

**Report of the Expert Group lead by Honb'le Minister for Revenue and
Disaster Management for the rapid assessment of the situation in Idukki
district after the earth tremors of 18 November 2011**

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**Department of Disaster Management
Government of Kerala**

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1. Introduction:

Idukki district of Kerala state is a multi-hazard prone district. Kerala in general is classified under Zone III as per the national seismic zone classification map. The natural hazard susceptibility map published recently (2010) by the Centre for Earth Science Studies reiterates this fact. Historical-earthquakes of Kerala show occurrence of considerable seismic activity in Kottayam-Idukki region of central Kerala because of the presence of several lineaments and bed rock fissures that transects these districts. These two districts suffered three earthquakes in the recent history, viz. the 1988 Nedumkandam (4.5 M), the 2000 Erattupetta (5.0 M) and the 2001 Erattupetta (4.5 M) events and the districts experience several micro-tremors (events less than 2.5 in magnitude). These events often generate a great deal of public anxiety, especially when the disastrous consequences of earthquakes such as those in Sikkim, Wenchuan (China), Bam, Latur etc. are all fresh in the minds of the people.

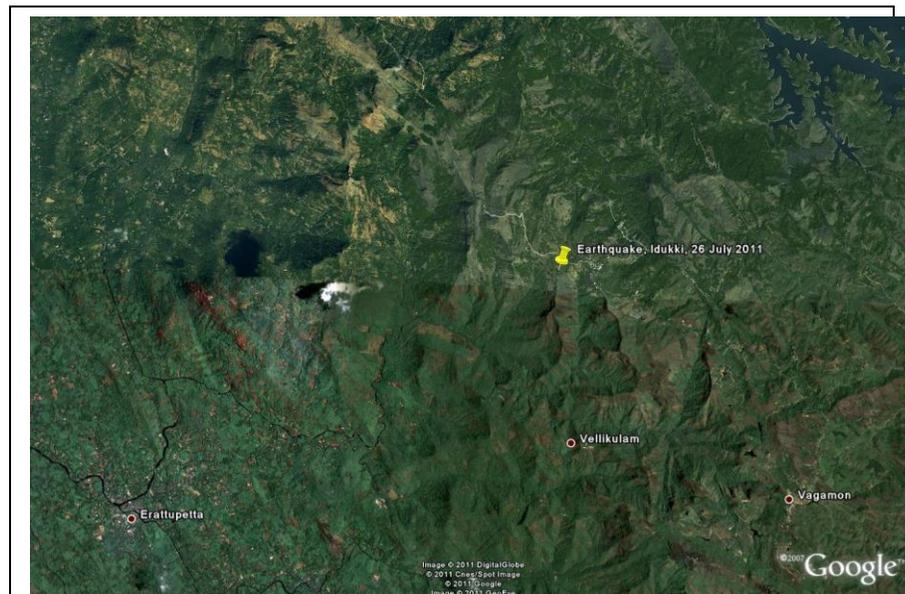


Figure 1: Relative location of the epicentre of the earthquake on 26 July

Adding to this anxiety is also the presence of several major dams including the Idukki arch dam and the Mullaperiyar dam in the region. Mullaperiyar dam particularly arouses a great deal of genuine public anxiety when tremors strike Idukki and/or Kottayam districts. People are often concerned of a dam break scenario given the age of Mullaperiyar dam, the

material and technology that has been used for its construction and the possibility of reduced structural integrity occurred over the last one century.

The seismic activity in and around Idukki district was particularly more frequent this year as compared to reported events in the previous years. The first major event of 2011 occurred on 26 July with a magnitude of 3.8 and the epicentre at Lat 9.6° N, Long 76.6° E. Following this event, public demand was significantly high especially from Cheruthoni, Kattappana, Peermed, Kumali, Vagamon and Adivaram to assess the event. An after shock of 3.1 M was also reported later on. Figure 1 shows the relative location of the epicentre of this tremor. After a brief period of calmness, two other events struck Idukki district on 18 November 2011, being a 2.8 M and a 3.1 M events. The epicentre of the 3.1 M (*IMD data*) quake was Lat 9.8° N, Long 77.1° E. This falls

near the Kalkoonthal area of Idukki district close to Upputhode and Nedumkandam near the Erattayar Dam in Idukki district. A map of the relative location of the epicentre is given as Figure 2. According to reports, Kattapana, Erattupetta, Teekoy, Vazhikkadavu, Vagamom, Poonjar Thekkekkara areas felt the impact of tremors.

