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# Technical Review of Pak Beng Hydropower Project – Dam Safety

*The 2nd Regional Stakeholder Forum*
*The Pak Beng Hydropower Project*
*5th May 2017*
*Vientiane, Lao PDR*

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# Background

- The following documents were provided and reviewed:
  - **Pak Beng Hydropower Project Engineering Status Report** (Kunming Engineering Corporation, September 2015)
  - Set of drawings from Kunming Engineering Corporation Ltd
  - Compliance with MRC Preliminary Design Guidance (Appendix to the previous report)
- Discussions with Ministry of Energy and Mines representatives
- Discussions with PB Project designers and developers

# Overview of Submitted Documents

For the safe design, construction and operation of the Pak Beng Dam the Feasibility Study Report (FSR) has stated to have made use of and reference to:

- *MRC Preliminary Design Guidance, Lao Electric Power Technical Standards, ICOLD and World Bank Guidelines*;

in order to address:

- *Safety issues related to geology, earthquake, flood risk, structural layout, etc. associated with location, scale and structure of the dam;*
- *Initial plan for Emergency Preparedness Plan (EPP) and Dam Safety Management System (DSMS)*

# Compliance with MRC's Preliminary Design Guidance (PDG)

- The FSR has provided substantial information about the results from a comprehensive feasibility assessment of the PBHP Project.
- The Dam Safety issues are covered in the Pak Beng Engineering Status Report and are generally in compliance with the MRC PDG.
- While the FSR largely complies with the MRC PDG, yet our review and findings recommend the provision of additional elaboration, studies and details in the future if the PBHPP will proceed.

# Main Review Findings

**Dam Design Criteria – Floods**

**Dam Design Criteria – Seismic**

**Dam Design Criteria – Structural Stability and Geology and Dam Safety Planning and Management**

# Dam Design Criteria - **Floods**

- Dam Design is based on the 1 in 500 yr and the 1 in 2,000 yr floods return period, only;
- International standards recommend checking the design with
  - the Probable Maximum Flood (PMF) to demonstrate that the dam will not fail under extreme load;
  - To check with most extreme case such as “a low flood return period when the greatest differential head occurs between upstream and downstream water levels”

# Dam Design Criteria – **Seismic**

- Local faults are described as active.
- The dam is located in an area of regional seismicity with several historic earthquakes of >6 magnitude
- ICOLD safety evaluation earthquake (SEE) depends on the hazard created by the dam. 5000yr would be acceptable for a medium hazard dam.
- Dam designed is based on probability of 475 yr and the 5,000 yr events. Peak Ground Accelerations (PGA) of 0.157g and 0.372g;
- It is also recommended to PB developers
  - to study a dam break assessment and the extent of the impact to the downstream areas of the dam.
  - Take account of the earth quake events occurring in Chiang Rai particularly the one in 2014.

# Regional historic earthquakes and closeness of active fault, F2

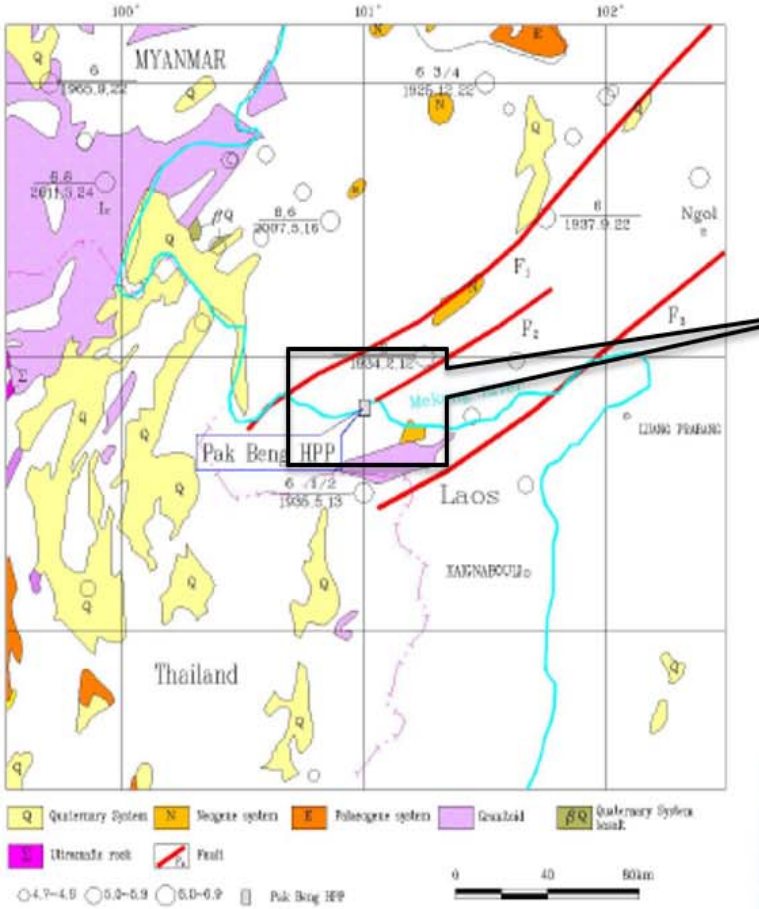


Fig.2.3-1Distribution of the Regional Pleistoseismic (M≥4.7) in Pak Beng HPP


Possible extension of Fault F2

Local faults are described as active. Nearest fault is likely to extend to within several kms of the dam site.

# Dam Design Criteria – Structural Stability and Geology

- Request for additional technical clarification were made to the PB HPP Designers to explain:
  - structural design criteria particularly Design Criteria related to sliding, overturning, strength and other structural criteria;
  - Methods of assessment, factors of safety and material characteristics;
  - mitigation measures applied to Areas of weak rock in the foundation under the structural design of the dam as well and at the end of stilling basin and other waterways

# Operational Dam Safety Planning and Management

Request for additional technical clarification were made to the PB HPP Designers to provide additional details for:

- Detailed development of operational strategy between Pak Beng dam and other downstream schemes such as Xayaburi and Don Sahong HPPs;
- A detailed failure modes assessment to inform the dam design, dam safety management plans and emergency planning for the downstream areas
- Dam break study to assist in understanding of hazards imposed by the dam and preparation of the emergency preparedness plans

# Recommendations

After the review of the Engineering Status Report, the recommendations are:

- Appoint an Independent Dam Review Panel as soon as possible (as recommended by the World Bank , indirectly by ICOLD and the PDG) i.e. at the earlier stage of the detailed design;
- Demonstrate that the dam will not fail under the Probable Maximum Flood (PMF);
- Study a dam break assessment and the extent of the impact to the downstream areas of the dam;
- Take into account the earth quake events occurring in Chiang Rai particularly the one in 2014;
- Consider additional seismic design accelerations tests due to the regional seismicity and the closeness of an active fault to the site.

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# Thank you!