The uptake of organic pollutants by plants is an important process for the exposure of humans to toxic chemicals. The objective of this study was to calibrate the parameters of a common plant uptake model by comparison to experimental results from literature. Radish was grown in contaminated soil (maximum concentration 2.9 mg/kg dw) and control plot. Uptake of HCHs, HCB, PCBs and DDT plus metabolites was studied (log Kow 3.66 to 7.18). Measured BCF roots-to-soil were near 1 g/g dw on the control plot and about factor 10 lower for the contaminated soil. With default data set, uptake into roots of most substances was under predicted up to factor 100. The use of site-specific data improved the predictions. Consideration of uptake from air into radish bulbs was relevant for PCBs. Measured BCF shoots ranged from <0.1 to >10 g/g dw and were much better predicted by the standard model. The results with default data and site-specific data were similar. Deposition from air was the major uptake mechanism into shoots. Transport from soil with resuspended particles was only relevant for the contaminated plot. The calculation results (in dry weight) were most sensitive to changes of the water content of plant tissue.