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Ground Water Status, Pollution and Maintenance in District Dhanbad, Jharkhand

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*Abstract***— Groundwater contamination with heavy metals released from mining activities is a worldwide environmental problem. The leachate generated from mine waste Overburden dumps may have the potential to pollute the surrounding water resources. It comprises overburden, run-of-mine rock as well as discard, slurry and tailings from the preparation/ beneficiation or extraction plants assessment of heavy metals contamination in soils using data on the total content of the individual heavy metals. In the process of mining huge amounts of water discharged on surface to facilitate the mining operation. In this review paper the maintenance of ground water is suggested.**

*Index Terms***— Coal mining, district Dhanbad, Ground water Pollution and Maintenance.**

I. INTRODUCTION

Groundwater contamination caused by human activities usually falls into one of two categories: point-source pollution and non point-source pollution. Fertilizers and pesticides applied to crops eventually may reach underlying aquifers, particularly if the aquifer is shallow and not "protected" by an overlying layer of low permeability material, such as clay. Drinking-water wells located close to cropland sometimes are contaminated by these agricultural chemicals.

Mining wastes include waste generated during the extraction, beneficiation, and processing of minerals. Extraction is the first phase of hard rock mining which consists of the initial removal of ore from the earth. Beneficiation is the initial attempt at liberating and concentrating the valuable mineral from the extracted ore. This is typically performed by employing various crushing, grinding and froth flotation techniques. Mineral processing operations generally follow beneficiation and include techniques. Coal mines are another major source of contaminants. When pyrite rocks associated with coal mining are exposed to oxygen they are oxidized to generate acid mine drainage. The waste then flows into streams and infiltrates into aquifers (Shiv and Nikhil, 2016). A complex series of chemical weathering reactions are spontaneously initiated when surface mining activities expose spoil materials to an oxidizing environment. The reactions are analogous to "geologic weathering" which takes place over extended periods of time (i.e., hundreds to thousands of years) but the rates of reaction are orders of magnitude greater than in "natural" weathering systems (Mark, 2005; Alley, et. Al., 2003 and Harman).

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II. GROUND WATER STATUS

Groundwater occurs in the area under unconfined condition in the weathered zones at shallow depths in most of the litho units in the Achaeans and almost all the litho units in the Gondwanas. Groundwater occurs under confined to semi-confined condition where the fractures are deep seated and are unconnected with the top weathered zone. The aquifer geometry for shallow and deeper aquifer has been established through hydro geological studies, exploration, the surface and subsurface geophysical studies in the district covering all geological formations. The shallow aquifers are being taped through dug wells, dug cum bore wells or shallow bore wells drilled to the depth of 60 m. The weathered mantle and shallow fractures constitute the shallow aquifers. The thickness of weathered mantle varies from 5 to 25 mbgl. The well inventory data suggest that the maximum depth of dug well in granite gneiss and Gondwana is 17 m and 25 m respectively. Exploration in granite gneiss indicates that shallow fractures are less productive. Many dug wells and hand pumps get dried up during summer. The depths to water level map of dug wells show water level between 1.29-14.60 mbgl. Topchanchi, Govindpur, Jharia, Katras, Nirsa areas show water level between 8-10 mbgl While Tundi, Rajganj have water level between 6-8 mbgl. Katras areas have deepest water level (14.60mbgl). During this period maximum area (Govindpur, Nirsa, Rajganj, Topchanchi, Tundi) have water level between 2.10-3.50 mbgl. And small patches of Mahuda,Sindri Dhanbad, Katras and Topchanchi area have 4-6 mbgl water level (Singh, 2013).

III. GROUND WATER POLLUTION

Groundwater contamination with heavy metals released from mining activities is a worldwide environmental problem. The leachate generated from mine waste Overburden dumps may have the potential to pollute the surrounding water resources. This study conducted to evaluate the heavy metal concentrations in the groundwater of coal mining area. Groundwater samples analyzed based on their heavy metal concentrations such as Co, Cu, Ni, Fe, Mn, Zn and Pb. Subsequently, statistical methods employed to identify the controlling factors affecting the heavy metal constituents of the groundwater. Finally, the results were compared with the Drinking Water Quality Standard of the World Health Organization (WHO), India Standard for Drinking Water Specification (IS: 10500) and United States Environmental Protection Act (USEPA) (Chandra and Jain 2013).

Dhanbad, a major coal mining area of India for more than a century, is situated in the middle of the Damodar river basin. The geology varies in age from Archean to Recent and includes schists, granites, pegmatite, feldspathic gneisses with associated bands of quartzites and amphibolites. In the study area, the occurrence and movement of groundwater is restricted to semi-weathered/weathered and fractured rocks.

