Review of physical and chemical remediation techniques for hydrogen sulfide abatement in a bottom-withdrawal hydropower reservoir

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Lake Wallenpaupack is a 5,700-acre impoundment of Wallenpaupack Creek in northeastern Pennsylvania. The reservoir was created in 1924 for hydropower purposes, with a 14-foot diameter bottom withdrawal pipeline extending 3.5 miles to a 44-MW powerstation on the Lackawaxen River. The powerstation is approximately 380 feet lower in elevation than the top of the reservoir surface, and is located on the Lackawaxen River approximately 13 miles above its confluence with the Delaware River. The Project is owned and operated by PPL Holtwood, LLC.

Water is withdrawn from Lake Wallenpaupack at a depth of 40 to 60 feet, with pipeline flow rates ranging from 125 to 1750 cfs and travel time ranging from 0.5 to 6 hours, depending on generation needs. The average water depth in Lake Wallenpaupack is approximately 40 feet. During late summer, the hypolimnion becomes anoxic, and sulfates are reduced to hydrogen sulfide. Preliminary measurements of hydrogen sulfide in August 2001 were approximately 2.0 mg/L in the hypolimnion. In August and September 2001, residents for more than a mile downstream of the powerstation complained that strong sulfide odors persisted when the plant was discharging.

Cold water releases from Lake Wallenpaupack through hypolimnetic withdrawal are essential in supporting a popular stocked trout fishery in the lower Lackawaxen River. Epilimnetic withdrawal is therefore not viewed as a viable option for eliminating the discharge of hydrogen sulfide. Efforts are underway to identify a remediation technique to either prevent hydrogen sulfide formation or significantly reduce it prior to powerstation discharge.

PPL convened a panel of national experts to review potential remediation approaches and identify strategic studies to solve the odor problem. This paper discusses several remediation techniques identified by the panel that will be investigated further, including pH modifications in the lake or pipeline, hydrogen peroxide injection into the pipeline, air diffusion into the pipeline, iron addition to the lake, and in-lake hypolimnetic aeration and controlled thermolayer mixing. These techniques and more detailed investigations of hydrogen sulfide levels and formation are being further investigated.

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