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From The Desk of the Editor-in-chief...

उद्धरेदात्मनात्मानं नात्मानमवसादयेत् ।

आत्मैव हमात्मनो बंधुः आत्मैव रिपुरात्मनः

Because of your own progress, don't be a cause of your own degradation. We ourselves are own friends or enemies (no one else). That is, a person will prosper or ruin due to his own deeds, He has to select what he wants

-Rigveda-

In the era of climate change, the extreme rainfall has become a menace in the Indian Peninsula .India is prone to almost all the major natural disasters. The high population density combined with poor preparedness, planning and management, has inevitably lead to huge losses of lives and property every year in the country. Uncontrolled growth at the expense of the environment will severely exacerbate the impacts of climate change in the near future. Our cities are simply not prepared for extreme weather conditions . The recent collapse of a bridge in Genoa, killing at least 43 people, is not only linked to poor maintenance, but also to heavy rainfall. Media call it the worst flood of the century in the region. After more than two weeks of relentless rain, Kerala, known internationally for its scenic green landscapes, touristic spots and backwaters, is left with over 1 million people in relief camps, and close to 400 reported dead – the number is expected to be much higher, as many areas remain inaccessible.

The hill station Coorg, in the neighboring state of Karnataka, witnessed thousands of people being marooned because of torrential rains. Exacerbated by landslides in hilly terrain, flooding has led to the destruction of homes, bridges, road networks and industries .What a disaster and whom to blame Humans or Nature are going to be blame Humans or Nature is a big question?

We can't deny the fact that it is us who are going to be blamed for this disaster ;we made tens to hundreds of thousands of large trees to get felled, we are responsible for uncontrolled sand mining .It has constrained river flows, while the rapid spread of high-rise buildings on unstable hill slopes has weakened the soil. This unplanned development has left the area susceptible to flash floods and landslides, caused by a combination of tree felling on steep hills lopes and heavy rainfall. Similarly flooding of the Kochi airport is another example of poor planning leading to disastrous outcomes. The airport was built on the paddy fields and wetlands adjacent to the Periyar river, and extends up to the banks of the river on one side.

A 2017 report by the Comptroller and Auditor General of India warned that not a single one of these dams had an emergency action plan in place for disaster management in kerla.

The Government needs to address these critical issues and take remedial measures at an urgent note, as is done in Nariobi. Nairobi is in the midst of an extensive demolition drive, uprooting thousands of buildings built on riparian land that choke the flow of water and contribute to severe annual floods. Such stern decisions and steps done can save the planet Earth.

The focus must be on long-term restoration projects that can reverse some of the environmental and ecological damage that has led to the current situation. But such learning need not be confined to the areas that have experienced the worst. The rest of the world has much to learn as well.

Happy Reading!

Dr. Sanjeev Bansal

Transition to Renewable Energy Resources

Pranjal Pant*

Pratyush Gupta**

Today, the prices of non-renewable sources of energy like fossil fuels have been skyrocketing, and there seems to be no end to it. Upon their combustion, the gases which are produced by them are not only hazardous to the humankind, but also to our beloved planet Earth's Ozone layer which protects us from the UV radiations of the sun. Mankind has not only seen melting of the Polar Icecaps due to these greenhouse gases, but there seems to be an inevitable need to forego the non-renewable sources of energy now, more than ever. The nuclear disaster at Chernobyl is a stark reminder of how nuclear power can be extremely dangerous as well, if not handled carefully. Renewable energy poses far lesser risks, and as the name suggests, is self-replenishing. Not only is generating power and energy from renewable sources more efficient, it also proves to be cheaper in the long run. In this paper, we discuss alternative technologies for enhancing renewable energy deployment and energy use efficiency.

Keywords: renewable, energy, power, fuel, efficiency, ozone, nuclear

INTRODUCTION

We need energy to run our machines, cars, etc. We need energy to keep us warm during the winters, and cold during the summers. Without any sources of energy, we would not be able to do half the work that we perform in our day to day life. This brings us to the bigger question – where does this energy come from?

The answer is simple. Being the advanced species that we are, us humans have zeroed in on various energy sources that we utilize for this very purpose. We use fossil fuels, nuclear power, solar power, etc. to generate energy that aids us in our daily activities. By their inherent nature, we have classified the sources of energy as renewable and non-renewable. For centuries, humans have been exploiting the non-renewable sources of energy to an extent wherein we have created an imbalance on our planet. The Polar icecaps are melting, greenhouse gases are rising, ozone layer is getting punctured and quite frankly, not only the humans, but the other species are also having to face the wrath of the myriad of consequences galore. We have witnessed many nuclear disasters like the Chernobyl disaster, many crude oil extraction disasters, one of the prominent one being the blowout on Deepwater Horizon – all this led to huge loss of lives of humans and other

species too, all because we were either busy utilizing the non-renewable energy resources, or because we were trying to extract them from our planet.

This has caused us to shift towards alternative sources of energy, or the renewable sources of energy. Not only are these sources inherently safer than the non-renewable sources of energy, by definition, they don't even deplete the planet of the various precious resources that we have. By utilizing the various sources like solar, wind, hydel energy etc., we can derive energy in a clean and efficient manner, and also whilst saving costs in the long term.

Hazards Posed by Non-Renewable Sources of Energy

Not only does the continued abuse of non-renewable energy resources have a myriad of negative impacts on our environment, but it also has a potentially deadly impact on our health too.

Air Pollution



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When non-renewable resources are used for the generation of energy in various forms, they generate a plethora of polluting agents that pose an extremely hazardous risk to anyone around them who inhales them. Deadly gases are produced upon combustion of coal.

Gases like SO₂ can cause a lot of breathing problems, and even diseases like asthma, pulmonary inflammation, etc. According to the EPA (Environment Protection Agency) research, in 2014, fossil fuel combustion at power plants accounted for 64 percent of US SO₂ emissions [1]. In 2013, a study was conducted which found that a mean cost of 32 cents per kWh for coal, 13 cents per kWh for oil, and 2 cents per kWh for natural gas, when it was considered that people fell ill and lost precious workdays.

Acid Rain

Acid rain may be caused due to emission gases like SO₂, Nitrogen oxides etc. which may lead to death of biodiversity. According to a research conducted by the US Acid Precipitation Assessment Program in 1991, 5% of the lakes in New England were acidic and 2% could no longer support fish like trout [2].

Land Pollution



The soil and land of a particular region where mining is being conducted for various ores or fossil fuels is usually left without being treated. The soil in these regions is abused to a huge degree by means of usage of various chemicals, etc. With no proper disposal done for this, and mindlessly throwing the excavated untreated soil here and there, we are left with poor quality polluted soil and polluted land, where we are inherently killing off various species which call this land their home. The worst case scenario is

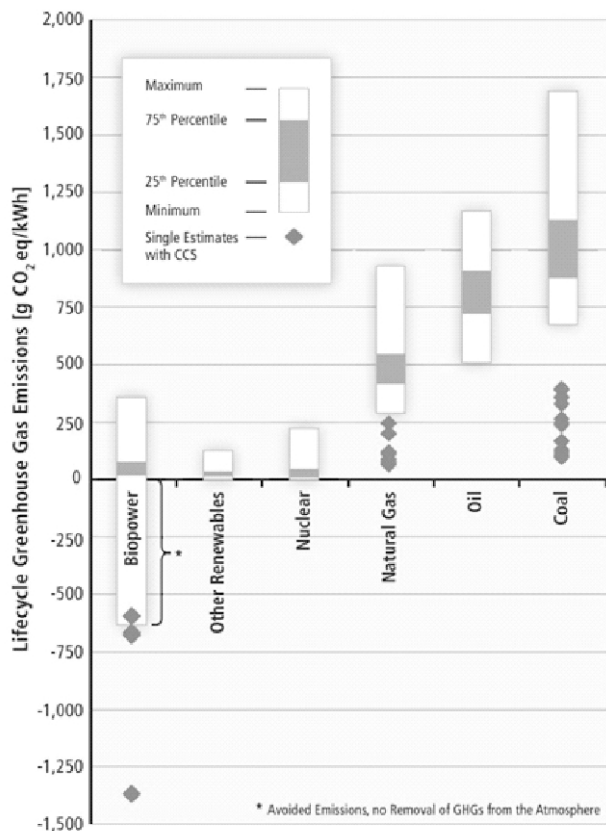
seen when Nuclear ores are being mined. Due to their radioactivity, the land is left polluted for multiple years. Not only this, the nuclear waste that may be dumped or buried in the ground may cause severe land pollution, death of species and polluted water table.

Water Pollution

Wastes generated by factories are often dumped into the water bodies or flowing rivers nearby. Researchers have estimated that in this chemical infused waste that is released into the water bodies, about 30% of the chemicals are carcinogens or may cause mutations of some kinds when consumed by humans or in aquatic species which thrive in those waters. It's of utmost importance that due effort is made in cleanup of the wastes before they are released into the water bodies.

Global Warming

Global warming is a very serious problem, and trends have shown that the temperature of our planet has indeed risen over the years. The below graph shows how the various non-renewable energy sources stack up next to each other when we compare their respective Greenhouse gases emission profiles [3].

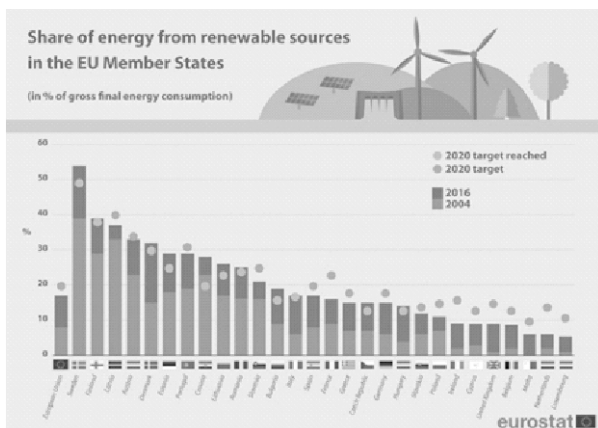


RENEWABLE ENERGY SOURCES AND THEIR BENEFITS

“Can A Country Achieve 100% Renewable Energy??”

If you think 100% renewable energy will never happen then I urge you to think again and again up to the extent of agreeing to it Yes it can happen. Many Countries have adopted assertive plans to obtain their power from renewable energy. Coming to the fact Iceland is getting 85% of the country's electricity from earth's heat. Norway is around 98% renewable and uses hydroelectric, geothermal and wind to achieve its goal. Portugal uses hydroelectricity from 38% to 58% as their electric supply. Paraguay uses hydropower to provide 90% of its electricity. Denmark uses 30% wind and 15% biomass for its energy needs. Scotland has promised to become 100% by renewable by 2020. Germany is already using 98% of renewable energy [4]. So yes if we work on it we can come to the extent of 100% renewable energy.

The below graph shows the share of energy from renewable sources in the EU member states.

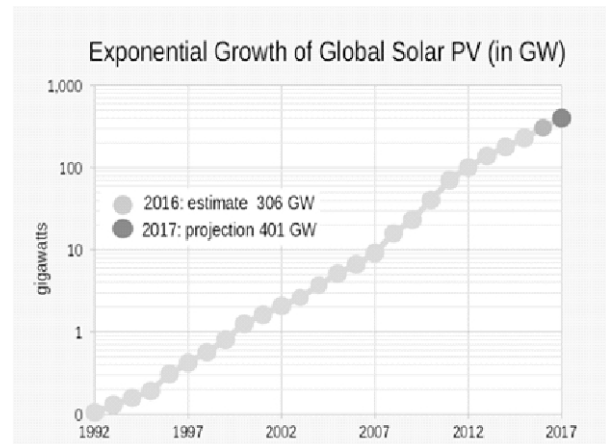


Renewable energy is collected from renewable resources that can be replaced or replenished in the same or lesser amount of time that is taken to actually harness them. Renewable energy provides energy in mainly four important areas: electricity generation, air and water heating/cooling, transportation, and rural energy services [5]. There are many forms of renewable energy.

Solar

Various methods can be used to convert the energy from the Sun into heat, electricity, etc. Photovoltaic systems are capable of converting light into DC, by making good on the principles of the photoelectric effect. Solar Panels can be easily found in various

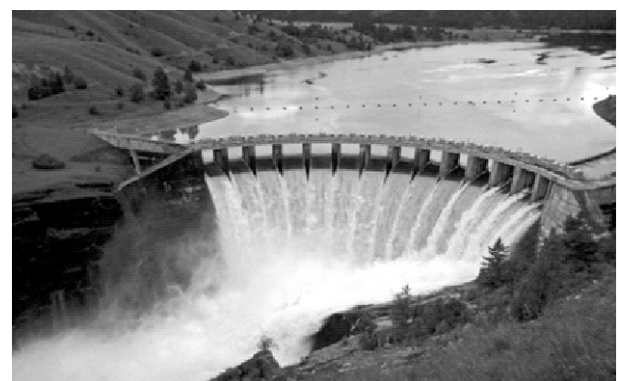
online as well as offline markets, and can be easily set up for personal use. Solar Panel industry has turned into a multi-billion-dollar industry [6]. The below graph shows the global exponential growth of solar photovoltaic systems.



Wind

The energy of the flowing wind can be harnessed by means of installation of windmills. This energy can be further used for various purposes - from generation of electricity to doing work like pumping, grinding, etc. Windmills, or wind turbines provide the easiest way to convert the power available from the wind. The power generated by the wind turbine is directly proportional to the wind and wind speed. In 2014 global wind generation was 706 terawatt-hours or 3% of worlds total electricity which reached to 4% within the next year i.e. 2015 [7].

Hydroelectric



Dams that store water in a reservoir are opened, water is released, and this water flows through various turbines which generate electricity. Currently, most of the available locations for hydroelectric dams are already being used in the world. There is a need to construct more dams that can assist in generating hydel power. 2015 was the

year noted that hydropower generated 70% of all renewable electricity and 16.6% of worlds total electricity.

Biomass

Biomass is basically any organic matter that is derived from plants or animals. Bioenergy generates a similar amount of carbon dioxide as fossil fuels. It must be noted however that as a principle of power generation via bioenergy, plants are grown as a replacement for those which are used. These remove an equal amount of CO2 from the atmosphere, thereby making it more viable than using fossil fuels. Biomass energy is primarily used for generation of gases like methane. These days, it is also being avidly used for fueling electric power plants. Utilizing biomass energy can minimize the greenhouse gases in our environment in the long run, and also prevent the harms of excessive greenhouse gases in our environment.

Geothermal

Geothermal power plants store the energy left over from Earth in the form of thermal energy. The heat can be trapped close to surface, from heated rocks, or from hot water reservoirs. In certain areas, geothermal energy is high enough that it can be exploited to generate electricity. US stands the highest in use of geothermal energy.

