so taking ...

cities.

GROUND WATER POLLUTION

Over 98% of the fresh water in the earth lies below the surface. The remaining 2% is what we see in lakes, rivers, streams and reservoirs. Of the fresh water below about 90% satisfies the description of ground water, that is water that occurs in saturated materials below the water table. About 2% water occurs as soil moisture in the unsaturated zone above the water table and is essential for plant growth.

Ground water acts as a reservoir by virtue of Large pore space in earth materials, as a conduit which can transport water over long distances and as a mechanical filter that improves water quality by removing suspended solids and bacterial contamination. It is the source of water for wells and springs that is the recommended source of rural domestic use. It is replenished by precipitation through rain, snow, sleet and hail.

Today, Human activities are constantly adding industrial, domestic and agricultural wastes to ground water reservoirs at an alarming rate. Ground water contamination is generally irreversible i.e. once it is contaminated; it is difficult to restore the original water quality of the aquifer. Excessive mineralization of ground water degrades water quality producing an objectionable taste, Odour and excessive hardness. Although the soil mantle through which water passes acts as an adsorbent retaining a large part of colloidal and soluble ions with its cation exchange capacity, but ground water is not completely free from the menace of chronic pollution.

India has a good industrial infrastructure in core industries like metals, chemicals, fertilizers, drugs and petroleum, industries like plastics, pesticides, detergents, fuels, solvents, paints, dyes and food additives, released effluents and emissions, polluting soil water-plant ecosystem. The disposal of solid and liquid wastes containing heavy metals like lead, nickel, chromium, molybdenum and mercury in land or water bodies, leads to heavy metal contamination of the soil-water-plant-animal ecosystems.

FACTORS AFFECTING GROUND WATER POLLUTION

1. Rainfall Pattern
2. Depth of water table
3. Distance from the source of contamination
4. Soil properties such as Texture, structure and filtration rate

SOURCES OF CONTAMINATION IN GROUND WATER

1. Domestic Wastes
2. Industrial wastes

3. Agricultural wastes
4. Run off from urban areas
5. Soluble effluents

1. Domestic wastes

Domestic wastes and methods of their disposal are of primary concern in urban are factors responsible for deteriorating the water quality include pathogenic organisms, o mand, nutrients and solids from domestic wastes. Solid wastes are the potential source of nation as they are partly burned and partly incorporated into the soil and pose serious the ground water.

2. Industrial wastes

Most industries generally produce wastes containing toxic heavy metals along wit ous organic and inorganic effluents. These chemicals contaminate with the ground wa severely pollute it.

Over 500 factories in North Delhi are severely polluting the ground water, which is domestic purposes. The steel re-rolling mills and pickling factories are dumping heavy me acids into open cesspools or drains, and from here these pollutants permeate into the wate The worst affected are the people which work in these factories or live around them, whom depend on hand pumps for potable water.

3. Agricultural wastes

Fertilizers, pesticides, insecticides, herbicides, processing wastes and animal wastes constantly added to the water. Leachates from agricultural land containing nitrates, phospha potash, move downward with percolating water and join the aquifers below posing danger ground water. So a harmless activity such as farming could lead to something as insid nitrate pollution. Nitrate causes eutrophication of the rivers also although in India phosp more blamed for this as phyxiation of water bodies.

Recent researchers showed that all pesticides were found in higher concentrations in water compared to surface water. The report explains that the high pesticide residue conce in ground water might be because ground water flows non-turbulently and experiences dilutions as compared to surface water and also due to higher stability of organochlorin cides residue concentration in ground water. The soil becomes a reservoir for these pe thereby steadily transferring them to ground water. This is a dangerous condition and prevented because, people depend on groundwater more than sources particularly rural because they believe it to be safer than surface water.

4. RUNOFF FROM URBAN AREAS

1. Effluents from urban areas contain large concentration of oils, greases, nutrients metals and detergents. The detergents being soluble can pass through the soil and ground water.
2. Raw sewage dumped in shallow soak pits and seepage from polluted lake, pond or also pollutes water.
3. Rainfall could pick up substantial contaminants from dust and air and join the below. The infiltration of liquids containing toxic pollutants may cause pollut sandy soils and well waters.
4. Clearing of forests, which increase surface runoff and reduce groundwater has wors situation.

