



Sustainable  
Chemistry  
Catalyst



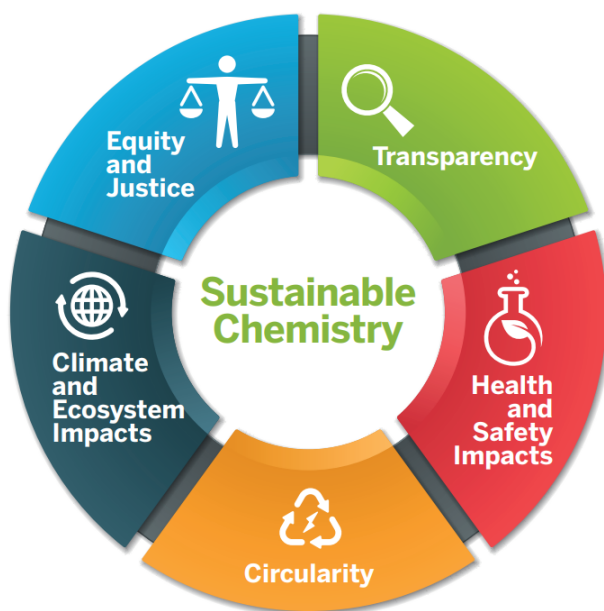
INVESTOR  
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# The Investment Case for Sustainable Chemistry

V.1, 2023

*“Sustainable chemistry is the development and application of chemicals, chemical processes, and products that benefit current and future generations without harmful impacts to humans or ecosystems.”<sup>1</sup>*



*Version 1, April 2023*

<sup>1</sup> Expert Committee on Sustainable Chemistry. [Definition and Criteria for Sustainable Chemistry](#). 2023

## Executive Summary: The Moment is Now for Financing the Transition to Sustainable Chemistry

*A recent United Nations report noted that the “production of chemicals doubled between 2000 and 2017 and is expected to double again by 2030 and triple by 2050,” resulting in “hundreds of millions of tons of toxic substances released into air, water and soil annually.”<sup>2</sup>*

Chemistry is essential to everyday life. Our economy and financial assets are dependent on chemical products and production. Unfortunately, many of these chemicals we depend on are also threatening lives and livelihoods. As the industry expands to meet growing market demand over the next decade, there is an opportunity for financial leaders to support the transition into sustainable chemistry.

Green and sustainable chemistry considers both decarbonization *and* detoxification in design and the life cycle assessment of new product development, thereby lessening or eliminating both the health and environmental as well as the financial risks to companies and investors that are often inherent in fossil fuel-based chemistries. However, the chemical risk and the opportunity space for sustainable chemistry are not yet well-known in the financial community.

Many chemicals that our global economy is deeply dependent on have been linked to disease and death in humans, biodiversity loss, climate change, and the plastic waste crisis.<sup>3</sup> A broad range of chemistries that are hazardous to human and environmental health are pervasive in our environment, leading to significant impacts on vulnerable populations and ecosystems. And due to regulatory changes, changing consumer demands, and litigation, costs are rising for companies reluctant to transition their businesses and value chains to more sustainable chemistries.

Litigation risk – which on its own has been a cost of doing business for decades – is rising. Regulations restricting harmful chemicals are also on the rise, and market and consumer demand for sustainable products is growing.<sup>4</sup> As this trifecta of forces strengthens, the financial risks and exposure become unsustainable. This convergence of three major forces is causing significant shifts in the marketplace and unexpected risks for investors.

As is often true in finance, however, there is an opportunity flip side to every risk. As costs rise for conventional forms of chemistry, new opportunities are emerging for sustainable

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<sup>2</sup> United Nations, Human Rights Council. [The Right to a Clean, Healthy and Sustainable Environment: Non-Toxic Environment \(A/ HRC/49/53\)](#). 2022

<sup>3</sup> Tickner et al. [Transitioning the Chemical Industry: The Case for Addressing the Climate, Toxics, and Plastics Crises](#). Environment: Science and Policy for Sustainable Development. 2021.

<sup>4</sup> Green Chemistry and Commerce Council. [Green Chemistry: A Strong Driver of Innovation, Growth, and Business Opportunity](#). 2021.

chemistry in key sectors like personal care, cleaning, and solvents. Businesses like chemical suppliers Solugen, Genomatica, and Itaconix, as well as brands such as BeautyCounter, have demonstrated the viability and scalability of high-performance products and processes designed to compete for customers seeking healthier, safer, better performing products.

Retail-facing companies such as Walmart, Apple, and Target are reducing their carbon and chemical footprints by investing in suppliers offering greener options. Financing the transition to sustainable chemistry is quickly becoming a viable pathway for investors concerned about these risks and costs. Growing the supply of green and sustainable chemistry is necessary, possible, and an investment opportunity, but growth is not happening fast enough to address the business risks associated with climate change, biodiversity loss and chemical pollution. For these solutions to scale, this issue needs to be a strategic focus of the finance community.

