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ESG Matters - US

Treading the dark waters of PFAS

Shareholder advocacy and the call for PFAS-free products

With hazardous chemicals, like PFAS, posing risks to biodiversity, health, and safety, companies engaged in their production face a gamut of financial and reputational challenges. The tide of consumer awareness is growing, amplified by a surge in shareholder activism advocating for heightened transparency and urging a shift away from these compounds in everyday products. Last year, a coalition of 50 investors, managing >$10T, pooled their efforts in the Investor Initiative on Hazardous Chemicals (IIHC). Simultaneously, there's a noticeable uptick in companies disclosing toxic chemical reduction initiatives, signifying a growing commitment to addressing these concerns.

Materiality, litigation, and valuable industry lessons

More than 9,900 PFAS-related lawsuits were filed in US federal courts between Jul '05 and Dec '23, covering water contamination, resource damage, personal injury, and CERCLA litigation (source: Bloomberg Law). Historical cases like Owens-Illinois (OI) and Crown Holdings (CCK) losing 70%-90% of their market cap during asbestos litigation serve as warnings of share price erosion due to widespread litigation. Over 90% of contamination sites are in Industrials, Waste Management, Energy, and Materials sectors (per EPA data). The chemicals industry lacks transparency, as only five of the 50 largest global companies plan to phase out hazardous chemicals. However, 3M has stated it plans to exit all PFAS manufacturing by 2025 due to regulatory and financial pressures.

Brace for impact with new regulations in 2024

As the EU moves towards a complete PFAS ban, US regulations vary by state, with Maine and Minnesota considering comprehensive PFAS bans. State laws often focus on PFAS in food packaging, while only 3 states have introduced regulations to address PFAS in pesticides, paints, and other chemicals. With 2024 upon us, expect numerous effective dates for federal and state PFAS laws. The EPA plans to finalize the first nationwide legally enforceable standards for PFAS in US drinking water in early 2024. Additionally, more facilities will be expected to report 2023 PFAS use to the Toxics Release Inventory in 2024 due to the removal of the de minimis exception. Retroactive reporting for PFAS materials manufactured or imported since 2011 will also be required under the Toxic Substances Control Act's PFAS Recordkeeping and Reporting Rule.

Unlocking the $220B remediation opportunity

PFAS remediation encompasses immobilizing, separating, concentrating, or destroying PFAS from water, soil, or air. AECOM estimates the cost to remediate approx. 55,000 PFAS sites in the US at around $220B. Wastewater dominates the PFAS market, followed by Industrial Remediation, presenting opportunities for companies involved in engineering, consulting, construction design for water infrastructure, PFAS removal technologies, and waste management. In PFAS detection and testing, the current market, estimated by BofA's Life Sciences & Diagnostic Tools analysts, is $175-225M and growing at 10-15% annually. We list 13 BofA-covered stocks or "solution-providers."

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See Team Page for List of Analysts

See quantitative screens for PFAS risk management in appendix

CERCLA: Comprehensive Environmental Response, Compensation, and Liability Act

EPA: Environmental Protection Agency

PFAS: Per- and polyfluoroalkyl substances

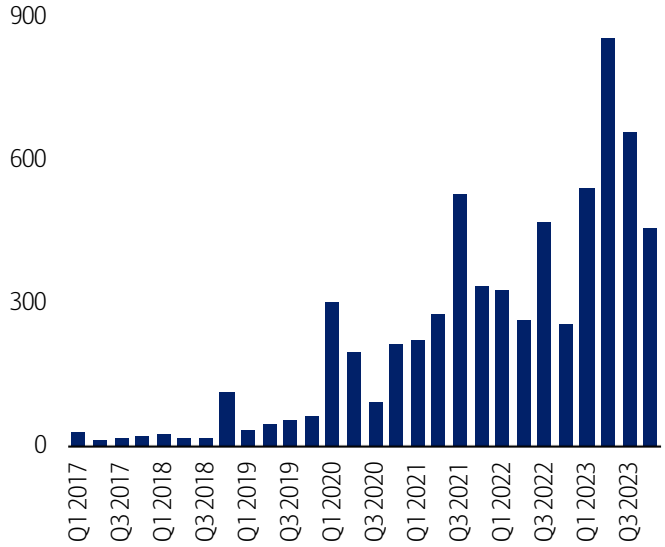
Growing risks from PFAS contamination

Per- and polyfluoroalkyl substances (PFAS), a class of synthetic chemicals, have undergone a transformative shift that investors, particularly those attuned to sustainability considerations, should closely monitor. PFAS has garnered widespread use in both industrial processes and consumer products. From non-stick cookware, firefighting foam, and electronics to food packaging and stain-resistant textiles, these chemicals have permeated various aspects of our daily lives. Renowned for their resistance to heat, water, and oil, the chemical bonds that make PFAS indispensable also render them virtually indestructible in the environment, earning them the moniker "forever chemicals." The release of PFAS into the environment raises concerns, as they can lead to soil, groundwater, and surface water contamination, posing potential risks to public health, safety and ecosystems.

The landscape surrounding PFAS is evolving, evident in the doubling number of shareholders advocating for the phase-out of PFAS in the past three years and the increasing disclosure of toxic chemical reduction initiatives by US companies. This shift holds substantial implications for sectors reliant on PFAS, prompting a strategic evaluation of their exposure to regulatory actions, such as bans in the European Union and specific U.S. states.

As environmental responsibility gains momentum in the investment landscape, more demand for PFAS testing, monitoring, and proactive remediation aligns with these shifting dynamics. Our note discusses the broader implications from regulation to litigation, to the nuanced impacts on various sectors.

Exhibit 1: 2023 saw an increase in the number of PFAS lawsuits
Number of US federal lawsuits containing the keyword "PFAS" by quarter, Q1 2017-Q4 2023



Source: BofA US ESG Research, Bloomberg Law

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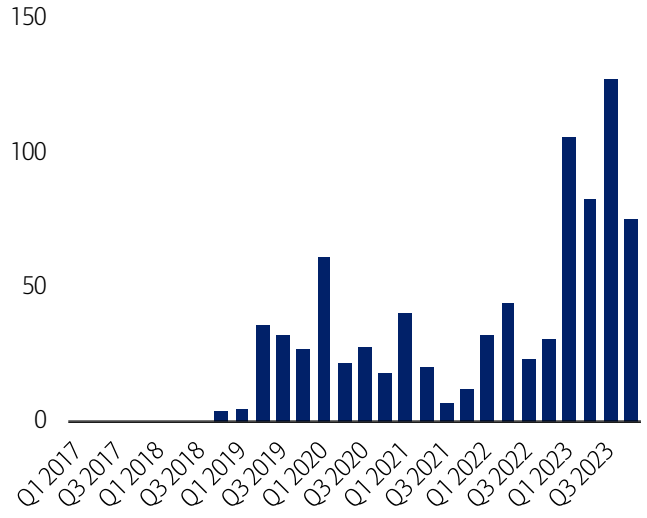
Exhibit 2: PFAS gaining greater attention in US company transcripts in 2023
Mentions of "PFAS" in S&P 500 corporate transcripts* by quarter, Q1 2017-Q4 2023



Source: BofA US ESG Research, Bloomberg. Corporate transcripts include earnings call transcripts, conference call presentations, shareholder meetings, guidance calls, M&A calls, sales results calls, investor days, and capital market days

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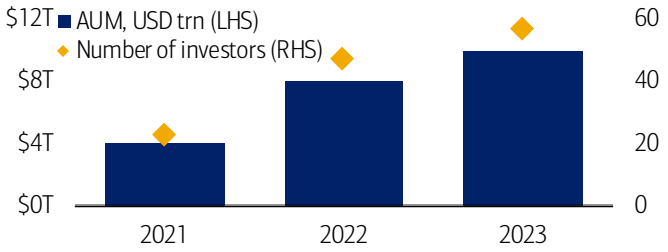
Exhibit 3: The number of investors calling for a phase-out of PFAS has more than doubled in the last 3 years

AUM (USD trn; LHS) and number of global investors (RHS) that signed an annual letter calling for PFAS producers to phase out PFAS as part of the Investor Initiative on Hazardous Chemicals (IIHC), 2021-2023



Source: BofA US ESG Research, ChemSec, Reuters, Financial Times. On the back of the letters signed by investors in 2021 and 2022, the Investor Initiative on Hazardous Chemicals (IIHC) was formally created in February 2023.

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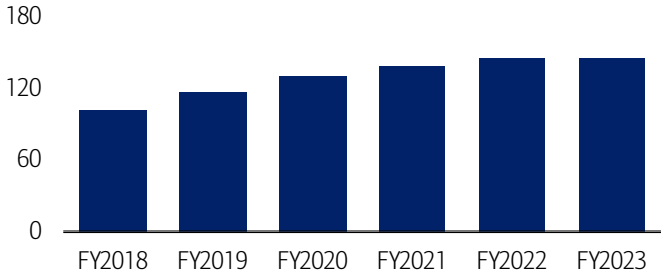
Exhibit 4: An increasing number of US companies are reporting on their initiatives to reduce their use of toxic chemicals

Number of S&P 500 companies that report on initiatives to reduce, reuse, substitute or phase out toxic chemicals or substances



Source: BofA US ESG Research, Refinitiv. Note: Per Refinitiv, "toxic chemicals or substances" includes chemicals, toxic materials, hazardous, PBT (persistent bio-accumulative toxic) and PVC (polyvinyl chloride).

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From human health to biodiversity: PFAS presents a multi-faceted risk

Throughout their production and use, PFAS (such as PFOA and PFOS) exhibit a concerning ability to migrate into soil, water, and air, persisting indefinitely without breaking down. The ubiquitous nature of these "forever chemicals" has led to their global presence in the bloodstreams of humans and animals, various food products, and the environment. This infiltration into water supplies contributed to an estimated ~6 million deaths in the US between 1999-2018 (source Wen et al., 2022).

Research highlights the detrimental effects of PFAS exposure on human health, including decreased fertility, developmental challenges in children, heightened cancer risk, disruption of hormones, elevated cholesterol levels, and compromised immune responses. New York University (NYU) Langone Health researchers estimate that the associated health conditions could accrue costs ranging from $5.5-63 billion in US health care expenses and lost productivity over the lifetime of the current population.

In fact, data from the Environmental Working Group (EWG) and Northeastern University show PFAS contamination in water systems across all 50 states, originating from various sources like industrial dumping, landfill seepage, and incineration of PFAS-containing products. Presently, it is estimated that over 200 million Americans could be exposed to PFAS in their drinking water at levels posing health risks.

