A pilot-scale study was conducted to evaluate the use of aerobic slurry reactors to treat soils that were highly contaminated with 2,4-dinitrotoluene (2,4-DNT) and 2,6-dinitrotoluene (2,6-DNT). Contaminated soils were obtained from Volunteer Army Ammunition Plant (VAAP; Chattanooga, TN) and Badger Army Ammunition Plant (BAAP; Baraboo, WI). Concentrations of 2,4-DNT and 2,6-DNT were 19 000 and 1380 mg/kg in VAAP soil and 8900 and 480 mg/kg in BAAP soil. Soils were homogenized and subjected to a soil washing process; the resulting soil slurry was subsequently fed to an Eimco bioreactor (70-L) operated in a draw-and-fill mode. Degradation of either isomer required augmentation with a DNT-mineralizing culture. Stable performance and essentially complete degradation of 2,4-DNT (within ~2 days) was demonstrated for both soils at slurry concentration (sum of aqueous, sorbed, and crystalline phases) exceeding 11 000 μM. Incomplete degradation of 2,6-DNT was observed after inoculation, and low-level degradation activity could not be sustained without repeated bioaugmentation. Changing reactor operation to maintain low slurry-phase concentrations of 2,4-DNT – through continuous feeding or by reducing the volume of soil slurry fed during draw-and-fill – improved the ability to sustain 2,6-DNT degradation activity. Complementary studies conducted in shake flasks demonstrated that the high concentrations of 2,4-DNT resulted in an inhibition of 2,6-DNT degradation. The impact of 2,4-DNT on 2,6-DNT degradation required a dual-stage approach to achieve complete treatment of both contaminants. Operating two reactors in series, where 2,4-DNT was degraded in the first reactor and 2,6-DNT was degraded in the second reactor, allowed for stable draw-and-fill operation. High nitrite concentrations resulting from 2,4-DNT degradation in the first reactor had no apparent impact on subsequent 2,6-DNT degradation.