## Inflection Point: Weight of Scientific Evidence

*Toxic chemicals, such as the per- and polyfluoroalkyl substances (PFAS), known as the “forever chemicals,” now have contaminated the entire planet, even remote areas in the Himalayas and Pacific and Atlantic oceans.<sup>5</sup> A recent article by Cousins, et al., concluded that the global spread of four perfluoroalkyl acids (PFAAs), a subset of PFAS, “in the atmosphere has led to the planetary boundary for chemical pollution being exceeded.”<sup>6</sup>*

*-The Sixth Annual Chemical Footprint Report*

Chemical pollution is a global threat. It is a crisis on par with – and often compounding – the crises of climate change, biodiversity loss, and plastic pollution. Over the last five years, the volume and weight of scientific evidence regarding chemical pollution and its effects on biodiversity and human health has reached an inflection point. Scientists have concluded that we have crossed the planetary boundary for “novel entities” – the point at which industrial chemicals are altering the “vital Earth system processes on which human life depends”.<sup>7</sup>

The modern chemical industry grew out of our increasing ability to harness fossil fuels as feedstock. Now we are reliant on tens of thousands of synthetic chemicals derived primarily from fossil fuels and used ubiquitously in products, infrastructure, and industrial systems for modern society. Approximately 96% of U.S. goods are manufactured using chemicals.<sup>8</sup> As a result, the chemical and petrochemical industry accounts for 14% of global industrial

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<sup>5</sup> Kurwadkar, S. et al [Per- and polyfluoroalkyl substances in water and wastewater: A critical review of their global occurrence and distribution](#). Science of The Total Environment. 2022.

<sup>6</sup> Cousins, I. et al. [Outside the Safe Operating Space of a New Planetary Boundary for Per- and Polyfluoroalkyl Substances \(PFAS\)](#). Environmental Science & Technology. 2022.

<sup>7</sup> Persson L. et al. [Outside the Safe Operating Space of the Planetary Boundary for Novel Entities](#). Environmental Science & Technology. 2022.

<sup>8</sup> Cybersecurity & Infrastructure Security Agency. [Chemical Sector Profile](#). 2022.

greenhouse gas emissions.<sup>9</sup> Just seven highly toxic chemicals account for two-thirds of the industry's emissions.<sup>10</sup> With the projected tripling of chemical production by 2050, the twin crises of chemical pollution and climate change will not be addressed without radical new thinking from the chemical industry. Put another way - the push to limit warming to 1.5°C above pre-industrial levels provides an opportunity to simultaneously address climate impact and toxicity.

*Although some pollution control measures exist they are often not being adopted at the rate needed to avoid chronic and acute effects on human health now and in coming decades. There is an urgent need for enhanced global awareness and scientific scrutiny of the overall scale of risk posed by chemical usage, dispersal and disposal.*<sup>11</sup>

## Chemical Pollution: A growing peril and potential catastrophic risk to humanity

The rise in environmentally related diseases from exposure to toxic chemicals in our water, air, and waste and their subsequent costs to our economy are consequential according to a 2017 study published in the journal *Environmental Health*.<sup>12</sup> The authors concluded that the cost of harmful chemical and heavy metal exposures globally surpasses 10 percent of global GDP. Exposure to air pollution, endocrine disrupting chemicals, flame retardants and pesticides and lead creates higher costs through increased rates of chronic diseases, higher health care bills, lost wages, or lower productivity for employers. Indeed, the World Health Organization conservatively estimates that 2 million lives and 53 million disability-adjusted life-years were lost in 2019 due to exposures to selected chemicals (not including many chemicals with known chronic impacts).<sup>13</sup>

The scientific consensus around what qualifies as a chemical of concern is strong, particularly CMRs (carcinogens, mutagens, and chemicals hazardous to reproduction), persistent bioaccumulative and toxic substances, endocrine disrupting chemicals, and chemicals with neurodevelopmental effects.<sup>14</sup> And the human and ecological harm caused by these chemicals is well documented. For example:

- Chemicals of concern are considered one of five key drivers of species extinction and loss of biodiversity.<sup>15</sup>

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<sup>9</sup> International Energy Agency (IEA) [Industry Sectoral Overview](#), 2022.

<sup>10</sup> ShareAction, [Slow Reactions: Chemical companies must transform in a low-carbon world](#), 2021.

<sup>11</sup> Naidu R. et al. [Chemical pollution: A growing peril and potential catastrophic risk to humanity](#), *Environ. Int.* 2021.

<sup>12</sup> Grandjean, P. and Bellanger, M. [Calculation of the disease burden associated with environmental chemical exposures: application of toxicological information in health economic estimation](#), *Environ Health*, 2017.

<sup>13</sup> World Health Organization, [The public health impact of chemicals: knowns and unknowns](#), 2021.

<sup>14</sup> UN Environment Program, [Outlook Global Chemicals Outlook II – From Legacies to Innovative Solutions: Implementing the 2030 Agenda for Sustainable Development](#), 2019.

<sup>15</sup> Groh, K. et al. [Anthropogenic Chemicals As Underestimated Drivers of Biodiversity Loss: Scientific and Societal Implications](#), *Environmental Science and Technology*, 2022.