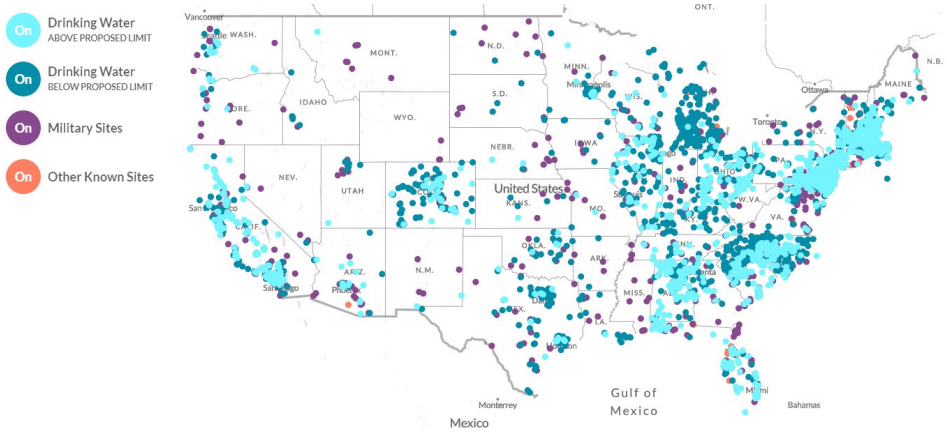
Our analysis, cross-referencing Environmental Protection Agency data on potential PFAS contamination sites with critical habitats identified by the U.S. Fish and Wildlife Service, reveals over 20,000 potential PFAS contamination sites within 5 miles of critical habitats, constituting approximately 12% of the critical habitat area in the US (Exhibit 6). This proximity poses serious implications for biodiversity, as PFAS may induce health and reproductive issues, endangering wildlife populations. The EWG identifies over 600 species at risk due to PFAS exposure.

Moreover, PFAS not only impacts water but also degrades soil health by reducing microbial diversity. This reduction in soil biodiversity worsens crop fertility and productivity, particularly concerning at a time when food security is already a global concern (see Feeding the future: the intersection between climate & AgTech report).

Did you know that nearly half of U.S states' tap water is contaminated? That's the finding of a nationwide study conducted by the US Geological Survey (USGS).

Over 4.6K public and private water systems are confirmed to be contaminated with PFAS—a number that continues to grow at an alarming rate (Exhibit 5; source: Environmental Working Group [EWG]). Interestingly, according to the Harvard T.H. Chan School of Public Health, people who live in communities with higher proportions of minority residents are more likely to be exposed to harmful levels of PFAS in their water supplies than people living in other communities.

Exhibit 5: Over 4.6K public and private water systems in the US have known PFAS contamination
PFAS pollution in public and private water systems, as of August 2023



Source: Environmental Working Group (EWG). Includes sites in the 50 US states, the District of Columbia and two territories. See https://www.ewg.org/interactive-maps/pfas_contamination/#about for details about EWG's sources and methodology.

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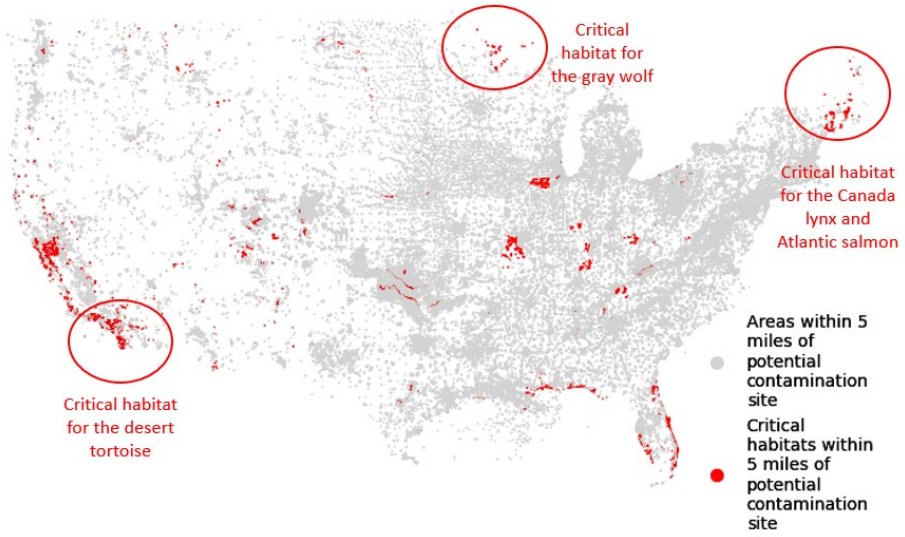
Exhibit 6: Endangered and threatened species are at risk of adverse PFAS health effects, with ~12% of habitats deemed critical to these species within 5 miles of a potential PFAS contamination site
Critical habitats within 5 miles of potential PFAS contamination sites



Source: BofA US ESG Research, US Fish and Wildlife Service, US Environmental Protection Agency

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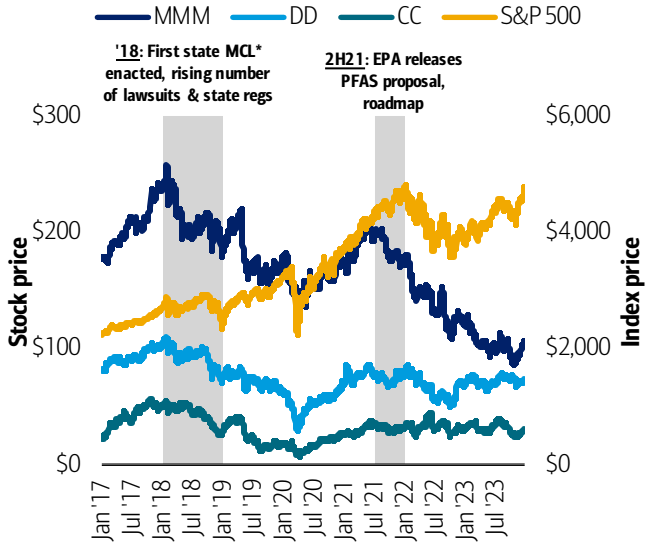
Financial materiality of PFAS too large to be ignored

Companies that fail to grasp the material impact of PFAS risk within their operations could face potentially expensive and even existential business disruptions. These may include reputational or brand damage, a decline in market share, diminished shareholder value, disrupted supply chains, environmental liabilities, and legal claims.

On the back of snowballing lawsuits and regulations, 3M (MMM), Chemours (CC), and DuPont de Nemours (DD) have collectively lost ~$145B (-60%) in market cap since January 31, 2018, even as the S&P 500 index grew 69% over the same timeframe (Exhibit 7).

Exhibit 7: 3M, DuPont, and Chemours have collectively lost 60% of their market cap since Jan 31, 2018
Stock price for MMM, DD, and CC (LHS) and index price for S&P 500 (RHS), 1/1/2017-12/22/2023



Source: BofA US ESG Research, Bloomberg. *MCL (maximum contaminant level) refers to a legally enforceable standard for PFAS in drinking water.

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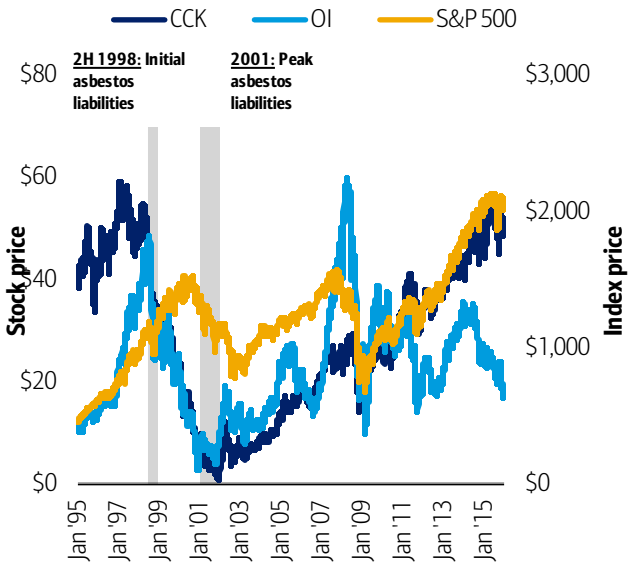
Exhibit 8: Historical analogue: CCK and OI shares fell over 90% and 70%, respectively, between public announcement in 1998 and the end of 2001 due to asbestos lawsuits
CCK and OI stock performance during peak asbestos liability periods, 1/3/1995-12/31/2015



Source: BofA Global Research, Bloomberg

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Case study: CCK and OI shares fell 30% following asbestos headlines

Asbestos litigation offers a historical analogue. Crown Holdings (CCK) and Owens-Illinois (OI) historically manufactured asbestos products and were caught in the peak of the issue. CCK and OI shares fell more than 30% in 2H 1998, when many asbestos manufacturers started publicly announcing the asbestos liability and settling claims related to asbestos exposure. By 2001, CCK and OI started seeing peak asbestos liabilities. CCK had $118mn in asbestos liabilities (~13% of market cap) and OI had $246mn in liabilities (~30% of market cap). CCK and OI shares fell over 90% and 70% respectively between public announcement in 1998 and the end of 2001 (Exhibit 8).

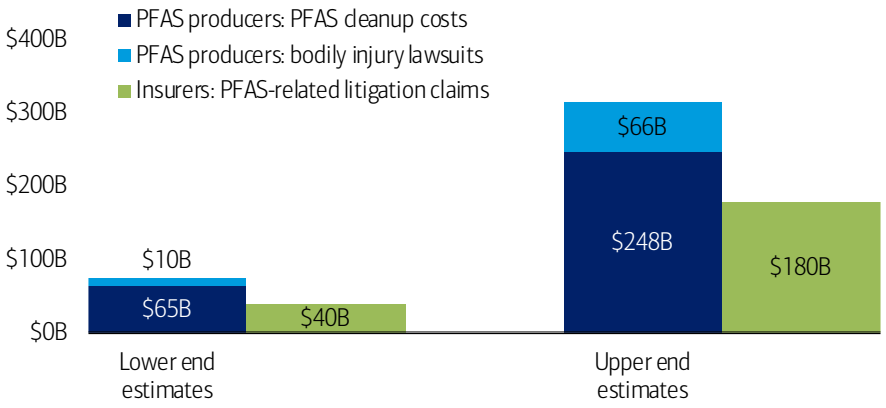
According to Bloomberg Law's litigation database, more than 9,900 PFAS-related lawsuits were filed in US federal courts between July 2005 and December 2023. For the most part, most litigation related to PFAS contamination has been directed towards PFAS manufacturers (source: Bloomberg Law). The litigation related to PFAS may take a long time to play out, especially considering that the Centers for Disease Control and Prevention estimate that 97% of Americans have some level of PFAS in their bloodstream. US District Judge Richard Gergel, a US judge overseeing thousands of PFAS lawsuits, said in December 2023 that individual cases could take up to a decade to resolve on their own.

The installation of PFAS treatment systems, potentially at thousands of public water suppliers, could effectively truncate a large portion of US exposures to PFAS. But other areas of longer-term litigation include lawsuits from State Attorneys General, litigation from human health effects, and CERCLA:

- **Drinking water contamination lawsuits:** US water systems are suing PFAS manufacturers for the costs of cleaning and filtering their wells and aquifers.
- **Natural resource damage lawsuits from State Attorneys General:** As of December 2023, 27 State Attorneys General have initiated lawsuits over PFAS contamination. Currently, four states have reached settlements in their cases.
- **Personal injury lawsuits:** PFAS personal injury lawsuits hold companies accountable for the health harms caused by PFAS contamination. This litigation could be driven by "safe dose" determinations, meaning that the IARC's recent classification of PFOA/PFAS as "carcinogenic to humans" could increase human health effects litigation risks and that the wording associated with the expected CERCLA designation (such as "carcinogenic" or "potentially carcinogenic") could be used in product liability claims. See Chem Weekly: PFOA carcinogenicity views, DOE call takeaways, EV tax credits report.
- **CERCLA litigation:** PFAS is expected to be named to the CERCLA (Comprehensive Environmental Response, Compensation, and Liability Act) list in the first half of 2024, which would require cleanup of PFAS-affected sites in the US. This could vastly expand the volume of PFAS litigation as a way to fund PFAS remediation activities.

