released into the atmosphere.

We have dangerously increased methane levels in the atmosphere as well. Methane leaks from natural gas wells and coal mines. It is also created anytime organic matter decays under oxygen-staved conditions. This occurs in rice paddies, and in the guts of herbivorous animals. As humans have cleared forests to make farms and expanded the number of cows, sheep, and goats, we have increased the amount of methane in the atmosphere. The arctic tundra is also now melting, and releasing enormous volumes of methane and carbon dioxide.

We Are Creating New Greenhouse Gases:

Humans are now synthesizing more artificial nitrogen, for use as fertilizer, than all of the natural nitrogen fixing process of all of the plants on Earth. In nature, nitrogen is pulled from plants out of the atmosphere in a process called nitrogen fixation. But when this artificial nitrogen is applied to farmland, some of it is released into the atmosphere as nitrogen oxide, a powerful greenhouse gas that is several hundred times more potent per unit volume than either carbon dioxide or methane.

Another set of highly potent gases are fluorinated gases. These are accumulating in our atmosphere. Fluorinated gases are a set of chemicals used as refrigerants, for insulation, and for other industrial purposes.

Global warming:

Global warming refers to the rising average temperature of Earth's atmosphere and oceans, which started to increase in the late 19th century and is projected to keep going up. Since the early 20th century, Earth's average surface temperature has increased by about 0.8 °C (1.4 °F), with about two thirds of the increase occurring since 1980.[2] Warming of the climate system is unequivocal, and scientists are more than 90% certain that most of it is caused by increasing concentrations of greenhouse gases produced by human activities such as deforestation and burning fossil fuels.[3][4][5][6] These findings are recognized by the national science academies of all the major industrialized nations.[7][A]

Climate model projections are summarized in the 2007 Fourth Assessment Report (AR4) by the Intergovernmental Panel on Climate Change (IPCC). They indicate that during the 21st century the global surface temperature is likely to rise a further 1.1 to 2.9 °C (2 to 5.2 °F) for their lowest emissions scenario and 2.4 to 6.4 °C (4.3 to 11.5 °F) for their highest.[8] The ranges of these estimates arise from the use of models with differing sensitivity to greenhouse gas concentrations.[9][10]

An increase in global temperature will cause sea levels to rise and will change the amount and pattern of precipitation, and a probable expansion of subtropical deserts.[11] Warming is expected to be strongest in the Arctic and would be associated with continuing retreat of glaciers, permafrost and sea ice. Other likely effects of the warming include more frequent occurrence of extreme-weather events including heat waves, droughts and heavy rainfall, species extinctions due to shifting temperature regimes, and changes in crop yields. Warming and related changes will vary from region to region around the globe, with projections being more robust in some areas than others.[12] If global mean temperature increases to 4 °C (7.2 °F) above preindustrial levels, the limits for human adaptation are likely to be exceeded in many parts of the world, while the limits for adaptation for natural systems would largely be exceeded throughout the world. Hence, the ecosystem services upon which human livelihoods depend would not be preservedspecies extinctions due to shifting temperature regimes, and changes in crop yields. Warming and related changes will vary from region to region around the globe, with projections being more robust in some areas than others.[12] If global mean temperature increases to 4 °C (7.2 °F) above preindustrial levels, the limits for human adaptation are likely to be exceeded in many parts of the world, while the limits for adaptation for natural systems would largely be exceeded throughout the world. Hence, the ecosystem services upon which human livelihoods depend would not be preserved

Global Warming Causes :

As said, the major cause of global warming is the emission of green house gases like carbon dioxide, methane, nitrous oxide etc into the atmosphere. The major source of carbon dioxide is the power plants. These power plants emit large amounts of carbon dioxide produced from burning of fossil fuels for the purpose of electricity generation. About twenty percent of carbon dioxide emitted in the atmosphere comes from burning of gasoline in the engines of the vehicles. This is true for most of the developed

countries. Buildings, both commercial and residential represent a larger source of global warming pollution than cars and trucks.

Building of these structures require a lot of fuel to be burnt which emits a large amount of carbon dioxide in the atmosphere. Methane is more than 20 times as effectual as CO2 at entrapping heat in the atmosphere. Methane is obtained from resources such as rice paddies, bovine flatulence, bacteria in bogs and fossil fuel manufacture. When fields are flooded, anaerobic situation build up and the organic matter in the soil decays, releasing methane to the atmosphere. The main sources of nitrous oxide include nylon and nitric acid production, cars with catalytic converters, the use of fertilizers in agriculture and the burning of organic matter. Another cause of global warming is deforestation that is caused by cutting and burning of forests for the purpose of residence and industrialization.

Global Warming is Inspiring Scientists to Fight for Awareness:

Scientists all over the world are making predictions about the ill effects of Global warming and connecting some of the events that have taken place in the pat few decades as an alarm of global warming. The effect of global warming is increasing the average temperature of the earth. A rise in earth's temperatures can in turn root to other alterations in the ecology, including an increasing sea level and modifying the quantity and pattern of rainfall. These modifications may boost the occurrence and concentration of severe climate events, such as floods, famines, heat waves, tornados, and twisters. Other consequences may comprise of higher or lower agricultural outputs, glacier melting, lesser summer stream flows, genus extinctions and rise in the ranges of disease vectors. As an effect of global warming species like golden toad, harlequin frog of Costa Rica has already become extinct. There are number of species that have a threat of disappearing soon as an effect of global warming. As an effect of global warming various new diseases have emerged lately. These diseases are occurring frequently due to the increase in earths average temperature since the bacteria can survive better in elevated temperatures and even multiplies faster when the conditions are favorable. The global warming is extending the distribution of mosquitoes due to the increase in humidity levels and their frequent growth in warmer atmosphere. Various diseases due to ebola, hanta and machupo virus are expected due to warmer climates. The marine life is also very sensitive to the increase in temperatures. The effect of global warming will definitely be seen on some species in the water. A survey was made in which the marine life reacted significantly to the

changes in water temperatures. It is expected that many species will die off or become extinct due to the increase in the temperatures of the water, whereas various other species, which prefer warmer waters, will increase tremendously. Perhaps the most disturbing changes are expected in the coral reefs that are expected to die off as an effect of global warming. The global warming is expected to cause irreversible changes in the ecosystem and the behavior of animals.

