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WATER POLLUTION A GLOBAL CHALLENGE FOR 21ST CENTURY

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Introduction:

From the very beginning of the earth water is the most inevitable element in the environment as well as for all living beings. Existence of life as well as ecosystem can't be consider without water. Generally water is ubiquitous everywhere in the earth. It is only one substance in the earth which exist three stages in the nature: liquid, solid and invisible vapour. Its natural three stage existence makes a sustainable environmental balance, natural desalinisation of marine water, evaporation by solar radiation, precipitation and solidification or ice and glaciers formation in lower temperature in polar or arctic region. Breakdown or hindrance of any or all these natural process can make a global catastrophe. Among the total water bodies in the earth major portions are belong to world ocean as saline water that is estimated 97.5% and only 2.5% is fresh water. The greater portion of this fresh water 68.7% is existed in the Antarctic, the Arctic and in the mountainous region in the form of ice and permanent snow cover and next 29.9% exist as fresh ground water (Shiklomanov 98). "Only 0.26% of the total amount of fresh waters on the earth are concentrated in lakes, reservoirs, and river system where they are most accessible for our economic needs and absolutely vital for water ecosystem"(Ibid).

Water which is important part of life are now polluted by different way mostly by human intervention. Water pollution

means the any introduction of unwanted substance which makes the water foul, unclean or dirty that is harmful for living beings as well as an adverse effect on environment. Rapid increase of global population, industrial development, urbanisation, agriculture practices, offshore drilling, mining, marine transportation all of these are severely responsible for global water pollution. In my report I will try to discuss the water pollution its sources and causes and adverse consequences on human life as well as global ecosystem.

Sources of water pollution:

Generally two types of water pollutants exist; point source and non point source. "Related to water resources, nonpoint source pollution is the introduction of impurities into a surface water body or an aquifer, usually through q nondirective route and from sources that are diffuse in nature" (Leeds et al). Discharge from nonpoint sources are often difficult to isolate ,identify and control. Urban and rural runoff by rain or Hood water, road dirt and grit, runoff and leachate from agriculture fields, construction, mining and logging operations, shoreline erosion, croplands Nurseries, live stock operations, land fills, vehicles emissions, gardens etc are the major nonpoint sources. According to the United States Department of Agriculture (USDA) most non point sources pollutants fall into six major categories: sediments, nutrients, acid and salts, heavy metals, toxic chemicals and pathogens. All these elements when they mix with water body either by runoff or drainage dilute the water. The effect of nonpoint source pollutants on specific waters vary and these pollutants have harmful effects on drinking water supplies, recreation, fisheries and wildlife(US- EP A 1994).

Point sources of pollution occur when harmful substances are directly discharged into a water body. Point sources are easily identifiable inputs where waste is discharged into the water from pipe or drain. Industrial unit, sewage and municipal wastes are the example of point sources.

Major Driving forces to water pollution:

Population Growth:

Increasing populations and its adverse effects on global economy and environment is burning questions from the beginning of the last century. Increase of population increase demand of food, water, habitat, urbanisation and other daily essentials. Until the mid if the 18th century population grow quite slowly and in 1730 world population was 700 million but then it began to rise quickly and by 1820 human population reached a billion (McNeill 2000).Since the eighteenth century populations grown extremely quickly and in 1950 global population was 2.5 billion and at the end of the 2000 it was increased to around 6.0 billion (ibid). "The rapid population growth between 1970 to 1994 has resulted in the potential water availability for the earth population decreasing from 12.9 down to 7.6 thousand cubic meters per year per person"(Shiklomanov 1998).Though population is increased as a rapid rate but infrastructure facilities like drainage system, sewerage system, waste treatment, hygienic sanitation are not equally existed all parts in the world mostly in developing and underdeveloped countries that causes the major water pollution or natural degradation in ambient environment. In 1995, 89 percent of the residents of greater manila had no connections to any sewer system, 82 percent in Dhaka and 80 percent in Karachi by contrast Mexico City left only 20% and Seoul 14% without sewerage (McNeill 2000). The wastes generated from house, urban areas and any human localities find their destination into near by canal, lakes, river or stagnant water bodies and pollute the water quality which consequently cause the water born diseases in human bodies as well as other living organisms, some cases in epidemic form and create lethal effect.

