# SEASONAL STORM-INDUCED METAL TRANSPORT DYNAMICS BETWEEN OXIDATIVE PASSIVE TREATMENT CELLS[1]

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**Abstract:** Iron oxidation, hydrolysis, and sedimentation are key processes promoted in passive treatment of net alkaline mine waters to remove iron from mine drainage. Oxidation cells are sized based on an area-adjusted mass removal rate of 20 g $m^{-2}$ $day^{-1}$ with a layout that maximizes the hydraulic retention time. Although the chemical composition and hydrology of the mine water is characterized over time as part of system evaluations, the frequency and intensity of storm events have not typically been considered. The purpose of this study was to determine if the metals transport by individual, seasonal, and annual rainfall events is significant with respect to the total amount of metals transported in the discharge of individual treatment cells. Total metals transport from a preliminary oxidation cell (Cell 1), surface flow wetland cells (Cells 2N/2S), and from the final polishing wetland (Cell 6) of the Mayer Ranch Passive Treatment System were characterized over a three-year period (2011-2013) based on rainfall intensity. Autosamplers installed at the effluent of each cell collected time-incremented total metals samples when the rainfall intensity exceeded 0.250 cm/hour over 30 hours. Storms were classified based on intensity as Low (0.25-0.99 cm/hr), Moderate (1.00-1.99 cm/hr), High (2.00-2.99 cm/hr), and Extreme (>3.00 cm/hr). Laboratory determination of total metals (EPA methods 3050 and 6010), produced a series of transport curves for the mass export of total metals including Fe, Zn, Cd, Ni, As, and Pb based on seasonally adjusted flow rates 450 gpm average system influent). Iron transport above baseline (without rainfall disturbance) for individual storm events was significant at all locations indicating that rainfall disturbance does mobilize iron, yet the amount of iron transported does not correlate to rainfall intensity. This suggests solids settling disruption rather than stored materials resuspension as the possible mechanism for total metals storm transport. Storm induced iron transport was at its greatest during spring rain events due to the frequency of storm events rather than their intensity. However, final effluent concentrations for the system were not impacted.

**Additional Key Words:** iron oxidation, lead-zinc mine drainage, total metals transport

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