UNIT-6 (Environmental protection -Acts)

THE ENVIRONMENT (PROTECTION) ACT

The Environment (Protection) Act, 1986 not only has important constitutional implications but also an international background. The spirit of the proclamation adopted by the United Nations Conference on Human Environment which took place in Stockholm in June 1972, was imple-mented by the Government of India by creating this Act.

Although there were several existing laws that dealt directly or indirectly with environmental issues it was necessary to have a general legislation for environmental protection because the existing laws focused on very specific types of pollution, or specific categories of hazardous substances or were indirectly related to the environment through laws that control landuse, protect our National Parks and Sanctuaries and our wildlife. However there were no overarching legislation and certain areas of environmental hazards were not covered. There were also gaps in areas that were potential environmental hazards and there were several inadequate linkages in handling matters of industrial and environmental safety. This was essentially related to the multiplicity of regulatory agencies. Thus there was a need for an authority which could assume the lead role for studying, planning and implementing long term requirements of environmental safety and give directions to, as well as coordinate a system of speedy and adequate response to emergency situations threatening the environment.

This Act was thus passed to protect the environment, as there was a growing concern over the deteriorating state of the environment. As impacts grew considerably environmental protection became a national priority in the 1970s. The decline in the environmental quality, was evidenced by increasing pollution, loss of forest cover and an increasing threat to biodiversity.

The presence of excessive concentrations of harmful chemicals in the atmosphere and aquatic ecosystems leads to the disruption of food chains and a loss of species. These are symptoms of a rapidly deteriorating environment. The growing risk of environmental accidents and threats to life support systems now loom threateningly over our civilization. The decision taken at the conference in Stockholm strongly voiced these environmental concerns and several measures were made possible for environmental protection. While the need for a wider general legislation to protect our environment is now in place, it has become increasingly evident that our environmental situation continues to deteriorate. We need to implement this Act much more aggressively if our environment is to be protected.

Public concern and support is crucial for implementing the EPA. This must be supported by an enlightened media, good administrators, highly aware policy makers, informed judiciary and trained technocrats who together can influence and prevent further degradation of our environment. Each of us has a responsibility to make this happen.

THE AIR (PREVENTION AND CONTROL OF POLLUTION) ACT:

The Government passed this Act in 1981 to clean up our air by controlling pollution. Sources of air pollution such as industry, vehicles, power plants, etc. are not permitted to release particulate matter, lead, carbon monoxide, sulfur dioxide, nitrogen oxide, volatile organic compounds (VOCs) or other toxic substances beyond a prescribed level. To ensure this, Pollution Control Boards (PCBs) have been set up by Government to measure pollution levels in the atmosphere and at certain sources by testing the air. This is measured in parts per million or in milligrams or micrograms per cubic meter. The particulate matter and gases that are released by industry and by cars, buses and two wheelers is measured by using air sampling equipment. However, the most important aspect is for people themselves to appreciate the dangers of air pollution and reduce their own potential as polluters by seeing that their own vehicles or the industry they work in reduces levels of emissions.

This Act is created ‘to take appropriate steps for the preservation of the natural resources of the earth which among other things includes the preservation of high quality air and ensures controlling the level of air pollution.

**The main objectives of the Act are as follows:**

To provide for the Prevention, Control and abatement of air pollution.

To provide for the establishment of Central and State Boards with a view to implement the Act.

To confer on the Boards the powers to implement the provisions of the Act and assign to the Boards functions relating to pollution.

Air pollution is more acute in heavily industrialized and urbanized areas, which are also densely populated. The presence of pollution beyond certain limits due to various pollutants discharged through industrial emission are monitored by the Pollution Control Boards set up in every State.

**Powers and Functions of the Boards**

**Central Board:** The main function of the Central Board is to implement legislation created to improve the quality of air and to prevent and control air pollution in the country. The Board advises the Central Government on matters concerning the improvement of air quality and also coordinates activities, provides technical assistance and guidance to State Boards and lays down standards for the quality of air. It collects and disseminates information in respect of matters relating to air pollution and performs functions as prescribed in the Act.

**State Pollution Control Boards:** The State Boards have the power to advice the State Government on any matter concerning the prevention and control of air pollution. They have the right to inspect at all reasonable times any control equip-ment, industrial plant, or manufacturing process and give orders to take the necessary steps to control pollution. They are expected to inspect air pollution control areas at intervals or whenever necessary. They are empowered to provide standards for emissions to be laid down for different industrial plants with regard to quantity and composition of emission of air pollutants into the atmosphere. A State Board may establish or recognize a laboratory to perform this function.

The State Governments have been given powers to declare air pollution control areas after consulting with the State Board and also give instructions for ensuring standards of emission from automobiles and restriction on use of certain industrial plants.

**Penalties:** Persons managing industry are to be penalized if they produce emissions of air pollutants in excess of the standards laid down by the State Board. The Board also makes applications to the court for restraining persons causing air pollution.

Whoever contravenes any of the provision of the Act or any order or direction issued is punishable with imprisonment for a term which may extend to three months or with a fine of Rs.10,000 or with both ,and in case of continuing offence with an additional fine which may extend to Rs 5,000 for every day during which such contravention continues after conviction for the first contravention.

**What can an individual do to control air pollution?**

* When you see a polluting vehicle takes down the number and send a letter to the Road Transport Office (RTO) and the Pollution Control Board (PCB).
* If you observe an industry polluting air, in-form the Pollution Control Board in writing and ascertain if action is taken.
* Use cars only when absolutely necessary. Walk or cycle as much as possible instead of using fossil fuel powered vehicles.
* Use public transport as far as possible, as more people can travel in a single large vehicle rather than using multiple small vehicles which add to pollution.
* Share a vehicle space with relatives and friends. Carpools minimize the use of fossil fuels.
* Do not use air fresheners and other aerosols and sprays which contain CFCs that deplete the ozone layer.
* Do not smoke in a public place. It is illegal and endangers not only your own health but also that of others.
* Coughing can spread bacteria and viruses. Use a handkerchief to prevent droplet infection which is air borne. It endangers the health of other people.

It is a citizen’s duty to report to the local authorities such as the Collector or the Pollution Control Board, and the press about offences made by a polluter so that action can be taken against the offender. It is equally important to prevent and report to the authorities on cutting down of trees, as this reduces nature’s ability to maintain the carbon dioxide and oxygen levels. preventing air pollution and preserving the quality of our air is a responsibility that each individual must support so that we can breathe air that will not destroy our health.

THE WATER (PREVENTION AND CON-TROL OF POLLUTION) ACT

The Government has formulated this Act in 1974 to be able to prevent pollution of water by industrial, agricultural and household wastewater that can contaminate our water sources. Wastewaters with high levels of pollutants that enter wetlands, rivers, lakes, wells as well as the sea are serious health hazards. Controlling the point sources by monitoring levels of different pollutants is one way to prevent pollution by giving a punishment to a polluter. However it is also the responsibility of people in general to inform the relevant authority when they see a likely source of pollution.

