This work considers secure downlink transmission in indoor multiple-input, single-output visible-light communication (VLC) links. In particular, we study the design of transmit beamformers that maximize the achievable secrecy rate subject to amplitude constraints imposed by the limited dynamic range of the light-emitting diodes (LEDs). Such constraints render the design problem nonconvex and difficult to solve. We show, however, that this nonconvex problem can be transformed into a solvable quasiconvex line search problem. We also consider the more realistic case of imperfect channel information regarding the receiver's and eavesdropper's links. We tackle the worst-case secrecy rate maximization problem, again subject to amplitude constraints. In our treatment, uncertainty in the receiver's channel is due to limited feedback, and is modeled by spherical sets. On the other hand, there is no feedback from the eavesdropper, and the transmitter shall utilize the line-of-sight channel gain equation to map the eavesdropper's nominal location and orientation into an estimate of the channel gain. Thus, we derive uncertainty sets based on inaccurate information regarding the eavesdropper's location and orientation, as well as the emission pattern of the LEDs. We also consider channel mismatches caused by the uncertain non-line-of-sight components. We provide numerical examples to demonstrate the performance gain of the optimal beamformer compared with the suboptimal schemes, and the robust beamformer compared with its nonrobust counterparts. We also evaluate the worst-case secrecy rate performance of the robust beamformer in a typical VLC scenario along with the aforementioned uncertainty sources.