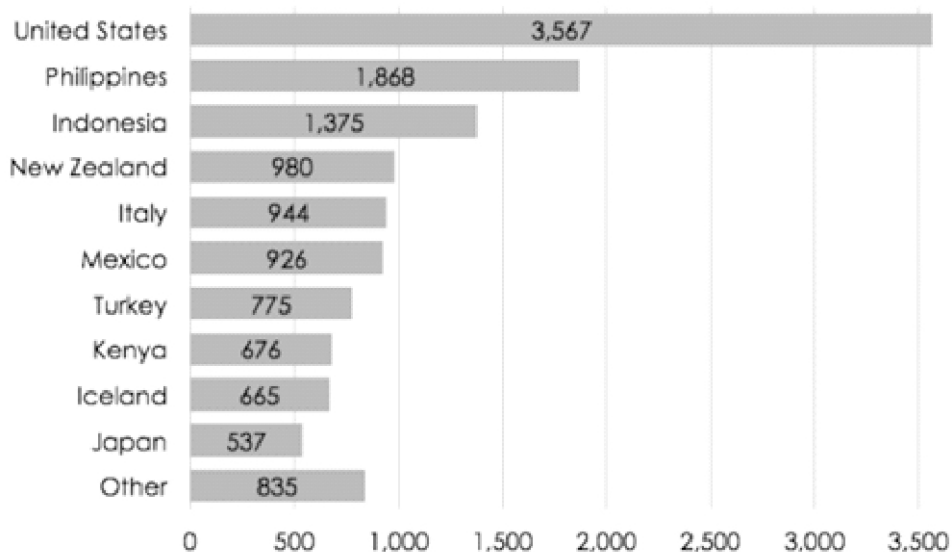
CONCLUSION

Our planet is in desperate need of our attention. Talking realistically, a transition to completely renewable sources of energy is only possible in stages. It is impossible to wake up to a green future if steps aren't taken towards it.

The following steps may be taken to shift us over to a clean and green future –

- We need to focus on making the engines etc. more efficient, so as to ensure that they consume lesser fuel.
- Mass adoption of renewable energy sources wherever and whenever possible.
- Encouraging the use of solar panels, solar water heaters, etc. instead of increased reliance on diesel powered generators.
- Reduced dependence upon crude and crude products.
- Setting up windmills in areas of heavy wind currents like deserts, coastal regions etc.
- Increased dependence upon Hydel energy sources etc.
- Encouraging the use of hybrid vehicles, if not all electric ones.
- Involvement of the Government in providing appropriate subsidies so that automobile manufacturers may feel motivated to launch all electric models.

TOP 10 GEOTHERMAL COUNTRIES
INSTALLED CAPACITY (NOV 2016)



Source: TGE Research (2016), GEA (2014), IGA (2015), Energi Atlas (2014)

Apart from the above direct suggestions, we also need to take indirect measures to reverse the harms that we have already caused to our planet, by –

- Planting more trees.
- Promoting recycling of products.

Overall, it is extremely essential that a move over to renewable energy resources must happen for the betterment of the environment, and the entire species on Earth.

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Water Pollution: Cases, effects and methodologies to tackle contamination

Tanya Bhattacharya*

Jyoti Garg**

Water is a basic asset in the lives of individuals who both advantage from its utilization & which is destroyed by its abuse & capriciousness (flooding, dry seasons, saltiness, sharpness, & corrupted quality). Water is a limited & most valuable asset. Subsequently, utilization of polluted water puts lives & employments in danger since water has no different chemical substitute. There also are numerous manners by which water planned particularly for human utilization can get polluted. These incorporate squanders from various activities like mining & development, sustenance preparing, radioactive squanders from control creating businesses, residential & agrarian squanders & by different microbiological specialists. These days, water is being cleansed by different techniques yet examine is being directed to search particularly for more solid & less expensive strategies that can sanitize water at a reasonable cost. Different systems have been produced like using battery-powered polymer dots, seeds of Morenga Oleifera tree, oxygen consuming granular ooze innovation, sap based particular treatment & two dimensional water treatment innovation.

Keywords: contamination, water pollution, Morenga, wastage, water cycle

INTRODUCTION

Water is chemical compound substance which is basic necessity for each living being to make possible life on this planet. Water is required by each cell of the living being's body to per particularly form typical capacity. Water covers 71% of the Earth's surface, particularly for the most part in seas & other substantial water bodies, with 1.6% of water subterranean in aquifers & 0.001% noticeable all around as vapor, mists & precipitation (U.S. Topographical Survey 2000). Water moves continually through a cycle of vanishing or transpiration (evapotranspiration), precipitation, & overflow, particularly for the most part achieving the ocean. Winds convey water vapor over l& at an indistinguishable rate from spillover into the ocean. Over l&, vanishing & transpiration add to the precipitation over l&.

LITERATURE SURVEY

Extremely, clear drinking water is fundamental to human & other life. A few onlookers have assessed that by 2025 the greater part of the total populace will confront water-based vulnerability, a circumstance which has been known as a 'water emergency's by the United Nations

(Kulsreetha 1998). An ongoing report recommends that by 2030, in some creating districts of the world, water request will surpass supply by half.

Unadulterated uncontaminated water does not happen in nature. Water contamination is any bothersome change in the condition of water, debased with destructive substances. It is the second most important natural issue beside air contamination. Any adjustment in the physical, compound & natural properties of water that harmfully affects living things is named as 'water contamination'. Because of the unwanted human exercises, water contamination is a developing peril in many creating nations. A more genuine part of water-contamination is what is caused by human action, & industrialization (Park 2009). There are likewise different miniaturized scale biological specialists that incorporate microorganisms, infections & protozoa which can likewise cause water contamination & may cause different water-borne sicknesses (Nevondo & Cloete 1999).

The earliest recorded endeavors to discover or produce unadulterated water go back to 2000 B.C. Early Sanskrit compositions sketched out strategies particularly for refining water (Early Water Treatment 2009). These techniques ran from bubbling or setting hot metal instruments in water be particularly for drinking it to separating that water through rough s& or charcoal channels. These compositions propose that the significant thought

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process in purging water was to give better tasting drinking water. It was accepted that great tasting water was additionally spotless (Mc Kinney & Schoch 2003). Individuals did not yet associate sullied water with infection nor did they have the innovation important to perceive dull yet destructive creatures & residue in water. Albeit different methods have been developed with a specific end goal to decontaminate water so it can be made protected & healthy however extensive scale refinement includes part of accounts. Research is being led worldwide keeping in mind the end goal to create fresher strategies which can be utilized to clean water & that too at a moderate cost (Rao 2001).

FACTS & NUMERICAL DATA RELATED TO WATER POLLUTION

Diseases spread by utilization of polluted water. It has been assessed that 50,000 individuals pass on day by day worldwide because of water-related illnesses. Countless in creating nations need access to sufficient water supply. In South Africa, it has been assessed that in excess of 12 million individuals don't get access to satisfactory supply of consumable water. Polluted water additionally contains infections, microscopic organisms, intestinal parasites & other hurtful microorganisms, which can cause waterborne sicknesses, particularly for example, looseness of the bowels, diarrhea, & typhoid. Because of water pollution, the whole eco-framework gets damaged. Hazardous drinking water, alongside poor sanitation & cleanliness, are the primary supporters of an expected 4 billion instances of diarrheal infection every year, causing in excess of 1.5 million passing, particularly for the most part among kids under 5 years. In excess of 50 nations still report cholera to WHO (World Health Organization). Millions are presented to risky levels of normally happening arsenic & fluoride in drinking water which prompts tumor & tooth/skeletal harm. An expected 260 million individuals are contaminated with schistosomiasis. 1.3 million Individuals kick the bucket of intestinal sickness every year, 90% of whom are kids under 5.

HUMAN ACTIVITIES RESPONSIBLE PARTICULARLY FOR WATER POLLUTION

Particularly for all intents & purposes every human action create some sort of ecological unsettling influence that contaminate encompassing waters. Eating (body squanders), planting (pesticide & silt overflow) & numerous different exercises make results that can discover their way into the water

cycle. Particularly for convenience, we can dole out the substantial larger part of well springs of water contamination to three general classifications of waste.

- a. Industrial
- b. Agricultural &
- c. Domestic wastage

a. Industrial Wastage

Wastes from industry fill in as significant hotspots particularly for all water contaminations. Many real enterprises contribute fundamentally to water pollution, yet a portion of the imperative are the (i) producing (ii) control creating (iii) mining & development, & (iv) sustenance handling ventures. Assembling ventures like concoction, oil refining, steel & so particularly forth contribute huge numbers of the most exceptionally harmful toxins, including an assortment of natural synthetic compounds & overwhelming metals. Different businesses have less potential effect however are as yet considered exceptionally risky with regards to pollution. These ventures incorporate the material, cowhide tanning, paint, plastics, pharmaceutical, & paper & mash businesses As a rule, both the items, particularly for example, the paint or the pesticide, & the results from the assembling procedure are profoundly harmful to numerous life particularly forms, including people.

Power creating businesses are the significant donors of heat & radioactivity. About all power plants, whatever the fuel, are significant wellsprings of (warm) pollution.

The mining & development enterprises are significant givers of dregs & corrosive waste. There are essentially four principle kinds of mining impacts on water and its quality.

- 1) Acid mine seepage
- 2) Heavy metal tainting & draining
- 3) Processing synthetic concoctions pollution
- 4) Erosion & sedimentation

Water assumes numerous basic parts inside the field of nourishment science. It is vital particularly for a nourishment researcher to comprehend the parts that water plays inside sustenance preparing to guarantee the achievement of their items. Water hardness is

likewise a basic factor in sustenance preparing. It can significantly influence the nature of an item & also assuming a part in sanitation. The sustenance preparing industry is extremely various. Significant segments incorporate products of the soil, dairy, meats & fish, alcoholic & non-mixed drinks, oils, & bundled sustenances. The most well-known natural worries in the business are water utilization & wastewater release, synthetics utilized as a part of handling & cleaning, bundling diminishment & transfer, & nourishment scraps & cannot.

b. Agricultural Wastes

These are created by the development of yields & creatures. Comprehensively, farming is the main wellspring of residue pollution which incorporates furrowing & different exercises that evacuate plant cover & aggravate the dirt. Farming is additionally a noteworthy patron of natural synthetic substances, particularly pesticides. Pesticides are broadly utilized as a part of present day farming in many nations all through the world & in an extensive scope of conditions. The utilization of nitrogen composts can be an issue in zones where agribusiness is ending up progressively heightened.

c. Domestic Wastes

These are those that are created by family units. Most household squander is from sewage or septic tank spillage that winds up in regular waters. Previously, a few urban communities dumped untreated or scarcely treated sewage specifically into streams, lakes, or beach front waters. Plant supplements happen as nitrogen & phosphorus. These come from human waste, as well as from composts utilized widely in house-hold yards & greenery enclosures. Today, numerous individuals dump their refuse into streams, lakes, waterways, & oceans, in this way making water bodies the last resting spot of jars, containers, plastics, & other family items. The vast majority of the present cleaning items are engineered cleansers & originate from the petrochemical business.

MICRO-ORGANISMS CAUSING WATER POLLUTION

There are different smaller scale organic operators which can likewise cause water contamination if drinking water gets defiled with these specialists. The pathogenic specialists included incorporate

microorganisms, infections & protozoa which may cause sicknesses that shift in seriousness from gentle gastroenteritis to extreme & at some point lethargy of the bowels, diarrhea, hepatitis or typhoid fever. The greater part of them are broadly conveyed all through the world. Fecal tainting of drinking water is just a single of a few faeco-oral components by which they can be transmitted starting with one individual then onto the next or, sometimes, from creatures to individuals.

A large portion of the mortality & dreariness related with water related illness particularly in creating nations is expected straight particularly forwardly or in a roundabout way to irresistible operators.

NEW TECHNIQUES IN WATER PURIFICATION PROCESS

1. Point-of-use Water cleansing & Purification Using Rechargeable Polymer Beads

'Halo-pure' is one such empowering specialized progress in the improvement of a completely new biocidal medium as chlorine-battery-powered polystyrene dots that depends on protected science. The disclosures were normal however innovative result of a progression of studies, covering over a time of research, concentrated on balancing out chlorine on water insoluble, engineered polymer surfaces.

The major standards of the innovation are misleadingly easy to under-stand, in spite of the fact that their fuse into a dependably reproducible & pragmatic medium particularly for water sanitation has required long periods of extraordinary exertion & research. Permeable polystyrene dots are like those utilized particularly for water conditioner gum beds, are changed artificially in order to have the capacity to tie chlorine or bromine reversibly in its oxidative shape. Thusly, a ground-breaking antimicrobial part can be brought into a water purifier that won't come up short on steam, & must be disposed of. Rather, it can have its capacity frequently & helpfully "beat up" by the client. Living beings reach the show of chlorine, particularly for instance, on the surface of the dabs, & get enough halogen to inactivate them in short request. Those not killed inside seconds endure a brush with death, & capitulate rapidly in the item water as the disciple chlorine

gradually harms the life particularly from to the point of deadly outcomes. The innovation holds the guarantee of diminishing the effect of water borne sicknesses all through the creating scene. Its broad utilize could add to the acknowledgment of UN objectives particularly for access to safe water particularly for all by 2015. What's more, it could do as such without fall back on the huge foundation ventures that are expected to achieve this objective utilizing more ordinary centralized sanitation & dispersion approaches.

2. *Water cleaning Treatment Using the Seeds of the Morengaolifera Tree*

Utilizing common materials to clear up water is a system that has been honed particularly for a considerable length of time & of the considerable number of materials that have been utilized, seeds of the Morenga have been observed to be a standout amongst the best (David,1956). Studies have been led since the mid 1970's to test the viability of Morenga seeds particularly for treating water (Paterniani et al. 2010). These investigations have affirmed that the seeds are very viable in expelling suspended particles from water with medium to elevated amounts of turbidity (Morenga seeds are less viable at treating water with low levels of turbidity).

Morengaolifera seeds treat water on two levels, acting both as a coagulant & an antimicrobial operator. It is by & large acknowledged that Morenga fills in as a coagulant due to decidedly charged, water-dissolvable proteins, which tie with contrarily charged particles (residue, dirt, microscopic organisms, poisons, & so on) permitting the subsequent "flocs" to settle to the base or be evacuated by filtration (David,1956). The antimicrobial parts of Morenga keep on being inquired about. Discoveries bolster recombinant proteins both expelling microorganisms by coagulation & acting specifically as development inhibitors of the microorganisms. While there is progressing research being directed on the nature & attributes of these parts, it is acknowledged that medicines with Morenga arrangements will expel 90-99.9% of the polluting influences in water (Paterniani et al. 2010).