Individuals can also do several things to reduce water pollution such as using biodegradable chemicals for household use, reducing use of pesticides in gardens, and identifying polluting sources at workplaces and in industrial units where oil or other petroleum products and heavy metals are used. Excessive organic matter, sediments and infecting organisms from hospital wastes can also pollute our water. Citizens need to develop a watchdog force to inform authorities to take appropriate actions against different types of water pollution. A polluter must pay for his actions. How- ever, preventing pollution is better than trying to cure the problems it has created, or punishing offenders.

**The main objectives** of the Water Act are to provide for prevention, control and abatement of water pollution and the maintenance or restoration of the wholesomeness of water. It is designed to assess pollution levels and punish polluters. The Central Government and State Governments have set up Pollution Control Boards that monitor water pollution.

**Functions of the Pollution Control Boards:**

The Government has given the necessary powers to the PCBs to deal with the problems of water pollution in the country. The Government has also suggested penalties for violation of the provisions of the Act.

Central and State water testing laboratories have been set up to enable the Boards to assess the extent of water pollution and standards have been laid down to establish guilt and default.

The Central and State Boards are entitled to certain powers and functions which are as follows:

**Central Board:** It has the power to advise the Central Government on any matters concerning the prevention and control of water pollution. The Board coordinates the activities of the State Boards and also resolves disputes. The Central Board can provide technical assistance and guidelines to State Boards to carry out investigations and research relating to water pollution, and organizes training for people involved in the process. The Board organizes a comprehensive awareness program on water pollution through mass media and also publishes data regarding water pollution. The Board lays down or modifies the rules in consultation with the State Boards on standards of disposal of waste.

The main function of the Central Board is to promote the cleanliness of rivers lakes streams and wells in the country.

**State Boards:** They have the power to advise the State Government on any matters concerning water pollution. It plans a comprehensive program for the prevention of water pollution. It collects and disseminates information on water pollution and participates in research in collaboration with the Central Board in organizing training of people involved in the process. The Board inspects sewage or trade effluents, treatment plants, purification plants and the systems of disposal and also evolves economical and reliable methods of treatment of sewage and other effluents. It plans the utilization of sewage water for agriculture. It ensures that if effluents are to be discharged on land the waste is diluted. The State Board advises State Governments with respect to location of industries. Laboratories have been established to enable the Board to perform its functions.

**The State Boards** have the power to obtain in-formation from officers empowered by it who make surveys, keep records of flow, volume, and other characteristics of the water. They are given the power to take samples of effluents and suggest the procedures to be followed in connection with the samples. The concerned board analyst is expected to analyze the sample sent to him and submit a report of the result to the concerned Board. The Board is required to send a copy of the result to the respective industry. The Board also has the power of inspecting any plant record, register, document or any material object, and can conduct a search in any place in which there is reason to believe that an of-fence has been conducted under the Act.

**Penalties** are charged for acts that have caused pollution. This includes failing to furnish information required by the Board, or failing to inform the occurrence of any accident or other unforeseen act. An individual or organization that fails to comply with the directions given in the subsections of the law can be convicted or punished with imprisonment for a term of three months or with a fine of Rs10,000 or both and in case failure continues an additional fine of Rs.5,000 every day. If a person who has already been convicted for any offence is found guilty of the same offence again, he/she after the second and every subsequent conviction, would be punishable with imprisonment for a term not less than two years but which may extend to seven years with fine.

**What can individuals do to prevent water pollution?**

* Inform the Pollution Control Board of any offender who is polluting water and ensure that appropriate action is taken. One can also write to the press.
* Do not dump wastes into a household or industrial drain which can directly enter any water body, such as a stream, river, pond, lake or the sea.
* Do not use toilets for flushing down waste items as they do not disappear but reap-pear at other places and cause water pollution. Use compost instead of chemical fertilizers in gardens.
* Avoid use of pesticides at home like DDT, Melathion, Aldrin, and use alternative methods like paste of boric acid mixed with gram flour to kill cockroaches and other insects. Use dried neem leaves to help keep away insects.

THE WILDLIFE PROTECTION ACT

This Act passed in 1972, deals with the declaration of National Parks and Wildlife Sanctuaries and their notification. It establishes the structure of the State’s wildlife management and the posts designated for Wildlife Management. It provides for setting up Wildlife Advisory Boards. It prohibits hunting of all animals specified in Schedules I to IV of the Act. These are notified in order of their endangeredness. Plants that are protected are included in schedule VI.

The Amendment to the Wildlife Protection Act in 2002 is more stringent and prevents the commercial use of resources by local people. It has brought in new concepts such as the creation of Community Reserves. It has also altered several definitions. For instance in animals, fish are now included. Forest produce has been redefined to ensure protection of ecosystems.

While there are several changes, the new Act still has serious issues concerned with its implementation. Laws are only as good as the ones that can be complied with. The Act is expected to deter people from breaking the law. However, there are serious problems due to poaching. One cannot expect to use the Act to reduce this without increasing Forest Staff, providing weapons, jeeps, radio equipment, etc. for establishing a strong deterrent force.

**Penalties:** A person who breaks any of the conditions of any license or permit granted under this Act shall be guilty of an offence against this Act. The offence is punishable with imprisonment for a term which may extend to three years or with a fine of Rs 25,000 or with both. An offence committed in relation to any animal specified in Schedule I, or Part II of Schedule II, like the use of meat of any such animal, or animal articles like a trophy, shall be punishable with imprisonment for a term not less than one year and may extend to six years and a fine of Rs 25,000.

In the case of a second or subsequent offence of the same nature mentioned in this subsection, the term of imprisonment may extend to six years and not less than two years with a penalty of Rs.10,000.

**What can an individual do?**

* If you observe an act of poaching, or see a poached animal, inform the local Forest Department Official at the highest possible level. One can also report the event through the press. Follow up to check that action is taken by the concerned authority. If no action is taken, one must take it up to the Chief Wildlife Warden of the State.
* Say ‘no’ to the use of wildlife products and also try to convince other people not to buy them.
* Reduce the use of wood and wood products wherever possible.
* Avoid misuse of paper because it is made from bamboo and wood, which destroys wildlife habitat. Paper and envelopes can always be reused.
* Create a pressure group and ask Government to ensure that the biodiversity of our country is conserved.
* Do not harm animals. Stop others from inflicting cruelty to animals. Do not disturb birds’ nests and fledglings.
* When you visit the Zoo do not tease the animals by throwing stones or feeding them, and prevent others from doing so. If you come across an injured animal do what you can to help it.
* If the animal needs medical care and ex-pert attention contact the Society for the Prevention of Cruelty to Animals in your city. Create awareness about biodiversity conservation in your own way to family and friends. Join organizations, which are concerned with protection of biodiversity, such as Worldwide Fund for Nature of India (WWF-I), Bombay Natural History Society (BNHS), or a local conservation NGO.