All this created significant panic amongst the people of Idukki. Realizing the need to alleviate the people from their fear and anxiety the Honb'le Chief Minister sent Shri. John Mathai, Senior Scientist, CESS, an expert on earthquakes and structural geology to the affected sites. He began his field tour on 19 November. Further reports started

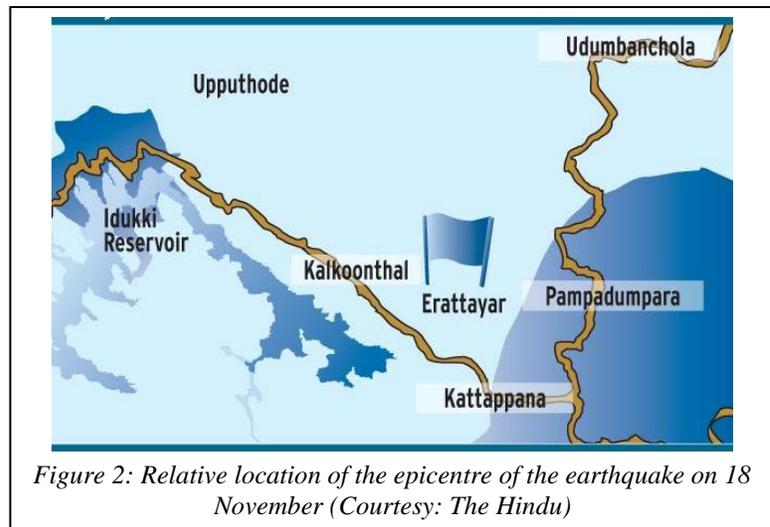


Figure 2: Relative location of the epicentre of the earthquake on 18 November (Courtesy: The Hindu)

flowing in regarding damages to residential and non-residential buildings. Reports of the development of a new crack in the already weak Mullaperiyar dam (Figure 3) added to the prevailing panicky situation.

The Honb'le Minister for Revenue and Disaster Management immediately constituted an expert group to assess the situation and the team left for Idukki on 20 November. The members of the team were Dr. N.P Kurian (Director, CESS), Dr. Keshav Mohan (Director, ILDM), Er. T.P Madhusoodhanan and Er. Vinod (Sr. Consultants, Habitat technology group), and Dr. Sekhar L. Kuriakose (Head-Project Scientist, HVRA Cell). Shri. John Mathai, Scientist, CESS joined the team at Upputhara.

1.1 The tour report

The team met the Honb'le Minister in the chamber of District Collector, Kottayam at 9.00 am, 20th November and took stock of the status of affairs. Director, CESS briefed the minister on the status of knowledge on seismic activities in Idukki. Director ILDM briefed the minister on the training and awareness programmes needed for betterment of community resilience to earthquakes and provided him with several awareness pamphlets

