Mechanical Mercury Extraction Process® Test Results at Combie Reservoir

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Abstract:

More than 4,500,000 kilograms (10,000,000 pounds) of mercury (Hg) were used during hydraulic and hard rock mining during the California Gold Rush era, and it is estimated that 10-30% of liquid Hg was lost to the environment (Churchill 2000, Alpers et al. 2005).

Mercury is entrained in river gravels containing hydraulic mining debris and is incorporated into the aquatic food chain, causing numerous environmental and public health problems for California communities today (CalEPA 2008, Wood et al. 2010). One of the problems is that Hg-contaminated sediment accumulates in water-supply reservoirs such as the Combie Reservoir (James 2005, Alpers et al. 2006, James et al. 2009). Sand miners and irrigation districts have removed these accumulated materials for more than 30 years (Crough 2010). The Combie Reservoir Sediment and Mercury Removal Project is to dredge Hg-contaminated sediment from

Combie Reservoir while implementing an innovative recovery process to remove the free elemental Hg (Hg(0)) from the dredged material. The project is estimated to take 3 to 5 years to complete and would remove and treat an estimated 100,000 cubic meters (135,000 cubic yards) of sediment from the upstream end of Combie Reservoir. The dredged material will be processed with the Pegasus Mercury Extraction Process® which passes the material through a specialized centrifuge, thereby removing Hg(0) as well as other heavy minerals, including gold (Au) and Au-Hg amalgam.

To measure the effectiveness of removal process, multiple equipment tests were conducted in September and October 2009. Total Hg (THg), methylmercury (MeHg) and reactive Hg(II) (operationally defined by reduction of divalent inorganic Hg(II) to Hg(0) with tin(II)) were measured in heads (input material) and tails (output material) from replicate closed system tests. Mass balances were calculated for water, sediment and the above forms of Hg to estimate Hg removal effectiveness in different grain-size fractions. The free Hg(0) in the sand size fraction (> 0.063 mm) that was removed by the Pegasus Mercury Extraction Process® represents approximately 93% of the calculated THg in the head material.

Process and equipment design modifications are being pursued to improve Hg recovery from the fine-grained fraction (< 0.063 mm). [Any use of trade, product, or firm names is for descriptive purposes only and does not imply endorsement by the U.S. Government.]

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