Chasing Hazards: Toxicity, Sustainability, and the Hazard Paradox

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Despite the fits and starts of the U.S. economy over the last twenty-five years, consumer demand for "greener," "safer," more "sustainable" products and services has grown from a small, niche market, to a potential market driver for many companies. "Environmental branding" promises something for every stakeholder niche. Enterprising manufacturers and retailers see the opportunity for market differentiation and premium pricing. Government regulators see opportunities to incentivize behavioral change that would be impossible to mandate under current resource constraints and statutory authorities. Environmental nongovernmental organizations (ENGOs) see opportunities, using the Internet, press, and social media, to drive consumers, retailers, and ultimately, manufacturers away from disfavored products and technologies and toward those deemed "preferable."

But while these divergent stakeholder groups may share enthusiasm for environmental branding in the abstract, they are far from agreement on which environmental attributes matter and how they should be measured and weighted in practice. That needs to change. If environmental branding is to retain its credibility as a positive market signal for environmental progress, stakeholders will need to create a common lexicon to define, value, and measure the desirable attributes of next-generation products and services.

This new paradigm must do more than just review product and service inputs against a list of disfavored chemicals or materials. Hazard analysis may offer useful data points as part of a more detailed risk assessment, but it cannot answer the more complex questions of relative risk and opportunity needed to optimize industrial, commercial, and consumer value chains.

How, then, do we move from a product regulatory paradigm obsessed with chasing theoretical hazards to one that drives improved health, environmental, and social performance? First, policy makers and stakeholders need to agree on the interdependence of financial performance and long-term product and service stewardship. If, as EPA has proclaimed, "business success today means not just a healthy bottom line, but a healthy triple bottom line that takes financial, social, and environmental performance into consideration," the converse must also be true: A healthy triple bottom line needs to allow for business success. *See* EPA, *Smart Steps to Sustainability: A Guide to Greening Your Small Business*, EPA/180/B-09/001 (2009) www.epa.gov/osbp/pdfs/smart_steps_greening_guide_042101.pdf.

Second, focus on the product attributes and market outcomes society wants, not just the ones that are easiest to measure. The new paradigm should capture the multiplicity of positive and negative environmental impacts from modern commerce and translate these into metrics that consumers, businesses, and regulators understand. Policy makers and stakeholders need to define what success would look like in terms of product, industry, and market evolution.

Take product safety. Before World War II, common-law tort remedies and local safety ordinances constituted the main government mechanisms for regulating the safety of products and services. During the late 1930s and 1940s, federal law assumed a more prominent role in certain high-risk product sectors, exemplified by passage of the Federal Food Drug and Cosmetic Act of 1938 (FFDCA), and later the Federal Insecticide Fungicide and Rodenticide Act of 1947 (FIFRA). Federal product regulatory law continued to expand in scope during the 1970s, with the passage of the Toxic Substances Control Act (TSCA), the Consumer Product Safety Act (CPSA), the Safe Drinking Water Act, and expansions to FIFRA and the FFDCA. Today, most consumers take it for granted that government regulators are monitoring the marketplace to ensure that the food, drugs, consumer products, services, and industries that make up the domestic economy are "safe."

Yet to many stakeholders, the current federal legislative framework has failed. Consumer activists, ENGOs, and some state legislatures have been particularly critical. Frustrated with the lack of progress in addressing the weaknesses of the federal system, these stakeholders have looked to state and quasigovernmental product standards for protection they see lacking in federal regulatory standards. At the state level, California has been a leader with its twenty-five-year-old Proposition 65 hazard labeling program and, more recently, with its unfolding Safer Consumer Product Regulation. EPA's Design for the Environment (DfE) labeling program, Clean Product Action's GreenScreen scoring system, and GreenBlue's CleanGredients database, and the recently announced Chemical Foot Print Project are prominent examples of an ever-expanding field of voluntary product standards. These and many other leading state and voluntary product standards share a common characteristic—the reliance on *hazard analysis* rather than *risk analysis* to assess "product safety."

The allure of hazard-based regulation is understandable. Risk-based regulation is complex, costly, and time-consuming, requiring collection of both product hazard and exposure data. Even when both hazard and exposure data are plentiful, translating risk data into sound, coherent, and defensible risk-based chemical-control policies is difficult. Indeed, one of the most commonly cited examples of failed risk-based regulation is EPA's ill-fated effort to ban asbestos, a known carcinogen, during the late 1980s. As the story goes, despite a ten-year rulemaking process that generated more than 10,000 pages of

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documentation regarding the risks associated with asbestos use, the Fifth Circuit concluded, in *Corrosion Proof Fittings v. EPA*, 947 F.2d 1201 (5th Cir. 1991), that EPA had failed to meet its regulatory burden under TSCA in selecting a comprehensive ban as the least burdensome alternative for managing asbestos risks. The merit and inherent legal significance of *Corrosion Proof Fittings* remain controversial to this day, but few dispute the chilling effect the case had on the next two decades of federal chemical control policy.

