ABSTRACT/PRESENTATION:
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Physicochemical and Toxicological Characterization of Electronic Nicotine Delivery Systems

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BACKGROUND

We evaluated the physicochemical and toxicological properties of emissions from a variety of electronic nicotine delivery systems (ENDS). We employed a puff generating system capable of operating pod and tank devices that was placed inside a 5m3 exposure chamber operating at an air exchange rate of 3 ACH. To examine the hypothesis that aged heating coils shed more toxic metal particles than new coils, we tested devices at multiple age states including new (the first 25 puffs for a coil), broken-in (puffs 101-125) and aged (puffs 201-250). For tank devices, we performed experiments at both the low- and high-end of the recommended power range for each type of coil, and for pod devices, we supplied power equivalent to a fully charged battery (although this power setting was always lower than all tank devices). We used a neutral flavor of e-liquid and generated puffs 3.5s in duration and 50mL in volume. ENDS emissions were diluted in a 1L buffer chamber by a clean dilution flow of 1-3 LPM. We collected samples for toxicological evaluation using 20-30m condensation tubes with a sample flow of 1 LPM. The remaining buffer chamber flow was vented into the exposure chamber, and we measured fine- and ultrafine-mode particle concentration and size distribution in exposure chamber air to simulate second-hand exposure characteristics. The total mass of particles emitted per puff was higher for high-power experiments, but the size distribution for low-power experiments consisted of larger particles. Consequently, the collection efficiency of the condensation tubes was higher for low-power experiments. Human airway epithelial cells exposed to ENDS emissions exhibited increased oxidative stress, increased single stranded DNA damage, and reduced cellular viability. For oxidative stress measures, there were modestly higher results for aged devices, but for DNA damage and cellular viability, results were significantly more pronounced for aged devices.