Rapid Response to Internal Erosion Initiation

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Training associated with desktop exercises of the Emergency Action Plan prepared the plant operator adequately to make the tough decisions without a second thought. An outbreak of sediment laden water from the embankment toe indicated that loss of the structure was possible due to initiation of an internal erosion piping failure. To provide safety for plant personnel, residents and businesses, activation of the emergency action plan was executed. Loss of the embankment was averted through actions made with confidence by trained tenders and operators. This presentation will focus on the emergency investigation and repair to address internal piping progression and erosion within an earth embankment. The Bigfork Hydroelectric Project, located in Bigfork, Montana, is owned and operated by PacifiCorp. Hydro power is generated using water supplied via an earthen canal system fed by the Swan River. During regular plant operations, the canal carries an approximate 270,000 gallons per minute (600 cfs) to permit operation of the plant’s 4.15 MW power generation. The canal became operational in 1902. The canal, approximately 1 mile in length, was constructed at the end of the 19th century via side hill cut with drag line equipment. The excavated soils were cast to provide the canal containment, i.e. uncompacted earth embankment. The canal interior was then lined with a spray-on asphalt liquid which created an impermeable barrier against infiltration and water loss. In recent years, after over 100 years of service, the liner has shown signs of aging and distress. However, the serviceability continued since aging did not affecting the hydroelectric project from operating safely. In the late summer 2018, during routine inspections, a seepage outbreak was observed on the downstream toe of the canal embankment. The seepage emanating from the canal was estimated at no less than 100 gallons per minute and contained soil material up to about an inch in diameter, an indication of initiation of an internal erosion failure mode. Immediately the canal was taken off-line, which ceased ability to generate power. Repair of the failed canal embankment was considered an emergency situation. Gannett Fleming was tasked with identifying rapid embankment repair techniques which included PacifiCorp’s first use of an asphalt impregnated geotextile liner. This presentation will focus on the emergency investigation and repair to address internal erosion and piping progression. Engineering, ingenuity and creative use of readily available supplies was required to return the plant to operation within three months’ time.