What is Global Warming and Climate Change?

Global warming and climate change refer to an increase in average global temperatures. Natural events and human activities are believed to be contributing to an increase in average global temperatures. This is caused primarily by increases in "greenhouse" gases such as Carbon Dioxide (CO_2).

A warming planet thus leads to a change in climate which can affect weather in various ways, as discussed further below.

What is the Greenhouse Effect?

The term greenhouse is used in conjunction with the phenomenon known as the greenhouse effect.

- Energy from the sun drives the earth's weather and climate, and heats the earth's surface;
- In turn, the earth radiates energy back into space;
- Some atmospheric gases (water vapor, carbon dioxide, and other gases) trap some of the outgoing energy, retaining heat somewhat like the glass panels of a greenhouse;
- These gases are therefore known as greenhouse gases;
- The greenhouse effect is the rise in temperature on Earth as certain gases in the atmosphere trap energy

Solid Waste management is the collection, transport, processing or disposal, managing and monitoring of waste materials. The term usually relates to materials produced by human activity, and the process is generally undertaken to reduce their effect on health, the environment or aesthetics. Waste management is a distinct practice from resource recovery which focuses on delaying the rate of consumption of natural resources. The management of wastes treats all materials as a single class, whether solid, liquid, gaseous or radioactive substances, and tried to reduce the harmful environmental impacts of each through different methods.

Waste management practices differ for developed and developing nations, for urban and rural areas, and for residential and industrial producers. Management for non-hazardous waste residential and institutional waste in metropolitan areas is usually the responsibility of local government authorities, while management for non-hazardous commercial and industrial waste is usually the responsibility of the generator.

Solid Waste Management Techniques:

Managing domestic, industrial and commercial waste has traditionally consisted of collection, followed by disposal. Depending upon the type of waste and the area, a level of processing may follow collection. This processing may be to reduce the hazard of the waste, recover material for recycling, produce energy from the waste, or reduce it in volume for more efficient disposal.

Collection methods vary widely between different countries and regions, and it would be impossible to describe them all. For example, in Australia most urban domestic households have a 240-litre bin that is emptied weekly by the local Council. Many areas, especially those in less developed areas, do not have a formal waste-collection system in place.

Disposal methods also vary widely. In Australia, the most common method of disposal of solid waste is to landfills, because it is a large country with a low-density population. By contrast, in Japan it is more common for waste to be incinerated, because the country is smaller and land is scarce.

Landfill

Disposing of waste in a landfill is the most traditional method of waste disposal, and it remains a common practice in most countries. Historically, landfills were often established in disused quarries, mining voids or borrow pits. A well-run landfill can be a hygienic and relatively inexpensive method of disposing of waste materials.

Older or poorly managed landfills can create number of adverse environmental impacts, including wind-blown litter, attraction of vermin and soluble contaminants (leachate) leaching into and polluting groundwater. Another product of landfills containing putrescible wastes is landfill gas (mostly composed of methane and carbon dioxide), which is produced as the waste breaks down.

Characteristics of a modern, well-run landfill should include methods to contain leachate, such as clay or plastic liners. Disposed waste should be compacted and covered to prevent vermin and wind-blown litter.

Many landfills also have a landfill gas extraction system installed after they are closed to extract the gas generated by the decomposing waste materials. This gas is often burnt to generate power. Generally, even flaring the gas off is a better environmental outcome than allowing it to escape to the atmosphere, as this consumes the methane (a far more potent greenhouse gas than carbon dioxide).

Many local authorities (especially in urban areas) have found it difficult to establish new landfills, due to opposition from adjacent landowners. Few people want a landfill in their local neighbourhood. As a result, solid waste disposal in these areas has become more expensive as material must be transported further away for disposal.

Some oppose the use of landfills in any way, anywhere, arguing that the logical end result of landfill operations is that it will eventually leave a drastically polluted planet with no canyons, and no wild space. Some futurists have stated that landfills will be the "mines of the future": as some resources become more scarce, they will become valuable enough that it would be necessary to 'mine' them from landfills where these materials were previously discarded as valueless.

This fact, as well as growing concern about the impacts of excessive materials consumption, has given rise to efforts to minimise the amount of waste sent to landfill in many areas. These efforts include taxing or levying waste sent to landfill, recycling the materials, converting material to energy, designing products that require less material, etc. A related subject is that of industrial ecology, where the material flows between industries is studied. The by-products of one industry may be a useful commodity to another, leading to reduced waste materials.

Incineration

Incineration is the process of destroying waste material by burning it. Incineration is carried out both on a small scale by individuals, and on a large scale by industry. It is recognised as a practical method of disposing of hazardous waste materials (such as biological medical waste).

Though still widely used in many areas (especially developing countries), incineration as a waste management tool is becoming controversial for several reasons.

First, it may be a poor use of many waste materials because it destroys not only the raw material, but also all of the energy, water, and other natural resources used to produce it. Some energy can be reclaimed as

electricity by using the combustion to create steam to drive an electrical generator, but even the best incinerator can only recover a fraction of the caloric value of fuel materials.

Second, incineration creates toxic gas and ash, which can harm local populations and pollute groundwater. Modern, well-run incinerators take elaborate measures to reduce the amount of toxic products released in exhaust gas. But concern has increased in recent years about the levels of dioxins that are released when burning mixed waste.

Until recently, safe disposal of incinerator waste was a major problem. In the mid-1990s, experiments in France and Germany used electric plasma torches to melt incinerator waste into inert glassy pebbles, valuable in concrete production. Incinerator ash has also been chemically separated into lye and other useful chemicals

Volume reduction

This means various techniques for making the waste fit into less space and easier to handle in bulk. Usually achieved by compaction or fragmentation.

Compaction

The waste is compacted or compressed. It also breaks up large or fragile items of waste.

- This process is conspicuous in the feed at the back end of many garbage collection vehicles.
- See car crusher
- In landfill sites, the waste is often compacted by driving over it a heavy excavator-type vehicle with spiked wheels.

Shearing

The waste is sliced with heavy metal shears.

Grinding

The waste is ground up hammer mill.

Resource Recovery Techniques

A relatively recent idea in waste management has been to treat the waste material as a resource to be exploited, instead of simply a challenge to be managed and disposed of. There are a number of different methods by which resources may be extracted from waste: the materials may be extracted and recycled, or the calorific content of the waste may be converted to electricity.