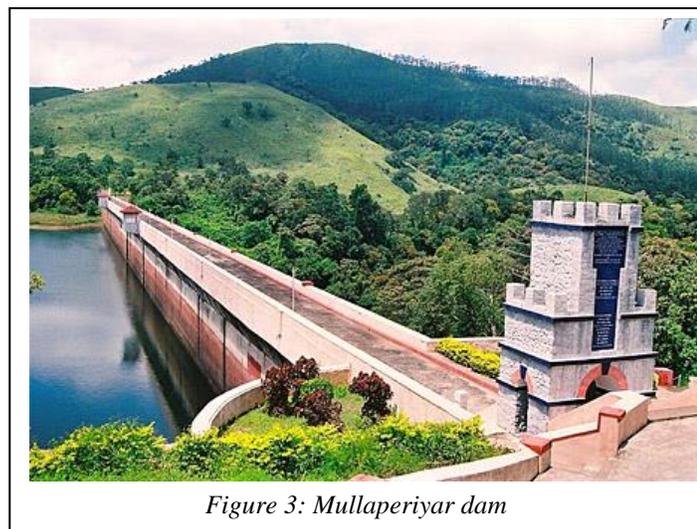


Figure 3: Mullaperiyar dam

available for public distribution that has been published by ILDM. He suggested for setting up a sub-unit of HVRA Cell in the area for enabling information dissemination and early warning. Sr. Consultants of Habitat carried several copies of the book “Kudumba surakshaykku surakshithamaya bhavana nirmanam” published by Dept. of Disaster Management with the support of UNDP and briefed the minister on safety precautions to be taken while constructing structures in earthquake prone areas. The Head (Project Scientist) of HVRA Cell carried the relevant documents pertaining to previous meetings related to tremors in Idukki and briefed the status of the deployment of seismographs by KSEB, the progress with regards to the preparation of the contingency plan for Mullaperiyar dam break scenario and the progress in the preliminary study for deploying an early warning system down stream Mullaperiyar. District Collector Ms. Mini Antony IAS offered support to Idukki district in conducting awareness campaigns in Idukki, especially in creating necessary materials, availing officials etc. given her previous experience in Ernakulam as the nodal officer for implementation of the UNDP project for disaster risk management there in.

The team left for Upputhara at 9.45 am. At Upputhara the team had a brief public interaction in the presence of Shri. Kodyeri Balakrishnan, Honb’le Dpy. Opposition Leader, Shri. P.T Thomas MP, MLAs and other people's representatives. Shri. John Mathai made a brief talk on his observations. He answered the queries by the public. The representatives of Mullaperiyar Samarasamithi handed over a memorandum to the Honb’le Minister during the public interaction session.

The team left for Mullaperiyar. Enroute the team visited a school and a couple of houses which were affected by the tremor.

The team left for Mullaperiyar by 3.00 pm from Thekkady. At Mullaperiyar the team visited various galleries and some of the members including District Collector Idukki, Shri. John Mathai, Dr. Sekhar and Prof. Roy of Mullaperiyar Samarasamithi were allowed to enter the lower gallery. After the visit, Honb'le Minister briefed the media at the dam site. He also instructed the team to submit are report immediately. He further requested the officials of Tamil Nadu to provide seepage measurements to the officials of Kerala. The team engaged in brainstorming for preparation of the report. The team dispersed at Thekkady at 5.30 pm on completion of the visit.

2. Observations:

All the observations listed below are based on what was witnessed by the team in a very short span of time. A detailed report on the apparent manifestations of the earthquake and the felt reports will be submitted by Shri. John Mathai, Scientist, CESS to the government through proper channel.

- a. The team witnessed fear and anxiety among the public regarding repeated tremors in Idukki and the condition of Mullaperiyar dam at the public interaction at Upputhara

- b. Shri. John Mathai clearly explained to the public why he thinks that such tremors will continue to occur every now and then around Idukki and Kottayam districts. According to him such minor tremors create a relatively safer sub-surface condition as it ventilates any build up of strain in the sub-surface rock strata. Yet people remained apprehensive
- c. The school buildings and the houses that the team visited were constructed poorly without taking into consideration the possibility of earthquakes
- d. The use of sub-standard workmanship/technology and material was apparent in most buildings (residential and non-residential)
- e. The team, given the short period of time and resources available for investigation, could not confirm if any new cracks have developed on Mullaperiyar dam specifically due to the 18 November earthquake
- f. As seepage data was not available with the Tamil Nadu officials at the time of the team's visit, it was not clear whether there was any increase in total seepage through the dam structure
- g. It was observed that due to lime leaching and subsequent deposition stalactites have formed inside the weeping holes of the dam structure
- h. Deposit of leached 'surki' mixture was found in all the seepage channels
- i. Although most of the standpipe piezometers in the gallery had pressure measurement gauges, none of the standpipes inside the flanking tunnels of the galleries had pressure measurement gauges
- j. All the standpipe piezometers with pressure measurement gauges showed no measurements. The team expressed concern over the condition of the instruments

3. Recommendations:

Based on the observations in Section 2, the following recommendations are made to the government to alleviate fear and anxiety of the people.