- Exposure to the PFAS family of “forever chemicals” is associated with cancer, liver damage, decreased fertility, and increased risk of asthma and thyroid disease.<sup>16</sup>
- Tests on U.S. residents find 99% of adults and children are exposed to phthalates, a class of chemicals known to disrupt hormone systems yet used ubiquitously in consumer products<sup>10</sup>. Childhood exposure to these chemicals referred to as “everywhere chemicals” was linked to a 20 percent higher incidence of cancer in a study published in the Journal of National Cancer Institute.<sup>17</sup>
- A 2017 meta-analysis documented the linkage between widespread exposure to endocrine disrupting chemicals to an emerging infertility crisis with their findings of a 59% decline in sperm count in men in North America, Europe, Australia and New Zealand from 1973 to 2011.<sup>18</sup>

Lower income, predominantly poorer, minority Black and Brown “fenceline” communities bear a disproportionate burden from increased risks to diseases from long standing air and water pollution<sup>19</sup> in areas such as “Cancer Alley”, a stretch of the Mississippi River between New Orleans and Baton Rouge that is home to more than 150 oil refineries, plastics plants and chemical facilities. The European Union’s Green Deal zero pollution ambition is driven in part by the rising costs of pollution from chemical facilities. The EU estimates that their largest industrial facilities cost society between €277 and €433 billion in 2017.<sup>20</sup>

More extreme weather events will likely lead to ever greater levels of pollution flowing into local communities, as plants release fuels and chemicals before shutting down.<sup>21</sup> And the probability of factories being damaged in extreme weather events will also lead to unintentional releases of chemical pollution. The liabilities resulting from this pollution could increase the price point for underwriting insurance and loans. For refineries and chemical companies that have records of controversies and or accidents, insurance rates for property damage and business disruptions have risen in some cases by 100%.<sup>22</sup>

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<sup>16</sup> Bonato, M. et al. [PFAS Environmental Pollution and Antioxidant Responses: An Overview of the Impact on Human Health](#). Int J Environ Res Public Health. 2020.

<sup>17</sup> Ahren, T.P. et al. [Medication-Associated Phthalate Exposure and Childhood Cancer Incidence](#). JNCI: Journal of the National Cancer Institute. 2022.

<sup>18</sup> Levine, H. et al. [Temporal trends in sperm count: a systematic review and meta-regression analysis](#). Human Reproduction Update. 2017.

<sup>19</sup> Terrell, K.A. and St Julien, G. [Air pollution is linked to higher cancer rates among black or impoverished communities in Louisiana](#). Environmental Research Letters. 2022.

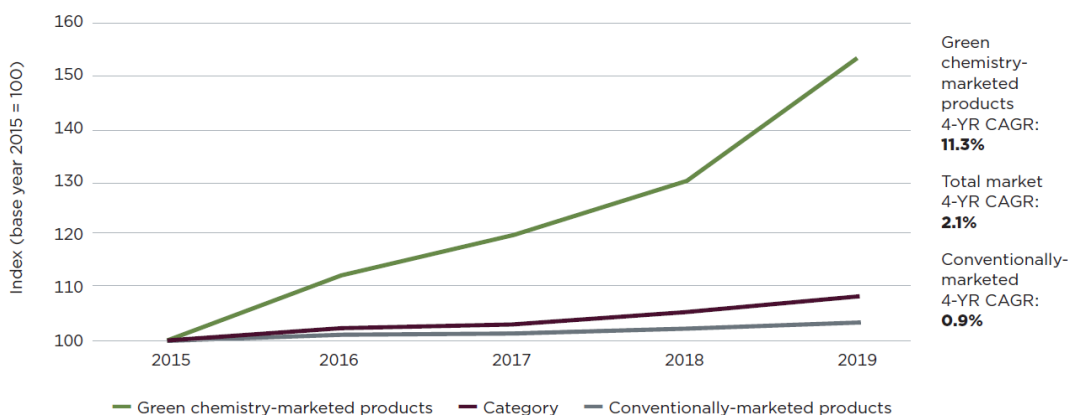
<sup>20</sup> European Environment Agency. [Counting the costs of industrial pollution](#). 2023.

<sup>21</sup> Environmental Protection Agency. [Report: EPA Needs to Improve Its Emergency Planning to Better Address Air Quality Concerns During Future Disasters](#). 2019.

<sup>22</sup> Reuters. [U.S. refiners, chemical makers pare insurance coverage as accidents boost costs](#). 2020.

# The Trifecta: Three converging market forces creating financial risks and opportunities

## One. Customer Demand



From 2015–2019, green chemistry-marketed products (10 categories examined) grew 12.6 times faster than their conventional counterparts, and 5.4 times faster than the market.

Growth of green chemistry marketed-products from 2015-2019.<sup>23</sup>

Increasing science, knowledge of chemical risks and health and health and environmental advocacy are increasing consumer concern which, in turn, is a driving factor behind new regulations, voluntary phase-outs of harmful chemicals, and the growing market demand for safer alternatives. 85% of Europeans are worried about the impact chemicals in products have on their health and the environment.<sup>24</sup> Despite—or perhaps because of—fewer protections in the U.S., Americans have a similar outlook: 92% of voters agreed that the government should require products to be demonstrated safe before reaching the consumer.<sup>25,26</sup>

*“Already in 2015, a Nielsen report found that 73 percent of the Millennial generation was willing to pay more for sustainable goods. Our own 2019 report, “The State of Consumer Spending: Gen Z Shoppers Demand Sustainable Retail,” notes that 62 percent of Generation Z, who will begin entering the workforce this year, prefer to buy from sustainable brands, on par with our findings for Millennials.”<sup>27</sup>*