The process of extracting resources or value from waste is variously referred to as secondary resource recovery, recycling, and other terms. The practice of treating waste materials as a resource is becoming more common, especially in metropolitan areas where space for new landfills is becoming scarcer. There is also a growing acknowledgement that simply disposing of waste materials is unsustainable in the long term, as there is a finite supply of most raw materials.

There are a number of methods of recovering resources from waste materials, with new technologies and methods being developed continuously

Recycling

Recycling means to reuse a material that would otherwise be considered waste. The popular meaning of 'recycling' in most developed countries has come to refer to the widespread collection and reuse of single-use beverage containers. These containers are collected and sorted into common groups, so that the raw materials of the items can be used again (recycled).

In developed countries, the most common consumer items recycled include aluminium beverage cans, steel food and aerosol cans, HDPE and PETplastic bottles, glass bottles and jars, paperboard cartons, newspapers, magazines, and cardboard. Other types of plastic (PVC, LDPE, PP, and PS: see resin identification code) are also recyclable, although not as commonly collected. These items are usually composed of a single type of material, making them relatively easy to recycle into new products. The recycling of obsolete computers and electronic equipment is important although more costly due to the separation and extraction problems. The recycling of junked automobiles also depends on the scrap metal market.

Recycled or used materials have to compete in the marketplace with new (virgin) materials. The cost of collecting and sorting the materials usually means that they are equally or more expensive than virgin

materials. This is most often the case in developed countries where industries producing the raw materials are well-established. Practices such as trash picking can reduce this value further, as choice items are removed (such as aluminium cans). In some countries, recycling programs are subsidised by deposits paid on beverage containers (see container deposit legislation).

Not accounted for by most economic systems are the benefits to the environment of recycling these materials, compared with extracting virgin materials. It usually requires significantly less energy, water and other resources to recycle materials than to produce new materials. For example, recycling 1000 kg of aluminium cans saves approximately 5000 kg of bauxite ore being mined and 95% of the energy required to refine it (source: ALCOA Australia).

In many areas, material for recycling is collected separately from general waste, with dedicated bins and collection vehicles. Other waste management processes recover these materials from general waste streams. This usually results in greater levels of recovery than separate collections of consumer-separated beverage containers, but are more complex and expensive.

Composting and Digestion

Waste materials that are organic in nature, such as food scraps and paper products, are increasingly being recycled. These materials are put through a composting or artificial digestion process to decompose the organic matter and kill pathogens. The organic material is then recycled as mulch or compost for agricultural or landscaping purposes.

There are a large variety of composting methods and technologies, varying in complexity from simple window composting of shredded plant material, to automated enclosed-vessel digestion of mixed domestic waste. Composting methods can be broadly categorised into aerobic or anaerobic methods, although hybrids of the two methods also exist.

Composting and Digestion Programs

The Green Bin Program, a form of organic recycling used in Markham, Ontario, Canada, makes use of anaerobic digestion to reduce the amount of garbage shipped to Michigan, in the United States. This is the newest facet of the 3-stream waste management system has been implemented in the town and is another step towards the goal of diverting 70% of current waste away from the landfills. Green Bins allow any

organic waste that in the past would have formed landfill waste to be composted and turned into nutrient rich soil. Examples of waste products for the Green Bin are food products and scraps, soiled papers and sanitary napkins. Currently, Markham-- like the other municipalities in the Greater Toronto Area-- ships all of its garbage to Michigan at a cost of $22 CAN per metric tonne.

The Green Bin Program is currently being studied by other Municipalities in the province of Ontario as a way of diverting waste away from the landfills. Notably, Toronto and Ottawa are in the preliminary stages of adopting a similar program.

The City of Edmonton, Alberta, Canada has adopted large-scale composting to deal with its urban waste. Its composting facility is the largest of its type in the world, representing 35 per cent of Canada's centralized composting capacity. The $100-million co-composter allows Edmonton to recycle 65 per cent of its residential waste. The co-composter iself is 38,690 square metres in size, equivalent to 8 football fields. It's designed to process 200,000 tonnes of residential solid waste per year and 22,500 dry tonnes of biosolids, turning them into 80,000 tonnes of compost annually.

Incineration, Pyrolysis and Gasification

Use of incinerators for waste management is controversial, and most Americans passionately oppose it. This controversy roots from the understandable conflict between short-term concerns and long-term ones, in this case between burning the wastes now, or postponing this problem by passing the waste burden to future generations. Whether any form of incineration or thermal treatment should be defined as "resource recovery" is a matter of dispute in policy-making circles.

Pyrolysis and Gasification are two related forms of thermal treatment where materials are incinerated with limited oxygen. The process typically occurs in a sealed vessel, under high temperature and pressure. Converting material to energy this way is more efficient than direct incineration, with more energy able to be recovered and used.

Pyrolysis of solid waste converts the material into solid, liquid and gas products. The liquid oil and gas can be burnt to produce energy or refined into other products. The solid residue (char) can be further refined into products such as activated carbon.

Gasification is used to convert organic materials directly into a synthetic gas composed of carbon monoxide and hydrogen. The gas is then burnt to produce electricity and steam. Gasification is used in biomass power stations to produce renewable energy and heat.

Hazardous waste:

A **Hazardous waste** is waste that poses substantial or potential threats to public health or the environment. In the United States, the treatment, storage and disposal of hazardous waste is regulated under the Resource Conservation and Recovery Act (RCRA). Hazardous wastes are defined under RCRA in 40 CFR 261 where they are divided into two major categories: characteristic wastes and listed wastes.[1]

- Characteristic hazardous wastes are materials that are known or tested to exhibit one or more of the following four hazardous traits:
    - ignitability (i.e., flammable)
    - reactivity
    - corrosivity
    - toxicity
- Listed hazardous waste are materials specifically listed by regulatory authorities as a hazardous waste which are from non-specific sources, specific sources, or discarded chemical products [2].

The requirements of RCRA apply to companies that generate hazardous waste as well as those companies that store or dispose of hazardous waste in the United States. Many types of businesses generate hazardous waste. For example, dry cleaners, automobile repair shops, hospitals, exterminators, and photo processing centers may all generate hazardous waste. Some hazardous waste generators are larger companies such as chemical manufacturers, electroplating companies, and oil refineries.

