

Alternatives Assessment: Searching for Safer Alternatives to Perfluorinated Chemicals

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What is alternatives assessment?

“A process for identifying, comparing, and selecting safer alternatives to chemicals of concern on the basis of their hazards, comparative exposure, performance, and economic viability”

- GOAL: To facilitate *an informed consideration* of the advantages and disadvantages of alternatives to a chemical of concern in order to guide substitution and product design decisions

National Research Council Report (2014)

<https://www.nap.edu/catalog/18872/a-framework-to-guide-selection-of-chemical-alternatives>

Focus of Alternatives Assessment

- Alternatives assessment is a step-defined, action-oriented process
- Focus on function not the particular chemical
 - Focus on “intrinsic impact reduction”
 - Considers the “necessariness” of a chemical
- Finding a safer alternative and getting industry to adopt the use of it are not the same thing.
- In some cases, safer, feasible alternatives may not exist and need to be developed

Functional Substitution – A way to think about chemical problems

Table 1. Functional Substitution for Chemicals in Products, Chemicals in Processes

Functional Substitution Level	Chemical in Product Bisphenol-a in Thermal Paper	Chemical in Process Methylene Chloride in Degreasing Metal Parts
Chemical Function (Chemical Change)	Is there a functionally equivalent chemical substitute (i.e., chemical developer)? Result: Drop-in chemical replacement	Is there a functionally equivalent chemical substitute (i.e., chlorinated solvent degreaser)? Result: Drop-in chemical replacement
End Use Function (Material, Product, Process Change)	Is there another means to achieve the function of the chemical in the product (i.e., creation of printed image)? Result: Redesign of thermal paper, material changes	Is there another means to achieve the function of the process (i.e., degreasing)? Result: Redesign of the process (e.g., ultrasonic, aqueous)
Function As Service (System Change)	Are cash register receipts necessary? Are there alternatives that could achieve the same purpose (i.e. providing a record of sale to a consumer)? Result: Alternative printing systems (e.g., electronic receipts)	Is degreasing metal parts necessary? Are there other alternatives that could achieve the same purpose (i.e., providing metal parts free of contaminants for other end uses)? Result: Alternative metal cutting methods

Tickner, et al, Environmental Science and Technology, 2014

Challenge for Perfluorinated Compounds

- ▶ A unique and very functional chemistry/set of materials used in a range of applications
- ▶ Substitutes may not have equivalent functionality and may impact other sustainability criteria
- ▶ Structurally similar substitutes may present similar or different hazards
- ▶ Rethinking functional needs/requirements and chemistry/material choices for different applications necessary.
- ▶ It will require new supply chain collaborations

GC3: Bridging the Supply Chain to Advance Green Chemistry Innovation

GC3

Green chemistry ideas & technology options



Green chemistry market requirements & desires



* Established companies & startups

What is the Green Chemistry and Commerce Council (GC3)?

- A cross-sectoral, business-to-business network
- Work collaboratively to accelerate the application of green chemistry across industry sectors and supply chains

Mission: To make green chemistry standard practice – **Mainstream** - in industry, for innovation, public health, and environmental protection

Started in 2005



120 members across sectors and value chain



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