Arrangements of Morenga seeds particularly for water treatment might be set up from seed

portions or from the strong buildup left finished after oil extraction (presscake). Morenga seeds, seed parts or dried presscake can be put away particularly for significant lots however Morenga answers particularly for treating water ought to be arranged new each time. All in all, 1 seed bit will treat 1liter (1.056 qt) of water.

3. *Water Purification Using Aerobic Granular Sludge Technology*

The innovation, accordingly, offers vital points of interest when contrasted with traditional water filtration particularly forms. Particularly for instance, every one of the procedures can happen in one reactor. Additionally, there is no compelling reason to utilize substantial re-sinking tanks, particularly for example, those utilized particularly for ordinary cleaning. Such huge tanks are required particularly for this in light of the fact that the microbes bunches that are framed set aside any longer opportunity to sink than the aerobic granule ooze.

The granular slop innovation is extremely encouraging, & has been named particularly for the Dutch Process Innovation Award. The technology is currently in the commercialisation stage. In the coming years, additionally research will be proceeded. Testing of this sanitization strategy is being done on a bigger scale. The principal establishments are as of now being used in the mechanical division.

4. *Resin Based Treatment particularly for Colour & Organic Impurities Removal*

Endeavors have been made to keep the unfriendly stylish impacts related with mechanical waste water releases by quickening the expulsion of shading amid treatment of the assortment of modern squanders. Shading expulsion is additionally critical if the water must be made reasonable particularly for drinking reason in light of the fact that multiple occasion's underground water accompanies shading & this shading must be expelled preceding drinking.

Among the assembling activities, the material coloring & completing ventures are straight particularly forwardly influencing shading; which is the most observable normal particularly for both the crude waste & treated

gushing from this industry (Edwards, 1989). Albeit natural treatment of these waste waters is typically successful in evacuating a substantial bit of oxidizable issue, however it is much of the time incapable in expelling shading. The present technique particularly for shading evacuation utilizes a green shading essential color, an anion trade sap called 'Duolite A 171/SC' & a section made of borosil glass of tallness 40cm(Edwards, 1989). From the outcomes it was reasoned that gum treatment is a superior technique than traditional biologic process even at substantially higher filtration rate.

CONCLUSION

Water is an inexhaustible asset. Because of regularly expanding industrialization, urbanization, this valuable asset is persistently under pressure. There are numerous measurements to water and its quality & its decay. Water contamination is rendering a significant part of the accessible water dangerous particularly for utilization. The weight of expanding population, loss of backwoods cover, untreated emanating release from enterprises & districts, utilization of non-biodegradable / pesticides/fungicides/herbicides/bug sprays, utilization of compound composts rather than natural fertilizers, & so particularly forth are causing water contamination (Edwards, 1989). In addition, there are various water borne illnesses like cholera, loose bowels, looseness of the bowels & so particularly forth which are transmitted by drinking polluted water. There are different new water sanitization methods which have come up to clean water particularly for instance by utilizing battery-powered polymer globules, utilizing the seeds of

Morengaolifera tree, decontaminating water by utilizing oxygen consuming granular slime innovation & so on. Research is being led everywhere throughout the world to grow an ever increasing number of strategies which can produce unadulterated water requiring little to no particularly fort. Every one of these systems are being created to guarantee that in not so distant future everyone will have access to clean & pure water & that too at an of particularly fordable cost.

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Conservation of Wildlife

Aneesh Chadha*

Conservation of Wildlife in India is quite challenging. The pace of development has picked up in last two to three decades and this has led to fragmentation and deterioration in quality of wildlife habitats across the country. Illegal trade in wildlife parts and trophies has become more and more organised and poaching has emerged as the most serious challenge for the wildlife managers. Even survival of flagship species like tiger and elephant is under threat. There is need for strengthening of legal framework, enforcement infrastructure, balancing the impact of development on our natural heritage and making people living around the Protected Areas stakeholders in conservation. Urgent steps are required to be taken without any loss of time to safeguard our natural heritage for posterity.

Keywords: Fragmentation of habitats ; Illegal trade; legal framework; enforcement.

INTRODUCTION

India is a mega-biodiversity country with diverse bio-geological regions. The habitats range from snow-clad mountains, deserts, semi and wet evergreen forests and rich oceanographic flora and fauna. With the requirements of development the biodiversity in the country has been significantly impacted. Fragmentation of habitats has adversely affected our wildlife and a number of flag-ship species are endangered and face a threat to their survival. Tiger, elephant, great Indian Bustard, Rhinoceros olive ridley turtles, crocodiles, dolphins, etc., are some of the animals facing extreme threats to their survival. India has been in the forefront of global efforts towards conservation of wildlife. Former Prime Minister Smt. Indira Gandhi led the world in Environment Summit in Stockholm with age old Indian ethics that man should use the natural resources as much as he gives back to the mother earth. This was followed by first national legislation - The Wildlife (Protection) Act, 1972. Project Tiger was launched to arrest the decline in Tiger populations across the country. A number of management interventions were made, protection efforts were strengthened and more funds were made available for conservation of wildlife. This was followed by creation of over 500 Wildlife Sanctuaries and National Parks in the country across different habitats in the country. The Forest Conservation Act was passed by the Parliament in 1980 to check rampant destruction of forests for

development projects. Since then, the conservation efforts have taken roots in the country. Creation of a separate Ministry of Environment and Forests in 1980s changed the paradigm and focused efforts towards conservation in general and species specific action plan for conservation started taking roots. Creation of Wildlife Institute of India at Dehradun provided a strong scientific temper to the conservation efforts and helped in capacity building of the field personnel in use of best practices in management and conservation of wildlife in the country. In last two decades National Tiger Conservation Authority has been created by an act of Parliament. National Wildlife Crime Control Bureau is one of the steps towards checking rampant trade in wildlife. Project elephant has been a successful initiative in conservation of this mega species that faces serious challenges after the pace of development has enhanced in last three decades. But our wildlife heritage cannot be conserved with efforts of the Government but all the stakeholders need to do their bit towards this national cause so that our future generations would get to see the magnificent glory of our rich biodiversity.

OBJECTIVES

1. To study the present legal framework for protection of wildlife in the country.
2. Identify the major threats to the conservation of wildlife.
3. Suggest immediate steps and management interventions required to be made to ensure long term survival of the wildlife and our natural heritage.

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Figure 1 : Some Endangered Species of India – Source: WWF India

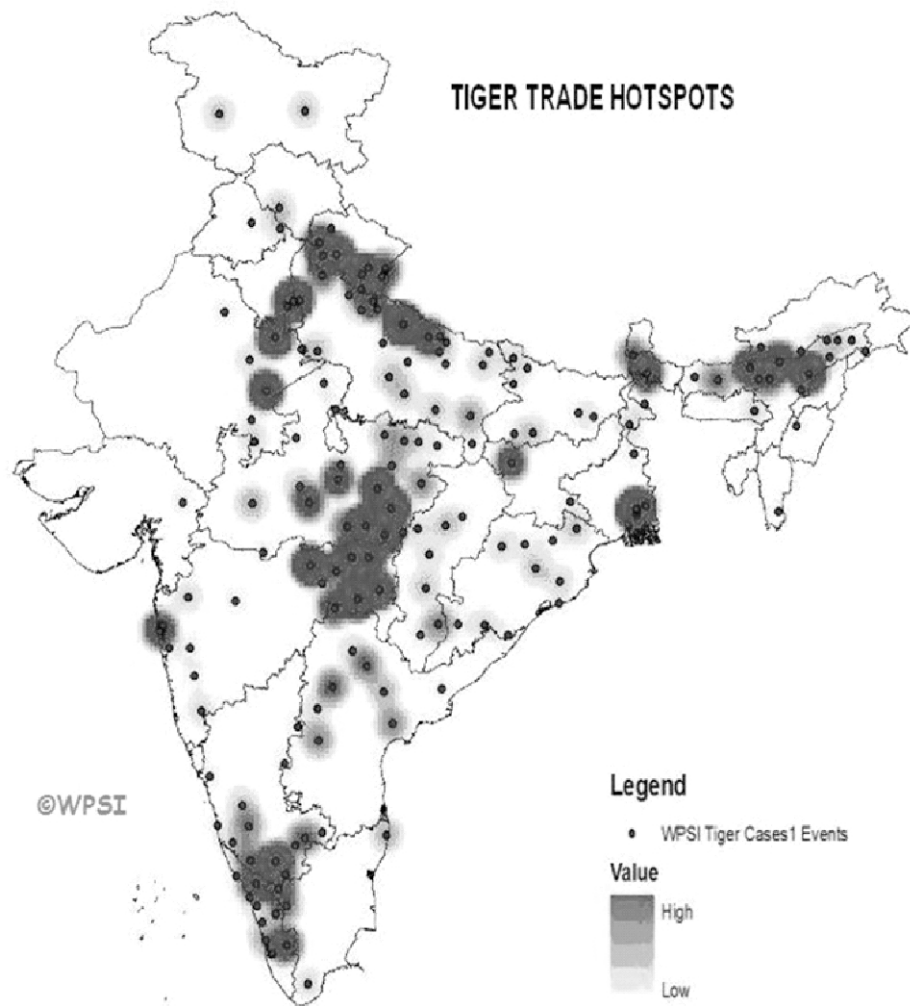


Figure 2 : Locations showing trade in tiger parts in India , Source: WPSI

LITERATURE REVIEW ON THREATS TO WILDLIFE:-

Wildlife in India and the world faces some of the threats that are common and are inter-linked. This makes it imperative to assess the threats and initiate concerted efforts to save our rich natural heritage. International efforts in this regard international instruments like the Convention on International Trade in endangered species of Fauna and Flora (CITES). Besides this three more such arrangements

for endangered species like whales, marine turtles, etc. Organisations like Interpol also spearhead the coordinated international efforts towards checking trade in wildlife articles. Major threats to wildlife conservation in India are listed below:-

1. **Habitat Degradation** - Continuous degradation of wildlife habitats across the country on account of increasing biotic interference and unplanned development projects has seriously affected the long term

survival of wildlife. Due to decline in quality of the forest habitats, the animals often move out in search of food and water and get killed. The degradation of habitat of wildlife has taken place over a period of time. This is affecting the ecological security – by way of failure to replenish the water system, provide food for wild animals, etc. The quality of forest is going down because of over exploitation for ridge fire, powers, building materials and raw material for industries. Diversion of the forest for agriculture is also affecting the quality of the forest. As a result of increase in biotic pressure, the quality of forests and their capacity to rejuvenate the eco system and support wild animals is constantly going down. This is affecting the long term survival of wild life population in the country.

2. Fragmentation of Habitats – There has been extensive fragmentation of habitats on account of development projects like construction of dams, canals, railway lines fast expanding highways, urbanisation, etc. These permanent barriers often divide the contiguous habitats and isolate the populations and their gene pool. Incidents of elephant deaths and tiger kills on account of train hits and kills by speeding vehicles are quite common. This has accentuated the man-animal conflict and wildlife has started straying into human enclaves and causing extensive damage to life and property in many parts of the country. The forests in most parts of the countries are becoming ‘Islands’ surrounded by human enclaves. These islands are under heavy stress because the surrounding lands cannot meet

basic needs of the people and for meeting their livelihood needs the biotic pressure is shifting to all these islands. The increasing cycle of poverty around the forests exerts more pressure on remaining bastions of wilderness.

In case of wild life species like tigers, elephants, lions etc., the human population has started over lapping the habitats. The co-existence of human and wildlife is threatened and inviolate areas are required to be maintained to ensure conservation of flagship species of wildlife. The areas adjoining to the core areas must be regenerated so that people are not fully dependent on the wildlife areas to meet their day to day requirements. The development projects must incorporate the mitigation measures for the wildlife at the planning stage itself so that the impact of the projects is mitigated and the continuity of the habitat is maintained. There is need to have a balance between the development and the conservation efforts.

3. Wildlife Trade– Wildlife trade is one of the most serious challenges faced towards wildlife conservation. Despite the laws becoming stringent and improvement in protection efforts, poachers and traders are using latest technology in killing the animals and trading their body parts. On global scale, this trade comes next to narcotics, human trafficking and counterfeit products. It is valued over US\$ 20 billion per year. In last decade, over 150000 seizures were reported worldwide and 26% took place in India. Over exploitation of endangered fishes in wild; collection of birds for

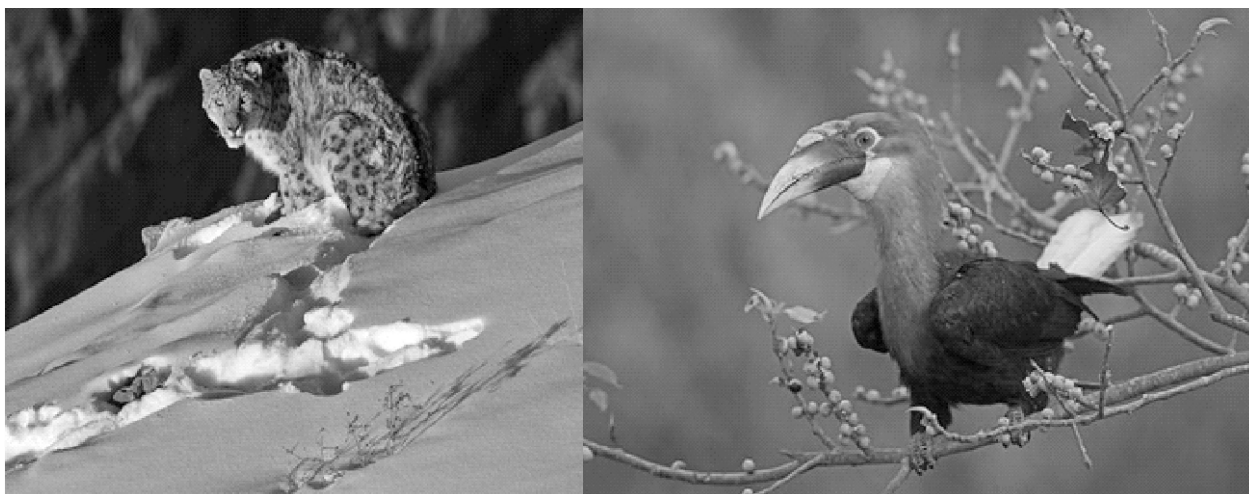


Figure 3 : Threatened animals - Snow leopard and Great Indian Pied Hornbill, Source: National Wildlife Action Plan

sport and food; exploitation of mammals for food, antlers, tusks, skins; trade in amphibians, reptiles, etc. is prevalent in many parts of the country. The trade in wildlife parts has become more and more organised and many gangs are operating in many countries and pose a serious challenge to the conservation and enforcement agencies all over the world.