Praedicat's estimates put legal liabilities for PFAS producers at $75B-$314B, with insurers potentially on the hook for $40B-$180B per Verisk Analytics estimates (Exhibit 9). Settlements in other sectors, including consumer companies accused of falsely advertising products that contained PFAS as "toxic-free" or "clean", are likely to further increase total PFAS-related litigation costs, although these settlement damages will be less than cleanup and bodily injury damages and will depend on how legal theory evolves.

Exhibit 9: PFAS liabilities could total hundreds of billions of dollars, potentially rivalling the $200B Big Tobacco settlement in the 90s
Lower and upper estimates for PFAS-related liabilities



Source: Praedicat, Verisk Analytics

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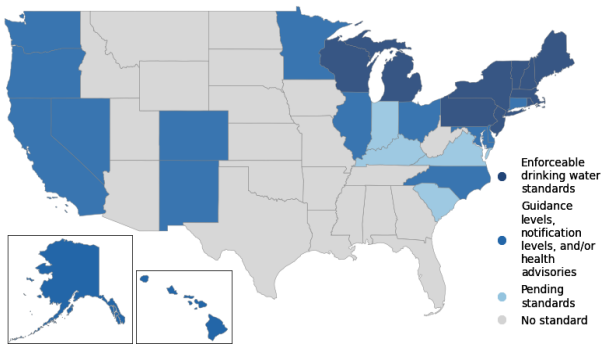
Is a PFAS ban on the horizon?

In February 2023, the EU announced that it is planning on universal PFAS restrictions that could ban some/all PFAS compounds which could potentially be adopted by the US over time. Congress has asked the US DoD (Department of Defense) to create a critical means report by looking at their supply chain, ammunitions, fighter jets, clothing, etc. for PFAS contamination and if there are any applications where they could avoid using PFAS. Federal watchdogs continue to move forward with increased regulation and guidance through the EPA while state legislatures have taken lead position in banning various PFAs in different products.

State regulation in the US

An increasing number of states are proposing and enacting laws on PFAS. In December 2023 alone, 11 PFAS legislation bills were introduced across states, addressing issues such as PFAS testing, remediation, and use in firefighting gear, signaling sustained scrutiny on PFAS manufacturers and downstream producers. Overall, ten states (ME, MA, MI, NH, NJ, NY, PA, RI, VT, and WI) have established enforceable standards on PFAS in drinking water, and other states have adopted guidance levels, notification levels, and/or health advisories for PFAS in drinking water, or have pending drinking water standards (Exhibit 10). Notably, while state standards for PFOA and PFAS are at or below the EPA's previous health advisory guidelines (70 ppt for both PFOA and PFOS), all but one state's standards are above the EPA's new proposed legally enforceable maximum contaminant levels (4 ppt for PFOA and 4 ppt for PFOS) and all states' standards are above the EPA's updated interim health advisory guidelines (0.004 ppt for PFOA and 0.02 ppt for PFOS). Various state bills will also impact specific products, including food packaging, cosmetics, and textile products (Exhibit 12-Exhibit 13). PFAS consumer product legislation is a rapidly developing area as states create new laws, with potentially significant penalties and litigation risks.

Exhibit 10: Growing number of states are enacting PFAS drinking water standards
PFAS drinking water standards by state



Source: BofA US ESG Research, Bryan Cave Leighton Paisner LLP, Safer States

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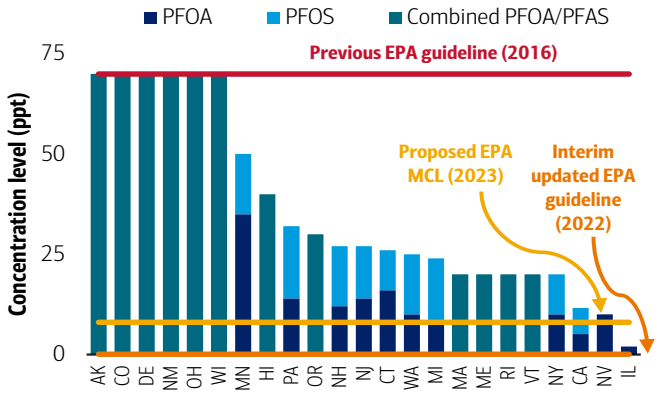
Exhibit 11: Widely varying state standards for PFAS in drinking water
Concentration levels (ppt) for PFOA and/or PFOS per state-promulgated standards and regulations



Source: BofA US ESG Research, Bryan Cave Leighton Paisner LLP. Note: The EPA's maximum contaminant level (MCL) represents a legally enforceable standard, while its health advisory guidelines are not legally enforceable.

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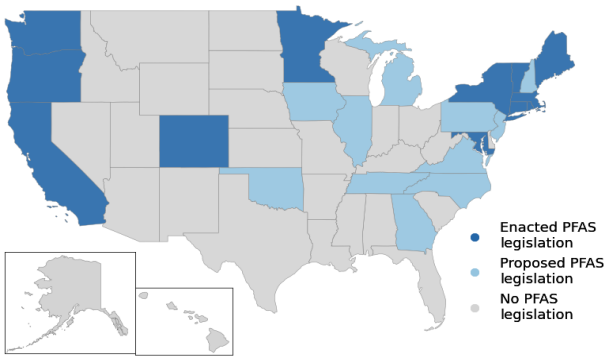
Exhibit 12: Growing number of states are enacting PFAS consumer product laws
State consumer product laws on PFAS



Source: BofA US ESG Research, Bryan Cave Leighton Paisner LLP. As of November 2023.
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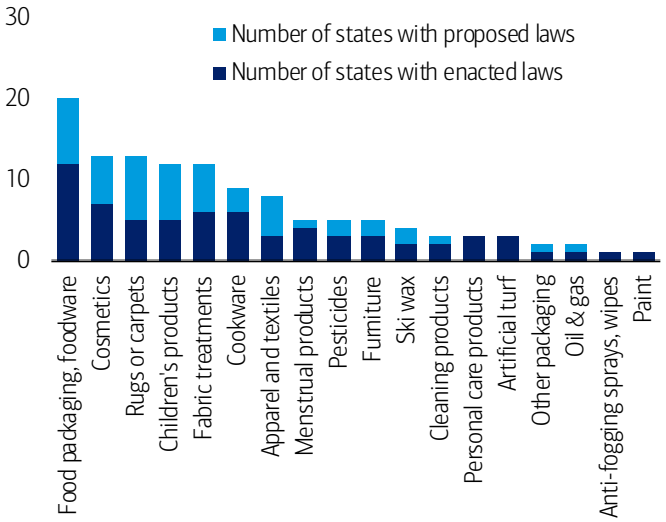
Exhibit 13: Food packaging most common focus among state PFAS consumer product laws
Number of states with enacted or proposed laws by product type



Source: BofA US ESG Research, Bryan Cave Leighton Paisner LLP. As of November 2023.
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Federal regulation

The EPA has been active in setting new PFAS rules in 2023, with further developments expected in 2024. Exhibit 14 summarizes these developments. Notably, the EPA is expected to finalize the first nationwide legally enforceable standards for PFAS in drinking water for the US in early 2024. Moreover, two EPA rules finalized in October 2023 will significantly increase disclosure requirements related to PFAS. First a greater number of facilities will need to report on the release and management of PFAS—even in small concentrations—due to the removal of the de minimis exception for Toxics Release Inventory (TRI) reporting (Exhibit 15). Second, for the first time, companies that have manufactured or imported PFAS *or any items containing PFAS* at any time since 2011 will need to disclose Information related to these items' production volumes and disposal practices, as well as employee exposure to PFAS.

Exhibit 14: EPA has been rolling out new PFAS rules in 2023-24
Federal regulations on PFAS

Federal Regulation	Timeline	Description
Final Rule to Enhance PFAS Toxics Release Inventory Reporting (TRI)	• Finalized **October 2023** • Effective **January 1, 2024** • Information reported **after July 2024** will be discoverable by plaintiffs' attorneys	In October 2023, EPA released a final rule (effective Jan 1, 2024) that will improve reporting on PFAS to the Toxics Release Inventory (TRI) by eliminating the "de minimis exemption," which allowed facilities to avoid reporting information on PFAS when those chemicals were used in small concentrations. The rule brings a broader scope of reporting requirements (as the list of PFAS compounds subject to TRI reporting has grown to 189) and greater litigation risks.
Final Rule to Require Reporting for PFAS Manufactured and Used in the US	• Finalized **October 2023** • Effective **November 13, 2023** • Reporting required by **May 8, 2025** (or November 10, 2025 for small manufacturers)	In October 2023, the EPA published a final rule under the Toxic Substances Control Act (TSCA) that will require all manufacturers (including importers) of PFAS and PFAS-containing articles in any year since 2011 to report extensive PFAS information to the EPA. Required disclosures include employee exposure data, production volumes, and disposal practices for PFAS manufacturers and downstream producers.
PFAS National Primary Drinking Water Regulation (NPDWR)	• Proposed **March 2023** • Expected **to** be finalized in early 2024 • Effective date will be three years after promulgation date (anticipated early 2027)	In March 2023, the EPA proposed the National Primary Drinking Water Regulation (NPDWR) for six PFAS. The rule establishes maximum contaminant levels (MCLs), which would federally enforce cleanup at sites with concentrations above the limit. In addition to the new limit for drinking water, this proposal would require public water systems to monitor for PFAS, notify the public of PFAS levels, and reduce the PFAS levels if they exceed the limits.
Comprehensive Environmental Response, Compensation, and	• Proposed **September 2022** • Final rule on PFAS expected in the **first half of 2024**	CERCLA provides EPA with the ability to require entities to clean up contaminated sites. CERCLA is a statue of liability, but it does not determine cleanup levels, nor does it provide cleanup technologies/processes. PFAS is expected to be named to the CERCLA list by February 2024. The EPA's lowered health advisory levels for PFOA

Exhibit 14: EPA has been rolling out new PFAS rules in 2023-24
Federal regulations on PFAS

Liability Act (CERCLA, also known as the Superfund)	and PFOS to near-zero implies a similarly low maximum contaminant level and screening thresholds for Superfund cleanup. Given the "joint and several" strict liability of CERCLA, responsible parties (e.g. landfill operators, commercial airports) will likely legally pursue chemical manufacturers to cover cleanup costs.