Risk-based product regulation is also difficult from a communication and messaging standpoint. Another common critique of contemporary federal chemical policy is that EPA has imposed complete bans on only five substances over thirty-eight years, drawing on a common but questionable assumption that the only way to manage the risk from hazardous substances in products is to proscribe their use entirely. It is a faulty assumption, as anyone who has relied on life-saving pharmaceuticals will attest. A foundation of modern toxicology is the axiom that the dose makes the poison, and both federal drug policy and pesticide policy are designed to harness the health and economic benefits of biologically active and potentially toxic substances while managing the health and environmental risks through careful attention to dose and exposure. Risk-based product regulation also requires consideration of the comparative risks associated with the substances, products, or behaviors that would replace a product or substance. As the Court stated in *Corrosion Proof Fittings*, "a death is a death, whether occasioned by asbestos or by a toxic substitute product." 947 F.2d at 1221. That may be true, but what makes for pithy legal reasoning does not always make for good marketing copy. Twenty five years after *Corrosion Proof Fittings*, few, if any, manufacturers or retailers have taken up the catchphrase "a death is a death" to explain comparative risk on their product labels.

Given the technical, political, and optics challenges associated with using risk-based methods to assess the tens of thousands of substances in the marketplace, most state regulators and voluntary certification programs have eschewed product-by-product, use-by-use risk analysis in evaluating and regulating products. Instead, most current "safer" branding systems rely on a simple, but flawed assumption that the safety of a product is a function of the ingredients on the label and nothing more. That may sound reassuring, but it offers a dangerously oversimplified view of how commercial products and services affect our health and the environment. If all other things were equal, who would not want to reduce the use of hazardous substances in commerce? The problem is that other things are rarely equal.

Consider the light bulb. In 2012, the Department of Energy (DOE) conducted an analysis of the life-cycle environmental and resource costs in the manufacture, transport, use, and disposal of light-emitting diode (LED) lighting, compact florescent lighting (CFL), and traditional incandescent lighting products. DOE, *Life-Cycle Assessment of Energy and Environmental Impacts of LED Lighting Products Part 2: LED Manufacturing and Performance* (June 2012) http://apps1.eere.energy.gov/buildings/publications/pdfs/ssl/2012_led_lca-pt2.pdf. The Report analyzed each lighting technology with respect to impacts at five stages in the product life cycle: raw materials; manufacture; transport to place of sale; energy in use; and disposal. Within each life-cycle stage, the study further analyzed each technology against fifteen separate health and environmental impact metrics, including: Global Warming Potential, Human Toxicity Potential, Freshwater Aquatic Ecotoxicity Potential, Marine Aquatic Ecotoxicity Potential, Eutrophication Potential, Land Use, Ecosystem Damage Potential, Terrestrial Ecotoxicity Potential, Abiotic Resource Depletion, Non-Hazardous Waste Landfilled, Radioactive Waste Landfilled, Hazardous Waste Landfilled, Acidification Potential, Photochemical Ozone Creation Potential, and Ozone Depleting Potential.

Not surprisingly, the largest source of impacts from all three bulbs occurred during the "Energy in Use" life-cycle stage, accounting for 93 percent, 78 percent, and 81 percent of the total impact for incandescents, CFLs, and LEDs, respectively. *Id.* at 53. Selection of raw materials, in contrast, accounted for a relatively small proportion of the aggregate impact: 5 percent for incandescents, 14 percent for CFLs; and 17 percent for LEDs. *Id.*

Even when singling out Human Toxicity Potential (HTP), the product's energy consumption (and the related releases of toxics to the environment while generating the power) contributed far more to the product's HTP than raw material selection. Energy consumption accounted for 96 percent of the HTP impact for incandescents, 80 percent of the HTP impact for CFLs, and 73–76 percent for LEDs. *Id.* at 49–50. Raw materials, the primary focus of many green programs, accounted for just 2 percent, 13 percent, and 22–25 percent of HTP for incandescents, CFLs, and LEDs, respectively. *Id.* at 50.

