



FEDERAL ENERGY REGULATORY COMMISSION

Office of Energy Projects

Division of Dam Safety and Inspections - Chicago Regional Office

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In reply refer to: P-10856

December 17, 2006

Mr. Terry P. Jensky
Assistant Vice President – Energy Supply Operations
Wisconsin Public Service Corporation
Upper Peninsula Power Company
600 E. Lakeshore Drive
P.O. Box 130
Houghton, Michigan 49931-0130

RE: Design Flood Analyses for South Levee Alternatives, Au Train Hydroelectric Project No. 10856

Dear Mr. Jensky:

We have completed our review of the *Design Flood Analyses for South Dike Alternatives* for Au Train Project No. 10856. The report was prepared by Washington Group International and submitted with your letter dated May 12, 2006. Although it appears that a fuse plug alternative may be applicable to assist in passing the PMF, several design considerations must be addressed in the final design of the fuse plug.

We have the following comments:

1. The fuse plug alternative must be designed to operate without presenting a hazard to downstream life or property. An incremental hazard analysis of the fuse plug spillway for a range of floods, starting with the smallest flood which would activate the fuse plug increasing up to the PMF should be performed.
2. Figure 5.1, the conceptual design drawing of the fuse plug spillway, shows two pilot channels. If the final design includes two pilot channels rather than one, then the analyses must be revised using a shorter time for activation of the fuse plug. The consultant based the activation time on a lateral erosion rate given by an empirical formula from the Bureau of Reclamation publication, *Hydraulic Model Studies of Fuse Plug Embankments*. If two pilot channels are used, the erosion rate would be significantly greater, resulting in a much shorter time of activation.

3. The South Dike is a homogeneous sand embankment with no core wall and a weak foundation. The proposed remediation project includes raising the South Dike one foot above its current average elevation (from 789.7 to 790.7 feet NGVD) to accommodate the PMF water surface elevation of 789.7 ft. Your project design analyses should include stability analyses for all loading conditions showing that the proposed South Dike during the PMF meets required safety criteria.
4. You should provide survey documentation of the rim of the reservoir to ensure that there are no low areas along the shoreline which could release water from the reservoir before activation of the fuse plug.
5. A freeboard analysis will be required.
6. During large floods the concrete overflow spillway at the North Dam could become blocked by debris causing the fuse plug to activate earlier than planned. This must be considered and addressed in the final design.
7. The two-foot high flashboards on the spillway at the North Dam have been removed as an interim risk reduction measure. If the design assumption for the spillway remediation includes continuation of "no flashboards in place", then changes in the operation plan for the project will also be required. You must convey this to all staff responsible for project operations so that flashboards are not accidentally replaced.
8. We note that activation of the fuse plug will result in loss of about 73% of the storage capacity of the reservoir (based on table 2.3 of the April 2004 Flood Frequency Analysis Report prepared by Washington Group International). Also, 80% of the spillway capacity for the PMF is provided by the fuse plug. A staged fuse plug spillway with differing base elevations may reduce the loss of storage during floods less than the PMF.
9. Determine the return period for the flood that will activate the fuse plug.
10. We have previously informed you that coordination with the affected resource agencies and general population will be required if the fuse plug in the South Dike was to be considered further. Please provide the status of your coordination efforts.
11. Your fuse plug design should specifically provide for the following general criteria.
 - A. The activation of a fuse plug spillway must not create a hazard to downstream life or property.

- B. A fuse plug for a high hazard project should not activate for a storm less than a 500 year storm. The 500 year flood should be compared to the storm frequency that will activate the fuse plug.
- C. The sill elevation of the fuse plug should generally not be much lower than the normal reservoir level of the project. The proposed sill level will drop the reservoir over 5 feet below the normal pool level when the fuse plug activates and releases a significant volume of normally stored water. This would create a greater flood volume downstream than the inflow from the storm.
- D. The proposed single row of caissons at the upstream toe of the fuse plug that are shown as a sill is not considered adequate for that purpose. The sill for the fuse plug must carry the flows through the fuse plug and downstream of the embankment toe without permitting down cutting into the foundation within the foundation foot print of the embankment/fuse plug or at the immediate downstream toe of these structures. Otherwise the stability of the structures could be compromised.
- E. The upstream slope of the fuse plug section indicates that rip rap is to be placed on filter fabric. This is not acceptable. Natural filter material must be used. During activation of the fuse plug, filter fabric can collapse over part of the fuse plug embankment and significantly slow or prevent erosion of the embankment down to the sill level.
- F. The area south of the south embankment should be spot surveyed to determine the gradients from points along the downstream toe of the proposed fuse plug to the start of the nearest waterway swales or channels to confirm that gradients do not exist which could cause head cutting from the fuse plug flows.

These design considerations must be addressed in the design of the fuse plug for the South Dike. Please confirm your plan and schedule to complete the necessary spillway upgrade within 30 days of the date of this letter. If you have any questions concerning this matter do not hesitate to call me at 312-596-4438 or Mr. Steve Spicer at 312-596-4449.

Sincerely,

PEGGY ANN HARDING

Peggy A. Harding, P.E.
Regional Engineer

bc: DIR, D2SI, OEP/e-Library
Spicer, S.A.
TABS: 5803

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