These wastes may be found in different physical states such as gaseous, liquids, or solids. A hazardous waste is a special type of waste because it cannot be disposed of by common means like other by-products of our everyday lives. Depending on the physical state of the waste, treatment and solidification processes might be required.

Worldwide, The United Nations Environmental Programme(UNEP) estimated that more than 400 million tons of hazardous wastes are produced universally each year, mostly by industrialized countries (schmit, 1999). About 1- percent of this total is shipped across international boundaries, with the majority of the transfers occurring between countries in the Organization for the Economic Cooperation and Development(OECD) (Krueger, 1999).[3] Some of the reasons for industrialized countries to ship the hazardous waste to industrializing countries for disposal are the rising cost of disposing hazardous waste in the home country.

Final disposal of hazardous waste

Historically, some hazardous wastes were disposed of in regular landfills. This resulted in unfavorable amounts of hazardous materials seeping into the ground. These chemicals eventually entered natural hydrologic systems. Many landfills now require countermeasures against groundwater contamination, an example being installing a barrier along the foundation of the landfill to contain the hazardous substances that may remain in the disposed waste.[4] Currently, hazardous wastes must often be stabilized and solidified in order to enter a landfill and many hazardous wastes undergo different treatments in order to stabilize and dispose of them.

Recycling

Many hazardous wastes can be recycled into new products. Examples might include lead-acid batteries or electronic circuit boards where the heavy metalsr these types of ashes go though the proper treatment, they could bind to other pollutants and convert them into easier-to- dispose solids, or they could be used as pavement filling. Such treatments reduce the level of threat of harmful chemicals, like fly and bottom ash[citation needed], while also recycling the safe product.

Portland cement

Another commonly used treatment is cement based solidification and stabilization. Cement is used because it can treat a range of hazardous wastes by improving physical characteristics and decreasing the toxicity and transmission of contaminants. The cement produced is categorized into 5 different divisions, depending on its strength and components. This process of converting sludge into cement might include

the addition of pH adjustment agents, phosphates, or sulfur reagents to reduce the settling or curing time, increase the compressive strength, or reduce the leach ability of contaminants.

Neutralization

Some HW can be processed so that the hazardous component of the waste is eliminated: making it a non-hazardous waste. An example of this might include a corrosive acid that is neutralized with a basic substance so that it is no-longer corrosive. (see acid-base reactions.)Another mean to neutralize some of the waste is pH adjustment. pH is an important factor on the leaching activity of the hazardous waste. By adjusting the pH of some toxic materials, we are reducing the leaching ability of the waste.

Incineration, destruction and waste-to-energy

A HW may be "destroyed" for example by incinerating it at a high temperature. Flammable wastes can sometimes be burned as energy sources. For example many cement kilns burn HWs like used oils or solvents. Today incineration treatments not only reduce the amount of hazardous waste, but also they also generate energy throughout the gases released in the process. It is known that this particular waste treatment releases toxic gases produced by the combustion of byproduct or other materials and this can affect the environment. However, current technology has developed more efficient incinerator units that control these emissions to a point that this treatment is considered a more beneficial option. There are different types of incinerators and they vary depending on the characteristics of the waste. Starved air incineration is another method used to treat hazardous wastes. Just like in common incineration, burning occurs, however controlling the amount of oxygen allowed proves to be significant to reduce the amount of harmful byproducts produced. Starved Air Incineration is an improvement of the traditional incinerators in terms of air pollution. Using this technology it is possible to control the combustion rate of the waste and therefore reduce the air pollutants produce in the process.

Hazardous waste landfill (sequestering, isolation, etc.)

A HW may be sequestered in a HW landfill or permanent disposal facility. "In terms of hazardous waste, a landfill is defined as a disposal facility or part of a facility where hazardous waste is placed or on land and which is not a pile, a land treatment facility, a surface impoundment, an underground injection well, a

salt dome formation, a salt bed formation, an underground mine, a cave, or a corrective action management unit

Bio-Medical Waste Management:

Introduction

Bio-Medical Waste is any waste generated during the diagnosis, treatment or immunization of human beings or in research activity . The waste produced in the course of health care activities carries a higher potential for infection and injury than any other type of waste

Bio-Medical waste generated in the hospital falls under two major Categories - Non Hazardous and Bio Hazardous. Constituents of Non Hazardous waste are Non-infected plastic, cardboard, packaging material, paper etc. Bio hazardous waste again falls into two types (a) Infectious waste- sharps, non sharps, plastics disposables, liquid waste, etc. (b) Non infectious waste-radioactive waste, discarded glass, chemical waste, cytotoxic waste, incinerated waste etc

Approximately 75-90% of the Bio-Medical waste is non-hazardous and as harmless as any other municipal waste. The remaining 10-25% is hazardous and can be injurious to humans or animals and deleterious to environment. It is important to realise that if both these types are mixed together then the whole waste becomes harmful

Major hospitals contribute substantially to the quantum of Bio-Medical waste generated. Smaller hospitals, nursing homes, clinics, pathological laboratories, blood banks, etc also contribute a major chunk.

Biomedical waste, (BMW), consists of solids, liquids, sharps, and laboratory waste that are potentially infectious or dangerous and are considered biowaste. It must be properly managed to protect the general public, specifically healthcare and sanitation workers who are regularly exposed to biomedical waste as an occupational hazard.

Biomedical waste differs from other types of hazardous waste, such as industrial waste, in that it comes from biological sources or is used in the diagnosis, prevention, or treatment of diseases. Common producers of biomedical waste include hospitals, health clinics, nursing homes, medical researchlaboratories, offices of physicians, dentists, and veterinarians, home health care, and funeral homes.

Biomedical Waste Management

Sorting of medical wastes in hospital.At the site where it is generated, biomedical waste is placed in specially-labelled bags and containers for removal by biomedical waste transporters. Other forms of waste should not be mixed with biomedical waste as different rules apply to the treatment of different types of waste.

