Gas chromatographic (GC) techniques are used to determine solution enthalpies, $\Delta H_{\text{Sol}}$, for a series of nitroaromatic explosives and explosive degradation products. Five commercially available GC stationary phases were evaluated with 13 nitroaromatic compounds, including including nitrobenzene, 2-nitrotoluene, 3-nitrotoluene, 4-nitrotoluene, 1,2-dinitrobenzene, 1,3-dinitrobenzene, 1,4-dinitrobenzene, 2,4-dinitrotoluene, 2,6-dinitrotoluene, 3,4-dinitrotoluene, 3,5-dinitrotoluene, 1,3,5-trinitrobenzene and 2,4,6-trinitrotoluene. To facilitate development of a predictive model, the $\Delta H_{\text{Sol}}$ of several $n$-alkanes were also determined as well as the Kováts retention indices for both the nitroaromatics and $n$-alkanes. Using the experimental data, various empirical correlations were attempted to describe the measured $\Delta H_{\text{Sol}}$ of nitroaromatic compounds including linear solvation energy relationships. Both solute and solvent descriptors were evaluated; however, the explosive-polymer systems were best described modeling relative molecular mass (RMM) of the explosives with the McReynolds constants for each of the respectively stationary phases. The described model serves as a first order approximation for predicting $\Delta H_{\text{Sol}}$ on polymer surfaces.