

## CLEANTNG UP PESTICIDE-CONTAMINATED SOIL WITH IRON METAL

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### Abstract

Spills at agricultural cooperatives and farmsteads can result in ground and surface water contamination by pesticide and fertilizer products. Finely ground iron metal (zerovalent iron, Fe<sup>0</sup>) can be used to promote rapid degradation of many chlorinated and nitrogenated compounds, including common agrochemicals. When Fe<sup>0</sup> is added to soil under anaerobic conditions, corrosion (oxidation) of the iron can be effectively coupled to reductive dechlorination and nitro group reduction. We conducted a field demonstration at a Nebraska farm cooperative on soil contaminated with metolachlor (>1400 mg kg<sup>-1</sup>), atrazine (>250 mg k<sup>-1</sup>), alachlor (>90 mg k<sup>-1</sup>), pendimethalin (>90 mg k<sup>-1</sup>), chlorpyrifos (>15 mg kg<sup>-1</sup>), and nitrate-N (>900 mg kg<sup>-1</sup>). Contaminated soil was placed in windrows and mixed with a high-speed mixing and fractionation implement. Soil windrows were treated with Fe<sup>0</sup>, Fe<sup>0</sup>+ aluminum sulfate, and/or acetic acid and incubated under clear plastic at a soil water content >35%. Within 90 d, pesticide concentrations decreased by as much as 99% (metolachlor, adachlor, pendimethalin), 96% (atrazine), and 96% (chlorpyrifos), while nitrate-N concentration decreased by >90%. Laboratory experiments using radio-labeled metolachlor indicate that the Fe<sup>0</sup> treatments can result in products that are more biodegradable. These results combined with the relatively low cost of Fe<sup>0</sup> support its use for field-scale treatment of pesticide-contaminated soil, especially when land spreading or landfilling is prohibitive.

**Key Words:** remediation, zerovalent iron, chemical reduction, dechlorination, abiotic degradation