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Insight in Exposure Patterns to Lead Using Water Demand, Hydraulic and Water Quality Modelling

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Chronic exposure to lead is associated with a wide array of adverse health effects, in particular in children. Part of the aggregated exposure to lead may originate from the consumption of tap water. Despite the implementation of increasingly stricter regulations, especially at child-dense locations (RIVM), lead contamination of drinking water remains a potential health risk. In order to prevent adverse health effects in children resulting from this exposure pathway it is imperative to understand the extent of exposures. This research aimed to characterize the exposures of children to lead via drinking water in childcare centres.

Following an interview at the childcare centres, their water usage habits were understood. The outcomes of this interview were used to fine-tune the input parameters of SIMDEUM which then generated synthetic water demand patterns. A premise plumbing model was designed on EPANET based on an architectural plan of the childcare centre. Water demand patterns synthesized by SIMDEUM were added to consumption points and a few pipes were chosen as sources of lead (for example, immediately following the service line or just before a tap). Thereafter, a hydraulic and water quality simulation model allowed for estimation of dissolved lead concentrations at the tap. The resulting concentrations were combined with the US EPA IEUBK model to estimate blood lead levels. This was then input for a (tentative) risk assessment informing on the need for potential mitigation measures.

Follow-up research will focus on the refinement and validation of the model for lead and potentially other metals related to exposures via the indoor water distribution system.

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