Household biomedical waste usually consists of needles and syringes from drugs administered at home (such as insulin), soiled wound dressings, disposable gloves, and bedsheets or other cloths that have come into contact with bodily fluids.[1] Disposing of these materials with regular household garbage puts waste collectors at risk for injury and infection especially from sharps as they can easily puncture a standard household garbage bag. Many communities have programs in place for the disposal of household biomedical waste. Some waste treatment facilities also have mail-in disposal programs. Biomedical waste treatment facilities are licensed by the local governing body which maintains laws regarding the operation of these facilities. The laws ensure that the general public is protected from contamination of air, soil,groundwater, or municipal water supply. A company that helps out by putting all of the laws and information in one location is B&D Biomedical Waste Services, they have all websites and links to all laws in Florida for the safe and proper disposal of biomedical waste. Another company, BioMedical Technology Solutions, Inc., offers a green alternative to haul-away services for disposal of biomedical waste. The Company's desktop unit, the Demolizer® II, is the only patented, portable, and self-contained system able to process both sharps and typical red bag biomedical waste onsite. Upon processing the

biomedical waste in the unit, all regulatory paperwork is printed from the system and the waste is able to be disposed of as common trash.

Protection from Biomedical Waste

Wash your hands with soap and warm water after handling biomedical waste. Also, wash all areas of your body with soap and water that you think may have come into contact with biomedical waste, even if you are not sure your body actually touched the biomedical waste.

- Keep all sores and cuts covered.
- Immediately replace wet bandages with clean, dry bandages.
- Wear disposable latex gloves when handling biomedical waste. Discard the gloves immediately after use.
- Wear an apron or another type of cover to protect your clothes from contact with the waste. If your clothes become soiled, put on fresh clothes, and take a shower, if possible.
- Launder or throw away clothes soiled with biomedical waste.
- Promptly clean and disinfect soiled, hard-surfaced floors by using a germicidal or bleach solution and mopping up with paper towels.
- Clean soiled carpets. First blot up as much of the spill as possible with paper towels and put the soiled paper towels in a plastic lined, leak-proof container. Then try one of the following:
- Steam clean the carpet with an extraction method.
- Scrub the carpet with germicidal rug shampoo and a brush. Soak the brush used for scrubbing in a disinfectant solution and rinse the brush. Let the carpet dry, and then vacuum it.
- Never handle syringes, needles, or lancets with your hands. Use a towel, shovel, and/or broom and a dustpan to pick up these sharp objects. Dispose of them in a plastic soda pop bottle with a cap. Tape down the bottle cap. Then throw the bottle in the trash.

As per Bio-Medical Waste (Management and Handling) Rules, 1998 and

amendments, any waste, which is generated during the diagnosis, treatment or immunization of human beings or animals or in research activities pertaining there to or in the production of testing of biological and including categories mentioned in schedule 1 of the Rule, is the bio-medical waste.

As per WHO norms the health-care waste includes all the waste generated by healthcare establishments, research facilities, and laboratories. In addition, it includes the waste originating from minor or scattered sources such as that produced in the course of health care undertaken in the home (dialysis, insulin injections, etc.).

1.2 Risks to Personnel Due to Bio-Medical Waste

Poor bio-medical waste management exposes hospital and other health care facility workers, waste handlers and community to infection, toxic effects and injuries.

Doctors, nurses, paramedical staff, sanitary staff, hospital maintenance personnel, patients receiving treatment, visitors to the hospital, support service personnel ,workers in waste disposal facilities, scavengers, general public and more specifically the children playing with the items they can find in the waste outside the hospital when it is directly accessible to them are potentially at risk of being injured or infected when they are exposed to bio- medical waste.

Risk to all those who generate, collect, segregate, handle, package, store, transport, treat and dispose waste (an occupational hazard). Occupational exposure to blood can result from percutaneous injury (needle stick or other sharps injury), mucocutaneous

injury (splash of blood or other body fluids into the eyes, nose or mouth) or blood contact with non-intact skin. Over 20 blood born diseases can be transmitted but particular concern is the threat of spread of infectious and communicable diseases like AIDS, Hepatitis B & C, Cholera, Tuberculosis, Diphtheria etc. Waste chemicalsradioactive waste and heavy metals also finds its way in waste stream which are also hazardous to health.

Dangers of improper Management of Bio-Medical Waste:

There is public health hazard due to poor management of bio-medical waste which can cause a number of disease. Serious situations are very likely to happen when biomedical waste is dumped on uncontrolled sites where it can be easily accessed by public. Children and rag pickers are particularly at risk to come in contact with infectious waste. Inappropriate treatment and disposal contributes to environmental pollution (uncontrolled incineration causes air pollution, dumping in drains, tanks and along the river bed causes water pollution and unscientific land filling causes soil pollution).

In many parts of the country bio-medical waste is neither segregated nor disinfected. It is being indiscriminately dumped into municipal bins, along the roadsides, into water bodies or is being burnt in the open air. All this is leading to rapid proliferation and spreading of infectious, dangerous and fatal communicable diseases. The improper handling and mismanagement of bio- medical waste is posing serious

problems, few of the problems due to improper disposal are as follows.

• The infectious waste which is only 20% – 25% of the entire waste from hospitals is not segregated and is mixed with general waste by doing so the whole of waste may turn up to infectious waste. If the same is dumped into the municipal bin then there are fair chances of the waste in municipal bin to become infectious.

• The disposal of sharps will lead to needle stick injuries, cuts, and infections among hospital staff, municipal workers, rag pickers and the general public. This will lead to transmission of diseases like Hepatitis B, C, E and HIV etc.

• The needles and syringes which are not mutilated or destroyed are being circulated back through traders who employ the poor and the destitute to collect such waste for repackaging and selling in the market.

• One of the reasons for spreading of infection is reuse of disposable items like syringes, needles, catheters, IV and dialysis sets etc

unit 3

ENVIRONMENTAL IMPACT ASSESSMENT (EIA):

Purpose

EIA is intended to identify the impacts (both beneficial and adverse) of a proposed public and private development activities. Often, the focus is dominantly environmental (biophysical); but good practice also addresses social and economic aspects. EIA is mainly used at the level of specific developments and projects such as dams, industrial plants, transport infrastructure (eg airport runways and roads), farm

enterprises, natural resource exploitation (eg sand extraction). Strategic environmental assessment (SEA) is a sister tool applied upstream at the level of policies, plans and programmes. Like SEA, EIA is most valuable when applied early in the planning process for a project as a support to decision-making. It provides a means to identify the most environmentally suitable option at an early stage, the best practicable environmental option, and alternatives to the proposed initiative; and thus avoid or minimise potentially damaging and costly negative impacts, and maximise positive impacts.

