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## Iron in Soils and Road Dust is Modulated by Coal-Fired Power Plant Sulfur Making Toxic PM<sub>2.5</sub>

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Transition metal ions, such as water-soluble iron (WS-Fe), are toxic components of fine particulate matter (PM<sub>2.5</sub>). In Atlanta, GA, from 1998 to 2013, WS-Fe was the PM<sub>2.5</sub> species most associated with adverse cardiovascular outcomes in a previous study. We examined this data set to investigate the sources of WS-Fe and effects of air quality regulations on ambient levels of WS-Fe. Insoluble forms of iron in mineral and traffic dust combined with sulfate from coal-fired electrical generating units (EGU) were converted to soluble forms by sulfate-driven acid-dissolution. Sulfate produced both the highly acidic aerosol (summer pH 1.5-2) and liquid water required for the aqueous phase acid-dissolution, but variability in WS-Fe was mainly driven by particle liquid water. These processes were more pronounced in summer when particles were most acidic, whereas in winter the relative importance of WS-Fe from combustion emissions increased. Although WS-Fe represents a minute mass fraction (0.15%) of PM<sub>2.5</sub>, the observed high correlation between WS-Fe and PM<sub>2.5</sub> mass ( $r=0.67$ ) may result from these formation routes and account for some association between mass and adverse health seen in past studies. Similar processes are expected in many regions, implying these unexpected benefits from coal-burning reduction may be widespread.