Federal Energy Regulatory Commission
Silver Lake Fuse Plug Activation, Dead River Project, P-10855

Summary of Conclusions
4/13/04

The activation of the fuse plug spillway at Silver Lake Reservoir, which resulted in release of the reservoir on May 14, 2003, required lake levels sufficient to activate the fuse plug, the activation of the fuse plug, and the erosion of the fuse plug foundation and emergency spillway channel.

Independent field observations after the event have established that the maximum reservoir level during the event reached about elevation 1485.6 feet. The last recorded lake level before the breach was elevation 1483.35 feet on May 7, 2003. Calculations taking into account the rainfall event of May 10-11, the low level outlet flows of 20 cfs, the stop log elevation 1486.25 feet, and the May 7, 2003 elevation of the lake indicate reasonable agreement with the maximum lake elevation 1485.6 feet prior to the breach.

The maximum lake level of about elevation 1485.6 feet, just prior to the breach, is consistent with the triggering pilot channel elevations of 1485.5 feet in the fuse plug and indicates that the fuse plug triggered as designed.

The reasons that the rainfall event of May 10-11, 2003 could cause this breach on May 14, 2003 were the low setting of the fuse plug pilot channels (elevation 1485.5 feet) relative to the spillway crest (elevation 1486.25 feet), the low discharge setting of the low level outlet (20 cfs), and the high setting of the stop logs (elevation 1486.25 feet) in Bay 4 of the spillway.

To be consistent with the design modification of the normal maximum operating level at elevation 1481.5 feet, the low level outlet should be fully open every time the reservoir level exceeds elevation 1481.5 feet. That operation after April 23, when the reservoir reached elevation 1482.34 feet, would have controlled the reservoir at about elevation 1481.5 feet and avoided the fuse plug activation due to the May 10-11 rainfall.

Alternatively, if the low level outlet discharge were held constant at 20 cfs, but the stop logs had been set at elevation 1482.5 feet, it is probable that the activation of the fuse plug could also have been avoided. It is not totally certain, however, because of the impossibility of knowing the real volume of run-off.

The principal difference between the design intention and the failure that occurred is that the resulting erosion continued about 25 feet below the base of the fuse plug embankment, and resulted in the loss of nearly the entire reservoir.

Thus, the release of the Silver Lake reservoir was a consequence of the flow velocities produced by the fuse plug activation and by the gradient of the channel

downstream of the fuse plug embankment. The actual flow velocities in the channel after the activation exceeded the velocities which could cause erosion of the foundation materials, which are classified as sand.

The operational requirements consistent with the design assumptions were not well communicated or understood by all parties which resulted in the fuse plug activating at a flood much smaller than the design intended. The fuse plug foundation and the emergency spillway channel were not adequate and eroded much more than expected.

The erodibility of the fuse plug foundation and the emergency spillway channel is the root cause of the Silver Lake reservoir release. The low elevation setting of the fuse plug crest, the low releases from the bottom outlet, and the high setting of the stop logs are factors which affect the frequency of fuse plug activation. The reservoir would not be released, except for the upper 5 feet, for any activation of the fuse plug if the fuse plug had been founded on a nonerodible foundation in a nonerodible spillway channel. The fuse plug solution was not well suited for the foundation conditions at the site.