The aim of an EIA is to ensure that potential impacts are identified and addressed at an early stage in the projects planning and design. To achieve this aim, the assessment finding are communicated to all the relevant groups who will make decisions about the proposed projects, the project developers and their investors as well as regulators , planners and the politicians. Having read the conclusions of an environmental impact assessment, project planners and engineers can shape the project so that its benefits can be achieved and sustained with out causing adverse impacts.

THE EIA PROCESS IN INDIA:

The role for EIA was formally recognized at the earth summit held at Rio conference in 1992. Principle 17 of the Rio declaration states that –
"EIA as a national instrument shall be undertaken for the proposed activities that are likely to have significant adverse impact on the environment and are subject to a decision of a competent national authority".
In India many of the developmental projects till as recently as the 1980s were implemented with very little or no environmental concerns. The environmental issues began receiving attention when a national committee on environmental planning and coordination was set up under the 4th five year plan (1969-1978). Till 1980, the subjects of environment and forests were the concern of the Dept of Science and Technology and Ministry of Agriculture respectively.
Later, the issues were formally attended by the Dept of Environment which was established in 1980. This was then upgraded to the Ministry of Environment & Forest in 1985. In 1980, clearance of large projects from the environmental angle became an administrative requirement to the extent that the planning commission and the central investment board sought proof of such clearance before according financial sanction.
Five year later, the Dept of Environment and Forests, Government of India, issued guidelines for Environmental Assessment of river valley projects. These guidelines require various studies such as impacts on forests and wild life in the submergence zone, water logging potential, upstream and down stream aquatic ecosystems and fisheries, water related diseases, climatic changes and sesmicity.
A major legislative measures for the purpose of environmental clearance was in 1994 when specific notification was issued under section 3 and rule 5 of the environment protection Act , 1986 called the "Environment impact Assessment Notification 1994".
The first step in seeking environmental clearance for a development project is to determine what statutory legislations apply to the particular project. The MOEF has brought out several notifications restricting the development of industries in specified ecologically sensitive areas. In addition there are also draft rules framed for the siting of industries.
Environmental clearance for development projects can be obtained either at the state level or at the central

level depending on certain criteria concerning the characteristics of the project. However (regardless of where the final environmental clearance is obtained from), for most projects the consent must first be taken from the state pollution control board or pollution control committees in the case of union terriorities.

ISO 9000:

The purpose of the ISO 9000 standard initially (1987 & 1994 revisions) was to provide a company with the minimum requirements for a quality system to be effective in providing customers with products of a consistent quality that met their requirements. Certification or Registration (the terms are used interchangeably) to ISO 9001, 9002 or 9003 provided customer organizations with confidence that a supplier had implemented an appropriate quality system, therefore providing a more reliable quality of product. If problems with the quality of products should arise, the customer complaint and corrective action system would ensure correction of the problem and prevention of recurrence.

The standards were updated in 1994 (ISO9000:1994) and again in December 2000 (ISO 9000:2000). All companies certified to one of the earlier ISO9000:1994 standards are required to re-certify under the latest ISO9000:2000 standard by December 2003 in order to maintain certification. This section is provided for reference only.

The old ISO 9000:1994 Series was a set of five individual, but related, international standards on quality management and quality assurance. They are generic in nature and not specific to any particular product or service. These standards were developed with the goal of effectively documenting the quality system elements to be implemented in order to maintain an efficient quality system in a company. However, the standards themselves do not specify the means to be used for implementing the quality system elements

ISO 9000 and ISO 14000:

ISO 9000 has become synonymous with quality. ISO 9000 translates "quality management" into a continuously improving process designed to meet or exceed customer and regulatory requirements.ISO 14000 has become synonymous with quality environmental matters. ISO 14000 translates "environmental management" into a continuously improving process designed to minimize harmful environment effects while improving environmental performance. The original set of ISO 14000 standards were published in 1997.

The ISO 14000 series of environmental management standards are intended to assist organizations manage the environmental effect of their business practices. The ISO 14000 series is similar to the ISO 9000 series published in 1987. The purpose of the ISO 9000 series is to encourage organizations to institute quality assurance management programs. Although ISO 9000 deals with the overall management of an organization and ISO 14000 deals with the management of the environmental effects of an organization, both standards are concerned with processes, and there is talk of combining the two series into one.

Both series of standards were published by ISO, the International Organization for Standardization. The purpose of ISO is to facilitate international trade and cooperation in commercial, intellectual, scientific and economic endeavors by developing international standards. ISO originally focused on industrial and mechanical engineering standards. Now, it has ventured into setting standards for an organization's processes, policies, and practices.

Both series of standards stemmed from concerns about international trade. One of the issues of the 1986 GATT negotiations in Uruguay was the removal of non-tariff trade barriers. Standards fall into this category. The ISO 9000 standard was published about a year after the Uruguay GATT negotiations. The ISO 14000 standards are a response to both the GATT negotiations and to the growing global concern for the environment as evidenced by the 1992 Rio Conference on the environment.

Both the ISO 9000 and the ISO 14000 series have critics and proponents. The critics of the standards point out that quality management policies proposed by ISO 9000 do not necessarily result in quality products. Critics also project that the environmental management policies of ISO 14000 will not guarantee that an organization is not damaging the environment. Both series require third-party certification, and the certification business is booming, thanks in part to these two standards. Questions have risen regarding the fairness of the certification process. Both series are heavy in their documentation requirements and demand a significant amount of time and personnel.

The proponents of the series point to the economic benefits that can be gained by putting the standards into practice. These benefits include the opening of new markets and the development of streamlined procedures, which can lead to increased profits. There are also non-tangible benefits of ISO 14000 certification, such as improved employee morale, improved corporate image, and the feeling of "doing the right thing".

Because of the strong similarities between the two standards, it is almost impossible to discuss ISO 14000 without including a discussion of ISO 9000 and the ISO standards-setting process. In addition, the experiences that organizations have had with the ISO 9000 series have raised questions that many people want resolved before they wholeheartedly embrace the ISO 14000 series.

