Groundwater and cement industry – the Indian experience

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Abstract: Pumping water from the limestone mines of any cement Factory may cause concern in the local population about the sustainability of their private wells. At the same time, the factory being a source of employment with good wages, the villagers want the factory to operate successfully.
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Introduction

Cement industry differs from many other major industries in that it is not only a consumer of water but also a producer of water in many cases. This is because water has to be pumped out from the open cast limestone mines, located not far from the Cement Factory, when the mines reach below the water table. In the initial stage, water required for site development, construction of cement plant and colony and for cement production is usually obtained from bore wells or dug wells, if a reliable source of surface water is not available. This causes depletion in local water table in and around the factory site. However, after a few years, when some portions of the limestone mining pits go below the water table, the water pumped from the mines could be brought to the factory site in a pipeline and the pumping from local bores/wells be reduced to a great extent. Till such a stage is reached, the cement industry is in competition with neighboring farmers and villagers who have already been using ground water for domestic use and for irrigation of their small land holdings. This often leads to a strained relationship between the Factory and the local people. Pumping of ground water from the mines usually does not upset the farmers as the mines area is rocky and the land is not suitable for agriculture.

The national water policy in India gives domestic use or drinking water, the first priority of ground water use. Irrigational use gets the second priority and the industrial use is the third priority. Cement factory being a major source of employment for the local people, the people wish that the factory should work satisfactorily but at the same time should not cause an appreciable reduction in their irrigational or domestic water supply. Such a delicate situation needs careful planning and monitoring of ground water resource, on the part of the factory. This extended abstract discusses amicable solution to this practical problem at two sites in India, having the following hydro-geological setting:

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1. Low rainfall coastal area: Factory site has saline ground water. But the dug wells in neighboring village have ground water suitable for irrigation. Mines also, have good quality of ground water.
2. Medium rainfall inland area: Factory site and mining area have good quality of ground water. Irrigational development in neighboring villages is minimal. But dug wells go dry in summer season and the villagers face drinking water scarcity.

CASE A: LOW RAINFALL COASTAL AREA

This cement factory is located in low rainfall (only 350 mm of Monsoon rains per year, between July and September), coastal area in north-western India. The factory site is just a few meters above the high tide level. Ground water at the factory site is saline. The mining area is about 5 km to the north of the factory, on a rocky limestone plateau with elevations ranging between 15 m to 33 m above sea level. In between factory and mining area, a village with a population of about 2,000 people is located. The main occupation of the villagers is farming in the agricultural fields surrounding the village, at elevations between 6 to 15 m above sea level. Villagers have dug open wells in their fields. Most of the dug wells have been excavated up to the sea level, while some have reached up to a couple of meters below sea level. These dug wells support irrigation of small plots of 0.25 hectare or so in summer season (March – June). In winter season, the irrigated area is two to six times bigger.

When the Cement Factory started limestone quarrying the mining area, at a higher elevation than the village, the villagers were worried that:

A) Before the quarry pits reach the water table, the Factory would dig wells or drill bores in the mining area to meet the water requirement of the factory. This would reduce the availability of water in their irrigation wells and also invite ingress of saline water into the aquifer.
B) When the quarry pits reach the water table, the Factory would have to pump all the incoming water to go deeper, even below the sea level. This would further aggravate the above problems.

In order to keep good public relations, the factory made it clear to the farmers that they will not drill bores and wells in the mining area for supplying water to the factory. It was also decided that the mining pits would not go below sea level. However, when the pits go below the water table, water will have to be pumped out. In order to compensate for this pumping, the factory will resort to recharge augmentation activity in their vast mining lease area of several hundred hectares.

In the initial stage, when the mining pits were still above the water table, the factory made a deal with the farmers. The farmers would pump water from their dug wells and instead of using it for irrigating crops they would bring the water in tankers to the factory and get paid in cash on the same day. The farmers were happy with this arrangement and about 80 to 100 wells in the surrounding area were used for water supply to the factory, during the construction phase and the first couple of years. Now the factory is in full swing and has constructed a desalination plant of 4,000 Cu. M. per day capacity, working on hot exhaust gas from chimney, for converting seawater into potable water. Only a part of the water requirement is met with water pumped from those mining pits, which have gone below the water table.

Case B: High Rainfall Inland Area

In this area in the limestone basin of central India, the annual precipitation is about 1,500 mm, during the Monsoon months of June to September. This is a flat terrain and several villages are located in the vicinity of the Factory and the mining lease area nearby. The farmers take only one crop of Paddy during the Monsoons season. Irrigated crops are not grown after the Monsoon paddy crop is harvested. Ground water is thus used only for drinking purpose. Dug wells of about 12 m depth and bores of about 50 m depth are used for supplying drinking water to the villages.

The cement factory drilled about 35 bores of 60 to 80 m depth in the area for supplying water to the factory and workers colony. Additional supply was also obtained from an infiltration gallery on the bank of a river, about 15 kms away. If any bore or dug well supplying drinking water to a village became dry due to pumping of water from the factory bores, such a village was provided with drinking water supply from the factory's network. When the mines reached below water table, water had to be pumped out to keep the operation going. This water was not required by the factory and was discharged into a nearby stream. A small bund was constructed on the stream to store the water. Farmers having their farms in vicinity of the bund were encouraged to use this water for irrigation of fruit trees or of 'high value' winter and summer crops like vegetables. The factory developed its own 'fruit & vegetable' farm to serve as a nursery, a demonstration plot and a training center for the farmers.

Conclusion

Pumping water from the limestone mines of any cement Factory may cause concern in the local population about the sustainability of their private wells. At the same time, the factory being a source of employment with good wages, the villagers want the factory to operate successfully. In such situations, amicable solutions of the water problems can be achieved if the factory officials adopt a sympathetic, sensitive and socially conscious attitude.