Mercury Emissions from Concrete Containing Fly Ash and Mercury-Loaded Powdered Activated Carbon

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ABSTRACT

Gas-phase mercury released by fly ash concrete during initial dry curing at 40°C was measured in laboratory-based experiments by a purge-and-trap approach. A mercury-free, controlled airflow above freshly prepared concrete placed in a sealed container transported gaseous mercury species from headspace air above the concrete into an iodated carbon (IC) trap. Total mercury captured on IC traps was dissolved in a strongly oxidative mixture of acids and then determined by cold vapor atomic fluorescence spectrometry. Releases were measured for ordinary portland cement concrete (OPC) and three concretes in which Class F fly ash substituted for a fraction of the cement: 1) 33% fly ash (FA33), 2) 55% fly ash (FA55), and 3) 33% fly ash plus 0.5% mercury-loaded PAC (HgPAC). System blanks were determined for empty containers. Average rates of release, which ranged from 0.10 to 0.44 ng/day/kg over the first 28 days of curing, followed the order: OPC<FA33≈FA55<HgPAC. Extended air sampling that continued for 28 days beyond the initial 28-day maturation was conducted for a small number of samples (OPC, FA55 and HgPAC). The average mercury release rate by OPC concrete appeared to be relatively constant over the full 56 days, whereas mercury release rates for FA55 and HgPAC during extended curing diminished to levels exhibited by OPC concrete. The laboratory results reported here suggest that concrete containing fly ash and/or mercury-loaded PAC is not a significant long-term source of atmospheric mercury in comparison to ordinary portland cement concrete. Field measurements of mercury above curing fly ash concretes would aid in substantiating the significance of these laboratory results.

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