A Review of ISO 9000

The ISO 9000 standards for quality assurance and quality management were published in 1987 by ISO Technical Committee 176. This series of standards had a dramatic impact due to their scope and rate of acceptance. This series of standards applies to all sizes and types of manufacturing and service companies and cover almost everything in a company's business functions with the main focus on processes, procedures and practices. As Hall states "The focus was to do things right in the first place rather th an the retrospective, and more expensive, doctrine of inspection for faults after the event." (Hall, T. J. The Quality Systems Manual: the definitive guide to the ISO 9000 family and TickIt. John Wiley and Sons: Chicester, England.1995).

The history behind this series of standards can be traced to the USA during World War II. From the USA, the concept of quality assurance spread to Europe via NATO where it evolved into the Allied Quality

Assurance Publication (AQAP). This series of docu ments discussed everything from production efficiency to selection of suppliers. The AQAP series were adopted by the UK Ministry of Defense for the British Armed Forces. This series had a trickle down effect as organizations began to require quality ass urance programs from their suppliers. The problem was that there was much diversity in the requirements for different organizations

The diversity issue was addressed by the British Standard BS 5750 which was based on the AQAP series and was introduced in 1979. The BS 5750 standard was considered so effective that it was adopted almost without change by ISO in 1987 as ISO 9000. The f ormation of the European Union and the perception that it was required in order to do business with Europe lead to the widespread acceptance of the ISO 9000 series.

The main documents in this series are:

- ISO 9000 - Guidelines for selection and use.
- ISO 9002 - Quality Systems Model for quality assurance in design, development, production and servicing.
- ISO 9003 - Quality Systems Model for quality assurance in final inspection and test.
- ISO 10011 - Guidelines for auditing quality systems.
- ISO 10012 - Quality assurance requirements for measuring equipment.
- ISO 10013 - Guidelines for developing quality manuals.

The main value of the 9000 series is that the analyses of processes required by the standard leads to improving or re-engineering of processes. The benefits to a company who follows the standard's practices are said to be new markets for their goods and services, increased cost-efficiency, improved employee morale and increased customer satisfaction.

ISO 14000 Overview

Many believe that environmental protection movements originated in the 1960s. However, the sentiments of environmentalism can be seen in the conservation efforts that began in the late 1800s. The first environmental protection law in the United States w as the Refuse Act of 1899. However, it was not until the 1960s that the environment became a political and consumer issue.

Increased environmental activism in the 1980s created a greater consumer awareness of the environmental issues. More and more environmental regulations were enacted and companies began to use their adherence to these regulations as marketing tools. The Rio Conference on the Environment in 1992 reflected increased global concerns about the environment and called for a world commitment to the protection of the environment. These concerns, coupled with the GATT negotiations in Uruguay in 1986 which calle d for the removal of non-tariff trade barriers, were the impetus behind ISO 14000.

ISO Technical Committee 207 is responsible for the ISO 14000 series of standards. Just as the ISO 9000 standards are based on the British BS 5750 standard of 1979, the ISO 14000 series are based on the British standard BS 7750 which was instituted in 199 2. This standard also served as the basis for the European Union's Eco-Management and Audit Scheme (EMAS), a more stringent set of standards strongly influenced by the high environmental standards of German companies. EMAS differs from ISO 14000 in that it emphasizes public environmental reporting.

Many organizations had taken little interest in ISO 9000 when it was in development and were surprised by the overwhelming acceptance of ISO 9000. These organizations were wary of a new international standard in ISO 14000 and they took a more active inte rest in it's development. Subsequently the standards of BS 7750 were softened in order to be acceptable by countries outside of Europe. In particular, US companies who can be subjected to expensive civil suits, were very hesitant to endorse a stringent set of environmental management standards. The fear is that violation of these standards could result in litigation. Some organizations, for example, fear that the extensive documentation required by the ISO 14000 series could be used against them in an y legal action regarding violation of environmental regulations.

The actual environmental standards of ISO 14000 deal with how a company manages the environment inside it's facilities and the immediate outside environment. However, the standards also call for analysis of the entire life cycle of a product, from raw ma terial to eventual disposal. These standards do not mandate a particular level of pollution or performance, but focus on awareness of the processes and procedures that can effect the environment. It should be noted that adherence to the ISO 14000 standa rds does not in anyway release a company from any national or local regulations regarding specific performance issues regarding the environment.

Some of the standards in the ISO 14000 series are:

- ISO 14001 - Specification of Environmental Management Systems
- ISO 14004 - Guideline Standard
- ISO 14010 through ISO 14015 - Environmental Auditing and Related Activities
- ISO 14020 through ISO 14024 - Environmental Labeling
- ISO 14031 through ISO 14032 - Environmental Performance Evaluation
- ISO 14040 through ISO 14043 - Life Cycle Assessment
- ISO 14050 - Terms and Definitions

Although the ISO 14000 standards are similar to the ISO 9000 standards, the nature of the environmental standards creates a need for people who are technical environment professionals in addition to those required to maintain the documentation necessary f or certification

ENVIRONMENTAL REGULATIONS AND LEGAL FRAMEWORK IN INDIA

ENVIRONMENT PROTECTION – FROM INDIAN CONSTITUTION PRESPECTIVE

a) The State's responsibility with regard to environmental protection has been laid down under Article 48-A of our Constitution, which reads as follows:

"The State shall endeavour to protect and improve the environment and to safeguard the forests and wildlife of the country".

b) Environmental protection is a fundamental duty of every citizen of this country under Article 51-A(g) of our Constitution which reads as follows:

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

c) Article 21 of the Constitution is a fundamental right which reads as follows:

"No person shall be deprived of his life or personal liberty except according to procedure established by law."

d) Article 48-A of the Constitution comes under Directive Principles of State Policy and Article 51 A(g) of the Constitution comes under Fundamental Duties.

e) The State's responsibility with regard to raising the level of nutrition and the standard of living and to improve public health has been laid down under Article 47 of the Constitution which reads as follows:

"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 medicinal purposes of intoxicating drinks and of drugs which are injurious to health."

h) The 42nd amendment to the Constitution was brought about in the year 1974 makes it the responsibility of the State Government to protect and improve the environment and to safeguard the forests and wildlife of the country. The latter, under Fundamental Duties, makes it the fundamental duty of every citizen to protect and improve the natural environment including forests, lakes, rivers and wildlife and to have compassion for living creatures.