FOREST CONSERVATION ACT

 To appreciate the importance of the Forest Conservation Act of 1980, which was amended in 1988, it is essential to understand its historical background. The Indian Forest Act of 1927 consolidated all the previous laws regarding forests that were passed before the 1920’s. The Act gave the Government and Forest Department the power to create Reserved Forests, and the right to use Reserved Forests for Government use alone. It also created Protected Forests, in which the use of resources by local people was controlled. Some forests were also to be con-trolled by a village community, and these were called Village Forests.

The Act remained in force till the 1980s when it was realized that protecting forests for timber production alone was not acceptable. The other values of protecting the services that forests provide and its valuable assets such as biodiversity began to overshadow the importance of their revenue earnings from timber. Thus a new Act was essential. This led to the Forest Conservation Act of 1980 and its amendment in 1988.

India’s first Forest Policy was enunciated in 1952. Between 1952 and 1988, the extent of deforestation was so great that it became evident that there was a need to formulate a new policy on forests and their utilization. Large tracts of forestland had already been diverted to other uses. The earlier forest policies had focused attention on revenue generation only. In the 1980s it became clear that forests must be protected for their other functions such as maintenance of soil and water regimes centered around ecological concerns. It also provided for the use of goods and services of the forest for its local in-habitants.

The new policy framework made conversion of forests into other uses much less possible. Conservation of the forests as a natural heritage finds a place in the new policy, which includes the preservation of its biological diversity and genetic resources. It also values meeting the needs of local people for food, fuel wood, fodder and non-wood forest products that they subsist on. It gives priority to maintaining environmental stability and ecological balance. It expressly states that the network of Protected Areas should be strengthened and extended.

In 1992, the 73rd and 74th Amendments to the Constitution furthered governance through panchayats. It gives States the ability to provide power to the local panchayats to manage local forest resources.

The Forest Conservation Act of 1980 was enacted to control deforestation. It ensured that forestlands could not be dereserved without prior approval of the Central Government. This was created as States had begun to dereserve the Reserved Forests for non-forest use. States had regularized encroachments and resettled ‘Project Affected People’ from development projects such as dams in these dereserved areas. The need for a new legislation became urgent. The Act made it possible to retain a greater control over the frightening level of deforestation in the country and specified penalties for offenders.

**Penalties** for offences in Reserved Forests: No person is allowed to make clearings or set fire to a Reserved Forest. Cattle are not permitted to trespass into the Reserved Forest. Felling, collecting of timber, bark or leaves, quarries or collecting any forest product is punishable with imprisonment for a term of six months, or with a fine which may extend to Rs.500, or both.

Penalties for offences in Protected Forests: A person who commits any of the following offences like felling of trees, or strips off the bark or leaves from any tree or sets fire to such forests, or kindles a fire without taking precautions to prevent its spreading to any tree mentioned in the Act, whether standing or felled, or fells any tree, drags timber, or permits cattle to damage any tree, shall be punishable with imprisonment for a term which may extend to six month or with a fine which may extend to Rs.500, or both.

When there is a reason to believe that a forest offence has been committed pertaining to any forest produce, the produce together with all tools used in committing such offences may be seized by any Forest Officer or Police Officer. Every officer seizing any property under this section shall put on the property a mark indicating the seizure and report the seizure to the Magistrate who has the jurisdiction to try the offence. Any Forest Officer, even without an order from the Magistrate or a warrant, can arrest any person against whom a reasonable suspicion exists.

**What can an individual do to support the Act?**

Be alert to destructive activities in your lo-cal green areas such as Reserved Forests and Protected Forests, and in Protected Areas (National Parks and Wildlife Sanctuaries). Report any such act to the Forest Department as well as the Press. Report of violations can be made to the Conservator of Forest, District Forest Officer, Range Forest Officer, Forest Guard or the District Commissioner, or local civic body.

Acquaint yourself with the laws, detailed rules and orders issued by the Government. Be in touch with concerned local NGOs and associations. Organize one with other likeminded people if none exist in your area.

Create awareness about the existence and value of National Parks and Sanctuaries and build up a public opinion against illegal activities in the forest or disturbance to wild-life.

Pressurize the authorities to implement the forest and wildlife laws and rules to protect green areas. Take legal action if necessary and if possible through a Public Interest Litigation (PIL) against the offending party. Use the help of NGOs who can undertake legal action.

Help to create public pressure to change rules laws and procedures when necessary. Use better, ecologically sensitive public transport and bicycle tracks. Do not litter in a forest area. Participate in preservation of greenery, by planting, watering and caring for plants.

Whom should forest offences be reported to? If you as a citizen come across anyone felling trees, encroaching on forest land, dumping garbage, cutting green wood, lighting a fire, or creating a clearing in Reserved Forests, Protected Forests, National Park, Sanctuary or other forest areas, you must report it to the forest / wild-life officers concerned. For urgent action one can contact the police. In fact you should file an FIR in any case because it serves as an important proof that you have made the report.

ISSUES INVOLVED IN ENFORCEMENT OF ENVIRONMENTAL LEGISLATION

Environmental legislation is evolved to protect our environment as a whole, our health, and the earth’s resources. The presence of a legislation to protect air, water, soil, etc. does not necessarily mean that the problem is addressed. Once a legislation is made at the global, National or State level, it has to be implemented. For a successful environmental legislation to be implemented, there has to be an effective agency to collect relevant data, process it and pass it on to a law enforcement agency. If the law or rule is broken by an individual or institution, this has to be punished through the legal process. Information to law enforcement officials must also come from concerned individuals. In most situations, if no cognizance is given, the interested concerned individual must file a Public Interest Litigation (PIL) for the protection of the environment. There are several NGOs in the country such as WWF-I, BEAG and the BNHS which take these matters to court in the interest of conservation. Anyone can request them to help in such matters. There are also legal experts such as MC Mehta who have successfully fought cases in the courts to support environmental causes. A related issue is the fact that there are several irregular practices for which a bribe to an unscrupulous official is used to cover up an offence. Thus the general public must act as a watch dog not only to inform concerned authorities, but also to see that actions are taken against offenders.

