Supporting information

**Fig S1** (a) Transfer curve of monolayer WSe$_2$ before and after step by step ozone exposure. At each exposure step, the device was illuminated with UV light for 1 minute and left in the chamber for 10 minutes to allow ozone molecules to adsorb on the surface. Transfer curves of monolayer (b) and multilayer (c) MoSe$_2$ before and after ozone exposure.

**Fig S2** Transfer curves of air-exposed monolayer (a), bilayer (b) and multilayer (c) WSe$_2$ devices after annealing at progressively increasing temperatures for 10 minutes.
Fig S3. Transfer curves of monolayer (a), bilayer (b) and multilayer (c) WSe$_2$ before and after progressive ozone exposure with varying conditions. The m-n indicates that the device were first UV-illuminated for m minutes and then kept in the chamber for n minutes. Long-term exposure results in irreversible degradation of the device. The degradation is most likely due to surface oxidation as recently reported by Yamamoto et al.$^{23}$.

Fig S4. Conductance of a trilayer WSe$_2$ device after multiple cycle of ozone exposure and annealing. The device was annealed at 150 °C for 10 minutes to remove adsorbed ozone.