Agriculture Practices

When human first invented agriculture around 8000 B.C., global population was probably between 2 and 20 million but in the 20th century with its pell-me!1 urbanisation and its vast expansion of farming and grazing, the scale of nutrient export became many times greater than ever before (McNeill 2000).In

the modern world there are twin problem facing simultaneously, rapid rate of population growth and there is an acute food deficit almost two third of its population. In order to maximise the,. food supply for overburden population modern and scientific agriculture practice. are innovated everywhere in the world. Uses of chemical fertilizer, long persistent pesticides for pest and pathogen control, construction of dam for irrigation is lead a global water pollution. Chemical fertilizer, manure, sewage contains nutrients such as nitrate and phosphates. Major part of these nutrients washed out by rain or land runoff and mixed with the water makes it polluted, increase the turbidity and decrease the transparency of water.

Pesticides that is applied to agriculture farms, road side, gardens, homeowners lawns ultimately find their way of destination to the water body. DDD, DDT, Aldrin, Dieldrin, Endrin, Malathion, Parathion, Telodrin etc which are long persistent in the nature increase the toxicity and create the lethal effect on living organisms (Heindel et al 1993).When pesticides used in the fields its missed targets and moved elsewhere and other awkward places. According to the world health organisation report 1990 that pesticides poising killed 20000 peoples per year and roughly a million people suffered acute poising, two third of them agricultures. Pesticides which sweep to the ground water and mix with the aquifer, due to its long life in the nature and chronic effect in human health, takes a lot of financial investment for exploration of pure and safe drinking water. In the Midwestern United States spend $ 400 million each year to treat water for just one chemical the pesticide Atrazine (http://www.grinningplanet.com).

Industrial development

Industrial development mostly in last two centuries 18th and 19th is the great contribution for human civilization. Still the medieval century human are almost depend on their 'somatic energy' for agriculture, food production, transportation, or any other goods or products. But after the industrial revolution development of internal combustion engine and petroleum-

fuelled explosion of the chemical industry human muscles energy or somatic energy transferred to machine energy, that's lead a massive production rate as well as decrease the labour cost. These industrial development in western Europe and northern America soon after transferred to everywhere in the world with a rapid space that consequently causes a global industrial water pollution over time. Water generally used in industry for cooling, boiling, transportation, washing, as a so] vent and as a composition of finished products. Volume of water for industrial operations depend upon individual branches of industry,. different kind of production, technology and manufacturing process. The development of industrial water withdrawal is one of the main causes of water pollution in the world(ShiklomanovI998).Along side the industry the treatment plants were not established everywhere in the world even still now many industries are operating without any treatment plant in most of the poor and developing countries. Even some cases treatment plant are faced with many pollutants, such as dioxins, heavy metals and polychlorinated biphenols (PCBs), which they cannot treat or remove, so these elements mix with water when discharged to the lakes or rivers(Stauffer1998). Industry like Iron and steel, textiles and leather, pulp and limper, petrochemicals and refineries, pharmaceuticals, mining, metal, microelectronics are producing different pollutants e.g. BOD, COD, sulphates, chlorinated organic compounds, phenols, cyanide, acids, chromium, f1uorine, salts suspended solids, heavy metals etc which have an adverse effect on ambient water body. Heavy metals which create a long term problem to health, when it mix into the water body, its neither breakdown nor biodegradable, enter into the food chain through primary tropic level and reach up to higher organisms by bioaccumulation and biomagnified overtime. It was estimated that between 1900 and 1977 the concentrations of heavy metals in Rhine sediments increased fivefold for chromium, two fold for nickel, sevenfold for copper, four fold for zinc twenty seven fold for cadmium and five fold for lead(McNeill 2000). So it is easily assumed that industrial development lead an increase input of wastes to the global water that causes the severe water pollution in the globe.

