

Zero-Valent Iron Particle Types and Characteristics That Influence Treatment Reactivity

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Since the early 1990s, zero-valent iron (ZVI) has been used effectively to treat a wide range of halogenated organics and inorganic compounds in ground water. However, in many instances, the term zero-valent iron is mistakenly used to reference a single type of iron stock material without credence to the many different varieties of iron powders available on the market today. Originally, the predominate ZVI type material used in the environmental remediation market was almost always granular iron for conventional PRB applications. This type of material is comprised of a mixture of ductile and cast iron cuttings and borings that are obtained by manufacturers from a number of primary industries that use iron in the production of automotive and industrial parts. As the application of ZVI materials has broadened to include source area remediation, treatment of soils and sediments as well as treating a wider range of contaminant types and concentrations, the demand for different types of ZVI materials with varying characteristics, availability and costs exists.

There are several methods of producing fine ZVI powders directly from iron ore materials. Under a common assumption that “smaller is better” (in terms of increased surface area, higher reactivity and greater ease of emplacement as compared to larger ZVI particles used in the PRB construction), greater varieties of materials are being produced in smaller particle sizes. However, physical characteristics, reactivity, performance consistency and economic considerations vary among ZVI sources resulting in confusion regarding the material selected and used at sites. This paper will present specific information identifying the different types of ZVI currently available in the market and discuss how the different manufacturing processes can enhance desirable particle physical and chemical properties to improve reactivity.