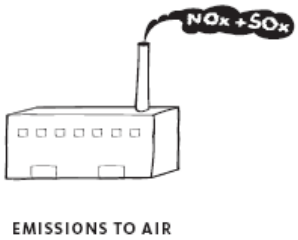

EFFECTS OF DECREASED WATER USE ON EMISSIONS TO AIR

Organic Air Emissions

In general, reduced water usage will increase concentrations of organic material and increase process flow temperatures; both factors tend to contribute to increased emissions of hazardous air pollutants (HAPs) and volatile organic compounds (VOCs). At low concentrations, the equilibrium behavior of VOCs can be described by Henry's Law, which is a directly proportional relationship between liquid and gas concentrations of a constituent at a given temperature. NCASI has conducted extensive sampling to characterize HAP and VOC emissions from kraft mills (Jain 1996). Methanol was the primary HAP constituent from most sources sampled and methanol air emissions were, in most mill cases, linearly dependent upon liquid methanol concentrations. Jain discusses the impact of reduced water usage on methanol and HAP emissions in the brownstock washing area, oxygen delignification area, smelt dissolving tanks, bleach plants, and paper machines. The general conclusion is that reduced water usage will increase HAP and VOC emissions from process vents (Jain 1996). Other authors have reached similar conclusions. Venkatesh et al. (1997) conducted sampling at several mills and applied process simulation for mill-wide methanol balances.

Figure W5 shows the linear relationship between liquid and air concentrations for paper machines and pulp dryers, based upon data from NCASI (1994) and Venkatesh et al. (1997). Gu et al. (1998) extended Venkatesh's modeling concept to include variation of process temperature upon methanol equilibrium, mass transfer rates to predict deviations from equilibrium, and model validation with a number of mill concentrations. Gu et al. (1988) showed that recycling evaporator condensate can double or triple methanol air emissions in process vents in the brownstock washing area.

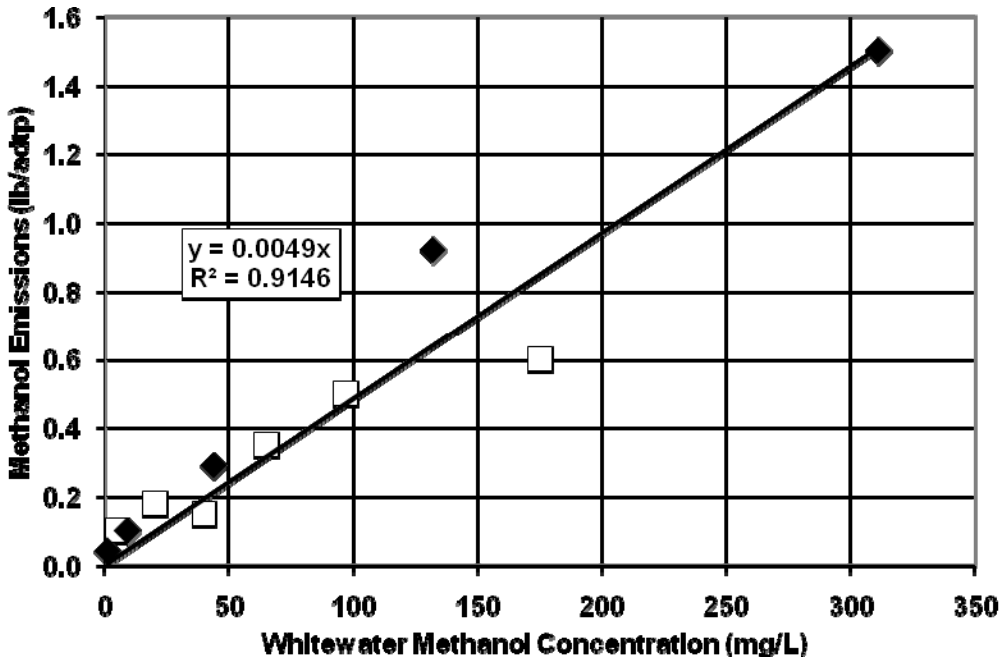

Figure W5. Methanol Emissions from Paper Machines/Pulp Dryers Based upon Mills Data
[filled diamonds from NCASI 1994; open squares from Venkatesh et al. 1997]

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