The thickness, size, extent and openness of the weathered zone and the interconnections of fractures govern the groundwater movement in the Dhanbad area of Jharkhand (Singh et al. 2007). The resistivity of the water-bearing weathered/fractured rocks varies from 120 to 150 ohm; the depth to ground water generally ranges from 2 to 10 m below ground level.
Urbanisation and the unregulated growth of the population of the Dhanbad district have altered the terrain and slope morphology of the area. As a consequence, changes have taken place in the surface drainage system which indirectly affects the hydrogeology while the water infiltration ratio has resulted in a lowering of the groundwater. Inadequate environmental protection measures in the coal mining and related industries as well as the presence of active and abandoned coal mines, waste dumps, coal washeries, coking coal plants, thermal power plants, refractories, steel, fertilizer and cement plants have resulted in significant water pollution (Chatterjee, et.al., 2010).

IV. MAINTENANCE OF GROUND WATER

Groundwater typically becomes polluted when rainfall soaks into the ground, comes in contact with buried waste or other sources of contamination, picks up chemicals, and carries them into groundwater. Sometimes the volume of a spill or leak is large enough that the chemical itself can reach groundwater without the help of infiltrating water. Groundwater tends to move very slowly and with little turbulence, dilution, or mixing. Therefore, once contaminants reach groundwater, they tend to form a concentrated plume that flows along with groundwater.
Despite the slow movement of contamination through an aquifer, groundwater pollution often goes undetected for years, and as a result can spread over a large area (Boulding, 1995 and Mordechai, 1985).
The most protective, lowest cost, and most feasible cleanup alternative is chosen as the preferred cleanup method. The selected cleanup method is designed and constructed during the remedial design/remedial action phase. The operations and maintenance phase then follows. Periodically the remedial action is evaluated to see if it is meeting expectations outlined in the record of decision (Boulding, 1995 and Mordechai, 1985).
The various ways to respond to site contamination can be grouped into the following categories:

- Containing the contaminants to prevent them from migrating from their source
- Removing the contaminants from the aquifer
- Remediating the aquifer by either immobilizing or detoxifying the contaminants while they are still in the aquifer
- Treating the groundwater at its point of use
- Abandoning the use of the aquifer and finding an alternative source of water.

Several ways are available to contain groundwater contamination: physically, by using an underground barrier of clay, cement, or steel; hydraulically, by pumping wells to keep contaminants from moving past the wells; or chemically, by using a reactive substance to either immobilize or detoxify the contaminant (Arun, et.al., 2012).
When buried in an aquifer, zero-valent iron (iron filings) can be used to turn chlorinated solvents into harmless CO_2 and water (Boulding, 1995 and Mordechai, 1985).

The most common way of removing a full range of contaminants (including metals, volatile organic chemicals, and pesticides) from an aquifer is by capturing the pollution with groundwater extraction wells. After it has been removed from the aquifer, the contaminated water is treated above ground, and the resulting clean water is discharged back into the ground or to a river. Another way of removing volatile chemicals from groundwater is by using a process known as air sparging. Small-diameter wells are used to pump air into the aquifer. As the air moves through the aquifer, it evaporates the volatile chemicals. The contaminated air that rises to the top of the aquifer is then collected using vapour extraction wells (Boulding, 1995 and Mordechai, 1985). *Bioremediation* is a treatment process that uses naturally occurring microorganisms to break down some forms of contamination into less toxic or non-toxic substances. By adding nutrients or oxygen, this process can be enhanced and used to effectively clean up a contaminated aquifer. Because bioremediation relies mostly on nature, involves minimal construction or disturbance, and is comparatively inexpensive, it is becoming an increasingly popular cleanup option ((Arun, et.al., 2012).
Some of the newest cleanup technologies use surfactants (similar to dishwashing detergent), oxidizing solutions, steam, or hot water to remove contaminants from aquifers. These technologies have been researched for a number of years, and are just now coming into widespread use. These and other innovative technologies are most often used to increase the effectiveness of a pump and treat cleanup (Harman, Fernando, 2005 and Abida, 2007).
Depending on the complexity of the aquifer and the types of contamination, some groundwater cannot be restored to a safe drinking quality. Under these circumstances, the only way to regain use of the aquifer is to treat the water at its point of use. For large water providers, this may mean installing costly treatment units consisting of special filters or evaporative towers called air strippers. Domestic well owners may need to install an expensive whole-house carbon filter or a reverse osmosis filter, depending on the type of contaminant (Wiedemeier, 1999 and Boulding, 1995).

V. CONCLUSION

Present review discuss the ground water status, ground water pollution and maintenance of ground water in district Dhanbad where coal mining areas is dominant features.

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