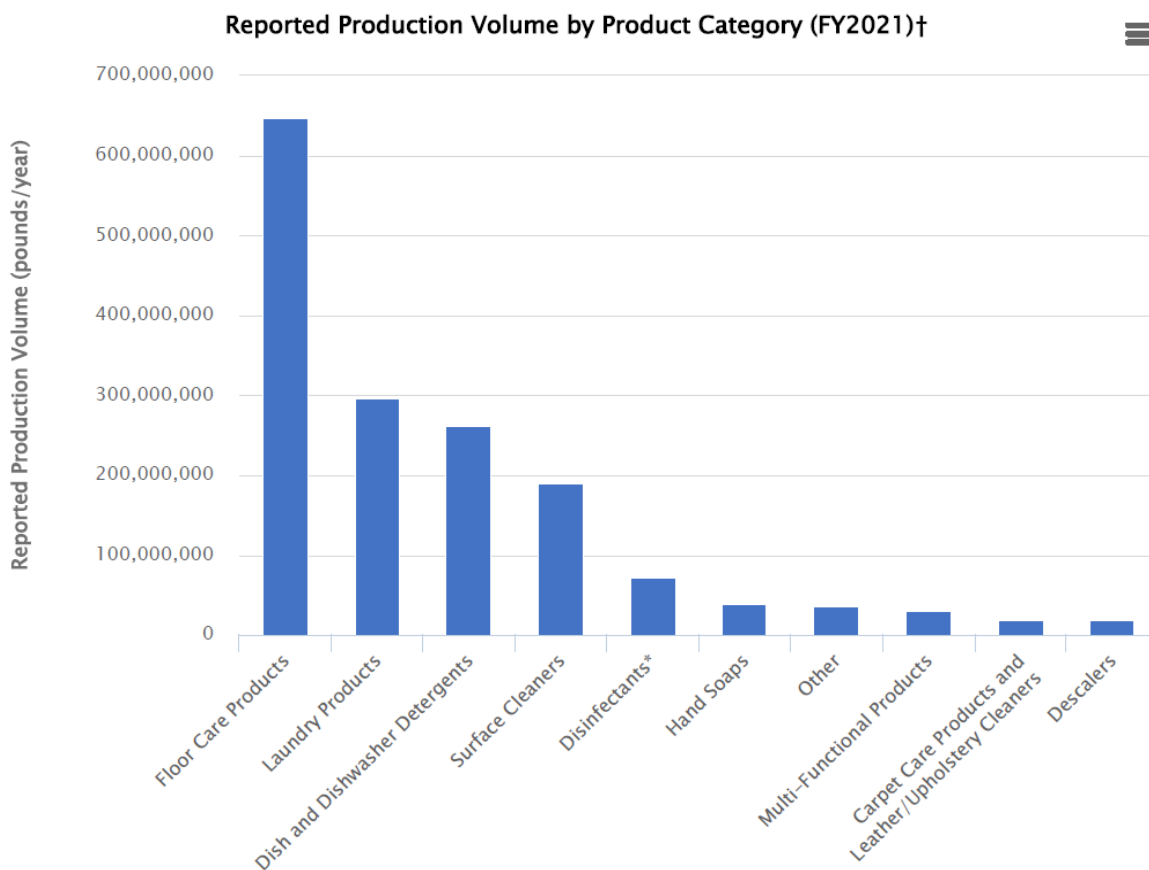
<sup>23</sup> Green Chemistry and Commerce Council. [Green Chemistry: A Strong Driver of Innovation, Growth, and Business Opportunity](#). 2021.

<sup>24</sup> European Commission. [Protecting the environment – Eurobarometer survey](#). 2020.

<sup>26</sup> University of California San Francisco Program on Reproductive Health and the Environment. [Public Opinion on Chemicals](#). 2022.

<sup>27</sup> Forbes. [Sustainable Retail: How Gen Z Is Leading The Pack](#). 2020.

For example, in an effort to respond to increasing market demand, the Environmental Protection Agency launched the Safer Choice recognition program in 2009 to differentiate products in the marketplace. Products certified under the Safer Choice label must meet stringent human health and environmental safety standards in specific product categories. Over 2,000 brands have received Safer Choice certification and over 1,000 chemicals have been approved for use and are listed on EPA’s Safer Chemical Ingredient List.



Safer Choice and DfE-certified products by category. <sup>28</sup>

Early adopters are building product portfolios that meet growing demand for more sustainable products. For example:

- Clorox announced plans to reduce its cleaning products’ chemical footprint, and now has 11 brands with the Safer Choice certification<sup>29</sup>.
- P&G has 24 products certified as Safer Choice<sup>30</sup>.

<sup>28</sup> U.S. Environmental Protection Agency. [Safer Choice Performance Measures](#). 2023.

<sup>29</sup> <https://www.prnewswire.com/news-releases/epa-again-names-clorox-as-safer-choice-partner-of-the-year-for-advancing-ingredient-and-product-safety-301665554.html>

<sup>30</sup> <https://www.epa.gov/saferchoice/2022-safer-choice-partner-year-award-winners#tab-23>

- Walmart, Target and Amazon require or incentivize some of their suppliers to meet the *Safer Choice* standards. Amazon has made it easier to find these products on their website with its Climate Pledge Friendly filter.
- Apple specifies Safer Choice and Green Screen Certified solvents in their supply chain, with 100% of their final assembly sites now using only approved safer cleaners.<sup>31</sup>

## Two. Regulatory Forces

The rise in regulations globally is impacting the marketplace and driving up costs for companies that are not prepared to transition their supply chains and production to safer and more sustainable chemistries.

