The autoignition and oxidation behavior of CH$_4$/H$_2$S mixtures has been studied experimentally in a rapid compression machine (RCM) and a high-pressure flow reactor. The RCM measurements show that the addition of 1% H$_2$S to methane reduces the autoignition delay time by a factor of 2 at pressures ranging from 30 to 80 bar and temperatures from 930 to 1050 K. The flow reactor experiments performed at 50 bar show that, for stoichiometric conditions, a large fraction of H$_2$S is already consumed at 600 K, while temperatures above 750 K are needed to oxidize 10% methane. A detailed chemical kinetic model has been established, describing the oxidation of CH$_4$ and H$_2$S as well as the formation and consumption of organo sulfenic species. Computations with the model show good agreement with the ignition measurements, provided that reactions of H$_2$S and SH with peroxides (HO$_2$ and CH$_3$OO) are constrained. A comparison of the flow reactor data to modeling predictions shows satisfactory agreement under stoichiometric conditions, while at very reducing conditions, the model underestimates the consumption of both H$_2$S and CH$_4$. Similar to the RCM experiments, the presence of H$_2$S is predicted to promote oxidation of methane. Analysis of the calculations indicates a significant interaction between the oxidation chemistry of H$_2$S and CH$_4$, but this chemistry is not well understood at present. More work is desirable on the reactions of H$_2$S and SH with peroxides (HO$_2$ and CH$_3$OO) and the formation and consumption of organosulfenic compounds.