- 4. Poaching** - Poaching for meat and wildlife trophies is one of the most serious threats to the wildlife in the country. Despite stringent laws and protection measures enforced by the enforcement agencies, poachers find it lucrative to indulge in killing of animals and trade in their



Figure 4 : Global Wildlife Trade, Source: IUCN Report

parts. The number of flagship species like tiger had declined to around 1500 in 2012 and with stringent measures taken by the wildlife authorities, the number has revived to around 2700. Asian Cheetah is already extinct from the sub-continent. Elephants face tremendous challenges to survive and the tusks are being lost to poachers' gun at a very fast pace. Unless poaching is brought under control, both herbivores and carnivores would continue to be threatened alongwith the entire related food chain. The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) is an important international agreement that regulates the trade in wildlife. Concerted international efforts are required to be made to check this trade all over the world so that demand for wildlife parts decreases and poaching is reduced as a chain reaction. The National legislations and their enforcement should be strengthened so that there is strong deterrent for poachers and the traders. The strengthening of enforcement mechanisms and increase in coordination among forest enforcement agencies is extremely essential to check the menace of poaching.



Figure 5: Elephant death by train accident, Picture by Sanjeev Kumar Chadha



Figure 6: Elephant Death by electrocution, Picture by Sanjeev Kumar Chadha



Figure 7: Tiger Cubs in Ranthambore Tiger Reserve , Picture by Sanjeev Kumar Chadha

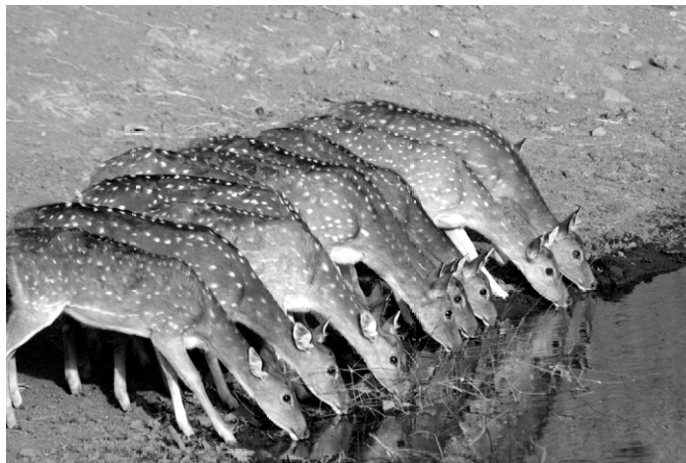


Figure 8: Alert Chitals drinking water at water hole Picture by Sanjeev Kumar Chadha



Figure 9: Endangered Barasingha in Grasslands in Kanha National Park, BySanjeev Kumar Chadha

Interventions required for conservation –

- 1. Strengthening of Wildlife Protected Area Network** – The network of over 500 wildlife sanctuaries and National Parks should be strengthened so as to ensure viable populations of threatened and endangered species of wildlife. Only sustainable and balanced development projects should be allowed in these areas.
- 2. Strengthening of Enforcement** – Enforcement of laws and regulations governing the protected areas should be made stringent so as to make the areas inviolate and safe to ensure population growth of the animals. The Rangers and other staff engaged in such hard duties should also be adequately incentivised to keep their moral high.

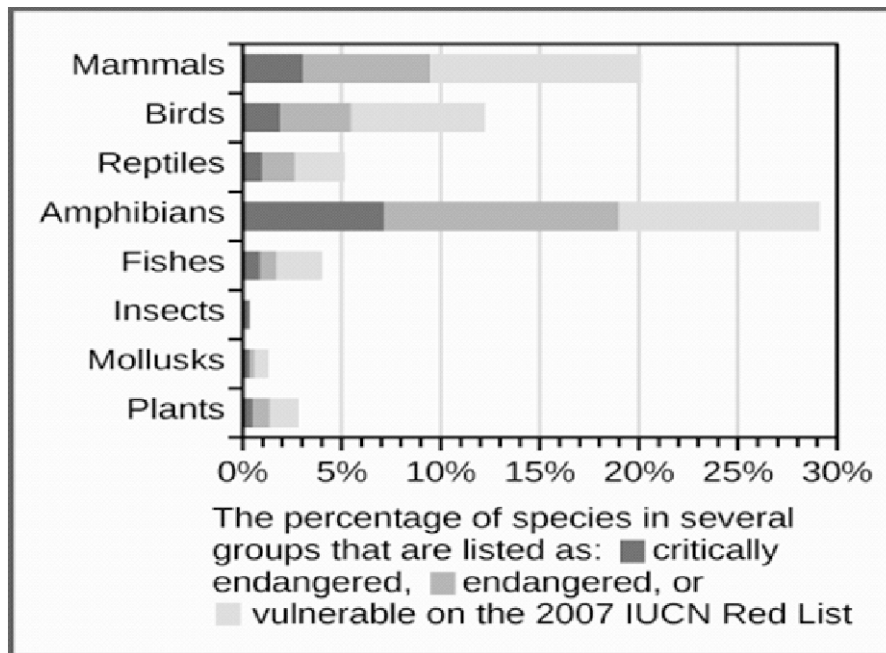


Figure 10: Status of vulnerable animals, Source: IUCN report

3. **Strong Legal Framework** - The existing laws and rules framed therein need to be strengthened to plug the loopholes and make the laws to act as deterrent for poachers and those who violate the act and rules. Prevention of crime with active coordination between the Park Management Authorities and the bodies like Wildlife Crime Control Bureau, Narcotics Bureau, CBI and State Police would be easier rather than working in isolation.
4. **Enhanced Budget Allocations** - It is seen that forests cover around 25% of the land mark of the country. The budget allocation for their management is proportionately low. The wildlife management is often not a priority. Adequate resources are required to be provided to the enforcement agencies to build modern infrastructure for crime prevention and management of the wildlife areas.
5. **Sustainable Development and checking of habitat fragmentation** - In last 4 to 5 decades, the pace of development in the country has enhanced and a number of development projects have come up in the form of fast moving highways, railway network, irrigation dams, etc. through the forest areas. This has enhanced conflict between wildlife and man and the casualties of animals have increased. The fragmentation of the habitat has also genetically isolated the population, thus endangering the long term survival of the wildlife. There is need for sustainable and balanced development and mitigation measures need to be incorporated in the projects right from inception.
6. **Special Conservation Efforts for Critically Endangered Species** - There are number of animals and plants which are critically threatened and need long term conservation strategy to ensure their survival on the planet. Focussed programme like Project Elephant, Project Tiger need to be initiated for such species.
7. **Promotion of Eco Tourism** - The balanced ecotourism activities should be initiated in and around the wildlife areas so as to involve the public at large and create more awareness among them for conservation of wildlife. This would also provide employment opportunities to the people who are living at the fringes of the forest areas and are important stake holders.
8. **Involvement of reputed NGOs and Conservation Societies** - The reputed NGOs like WWF, Wildlife Conservation Societies etc., are also required to be associated in the conservation efforts so that their expertise and resource are meaningfully utilised in the conservation efforts.

CONCLUSION

It is thus amply clear that for conservation of wildlife and their habitats, there is need for a concerted national action plan and strategy. Besides strengthening our legal framework and

enforcement mechanism, the development needs have to be calibrated in such a way so as to mitigate the impact of such projects on the habitats. Fragmentation of the left over habitats would jeopardize the survival of major flagship species and our future generations would hold us responsible if our natural heritage is not conserved for posterity.

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A Research Paper on Overpopulation in India and its Effects

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Kushagra Verma**

Nearly all our economic, social, and political problems has become more difficult to solve in the face of an uncontrolled population growth. It is clear that in economically sound nations many individuals and families experience misery and unhappiness because of the birth of unwanted children. The desirability of limiting family size is now fairly general, though not universally recognized, particularly among the better-educated and culturally advanced segments of the population in India. The main purpose of this research paper is to spread awareness about the repercussions of over population and how it affects an individual in his daily life, further causing unsustainable development in the developing countries.

Keywords: Over Population Effects, Population Growth, sustainability

INTRODUCTION

Overpopulation occurs when there is excess burden of any species on the environment. Overpopulation is not a problem that arose yesterday, rather this issue is an ocean which got created by pouring drop by drop from past several years. The population of India represents 17.99 percent of the world's total population which arguably means that one in every six persons on the planet, is a resident of India. India's population reached a billion mark in the year 1998, As per a latest statistical report India's current population has crossed 1.35 billion, ranking it as the 2nd largest population in the world, whereas India has been ranked at the 7th position in terms of its land area (3287263km²), which has given rise to an inequality between the land mass and the population density. Further India has more than 50% of its population below the age of 25 and it is projected that India will be the most populous country by the year 2024 surpassing the population of China. The land mass has no scope of expansion but the human population is increasing year after year. This population explosion is held responsible for over burdening both renewable and non-renewable resources which are diminishing as the burden on them is increasing. Be it clean water to drink, fresh air to breathe, and its dependence on flora and fauna, further affecting major issues like global warming, environmental issues like deforestation, climate variances, rapidly melting icebergs and other social inequalities.

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RESEARCH METHODOLOGY AND ITS PURPOSE

This research paper comprises of the core content obtained from data analysis and statistical reports and the information is congregated from various websites. References to other research materials have been consulted to bring upon the relevant facts and figures, its relevance and the knock-on effect of the issue has been discussed. The collected information was analyzed to develop an understanding of the current scenario and its future repercussions.



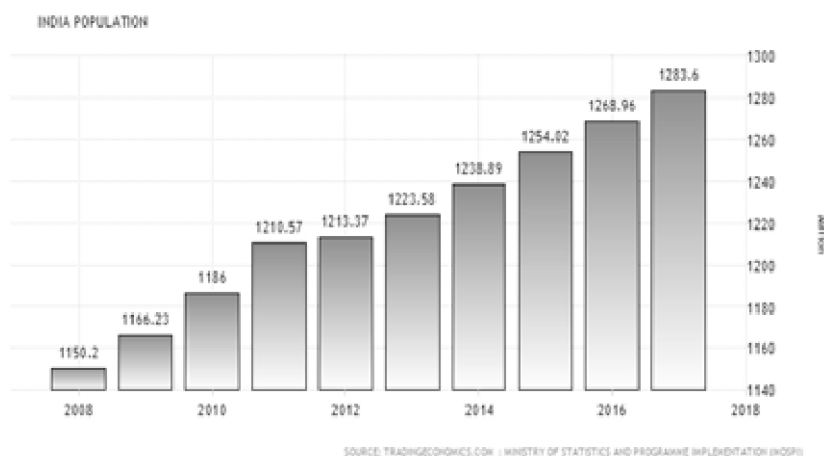
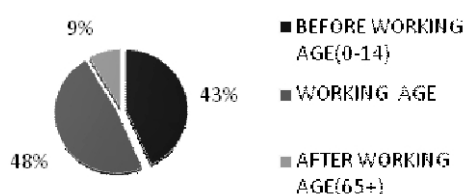
The purpose behind this study is to spread awareness about the issue and its impact on the environment, society and the future generations to come. Policies should be initiated so that the economic growth of the country can keep pace with the demands of a growing population, adequate steps should be taken to increase the welfare and

status of women and girls, spread of education for all should be a major concern as well, educated minds possess the capability of understanding the issue and its effects better, increasing awareness for the use of contraceptives and family planning methods and sex education, health care centers for the poor should be spread even to the rural areas, educational sessions should be conducted for encouraging male sterilization and spacing births, free distribution of contraceptives and condoms among the poor and encouraging female empowerment, can play a major role in controlling population. These steps should be implemented right away as a major portion of the population spread is either too young or under working age. As these toddlers and youth acts as a clay to shape the future of India.

OBJECTIVE OF RESEARCH

- To describe the causes of overpopulation.
- To analyze the effect of overpopulation on individual as well as on country's resources
- To spread awareness for the control of population explosion.
- State its impact on future generations and its huge dependency on non-renewable resources.
- The disruption on ecological balance.

POPULATION SPREAD(2018)



CAUSE AND EFFECT RELATIONSHIP

The causes leading to overpopulation in India are:

- The birth rate is 19 births/1000 population, whereas the death rate is 7.3 deaths/1000 population, the birth remains higher than the death rate, improved medical facilities, health and hygiene awareness has declined the death rate which though is an achievement on medical grounds but this has led to a rational disparity.
- Improved technological advancement in fertility treatment, treating infertility medical conditions with latest techniques available to conceive and undergo fertility treatment methods and making the pregnancies much safer.
- Lack of family planning is another cause to the problem especially in the rural areas and poverty stricken people as they believe, more children are add-ons as more number of earning hands.
- 21.3% Indians live on less than 120/- per day. In the first place, there is a total of about 1.45 billion population that could be termed as multidimensional poor. Second, about 689 million of the population are children. Third, and the most shocking of all, 31% of all these children live in India. Income disparities make the rich go richer and the poor go poorer, the literacy rate and their standard of living is another cause of their current mindset.
- Lack of awareness about contraceptive pills and other birth control measures and the adverse affects of conceiving frequently are yet not discussed at a wider scale.

- The past tradition of child marriage and universal marriage system, is rooted in 21st century even though our law has defined a legal marriageable age of 18 years, yet the concept of early marriage still prevails in the rural sector and most of the girls are pushed under this sacred obligation and are tied under knots at their reproductive age itself. A report by UNICEF for the year 2017 declared that 7% of Indian girls are married by the age of 15 and 27% is married by the age of 18, which is still an alarming scenario.
- People's belief in an old cultural norm that sons are the bread earners of families in India, this age old norm, puts considerable pressure to give more births to male child.
- The fact of illegal migration from Bangladesh, Nepal and other neighboring countries are rapidly adding on to the problem, a report stated India to be one of the world's top destinations for international migrants making it the 12th-largest immigrant population in the world. The overwhelming majority of India's immigrants are from neighboring countries such as Bangladesh (3.2 million), Pakistan (1.1 million), Nepal (540,000) and Sri Lanka (160,000).

Even after so many years of independence the

scenario of our country hasn't witnessed much change, our country still remained in the list of developing countries, some of the problems faced by India before independence are still rooted and one of the reasons to be blamed for this situation is overpopulation in India. Some of the major impacts led by overpopulation are:

- Generating employment opportunities for a huge population in a country like India is a tedious task, the numbers of illiterate persons are also increasing and showing an increased trend in the unemployment rate and this has a direct impact in terms of increased crime rate. The unemployment rate is 3.52% in the year 2017 which was earlier 3.51%. More people are now walking on the path of crime due to lack of employment opportunities and correct guidance.
- Increased poverty rate has also been witnessed; it seems difficult for few to satisfy their basic needs, hygiene requirements and sanitation facilities, the poverty rate in rural area is at 25% whereas the poverty rate in urban area is at 14%, hence the standard of living needs to be improved and for that the root cause of overpopulation needs to be evaded. So that people could adhere to their basic needs and do not undergo scarcity of resources.