- a. The Institute of Land and Disaster Management in collaboration with Habitat Technology Group and Centre for Earth Science Studies should conduct widespread awareness campaign in Idukki district to propagate the need for safe building construction. The campaign should have workshops and training programmes for construction workers, architects, civil engineers, government officials and general public. A series of such campaigns should be completed before May 2012, prior to the next monsoon season. This should be done in close liaison with the District Administration and Local Self Governments. District Administration and Local Self Governments should extend all necessary support for organizing the campaign
- b. The Kerala Police guarding the dam should be provided with continuous electricity, hotline and other necessary facilities for rapid communication with down stream officials. They should be trained in handling disastrous situations that may arise in the event of a major earthquake or dam break. Training may be conducted at the training centre of the National Disaster Response Force
- c. Kerala Police should ensure that mutually agreed number of their staff are trained and deputed to the State Disaster Response Force. The functioning of SDRF in the premises allocated for the same at Idukki district should begin as early as possible
- d. Dept. of Disaster Management and KSDMA should ensure that the purchase of laboratory facilities and recruitment of staff of the Hazard Vulnerability and Risk Assessment Cell are completed by December 2011 such that the contingency plan of Mullaperiyar dam break scenario (to be prepared jointly by HVRA Cell, CESS and Kerala Police) can be prepared and submitted to the government before mid May 2012, prior to the next monsoon season
- e. Dept. of Disaster Management and KSDMA should ensure that the sub-centre of HVRA Cell for the HVRA of Idukki is setup in the district and this sub-centre starts functioning from January 2012
- f. KSEB should ensure that the digital seismographs are deployed and a real time monitoring system with real time access to CESS and HVRA Cell (*as instructed by Honb'le Chief Minister during the meeting that he convened on 5 August 2011 in light of the earthquake at Idukki on 26 July 2011*) is in place before May 2012, prior to the next monsoon season
- g. Dept. of Disaster Management should ensure that sufficient funding and administrative clearance is made available to HVRA Cell for setting up of the real time flood early warning system down stream Mullaperiyar by March 2012. Dept. of Forests and Wildlife should provide necessary support for the implementation of this project

- h. It should be ensured that all buildings (residential and non-residential) that are to be newly sanctioned complies with building safety regulations that are mandatory for areas in Zone III as prescribed by Prof. A.S Arya
- i. The school building that the team visited, which got damaged due to the recent tremor, should be decommissioned
- j. There should be an earthquake evacuation mock drill organized in every school and hospital before May 2012 in the district and availability of sufficient cleared space in the vicinity for the complete and smooth evacuation of the inmates should be ensured
- k. All possible buildings (public buildings, schools and hospitals particularly) in Idukki should be audited and retrofitting should be done to reduce the vulnerability of those that are weak. An agency competent enough to conduct this auditing should be entrusted with this task and they should complete the auditing before May 2012. Sufficient funding for the same should be sanctioned by the government
- l. A four stage permit scheme and regular monitoring scheme should be implemented whereby proposals for new buildings (residential and non-residential) will be scrutinized by a team of officials and experts including those from Dept. of Disaster Management or District Disaster Management Authorities right from plan approval stage until issuance of building number. A scheme for this should be evolved in consultation with LSGD immediately and this should be implemented starting December 2011.
- m. Safe building construction measures detailed in “Kudumba surakshaykku surakshithamaya bhavana nirmanam” published by Dept. of Disaster Management should be promulgated amongst construction site engineers, architects, civil engineers etc.
- n. The recommendations of the committee already constituted by the Dept. of Disaster Management and Dept. of LSGD (Urban) for the revision of the building codes and by-laws of the state should be implemented (as and when they complete their deliberations) state wide with modifications as in to suite the specific situations prevailing in rural areas of the state and particularly Idukki district
- o. Given the panicky situation prevailing in the down stream districts and the occurrence of frequent tremors in the region, the Government of Kerala may request Government of Tamil Nadu to lower the water level in Thekkady reservoir to a safer limit

It is also recommended that the listed out programmes may be implemented on a priority basis by including them in the priority programme of the Honb’le Chief Minister.

4. Acknowledgement:

The expert group acknowledges the support by the Honb'le Minister for Revenue and Disaster Management, the people's representatives of Idukki and Kottayam districts, Additional Chief Secretary (Revenue and Disaster Management), Secretary (Office of KSDMA), officials of Kottayam and Idukki Collectorates, Department of Irrigation, Periyar Tiger Reserve (Forests and Wildlife Department) and the Kerala Police. We are also thankful to the officials of Tamil Nadu state government in providing us access to all locations of the dam that we wanted to investigate.

Last but not the least we thank the Kerala Police who is guarding the Mullaperiyar dam. They are the first eyes of the people of Kerala living downstream Mullaperiyar.