Disaster looms large over Joshimath

The area around Kunwari Pass in Central Himalayas is the source of a number of streams that include Dhaknala, Karmanasa, Patalganga, Belakuchi and Garurganga. The first is the tributary of Dhauliganga whereas the rest drain into Alaknanda. These streams are known for the devastation they have caused in the past, due to the flash floods that followed blockade of these streams due to landslides.

The configuration of these streams exhibits distinct structural control, with Karmanasa and Dhaknala being associated with Munsyari and Vaikrita thrusts respectively. Munsyari Thrust brings the low to medium grade rocks of Munsiari Formation in juxtaposition with the Lesser Himalayan metasedimentaries. This contact can be observed around 900 m south of Helong[1]. Garnetiferous mica schist interbanded with quartzites and fairly thick tabular bodies of augen gneisses appears in the vicinity of the Munsyari Thrust. Further up in this section near Jharkul, a thick continuous band of white quartzite occurs within the gneisses and schists. This resembles the Berinag quartzite of the Lesser Himalayas. The presence of this quartzitic band within the Munsiari Formation is due to imbrication. The quartzite is overlain by highly deformed gneisses. The Munsiari Formation is essentially made up of garnet-bearing mica schists, deformed amphibolites, calc-silicate lenses, quartzites, mylonitic biotite rich fine-grained gneisses, augen gneisses and phyllonites. The grade of metamorphism increases towards the Vaikrita Thrust (MCT). Joshimath Formation comprising predominantly of gniesses and schists is thrust over the rocks of Munsiari Formation along the Vaikrita Thrust[2]. Hot springs are located at Tapovan in the Dhauliganga valley along this zone.

Joshimath is situated in the middle slopes of the hill bound by Karmanasa and Dhaknala on the west and the east respectively, together with Dhauliganga and Alaknanda on the other sides. Apart from Joshimath, a number of settlements are located in the lower and middle slopes that include Chami, Shelong, Khanoti Chatti, Animath, Vishnuprayag, Khan, Parsari, Ganeshpur, Sunil, Gaukah, Dadon, Regaon, Oucha, Auli, Kharori, Kuni, Paiyan, Khancha, Barhgaon, Paini, Vishnupuram, Marwari, Bilagarh, Mirag, Karchhigaon, Tugasi, Chamtoli and Jharkula Chatti. The total population of these habitations is around 18,000. The altitude varies between 1440 and 3797 m above sea level, and the upper reaches of the hill have gentle gradient and thick cover of old slide material. During winter, the upper reaches experience appreciable snow and the groundwater recharge due to the same is responsible for keeping the springs and streams around the area perennial.

Being situated in close proximity of major tectonic discontinuities, Joshimath has been showing signs of distress due to the burgeoning anthropogenic pressure. The area reportedly shows signs of continuous ground subsidence and the same has been recorded earlier[1,3,4]. The Mishra Commission[5] reported that Joshimath is situated on an old landslide zone and is sinking. The report recommended that heavy construction be banned in the area around Joshimath.

Despite being fully aware of the geological/environmental vulnerability of the area, a number of hydroelectric schemes have been sanctioned around Joshimath and Tapovan. The Vishnugad HE Project is one such scheme. The head race tunnel of the project traverses all through the geologically fragile area below Joshimath. It is interesting to note that a private company was preferred by National Thermal Power Corporation (NTPC) over the Geological Survey of India, for undertaking geological investigations related with the project. These investigations failed to take cognizance of the earlier geological investigations carried out in the area and did nothing to establish the depth of overburden all through the tunnel alignment.

A tunnel boring machine (TBM) was employed for excavating the head race tunnel. On 24 December 2009, it punctured a water-bearing strata some 3 km inward the left bank of Alaknanda near Shelong village. The site was more than a kilometer below the surface, somewhere below Auli, according to the project authorities. The water discharge was reportedly between 700 and 800 litres per second. The aquifer discharge was about 60–70 million litres daily, enough to sustain 2–3 million people. Even after a month, the aquifer had not dried out. What a waste of the scare resource!

Sudden outpouring of water from a aquifer will have multifarious impacts but it would be a little early to dwell upon full implications of the same. The water draining out through the tunnel would result in drying up of springs around. Habitations around Joshimath would face shortage of drinking water during the summer season. It is important to note that depletion in spring discharge and untimely drying up of a few springs have already been reported. This sudden and large scale dewatering of the strata has the potential of initiating ground subsidence in the region, thereby augmenting the problems of the masses living in the area. Reduced ground moisture regime would result in depleted biomass availability and crop produce that would adversely affect the life support strategy of the masses. It would also impact floral and faunal diversity.

Being the gateway to Badrinath and Hemkunt Sahib shrines, the population of Joshimath generally witnesses manifold increase, and the local administration would be hard pressed for making water available to the visitors as also the local residents.

It is too early to foresee the full long-term implications of this event but these are sure to be serious. This is a clear case of negligence on the part of the agency undertaking the exploration in this sensitive zone. It calls for stringent compliance of the preliminary investigations together with harsh punitive measures for the ones who fail to comply.

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4. Valdiya, K. S., *Aspects of Tectonics, Focus on South-Central Asia*, Tata McGraw-Hill, New Delhi, 1984, pp. 319.
5. Mishra Commission, 1964, Report of the Commission set up by the Government of India vide letter No. 142/23-5/44/76 dated 08.04.1976.

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