Source: BofA US ESG Research

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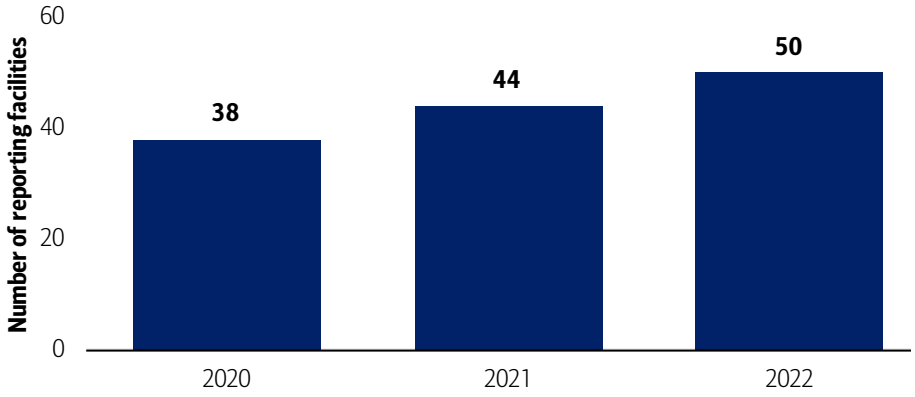
Exhibit 15: Just 50 facilities reported PFAS to the Toxics Release Inventory (TRI) for 2022, but this number is set to increase due to changes in TRI reporting requirements for 2023 data
Number of facilities reporting the release or management of PFAS to the Toxics Release Inventory (TRI) for 2020, 2021, and 2022



Source: BofA US ESG Research, US Environmental Protection Agency (EPA)

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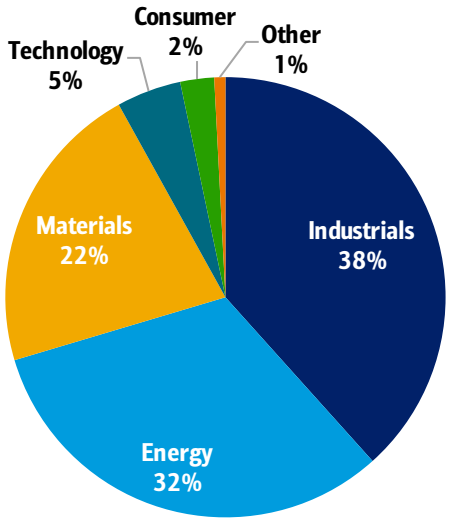
Sector implications

The Investor Initiative on Hazardous Chemicals (IIHC) was created in February 2023, uniting over 50 institutional investors holding a total of more than US$10T in assets. These investors are drawing attention to the increasing problems associated with PFAS. This heightened awareness may continue to see a rise in lawsuits against companies and efforts worldwide to tighten regulations addressing the risks posed by PFAS.

Regulatory developments will likely have wide-ranging implications on costs and liabilities among chemicals, industrials, waste, water utilities, insurance, and consumer companies. Although industry exposures have been difficult to quantify due to evolving science and difficulties with identifying the sources and timing of contamination, the EPA's analysis of potential sources of contamination indicates that over 90% of potential contamination sites occur within the Industrials, Energy, and Materials sectors, led by Oil and Gas (where PFAS has been used in fracking and for fire suppression) and Waste Management (due to PFAS disposal in landfills). Chemicals manufacturing sites make up half of the 50 facilities that officially reported managing or releasing PFAS to the Toxics Release Inventory (TRI) in 2022 (Exhibit 18). However, despite PFAS contamination risks in these sectors, less than a third of S&P 500 companies in Materials, Industrials, and Utilities report on initiatives to reduce, reuse, substitute or phase out toxic chemicals or substances (Exhibit 19).

Exhibit 16: Over 90% of the 150K+ facilities that have potentially used or released PFAS occur within the Industrials, Energy, and Materials sectors...
Percent of US facilities that have been identified by the US EPA as possibly handling, using, or releasing PFAS chemicals by sector



Source: BofA US ESG Research, US Environmental Protection Agency (EPA). Note: These industry sectors were identified from literature reviews and other investigations undertaken by EPA.
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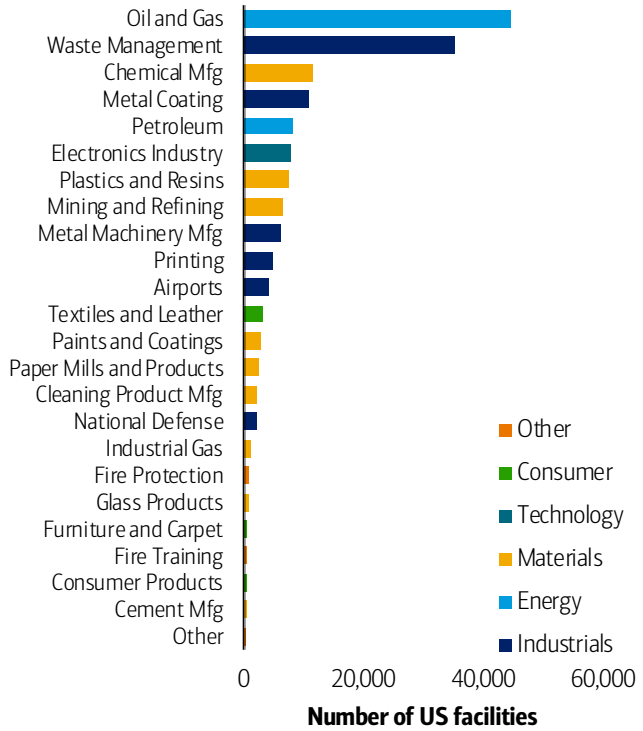
Exhibit 17: ...specifically led by facilities in the Oil and Gas, Waste Management, and Chemical Manufacturing industries
Number of facilities that have been identified by the US EPA as possibly handling, using, or releasing PFAS chemicals by industry



Source: BofA US ESG Research, US Environmental Protection Agency (EPA). Note: These industry sectors were identified from literature reviews and other investigations undertaken by EPA.
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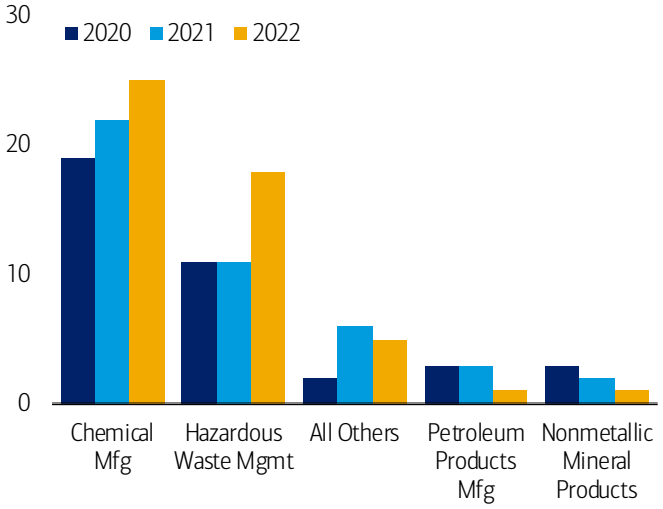
Exhibit 18: 86% of facilities reporting PFAS to TRI were either chemical manufacturing or hazardous waste management facilities
Number of facilities reporting the release or management of PFAS to the Toxics Release Inventory (TRI) by industry for 2020, 2021, and 2022



Source: BofA US ESG Research, US Environmental Protection Agency (EPA) TRI Database
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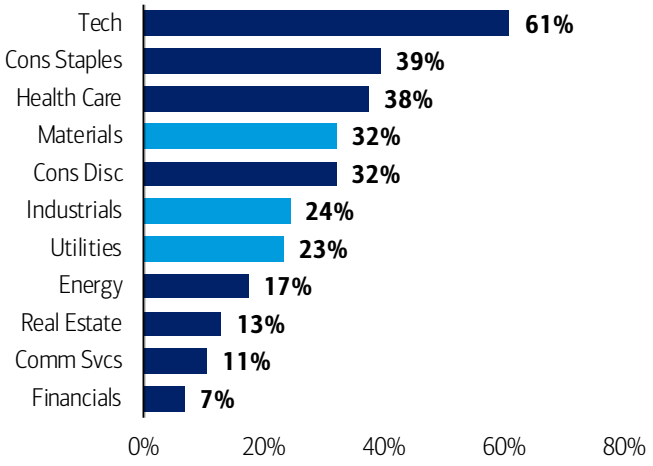
Exhibit 19: Less than a third of Materials, Industrials, and Utilities companies report on initiatives to reduce toxic chemicals use
Percent of S&P 500 companies that report on initiatives to reduce, reuse, substitute or phase out toxic chemicals or substances by sector, as of FY2023 or most recent year



Source: BofA US ESG Research, Refinitiv. The data includes chemicals, toxic materials, hazardous, PBT (persistent bio-accumulative toxic) and PVC (polyvinyl chloride).
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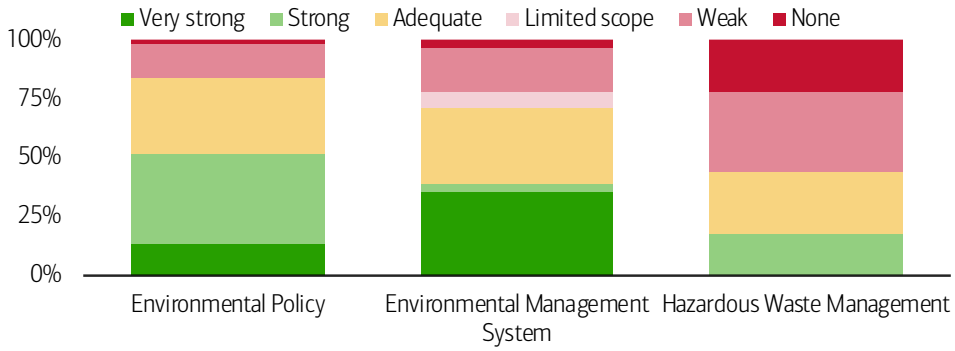
Chemicals/Multi-Industrials: Rising litigation risks

Despite mounting risks, the US chemicals industry performs poorly on hazardous waste programs: only 18% of public US chemicals companies have a "strong" program and no companies have a "very strong" program, per Sustainalytics' ESG Risk Ratings (Exhibit 20). Moreover, the chemicals industry has made little progress on transparency on hazardous chemicals production, per ChemSec's 2023 ChemScore report. Just five of the 50 largest chemicals companies globally (3M, SABIC, Indorama Ventures, Yara, and Solvay) plan to phase out hazardous chemicals beyond regulatory compliance (source: ChemSec). MMM had announced in December 2022 it will exit all PFAS manufacturing by 2025 due to rising regulatory and financial pressure.

Exhibit 20: Hazardous waste programs represent a risk among US Chemicals companies
Percent of public US chemicals companies in the Sustainalytics universe by the strength of their environmental management system, environmental policy, and hazardous waste management program



Source: BofA US ESG Research, Sustainalytics. 62 public US Chemicals companies in the Sustainalytics universe with available data.
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PFAS producers and intermediaries facing lawsuits

The chemical and multi-industrial companies that produced PFAS and PFAS-containing products face liability from lawsuits pertaining to drinking water contamination, natural resource damages, and personal injuries (e.g., health harms caused by PFAS contamination of well water or the presence of PFAS in firefighting foam). Additional

lawsuits could be incurred following the classification of PFAS as a hazardous substance under CERCLA (expected in the first half of 2024). While these CERCLA lawsuits will initially target waste companies, those waste companies will likely look to defray the cleanup liability across other parties involved in PFAS contamination, including industrial intermediaries and chemical companies. PFAS producers have argued in court that upon selling their product to an industrial intermediary, the responsibility born for that product transfers to said company, although this defense relies on the ability to identify where their product ended up and through which intermediary. See EPA steps up its game on PFAS – BofA event takeaways on what lies ahead report.

BofA's Chemicals and Industrials analysts have highlighted 3M (MMM), Chemours (CC), DuPont de Nemours (DD), Corteva (CTVA), Carrier Global (CARR), and Johnson Controls (JCI) as PFAS producers and intermediaries exposed to PFAS litigation risks.