**Environment Impact Assessment (EIA):**

For all development projects, whether Government or Private, the MoEF requires an impact assessment done by a competent organization. The EIA must look into physical, biological and social parameters. EIAs are expected to indicate what the likely impacts could be if the project is passed. The Ministry of Environment and Forests (MoEF) has identified a large number of projects that need clearance on environmental grounds. The EIA must define what impact it would have on water, soil and air. It also re-quires that a list of flora and fauna identified in the region is documented and to specify if there are any endangered species whose habitat or life could be adversely affected. Most development projects such as industries, roads, railways and dams may also affect the lives of local people. This must be addressed in the EIA. There are 30 different industries listed by MoEF that require a clearance before they are set up.

An impact created by each type of industry differs and the proposed sites also vary in their sensitivity to impacts. Some areas are more fragile than others. Some have unique ecosystems. Others are the habitats of wildlife and some may be the home of endangered species of plants or animals. All these aspects require evaluation before a development project or an industry site is cleared.

New projects are called ‘green field projects’ where no development has been done. Projects that already exist but require expansion must also apply for clearance. These are called ‘brown field projects’.

After the Environmental Protection Act of 1986 was passed, an EIA to get an environmental clearance for a project became mandatory.

Project proponents are expected to select a competent agency to undertake an EIA. Projects can be classified into those with a mild impact, a moderate impact or a serious impact. Some may have temporary major impacts, during the construction phase, which could later become less damaging, or be mitigated by a variety of measures. In other situations the impact may continue and even increase, for example where toxic solid waste will be constantly generated.

Some projects could thus cause temporary reversible damage while others can have irreversible or even permanent impacts.

To get an environmental clearance the proposer of the project is expected to apply to the State Pollution Control Board. The PCB checks and confirms that the EIA can be initiated. The Agency that does the assessment submits a Re-port to the proposer. This may take several months. A Report of the Environmental State-ment is forwarded to the MoEF, which is the impact assessment authority.

After 1997, the MoEF has stipulated that a public hearing should be done at the local level. The Pollution Control Board puts an advertisement about the hearing in the local vernacular press. An Environmental Impact Statement which is an Executive Summary of the EIA is kept for the public to read. The venue and time of the Public Hearing is declared. Once the hearing is held and opinions have been expressed, both for and against the project, the minutes of the meeting are sent to the MoEF. Though this is done, it is evident that the voices of project affected people are still not heard. In some cases NGOs have taken up the cause of local people. Until educational levels and environmental awareness be-comes a part of public thinking and is objectively based on the facts of the case, these hearings will remain an inadequate tool to control possible impacts of new development projects.

Experience shows that a large number of EIAs are inadequately researched and frequently biased as they are funded by the proposer of the project. While most EIAs are adequate for studies on the possibilities of air, water and soil pollution, they generally deal inadequately with issues such as preservation of biodiversity and the social issues that may arise from future environmental impacts.

Biodiversity concerns frequently are sketchily considered and mostly consist of a listing of species without population assessments, or census figures of wildlife, or a study of the effects on the ecosystem as a whole. Changes in land use patterns effect whole communities of living organisms. This is rarely taken into account, as such issues are difficult to assess in quantifiable terms.

Issues related to equity of resources that are inevitably altered by development related projects are also not fully addressed. These cryptic concerns must be dealt with more seriously in environmental assessments and the public at large should know and appreciate these inadequacies. It is not sufficient to say that an EIA has been done. It is the quality and sincerity of the EIA that is of importance.

An EIA is not intended to stop all types of development. The siting of an industry can be selected carefully and if it is likely to damage a fragile area an alternate less sensitive area must be selected.

In some cases it is essential to drop projects altogether if the anticipated impacts are likely to be very severe. In other cases it is necessary for the project to counter balance its effects by mitigating the ill effects on the environment. This means compensating for the environmental damage by afforestation or creating a Protected Area in the neighborhood at the cost of the project. Rehabilitation and resettlement of project affected people is a key concern which should be given adequate funds and done after a consent is clearly obtained from the people living in the area. In most cases it is advisable to avoid resettlement altogether. If an area’s vegetation is being affected project costs must include the cost of compensatory afforestation and other protective measures.

**SILENT VALLEY PROJECT- CASE STUDY**

Long before the Internet era, a remarkable people’s movement saved a pristine moist evergreen forest in Kerala’s Palakkad District from being destroyed by a hydroelectric project.



 The battle for the now famous Silent Valley raged for over ten years and involved thousands of people who did not even live in the vicinity of the area that was to be destroyed. Although the campaign did not have any centralized planning, it was highly effective. The sustained pressure exerted on the government by citizens using every possible means available at the time – letters to the editors of newspapers, seminars, widespread awareness programmes, and finally petitions and appeals in court and other high offices – proved ultimately successful. In 1986 Silent Valley was declared a National Park, a striking testimony to the power of peoples’ action. The lessons from this inspiring and hard-fought campaign are still relevant today. Events happened then, in brief as follows:

 **1970**: the Kerala State Electricity Board (KSEB) proposes a hydroelectric dam across the Kunthipuzha River that runs through Silent Valley, that will submerge 8.3 sq km of untouched moist evergreen forest.

 Arguments it makes for the Silent Valley Hydroelectric Project (SVPH):

* It will generate electricity for the state of Kerala with the installation of four units of 60 MW each. (The KSEB avers that the state’s electricity requirements will not be met without this additional power).
* Irrigate an additional 100 sq km in the Mallapuram and Palghat districts.
* Provide employment to several thousand people during the construction phase and boost the economy of the state.

 **1971 – 72**: Steven Green, a scientist from the New York Zoological Society, conducts studies on primates, especially the lion-tailed macaque in Silent Valley. Green expresses concerns about the possible threats to the rare macaque from the project. Around the same time, herpetologist Rom Whitaker explores Silent Valley to study the snakes of the region. He writes a letter to the Bombay Natural History Society about the need to conserve the Valley. Reports like these alert other naturalists.

 **February 1973**: The Planning Commission approves the project at a cost of about Rs 25 crores. However, due to lack of sufficient funds, implementation is delayed.

 Protests begin to mount against the project.

 **October 1976**: National Committee on Environment Planning and Coordination (NCEPC) sets up a task force, chaired by Zafar Futehally, to study the ecological problems that could be precipitated by the project. Work on the project is suspended pending the task force’s impact analysis. Task Force recommends that project be scrapped. However it provides a loophole that stipulates that, if abandoning the project is not possible, a series of safeguards should be implemented. Unsurprisingly, the Kerala government opts to proceed with the project by promising to implement all safeguards. State argues that the area submerged by the dam is only 1022 hectares, of which 150 ha is grasslands. Also argues that only 10 percent of the ecosystem will be damaged, while ecological safeguards will protect the rest.

 However, several NGOs strongly oppose the project and urge the government to abandon it. Conservationists argue that:

* The entire lower valley will be submerged by the dam, destroying its biodiversity.
* The 10 percent loss projected by the government will actually be far worse.
* The workforce brought in for the construction of the project will reside in the area for several years and the destruction they cause – illegal wood felling, cattle grazing, poaching, encroaching – will destroy the Valley.

