Health Impacts of Consumer Exposure During Product Use: Near Field Exposure Applied to Risk Assessment and LCA

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ability to determine mass used. We found a) 63% of personal care products and 87% of the household care products had readable barcodes with 47% and 41% having sufficient data for product identification, respectively and b) the amount used could be determined most of the time. We attached motion sensors to the two cleaning products the participant cited as the most frequently used as an alternative method to record product use. Fourth, we conducted home walkthroughs to determine furnishings, discussing the furnishings with the participant, allowing us to gain insight to the typical level of knowledge homeowners had on product materials, ages, and treatments. We will provide lessons learned from this effort, insights on the optimal data collection platforms, and needed frequency of collection.

Keywords: A-activity patterns, A-exposure factors, C-consumer products, B-pesticides

We-S-A2: Integration of Life Cycle Assessment (LCA) and Risk Assessment

We-S-A2-01
Life-Cycle inventory/impact Assessment in the context of Chemical Risk Assessment: An Informatics-driven Scoping Review

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Abstract: One of the goals of Life-Cycle Assessment (LCA) is to compare the full range of environmental effects assignable to products and services in order to improve processes, support policy and provide a sound “systems-thinking” basis for decision support. How in fact LCA can be incorporated into chemical risk assessment (CRA) and management/decision support is not as clear, although it is widely anticipated to function symbiotically and provide comprehensive rigor in CRA. Aside from a brief history on how the two disciplines evolved and overlap, in this presentation we will provide an informatics driven scoping review and bibliometric analysis of the entire corpus of literature related to the overlap of LCA/CRA including, but not limited to; visualization of key themes, available and accessible data, information, modeling gaps and chemical space thus far explored in pre-existing literature into a concise overview. We will identify new data-streams, proxies and models to support the initiative of re-contextualizing or tailoring LCA to chemical risk assessment from both a source-to-exposure (receptor) and exposure (receptor)-to tissue dose -adverse outcome pathway context to identify key elements in supporting "screening-level" methods, and translate CRA into an LCA setting. [Disclaimer: The views expressed in this abstract are those of the authors and do not necessarily reflect the views or policies of the U.S. Environmental Protection Agency]

Keywords: A-life cycle analysis, A-risk assessment, Scoping Reviews

We-S-A2-02
Health Impacts of Consumer Exposure During Product Use: Near Field Exposure Applied to Risk Assessment and LCA

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Abstract: Both Risk Assessment (RA) and Life Cycle Assessment (LCA) constitute potential approaches to quantify exposure to consumer products. RA is primarily chemical focused, one chemical being used in numerous consumer products used in very different ways. LCA, in contrast, is product-oriented and usually considers a well-defined application, which a priori makes it well suited to assess chemicals embedded in products. Despite this, LCA paradoxically has often neglected exposures occurring during the use stage and has primarily focused on exposures to outdoor emissions. Thus, there is a need to extend LCA and RA practice and develop appropriate metrics for assessing direct use stage exposure. We first propose a systematic ontology of exposure to relate the product classification within the ACToR and Household Product databases to exposure models, looking at the mode of application and the environment in which each product is used. We then introduce the product intake fraction - the fraction of a chemical in a product that is eventually taken in by the exposed human population, e.g. the product user(s) - as a measure to consistently and transparently quantify human exposure to chemicals in consumer products. The product intake fraction is both LCA and RA compatible: it may be used to estimate average exposure to consumer product chemicals (e.g. phthalates in children’s mouthing toys) and it also may be used to back-calculate maximum allowable concentrations of substances inside products (e.g. dermally applied parabens in cosmetics). We finally discuss which method of RA and LCA is best adapted to which application. We show how the use of sentinel products and of plausible

ranges in concentrations derived from chemical function within a product, may be used to assess use stage-related product exposure.

Keywords: A-chemical prioritization, A-exposure models, A-life cycle analysis, A-risk assessment, C-consumer products

We-S-A2-03
Framework on Life Cycle Impact Assessment for Indoor Emissions of Engineered Nanoparticles, Part 1: Exposure and Uptake
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Abstract: The growing use of engineered nanoparticles in consumer products may pose a potential risk to human health based on initial results from toxicity studies. A primary group that will be affected by these materials is the workers involved in the manufacture of either the nanocomponents or the products incorporating them. The inclusion of indoor health risks in life cycle impact assessment methods is still relatively new and has first focused on evaluating exposure to gases using a one-box version of the USEtox model. Further enhancements to this approach are discussed for the purpose of introducing worker health as an impact category when applying life cycle assessment to consumer nanoproducts. Initial modeling results have focused on the exposure and uptake of nanomaterials in the absence of consensus effects data. Preliminary impact calculations are demonstrated using interim characterization factors derived from a literature review of exposure and toxicity studies. A key challenge when modeling nanomaterials is the need to reconcile the use of various concentration units (surface area, particle number, mass, etc.) in reported toxicity and exposure studies.

Keywords: A-nanotechnology, A-indoor environment, A-life cycle analysis, A-risk assessment, A-workplace

We-S-A2-04
Use of Disability Adjusted Life Years (DALYs) in Integration of Life Cycle Assessment (LCA) and Quantitative Microbial Risk Assessment (QMRA): Sydney Replacement Flows Project
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Abstract: Life cycle assessment (LCA) and quantitative microbial risk assessment (QMRA) are commonly used to evaluate human health impacts from the production of goods or services. However, given their very different approaches and coverage of issues, the two methods may yield contradictory results. Here we describe key differences based on health risks for separate analyses and for combining LCA and QMRA through the use of the common health metric, the disability adjusted life years (DALYs) in order to achieve a more holistic environmental assessment of human health impacts. As a part of the Western Sydney Recycled Water Initiative, the Sydney Replacement Flows Project (RFP) is providing some of the required environmental flow in the Hawkesbury-Nepean River with reclaimed wastewater to secure Sydney's water needs. We undertook LCA to assess human health impacts associated with energy and chemicals used in the associated water and wastewater treatment plants and QMRA to address waterborne pathogen risks for two scenarios: with and without RFP. The results of LCA and QMRA were then combined using the common metric, DALYs. The assumptions used behind DALY value derivations and potential obstacles in merging the results of LCA and QHRA will be discussed. Based on the supply chain-associated risk, the LCA results for the "With RFP" scenario yielded more DALYs than "Without RFP" scenario, whereas the direct human exposure QMRA results with reference pathogens (viral, bacterial and parasitic protozoan) indicated that the RFP would yield less DALY impact than the "Without RFP" scenario. Hence, given the different hazards evaluated by the two approaches, the importance of utilizing both LCA and QMRA aspects in comparative health assessments helps to avoid problem shifting and together provides a more holistic assessment.

Keywords: A-life cycle analysis, A-risk assessment, Disability adjusted life years (DALYs), B-microbial agents, C-water