The thermal stability of kerosene-based rocket fuels such as RP-2 is important because the fuel also serves as a coolant in many modern rocket engines. Prior to combustion, the fuel circulates through channels in the wall of the thrust chamber. In this way, it carries heat away from the wall and maintains a safe wall temperature. This process, commonly referred to as regenerative cooling, exposes the fuel to high temperatures, which can lead to coking and engine failure. For this reason, it is important to understand the thermal stability of RP-2 and, if possible, to improve its thermal stability. The objective of this work was to identify compositional changes that could improve the thermal stability of RP-2. For this study, we tested the effect of alkane concentration on the thermal stability of the RP-2 sample known as 08POSF5433. The proportion of linear, branched, or cyclic alkanes in the RP-2 was increased by mixing RP-2 with 25 % percent of one of the following alkanes: n-dodecane, n-tetradecane, 4-methylldodecane, 2,6,10-trimethylldodecane, or 1,3,5-triisopropylcyclohexane. These mixtures were thermally stressed in stainless steel ampoule reactors at 400 °C for up to 4 hours. All of the reactions were run with an approximate initial pressure of 5000 psi (34.5 MPa). After each reaction the extent of decomposition was determined by analyzing the remaining liquid phase by gas chromatography. The “global” kinetics of decomposition was determined by monitoring the increase in a suite of light decomposition products as a function of time. These data were used to derive pseudo-first-order rate constants that approximate the overall decomposition rate of the mixture. Simultaneously, the decomposition kinetics of the added alkane was monitored by gas chromatography. We did observe significant differences in the thermal stability of the added alkanes, but we did not observe significant differences in the global stability of the fuel mixtures.