Marine water pollution:

Marine environment consisting major volume (97%)01' world water resources which is now under severe threat of pollution. Seas or ocean are polluted by twin process one is —-pollutant sources, like port, industry, infrastructure which is situated in ambient marine environment and other is by river runoff because sea is the last destination of river flaw. The Amazon the greatest river in the world, produces 16% of annual global river runoff; five largest river systems the Amazon, the Ganges, the Brahmaputra, the Congo, the Yangtze and the Orinoco are formed the 27% of the world water resources and all these rivers are located throughout all the earth continents except Australia(Shiklomanov 1998). "Approximately half of the total river water inflow to the world ocean where four of the six largest rivers of the world go, the Amazon, the Congo, the Orinoco and the Parana" (Ibid).Naturally rivers are the carrier of all wastes and pollutants which directly dumped or discharged or admixed through land runoff into it, carried by her own water agency and finally deposited into the ocean. Baltic sea which is the major source of water resources for eleven riparian states now under great threat of water pollution due to high nutrient load. The Mediterranean which is the world largest inland sea, due to the growth of the modern industry in many Mediterranean countries, the emergence of chemical zed agriculture and) rise in human and animal populations, increased the basin pollution loads after about 1950 (McNeill 2000). Heavy metal pollution, e.g. Cadmium, Mercury, lead causes severe damage of marine life as well as human health hazards. Minamata diseases which effected children brain damage, caused by mercury-laden waste into Minamata bay in .Japan in 1956, was one of the worst case of the contamination of the sea in the twentieth century.

Oil pollution and atmospheric deposition into the ocean are the two other important sources of marine water pollution. Oil comes to the ocean, from transportation, Fishing. trawler, routine operation, loading -unloading, tanker accident, offshore drilling, leakage, dumping the ballast and bilge water. Half a million tons of oil leaked into the Mediterranean sea each year, the result

came out from the survey in 1975; another in 1980 to 1981 suggested about 820000 tons and it absorbed a sixth of the world oil pollution(McNeill 2000).This is the one worst example for one sea, one year for specific one area. According to .Johnston(1984) estimated that five million tons of oil enter the sea annually from anthropogenic sources.

Land Use and water pollution:

The expansion of agriculture abruptly change the global land use in 20th century. With the mercy of technological development now it is easy to cultivate more lands in short time and low cost, before industrial revolution it was quite impossible to imagine, agriculture sector was fully depended on human manual effort. Cultivation of bigger field and expanded scale of production compel the government to adoption of tractor and other equipments in the field. Integrated agricultural advancement causes great threat to the forest. coastal fish farming greatly decrease the mangrove forest. Greater energy demand for additional population started deforestation. So from any barren lands wind and water can carry fine clay and mineral particles from the soil and deposit them into local water bodies. Tilling and ploughing also encourages the soil erosion. In 1977 the US soil conservation service stated that 9 tons of soil blowing and washing away per hectare per year(Stauffer 1998).1n the earth surface one third is the land and of that no more than a quarter 26 to 30 million allowed to cultivation, of that about a quarter roughly the area of Australia was cultivated by 1900; by the 1995 that area was more nearly the size of Russia or South America (McNeill 2000). New and modern urbanisation, encroachment of coastal land, more uses of beach and sea shore for recreational and tourism industry increase the soil and land erosion causing the water pollution. Plant root system stabilize the soil, protected it from washing way, but deforestation process for agriculture or human settlement, damage the soil stability;

Eutrophication and Water Pollution:

Eutrophication means the enrichment of aquatic ecosystem by addition of the nutrients into the lakes, rivers, coastal waters

and marine environments as well. Eutrophication is the enrichment of an ecosystem with chemical nutrients, typically compounds containing nitrogen, phosphorus or both (Wikipedia).Intense load of nutrients causes the abrupt gro\V1:h of certain plant and animal species, mostly plankton biomass generally known as phytoplankton bloom or algal bloom. Rapid increase of global population, industrial development, urbanisation and land use pattern are made the new dimension of global eutrophication. In other words rising temperature and changing pattern of precipitation due to climate change may alter the eutrophication. Abrupt growth of plankton and their death disrupt the normal functioning of the aquatic ecosystem and made various problem with in the environment as well as water pollution. Mostly human beings are affected by this phenomenon because it decreases the resources value of lakes, reservoirs, river and estuaries, hindered the quality water supply, fishing, hunting and aesthetic enjoyment.

