International Conference on Environment Audit-
Concerns about Water Pollution

Contamination of Ground Water Resources

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Central Ground Water Board

Central Ground Water Board

- National Apex Organization to provide scientific inputs for GW development and management in the country.
- Multidisciplinary scientific organization consisting of Hydrogeologists, Geophysicists, Chemists, Hydrologists, Hydrometeorologists and Engineers.

Central Ground Water Board

- Subordinate office of the Ministry of Water Resources, Government of India
- Headed by Chairman with four "Members" looking after
  - Survey, Assessment & Monitoring
  - Sustainable Management & Liaison
  - Exploratory Drilling & Material Management
  - Training & Technology Transfer
- 18 Regional Offices throughout the country

Major Activities of CGWB

- Ground Water Exploration.
- Ground Water Regime Monitoring.
- Ground Water Management Studies.
- Demonstrative Artificial Recharge to Ground Water.
- Estimation of Ground Water Resources.
- Ground Water Quality Studies .
- Awareness Creation & Capacity Building.
- Regulation of Ground Water Development.
- Publication of Reports & Maps.

Ground Water Scenario

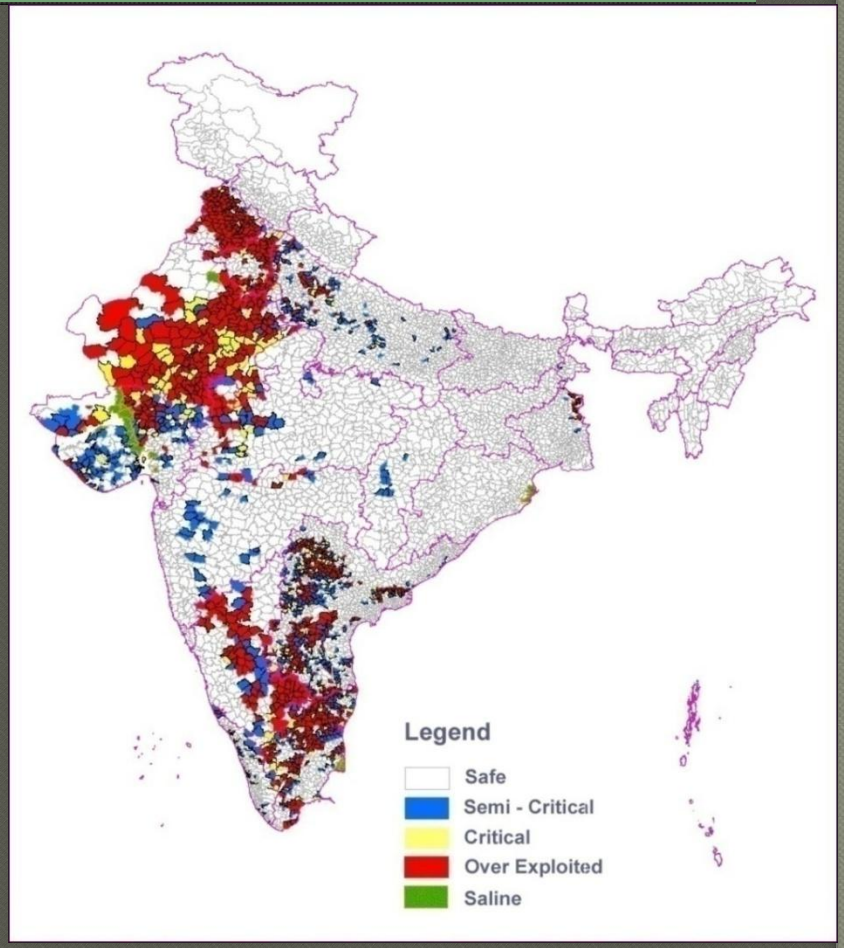
- Replenishable resources , stored in the zone of water level fluctuation, is the major source of GW for various uses.
- As per the latest assessment,
  - the annual replenishable GW resource in this zone - 433 bcm
  - Utilizable GW resources - 399 bcm
- GW extraction for various uses - 231 bcm
- Stage of GW Development - 58%

Ground Water Scenario

- Assessment of dynamic ground water resources carried out with block/taluka/watershed as the unit.
- Assessment units categorized based on the stage of ground water development and long term declining trend of ground water levels.
- Out of the total of 5723 assessment units –
  - 839 units (15%) are 'Over-exploited',
  - 226 units (4%) are 'Critical',
  - 550 units (10%) are 'Semi-critical'
  - 4078 units (71%) as 'Safe'
  - 30 units excluded due to the ground water being completely saline