The European Union (EU): Several new and updated laws and regulations will significantly restrict the production and use of toxic chemicals in one of the world's largest economies. Well known for its focus on cutting carbon emissions, the European Green Deal is also focused on eliminating chemical pollution. The Chemical Strategy for Sustainability, the Ecodesign for Sustainable Products Directive, and others are leading to major changes to how chemicals of concern are regulated in Europe. Importantly, based on the European Commission's Restrictions Roadmap, the European Environmental Bureau estimates that the number of restricted chemicals is expected to increase from around 2,000 to around 7,000.<sup>32</sup> CEFIC, the EU trade group for chemicals, estimates that 12-42% of the chemical industry's product portfolio could be restricted as new EU laws are phased in between 2023 and 2040.<sup>33</sup> The Chemicals Strategy also requires greater information on chemical hazards to be shared across the value chain.

The EU is effectively using the size of the European market to lead a global shift away from toxic chemicals towards ones that are Safe and Sustainable by Design. The Industrial Transition Pathway for Chemicals establishes a roadmap for the industry to meet both emissions and circularity goals. The EU Taxonomy is yet another development with major implications for the production of toxic chemicals, as it aims to determine which economic activities are environmentally sustainable (or not) and label them as such. Finally, the carbon border adjustment mechanism, approved in 2022, is another tool in the effort to meet Green Deal goals. It addresses "carbon leakage" arising from the importing of carbon-intensive products from countries with weaker climate legislation. Fertilizers are currently covered, and the list is expected to grow in the future.<sup>34</sup>

The United States: Individual states are enacting safer chemicals policies, sometimes leading to similar action at the national level. According to Safer States, 294 bills restricting chemicals in 38 states have been passed.<sup>35</sup> These bills are influencing the marketplace in

<sup>31</sup> Clean Production Action. [GreenScreen Certified™ for Cleaners & Degreasers in Manufacturing](#). n.d.

<sup>32</sup> European Environment Bureau. [The great detox – largest ever ban of toxic chemicals announced by EU](#). 2022.

<sup>33</sup> CEFIC. [Economic Analysis of the Impacts of the Chemicals Strategy for Sustainability Phase 1 Report](#). 2021.

<sup>34</sup> KPMG. [Impact of the EU's Carbon Border Adjustment Mechanism](#). n.d.

<sup>35</sup> Safer States. [Bill Tracker](#). 2023.



major economies like California and New York, which will have national reverberations. Though limited in the number of chemicals it can address through regulatory means, the Lautenberg Chemical Safety for the 21<sup>st</sup> Century Act provides US EPA with the capability to shift markets for chemicals of concern through its prioritization, risk assessment, and risk management processes. While far from meeting the European level of regulation, the recently passed Modernization of Cosmetics Regulation Act of 2022 (MoCRA) will impact chemistry in cosmetic products by requiring cosmetic products manufacturers to both substantiate safety claims as well as increased labeling requirements, particularly for fragrances.

Lawmakers across more than 20 states and at the federal level have begun addressing this disparity of exposure to toxic chemicals – primarily at the facility level and end of life - through proposed environmental justice legislation, which will impact permits and licenses needed to operate, with New Jersey passing a landmark environmental justice bill in late 2020.<sup>36</sup> While many companies have recently committed to pursuing racial justice, few have taken demonstrable steps to address the potential disparate impacts that their operations may have on surrounding communities of color. Companies that proactively address environmental justice now could not only mitigate these risks and strengthen their licenses to operate while addressing disproportionate impacts through their value chains to which they may be unknowingly contributing.

In addition to regulatory efforts, incentivizing sustainable chemistry has been incorporated into legislation such as the US Sustainable Chemistry R&D Act. The recently passed Inflation Reduction Act (IRA) not only puts billions of dollars of funding and other incentives to transition to a renewable energy economy (including supporting new lower carbon chemistries), it also allocates over \$60 billion in resources to accelerate environmental justice and pollution prevention programs. The Infrastructure Investment and Jobs Act and the CHIPS and Science Act also provide funds to get new clean energy technologies to market.<sup>37</sup>

China: China's central role in the global supply chain means any incremental regulation of pollution and emissions can be felt everywhere.<sup>38</sup> In 2018, a shortage of benzisothiazolinone was caused because plants producing its precursor were shut down in China due to emissions concerns.<sup>39</sup>

In response to new regulations in the US and EU, as well as increased pressure from consumers and investors, companies are also actively reducing their use of chemicals of concern and reporting progress through efforts such as the Chemical Footprint Survey. The recent 6<sup>th</sup> Annual Chemical Footprint Project Report<sup>40</sup> announced that corporate leaders in the 2021 Survey collectively achieved chemical footprint reductions of 37.8 million kilograms over a year. Notable results include:

- Walmart's 17% chemical footprint reduction of 37 million pounds (lbs) / 16.8 million kilograms (kgs) removed from select private-label and brand-name products exceeded

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<sup>36</sup> Bloomberg Law. [ANALYSIS: State Laws Are Codifying Environmental Justice](#). 2021.

<sup>37</sup> RMI. [Congress's Climate Triple Whammy: Innovation, Investment, and Industrial Policy](#). 2022.

<sup>38</sup> GreenBiz. [China's new frontier for VOC regulations](#). 2021.

<sup>39</sup> Royal Society of Chemistry, Chemistry World. [Chinese plant closures disrupt supply chains](#). 2019.