 **1977**: Sathish Chandran Nair visits Silent Valley. With missionary zeal he starts a movement to create awareness in academic circles through talks and slide shows. V.S. Vijayan of the Kerala Forest Research Institute does a study on the impact of hydroelectric projects on the environment, and writes to the authorities not to begin the project till his report is submitted. He is admonished and his report is suppressed.

 The message of the conservationists is taken to villages and cities all over Kerala. S Prabhakaran Nair tours the villages of north Malabar; Prof. John Jacob trains young nature lovers. Soon Nature Clubs spring up all over the state.

 Undeterred, the state government plunges ahead with the project.

 The result is that the outcry against the Silent Valley Hydroelectric Project – which started as a localized movement through individual and small group protests – goes national and international.

 The General Assembly of the IUCN urges the Government to conserve the undisturbed forest area. Many eminent people, including conservationists and corporate and political leaders, write to the Central Government requesting that no sanction be given to the project. These include Salim Ali, Madhav Gadgil, CV Radhakrishnan, MS Swaminathan, Subramaniam Swamy, Sitaram Kesari, Piloo Modi and Krishna Kant. Salim Ali writes that the project is ‘shortsighted’ and has ‘limited objectives’. Institutions like the BNHS and Geological Survey of India ask that the area be declared a Natural Bioreserve.

 However, Prime Minister Morarji Desai rejects all the appeals and recommends that the proposal begin with no delay.

 **June 1979**: Kerala begins the project in earnest.

 **August 1979**: N.V. Krishna Warrier of the Prakriti Samrakshana Samiti, Prof. Joseph John, and P. Gopalakrishnan Nair, an advocate, file a petition and get a stay order from the High Court of Kerala, stopping work on the project.

 Soon after, the Silent Valley Samrakshana Samiti and Kerala Sastra Sahitya Parishad start awareness campaigns with vigour. They hold protest meetings, rallies and debates all over the state, turning the campaign into a mass people’s movement.
Famous writers from Kerala join the movement and contribute their skills: poems, plays, stories and articles, to convey the message to the ordinary citizen.

 Meanwhile, at the Centre, Morarji Desai is replaced by Charan Singh as PM. He institutes a Central Committee to re-investigate the issue, headed by M.S. Swaminathan, much to the chagrin of the Chief Minister of Kerala. In a move reeking of money-backed counter-propaganda, the State Government sets up its own panel of ‘environmentalists’ and scientists who support the government’s views.

 **January 1980**: the High Court rejects the writ plea, saying that it is not for the courts to go into the merits of scientific arguments and that it is “satisfied that the matters have received attention before the State decided to launch the project”. Work on the project begins again in earnest.

 Meanwhile, a small group of campaigners meet the Kerala Governor and request her to issue a stay order against continuing work on the project until the Committee set up by the Centre gives its report. She agrees, and work is halted once again. On the streets, the awareness campaigns continue.

 The role of the media: In the media too, the fight for Silent Valley marks a distinct curve. The leading Malayalam newspapers first carry positive columns on the hydroelectric project. By 1977, four years after the project is approved and environmentalists begin their opposition to it, the newspapers still largely carry only news of the government’s efforts to start the project. Editorial opinion, on the rare occasions that it is expressed, strongly support the project and ‘development’. Some publications even take potshots at the lion-tailed macaque, which has become a symbol of the wildlife that the environmentalists are trying to protect in Silent Valley.

 The Express, a local daily, is an exception. It carries editorials that constitute a deliberate and strong tilt towards saving Silent Valley; it also carries a feature with a measured argument explaining the importance of rainforests in layman’s terms.

 In 1979, a slight shift in newspaper reportage is noticeable. Along with support for the project, some newspapers raise concern for the ecological consequences of destroying the rainforest. Malayalam Manorama, a popular magazine, although inclined to view the project favourably, opens up its letters and features columns to environmental opinions.

 At first, few national newspapers consider the environment a particularly interesting subject, and the Silent Valley battles that are raging in Kerala may well be in another continent. The political push and shove that the project endures eventually gets the newspapers to cover the opposition to the project. The Indian Express, with its many southern editions, is ideally placed to pick up the issue. It’s Kochi editions regularly feature Silent Valley and its concerns – even lambasting the Morarji Desai government for approving the project.

 The Hindu regularly features editorials on the subject. In August 1979, the paper carries a full-page report on the flora and fauna of Silent Valley. The letters section of the paper attracts several eminent people, among them Rom Whitaker, M.K. Prasad, Madhav Gadgil. The eminent naturalist, M. Krishnan writes, “In my lifetime I have seen many fine wildlife habitats demolished for hydel projects. Silent Valley is more important than them all – the last authentic sizeable evergreen forests left.”

 More political twists and turns: Meanwhile, in Delhi, Charan Singh’s term as Prime Minister is over in a short six months. He is replaced by Indira Gandhi. Luckily for the conservation movement, she takes an active personal interest in the Silent Valley project, as national and international pressure mounts.

 **January 1981**: Bowing to unrelenting public pressure, Indira Gandhi declares that Silent Valley will be protected.

 However – when the fine print is read – it is learned that the area under the hydroelectric project is not covered under the protected area! When the people become aware of this ‘little detail’, hundreds of protest telegrams are sent to the Central Government. More pressure is heaped on the government by NGOs, reputed scientists and intellectuals, and ordinary citizens.

 **June 1983**: the Centre re-examines the issue through a commission chaired by Prof. M.G.K. Menon. **November 1983**: the Silent Valley Hydroelectric Project is called off.

 **1985**: Prime Minister Rajiv Gandhi formally inaugurates Silent Valley National Park.

 **TAJ MAHAL**

The TajMahal is an ivory-white marble [mausoleum](https://en.wikipedia.org/wiki/Mausoleum) on the south bank of the [Yamuna](https://en.wikipedia.org/wiki/Yamuna) river in the Indian city of [Agra](https://en.wikipedia.org/wiki/Agra). It was commissioned in 1632 by the [Mughal emperor](https://en.wikipedia.org/wiki/Mughal_Empire%22%20%5Co%20%22Mughal%20Empire), [Shah Jahan](https://en.wikipedia.org/wiki/Shah_Jahan) , to house the tomb of his favourite wife, [MumtazMahal](https://en.wikipedia.org/wiki/Mumtaz_Mahal%22%20%5Co%20%22Mumtaz%20Mahal). The tomb is the centrepiece of a 17-hectare (42-acre)complex, which includes a [mosque](https://en.wikipedia.org/wiki/Mosque) and a guest house, and is set in formal gardens bounded on three sides by a [crenellated](https://en.wikipedia.org/wiki/Crenellated%22%20%5Co%20%22Crenellated) wall.