MANDATORY REQUIREMENTS - ENVIRONMENT

THE ELECTRICITY ACT, 2003

This Act seeks to create a framework for the power sector development by measures conducive to the industry. Electricity Act does not explicitly deal with environmental implications of activities related to power transmission. The applicable legal provisions under this Act are as follows: Section 68(1) - sanction from the Ministry of Power (MOP) is a mandatory requirement for taking up any new project. The sanction authorizes SJVN to plan and coordinate activities to commission new projects.

THE FOREST (CONSERVATION) ACT, 1980

This Act provides for the conservation of forests and regulating diversion of forestlands for non-forestry purposes. When projects falls within forestlands, prior clearance is required from relevant authorities under the Forest (Conservation) Act, 1980. State governments cannot de-reserve any forestland or authorise its use for any non-forest purposes without approval from the Central government

ENVIRONMENTAL (PROTECTION) ACT, 1986

The Environment (Protection) Act, 1986 was introduced as an umbrella legislation that provides a holistic framework for the protection and improvement to the environment.

In terms of responsibilities, the Act and the associated Rules requires for obtaining environmental clearances for specific types of new / expansion projects (addressed under Environmental Impact Assessment Notification, 1994) and for submission of an environmental statement to the State Pollution Control Board annually. Environmental clearance is not applicable to hydro projects also. SJVNL undertakes Environmental Impact Assessment for all projects as a standard management procedure as laid down in The Environment (Protection) Act, 1986 and also functions within permissible standards of ambient air quality and noise levels as prescribed by national laws and international regulations.

AIR (PREVENTION AND CONTROL OF POLLUTION) ACT 1981

The objective of this Act is to provide for the prevention, control and abatement of air pollution, for the establishment, with a view to carrying out the aforesaid purposes, of Boards, for conferring on and assigning to such Boards powers and functions relating thereto and for matters connected therewith.

Decisions were taken at the United Nations Conference on the Human Environment held in Stockholm in June 1972, in which India participated, to take appropriate steps for the preservation of the natural resources of the earth which, among other things, includes the preservation of the quality of air and control of air pollution.

Therefore it is considered necessary to implement the decisions foresaid in so far as they relate to the preservation of the quality of air and control of air pollution.

WATER (PREVENTION & CONTROL) ACT 1974

The objectives of the Water (Prevention and Control of Pollution) Act areto provide for the Prevention and Control of Water Pollution and the maintenance or restoration of the wholesomeness of water for the establishment, with a view to carrying out the purposes aforesaid, of Boards for the prevention and control of water pollution, for conferring on and assigning to such Boards powers and functions relating thereto and for matters connected therewith.

WILDLIFE PROTECTION ACT, 1972

According to the Wildlife Protection Act, 1972 "wildlife" includes any animal, bees, butterflies, crustacea, fish and moths; and aquatic or land vegetation which forms part of any habitat. In accordance with Wildlife (Protection) Amendment Act, 2002 “no alternation of boundaries / National Park / Sanctuary shall be made by the State Govt. except on recommendation of the National Board for Wildlife (NBWL)”.Further, in terms of Supreme Court Order dated 13.11.2000 the State Govts have to seek prior permission of Supreme Court before submitting the proposal for diversion of forest land in National Park sanctuaries.

Whenever, any part of Wildlife Sanctuary / National Park is getting affected by a hydro project the forest proposal in respect of such project is entertained by MoEF, GOI only after permission of de-reservation / de-notification of Wildlife Sanctuary /National Park has been accorded. After recommendation of Standing Committee of NBWL proposal for de-reservation/ de-notification is ratified by Hon’ble Supreme Court.

Delhi environmental laws:

India Program

In 1998, ELI(environmental laws india) launched its India Program to promote environmental law, policy, and management in India. The Institute works in conjunction with the government, NGOs, industry, and academic institutions to strengthen the legal, policy, and institutional infrastructure for sustainable development, environmental protection, and natural resource conservation in India. ELI has worked with its partners to build the capacity of the judiciary and enforcement agencies, to build the capacity of civil society to participate in environmental decision making, to build the capacity of industry to comply with environmental law, and to strengthen implementation of environmental law.

ELI's India Program team consists of Senior Attorney John Pendergrass and Visiting Scholar Usha Wright.

Factory Manager Compliance Training

Since 2003, ELI has worked with industry, state pollution control boards, NGOs, and academia to build the capacity of India's private sector to comply with environmental law. Supported by the GE Foundation and by USAID, and working with Environmental Management and Policy Research Institute (EMPRI) of Bangalore and the Federation of Indian Chambers of Commerce and Industry (FICCI), ELI developed two courses for managers of small and medium sized enterprises on how to comply with environmental law. FICCI and ELI delivered a pilot workshop to managers of electroplating facilities clustered in Mathura in northern India.

Contemporaneously, EMPRI and ELI delivered a pilot workshop in Bangalore for a diverse audience of managers of small and medium sized enterprises. In addition to segments on India's water, air, hazardous waste, and other substantive laws, the course covered why it is beneficial to industry to comply with environmental law. Faculty included senior officials of the Karnataka State Pollution Control Board, Professor MK Ramesh, experts from NGOs and industry, and ELI Senior Attorney John Pendergrass. ELI and EMPRI prepared a Pocket Guide to Environmental Compliance, which provided information on the environmental rules applicable to industry. The Bangalore workshop included a site visit to a model facility to observe good environmental management in practice. A follow up session three months later demonstrated the value of the training as the majority of participants described specific improvements to environmental performance at their facilities.

In 2008, with additional support from several multinational corporations in India, ELI worked with academic institutions and state pollution control boards in Gujarat and Karnataka to expand the coverage of the course to include segments on occupational health and safety and product stewardship and to involve managers from staff of suppliers. The courses were hosted by Indus Institute of Technology and Engineering in Ahmedabad and the National Law School of India University (NLS) in Bangalore, with the respective state pollution control boards as additional sponsors and speakers. In Ahmedabad, the course was keynoted by India's retired Chief Justice PN Bhagwati, author of several seminal decisions by the Indian Supreme Court on environmental rights. ELI and its academic, industry, and state pollution control board partners repeated the course in Bangalore in November 2009 and in Ahmedabad and Bangalore in January 2011.

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