EPA's DfE team found similar results in a 2013 study evaluating the health and environmental impacts from various lithium battery technologies used in electric vehicles (EVs) and long-range plug-in hybrid electric vehicles (PHEVs). EPA, DfE, *Application of Life-Cycle Assessment to Nanoscale Technology: Lithium-ion Batteries for Electric Vehicles*, EPA 744-R-12-001 (Apr. 24, 2013) www.epa.gov/dfe/pubs/projects/lbnp/final-li-ion-battery-lca-report.pdf. The analysis compared four types of battery technologies, assessing ten categories of environmental impacts across five life-cycle stages. As with the LED example, the "use-stage" impacts associated with the energy used to operate the battery technologies had a significant and disproportionate contribution to the overall impact of every technology choice. Comparing the lifecycle of batteries used in EVs and PHEVs, for example, input selection, sourcing, and manufacturing combined accounted for only 11 to 21 percent of the batteries' total human toxicity potential, while 80 to 90 percent of the batteries' human toxicity potential resulted from energy use. *Id.* at 86–87. EPA explained:

> The use stage human toxicity impacts primarily result from air emissions due to the combustion of fuels to supply electricity. Combustion of bituminous coal is the major driver (~60% of stage total), followed by biomass (~25%), and natural gas (~15%). The top three air emissions in order of impact are the organic compounds acrolein (~50%), isoprene (~25%), and benzene (~10%).

Id. at 87.

Of course, the magnitude, weighting, and proportion of impacts across the product life cycle will vary for other types of products. While energy use was the logical and primary impact driver for electric lighting and vehicle batteries, one would expect a very different impact profile for personal care consumer products not requiring sustained power for use. Still, the DOE and EPA reports offer insight into the unexpected ways in which factors other than the toxicity of a product's ingredients and raw materials may drive a product's human toxicity potential. Here, for example, even if the primary goal of product regulatory policy is to minimize human exposure to toxic substances, increasing the product's energy efficiency would be far more important than adjusting the product's raw material inputs based on hazard.

The Metrics of "Green"

If hazard-based metrics limit the value and reliability of safer labeling, the multitude of single-attribute environmental marks and brands in the green or sustainable product marketplaces illustrates a similar weakness with environmental and sustainable product marketing. EPA's Greener Products Portal offers to "help the user navigate the increasingly important and complex world of greener products," identifying more than a dozen distinct EPA programs purporting to recognize and incentivize commercial adoption of sustainable commercial practices. http://epa.gov/greenerproducts. Each program addresses a laudable and important facet of EPA's mission to reduce the negative societal and environmental impacts and footprint of our economy, promoting reduced use of hazardous substances (DfE), water efficiency (Watersense), energy efficiency (Energy Star), recycled content (Comprehensive Procurement Guidelines or CPG), renewable power procurement (Green Power Partnership), and fuel economy/reduced carbon vehicle emissions (Smartway). As individual facets of a multifaceted problem, however, each program reduces "greenness" to a single attribute or performance aspect, ignoring other competing considerations.

During a test run of the Greener Products Portal on October 3, 2014, for example, a search for a greener cleaning product recommended the DfE program for a product screened to exclude substances with unacceptable hazard profiles. A search for greener flooring materials highlighted EPA's CPG program promoting recycled content. A search for a green automotive cleaning solvent recommended EPA's Significant New Alternative Program, which promotes transition from ozone depleting chemicals. These are good programs, but can any one of them consistently steer environmentally minded consumers or businesses to the environmentally or socially optimal product or service? Within a single-attribute policy silo, these programs probably do work. If the goal is to incentivize product and service technologies that reduce the health, environmental, and social impacts of our economy at a more holistic level, something more is needed.

Overreliance on single-attribute standards and claims also puts claimants (and certifiers) at risk of promoting consumer confusion, if not greenwashing. *The Oxford American Dictionary* defines greenwashing as "disinformation disseminated by an organization so as to present an environmentally responsible public image." TerraChoice Environmental Marketing Inc., a subsidiary of UL Industries, has distilled common greenwash tactics into a list known as "[t]he Seven Sins of Greenwashing." Among these sins are: (1) the Sin of the Hidden Tradeoff (highlighting one positive attribute while ignoring a glaring negative), (2) The Sin of Irrelevance (claiming credit for an attribute that, even if true, lacks relevance or importance in the context of the product or industry), and (3) The Sin of the Lesser of Two Evils (citing marginal improvements in a health or environmental attribute to redeem a fundamentally irredeemable product or service).

A 2001 EPA study illustrates how single-attribute metrics can run afoul of the "hidden tradeoff" and other sins:

> [A] study of the environmental impacts of disposable cups found that wax-coated paperboard was preferable to polystyrene in terms of reduced volumes of solid waste generation, but inferior in the areas of energy consumption, air emissions, water pollution, and weight of solid waste generation. Disposable diapers generate more solid waste than cloth diapers, but they also use less water and result in less water pollution.