Construction of the mausoleum was essentially completed in 1643 but work continued on other phases of the project for another 10 years. The TajMahal was designated as a UNESCO [World Heritage Site](https://en.wikipedia.org/wiki/World_Heritage_Site) in 1983 for being "the jewel of Muslim art in India and one of the universally admired masterpieces of the world's heritage"

The TajMahal is built on a parcel of land to the south of the walled city of Agra. Shah Jahan presented Maharajah Jai Singh with a large palace in the centre of Agra in exchange for the land. An area of roughly 1.2 hectares was excavated, filled with dirt to reduce seepage, and levelled at 50 metres above riverbank. In the tomb area, wells were dug and filled with stone and rubble to form the [footings](https://en.wikipedia.org/wiki/Foundation_%28engineering%29) of the tomb. Instead of lashed [bamboo](https://en.wikipedia.org/wiki/Bamboo), workmen constructed a colossal brick scaffold that mirrored the tomb. The scaffold was so enormous that foremen estimated it would take years to dismantle.

In 1942, the government erected a scaffolding to disguise the building in anticipation of air attacks by the [Japanese Air Force](https://en.wikipedia.org/wiki/Imperial_Japanese_Navy_Air_Service). During the [India-Pakistan wars](https://en.wikipedia.org/wiki/India-Pakistan_wars) of 1965 and 1971, [scaffolding](https://en.wikipedia.org/wiki/Scaffolding) were again erected to mislead bomber pilots.

More recent threats have come from [environmental pollution](https://en.wikipedia.org/wiki/Environmental_pollution) on the banks of the [Yamuna River](https://en.wikipedia.org/wiki/Yamuna_River) including [acid rain](https://en.wikipedia.org/wiki/Acid_rain) due to the [Mathura Oil Refinery](https://en.wikipedia.org/wiki/Mathura_Refinery), which was opposed by [Supreme Court of India](https://en.wikipedia.org/wiki/Supreme_Court_of_India) directives. The pollution has been turning the TajMahal yellow. To help control the pollution, the Indian government has set up the Taj Trapezium Zone (TTZ), a 10,400-square-kilometre (4,000 sq mi) area around the monument where strict emissions standards are in place.

Concerns for the tomb's structural integrity have recently been raised because of a decline in the groundwater level in the [Yamuna river](https://en.wikipedia.org/wiki/Yamuna_river) basin which is falling at a rate of around 1.5 m per year. In 2010, cracks appeared in parts of the tomb, and the minarets which surround the monument were showing signs of tilting, as the wooden foundation of the tomb may be rotting due to lack of water.

**MATHURA OIL REFINERY**

The **Mathura Refinery**, owned by [Indian Oil Corporation](https://en.wikipedia.org/wiki/Indian_Oil_Corporation), is located in [Mathura](https://en.wikipedia.org/wiki/Mathura%2C_Uttar_Pradesh), [Uttar Pradesh](https://en.wikipedia.org/wiki/Uttar_Pradesh). The refinery processes low sulphur crude from Bombay High, imported low sulphur crude from [Nigeria](https://en.wikipedia.org/wiki/Nigeria), and high sulphur crude from the [Middle East](https://en.wikipedia.org/wiki/Middle_East).

 The refinery, which cost Rs.253.92 [crores](https://en.wikipedia.org/wiki/Crore) to build, was commissioned in January, 1982. Construction began on the refinery in October 1972. The foundation stone was laid by [Indira Gandhi](https://en.wikipedia.org/wiki/Indira_Gandhi), the former [prime minister of India](https://en.wikipedia.org/wiki/Prime_minister_of_India). The present refining capacity of this refinery is 8.00 MMTPA. In January 2009, the plant shut down for a period of time due to a strike. Because, the refinery was in the news for allegedly causing the white marble of the [Taj Mahal](https://en.wikipedia.org/wiki/Taj_Mahal) to yellow. It is located about 50 kilometers away from the Taj Mahal.

 It is currently asking the Indian government to allow an expansion, raising the capacity to 11 million tonnes. The refinery also wants to create a new garbage disposal site, which has garnered new outrage from environmental activists because the site will be located even closer to the Taj Mahal and Mathura. The Mathura oil refinery releases toxic gases and disposes waste into the rivers making the area dirty and unhealthy. Even the Taj Mahal is getting affected because of this. The India government hired a panel to examine the effects of the refinery on the Taj Mahal. The panel found that the air has high levels of suspended particulate matter, caused by factory emissions, dust, construction, and exhaust from automobiles. These are causing the Taj Mahal to change color.

**TEHRI DAM**

 Tehri dam is being constructed across the Bhagirathi (Ganga) below the confluence of its two main head tributaries, e.g., the Bhagirathi and the Bhilangana rivers in Tehri district of Uttaranchal. The major objectives of the project are to impound floodwaters of the Bhagirathi and the Bhilangana rivers into a large reservoir behind the dam, genera­tion of hydroelectricity and irrigation of agricultural land in the western Uttar Pradesh.

 The project was cleared by the Planning Com­mission of India in 1972 and the work was started by the Irrigation Department of Uttar Pradesh on April 5, 1978. Tehri Hydro-Dam Corporation (THDC) was constituted in 1989. The project is being imple­mented with Soviet (Russian), technical and eco­nomic aid.

 The Tehri dam (260.5 m) is the highest rock-fill dam in the country. The Tehri reservoir will impound 345 million cubic meters of water of the Bhagirathi and Bhilangana rivers. The reservoir will submerge 467 square kilometers of area belong­ing to 172 villages and will displace 1, 25,000 peo­ple. Tehri town will also be submerged under the dam.

 The project will provide irrigation to 2, 70,000 hectares of agricultural land in the western Uttar Pradesh and supply 300 cusecs of water to Delhi. The installed capacity of power generation is 2,400 mw.

 About 1,000 mw of hydroelectricity would be generated in an underground powerhouse constructed near the dam, while another 1,000 mw will be produced by 4 units (each unit of 250 mw) from the water pumped back to the reservoir during off-peak hours. The water released from Tehri dam during the generation of power will be again impounded by a concrete dam at Koteshwar, 22 km down-stream from Tehri dam site.

This balancing reservoir of Koteshwar Hydel Station will generate another 4 mw of hydroelectricity.

The Tehri dam project estimated to cost Rs. 3,000 crores (1989 esteem and the life of the dam would be 100 economic Serious objections have been raised environmentalists and men of public over mainly on three counts viz., (i) seismity region and therefore safety problem of the environmental degradation and ecologieance, and (iii) displacement of loc al inhabit destruction of regional age-old culture, has given due credence to these objection.