Partial de-risking following 2023 settlements, but tail risks remain

In June 2023, some of the largest PFAS manufacturers (MMM, CC, DD, CTVA) announced that they were pursuing settlements with public water utilities for alleged contamination of the drinking water. Combined, the settlements total more than $11B ($10.3B for MMM and $1.2B for CC, DD, and CTVA). The settlement with CC, DD, and CTVA received broad support, with just 5% (717) of the 14K water utilities on the original class list opting out, as per the January 3 disclosure. The 717 opt-outs may rejoin until March 1, or may go to trial (see Chem Weekly: Hydrogen costs for FC cars, Red Sea disruption, PFAS update report). In the view of BofA's Chemicals analyst, Steve Byrne, water contamination and remediation costs were big unknowns for CC, DD, and CTVA investors, which means the 2023 settlement could represent a partial derisking to these companies (see PFAS agreement on drinking water could clear big hurdle report). BofA's Multi-Industrials' analyst Andrew Obin also views the settlement update as a positive for MMM, which will be hearing its opt-out numbers on February 2 (see 3M Company: Dupont opt-outs levels a positive for 3M report). Potential insurance recovery, which have historically ranged from 20-65% of settlement costs, could also reduce liabilities among PFAS producers, according to BofA Industrials analyst Andrew Obin (see 3M Company: Insurance may help fund settlements report). However, lawsuits from water utilities that opted out of the settlements could take years to resolve in court, and the settlements do not clear the group from ongoing litigation with State Attorneys General, lawsuits that may arrive from CERCLA designation, or any personal injury claims.

New disclosure requirements could drive more lawsuits

PFAS producers and intermediaries will also face increased disclosure requirements under the EPA's new disclosure rules. Information disclosed under the EPA's Toxics Release Inventory Reporting (TRI) rule will be discoverable by plaintiffs' attorneys after July 2024, which could lead to additional lawsuits. Under the Toxic Substances Control Act (TSCA), disclosure on disposal practices could potentially expose companies to liability for water utilities seeking additional funding, and the disclosure of employee exposure data may potentially increase the number of personal injury lawsuits.

See appendix for quantitative screens of US chemicals companies with better PFAS risk management.

Water utilities: High costs and energy use to treat PFAS

Making water safe to drink is a highly energy intensive process. To provide clean drinking water to communities and make wastewater safe to discharge, water utilities spend as much as 40% of their operating costs on energy for water treatment processes, emitting 45 million tons of greenhouse gas (GHG) emissions in the US annually (source: EPA). This high energy consumption exposes water utilities to operating risks related to the low-carbon transition as well as earnings volatility. The needs are set to increase even further as utilities implement new PFAS treatments to meet the EPA's proposed standards. From a fundamental standpoint, PFAS related increase in energy consumption increases short-term commodity exposure to power prices, and thus natural gas.

The EPA's proposed limits on PFAS in drinking water (via the National Primary Drinking Water Regulation) would require every US municipality to regularly test its water for PFAS and to keep the chemicals at or under the limits. In cases where PFAS levels exceed the limits, water utilities will need to treat the water and/or dilute it with cleaner water. Per estimates from the American Water Works Association (AWWA), a nonprofit association which represents 80% of US water utilities, 5,000 water systems will need to develop new water sources or install advanced treatment technologies, while an additional 2,500 will need to adjust their existing PFAS treatment systems.

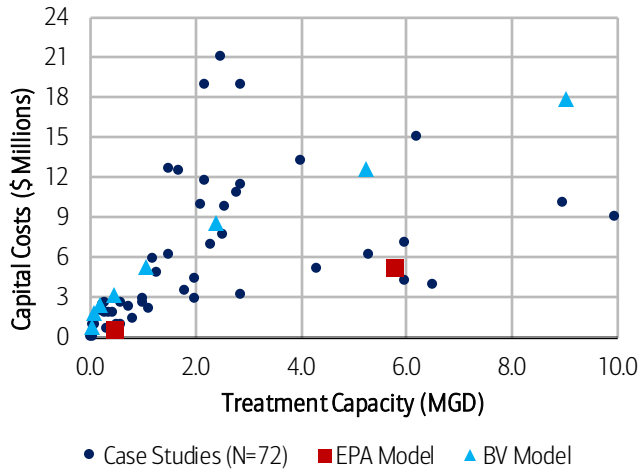
Less than half of est. $48B in costs covered by fed funding & settlements

The cost associated with these changes is significant—and potentially underestimated by the EPA. The EPA estimates ~$20B upfront capital costs and $0.8-1.2B annual operating costs. AWWA estimates the costs to be 3-4x higher, with annual costs of at least $2.5-3.2B for the next several decades and upfront capital costs of ~$48B. Black & Veatch, who ran the cost analysis for AWWA, based its cost model on prior case studies and extensive experience with design, permitting, and construction, all of which can have delays (Exhibit 21). In its cost estimates, Black & Veatch also considered the cost to comply with state specific PFAS drinking water standards (unlike the EPA's estimates). See PFAS event takeaways: regulatory, treatment, and litigation update report.

There is federal funding available to help with treatment costs. The Bipartisan Infrastructure Law (BIL) allocated $9B over five years (i.e., $4B in Drinking Water State Revolving Loan Funds and $5B for Emerging Contaminants in Small or Disadvantaged Communities grants). Settlements with chemical providers can also provide funding to cover the costs. The $1.2B settlement with water district plaintiffs by DD/CC and the $10B settlement by MMM represent 3% and 25% of the AWWA's water treatment cost estimates, respectively. Considering the $9B allocated under the BIL and the settlements with MMM, DD, CC, and CTVA, over half (~58%) of the costs to comply with the proposed EPA rule remain uncovered (Exhibit 22). However, public water suppliers may also receive money from the US government, given its key role in the mandating use of AFFF (Aqueous Film Forming Foam).

Exhibit 21: Black & Veatch (BV) estimates significantly higher capital costs of PFAS treatments than the US EPA's model

Comparison of granular activated carbon (GAC) PFAS treatment capital costs for medium-sized systems (<25 millions of gallons per day [MGD])



Source: Black & Veatch. Note: GAC is the most studied treatment for PFAS removal.

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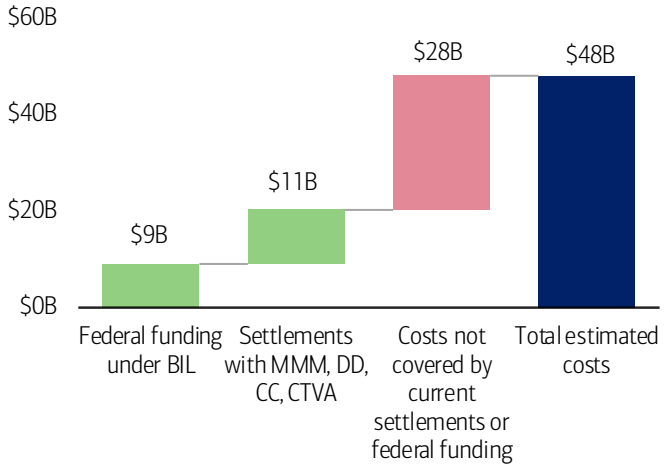
Exhibit 22: ~58% of the costs to comply with the EPA's proposed PFAS drinking water standards are not covered under current settlements or federal funding

Funding sources for estimated water treatment costs



Source: BofA US ESG Research, American Water Works Association

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BofA's Utilities analysts see PFAS capital and operating expense requirements still being refined among water utilities companies, as companies want to evaluate if there are opportunities for funding from the Federal government and industrial parties as part of the capital budgeting cycle. Traditionally, government funding has been a small source of capital for utility investments. Some companies have begun sharing estimates:

- **American Water (AWK)** expects 100+ of its existing drinking water treatment facilities (a 3-4x increase) will need to be upgraded to provide PFAS removal capability. It estimates $1B in capital investment for PFAS treatment facilities over a three- to -five-year period and $50M in annual operating expenses related to PFAS testing and treatment. This ~$1B capex was introduced into the formal plan with 3Q23 earnings when the five-year capital program increased +$2B to $16-17B 2024-2028 vs $14-15B 2023-2027. The spending is concentrated in 2025-2027 (see AWK EPS & LT guidance roll report).

- **Essential Utilities (WTRG)** preliminary multi-year capex estimate is $450M+ for PFAS, disclosed on the 3Q23 call, relative to $1.0-$1.1B annual capital investments in 2021-2022. This estimate is up from $350Mn previously but again the company is working to assess the ultimate needs. Similar to AWK, WTRG is looking for third party financing (i.e., not from ratepayers), which would reduce the bill impact and thus earnings opportunity. WTRG has disclosed $40M+ investment to treat for PFAS in its 2022 annual report.

- **SJW Group (SJW)** has estimated that PFAS compliance will cost $170-190M over the next three to five years.

According to BofA's Utilities analyst Paul Zimbardo, additional capex from PFAS is a potential opportunity for AWK and water utilities broadly; however, he does not expect a material enough change to consolidated capital generating a shareholder return to cause a deviation in long-term growth expectations. Like most utilities, the governor of the pace of spending is managing customer bill increases. As a result, if these capital and associated operating costs are required, BofA's Utilities analysts would expect water utilities to reduce spending elsewhere as an offset. AWK's plan is an example where there was -$500M capex reduction from the company's "risk-based assessment." Still net positive for AWK, but less than 5% of the investment program. Further, there are potentials for Federal funding and other zero/low cost sources of capital that would offset the shareholder earnings opportunity. See American Water Works: Valuation the main holdback. Improving near-term EPS on weather & int. rates 18 December 2023 report.

New Jersey advances new water health rider: an avenue for PFAS recovery

The New Jersey legislature recently advanced Assembly Bill 4791 (A4791) titled "Establishes '"Resiliency and Environmental System Investment Charge"'. The bill passed the assembly 68-3 and Senate 35-1 on January 8th. The bill creates a Resiliency and Environmental System Investment Charge (RESIC) rider subject to annual caps for eligible investments with recovery at the adjusted weighted average cost of capital. Utilities would make initial filings with three-year projected capex and customer bill impacts followed by semi-annual recovery filings which would be contingent on refreshed base rate case finalization in the past three years. Eligible costs include the following cost categories: "lake, river, and other intakes; wells and springs; power generation equipment; pumping equipment; water treatment plant equipment; distribution reservoirs and standpipes; communication equipment; wastewater pumping equipment; wastewater treatment and disposal equipment; and wastewater communication equipment." The annual RESIC cap starts at 2.5% total revenue in year zero (initial filing), grows to 3.5% year one (second filing), 4.5% year two (third filing), and 5% in subsequent "foundational filings".

New Jersey is one of the largest subsidiaries for AWK with $4.1B disclosed 2022 rate base representing 20-25% of total estimated rate base. Adding a new regulatory mechanism to reduce regulatory lag and provide visibility to capital recovery is positive. We would look for water utilities to pursue similar regulatory (or legislative if necessary) avenues to support timely cost recovery.

See appendix for quantitative screens of US water utilities companies with better PFAS risk management.

Waste providers: $1B in costs; potential net positive LT

Landfills play a critical role in pollution control by reducing the amount of waste that makes it into the environment. Yet they also carry pollution risks, as leachate (a liquid produced by landfill sites) can leak through landfill lining and contaminate nearby soil and water. This contamination disproportionately impacts minority and low-income areas, which are more likely to surround landfills and hazardous waste sites. As a result, it is critical that waste service providers have robust environmental and social programs in place to mitigate these risks.