S.No	Name of UA/Cities	No. of Households	Population
1.	Greater Mumbai UA	3,522,358	16,434,386
2.	Kolkata UA	2,40,607	13,205,697
3.	Delhi UA	2,548,359	12,877,470
4.	Chennai UA	1,473,780	6,560,242
5.	Hyderabad UA	1,111,116	5,742,036
6.	Bangalore UA	1,278,333	5,701,446
7.	Ahmedabad UA	901,949	4,525,013
8.	Pune UA	828,890	3,760,636
9.	Surat UA	573,756	2,811,614
10.	Kanpur UA	469,562	2,715,555
11.	Jaipur UA	408,888	2,322,575
12.	Lucknow UA	403,457	2,245,505
13.	Nagpur UA	427,704	2,129,500
14.	Patna UA	269,619	1,697,976
15.	Indore UA	284,782	1,516,918
16.	Vadodara UA	320,455	1,491,045
17.	Coimbatore UA	358,856	1,461,135
18.	Bhopal UA	283,176	1,458,416
19.	Ludhiana UA	268,700	1,398,467
20.	Kochi UA	301,079	1,355,972
21.	Visakhapatnam UA	309,123	1,345,938
22.	Agra UA	207,834	1,331,335
23.	Varanasi UA	167,476	1,203,961
24.	Madurai UA	279,656	1,203,095
25.	Meerut UA	187,607	1,161,716
26.	Nashik UA	239,727	1,152,326
27.	Jamshedpur UA	199,864	1,104,712
28.	Jabalpur UA	209,274	1,098,000
29.	Asansol UA	196,486	1,067,365
30.	Dhanbad UA	192,233	1,065,327
31.	Faridabad UA	217,647	1,055,938
32.	Allahabad UA	162,400	1,042,225
33.	Vijaywada UA	231,759	1,039,518
34.	Amritsar UA	185,858	1,003,917
35.	Raikot UA	195,947	1,003,015

- Overpopulation has made India face the situation of economic depression, slow business development and expansion activities due to under utilization of available manpower.
- This problem has raised the pressure on infrastructure facilities as to create a space for all has been a troublesome scenario. The development of infrastructural facilities is not keeping pace with the rate of increasing population leading to overpopulated houses.
- Increase in number of people has led to a corresponding increase in the need of resources, which has adversely affected the ecological balance and bio-diversity. Rise in amount of CO₂ emissions leads to global warming. India's emissions are 1.8 tones of CO₂ per capita, and these emissions are growing steadily with an average growth rate of 6%. Melting of polar ice caps, changing climate patterns, rise in sea level (the sea level rises in two ways, first warmer water expands, and this "thermal expansion" of the ocean has contributed about half of the 2.8 inches (7 centimeters) of global mean sea level rise we've seen over the last 25 years and Secondly, melting land ice flows into the ocean, also increasing sea level across the globe), are few of the consequences that we might have to face due to environment pollution.
- India is now counted amongst the top polluted countries of the world, records show the pollution index of 75.17, roads are flooded with vehicles and traffic congestion and this chaos has increased the pollution levels to a greater extent.
- The land resources, water resources, forests are over exploited and the burden on the natural resources are creating a pressure on the overall environment leading to an adverse living scenario for the future generations. For instance at Present, India is the poorest in the world as far as capital land is concerned. The per capita forest Land in India is 0.10 hectare compared to the world average of 1 hectare. These devastating effects of deforestation in India include soil, water and wind erosions, estimated to cost over 16,400 crores every year.
- Food production and distribution have not been able to catch up with the increasing population and hence the costs of production have increased and here inflation has played a major role as a consequence of over

population. As difference between demand and supply continues to expand due to overpopulation, it raises the prices of various commodities including food, shelter and healthcare. The consumer prices have increased by 5.21% year on year basis, this means that people have to pay more to survive and feed their families.

- In the face of an increasing population, there is an unequal distribution of income (as per a survey India's top 1% bags 73% of the country's wealth) and inequalities within the country has widened, as a result of which the gap between income disparities have increased.
- Increased conflicts amongst people for the scarcity of resources, social conflicts, and other wars for the division of land and other scarce resources have occurred, the increased stress on natural resources have led to a rapid rise in natural calamities and manmade hazards.
- More people lead to more generation of waste (India's generation of 960 million tonnes of waste annually comprises of 350 million tonnes are organic wastes, 290 million tones are from inorganic waste and 4.5 million tonnes from hazardous waste) and our current facilities are not adequate enough to provide proper waste disposal methods and hence much of non biodegradable waste is dumped into water bodies which as a result adversely affect the marine life.

REMEDIAL ACTION PLAN

- First and foremost the policy makers should initiate a clear population policy and enlisting population control norms by the Government so as to keep a pace between economic growth of the country and the need to meet the demand for increasing population.
- Secondly, emphasis should be laid to increase the status of women and girls and spreading awareness and education amongst them. In terms of family planning methods, sex education, encouraging male sterilization and spacing births, free distribution of birth control pills and contraceptives and condoms should be made easily available to the poor.
- Thirdly, more health care centers for the poor can play a major role in controlling population and control the adverse affect of overpopulation on the economy as a whole.

- Further, manpower should be exported and migration should be encouraged so as to create employment opportunities and reduce the burden on India's resources. More setups of Skill development centers should be promoted to develop adequate skills in the people which would help them in attaining a good job for themselves and raising their current status.
- The three elements air, water and land are immensely polluted and it's high time to make people aware that even their own survival will be at stake if they don't respect and use the available resources wisely.

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Radioactive Waste Management

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Today one of the major challenges facing by mankind is to provide proper management for radioactive waste management. Any industrial activity results in generation of some waste material. Nuclear industry is no exception and the presence of radiation emitting radioactive materials which may have adverse impact on living beings and which is likely to continue to the subsequent generation as well is what sets nuclear or radioactive wastes apart from other conventional hazardous wastes. Another unique feature of the radioactive waste is the decay of radioactivity with time. This fact is gainfully exploited by the nuclear waste managers. The NRC regulates the management, storage and disposal of radioactive waste produced as a result of NRC-licensed activities. The agency has entered in to agreements with 32 states, called Agreement States, to allow these states to regulate the management, storage and disposal of certain nuclear waste. Any industrial activity results in generation of some waste material. Nuclear industry is no exception and the presence of radiation emitting radioactive materials which may have adverse impact on living beings and which is likely to continue to the subsequent generation as well is what sets nuclear or radioactive wastes apart from other conventional hazardous wastes. Another unique feature of the radioactive waste is the decay of radioactivity with time. This fact is gainfully exploited by the nuclear waste managers. The Department of Energy (DOE) is responsible for radioactive waste related to nuclear weapons production and certain research activities. The Nuclear Regulatory Commission (NRC) and some states regulate commercial radioactive waste that results from the production of electricity and other non-military uses of nuclear material. Various other federal agencies, such as the Environmental Protection Agency, the Department of Transportation, and the Department of Health and Human Services, also have a role in the regulation of radioactive material.

Keywords: Radioactive waste, Hazardous components, Recycle, Reduce, Reuse

INTRODUCTION

Radioactive waste is waste that contains radioactive material. Radioactive waste is usually a by-product of nuclear power generation and other applications of nuclear fission or nuclear technology, such as research and medicine. Radioactive waste is hazardous to all forms of life and the environment, and is regulated by government agencies in order to protect human health and the environment.

Radioactivity naturally decays over time, so radioactive waste has to be isolated and confined in appropriate disposal facilities for a sufficient period until it no longer poses a threat. The time radioactive waste must be stored for depends on the type of waste and radioactive isotopes. Current approaches to managing radioactive waste have been segregation and storage for short-lived waste, near-surface disposal for low and some intermediate level waste, and deep burial or partitioning/transmutation for the high-level waste.

A summary of the amounts of radioactive waste and management approaches for most developed countries are presented and reviewed periodically as part of the International Atomic Energy Agency (IAEA) Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management. It is the first treaty to address radioactive waste management on a global scale in 1997.

Radioactive waste can be in gas, liquid or solid form, and its level of radioactivity can vary. The waste can remain radioactive for a few hours or several months or even hundreds of thousands of years. Depending on the level and nature of radioactivity, radioactive wastes can be classified as Exempt Waste, Low & Intermediate level waste and High Level Waste. Exempt wastes have levels of radioactivity too low to warrant any concern from the regulators. These can be disposed of to the environment and are not likely to cause any adverse impact.

The production of electricity by nuclear means has created radioactive residues, which have to be carefully managed and accounted for because they are potentially hazardous to human health. Similar residues have been generated as a result of the Defence Programmes in several countries. The

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residues include solid and liquid radioactive waste from civilian nuclear power production and from the production of nuclear weapons and residues from the above surface or underground testing of nuclear weapons.

INDIAN SCENARIO OF RADIOACTIVE WASTE MANAGEMENT

Management of radioactive waste in Indian context includes all types of radioactive wastes generated from the entire nuclear fuel cycle right from mining of Uranium, fuel fabrication through reactor operations and subsequent reprocessing of the spent fuel. Since the spent fuel is reprocessed with a view to recover and reuse the Uranium and Plutonium produced there, the fuel cycle is termed as 'closed', unlike in other countries like USA, Canada, etc. where the spent fuel is stored as waste.

Various units of the Department of Atomic Energy (DAE) provide fuel cycle and waste management services. Uranium Corporation of India Ltd., (UCIL), a public sector company of DAE, carries out mining and processing of uranium deposits surveyed by the Atomic Minerals Directorate of Exploration & Research (AMD) of DAE. Nuclear Fuel Complex (NFC), an industrial unit of DAE, utilizes the uranium concentrates supplied by UCIL to fabricate PHWR's (Pressurized Heavy Water Reactors) nuclear fuel assemblies. For the BWR's in Tarapur, NFC manufactures the fuel assemblies from imported uranium. NFC also supplies the required zircaloy components. Heavy water

required for the initial charge and the Heavy Water Board of DAE supplies subsequent make-up requirements of the nuclear power plants.

Spent fuel from the PHWRs is reprocessed to extract the plutonium contained in it. Build up of plutonium inventory is vital for development of the second stage of the Indian nuclear power programme consisting of FBRs. The fuel reprocessing plants are set up by the BARC based on the technology developed by it. Power Reactor Fuel Reprocessing Plants at Tarapur and Kalpakkam are operational.

The primary objective of radioactive waste management is protection of human health, environment and future generation. The overall philosophy for the safe management of radioactive waste relies on the concepts of (i) delay and decay, (ii) dilute and disperse and (iii) concentrate and contain. Wide range of treatment and conditioning processes are available today with mature industrial operations involving several interrelated steps and diverse technologies.

TYPES OF RADIOACTIVE WASTE

According to the United States Nuclear Regulatory Commission more than 104 licensed nuclear facilities are located inside of the United States. These reactors total 20% of the energy consumption being used. There are five types of radioactive waste- high level, low level, intermediate level, mining and milling and transuranic waste. All types of nuclear wastes have their own separate storage and clean-up procedures.

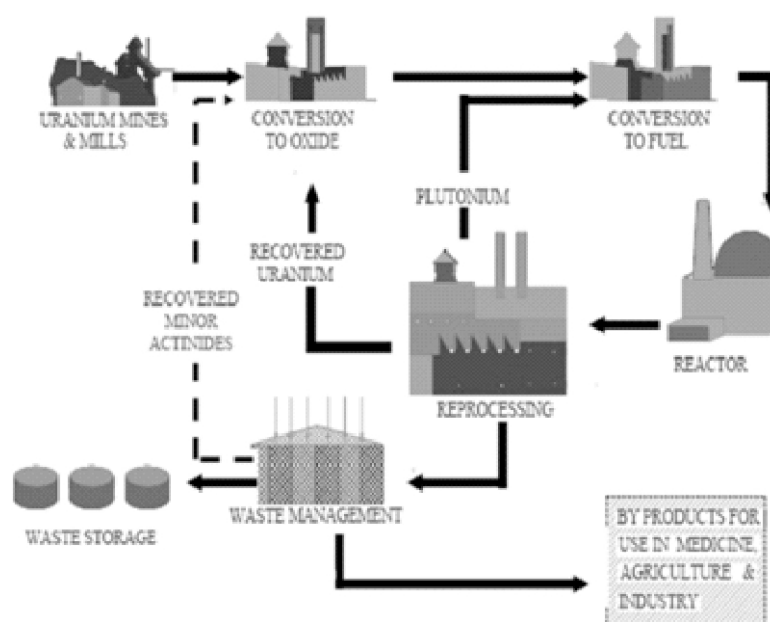


Figure 1: Nuclear Fuel Cycle

LOW AND INTERMEDIATE LEVEL WASTES

LIQUID WASTES

Low and intermediate level (LIL) liquid wastes are generated in relatively large volumes with low levels of radioactivity (few micro curie/l to millicurie/l). If a particular stream of radioactive liquid waste contains short-lived isotopes, it may be stored for adequate time period to ensure that majority of the radionuclides die down, thus, following the 'delay and decay' principles.

Low-level nuclear waste usually includes material used to handle the highly radioactive parts of nuclear reactors (i.e. cooling water pipes and radiation suits) and waste from medical procedures involving radioactive treatments or x-rays.

Depending on the nature of the waste, radionuclides present and level of contamination, the treatment scheme is chosen to concentrate bulk of the activity in a small volume and discharge the supernatant to large water bodies after further polishing and monitoring as per national and international standards. The discharges are only a small fraction of the allowed limits. The radioactive concentrate is conditioned and immobilized in highly durable matrices like cement, polymer, etc. fulfilling the objectives of 'concentrate and contain'.

SOLID WASTES

Significant quantum of solid LIL wastes of diverse nature gets generated in different nuclear installations. They are essentially of two types as follows:

Primary Wastes: comprising of radioactively contaminated equipment (metallic hardware) spent radiation sources etc.

Secondary Wastes: Resulting from different operational activities, protective rubber and plastic wears, cellulosic and fibrous material, organic ion exchange resins filter cartridges and others.

Solid waste management plants in India are equipped with facilities for segregation, repacking, processing and embedment for radiation sources. Low active combustible wastes are incinerated and compactable wastes are reduced in volume by mechanical compaction.

The final packaged conditioned waste is then disposed off in near surface disposal facilities (NSDF), a few meters below the earth's surface. A

multi barrier approach is followed in NSDF to ensure confinement and isolation of the wastes from biosphere. wastes which give out very low doses are disposed off in stone lined or brick-walled trenches, wastes having higher activity are disposed off in reinforced concrete trenches and tile holes. Special emphasis is laid on closure of such modules after it gets filled. These include appropriate closure such as clay for the stone lined trench and concrete cover for the other two. Provisions for monitoring and surveillance are also incorporated in the NSDF. Regular environmental monitoring ensures that radioactivity in air, water and soil in and around the disposal facility remains within the safe limits prescribed by the regulatory body. As a national policy, NSDF is co-located at each site of nuclear installations in India.