**KOLLERU LAKE - AQUACULTURE**

 Kolleru is one of Asia's largest freshwater lakes. It is located in Andhra Pradesh, and is a famous habitat for a number of resident and migratory birds, including the vulnerable grey pelican. Situated between the Godavari and Krishna river basins, it is an invaluable wetland ecosystem. The lake spans 90,100ha and the water shrinks or expands depending on the rains' many rivulets drain into the Kolleru and surplus waters run off into the Bay of Bengal. There are about 75 abutting villages who long co-existed harmoniously with the birds and resources of the lake. The government assigned lands in the lake area to Scheduled and Backward Castes, who used their areas for fish tanks and agriculture.

 During the 1970s the fishermen were encouraged to form co-operatives and loans were sanctioned for seasonal cultivation. Because of repeated floods, the banks and government encouraged them to convert agricultural land to fish ponds and tanks. In the early 1990s aquaculture boomed. The problem was that it needed saline water to flourish and borewells were sunk in the lake bed to pump out saline water for the aqua ponds. Consequently the lake bed and banks sank and the tides brought in more saline water. The aquaculture practice requires chemical fertilizers, manure and chicken waste. Once the harvest is over, the water stagnates and pollutes surrounding water.

 As a result, the drinking water of dozens of island villages has been polluted and the lake has undergone chemical and biological changes that have contributed to its depletion and pollution. The water has turned saline, fish are contaminated with pesticides, and polycyclic aromatic hydrocarbons and heavy metals have entered the lake, making fish and prawns unfit for human consumption. The degradation of the Kolleru has many implications for the weaker sections of the community. The poor blame the rich aqua farmers who were responsible for the shift from traditional freshwater fishing to saline prawn farming.

 It is ironic that the main problem is the dearth of drinking water in the neighbourhood of the largest freshwater lake in the country. Four tonnes of fish died at the Atapaka bird sanctuary in 2015. Residents alleged Forest Department authorities were negligent in their management of the lake, while the Krishna district Deputy Director of Fisheries said fish deaths were due to decreased water levels and low dissolved oxygen levels. Though the locals have been alerting the forest staff over the decreasing water levels from December, no measures have been taken for maintaining the water levels to ensure survival of the fish which are prey for migratory birds.

 In 2012, the lake huge quantities of fish were killed for similar reasons. But the officials, in a planned manner, have not taken preventive measures. Public conflict has been somewhat limited, with most coming in the forms of legal challenges. The lake has unlawfully been converted into a commercial fishing hub, but according to a Times of India report, there is limited local opposition. There is conflict between conservationists and the local community over reducing the size of the lake - wildlife groups oppose the reduction, while residents support the government proposal. Women and fishermen protested efforts to demolish a 607ha as part of 'Operation Kolleru'.

**FLUOROSIS**

 Fluorosis is an important public health problem in parts of India and is endemic in 20 out of 35 states and union territories. As high as 70% to 100% of the districts are affected with fluorosis in the states of Andhra Pradesh, Gujarat and Rajasthan. Fluoride levels in Andhra Pradesh vary from 0.4 mg/l to a very high level of 29 mg/l. Since May 2007, a new water source was established (river Krishna water from Nagarjunsagar dam) to provide water to Nalgonda district, which had permissible limits of fluoride.

 Fluoride is a mineral that is found naturally in many foods and water. We rely on it to help develop healthy teeth and protect against tooth decay—so much so that extra fluoride is added to drinking water across nearly the entire country. It’s so effective that half of all children from 5 to 17-years-old who drink fluoridated water have never had a cavity.

 Fluorosis is a condition caused by the intake of too much fluoride while the teeth are being formed. It’s not a disease but a cosmetic condition that affects the appearance of teeth. Fluorosis can cause white or brown discoloration on tooth enamel, or irregularities on the tooth surface. The effects are permanent and may darken over time, but often they’re so mild that only a dental professional can detect them. Typically only children under 8-years-old are at risk of fluorosis, since it can only occur while teeth are developing.

 A major cause of fluorosis comes from the misuse of fluoride-containing dental products, like toothpaste or mouthwash. Consumption of these products is usually accidental, but some kids enjoy flavored toothpastes so much that they eat them or intentionally swallow after brushing. Products containing fluoride should always be kept out of reach of children and used under adult supervision. As a parent, you may also want to buy flavors that discourage swallowing.

 Another cause of fluorosis is the misuse of fluoride supplements - either by taking an amount more than is prescribed, or unnecessarily taking them when tap water, fruit juices, and other sources already provide enough fluoride. Only children who live in an area without fluoridated drinking water should take supplements under the direction of a dental professional.

 Further increase in the concentration of fluorides in drinking fluoridated water can also lead to more serious problems, including Skeletal fluorosis. Skeletal fluorosis, a complicated illness caused by the accumulation of too much fluoride in the bones, has a number of stages. The first two stages are preclinical-that is, the patient feels no symptoms but changes have taken place in the body. In the first preclinical stage, biochemical abnormalities occur in the blood and in bone composition; in the second, histological changes can be observed in the bone in biopsies. Some experts call these changes harmful because they are precursors of more serious conditions. Others say they are harmless.

 In the early clinical stage of skeletal fluorosis, symptoms include pains in the bones and joints; sensations of burning, pricking, and tingling in the limbs; muscle weakness; chronic fatigue; and gastrointestinal disorders and reduced appetite. During this phase, changes in the pelvis and spinal column can be detected on x-rays. The bone has both a more prominent and more blurred structure.

 In the second clinical stage, pains in the bones become constant and some of the ligaments begin to calcify. Osteoporosis may occur in the long bones, and early symptoms of osteosclerosis (a condition in which the bones become more dense and have abnormal crystalline structure) are present. Bony spurs may also appear on the limb bones, especially around the knee, the elbow, and on the surface of tibia and ulna.

 In advanced skeletal fluorosis, called crippling skeletal fluorosis, the extremities become weak and moving the joints is difficult. The vertebrae partially fuse together, crippling the patient.

 There are two interventions to practice for the management of the disease. Fluorosis can be totally prevented and the individual can lead a normal, healthy life. The interventions to practice are: Provision of safe drinking water and Nutritional intervention

**1. Provision of safe drinking water:**

* Locating alternative sources of safe water (Best method)
* Bringing in water from a distant, safe source
* Dual water source
* Rain water harvesting
* Removal of fluoride from water (defluoridation), using suitable techniques
* Prevention of industrial fluorosis by rigorous enforcement of procedures for minimizing industrial fluoride pollution.

**Defluoridation of water:**

 Defluoridation is the conventional and widely tested method for supplying safe water to the fluorosis affected communities. It is defined as “the downward adjustment of level of fluoride in drinking water to the optimal level”.

 Defluoridation can be achieved through: (i) the treatment of water at the source (central treatment); (ii) the treatment of water at the household level (point of use treatment). Treatment at the source is the preferred method in most of the developed countries as it can be carried out on a large scale under direct supervision of skilled personals.