The EPA's drinking water standards for PFAS and the inclusion of PFAS as hazardous under CERCLA could impact how landfill operators monitor or manage PFAS-containing material, including leachate. A 2021 EPA study found PFAS in leachate at 95% of the 200 landfills studied, which poses a PFAS contamination risk to nearby water sources. Although leachate is typically handled at wastewater treatment plants, these may become less available to landfills due to the EPA's new standards. In response, landfills are increasingly building their own on-site facilities to treat leachate.

> The National Waste & Recycling Association (NWRA) and the Solid Waste Association of North America (SWANA) have estimated national costs to remove PFAS from landfill leachate to be at least $966 million per year.

The waste industry is likely to pass along the costs of PFAS treatment to customers. Although it's too early to say for sure, some studies indicate that scaling up treatment systems could increase tipping fees (the fees paid to dispose waste in a landfill) by $1.5 per ton, i.e., by ~2.5%. PFAS treatment costs are also likely to strengthen the trend towards consolidation among landfill operators. Smaller landfills, typically owned by municipalities, are likely to struggle and be at a disadvantage in contending with emergent contaminants like PFAS (due to more limited knowledge, resources, and funding), while larger landfills like public companies WM, RSG, and WCN have large environmental engineering staff and are leveraging new technologies to manage and treat (or pre-treat) leachate.

Despite near-term remediation costs, the two largest public waste companies have both mentioned that they see PFAS as a net positive for their business:

- **Waste Management (WM)** noted that some costs related to PFAS remediation will be incurred in the short-term, but ultimately sees the waste industry as a solution provider for PFAS (for example, via Subtitle D landfills).
- **Republic Services (RSG)** said they see lots of opportunities relating to PFAS emerging on the Environmental Services side of their business and highlighted that they have a good history of passing regulatory costs onto their customers.

See PFAS event takeaways: regulatory, treatment, and litigation update report.

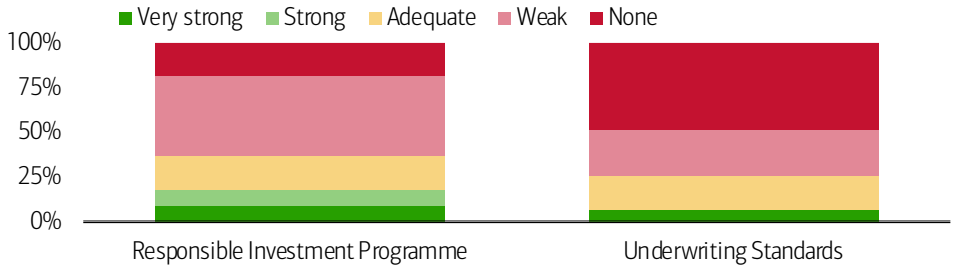
See appendix for quantitative screens of US waste providers with better PFAS risk management.

Insurance: PFAS overhang on P&C insurers

The insurance industry faces a dual-sided vulnerability to environmental risks like pollution. On one side, insurers can be liable for claims on environmental policies. On the other side, insurers are exposed to environmental risks via their investment portfolios. However, Sustainalytics' ESG Risk Rating scores for insurers' responsible investment programs (i.e., the extent to which insurers integrate ESG factors in investments) and underwriting standards (i.e., the extent to which insurers integrate environmental and social standards in underwriting) suggests a potential gap here, as less than half of the US public insurers have ratings of "adequate" or better for their responsible investment programs or underwriting standards in place, per Sustainalytics (Exhibit 23).

Exhibit 23: Integration of environmental risks in investments and underwriting represents a risk

Percent of public US insurance companies in the Sustainalytics universe by the strength of their Responsible Investment Programme and Underwriting Standards



Source: BofA US ESG Research, Sustainalytics. 33 public US insurance companies in the Sustainalytics universe with available data.

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Too early to identify the size and scope

Following recent news around potential settlements from corporations, such as 3M related to PFAS exposure and pollution, some industry participants are concerned about the potential of PFAS to be a redux of the asbestos mass tort of years past. Verisk Analytics, a risk analytics firm, has estimated US property and casualty insurers could face $40-180B in losses related to PFAS litigation. While these are staggering sums, there are debates whether PFAS litigation will reach the same degree as severity as the asbestos issues of years past and whether insurers should begin reserving for this potentially emerging liability today. It is expected the litigation related to PFAS will take a long time to play out, especially considering that most people are likely to have various PFAS in their bloodstream.

With the ever-increasing flood of claims being filed, increased focus from the current administration, and potential upside risks to claimant payouts from social inflation, the end result could prove material to commercial insurers, requiring many to strengthen their loss reserves and apply upward pressure on liability.

General liability (GL) and pollution legal liability (PLL) lines most at risk

While BofA's Insurance analyst, Joshua Shanker, believes it is too soon to identify with confidence which companies could be impacted and to what severity, he believes that PFAS litigation will remain an overhang on the industry as more cases are heard before the courts. He expects most of the commercial lines carriers within BofA's coverage to be impacted to some degree. AIG (AIG), Arch Capital Group (ACGL), AXIS Capital Holdings (AXS), Chubb (CB), Cincinnati Financial Corporation (CINF), CNA (CNA), Everest Group (EG), Hartford (HIG), RenaissanceRe Holdings (RNR), Selective Insurance Group (SIGI), Hanover Insurance Group (THG), Travelers (TRV), and Berkley (WRB) could all be impacted. The reinsurers should be relatively unexposed, given their formation much later than the legacy PFAS issues and presumable inclusion of tight pollution exclusions in more recent policies. See Mass torts overview: Examining the past could shed light on future outcomes report.

See appendix for quantitative screens of US insurance companies that score better on ESG risk integration.

Consumer: PFAS risk in secondhand, recycled products

An increasing number of U.S. states are enforcing bans on PFAS in clothing, urging companies to seek less-toxic alternatives for water- and stain-resistant shirts, hats, and rain jackets. California and New York have set 2025 deadlines for PFAS bans in new (not previously used) apparel, while Maine's ban on PFAS in consumer products, including apparel, starts in 2030. Despite these measures targeting the health risks associated with PFAS, a gap exists as products that contain PFAS continue to be sold and circulated in secondhand markets. This is significant as the US secondhand market has risen to $39 billion as of 2022 and is projected to reach $70 billion by 2027 as we discussed in our sustainable fashion note (source: ThredUp). The popularity of secondhand shopping is fueled by both economic considerations amid rising inflation and a growing preference for sustainable consumer choices. This now begs the question of whether it is considered a sustainable conscious practice to resell apparel that contains PFAS.

In fact, some apparel retailers are destocking inventory in early 2024. For example:

- **Columbia Sportswear (COLM)** anticipates some retailers will choose to destock PFAS styles in the first half of 2024 before loading in the new styles designed with PFAS free chemistry in Fall 2024 (see Columbia Sportswear: See headwinds from PFAS & continued retailer cautiousness report).

- **VF Corp (VFC)** has noted that it is working aggressively to sell through its PFAS apparel inventory by spring 2024.

Food packaging is another large focus of state PFAS bans. Bans on PFAS in food packaging went into effect in New York at the end of 2022, followed by California, Washington, Vermont and Connecticut in 2023. Additional bans in Maryland, Minnesota, Rhode Island, and Hawaii become effective in 2024. This creates challenges for food and beverage companies, who must find sustainable and chemical-free packaging alternatives. Yet the use of PFAS in packaging has implications for recycled plastics—a major focus of sustainable packaging targets—as hazardous chemicals can accumulate in recycled material.

In general, a number of consumer brands are taking action. For example:

- **Walmart (WMT)** reduced the footprint of priority chemicals in Walmart U.S. and Sam's Club U.S. formulated consumables by 20% compared to a 2017 baseline.

- **Target (TGT)** intends to remove intentionally added PFAS from owned brand products, including but not limited to textiles, formulated products, cosmetics, beauty and cookware items by 2025.

Litigation risks for consumer companies

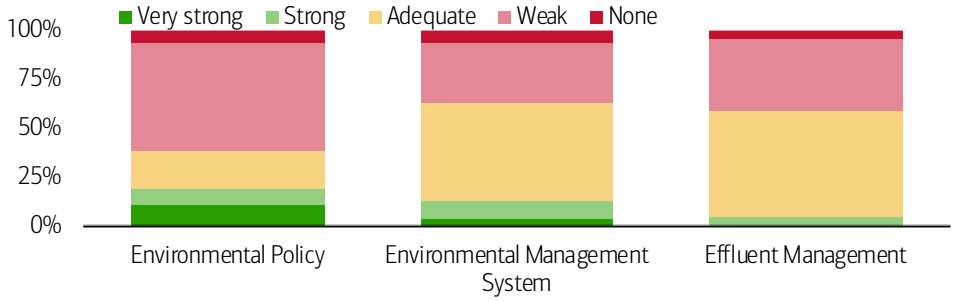
Since 2020, ~50 separate lawsuits have been filed in the US alleging consumer protection liability for manufacturers' failure to disclose the presence of PFAS in various consumer products (e.g., cosmetics, fast food packaging, apparel, and car seats). Defendants include Procter & Gamble (PG), Conagra Brands (CAG), and McDonald's (MCD). Claims and settlements have thus far appeared to focus on marketing harm rather than actual harm from PFAS, meaning that the viability of the claims depends on the strength of the sustainable and toxic-free language used by the consumer products companies. Settlement damages in these cases are less than other cleanup and personal injury lawsuits, but the growth in legislation is expected to encourage further litigation in consumer products based on alleged personal injuries and greenwashing.

See appendix for quantitative screens of US consumer companies with better PFAS risk management.

Oil and Gas: Underappreciated PFAS litigation risk

Although the oil and gas industry is not commonly identified as a user of PFAS, the EPA's analysis suggests that this industry has the largest number of potential contamination sites relative to other industries.[1] Toxic emissions & waste is a material risk for oil and gas companies per our analysis in our Follow the numbers, not the naysayers report, yet less than 5% of oil and gas producers have a strong effluent (wastewater) management program (per Sustainalytics' ESG Risk Ratings; Exhibit 24). Given the rising focus on PFAS, oil and gas producers with PFAS contamination on their sites could be at risk of increasing litigation.

Exhibit 24: Effluent management represents a risk for Oil and Gas producers
Percent of public US oil and gas producers in the Sustainalytics universe by the strength of their environmental management system, environmental policy, and effluent management program



Source: BofA US ESG Research, Sustainalytics. Based on 62 US oil and gas producers with data.

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PFAS contamination at oil and gas sites could result from a variety of use cases. For example, PFAS can be found in Aqueous Film Forming Foam (AFFF) used to suppress liquid-based (i.e., oil, gas, or petroleum) fires at oil and gas sites, hydraulic oils used to prevent corrosion, surfactants in oil reservoirs used to increase production, and fracking fluids used to reduce friction for drill bits. The FracFocus database, which tracks chemicals used in fracking based on publicly reported data, indicates that at least 100 companies have used PFAS (or chemicals that can break down into PFAS) in the last decade in Texas, Arkansas, Louisiana, Oklahoma, New Mexico, and Wyoming.

See appendix for quantitative screens of US oil and gas companies with better PFAS risk management.

