In field studies and remediation projects, contaminants persist in soil and sediment much longer than would be estimated based on contaminant physical and chemical properties; such observations indicate that a fraction of contaminants in soil/sediment is much less available to the degrading microorganisms or chemical reagents. Many researchers attribute this reduced availability/bioavailability to the sequestration (also referred to as resistant desorption or desorption hysteresis) of contaminants in soil/sediment. In the present research, desorption and bioavailability of naphthalene, phenanthrene, and fluoranthene were studied to evaluate the impact of sequestration on the biodegradability of these three polycyclic aromatic hydrocarbons (PAHs). Experimental results indicate that only desorbed PAHs are bioavailable and that the bioavailability of sequestered PAHs could be well predicted with a modified bioavailability model, which uses a biphasic desorption model to replace the conventional adsorption/desorption model. Findings in the present study might have important implications for site remediation: After the initial stage of remediation (i.e., after the readily desorbable fraction of contaminants is removed from soil/sediment), desorption of sequestered contaminants becomes the rate-limiting step of remediation. In this stage, the availability of contaminants is so low that even aggressive remediation would have little effect on overall mass reduction. Thus, a more cost-effective approach for site remediation might consist of an initial aggressive treatment followed by plume control, such as monitored natural attenuation.