

## Using Novel Cd Isotopes to Trace Heavy Metal Pollution Related to Coal Combustion Products

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High energy demands have necessitated the intensive use of coal in recent decades. The disposal/beneficial use of coal combustion products (CCPs) have the potential to release toxic metals, including Cd, into the environment. The physical state of Cd changes with high temperature processes and mass dependent isotopic fractionation can be caused by evaporation/condensation. These processes may allow Cd isotope analyses to be used as a tool to determine if materials found in the environment have anthropogenic origin. We analyzed Cd isotopes of CCPs [bottom ash (BA), economizer fly ash (EFA) and fly ash (FA), known anthropogenic materials] and parent feed (FC) and pulverized coal (PC) to test the hypothesis. To characterize the Cd isotope signatures in the reactive phase in CCPs and coals, the samples were leached with 5% HNO<sub>3</sub>. Low temperature ashed FC and PC samples show a narrow range of  $\delta^{114}\text{Cd}$  values from 0.4 to 1.3‰ (relative to NIST 3108). In contrast,  $\delta^{114}\text{Cd}$  values of EFA and FA are significantly enriched in heavy Cd (1.1-5.1‰) and BA samples are enriched in light Cd (-2.7-0.1‰), an unexpected finding. Our preliminary explanation is that Cd isotope fractionation i.e. condensation of heavy Cd onto the fine FA begins in the boiler and continues as the FA moves downstream along with Cd vapor. Transport of FA and heavy Cd out of the boiler leaves relatively lighter Cd vapor to precipitate on BA. Fine FA could provide a larger surface area for condensation to occur. Ongoing work is focused on the determination of Cd isotope signatures in different speciation phases, including Cd released by different leaching solutions (DI water, acetic acid and hydroxyl ammonium chloride).