 On the other hand, treatment of the water at point of use level i.e. at household level can be preferred in less developed countries. Treatment at the point of use has several advantages over treatment at community level. Only water required for cooking and drinking purposes can be treated through point of use defluoridator which will be cost effective and will create less amount of sludge as compared to community level defluoridation .

Defluoridation techniques can be broadly classified into following categories:

1. Adsorption technique
2. Ion-exchange technique
3. Precipitation technique
4. Other techniques, which include electro chemical defluoridation and Reverse Osmosis.

**1. Adsorption:**

 This technique functions on the adsorption of fluoride ions onto the surface of an active agent. In the adsorption method, raw water is passed through a bed containing defluoridating material. The material retains fluoride either by physical, chemical or ion exchange mechanisms. The adsorbent gets saturated after a period of operation and requires regeneration.

**A. Activated Alumina:**

 Activated alumina (Al2O3), which has been in use for defluoridation since 1934, is prepared by low temperature dehydration (300-600°C) of aluminum hydroxides. The ligand exchange reaction at the surface of activated alumina is thought to be the probable mechanism of fluoride removal.

 Handpump attached Defluoridation Units and Domestic Defluoridation Units have been developed in India by IIT Kanpur in collaboration with UNICEF using indigenously manufactured activated alumina. The advantages of this approach domestic defluoridation units are: a lower cost for treatment as only a limited volume of water is required (for cooking and drinking) to be treated and the lower requirement of treated water correspondingly lowers the need of chemicals and generates lower volume of sludge.

**B. Bone Char :**

 Bone char is ground animal bones, charred at optimum temperature (5000C) to remove organics. The fluoride removal mechanism involves the replacement of carbonate of bone char by fluoride ion. Exhausted bone char is regenerated using caustic soda. Bone char has been used for defluoridation of drinking water in USA in the 1950's and 1960's. But first domestic defluoridation unit of drinking water, primarily using bone char, was developed by the Inter-country Centre for Oral Health (ICOH), Chiangmai, Dental Faculty of Chulalongkoran University, Bangkok, and the WHO in 1988.

**C. Calcined Clay :**

 Aluminum oxide (Al2O3) present in the brick soil gets activated during burning and adsorbs excess amount of fluoride present in the raw drinking water. Filter media need to be replaced every three months if the fluoride content of raw water is 2.5 ppm. Freshly fired brick pieces were used in Sri Lanka for the removal of fluoride in domestic defluoridation units.

**D. Mud Pots :**

 Collection and storing of water in mud pots is an ancient method. Red soil and clay are used to prepare the mud pots. The raw pots are subjected to heat treatment as in the case of brick production. Hence, the mud pots also act as an adsorbent media. The major advantages of mud pots are they are economic and readily acceptable for the rural communities.

**E. Natural Adsorbents** :

 A relatively less known approach of potential utility, particularly in third world rural communities, that has attracted the attention of researchers in recent years is plant-based (natural) defluoridation technique. The plants can be grown locally as needed and the costs for production and transportation can be relatively low. The use of plants for defluoridation might also achieve widespread acceptance and application by local communities more easily. Many natural adsorbents from various trees and animal sources have been tried as defluoridation agents. Seeds of the Drumstick, roots of Vetiver grass, Tamarind seeds, tea ash, egg shell powder are few among them.

**2. Ion Exchange :**

 The different ion exchange materials studied include bone, bone char, anion and cation exchange resins such as carbon, defluoron-1, defluoron-2, etc.

**3. Precipitation**

 In this method, chemicals added to raw water cause precipitation of the fluoride salt as insoluble fluorapatite, which is separated from the water. Commonly used materials in precipitation technique are Aluminium salts (e.g. Alum), lime, Poly Aluminium Chloride, Poly Aluminium Hydroxy sulphate and Brushite.

**A. Nalgonda Technique**

 The first community defluoridation plant for removal of fluoride from drinking water was constructed in the district of Nalgonda in Andhra Pradesh, in the town of Kathri. The technology was developed by National Environmental Engineering Research Institute (NEERI), Nagpur in 1961. Nalgonda Technique involves addition of Aluminium salts, lime and bleaching powder followed by rapid mixing, flocculation, sedimentation, filtration and disinfection. Aluminium salt may be added as aluminium sulphate (alum) or aluminium chloride or combination of these two. It is responsible for removal of fluoride from water .

 The technique is highly versatile and has the applications like; for large communities, fill and draw technique for small communities, fill-and-Draw defluoridation plant for rural water supply, for domestic defluoridation units, etc.

**B. Contact Precipitation:**

 Contact precipitation is a recently reported technique in which fluoride is removed from water through the addition of calcium and phosphate compounds which leads to precipitation of fluoride. The water is then filtered through bone char that has been pre-saturated with fluoride. The presence of saturated bone charcoal medium acts as a catalyst for the precipitation of fluoride either as CaF2, and/or fluorapatite. The process uses buckets, column filters or a combination of both (developed by WHO; 2006).

**C. IISc Method:**

 The Indian Institute of Science (IISc), Bangalore developed this simple defluoridation technique. The method uses magnesium oxide, calcium hydroxide and sodium bisulfate. Magnesium oxide removes dissolved fluoride ions from water samples by precipitating fluoride as insoluble magnesium fluoride;

A simple to use domestic defluoridation unit was developed for fluoride removal based on IISc Method at Kolar, Karnataka to treat 15 litres of fluoride contaminated water.

**4. Other techniques of defluoridation of water:**

 Reverse osmosis, electrolysis & electro dialysis and distillation are physical methods that are tested for defluoridation of water. Though they are effective in removing fluoride salts from water, but there are certain procedural disadvantages that limit their usage on a large scale.

 **Prevention of Industrial fluoride emission:**

In the industrialized western world, industrial fluorosis leads to inhalation of fluoride dust or gas or fumes. Workers in industries and mining exposed to fluorides should be monitored and it should be ensured that their fluoride content of urine is below 5 PPM (Zsogon 1989). If the workers are found to be suffering from skeletal fluorosis, they should be removed from exposure to fluoride. Central Pollution Control Board, Ministry of Environment & Forest, Govt. of India (1998), has given a permissible limit of industrial emission of fluoride which is less than 25 mg/Nm3.

**2. Nutritional Interventions**

 Fluorosis mitigation is mainly addressed through defluoridation of water in most of the cases. There are isolated cases where nutritional supplements can also be used as a part of curative measures. Nutritional intervention should focus on adequate intake of foods rich in calcium, vitamins C&E and antioxidants, along with consuming safe drinking water.

 Along with these interventions, people residing in endemic areas should be made aware about the adverse health impacts of excessive fluoride and need to be motivated to adapt to the methods for mitigating fluorosis.