GASEOUS WASTES

The air in the working area and the environment is free from radioactive contamination. The off gas ventilation system in nuclear power plants play an important role in ensuring clean air. Radioactive gases and particulates carrying adsorbed radionuclides are the two pollutants in the gaseous waste. Various designs of scrubbers are deployed wherein off-gases are intimately contacted with suitable liquid media so as to retain the activity in the liquid phase. Specific adsorbents are also used to remove volatile radionuclides like iodine, ruthenium, etc. The off-gases are finally routed through high efficiency particulate air filters (HEPA) which are designed for an efficiency of >99.9% for sub micron size particles.

HIGH LEVEL WASTES

High-level radioactive liquid waste (HLW) containing most (~99%) of the radioactivity in the entire fuel cycle is produced during reprocessing of spent fuel. Planning for management of HL waste thus takes into account the need for their effective isolation from the biosphere and their continuous surveillance for extended periods of time spanning several generations. To meet this objective in the long term, waste isolation systems comprising multiple barriers are employed so as to prevent the movement of radionuclides back to the human environment.

Strategy for management of HLW takes into account the need for effective isolation from the biosphere and surveillance for extended periods of time spanning over future generations.

Thus the management of high-level liquid waste in the Indian context encompasses the following three stages.

1. Immobilization of high-level liquid waste into vitrified borosilicate glasses.
2. Engineered interim storage of the vitrified waste and other high level wastes with passive cooling and surveillance over a period of time, qualifying it for ultimate disposal.
3. Ultimate storage/disposal of the vitrified waste and other high active solid waste in deep geological repository.

India is one of the few countries to have mastered the technology of vitrification. Owing to the high radiation fields, various operations are carried out remotely in specially designed and state-of-the-art cubicles made of 1.5 meter thick concrete walls known as 'hot cells'. These hot cells are equipped with remote handling gadgets and systems. Some of the major remotisation gadgets include custom designed robots, remote welding units, remote inspection/surveillance devices and manipulators. Indigenous development of the remote handling

equipment has been pursued in active collaboration with the Indian industries, academic and national institutions.

Development of glass matrix for HLW is interplay of its composition, specific glass additives and the processing temperatures. Solubility of the waste components and the decay heat limits maximum loading of waste into glass, though desirable. Glass forming additives should conform to chemical durability and acceptable processing temperatures. These processing temperatures are dictated by volatility of the specific radionuclide and compatibility of the melter material under corrosive environment of molten glass. Presence of certain chemical species like sulphate, aluminium, thorium, fluorine, platinum group metals, etc. in high level waste poses additional challenge for glass formulation development on account of their limited solubility/non-compatibility in glass composition. The vitrified products are evaluated for various properties like melt temperature, waste loading, homogeneity; thermal stability, radiation stability and chemical durability using advanced analytical instruments. The solidified waste form

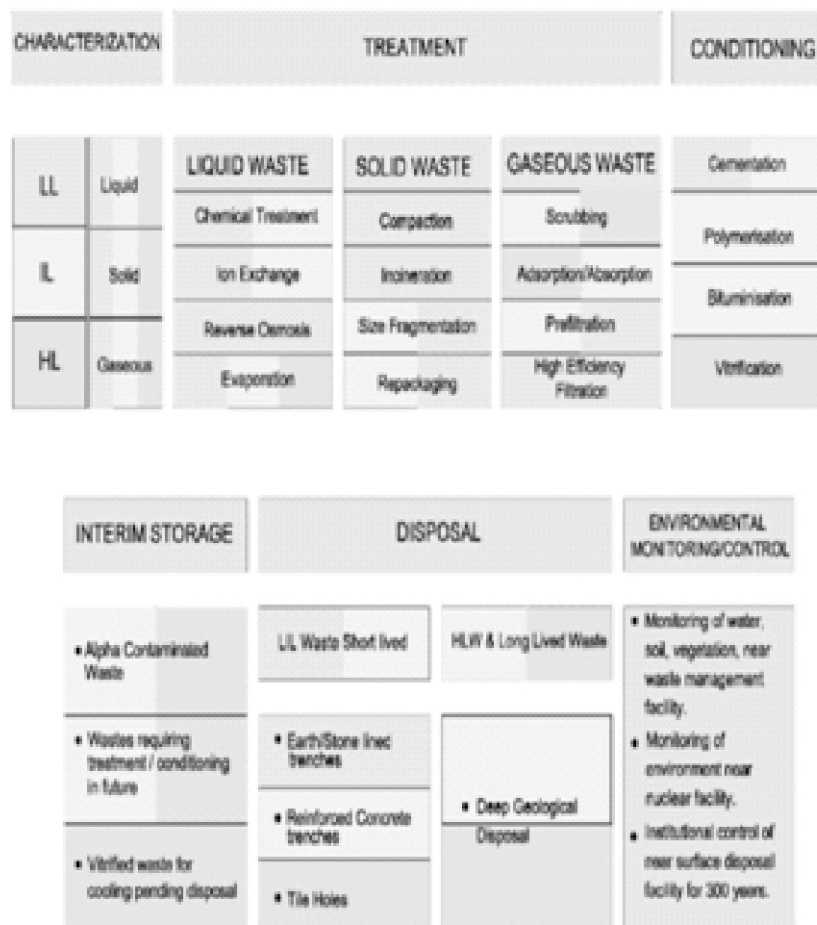


Figure 2: Summarizing of Nuclear Waste Management Practices

must also meet the criterion for its interim and long-term storage followed by its ultimate disposal in deep geological repository.

India has rich experience in operation of vitrification plants at Trombay and Tarapur. Figure shows the design of induction heated metallic melter operating at Trombay and the Joule heated ceramic melter operating at Tarapur. A third plant consisting of ceramic melter is nearing completion at Kalpakkam.

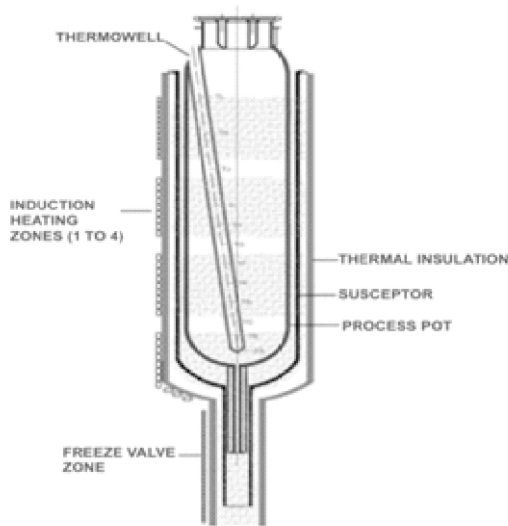


Figure 3: Design of POT Melter used for Vitrification of HLW

Cold crucible induction melting (CCIM) is emerging as the futuristic technology for the vitrification of high-level liquid waste at much higher temperatures. Besides being compact and advantageous as in-cell equipment, it offers flexibility to treat various wastes with better waste loading and enhanced melter life. Figure below shows the melting of glass in inactive engineering scale cold crucible at Trombay.

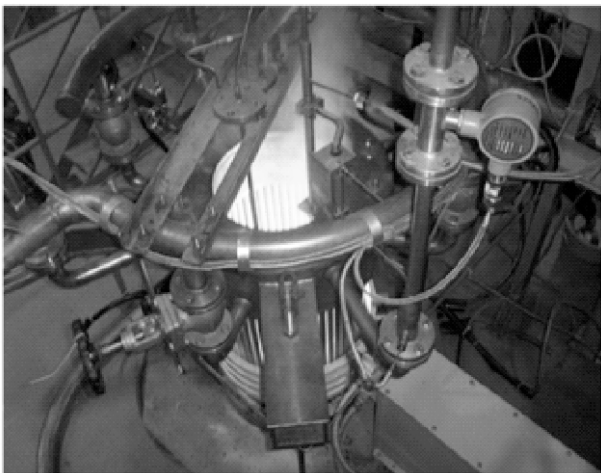


Figure 4: Glass melting in engineering scale cold crucible set-up.

On the basis of safety and detailed techno-economic considerations, natural draught air-cooling system has been designed for the storage vault. A solid storage and surveillance facility (SSSF) has been set-up at Tarapur for interim storage of vitrified high-level waste.

DEEP GEOLOGICAL DISPOSAL

Among the options considered for disposing of vitrified high level waste, international consensus has emerged that deep geological disposal is the most appropriate means for isolating such wastes permanently from man's environment. The basic requirement for geological formation to be suitable for the location of the radioactive waste disposal facility is remoteness from environment, absence of circulating ground water and ability to contain radionuclides for geological periods of time. India has wide spectrum of rock types especially those offering good potential as natural barrier for isolation and confinement of vitrified waste products. Granites, constituting about 20% of the total area of the country, could be the most promising candidates for deep geological repository. Even though the need for deep geological repository in India will arise only after a few decades, nonetheless, research and development work is in progress in the field of natural barrier characterization, numerical modelling, conceptual design and natural analogues of waste forms and repository processes. The overall safety against migration of radionuclides is achieved by a proper selection of waste form, suitable engineered barrier, back fill and the characteristics of the geo-environment of the site.

Backfills and buffer constitute most important components of multibarrier scheme adopted in a geological disposal system in hard rocks. These are placed as layers between the waste over pack and the host rock mainly to restrict the groundwater flow towards the waste form and to retard the migration of radio-nuclides to the biosphere in the unlikely event of their release from the over pack.

Model formulations, implementation and data are essential for safety assessment of disposal facilities under various scenarios. This is systematically assessed through predictive modelling of the gradual failure of the engineered barriers (i.e., the waste form, waste package, and backfill) and the subsequent transport to environment of radionuclides by circulating groundwater. Such

safety assessments are based on a good physical understanding of the processes involved in the release and transport of radionuclides, and also those affecting the repository and the geological formation.

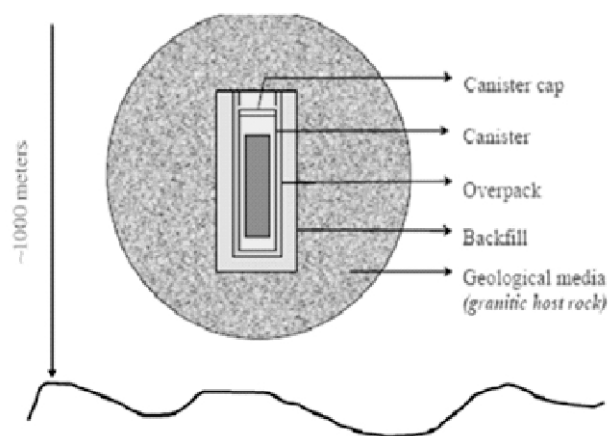


Figure 5: Schematic of Multi Barrier Disposal Concept

MINING AND MILLING

Tailings and waste rock are generated by mining and milling of uranium ore. The tailings material is covered with water and has the consistency of fine sand, when dried. It is produced by grinding the ore and the chemical concentration of uranium. After a few months, the tailings material contains 75% of the radioactivity of the original ore.

Clean and mineralized waste rock is produced during mining activities which must be excavated to access uranium ore body. It has little or no concentration of uranium. While clean waste rock can be used for construction purposes mineralized waste rock could generate acid when left on the surface indefinitely that could affect surrounding environment.

TRANSURANIC WASTE

Transuranic waste, or TRU waste contains more than 3700 becquerels per gram of elements. It is much heavier than uranium. This type of waste is produced through nuclear waste reprocessing procedures in most cases. This is one of the least worried about types of radioactive waste that is out there but it is worth mentioning since it is a part of nuclear waste.

RECYCLE AND REUSE

The need for resource utilization along with technological advancement has led to emerging scenarios of recycle options, which may also reduce the burden on future generation. Significant

reduction in the potential radioactivity of the waste can be achieved through improved recovery and recycling of plutonium.

In the partitioning and transmutation technology, the long lived minor actinides (Np, Am, Cm) and fission products (^{129}I , ^{99}Tc , etc.) are isolated from the waste and transmuted by subjecting them to neutron bombardment whereby they either become non-radioactive or convert into elements with much shorter half-lives than the original. This transmutation may be achieved in Integral Fast Reactors (IFR) or Accelerator Driven Sub-critical Systems (ADSS), leading to either elimination or reduction of radioactive inventories. This would be a long-term strategy for the management of high-level waste and would provide both environmental and resource advantage.

FUNDING WASTE MANAGEMENT

Nuclear power is the only large-scale energy-producing technology that takes full responsibility for all its waste and fully costs this into the product. Financial provisions are made for managing all kinds of civilian radioactive waste. The cost of managing and disposing of nuclear power plant waste typically represents about 5% of the total cost of the electricity generated.

The actual arrangements for paying for waste management and decommissioning vary. The key objective is, however, always the same: to ensure that sufficient funds are available when they are needed. There are three main approaches:

- Provisions on the balance sheet. Sums to cover the anticipated cost of waste management and decommissioning are included on the generating company's balance sheet as a liability. As waste management and decommissioning work proceeds, the company has to ensure that it has sufficient investments and cashflow to meet the required payments.
- Internal fund. Payments are made over the operating lifetime of the nuclear facility into a special fund that is held and administered within the company. The rules for the management of the fund vary, but many countries allow the fund to be re-invested in the assets of the company, subject to adequate securities and investment returns.
- External fund. Payments are made into a fund that is held outside the company, often within government or administered by a group of

independent trustees. Again, rules for the management of the fund vary. Some countries only allow the fund to be used for waste management and decommissioning purposes, whilst others allow companies to borrow a percentage of the fund to reinvest in their business.

According to GE Hitachi, by 2015 funds set aside for managing and disposal of used fuel totalled about \$100 billion (most notably \$51 billion of this in Europe, \$40 billion in the USA and \$6.5 billion in Canada).

CONCLUSION

Radioactive waste disposal practices have changed substantially over the last twenty years. Evolving environmental protection considerations have provided the impetus to improve disposal technologies, and, in some cases, clean up facilities that are no longer in use. Designs for new disposal facilities and disposal methods must meet environmental protection and pollution prevention standards that are stricter than were foreseen at the beginning of the atomic age. Disposal of radioactive waste is a complex issue, not only because of the nature of the waste, but also because of the stringent regulatory structure for dealing with radioactive waste. India has achieved self-reliance in the management of all type of radioactive waste. In line with global scenarios, technologies are constantly upgraded for minimization of discharges to the environment.

