Arousals caused by external stimuli during human sleep have been studied for most of the sensorial systems. It could be shown that a pure nasal trigeminal stimulus leads to arousals during sleep. The frequency of arousals increases dependent on the stimulus concentration. The aim of the study was to evaluate the influence of different stimulus durations on arousal frequency during different sleep stages. Ten young healthy volunteers with 20 nights of polysomnography were included in the study. Pure trigeminal stimulation with both different concentrations of CO2 (0, 10, 20, 40% v/v) and different stimulus durations (1, 3, 5, and 10 s) were applied during different sleep stages to the volunteers using an olfactometer. The application was performed during different sleep stages (light sleep, deep sleep, REM sleep). The number of arousals increased with rising stimulus duration and stimulus concentration during each sleep stage. Trigeminal stimuli during sleep led to arousals in dose- and time-dependent manner.