5. SOLUBLE EFFLUENTS

1. Several soluble effluents pollute the ground water critically. The extent of pollution is more in sandy soils and humid regions having high water table conditions.
2. Agriculture takes about 70% of the water withdrawals, often rising to 90% in dry tropics. High yielding crop varieties require a lot of water. Now water withdrawals are so high that water bodies such as rivers and lakes have shrunk in size.
3. A direct impact of this has been on the levels of ground water. Increasing use of ground-water has pushed the water table lower.
4. Along the coasts, increasing ground water withdrawals have led to the ingress of saline water into groufft water.
5. Pollution is another major factor that is reducing water quality and thereby the availability of clean water.
6. The amounts and types of wastes discharged have outstripped nature's ability to break-down pollutants into less harmful elements.
7. In the case of Yamuna river in India, over extraction of fresh water had denied the river of the minimum flow it requires to actually cleanse itself.

Other potential sources of Groundwater Contamination

1. Waste water Treatment Lagoons
2. Mine Spills
3. Seepage pits
4. Urban and Rural garbage
5. Earthen septic tanks
6. Refuse Dumps
7. Leaching and Downward movement of pollutants

HARMFUL EFFECTS OF GROUND WATER POLLUTION

Ground water pollution causes irreparable damage to soil, plants and animals including man.

HARMFUL EFFECTS ON MAN

(i) Polluted ground water is the major cause for the spread of epidemics and chronic diseases in man. It causes typhoid, jaundice, dysentery, diarrhoea, tuberculosis and hepatitis.

(ii) Water contaminated by fibers i.e. asbestos causes fatal diseases like asbestosis and lung cancer.

(iii) Groundwaters in excessive rainfall areas contain iron in toxic amounts as 20 ppm. In deep tube wells, iron exists as ferrous ion which on taking out rapidly changes to light yellow orange colour due to oxidation and precipitation as ferric hydroxide. Such waters are extremely harmful for drinking purposes as permissible limits of iron is only 0.3ppm.

(iv) In Punjab-Ludhiana, Amritsar, Haryana-Sonepat, Ambala the woolen industries contribute large amounts of toxic metals such as Hg, Ni, Cu, Cr, Fe and cyanides to groundwater causing skin and stomach diseases in human.

(v) High fluoride content more than 0.5-1.5 ppm leads to mottling of teeth, deformation of bones and joint pain incapacitating people for almost all productive activities.

(vi) Rising nitrate levels in groundwater has adverse effects on humans and animals. "Methaemoglobinaemia" or "Blue baby disease" is caused by the reaction of nitrate with

haemoglobin, the oxygen carriers in the blood, producing methaemoglo strangles the oxygen carrying capacity of the tissue.

HARMFUL EFFECTS ON SOIL

(i) The use of polluted groundwater for irrigating agricultural fields severely dam and decreases grain production.

(ii) Polluted water acutely affects soil fertility by killing bacteria and soil micro-

(iii) Contaminated groundwater increases alkanity in the soils.

(iv) Groundwater pollution affects plant metabolism severely and disturbs the whol tem.

PROTECTING GROUNDWATER FROM POLLUTION

(i) The contaminant sources should be carefully surveyed

(ii) Location of industrial and municipal disposal sites should be decided keeping the groundwater levels and flow pattern in the area.

(iii) In case of toxic industrial effluents, steps should be taken for predisposal treat the industry itself.

(iv) Location of wells for drinking water supplies should be decided with utmost ca

(v) Surrounding contaminant's sources and flow direction should be considered.

(vi) It is not advisable to tap the uppermost aquifer in case of drinking water well

RECHARGING AQUIFERS WITH TREATED WASTE WATER BY PERCOLATION

Recycled wastewater is no longer the anathema it used to be. Several countries have using recycled wastewater for crop irrigation and landscape gardening. Now researchers are ing the possibility of using treated sewage water for both drinking and replenishing fast dep aquifers- a water bearing layer of the permeable rock to satisfy the needs of the ever-expa towns and cities.

There are two ways to replenish the aquifers with treated wastewater.

1. Soil infiltration system
2. Direct infecting of wastewater

1. Soil infiltration system-_It involves spreading the chemically treated sewage water ground surface and then allowing it to percolate down. The soil can strip the rem viruses from the treated wastewater as the water infiltrates an aquifer but virus re depends on virus type and environmental conditions. The soil infiltration system re total organic carbon by as much as 90% and 50% of all nitrogen in the water. It ca remove parasites that tend to be resistant to the chemical disinfectants.

2. Direct infecting of wastewater- It involves the direct injection of the treated waste into the aquifer.

So with depleting aquifers, recharge may be the only economically feasible option left. of artificial recharge are variable, but reclaimed water can be less expensive th