RECOMMENDATIONS

Disposal volumes vary based on the chosen solution for waste disposal. In arriving at its estimate, the IAEA has made assumptions with respect to packaging and repository design for countries without confirmed disposal solutions based on the

plans proposed by countries more advanced in the process. All hazardous waste requires careful management and disposal, not just radioactive waste. The amount of waste produced by the nuclear power industry is small relative to both other forms of electricity generation and general industrial activity. In over 50 years of civil nuclear power experience, the management and disposal of civil nuclear waste has not caused any serious health or environmental problems, nor posed any real risk to the general public. Alternatives for power generation are not without challenges, and their undesirable by-products are generally not well controlled. In addition to producing very significant emissions of carbon, hydrocarbon industries also create significant amounts of radioactive waste. The radioactive material produced as a waste product from the oil and gas industry is referred to as 'technologically enhanced naturally occurring radioactive materials' (Tenorm). In oil and gas production, radium-226, radium-228, and lead-210 are deposited as scale in pipes and equipment in many parts of the world.

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Air Pollution

Vidhi Gupta*

Sukritee Raizada**

Clean Air is a vital need to encourage a healthy eco system. Air Pollution is the one of major concerns all over the world. It affects all age groups but, its affects are quite different from region to region. More than 95 percent of the world's population is breathing polluted, unsafe air and the worst hit areas are in Africa and Asia. A major study of global air pollution has found, urban areas, which are home to a bigger percentage of the world's population, are exposing hundreds of millions to air that is filled with pollution from automobiles and factories. In many rural areas, the burning of solid fuels such as wood, charcoal and coal, is also a threat. The main sources of Air pollution are Ambient Air pollution and Household Air Pollution. Regions with the highest concentration of pollution include countries in North and West Africa, as well as South Asia. Countries have been recommended to limit their average annual air pollution levels to 10 micrograms of PM2.5 for every cubic metre of air. Greenhouse gases also trap the heat in the earth's atmosphere which results in warming of the planet. There are various types air pollution which include; lead, nitrogen oxide, ozone, particulate matter, carbon dioxide, and sulfur dioxides. Air Pollution is hazardous to human health and has severe effects on lungs, cardiovascular health, fertility, immune system damage.

INTRODUCTION

Air pollution

Air Pollution is the presence of toxic chemicals or compounds (including those of biological origin) in the air, at levels that pose a health risk. Air pollution is the presence of chemicals or compounds in the air which are usually not present and which degrade the quality of the air or cause calamitous changes to the quality of life (such as the destroying of the ozone layer or causing global warming). Many a times, it is caused by industrial activities such as mining, construction, transportation, industrial work, etc. Also, natural processes including volcanic eruptions and wildfires may also pollute the air, but their occurrence is rare and they mostly have a local effect, unlike human activities that is the leading cause of air pollution and contribute to the global deterioration in the quality of Air.

Some facts about Air Pollution:

1. The lower the levels of air pollution, lead to better cardiovascular and respiratory health both in the long term and short term.
2. The WHO Air Quality Guidelines: Global Update 2005 provides an analysis of health effects of air pollution and benchmarks for health-harmful pollution levels.
3. In 2016, 91% of the world population was living in places where the harmful level of pollutants in the air exceeded the benchmarks provided by WHO.
4. Ambient (outdoor air pollution) in both cities and rural areas caused about 4.2 million premature deaths worldwide in 2016.
5. Some 91% of such premature deaths struck the low- and middle-income countries, and the largest number occurred in the South-East Asia and Western Pacific regions as per WHO.
6. The primary steps to reduce air pollution include policies and investments that support cleaner transport, energy-efficient homes, power generation, industry and effective municipal waste management.
7. Additionally, indoor smoke is a grave health risk for about 3 billion people who resort to cooking and heating their homes with biomass, kerosene fuels and coal.
8. Air pollution is responsible for 1.7 million child deaths a year

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Main Sources of Air Pollution:

Ambient Air Pollution:

Ambient or outdoor air pollution in both cities and rural areas of low and middle income countries was forecasted to cause 91% of 4.2 million premature deaths per year in 2016. The given mortality estimate is due to exposure to minute PM of 2.5 microns or less in diameter. PM is a common proxy measure for air pollution. It holds the highest adverse impact. The main components of PM are sulfate, nitrates, ammonia, sodium chloride, black carbon, mineral dust and water. It consists of a composite mixture of solid and liquid particles of organic and of organic and inorganic substances slinging in the air. While particles with a diameter of 10 microns or less, (\leq PM10) can pierce and get deposited deep inside the lungs, the even more harmful particles are those with a diameter of 2.5 microns or less, (\leq PM2.5). PM2.5 can go through the walls of lungs and reach our blood system. Persistent exposure to particles leads to the risk of developing cardiovascular diseases, respiratory diseases, and lung cancer. Air quality measurements are primarily measured in terms of either daily or annual mean concentrations of PM10 particles per cubic meter of air volume (m^3).

Everyday, air quality measurements evaluate such PM concentrations in terms of micrograms per cubic meter ($\mu g/m^3$). If sufficient measurement tools are available, concentrations of fine particles (PM 2.5 or smaller), are also reported.

Household Air Pollution:

Around 3 billion population cooks polluting open fires or simple stoves fuelled by biomass, (wood, animal dung and crop waste), coal and kerosene. Each year, close to 3.8 million people die untimely from problems coming from household air pollution from unsuitable cooking practices which use polluting stoves along with solid fuels kerosene. Household air pollution leads to non-communicable diseases. Present data reveals stroke, ischaemic heart disease, chronic obstructive pulmonary disease (COPD) and lung cancer are the consequences of air pollution. Children below the age of 5 years are particularly affected because of particulate matter or soot inhaled from household Pollution. . Among these 3.8 million deaths:

1. 27% due pneumonia
2. 18% attributable to stroke
3. 27% result from ischaemic heart disease

4. 20% come from chronic obstructive pulmonary disease (COPD)
5. 8% come from lung Cancer

The Main types of Air Pollution

Ozone (O_3)

Ozone is the primary factor which contributes to asthma, morbidity and mortality. The current guiding value is $100 \mu g/m^3$ 8-hour mean which was reduced from the earlier level of $120 \mu g/m^3$ based on daily mortality and lower ozone concentrations. Ozone at ground level and top atmosphere are different. It's formed as a result of reaction of pollutants such as nitrogen oxides from vehicle and industry emission and volatile organic compounds.

Nitrogen dioxide (NO_2)

Guideline values

$40 \mu g/m^3$ annual mean

$200 \mu g/m^3$ 1-hour mean.

NO_2 is the primary source of nitrate aerosols, which in turn is an important part of PM2.5 and in the presence of ultraviolet light of ozone. The chief sources of anthropogenic emissions of NO_2 are a result of combustion processes such as power generation, heating and engines in vehicles and ships. The present WHO guideline value has been set to $40 \mu g/m^3$ (annual mean). Concentrations exceeding $200 \mu g/m^3$, are considered toxic and can cause significant inflammation of the airways.

Sulfur dioxide (SO_2)

It's a colorless gas with a sharp odor. It's the result of the burning of fossil fuels like coal and oil for domestic heating, power generation and motor vehicles, and the smelting of mineral ores containing sulfur. The chief anthropogenic source of SO_2 is the burning of sulfur-containing fossil fuels for domestic heating, power generation and motor vehicles. SO_2 benchmark value is $20 \mu g/m^3$ 24-hour mean and $500 \mu g/m^3$ 10-minute mean as per WHO.

Carbon oxides

Carbon Dioxide includes both carbon monoxide (CO) and carbon dioxide (CO_2). These are colorless, odorless gases. CO has toxic effects on both plants and animals. CO and CO_2 are greenhouse gases.

Particulate Matter

These are minute particles of liquid or solid suspended in a gas. Some are man-made and some are natural. Natural ones originate from dust

storms, volcanoes, forest, grassland fires, seaspray, living vegetation. Human activities such burning of fossil fuels and industrial processes generate aerosols. Aerosols are both gas and particles together.

Lead

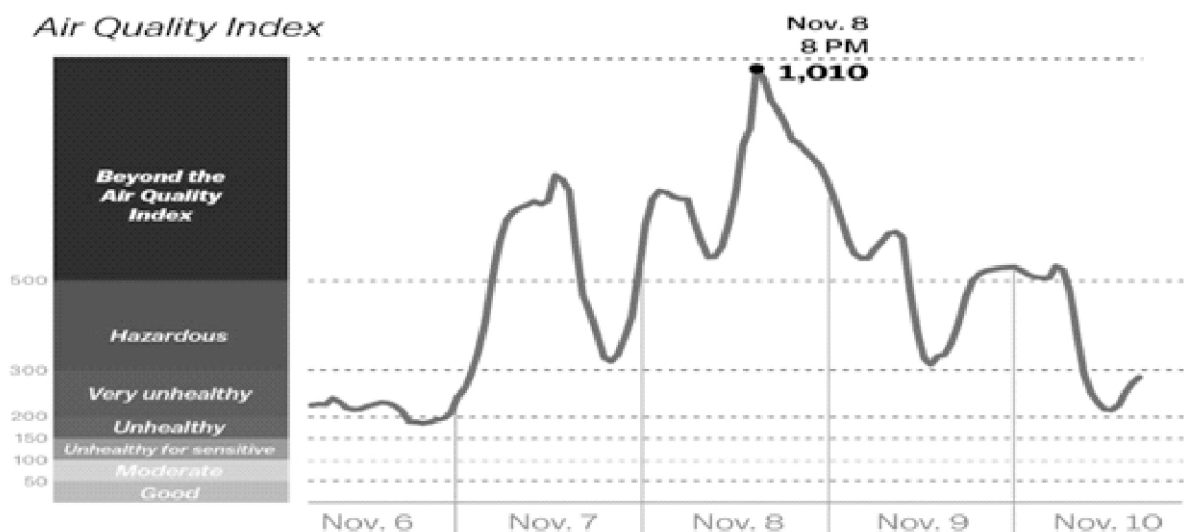
Lead comes from metal refineries and combustion and mining activities.

Delhi Air pollution

Delhi has been experiencing exacerbating affects of Air pollution. November 8,2017 is marked as the Red Letter Day in the history of Delhi as the whole Capital came to a stand still. AQI levels indicated 999 which was way above the worst AQI category. The safe limits for PM2.5 is 60 AQI and for PM10 it is AQI 100. AQI over 150 is unhealthy and anything over 300 is considered perilous. Medical Experts compared the pollution levels to smoking 50 cigarettes a day. There was an altitudinous increase in the number of people complaining of respiratory problems and hospitals raised a health emergency. The Air quality was so bad that it resulted in dropping cricket Test Match because both Indian and Sri Lankan Teams found it difficult to play. Moreover, this was the first time a cricket match had been stalled for these reasons. It led to increased accidents on the highway. However, Union Environment Minister Harsh Vardhan attributed the dust coming in from the Gulf and stubble burning as the major reason behind an air pollution crisis here in November.

Case Study 1

When Delhi became the most polluted city on Earth



Source: US State Department

Vox

Primary Causes:

Burning of Crops

Burning of crops by the farmers of neighboring states of Haryana and Uttar Pradesh. Farmers burn rice stubbles at the end of the kharif season before planting crops for Rabi season. The smog in Delhi trapped the pollutants making it difficult to breathe.

Traffic Pollution

Delhi has a good number of environment friendly CNG buses. Even then the air pollution level in Delhi is tremendous, which is also due to number of vehicles in Delhi per household. Due to mighty growth of real estate, the green cover over Delhi has declined.

Onset of Winter

The winter air is cold and dense and dust particles get trapped into it. And Absence of wind current mostly aggravated the situation.

Construction Activity

Construction activity also leads of increased circulation of dense dust particles.

Dumping and Burning of Garbage from industries also contributes to it.

Western disturbances

Dust storm from the Gulf contributed to 40% of pollution, stubble burning in neighbouring states attributed for 25% pollution, the local reasons had only 35% contribution.

Lastly, the crackers wreaked havoc over the already hazardous AQI in Delhi.

Measures issued by National Disaster Management Authority:

1. People were advised not to step out of the house and avoiding areas with dust. If it was urgent, they were advised to set up when the sun started shining brightly.
2. Immediately resorting to medical help
3. Ensuring children remain indoors.
4. Drinking lots of water and eating foods high in Vitamin C, Magnesium and omega fatty acids.
5. Avoiding strenuous activities
6. Nasal filter and Air purifiers were suggested to be purchased at homes
7. Indoor Plants like Aloe Vera should be installed for better air quality.

Measures taken by government:

A prohibitory order regarding burning of crops, industrial waste were issued. There was a ban on use of Generator sets and prohibition on burning of open Garbage. Increased frequency of metros and mechanical sweeping of roads. Sprinkling of Water of water on roads was instructed. Government also issued an order to shut schools and colleges temporarily. Bulky Vehicles were prohibited.

Case study 2

Around 1.6 million people in China die each year from heart, lung and stroke problems which come from polluted Air. China experienced Airpocalypse in December,2015. From Nov 28,an expanse of toxic

air had spread over China. By Nov 30,2015 Beijing Air contained hazardous level of PM2.5, almost 40% more than the benchmark set by WHO. AQI(Air Quality Index) reached it's maximum at 500. Beijing had created a four tier response system for Air pollution Levels in October 2013. It stated that a red alert must be issued during the periods Air Quality Index is expected to surpass 200 for three consecutive days. In spite of the chronic situation, China had initially issued an Orange Alert which was met with heavy criticism.

Pursuant to the criticism, and the alarming situation being continued it finally issued a red alert.

Causes

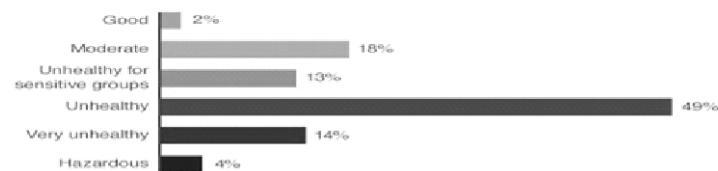
1. Industrial Coal Burning
2. Motor Vehicle emission
3. Neighbouring regions particularly Industrialised and one of the 10 most polluted areas like Hebei Province

Measures Taken:

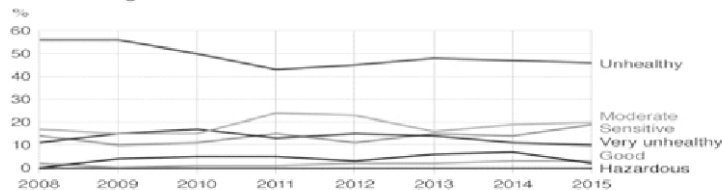
1. The city's emergency management headquarters advised kindergartens, primary and high schools to shut classes, outdoor operations on construction sites were banned and some industrial plants were required stop production.
2. Schools designed specific set of activities for children to keep students fit.
3. Vehicle use was limited as odd and even number plates were allowed on alternate days. 30% Government Cars were banned. 21000-25000 buses were added as a result out of which

Beijing air quality 2008-2015

Daily average air quality index (AQI*) at US embassy, based on PM2.5 concentration readings



Annual averages



Daily average compiled from valid hourly readings Apr 2008-Jun 2015. *AQI categories as set by the US Environmental Protection Agency

Source: US embassy, Beijing



about 8000 were clean energy buses.

