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## The possible role of contact current in cancer risk associated with residential magnetic fields.

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Residential electrical wiring safety practices in the US result in the possibility of a small voltage (up to a few tenths of a volt) on appliance surfaces with respect to water pipes or other grounded surfaces. This "open circuit voltage" (V(OC)) will cause "contact current" to flow in a person who touches the appliance and completes an electrical circuit to ground. This paper presents data suggesting that contact current due to V(OC) is an exposure that may explain the reported associations of residential magnetic fields with childhood leukemia. Our analysis is based on a computer model of a 40 house (single-unit, detached dwelling) neighborhood with electrical service that is representative of US grounding practices. The analysis was motivated by recent research suggesting that the physical location of power lines in the backyard, in contrast to the street, may be relevant to a relationship of power lines with childhood leukemia. In the model, the highest magnetic field levels and V(OC)s were both associated with backyard lines, and the highest V(OC)s were also associated with long ground paths in the residence. Across the entire neighborhood, magnetic field exposure was highly correlated with V(OC) ( $r = 0.93$ ). Dosimetric modeling indicates that, compared to a very high residential level of a uniform horizontal magnetic field (10  $\mu\text{T}$ ) or a vertical electric field (100  $\text{V/m}$ ), a modest level of contact current (approximately 18  $\mu\text{A}$ ) leads to considerably greater induced electric fields ( $> 1 \text{ mV/m}$ ) averaged across tissue, such as bone marrow and heart. The correlation of V(OC) with magnetic fields in the model, combined with the dose estimates, lead us to conclude that V(OC) is a potentially important exposure with respect to childhood leukemia risks associated with residential magnetic fields. These findings, nonetheless, may not apply to residential service used in

several European countries or to the Scandinavian studies concerned with populations exposed to magnetic fields from overhead transmission lines.  
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