<sup>40</sup> Chemical Footprint Project. [6<sup>th</sup> CFP Report](#). 2022.

its goal of a 10% reduction by 2022;

- Hewlett Packard (HP) reduced its chemical footprint by 12.3 million lbs/5.6 million kgs for all products; and
- Reckitt has set an industry leading 2030 chemical footprint reduction goal of 65%.

### Three. Litigation Risk

Companies face increasing risks arising from the harm caused by their products and processes. Several high-profile examples demonstrate how expensive it can be to be reactive instead of proactively managing avoidable risk. Johnson & Johnson chose to not decisively act on evidence of the presence of asbestos in its signature baby powder product for decades, a decision that may cost the company \$8.9 billion, after it tried and failed to limit the financial cost in a bankruptcy maneuver recently rejected in federal court.<sup>41</sup> The company discontinued the product in 2020. Once a trusted brand, Johnson and Johnson's reputation has fallen considerably.<sup>42</sup>

Companies dependent on per- and polyfluoroalkyl substances (PFAS), commonly known as forever chemicals, in their products and manufacturing processes are facing increased financial risk.<sup>43,44</sup> PFAS, now found widely in the environment and our bodies, has been linked to cancer, infertility, and other diseases in animals and humans. There is a rising toll of litigation against companies that manufacture or use PFAS and other “forever chemicals” as a result. DuPont and its spin-offs have set aside \$4 billion for future liabilities due to PFAS contamination.<sup>45</sup> 3M delayed adopting safer substitutes for its PFAS product portfolio, and Bloomberg Intelligence estimates that their liability for damages could potentially cost up to \$30 billion.<sup>46</sup> In response to regulatory restrictions in the US and Europe, as well as pressure from investors and consumer advocates, 3M announced it will phase out PFAS production and products by 2025. Initially litigation focused on PFAS manufacturers, but as more research has emerged on widespread PFAS contamination, use and potential harm, new lawsuits are being filed against major brand name companies selling cosmetics, personal care products as well food manufacturing containing PFAS.<sup>47</sup>

*“ESG controversies can be especially costly and long lived, and even highly regarded companies are subject to such reputational risk. In fact, we estimate more than \$600bn of market cap for S&P 500 companies has been lost to “ESG controversies,” such as data privacy issues or governance failures, in the last seven years alone. And controversies are a long-lived*

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<sup>41</sup> New York Times. [Johnson and Johnson reaches deal for \\$8.9 Billion Settlement](#). 2023

<sup>42</sup> Alva group. [Johnson & Johnson: The alva Reputation Case Study](#). 2019.

<sup>43</sup> Moody's ESG Solutions. [Rising litigation, tighter regulation pose risks for PFAS producers and users](#). 2021.

<sup>44</sup> Sustainalytics. [PFAS Sparks a Wave of Litigation in the U.S. Chemical Industry](#). 2019.

<sup>45</sup> Royal Society of Chemistry, Chemistry World. [DuPont and spinoffs reach \\$4bn settlement to resolve PFAS liability issues](#). 2021.

<sup>46</sup> Bloomberg. [3M Will Stop Producing 'Forever Chemical' PFAS by End of 2025](#). 2022.

<sup>47</sup> National Law Review. [PFAS and Cosmetics: Another Lawsuit, Another ESG Lesson](#). 2022.

*overhang — the average stock doesn't recover from a controversy until almost a year has passed, based on our analysis of recent controversies for S&P 500 companies. So, we think investors of all stripes — not just ESG-focused investors — can use ESG controversy data to better manage risk”.*<sup>48</sup>

- Savita Subramanian, Head of ESG Research at Bank of America Securities

These examples of lack of action and poor management of toxic substances are likely just the beginning of large financial, legal and reputational risks related to toxicity and pollution as evidence increases about toxic chemical impacts. A recent report by the Minderoo Foundation estimates that litigation could cost the plastics industry and its insurers \$20 billion over the next eight years. Given the central role chemicals and plastics have in economies, the liabilities will extend beyond the chemicals industry; consumer goods companies will likely find themselves liable for the cost of cleaning up plastic pollution.<sup>49</sup>

Investors are increasingly working with real-time data analysis to assess the costs of controversies on long term financial performance. These data will provide a more complete perspective on the exposure investors face with companies that have higher rates of controversies than their peers.