4. The neighboring provinces of Hebei and Shandong and Tianjin Municipality took emergency measures as well to lessen the affect on Beijing. A joint Law enforcement Action plan was formulated.
5. Use of desulfurizing equipment and Inspectors were assigned duties to overlook implementation of action plan.
6. Strict Punishment and penalties on Agencies and Personnel failing to implement emergency plans.

Conclusion: Both India and China are dealing with alarming levels of air pollution. While China is effectively taking steps and working on its air quality India still lacks the basic framework, technology, strict policies and guidelines to address the problem. Also, the government efforts are not enough, participation of people at individual levels will have an indisputable effect in Air Pollution.

The cost of Air Pollution:

Pneumonia

Pneumonia attributes to 45% of all pneumonia deaths in children less than 5 years old. Household air pollution is also risk for acute lower respiratory infections (pneumonia) in adults, and is responsible for 28% of all adult deaths.

Chronic obstructive pulmonary disease

25% of untimely deaths are a result of chronic obstructive pulmonary disease (COPD) in adults in low- and middle-income countries because of exposure to household air pollution. Women who are exposed to high levels of indoor smoke are more than twice as likely to suffer from COPD than women who use cleaner fuels and technologies. Among men (who already have a heightened risk of COPD courtesy their smoking habits), exposure to household air pollution doubles that risk.

Stroke

12% of all early deaths due to stroke can be pursuant to the everyday exposure to household air pollution which arise from cooking with solid fuels and kerosene.

Ischaemic heart disease

Nearly 11% of all deaths due to ischaemic heart disease, which accounts to 1 million death yearly, are a result of exposure to household air pollution.

Lung cancer

Nearly 17% of premature lung cancer deaths in adults are a result of exposure to carcinogens from household air pollution emitted from cooking with kerosene or solid fuels like wood, charcoal or coal. The risk for women is higher, due to greater participation in food preparation.

Other health impacts and risks

Small particulate matter and other pollutants in indoor smoke lead to swollen airways and lungs, damaging immune response and reducing the oxygen-carrying capacity of the blood. There is also evidence of connection between household air pollution and low birth weight, tuberculosis, cataract, nasopharyngeal and laryngeal cancers.

Note: For lung cancer and chronic obstructive pulmonary disease, active smoking and second-hand tobacco smoke are also main risk factors.

The use of kerosene is the major cause of childhood poisonings.

The lack of access to electricity for 1 billion people exposes households to very high levels of fine particulate matter. The use of lighting fuels introduces other health risks, such as burns, injuries.

Fuel gathering increases the risk of musculoskeletal damage, consumes considerable time for women and children.

Both short and long-term exposure to ambient air pollution may lead to reduced lung function, respiratory infections and severe asthma. Maternal exposure to ambient air pollution is related to adverse birth outcomes, such as low birth weight, pre-term birth and small gestational age births. Emerging research also proposes that ambient air pollution may lead to diabetes and affect neurological development in children.

Role of WHO

WHO Member States data adopted a resolution (2015) and a road map in 2016 for a more high reaching global response to the hazardous health effects of air pollution. WHO is responsible for developing and producing air quality guidelines and thereby providing exposure limits to key air pollutants (indoor and outdoor). WHO creates health related assessment of the effect of different types of pollutants as mentioned above. It has created Airo+, Health Economic Assessment Tool to assess walking and cycling interventions, Green+ tool, Sustainable Transport Health assessment

tool(STHAT) and Integrated Transport and Health Impact Modelling Tool. It is developing Clean Household Energy Solutions Toolkit(CHEST) to guide countries with tools needed to make policies for clean household energy access. The WHO has co-sponsored Pan European Programme on Transport Health and Environment (PEP), and built a model of regional, Member State, and multi-sectoral cooperation for reducing the effects of air pollution and other health impacts in the transport sector.

Some Solutions to combat Air Pollution:

As seen from the above data air pollution attributes to cardiovascular illnesses, Respiratory diseases and causes premature deaths.

1. Industry: Clean technologies which reduce industrial smokestack emissions need to be implemented. Improved management of agriculture and industrial waste, including capturing of methane gas emitted from waste sites as an alternative to incineration.;
2. Energy: Providing ways to budget friendly clean household energy solutions for cooking, heating and lighting. Black carbon and methane emissions by inefficient stove combustion are hazardous climate change pollutants
3. Transport: There is a need to shift to energy efficient and cleaner resources of power generation. More environment friendly vehicles need to developed, walking and

cycling networks in cities should be encouraged. Moving to environment friendly heavy duty diesel vehicles and low-emissions vehicles and fuels, including fuels with reduced sulfur content. Netherlands wants to ban the further sale of petrol and diesel cars from 2025 and make way for electric and hydrogen vehicles.

4. Urban planning: Building should become more energy efficient and shouldn't destroy forest cover and cities should have more green spaces, new policies for conservation of forest spaces need to be set up. Freiburg in Germany has 500km of bike routes, tramways, Copenhagen gives preference to bikes over cars and consequently has more cycles than people. Oslo is planning to
5. halve its climate emissions by 2020 and suggests a large no-car zone, the building of 40 miles of new bike lanes, steep congestion charges, a rush-hour fee for motorists, and the removal of many parking spaces.
6. Power generation: There's a dire need to use low-emissions fuels and renewable combustion-free power sources which are available in abundance like solar, wind or hydropower.
7. Municipal and agricultural waste management: Strategies to reduce waste, separate waste, recycle, reuse or waste reprocessing. Efficient methods of biological waste management such



as anaerobic waste digestion to produce biogas, are feasible, low cost alternatives to the open

8. Burning of solid waste. Where it is inexorable, then combustion technologies with strict emission controls are necessary.

The Concept Skyscraper Trees is gaining popularity. Full size trees, thousands of shrubs and plants scale the sides of the building. Bosco Verticale in Milan is being constructed. Liuzhou Forest City is the most ambitious project undertaken by China. It will be a new town with homes for 30,000 people, wherein buildings will be covered by 40,000 trees and 1 million plants. Similar projects have been enrolled for Lausanne in Switzerland, Utrecht in the Netherlands.

At individual Level we can contribute by keeping a regular check on the pollution emitted by our vehicles, conserving energy by switching off lights and computers when not in use. Opt for carpooling with your colleagues and friends. Avoid excessive idling of your vehicle during red lights. Use energy efficient equipments and use indoor plants to curb Air Pollution levels. Buy products that say low 'VOC'. Plant more trees in your neighbouring areas.

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Water - Indispensable for Life

Jyoti Garg*

Tanya Bhattacharya**

Time is over for such awareness. It is high time to practically implement some measure in order to save natural resources. Any threat to natural resources is threat to human existence. This article focus on the issue of water scarcity not only in India but also in other countries like China, Brazil, Iran, South Africa. This article analyze the availability and usage of water today and in past. Based on secondary data, future predictions are made that focus the water scarcity issue. These future data tells about the availability of water in future if present type usage will continue.

Keywords- Water, Water scarcity

INTRODUCTION

All Natural resources are very important for human existence. Just like air, water is very important for each individual living on earth. No one on earth can survive without water. Water is not just used for drinking but also for bathing, agriculture, industrial purposes, sanitation, cooking etc.



“When less is life-Threatening”.

This statement summarizes the purpose of this article very well. At present, India is facing water crisis and if such conditions continues then soon no water will be available and that can result in endangering people’s life. Today’s situation is such that the demand for water is exceeding its supply and if this continues then in no time people will have zero availability of water. In spite of water being an existential requirement for people, it's likewise a standout amongst the most under organized

however finished mishandled item. Water is vital for our lives yet as we move towards modern culture, it has not been the main issue of concern and also nobody is undertaking any solution for the same.

Water Stress is a situation identified by the scientists when demand of water gets limitless and the supply of water is not balancing the demand for a longer period of time. This problems leads to scarcity of water and also the quality of fresh water degrades.

Major causes of these problems are by humans and is uncontrollable. Some of the reasons of water scarcity are:

Population Growth : When population increases then the usage of water also increases. Population growth is directly proportional to water scarcity. More people more water usage and more water scarcity.

Deforestation : Clearing the land and cutting all the trees from the surface of earth can result in water stress. Many big industries and companies are cutting down trees for building huge factories. Cutting of tress will lead to less rainfall and less storage of water. Companies and factories use a large amount of water as some ingredient and also water is also used for domestic purposes.

Poverty : Developing nations like India involves poor, illiterate people and and also these nations does not have adequate resources and technology for converting water from rivers lakes into safe drinking water. In such nations, it is important to introduce some new techniques and machinery that could convert water from river into safe drinking water.

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Inefficient utilization of water for horticulture : India is among the best cultivators of horticultural deliver on the planet and in this way the utilization of water for water system is among the most noteworthy. Conventional strategies of water system causes most extreme water misfortune because of dissipation, waste, water transport, and overabundance utilization of groundwater.

As more regions go under conventional water system methods, the worry for water accessible for different purposes will proceed. The arrangement lies in broad utilization of miniaturized scale water system procedures, for example, dribble and sprinkler water system.

Diminishment in customary water energizing territories : Fast development is overlooking customary water bodies that have additionally gone about as ground water reviving system. We have to direly restore conventional aquifers while executing new ones.

Sewage and wastewater seepage into customary water bodies : For handling this issue, it is very important for our government to intervene and take some measures for resolving this problem.

Arrival of synthetic compounds and effluents into waterways, streams and lakes : Strict checking and usage of laws by the administration, NGOs and social activists is required.

Absence of on-time de-silting tasks in expansive water bodies that can improve water stockpiling limit amid rainstorm : It is astounding that the legislatures at state levels has not taken this up on need as a yearly practice. This demonstration alone can fundamentally add to the water stockpiling levels.

Absence of proficient water administration and dispersion of water between urban buyers, the farming division and industry : The administration needs to upgrade its interest in innovation and incorporate all partners at the arranging level to guarantee enhancement of existing assets.

LITERATURE SURVEY

According to the analysis done by government think tank NITI Aayog, (chaired by Prime Minister Narendra Modi), it is stated that currently India is a country that is facing long term water crisis in the history. If no immediate steps will be considered then by 2030 demand of water will exceed its supply. Also it tells about “composite water index”.

This index shows that in 2018, approximately 600 million Indians faced water scarcity problem. High to Extreme water shortage problems were faced by Indians in 2018. In the same year around 200,000 people died just because of drinking unsafe water and also from the shortage of water.

This analysis findings also focused on the availability of water that is contaminated. It tells that about 70% of available water is contaminated and major cities in India like Delhi, Bangalore, Chennai will have no groundwater also by 2020. This crisis could affect 100 million Indians. These reports suggested to undertake major steps in order to save water for future generations.

WORST AFFECTED REGIONS

India as a whole country is facing water crisis and it is an alarming situation for whole country to take a look on this situation and do some measure to save water.

Worst affected regions in India is Uttarakhand. Dehradun and other districts of Uttarakhand are worst affected by water scarcity. Findings by UNDP tells that there were 2.6 lakh springs that proved approximately 90% of drinking water for the people of that region but due to deforestation and building of roads, getting fuel activities led to water scarcity by 50% in 500 water supply resources like streams, springs, ponds etc. Same situation is faced by other cities of India like Maharashtra, Rajasthan , Orissa , Jharkhand etc.

Table 1. Availability of water in India

YEAR	POPULATION (million)	PER CAPITA WATER AVAILABILITY (m ³ / year)
1951	361	5,177
1955	395	4,732
1991	846	2,209
2001	1027	1,820
2025	1394	1,341
2050	1640	1,140

WATER AVAILABILITY

Based on past and present record stored by government of India, 2009 it is analysed that how much per capita water is available in India and how much water will be available in future.

This table below clearly shows how the population growth is affecting water availability and is leading to water scarcity.

BAIF Development Research Foundation , Pune released a study telling about the usage of water in different sectors. It tells that how much water was used earlier for different sectors like agriculture, industry etc and what is the situation now and what will be the water crisis in future.

Table 2 : Water usage

YEAR	2000	2050
Agriculture (BillionLit/Day)	1,658	1,745
Industry (BillionLit/Day)	115	441
Domestic (BillionLit/Day)	93	227
Total (Lit/Day)	1,866	2,413
Per Capita (Lit/Day)	88.9	167.0

As shown in table 2, it is clear that in future the water usage is highly increased for domestic purposes and also for the industrial purposes which leads to shortage of water and water crisis. By 2050, least amount of water will be available and would lead to threat to human life.

RECOMMENDATION AND CONCLUSION

BAIF Development Research Foundation, Pune proposed some changes in different sectors in national water policy in order to save water and prevent situations like water crisis.

In Agriculture Sectors they recommended :

- To improve the water usage techniques and recommended to efficiently use water with less wasting it.
- To imply watershed management techniques and adopt rainwater harvesting techniques For pumping water, to reduce power supply subsidies.
- They introduced many rewards, differential pricing and punishments in order to prevent ground water exploitation.
- For connecting 30 rivers and canals that could generate 175 trillion litres of water, their recommended to implement National River Link project.

For Industrial sector :

- They recommended to analyse regulations and

subsidies the tells about recycling and treating industrial wastewater so as to use it again.

- They introduced some new technologies and encouraged people to use them, these techniques used less amount of water.

For Domestic Sector :

- For mandatory use of rainwater harvesting in cities like Delhi, they introduced a new policy.
- They recommended propagation of efficiently utilisation of water.
- As a large proportion of India is illiterate and are unaware of such water crisis, they recommended to create awareness among people about water conservation and saving water.

A straightforward expansion of a 'water free' male urinal in our homes can spare well more than 25,000 liters of water, per home every year. The conventional flush administers around six liters of water for each flush. In the event that every single male part including young men of the house utilise the 'water free urinal' rather than pulling the conventional flush, the aggregate effect on the interest for water will lessen fundamentally. This must be influenced compulsory by law and took after to up by instruction and mindfulness both at home and school.

The measure of water that is squandered amid dish washing at home is huge. We have to change our dish washing strategies and limit the propensity for keeping the water running. A little advance here can make a noteworthy sparing in water utilisation.

Each autonomous home/level and gathering lodging province must have rain water reaping office. On the off chance that effectively planned and appropriately dealt with, this by itself can decrease the water request fundamentally.

Squander water treatment and reusing for non-drinking purposes. A few minimal effort innovations are accessible that can be actualised in bunch lodging zones. Frequently, we see water spilling in our homes, in broad daylight zones and settlements. A little relentless water hole can cause lost 226,800 liters of water for each year! Except if we know and aware of water wastage we won't have the capacity to profit the fundamental amount of water that we have to go ahead with our ordinary lives.

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I Sanjeev Bansal, hereby declare that the particulars given above are true to the best of my knowledge.

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