EPA, *The United States Experience with Economic Incentives for Protecting the Environment,* EPA-240-R-01-001 (Jan. 2001) http://yosemite.epa.gov/ee/epa/eerm.nsf/vwAN/EE-0216B-13.pdf/$file/EE-0216B-13.pdf.

The Federal Trade Commission (FTC) has also taken notice of the growing misuse of environmental marketing claims. Acting under its authority to police unfair competition and regulate false and misleading claims in commerce, FTC has developed *Guidelines for Environmental Marketing*, commonly known as the "Green Guides." 15 U.S.C. § 45(a); 16 C.F.R. § 260. Though lacking the force of law, the Green Guides offer rules of thumb, presumptive prohibitions, and safe harbors with respect to marketing practices. Marketers are accountable for all claims reasonably conveyed by a marketing statement or advertisement, whether express or implied, and whether intended or not. 16 C.F.R. § 260.2. Marketers must be able to substantiate claims, both express and implied, under a "reasonable basis" test. *Id.* Marketers must qualify and limit claims where the purported claim would otherwise expressly or impliedly overstate the attribute or benefit. Finally, marketers should not make express or implied claims for environmental attributes with a negligible net benefit. *Id.* at § 260.3.

The Green Guides also provide more tailored guidance for a long list of commonly used environmental claims and terms of art, discussing potential sources of consumer confusion and offering examples of compliant and noncompliant claims. For example, companies will often make "free-of" claims that imply a health or environmental benefit from the absence of a specific substance in a product or service. Even a verifiable "free-of" claim may be deceptive "if the product, package, or service contains or uses substances that pose the same or similar environmental risks as the substance that is not present," or "if the substance's presence does not cause *material harm* that consumers typically associate with that substance." *Id.* at § 260.9 (emphasis added). FTC's insistence on materiality raises an important question regarding the many hazard-based sustainability marks in the public arena. Without some meaningful assessment of the actual health and environmental risk associated with materials in a product, how can any hazard-based label ever pass FTC's basic materiality test?

The Metrics of Sustainability

Single-attribute hazard metrics are even more deficient under a "sustainability" paradigm. The concept of "sustainable development" as a shared global policy goal grew out of the 1992 United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro, which sought to integrate environment and development considerations at the policy, planning, and management levels. UNCED, *Rio de Janerio, Brazil, 3 to 14 June 1992: Agenda 21* at 21 (Apr. 2003) https://sustainabledevelopment.un.org/content/documents/Agenda21.pdf. Under the UNCED sustainability paradigm, "human beings are at the centre of concerns for sustainable development" and "are entitled to a healthy and productive life in harmony with nature." UNCED, *RIO Declaration on Environment and Development* (Aug. 12, 1992) www.un.org/documents/ga/conf151/aconf15126-1annex1.htm. "[E]nvironmental protection [must] constitute an integral part of the development process," but it "cannot be considered in isolation from [social and economic development]." *Id.*

At the conceptual level, terms like "sustainability," "sustainable development," "sustainable commerce," and "sustainable products" offer a practical bridge between the traditional antigrowth bias of more "eco-centric" environmental philosophies and the powerful pro-growth bias reflected in most developing and developed political economies. Rather than pitting one goal against another, sustainability "calls for a convergence between the three pillars of economic development, social equity, and environmental protection." Drexhage et al., International Institute for Sustainable Development (IISD), *Sustainable Development: From Brundtland to Rio 2012 Background Paper* (Sept. 19, 2010) www.un.org/wcm/webdav/site/climatechange/shared/gsp/docs/GSP1-6_Background%20on%20Sustainable%20Devt.pdf.

"Sustainable commerce" is an appealing policy in concept, but it remains poorly defined in practice. Today, the term "sustainable" is no less ambiguous than terms such as "safer," "environmentally friendly," and "green." Without relevant and meaningful metrics to define and measure the relevant impacts, these terms are subject to manipulation by stakeholders on every side, from the marketer seeking to earn a premium on their good to the activist seeking to blacklist a disfavored product or substance.

Lifecycle Thinking and the Hazard Paradox

If single attribute metrics flourish from their deceptive simplicity, Life Cycle Analysis (LCA), the logical alternative, has struggled to take hold at the consumer level due to its cost and complexity. LCA considers the entire life cycle of a product: raw material extraction and transport; product manufacture; product use; and end of life treatment or disposal.