In changing world eutrophication is not a local or regional problem, it is a global issue because nutrients come from point (mines, oil fields and industrial sites, runoff from construction sites, leachate from waste disposal system etc) and nonpoint sources (runoff from agriculture irrigation, urban areas, atmospheric deposition etc) are not easy to control locally, it is the matter of riparian states or even inter continental issue

“By the end of the twentieth century one of our most important scientific accomplishments has been the explicit realization that the human population is changing the earth system” (Cloern 2001).These changes includes land use, habitats, biogeochemical process as well as diversity of life. According to Nixon 1995 human disturbance has resulted from activities that mobilize the nutrient elements nitrogen and phosphorus through land clearing, production and application of fertilizer, combustion of fossil fuel and discharge of human wastes. Human activities have increased N flux to coastal rivers of the north-eastern United States 5 to 14 times above natural rate’s and Phosphorus loading to estuarine system has increased 2 to 6 folds since 1900 (Ja’Yorski et al.

1997).Nitrogen and phosphorus are core nutrient element for primary production and phosphorus is considered primary limiting element in fresh water and Nitrogen is considered for marine environment as well Human involvement by mass agriculture practice, using fertilizer, municipal wastes, industrial discharge and atmospheric precipitation causes eutrophication in Baltic sea, Gulf of Bothnia, Atlantic and Pacific coast. "Approximately 20% of the world's human population live within 30 km of the sea and nearly double that number live within the nearest 100km of the coast"(Cohen et al 1997).According to American Pew centre report on Coastal and Marine Ecosystems, 600milion people will occupy coastal floodplain land below the 1000 year flood level by 2100.So an increase introduction of population to the coastal area will ultimately increase the nutrients load the aquatic system. But subsequent effect of eutrophication is harmful for fish populations as well as human beings. Consequence of phytoplankton bloom is high level of toxicity that severely damage the water quality, infected the fish population and hindrance of their growth, production and other biological activities. Peoples are mostly depend on fish protein world wide and large number of fishes are exploited either from coastal or deep sea areas. But consumption of infected fish caused the human health problem. It is estimated that 300 human fatalities each year caused by consumption of shellfish contaminated with algal derived toxins (Halle graeff 1993).More over drinking of contaminated coastal water has other link to the human health concern. A dramatic epidemic of cholera type disease spread rapidly in 1992 from the port city of Madras to nOlihern cities of India and all of Bangladesh, affecting thousands of people and causing many deaths on the Indian continent (Colwell 1996).

Some other cause of water pollution:

Radioactive substances, petroleum and heat are the three other causes of water pollution. Oil spills are the major cause of water pollution, off shore drilling and operations, super tanker accident, handling loss makes the great input of oil in water bodies. It is estimated that one ton of oil is spilled for every million tons of oil transported that is equal to about 0.0001 percent (Kifferstein et al). Radioactive substances that are mostly derived

from nuclear power plant, submarine, under ocean atomic testing, industrial, medical and scientific usages of radioactive. materials. Uranium and Thorium mining and refining for atomic power plant contribute the additional wastes to the water body. The last form of water pollution is heat, increase or decrease of temperature causes the death of aquatic organisms. Because some industries they discharges cooling water or hot water into the water body as effluent that is not lvourable for organisms and the death or decomposition of biota spoil the water quality.

Conclusion:

Clean and plentiful water is inevitable for all living beings in the earth. Growing trend of water pollution is still alarming mostly for human induced activities and water itself characteristics. It is well established and widely recognised fact that nature does not respect man-made political borders. Water which is polluted in one continent of the earth certainly moved around the world, because there are three hundreds rivers that crosses transboundary, easily transport the pollutant and largely admix into the world ocean. Projected human population in 2050 would be approximately 9 billion, mcans thc world will be suffer additional three billion in coming days. Increase population is one of the major driving force of water pollution. Hopefully developing countries are now trying to control their population growth and environmental safety measures. Industrial development and agricultural advancement is two other driving force for water pollution. But establishment of treatment plant, improvement of urban waste management and transferring the CDM (Clean development mechanism) to the developing countries under the Kyoto protocol will be helpful to abate the water pollution. Climate change is one of the most triggering factor for global water pollution but if the 'annex one countries' reduce their green house gas emission 5.2% below their 1990 level over the 2008 to 2012 period than their would be a better climate we expect. Going trend on marine pollution is quite alarming, but safer seas for safer earth. More over for pollution free world we need international commitment, bilateral agreement, mutual trust as well as global environmental awareness.

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