The fate of 2,4,6-trinitrotoluene (TNT) and TNT transformation products in two aerobic enrichment cultures was investigated. Contaminant fate was assessed through analysis of TNT and its oxygen-stable aminated derivatives using capillary electrophoresis and by tracking the distribution of 14C-labeled products in either the dissolved, mineralized, or biomass fractions. TNT transformation products were generated by reduction with Fe(0), reduction by S2−, and transformation by Clostridium acetobutylicum and by Eichornia crassipies (water hyacinth). Enrichment cultures varied in the growth substrate and nitrogen source supplied. The dextrose-fed mixed culture (DMC) was enriched on dextrose with yeast extract providing nitrogen for growth, whereas the anthranilic acid-fed mixed culture (AMC) received anthranilic acid as its source of both energy and nitrogen. Each culture transformed TNT, but their product distributions varied. The DMC exhibited higher levels of biomass association, whereas the AMC produced higher levels of aminated nitrotoluenes and unidentified water-soluble products. Neither mineralized TNT to a significant degree. TNT disappearance was observed in all transformation systems, along with the formation of water-soluble products; however, formation of aminated nitrotoluenes was observed only in the sulfide systems. Neither aerobic culture was capable of mineralizing the TNT transformation products introduced, regardless of the transformation method used to prepare them. The distribution of products between the aqueous phase and the biomass did vary between cultures and was affected by the transformation system used.