LCA also provides a framework for weighing different impacts within a common impact assessment framework. The National Institute of Standards and Technology (NIST), for example, has developed a LCA program for the building products industry, known as BEES (Building for Environmental and Economic Sustainability). *See* NIST, *BEES 4.0: Building for Environmental and Economic Sustainability Technical Manual* (May 2007) http://fire.nist.gov/bfrlpubs/build07/PDF/b07018.pdf. BEES provides users three different options for weighting the relative significance of the twelve impact categories analyzed. Users can apply an equal-weighting approach, assigning nine points to each of the twelve impact categories. Alternatively, users can select a weighting scheme based on impact priority assessments done by EPA Science Advisory Board (SAB) between 1990 and 2000. *Id.* at 26–27. Under the SAB weighting scheme, the four most highly-weighted impact categories would be: global warming (16 points); habitat alteration (16 points), ecotoxicity (11 points), and human health (11 points), with other impacts having lower weighting value. *Id.* at 28 (Table 2.13). BEES offers a third weighting approach, based on input from a voluntary panel of stakeholders in 2006, including building product manufacturers, green building designers, and LCA experts. *Id.* at 28–29. Under this third approach, global warming potential accounts for almost 30 points of total impact, with human health impacts (13 points); fossil fuel depletion (10 points); criteria air pollutants (9 points); and other measures following well behind. *Id.* at 30 (Table 2.14).

The accuracy and adequacy of the point allocations in the NIST weighting schemes are debatable, but the lesson of NIST's life-cycle-based system is not: Building product sustainability is about more than just the theoretical toxicity of the materials in the finished product. A meaningful sustainability metric needs to look at the full range of environmental attributes and impacts in a product's life cycle. Indeed, without understanding the health and environmental impacts across a product's full life cycle, single attribute standards can foster the perception that a less "hazardous" product or technology is "safer" or more "environmentally preferable," while, in practice, discouraging material, design, and innovation that could offer far greater health and safety improvements across the full product life cycle.

Therein lies the hazard paradox. Slavish focus on the theoretical toxicity of a product's ingredients, without attention to actual exposure, risk, and the many other potential health and environmental impacts during the product's life cycle, may push society toward less preferable products from a health and environmental impact perspective.

These are not just theoretical concerns. Work by EPA, DOE, and NIST illustrate how other attributes and impacts, including greenhouse gas emissions, energy and water use, and emissions from power generation, can be just as, if not more important than the toxicity of raw materials in driving a product's health impacts. Along similar lines, recent studies suggest that carbon nanotube technology could create an energy-efficient, flat light source requiring just a fraction of the energy used by LEDs—the current gold standard for energy efficiency lighting. Yet, under a hazard-driven green standard, the theoretical health hazards associated with uncontrolled carbon nanotube (CNT) use could disqualify CNT-containing products from consideration as sustainable technologies, regardless of the measures taken to manage actual risk. *See, e.g.*, EPA, *Significant New Use Rules on Certain Chemical Substances; Direct Final Rule*, 79 Fed. Reg. 38464 (July 8, 2014) (imposing premarket notification and reporting requirements on certain single and multi-walled nanotube technologies based on potential health hazards).

These examples beg a larger question: If toxic emissions from a product's energy use account for 75 percent of the product's toxicity impacts, should efforts to promote product safety consider energy efficiency along with theoretical hazard?

Recent recommendations from National Research Council (NRC) suggest yes. In the fall of 2014 the NRC released a report reviewing ten different "alternatives assessment" frameworks, including DfE, the California Safer Consumer Products Regulation, and various other governmental and private models currently in use. NRC, *A Framework to Guide Selection of Chemical Alternatives*, ISBN 978-0-309-31013-0 (2014) www.nap.edu/catalog/18872/a-framework-to-guide-selection-of-chemical-alternatives. The Report noted that "despite the known importance of exposure, many frameworks downplay it and focus on inherent hazards of chemicals." *Id.* at 2. The NRC Report also recommended building lifecycle considerations into the analytical process for alternative assessments, without requiring full blown LCAs. *Id.* at 16. The Report introduced the concept of "Life-Cycle Thinking" as a path forward, calling for, at minimum a "qualitative discussion to identify stages of the life cycle and/or the potential environmental impacts of greatest significance." *Id.* at 162.

Sustainability analysis using Life-Cycle Thinking is doable. It is being conducted regularly by forward-thinking governments, corporations, and nongovernmental organizations. The challenge now is to make it affordable and manageable as a tool, not just behind the scenes, but for the product label as well. Before accepting that challenge, however, policy makers and stakeholders will need to move beyond metrics that are expedient and embrace metrics that are meaningful and material.