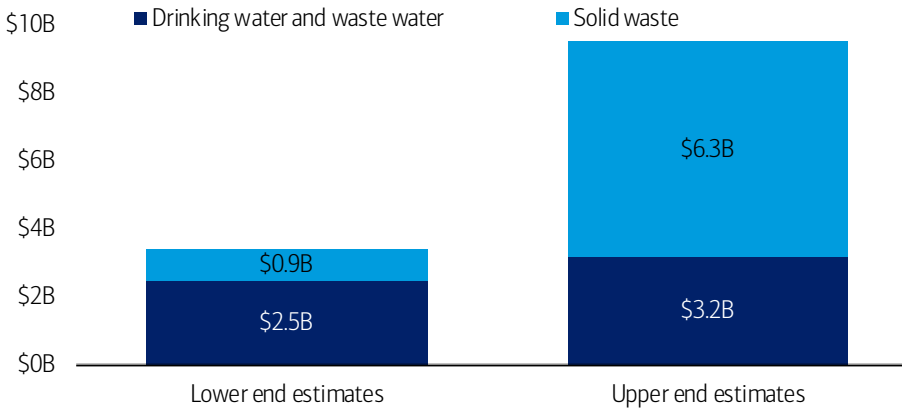
[1] Number of US sites identified by the US EPA as possibly handling, using, or releasing PFAS chemicals based on literature reviews and other investigations undertaken by EPA.

>$220B market for PFAS solutions

New US federal and state regulations are positive for PFAS solution providers, as the regulations are increasing demand for PFAS testing, monitoring, and proactive remediation. Designating PFAS substances to the CERCLA list is likely to drive significant private sector spend on PFAS testing and treatments, while the EPA's proposed rule on PFAS drinking water standards is expected to drive significant spend by water utilities and landfill operators.

PFAS can be purchased for $50-1,000 per pound, but costs between $2.7 million and $18 million per pound to remove and destroy from municipal wastewater (source: Minnesota Pollution Control Agency). Nationally, projections from American Water Works Association/Black & Veatch and the National Waste & Recycling Association estimate PFAS removal costs for water and solid waste to reach nearly $10 billion, with the distribution of this financial burden among industries responsible for PFAS contamination remaining uncertain at this point in time.

Exhibit 25: Combined annual costs to remove PFAS from water and solid waste could total nearly $10B p.a.
Lower and upper estimates for annual PFAS removal costs



Source: American Water Works Association/Black & Veatch, National Waste & Recycling Association

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Emerging technologies may offer cheaper PFAS removal in the future, potentially destroying PFAS at industrial, landfill, or wastewater sites. However, technologies like supercritical or electrochemical oxidation are still in development and face challenges, especially in terms of energy consumption. We estimate that treating US wastewater for PFAS could use enough electricity annually to power 215K electric vehicles for a year.[2]

Until advanced technologies become viable, engineering, procurement and construction (EPC), life sciences and waste and hazardous waste management companies are expected to play an important role. Methods such as deep-well injection, controlled landfills, or specialized incineration may be employed to manage PFAS waste efficiently.

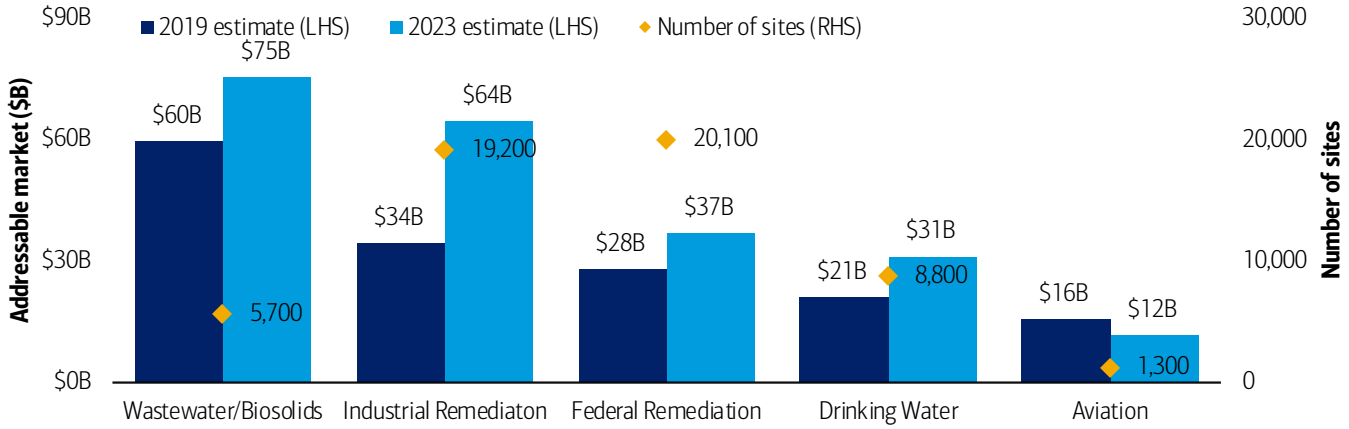
PFAS remediation: ~$220B addressable market

PFAS remediation involves immobilizing, separating and concentrating, or destroying PFAS from water, soil, or the air. The cost to remediate ~55K PFAS sites in the US could total ~$220B, per estimates from AECOM, a leading environmental services consulting provider. Wastewater reflects the largest sub-sector within the PFAS market, followed

[2] Academic research suggests that PFOA/PFOS removal requires energy consumption of 0.18 kWh/m3 (Lin et al., 2015). 34 billion gallons (~130 million cubic meters) of wastewater is treated in the US each day (source: US EPA). We assume 11% of this wastewater would need to be treated for PFAS, as the AWWA estimates that 7,500 US water systems (11% of the 66,000 water systems expected to be subject to the EPA's proposed rule) could require PFAS filtration. This implies 930 million kWh per year for PFAS treatment. An electric vehicle consumes 0.32 kWh/mile on average and the average US driver drives 13,476 miles in a year, implying energy consumption of 4,312 kWh/year for an electric vehicle (source: EVbox, US Department of Transportation).

by Industrial Remediation (Exhibit 26). See PFAS event takeaways: regulatory, treatment, and litigation update report.

Exhibit 26: The total addressable PFAS market within the US has increased by ~40% between 2019 and 2023
Estimated addressable PFAS market in 2019 vs. 2023 (LHS) and the number of PFAS sites in the US (RHS)



Source: AECOM

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There is no standardized solution for treating PFAS. Various filtration technologies, such as granular activated carbon, ion exchange resins, and reverse osmosis or nanofiltration, are capable of reducing PFAS levels to below EPA's proposed maximum contaminant levels but have trade-offs. These include space and engineering requirements, as well as suitability for different PFAS types. Additionally, each method produces PFAS-contaminated waste, which requires proper management, adding to the overall costs.

The EPA's proposed limit of four parts per trillion (ppt) for PFAS in drinking water could require filtration in around 7,500 US water systems (11% of the 66,000 water systems expected to be subject to the rule), per AWWA estimates. This could result in annual capital and operating expenses of $5.7 billion. While the Infrastructure bill allocated $9 billion for emerging contaminants, including PFAS, the scale of funding needed could be greater than this.

Our BofA Global Research sector analysts have identified the US companies in their coverage universe that sell equipment and services used in PFAS remediation and treatment and therefore could be potential beneficiaries of increased PFAS demand in Exhibit 27 (note that this analysis is agnostic as to the analysts' ratings for each stock). Specifically, they highlight that BofA-covered companies specializing in engineering, consulting, and construction design for water infrastructure (like ACM, J, MEG, NVEE); companies that sell PFAS removal technologies (like DD, ECL); and waste management companies with hazardous or chemical waste programs (like CWST, GFL, RSG, and WCN) could benefit from an increase in PFAS-related regulations. Companies that provide PFAS remediation solutions benefit from high barriers to entry and global scale, as many clients tend to prefer a handful of companies with scale and reputation in the field as a hedge to reputational risk given heightened awareness around PFAS. See PFAS regulatory and remediation technology update report and Ammonia from bacteria, new PFAS destruction technology, PE inventories up report.

Exhibit 27: BofA-covered US companies that sell equipment and services used in PFAS remediation and treatment
List of companies that sell equipment and services for PFAS remediation and description of their offerings

BofA Ticker	Company Name	BofA Analyst	GICS Sector	Description of PFAS remediation offerings	Mkt Cap (USD bn)
ACM	AECOM	Michael Feniger	Industrials	AECOM's offerings include PFAS remediation and treatment.	12.63
CWST	Casella Waste Systems Inc	Michael Feniger	Industrials	Casella Waste provides waste services, including Subtitle D landfills and PFAS treatment.	4.99
DD	DuPont de Nemours Inc	Steve Byrne	Materials	DuPont's offerings for PFAS remediation include ion exchange resins and reverse osmosis membranes which are integrated by other manufacturers into water treatment systems.	33.13
ECL	Ecolab Inc	Steve Byrne	Materials	Ecolab acquired Purolite in 2021, which has designed and developed a specialty ion exchange resin with dual removal mechanisms of ion exchange and adsorption technology for PFAS removal.	56.71
GFL	GFL Environmental Inc	Michael Feniger	Industrials	GFL Environmental provides waste management services, including hazardous waste programs.	12.76
J	Jacobs Solutions Inc	Michael Feniger	Industrials	Jacobs Solutions offers engineering and construction services, including PFAS management strategies.	16.43
MEG	Montrose Environmental Group I	Andrew Obin	Industrials	MEG provides environmental consulting services, including environmental PFAS testing, remediation, and interventions. MEG has already completed remediation projects at US manufacturing and military sites.	0.99
NVEE	NV5 Global Inc	Michael Feniger	Industrials	NV5 provides engineering consulting services, including PFAS consulting and environmental services.	1.80
RSG	Republic Services Inc	Michael Feniger	Industrials	Republic Services offers hazardous waste treatment and disposal services, including for PFAS.	51.70
WCN	Waste Connections Inc	Michael Feniger	Industrials	Waste Connections offers hazardous waste treatment and disposal services, including for PFAS.	38.34

Source: BofA Global Research

BofA GLOBAL RESEARCH

PFAS detection and testing solutions

Based on management commentary from several Life Sciences Tools (LST) companies, BofA's Life Sciences & Diagnostic Tools analysts conservatively estimate the current market for PFAS detection and testing at $175-225M, growing at 10-15% annually, but estimates from some analytical instrument vendors have more recently suggested that the market is closer to $300-350mn in size and growing at ~20%. Methods to detect PFAS in water include laboratory analysis, field test kits, passive samplers, and online sensors. The testing of PFAS requires highly sensitive and accurate analytical instruments (e.g., liquid chromatography (LC) and mass spectrometers (MS) systems) to quantify trace levels of PFAS.

PFAS testing illustrates how LST technologies can be leveraged across end markets outside of core applications in biomedical research, drug development, and drug manufacturing. It also shows that while many industries "dread" new regulation, LSTs often benefit from more stringent rules covering environmental monitoring, food safety, and drug quality. Analytical instrument vendors will likely benefit from more PFAS testing. However, given the size of these vendors' total revenue base, BofA's Life Sciences & Diagnostic Tools analysts see PFAS testing as more of an incremental positive. Among BofA-covered US companies, our sector analysts identified A, DHR, and TMO as PFAS testing solution providers that stand to benefit (Exhibit 28). See New PFAS testing proposal a modest positive for LC/MS instrument vendors.

