CHAPTER 5

Conclusions

Reducing the chemical footprint of plastics is a significant challenge. Starting from their feedstock base of fossil fuels, CoHCs litter the plastics pathway from primary chemicals to intermediates to monomer to final product compounded with additives. Exposure to a wide array of CoHCs during manufacturing, usage, and disposal poses a significant risk to the health of workers, communities, and the global environment. Reducing CoHCs in manufacturing will improve the health and safety of workers and communities, both by reducing the number of hazardous chemicals and their overall volume. In addition, safer chemicals and materials can generate innovative new markets for companies, workers, and communities alike.

It is important to note that the Plastics Scorecard v1.0 did not address the thorny issue of comparing feedstocks. Potential questions in this arena, for example, could include: is polystyrene derived from the Alberta tar sands preferable or not to PLA derived from genetically modified (GM) corn? The reality is that fossil fuel-based plastics largely get a pass on the feedstock question, with few people asking did that crude oil come from Alberta, Nigeria, Texas, Venezuela, or Saudi Arabia. Comparing fossil fuel feedstocks in terms of their chemical footprints to PLA derived from GM corn clearly opens a significant topic for further research.

In Measuring Progress to Safer Chemicals in Polymer Manufacturing the Plastics Scorecard v1.0 clearly illustrates the lack of polymers based

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on green chemistry, and thereby the need for new, greener chemistries like PLA. The fossil fuel based chemistries of the 20th century rest largely upon CoHCs, and their dominance and scale in the global plastics economy makes them very difficult to displace.

In terms of the chemicals in products, additives are the key driver affecting the Chemical Footprint of Plastic Products. Residing in the product in the greatest concentrations beyond the polymer, additives dictate the concentration of CoHCs in plastic products. Companies are reducing CoHCs in plastic products by eliminating the need for the additive, changing additives, or changing polymers to avoid the need for the additive in the first place.

The chemical footprints of IV bags and electronic enclosures clearly demonstrate that material designers and purchasers can select alternative products that avoid most CoHCs and can document that progress. Plastic markets are shifting more quickly to safer additive packages because that is the often the easiest route to reducing the chemical footprint of a plastic product. Witness the PVC industry's recent plans to eliminate the use of lead and cadmium stabilizers, certain phthalates like DEHP, and BPA. Reducing the use of CoHCs in plastics is good news, but as the Progress to Safer Chemicals in Manufacturing component of the Plastics Scorecard illustrates, safer additive packages on their own do not reduce the hazards of polymer manufacturing.

Among the challenges of effectively evaluating the hazards of additives include the absence of relevant publically available data for the various additive chemistries. As companies move away from well-known CoHCs it will drive down the percentage of CoHCs in products. What will remain are questions around the chemicals used in manufacturing, the hazard profiles of the alternative additives, as well as the levels of residual monomers like BPA and residual catalysts in final products. The knowledge gaps on chemicals in additive packages will become increasingly significant along with the necessity for full hazard assessments of the substitutes. Additives are another area ripe for research and green chemistry solutions.

Manufacturers and purchasers are making progress on the pathway to safer chemicals in plastics. From polymer manufacturing to final products, safer chemical use is growing. That said, much progress is still to be achieved. The plastics economy, from cradle to grave, remains largely based on CoHCs. The Plastics Scorecard v1.0 presents a novel method for evaluating the chemical footprint of plastics, selecting safer alternatives, and measuring progress away from CoHCs. Version 1.0 supports the design, production, and selection of safer and healthier plastics.

The goals of the Plastics Scorecard are to inform the selection of safer plastics by businesses and catalyze manufacturers to reduce the number and volume of CoHCs in manufacturing processes and products. Truly achieving these goals will require:

- Knowing all the chemical constituents in a compounded plastic product.
- Knowing whether chemicals of high concern (CoHCs) are used in manufacturing or contained in the final product.
- Prioritizing CoHCs for avoidance or substitution.
- Selecting safer alternatives.
- Continuous improvement—reducing the number and volume of CoHCs over time.

The overarching philosophy that underpins v1.0 is that the optimum route to addressing the life cycle concerns of chemicals in plastics is to use inherently safer chemicals in manufacturing and in products, thereby eliminating concerns surrounding CoHCs in manufacturing, usage, and end of life management of plastics. Hazardous chemicals in plastics create legacy issues that block closed loop systems. To effectively close the loop plastics need safer chemical inputs. Polymers are a bedrock of nature and the human economy—now the challenge is making plastics that are safer for humanity and the environment.