Radioactive ^{129}I, a byproduct of nuclear power generation, can pose risks to human health if released into the environment, where its mobility is highly dependent upon speciation. Based on thermo-dynamic principles, ^{129}I should exist primarily as iodide (I^-) in most terrestrial environments, however organo-^{129}I and ^{129}iodate are also commonly detected in contaminated soils and groundwater. To investigate the capability of biogenic manganese oxides to influence iodide speciation, seventeen manganese-oxidizing bacterial strains, representing six genera, were isolated from soils of the Savannah River Site, South Carolina. The isolates produced between 2.6 and 67.1 nmol Mn-oxides (mL^{-1} media after 25 days, pH 6.5). Results from inhibitor assays targeting extracellular enzymes and reactive oxygen species indicated that both play a role in microbe-induced Mn(II)-oxidation among the strains examined. Iodide oxidation was not observed in cultures of the most active Mn-oxidizing bacteria, *Chryseobacterium* sp. strain SRS1 and *Chromobacterium* sp. strain SRS8, or the fungus, *Acremonium strictum* strain KR21-2. While substantial amounts of Mn(III/IV) oxides were only generated in cultures at ≥ pH 6, iodide oxidation was only observed in the presence of Mn(III/IV) oxides when the pH was ≤ 5. Iodide oxidation was promoted to a greater extent by synthetic Mn(IV)O_2 than biogenic Mn(III/IV) oxides under these low pH conditions (≤ pH 5). These results indicate that the influence of biogenic manganese oxides on iodide oxidation and immobilization is primarily limited to low pH environments.