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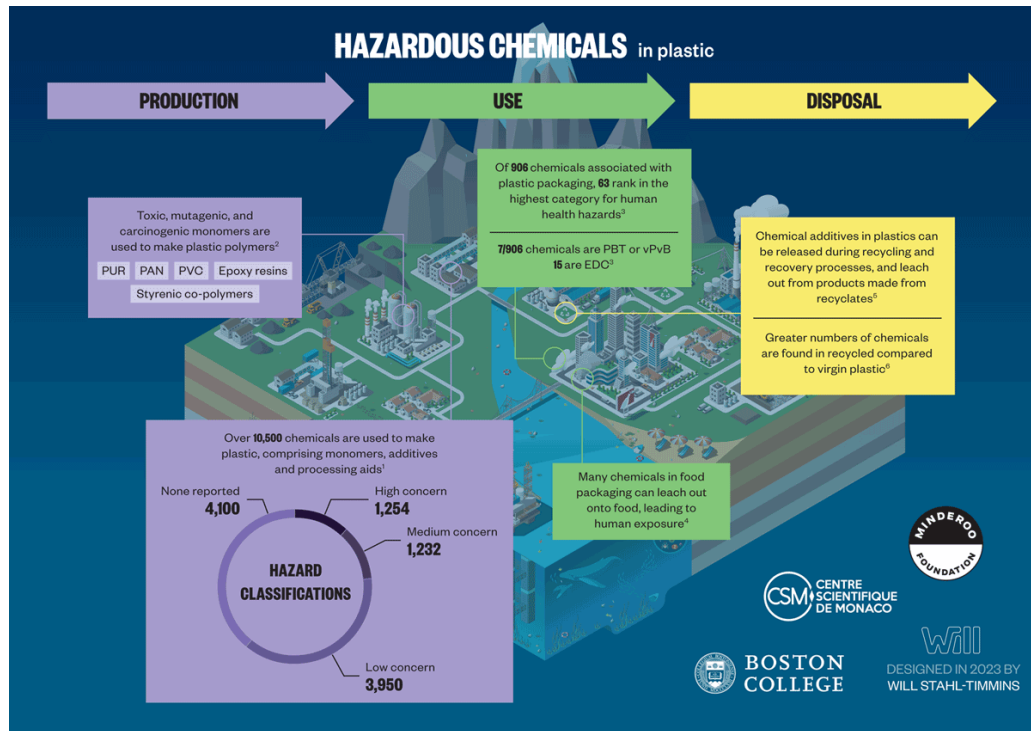
<sup>48</sup> RepRisk. [RepRisk interviews Savita Subramanian, Head of ESG Research at BofA Securities](#). 2020.

<sup>49</sup> Merkl A & Charles D for the Minderoo Foundation. [The Price of Plastic Pollution: Social Costs and Corporate Liabilities](#). 2022.

## Trifecta in action - The case of plastics

### Hazard to Human Health and the Environment

The Minderoo Foundation recently found that the health costs associated with the use of plastics totals over \$900 billion in 2015 dollars due to the prevalence of harmful chemicals in plastics causing disease.<sup>50</sup> The same report found other harmful effects of plastic at every stage of the materials' life cycle.



Hazardous chemicals in plastics and their impacts throughout plastics' life cycle.  
Source: Minderoo-Monaco Commission<sup>51</sup>

### Customer Demand

Over 500 consumer-facing companies have pledged to use more recycled content in their packaging and products. The American Chemistry Council acknowledged that this demand for recycled plastic outstrips production.<sup>52</sup>

### Regulatory Forces

Various states and countries have implemented bans on single use plastics.<sup>53</sup> For example, Maine's Extended Producer Responsibility Program for Packaging increases costs for companies who have toxic chemicals in their packaging.<sup>54</sup> The UN is developing a legally binding international agreement on plastic pollution by 2024.<sup>55</sup>

### Litigation Risk

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economies, the liabilities will extend beyond the chemicals industry; consumer goods companies will likely find themselves liable for the cost of cleaning up plastic pollution.<sup>56</sup>

### Demand for Sustainable Chemistry Solutions

The OECD recently released a report on considerations for designing sustainable plastics.<sup>57</sup> In addition to action on plastic pollution, two broad routes to sustainable plastics production are emerging – biobased and recycled. Despite their relatively smaller size, Bloomberg predicts that recycled and biobased plastic production will grow more quickly than virgin fossil plastics.<sup>58</sup>

## Financial Opportunities: The Future is in the Safe and Sustainable Bio-Economy

Companies that design out pollution and waste in their production processes and products will benefit from a playing field that favors sustainable chemistry. For example, **Solugen** has found ways to decarbonize and detoxify the production of industrial chemicals like organic acids and aldehydes. Their bioproduction creates carbon-negative industrial chemicals out of sugar.<sup>59</sup> The company was valued at \$1.8Bn in 2022 after successfully raising \$350m to grow production.<sup>60</sup> Solugen develops specialty chemicals that replace petroleum-based products with plant-derived substitutes used to make hydrogen peroxide. Their line of environmentally friendly chemicals compete on cost and performance with petroleum-based products. Business risks and costs associated with pollution and harm are intentionally designed out of their system.

Start-up companies like **Kalion** are making headway in commercializing bio-based products such as a sugar-derived glucaric acid. This product can be a safe, cost-competitive alternative to phosphates used in the billion-dollar water treatment business. Water treatment facilities are looking for replacements given the environmental hazards associated with phosphate use and costs associated with restrictions on their use. It can also be used to strengthen fiber in textiles. In 2021, the company moved closer to full commercialization with the completion of custom manufacturing for glucaric acid at Evonik in Europe.

There is a major shift in the consumer facing marketplace, particularly in major sectors like clean beauty where consumer preference and demand for safer products is growing rapidly.

<sup>50</sup> Minderoo Foundation. [Minderoo-Monaco Commission on Plastics and Human Health](#). 2023

<sup>51</sup> Minderoo Foundation. [Minderoo-Monaco Commission on Plastics and Human Health](#). 2023.

<sup>52</sup> American Chemistry Council. [What is Advanced Recycling? And Why is it So Important for Meeting the Growing Demand for Recycled Plastics?](#) 2021.

<sup>53</sup> Diana et al. [The evolving global plastics policy landscape: An inventory and effectiveness review](#). Environmental Science & Policy. 2022.

<sup>54</sup> Maine Department of Environmental Protection. [Extended Producer Responsibility Program for Packaging](#). n.d.