Ground Water Scenario

- GW exploitation is highly uneven and shows considerable variations from place to place.
- GW development is high (>100%) in the states of Delhi, Haryana, Punjab and Rajasthan and UT of Daman & Diu and Pondicherry.
  - Implies that in these areas the average annual gw withdrawal is more than average annual gw recharge.
- In the states of Gujarat, Karnataka, Tamil Nadu and Uttar Pradesh the average stage of gw development is 70% and above.
- In rest of the states / UTs the stage of ground water development is below 70%.



Ground Water Quality - Monitoring / Studies

- Water Quality monitoring (inorganic parameters) through a network of ~15600 ground water observation wells.
- Samples collected once a year (April /May) and analysed in Regional Chemical Laboratories of the Board.
- Geogenic Quality aspects of ground water studied as part of ground water management studies and exploratory drilling programme.
- Special studies in select areas of anthropogenic ground water contamination.

Ground Water Contamination

- Two Types
  - Geogenic : Caused by naturally occurring contaminants (Eg. Fluoride, Arsenic, Iron, Inland salinity)
  - Anthropogenic : Caused by human activities (Eg. Nitrate, Heavy metals, pesticides, pathogens, Salinity due to waterlogging, sea water ingress etc)

Ground Water Contamination

- Many groundwater quality problems are caused by contamination, over-exploitation, or combination of the two.
- Almost all activities carried out on land have the potential to contaminate the groundwater, whether associated with urban, industrial or agricultural activities.
- Large scale concentrated sources of pollution such as industrial discharges, landfills & subsurface injection of chemicals & hazardous wastes are an obvious source of groundwater pollution.
- These concentrated sources can be easily detected & regulated
- but the more difficult problem is associated with diffused sources of pollution like leaching of agrochemicals & animal wastes, subsurface discharges from latrines & septic tanks & infiltration of polluted urban run-off & sewage where sewerage does not exists or is defunct.
- Diffused sources can affect the entire aquifer, which is difficult to control & treat.
- Once pollution has entered the sub-surface environment, it may remain concealed for many years, becoming dispersed over wide areas & rendering groundwater supplies unsuitable for human uses.

Geogenic Contamination of Ground Water in India

- **Salinity**
  - Normally of two types i) Coastal salinity due to sea water ingress in coastal areas and ii) Inland salinity due to processes other than the sea water ingress.
  - Both inherent salinity resulting from the presence of salinity in aquifer systems due to the environment of deposition as well as from saline water ingress due over-exploitation of ground water from coastal aquifer systems in hydraulic connection with the sea has been reported.
  - In certain areas problem of up-coning of saline water due to overexploitation of ground water has also been reported.
  - Problem of salinity ingress has been noticed in Minjur area of Tamil Nadu, Mangrol – Chorwad- Porbander belt along the Saurashtra coast, Subarnrekha, Salandi, Brahamani out fall regions In Orissa ,and Pondicherry region east of Neyveli Lignite Mines.
  - Inland Ground water salinity occurs mainly in the states of Maharashtra, Punjab, Rajasthan, Haryana, Gujarat, Karnataka, Uttar Pradesh, Delhi, Orissa and Bihar.
  - The occurrence of inland salinity may be due to over development of ground water, use of surface water and ground water in complete isolation, characteristics of aquifer or some other reasons.

Geogenic Contamination of Ground Water in India

- Fluoride
  - High concentration of Fluoride in ground water beyond the permissible limit of 1.5 mg/L is a major health problem in India.
  - There are several locations in the States of Andhra Pradesh, Gujarat, Karnataka, Madhya Pradesh, Rajasthan, Chattisgarh, Haryana, Orissa, Punjab, Haryana, Uttar Pradesh West Bengal, Bihar, Delhi, Jharkahnd, Maharashtra, and Assam where the fluoride in ground water exceeds 1.5 mg/l.
  - The distribution of fluoride shows considerable spatial variation.
  - A large number of people, especially in rural habitations, is threatened with serious health hazards of Fluorosis.

