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Ozone reaction with human surfaces: Influences of surface reaction probability and indoor air flow condition

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1 **Ozone reaction with human surfaces: influences of surface reaction**
2 **probability and indoor air flow condition**

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11 **Abstract**

12 It is well-established that indoor surfaces, such as building materials, act as a sink for indoor
13 ozone. However, comparatively little research has been done regarding ozone reactions with
14 human surfaces such as skin and clothing. Reaction characteristics of human surfaces and airflow
15 around the human body may affect ozone removal and reaction byproduct formation. The
16 objective of this study is to investigate effects of the reactivity of human surfaces, modeled for a
17 range of reaction probabilities (γ), on ozone deposition and reaction byproduct formation.
18 Computational fluid dynamics models are verified and validated with previously published
19 studies, and used to analyze ozone reaction dynamics due to human surfaces under varying
20 indoor air flow conditions. The results show that for indoor environments with air exchange rate
21 $< 5 \text{ h}^{-1}$, ozone deposition velocity is in the range of 8-10 m/h for human skin oil while it is 2-3
22 m/h for clean clothing. Surface reactivity of the human body has a larger influence on the ozone
23 deposition velocity than do the air exchange rates or indoor airflow patterns. Modeled emission
24 rates of major reaction byproducts from ozone chemistry with human surfaces included acetone
25 (0.3 mg/h/person), decanal (0.2 mg/h/person), nonanal (0.1 mg/h/person) and 6-MHO (0.1
26 mg/h/person) for a transport-limited scenario with 90 ppb bulk ozone concentration. These
27 results imply that exposures to indoor ozone and reaction byproducts can be meaningfully
28 modulated by an interaction of building airflow and chemistry occurring on and around
29 individuals, and should be considered in models of human exposure.

30 **Keywords:** deposition velocity, transport-limited rate, indoor chemistry, skin oil, clothing, ozone
31 reaction byproducts

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