SAFETY OF DAMS IN SEISMIC AREAS

Tsunamis in the Mekong River?

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The dramatic events following the recent Japanese earthquake, triggering an unprecedented tsunami and a serious nuclear reactor incident at Fukushima points out rather glaringly the adverse impacts arising from natural disasters caused by seismic activities and exacerbated by man-made structures.

A general view of the Mekong River at the Golden Triangle in Chiang Rai province, northern Thailand.

An earthquake measuring 9.0 on the Richter scale, with its epicentre about 130 kilometres off the coast of eastern Japan, on March 11 triggered a deadly tsunami which caused tremendous destruction across an extensive part of the coastal area of that particular region of the country.

As a result the Fukushima nuclear facility was badly damaged and radioactive substances were released into the surrounding areas, leading to evacuation of the people around the nuclear power plant and raising concern about fallout of radioactive materials in other parts of the country and elsewhere around the globe.

The Mekong River Basin, while seemingly having no direct link to what has happened in Japan recently, could however also be a potential site for catastrophe, if appropriate safeguards are not put in place soon. Several hydropower dams have already been built in the mainstream upper reaches of the river in Yunnan province of China, while a few more
are either under construction or planned, eventually forming a cascade of reservoirs along the river.

Riparian countries in the lower downstream parts of the river, although in principle more legally bound in their actions by virtue of their membership in the Mekong River Commission, also have plans to build such dams along the mainstream of their respective reaches. The Xayaboury hydropower project in northern Laos has attracted much attention in the news recently and many academic and civic groups in the region, and especially in Thailand, have called for it to be carefully studied for potential social and environmental impacts or to be scrapped altogether. Similarly, alarm bells have also been sounded regarding the series of dams that have already been or are being constructed further upstream in China.

Geologically, Yunnan is situated in a very seismic-prone area, with numerous earthquakes occurring annually, the latest noteworthy one being a quake of magnitude 5.8 on the Richter scale on March 10, which caused some loss of lives and property damage. On Feb 23, a moderate tremor of magnitude 4.6 also occurred in the Xayaboury area of Laos, resulting in some structural damage reported even in some provinces of neighbouring Thailand. Data on the impact of the Mar 24 quake in northern Burma which was felt across northern Thailand and Laos, is still being gathered.

The impact of earthquakes on dams and the effects of reservoirs on seismicity have so far been at best muted in the critical analysis and debate when evaluating overall impacts of such man-made impoundment structures.

Even the recently published Strategic Environmental Assessment of Hydropower on the Mekong Mainstream, prepared for the MRC, did not include geological/seismic aspects with the disaster risk potential and its associated consequences in its assessment.

The question that should then be raised is: how seismic-proof are the dams on the Mekong River — the ones already in place as well as those on the drawing boards, and what seismic design criteria have been used in these projects? The probability is small that a strong earthquake will hit one of the large dams situated especially in the uppermost portion of the river causing it to collapse. However, should it occur, the huge amount of water retained behind the dam will suddenly be released in an uncontrolled way, creating a large flood wave travelling down the river. If there is another dam located further downstream, that one will probably not be able to withstand this wave. The other dams located further down the river's cascade would also most likely break, further increasing the amount of water released. In the worst case, this may create a domino tsunami-type tidal wave effect further downstream. Such a scenario would have catastrophic consequences for the communities located in the path of the destructive flood waters.

Moreover, there is also a well-documented phenomenon called reservoir-triggered or induced seismicity. In other words, the sheer weight of the large amount of water
impounded behind a dam would add pressure on the underlying geologic layer which has sometimes resulted in tremors in the vicinity of the reservoir.

How the natural seismicity interacts with the reservoir-triggered ones are another interesting case for further study and also possibly add another cause for concern.

As stated earlier, the likelihood of this happening on the Mekong is pretty small. Nonetheless, the literally earth-shaking events occurring around the globe recently, some with catastrophic effects, suggest that confident predictions on such matters may be misplaced. In short, the only certainty nowadays is, ironically, uncertainty. It would therefore seem prudent to err on the side of caution.

Following the severe earthquake measuring 8 on the Richter scale occurring on May 12, 2008 with its epicentre in the Chinese province of Sichuan, a number of Chinese experts and activists have submitted a petition requesting their government to review the safety of large-scale dam projects, especially in seismically active areas like Sichuan and Yunnan provinces, and to make the findings public.

This petition was further supported by other parties outside China.

What is really needed is an open and participatory debate or discussion on the potential risk and benefit of such infrastructural schemes located in geologically unstable regions.

Interestingly, following the recent earthquake in Yunnan, one member of the recently-concluded Standing Committee of the 11th National People's Congress of China urged the central government to pay attention to the special and complex geological and seismological conditions in that particular part of the country and to be cautious in making decisions concerning hydropower development in such areas.

Obviously, cooperation among various concerned parties, both within a riparian country as well as among the different riparian nations, in terms of sharing of information and experiences, is vital.

The idea is not to dismiss the need for building dams altogether, but any decision to proceed should be arrived at only after a critical analysis of all the feasible options, careful examination of the conditions around the dam's location including the potential risk factors, and ensuring adequate safeguards are incorporated in the design, construction and renovation of such structures.

Contingency plans and mitigation measures should also be mapped out in the event that disasters strike, as is already the current practice in some countries.

Putting in place emergency warning systems coupled with periodic evacuation drills for not just the dam operators, but also the people who might be affected is a must. It is very much like the regular tsunami alert and evacuation drills being undertaken in coastal
areas or fire evacuation drills in buildings and the demonstration of safety procedures each time we fly on airplanes.

The protection systems that are to be put in place should be cost-effective, responsive and resilient to various kinds of potential shocks, including from tsunamis and flood waves — both sea- as well as land-borne — generated by seismic activity, be it natural or induced.

After all, the lives, livelihoods and property of some 60 million inhabitants in the Mekong River Basin are at stake.

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