Geogenic Contamination of Ground Water in India

- **Arsenic**
  - The occurrence of Arsenic in ground water was first reported in 1980 in West Bengal in India.
  - In West Bengal, 79 blocks in 8 districts have Arsenic beyond the permissible limit of 0.05 mg/l.
  - The most affected areas are on the eastern side of Bhagirathi river in the districts of Malda, Murshidabad, Nadia, North 24 Parganas and South 24 Parganas and western side of the districts of Howrah, Hugli and Bardhman.
  - The occurrence of Arsenic in ground water is mainly in the aquifers up to 100 m depth. The deeper aquifers are free from Arsenic contamination.
  - Arsenic contamination in ground water also found in the states of Bihar, Uttar Pradesh, Assam & Chhattisgarh.
  - The occurrence of Arsenic in the states of Bihar, West Bengal and Uttar Pradesh is in alluvial formations but in the state of Chhattisgarh, it is in the volcanic rocks.
  - It has also been reported in Dhemaji district of Assam

Geogenic Contamination of Ground Water in India

- **Iron**
  - High concentration of Iron in ground water has been observed in more than 1.1 lakh habitations in the country.
  - Highly contaminated areas are in Assam, West Bengal, Orissa, Chhattisgarh, and Karnataka. Localized pockets are observed in state of NE, Bihar, UP, Punjab, Rajasthan, Maharashtra, Madhya Pradesh, Jharkhand, Tamil Nadu and Kerala.

Anthropogenic Contamination of Ground Water in India

- **Nitrate**
  - Nitrate is a common constituent present in the ground water especially in shallow aquifers.
  - The source is mainly from man made activities. The disposal of urban waste and landfills are among the major causes of nitrate pollution in ground water.
  - Urban as well as rural areas of several states are affected by high concentration of Nitrate.

Anthropogenic Contamination of Ground Water in India

- **Heavy Metals**
  - Haphazard disposal of industrial effluents is one of the major reasons for ground water pollution due to heavy metals.
  - Ground water pollution by heavy metals such as Chromium, Lead, Nickel etc. in ground water reported from various parts of the country mainly due to unplanned disposal of industrial effluents.

Critical Issues

- **Urban Wastes**
  - About 33,000 million liters per day (MLD) of domestic wastewater is generated from class I cities and class II towns (CPCB)
  - Available treatment capacity only for 7,000 MLD.
  - Industrial sector generates about 15,468 MLD of wastewater, out of which only about 10,000 MLD receives treatment.
  - Big gap in wastewater generation and treatment.
  - With the increasing urbanization and industrial growth, the gap is expected to be gradually widened.

Critical Issues

- **Arsenic & Fluoride Pollution**
  - Arsenic & Fluoride pollution constitutes the most serious threats as far as geogenic contaminants are concerned.
  - As these are geogenic, their presence in groundwater in certain areas cannot be prevented.
  - With increasing dependence on ground water for meeting drinking and domestic uses, more and more people are likely to be affected.

Critical Issues

- **Industrial Pollution**
  - Several industries contribute significantly to GW pollution
  - Major ones include Fertilizers, Chemicals, Pharmaceuticals, Dyes, Paper Mills, Refineries, Petrochemicals, Electroplating, Organic Chemicals, Tanning, Textiles etc.
  - Pollution due to trace metals, organic compounds, Pesticide residues etc.
  - GW in Several industrial areas severely polluted. Ankaleshwar (Gujarat), Bhadravathi (karnakata), Howrah (W.Bengal), Manali (Tamil Nadu) and Visakhapatnam (AP) are a few examples.

Interventions

- **Geogenic Contamination**
  - Water supply from contaminant-free sources
  - Design of tube wells to tap contaminant free zones
    - CGWB has developed the technique for isolating Arsenic-free aquifer zones for water supply through cement sealing in W.Bengal and Bihar.
  - Treatment of water before supply (Domestic / Community level)
  - Artificial recharge to ground water for quality remediation through dilution in suitable areas.
  - Development of cost-effective technologies for treatment.

Interventions

- **Anthropogenic Contamination**
  - Strengthening of institutional framework for monitoring & regulating pollution.
  - Recycling of water to reduce industrial effluents
  - Effluent treatment plants for treating liquid wastes in industrial areas
  - Safe disposal of solid wastes
  - Development of eco-friendly processes for industries through collaborative R & D efforts between academic institutions and industrial houses.
  - Regular monitoring of surface and ground water quality

Interventions

- **Others**
  - Creation of awareness among public on the importance of protection of water supplies from contamination.
  - R &D studies on water quality remediation
  - Strengthening of legal framework for water quality monitoring & Protection.

Thanks