<sup>55</sup> UN Environmental Program [Press Release](#) 2022.

<sup>56</sup> Merkl A & Charles D. [The Price of Plastic Pollution: Social Costs and Corporate Liabilities](#), Minderoo Foundation. 2022

<sup>57</sup> OECD. [A Chemicals Perspective on Designing with Sustainable Plastics Goals, Considerations and Trade-off](#). 2021

<sup>58</sup> BloombergNEF. [The World's Addiction to Plastic in Five Charts](#). 2022.

<sup>59</sup> Bloomberg. [How Texas Could Save Us From Toxic Chemicals](#). 2022.

<sup>60</sup> Fast Company. [How Solugen creates carbon-negative industrial chemicals out of sugar](#). 2022.

This creates competitive advantage for companies scaling safer cosmetic and personal care products. This includes PFAS-free products, and products with reduced dependency on plastics and packaging. For example, companies like **Beautycounter** are well positioned for growth in this changing landscape. Beautycounter sells over 100 nontoxic, ecofriendly products that adhere to “The Never List”, a list comprised of more than 1,800 questionable or harmful chemicals that are restricted from use in their products. Seeing the revenue growth opportunity, the Carlyle Group bought a majority stake in 2021 that valued the company at \$1bn.<sup>61</sup>

Companies like **Evolved By Nature** are advancing sustainable chemistries that can be used for personal care products as well as coatings for textiles and apparel. The company received financing to accelerate the commercialization of their activated silk technology platform that will help customers move away from synthetics and fossil fuel derivatives. This product can replace petrochemical coatings for leather and textiles as well as be used as effective skin barrier-enhancing ingredients for personal care products. In 2019, Chanel acquired a minority stake in the company as part of its sustainable materials development strategy. And the company raised USD 120M of Series C venture funding in a deal led by Teachers' Venture Growth and Senator Investment Group, putting the company's pre-money valuation at \$350 million.<sup>62</sup>

These trends are creating revenue growth opportunities for brands selling safer products and suppliers like **Itaconix**. Itaconix makes sustainable ingredients for makers of dishwasher pods and tablets. Over 130 brands use their ingredients including Clorox and Colgate-Palmolive. The company is expanding into other product lines including diapers, haircare and deodorant. Their goal is to detoxify and decarbonize everyday products with no additional costs to consumers. Their first half revenues of \$31.1M in 2022 were 148% higher than the second half of 2021.<sup>63</sup> The company estimates the total addressable market to be at least \$2.3bn.<sup>64</sup>

Unilever, a company whose products are used by over 3.4 billion people daily, has a goal to eliminate fossil fuels in cleaning products by 2030. The company partnered with **Genomatica**, a biotechnology company, to commercialize and scale plant-based alternatives to feedstocks like palm oil and fossil fuels. \$120 million has jointly been invested in this newly formed initiative, and there are more investors expected to join.<sup>65</sup> Genomatica is also developing bio-materials for Lululemon Athletica, Covestro AG and Cargill-Helm.

*“Biotechnology has the potential to revolutionize the sourcing of our cleansing ingredients and ensure Unilever is a future-fit business – for consumers, shareholders and the planet we all share. This new venture will sit at the intersection of science and sustainability, meaning we can continue to grow our business without relying only on*

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<sup>61</sup> Los Angeles Business Journal. [Beautycounter Sells Majority Stake to Carlyle Group](#). 2021.

<sup>62</sup> BeautyMatter. [Biotech firm Evolved By Nature raises \\$120 million series C](#). 2022.

<sup>63</sup> Itaconix. [Half year results for the period ended 30 June 2022](#), 2022.

<sup>64</sup> Edison. [Five things every investor should know about everyday decarbonisation and Itaconix](#). 2022.

<sup>65</sup> Geno. [Geno and Unilever launch \\$120m venture to scale alternative to palm oil and fossil fuels](#). 2022.

*palm oil or fossil fuel derivatives, while also making our supply chains more resilient from having access to ingredient alternatives.*

*“We will be marrying science and nature to make sure there is no tradeoff for our consumers between the efficacy and sustainability of their products. We are building this innovative new venture to have the scale to drive real impact and change in our industry, helping to reinvent the chemistry of home and personal care products for the 21st Century.”*

*- Richard Slater, Unilever’s Chief R&D Officer*

To ensure that these new products and opportunities outperform conventional products in the marketplace, third party assessments provide data and comparative analysis for customers and investors. As more new products enter the marketplace and compete on a broader set of performance attributes aligned with customer needs and values, products are increasingly being differentiated in the marketplace by private and public labels assessing sustainability attributes including safer chemical use. Examples include:

- US government certifications, including *Safer Choice* and *Biopreferred*
- EU government certifications, including *EU Ecolabel*
- Cradle to Cradle
- GreenScreen Certified
- Global Electronic Council’s ecolabel, EPEAT
- Greenseal

## Conclusion

Sustainable chemistry solutions have a demonstrated ability to address the multiple planetary crises we currently face. Historically, toxicity and pollution are underappreciated financial risks to companies. The convergence of the three major shifts discussed here is beginning to force companies to re-think business as usual. Concurrently, the accumulation of trends is changing both risks and opportunities for the financial community. The risks are being reduced by companies transitioning to more sustainable chemistry in their products and production, which in turn creates new investable opportunities in sustainable chemistry.