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Inhaled irritants can cause respiratory depression by stimulating trigeminal nerves in the nasal cavity. This decrease in inhalation rate results in a decrease in the rate of the irritant gases flowing to the stimulated nerves, creating a complex feedback response. Previously, a model was created to describe how the presence of formaldehyde affects respiration in the rat. This ordinary differential equation model incorporated a model of the physiology of the upper respiratory tract of the rat and a model of the neurological control of the respiration rate due to signaling from the stimulated nerves in the nasal cavity. However, an optimal fit to data was not fully established. In the current study, the fit of the previously established model is re-evaluated while incorporating the recovery of the ventilation rate after the end of exposure. Additionally, the dose-dependence of the adaptation time allowed by the previous model is more fully quantified, and the updated model predicts formaldehyde data well. The results of the previous study are improved and the model is more appropriate to translate to other irritants. (Received September 20, 2011)