TSUNAMI DISASTER AND GROUNDWATER RESOURCES: THE SOUTHEASTERN COAST OF INDIA

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On December 26, 2004, Tsunami waves struck the coast of the Indian subcontinent, resulting in 229,886 causalities. The event has alarmed water resources experts, planners, and managers. The need for finding solutions for emergency situations has become apparent. Specifically, the focus is on identifying closed aquifers that can be utilized during such emergencies.
Assessment of the Southeastern coast of India was carried out in March 2005
- To document the effects of Tsunami on the coastal groundwater resources.
- To evaluate solutions to deal with similar situations in future
Cuddalore, Portnova, Nagappattinam, and Kolachal were studied (representative spots on the southern cost of India)
Tsunami Affected Coast
Ground water sample location of the study area.
Available information are scanty and the information on groundwater resources is not properly documented

- No or improperly archived historical record on peizometry and hydrogeological information

Local people’s account was taken as a base to move forward.

GIS based analysis was carried out.
Observations

- Damaged many open wells and has contaminated the shallow groundwater through infiltration and percolation.
- Quality and quantity variations in groundwater was observed.
- Changes to the coastal land use was observed.
  - Impact on the landforms, dimensions of the sea beaches, and more importantly on the subsurface strata.
Inland intrusion
A thick sediment layer was deposited on the soil surface,

This has changed the soil porosity, infiltration characteristics and hydraulic conductivity.

It is likely that the hydrological cycle in the area has been altered as groundwater recharge and subsurface discharge both are affected.
Debris
Observations

- Debris deposited on the soil surface has provided a favorable situation for percolation of contaminants.
  - TDS, chloride and EC all has remarkably increased.
  - Before Tsunami the abundance of ions was HCO₃ > Cl > SO₄= Na+K≥ Ca>Mg.
  - After tsunami it was Cl>SO₄≥HCO₃= Na+K>Ca>Mg.
Chloride/Bicarbonate ratio (April)
Spatial variation of TDS (April)
Lessons Learned

- Impact of tsunami is very pronounced in the coastal aquifers
- Reverse hydraulic gradient has resulted seawater intrusion, and significant time will be required for natural flushing.
  - Outflow to the sea has to be modeled and quantified.
  - Further investigation of groundwater flow pattern & velocity is needed.
  - Hydraulic head at every grid in coastal belt needs to be determined.
  - Apply available flow & saltwater intrusion model to understand saltwater-freshwater interface
Lessons Learned

- There is a need to establish proper geochemical characteristics of the tsunami affected region and evaluate long-term impacts on the groundwater quality.
  - Further monitoring fluxes of nitrate, fluoride and other chemicals is needed which might get remobilized because of their sensitivity to the changes in salinity.
  - Planned groundwater quality monitoring program in coastal belt in alluvium as well as upper tertiary aquifers is needed.
- Continuous pumping may restore some of the wells in coastal belt.
  - There is need to document such findings and to develop appropriate policy guidelines.
Lessons Learned

- Since groundwater plays crucial role in drinking water supply and tube well irrigation, it is essential to provide an especial provision for groundwater that can be used for emergency situations;
- Estimation of groundwater resources in coastal belt & its temporal variation is required to draft a risk reduction strategy.
Lessons Learned

- It calls for developing an appropriate risk reduction strategy to identify fresh groundwater resources in such vulnerable areas
  - Involve characterization of the safe aquifers,
  - development of guidelines for community well installation,
  - providing awareness to the villagers, and
  - strategic measures for quick rehabilitation of the wells.

- Evaluation of other options are equally needed
  - Options such as rainwater harvesting in depletion/augmentation of groundwater level
Thank you

IN FOCUS

October 20-25: World Population Awareness Week 2003 focuses on water
This year, World Population Awareness Week (WPAW), initiated by the Population Institute in 1985 and observed October 20 to 25, focuses on water scarcity. The theme, "Water: the 21st Century Crisis", reminds us that over the next 20 years, the world’s population will increase from 6 billion to around 7.2 billion, with increasing competition for available water resources. By 2025, it is estimated that some 30 percent of the world's population in 50 countries will suffer from water scarcity.

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