Exhibit 28: BofA-covered US companies that offer PFAS detection and testing solutions
List of companies that offer PFAS detection and testing solutions and description of their offerings

BofA Ticker	Company Name	BofA Analyst	GICS Sector	Description of PFAS testing offerings	Mkt Cap (USD bn)
A	Agilent Technologies Inc	Derik De Bruin	Health Care	Agilent is one of the top two liquid chromatography (LC) instrument and consumable vendors. It offers complete start-to-finish workflows for extraction, screening, quantification, and reporting of PFAS in water and environmental samples, including integrated liquid chromatography/mass spectrometry (LC/MS) platforms.	38.43
DHR	Danaher Corp	Michael Ryskin	Health Care	Danaher is the leading vendor of triple quadrupole mass spectrometers, as well as LC consumables, which are used in PFAS testing.	170.55
TMO	Thermo Fisher Scientific Inc	Derik De Bruin	Health Care	Thermo Fisher Scientific is the market leader in mass spectrometry and a key LC vendor. It offers analytical instruments and software for PFAS testing, including LC/MS platforms. They also provide laboratory analysis services for PFAS in water, soil, and other environmental samples.	204.32

Source: BofA US Research

BofA GLOBAL RESEARCH

Appendix

Screens

The exhibits below are screens and not recommended lists either individually or as a group of stocks. Investors should consider the fundamentals of the companies and their own individual circumstances/objectives before making any investment decisions. The screens are intended to be indicative metrics only and may not be used for reference purposes or as a measure of performance for any financial instrument or contract, or otherwise relied upon by third parties for any other purpose, without the prior written consent of BofA Global Research. These screens were not created to act as a benchmark.

Screening criteria

We utilize data and scores from ChemSec, Sustainalytics, Refinitiv, Bloomberg, and the National Resources Defense Council (NRDC) to screen for US companies that score more highly on metrics relevant to PFAS risk management in their industry. The full list of screening criteria can be found in Exhibit 29 along with the relevant data providers' field definitions.

ChemSec's ChemScore report grades the world's top 50 chemical producers on their work to reduce their chemical footprint. It provides scores between A+ and F. The best score achieved by a US company is a C+ (globally, the best score is a B). Half of the US companies received a score of D+ or lower, meaning that a company with a score of C- or better ranks within the top half of their US peers.

Sustainalytics scores companies on their environmental policies, environmental management systems, hazardous waste management, effluent management, responsible investment programs and underwriting standards (see definitions in Exhibit 29). ESG Risk Ratings measures the strength of a company's hazardous substance management program. It assesses whether companies have procedures in place to identify and review the use of substances of concern in their products (i.e. includes PFAS in this case). It also assesses whether they have targets to reduce their use or have phase-out plans in place. Sustainalytics scores policies and programs as None, Weak, Limited Scope, Adequate, Strong, and Very Strong (in order from worst to best). Having a policy/program that is ranked as "Adequate"/"Strong"/"Very Strong" means that Sustainalytics deems the company's program is adequate/strong/very strong from a risk management perspective.

When it comes to PFAS transparency and target-setting, Bloomberg tracks companies' commitments to eliminate toxic chemicals, while Refinitiv tracks companies' transparency on their initiatives to reduce toxic chemicals.

The National Resources Defense Council (NRDC) released a scorecard that graded the PFAS-related policies and commitments of 30 top U.S.-based apparel brands and retailers. It provides scores between A+ and F. The best scoring company received a score of A+, while 18 companies received scores of D or worse.

Exhibit 29: Field definitions
Field definitions for screens

Source	Field	Definition
ChemSec	ChemScore	ChemSec's ChemScore grades assess which companies have strong chemicals management strategies, and which do not.
Sustainalytics	Hazardous Waste Management	This indicator assesses a company's initiatives to reduce waste generated by its own operations that it defines as hazardous, or waste that bears the following characteristics: it is toxic, flammable, corrosive or reactive. The assessment does not include mineral waste management, non-hazardous waste management or nuclear waste management, as these are covered by other indicators.
Sustainalytics	Environmental Policy	This indicator assesses a company's commitment to manage its operations with a view to prevent, reduce or mitigate any harmful effects on the environment and natural resources.
Sustainalytics	Environmental Management System	This indicator assesses the quality and scope of a company's existing environmental management system (EMS), including executive oversight, compliance with regulations, measurable targets and deadlines and EMS certification.

Exhibit 29: Field definitions
Field definitions for screens

Source	Field	Definition
Sustainalytics	Effluent Management	This indicator assesses a company's programmes to reduce, reuse and manage wastewater generated through a company's operational processes, prior to its release in the environment, as well the management of any incidents that might occur in relation to wastewater.
Sustainalytics	Responsible Investment Programme	This indicator assesses a company's initiatives to integrate environmental, social and governance (ESG) factors into investment decisions, including executive or board oversight and reporting on strategy implementation.
Sustainalytics	Underwriting Standards	This indicator assesses a company's initiatives to incorporate environmental and social criteria into its core insurance underwriting practices, including procedures and guidelines, exclusion based on ESG factors and executive or board oversight.
Bloomberg	Commitment to Eliminate Chemicals of Concern	Indicates whether the company has made a commitment to eliminate the use of toxic chemicals of concern. Chemicals of concern are highly hazardous and can negatively affect human health and the environment when improperly managed. This is marked "Y" if the company has publicly committed to eliminate the use of chemicals of concern in their production. Registration, Evaluation, Authorization and Restriction of Chemical (REACH) and equivalent regional, or national, regulations restrict the manufacture, import, and use of these chemicals. As defined by the World Health Organization (WHO), European Chemicals Agency (ECHA) and U.S. Environmental Protection Agency (EPA), chemicals and substances of concern includes asbestos, lead, mercury, arsenic, highly hazardous pesticides, formaldehyde, polychlorinated biphenyls (PCBs), PFAS, among others.
Refinitiv	Toxic Chemicals Reduction	Does the company report on initiatives to reduce, reuse, substitute or phase out toxic chemicals or substances? - in scope, the data includes chemicals, toxic materials, hazardous, PBT (persistent bio-accumulative toxic) and PVC (polyvinyl chloride).
National Resources Defense Council (NRDC)	PFAS scorecard	NRDC's PFAS grade assesses apparel brands on the basis of their timelines for PFAS phaseout, the range of products covered by their PFAS policy, and public availability of company PFAS commitments, as well as their PFAS labeling and testing protocols.

Source: Sustainalytics, ChemSec, Refinitiv, Bloomberg, National Resources Defense Council (NRDC)

BofA GLOBAL RESEARCH

US Chemicals

Being transparent and having adequate environmental programs and policies in place can be a risk mitigating factor for chemicals companies. On this basis, we screen for S&P 500 Chemicals companies that have received a 2023 ChemScore grade of at least C- and have at least an "adequate" rating for their environmental policies, environmental management systems, and hazardous waste management per Sustainalytics' ESG Risk Ratings (Exhibit 30).

Exhibit 30: Chemicals screen
S&P 500 Chemicals companies with a minimum rating of "adequate" for their environmental policies, environmental management systems, and hazardous waste management and a 2023 ChemScore grade of at least C-

BofA Ticker	Company Name	2023 ChemScore grade	Strength of Environmental Policy	Strength of Environmental Management System	Strength of Hazardous Waste Management	Market Cap (USD bn)
LYB	LyondellBasell Industries NV	C-	Strong	Adequate	Adequate	31.26
MOS	Mosaic Company	C-	Strong	Strong	Adequate	11.51
PPG	PPG Industries, Inc.	C-	Very strong	Adequate	Strong	34.55

Source: BofA US ESG Research, Sustainalytics, ChemSec - ChemScore

BofA GLOBAL RESEARCH

US Water Utilities

Water utilities can mitigate risks associated with their environmental impacts by having strong environmental programs in place. On this basis, we screen for Russell 3000 Water Utilities companies with ratings of "adequate," "strong," or "very strong" for their environmental policies and environmental management systems per Sustainalytics ESG Risk Ratings (Exhibit 31).

Exhibit 31: Water utilities screen
Russell 3000 Water Utilities companies with a minmium rating of "adequate" for their environmental policies and environmental management systems (per Sustainalytics)

BofA Ticker	Company Name	Strength of Environmental Policy	Strength of Environmental Management System	Market Cap (USD bn)
AWK	American Water Works Co Inc	Adequate	Strong	25.58
CWT	California Water Service Group	Adequate	Adequate	2.82
WTRG	Essential Utilities Inc	Strong	Adequate	10.27
SJW	SJW Group	Strong	Adequate	2.02

Source: BofA US ESG Research, Sustainalytics

BofA GLOBAL RESEARCH

US Waste Providers

Waste providers can mitigate risks associated with their environmental impacts by having strong environmental programs in place. On this basis, we screen for S&P 500 Environmental and Facilities Services companies with ratings of “adequate,” “strong,” or “very strong” for their environmental policies and environmental management systems per Sustainalytics ESG Risk Ratings (Exhibit 32).

Exhibit 32: Waste screen
S&P 500 Environmental and Facilities Services companies with a minimum rating of "adequate" for their environmental policies and environmental management systems (per Sustainalytics)

BofA Ticker	Company Name	Strength of Environmental Policy	Strength of Environmental Management System	Market Cap (USD bn)
RSG	Republic Services, Inc.	Adequate	Strong	51.13
WM	Waste Management, Inc.	Very strong	Strong	71.19

Source: BofA US ESG Research, Sustainalytics

BofA GLOBAL RESEARCH

US Insurance

Insurers can integrate ESG factors into their underwriting and investment to lessen the risk associated with adverse ESG events. On this basis, we screen for S&P 500 Insurance companies that have ratings of “adequate” or better for their responsible investment programs and underwriting standards per Sustainalytics’ ESG Risk Ratings (Exhibit 33).

Exhibit 33: Insurance screen
S&P 500 Chemicals companies with a minimum rating of "adequate" for their responsible investment programs and underwriting standards (per Sustainalytics)

BofA Ticker	Company Name	Strength of Responsible Investment Programme	Strength of Underwriting Standards	Market Cap (USD bn)
AIG	American International Group, Inc.	Adequate	Adequate	47.64
ACGL	Arch Capital Group Ltd.	Adequate	Strong	28.35
HIG	Hartford Financial Services Group, Inc.	Very strong	Very strong	24.49
WRB	W. R. Berkley Corporation	Adequate	Adequate	18.58

Source: BofA US ESG Research, Sustainalytics

BofA GLOBAL RESEARCH

US Consumer

Consumer companies can reduce their risk from PFAS liabilities by eliminating toxic chemicals from their products. On this basis, we screen for S&P 500 Consumer Discretionary and Consumer Staples companies that have a stated commitment to eliminate toxic chemicals use in place (per Bloomberg) and report on initiatives to reduce toxic chemicals (per Refinitiv) (Exhibit 34).

Exhibit 34: Consumer screen
S&P 500 Consumer Discretionary and Consumer Staples companies that have a stated commitment to eliminate toxic chemicals use (per Bloomberg) and report on initiatives to reduce toxic chemicals (per Refinitiv)

BofA Ticker	Company Name	Market Cap (USD bn)

Exhibit 34: Consumer screen
S&P 500 Consumer Discretionary and Consumer Staples companies that have a stated commitment to eliminate toxic chemicals use (per Bloomberg) and report on initiatives to reduce toxic chemicals (per Refinitiv)

CHD	Church & Dwight Co., Inc.	25.10
CL	Colgate-Palmolive Company	65.75
DLTR	Dollar Tree, Inc.	29.96
EL	Estee Lauder Companies Inc. Class A	49.61
GM	General Motors Company	50.40
KDP	Keurig Dr Pepper Inc.	44.24
KR	Kroger Co.	32.95
RL	Ralph Lauren Corporation Class A	9.39
TGT	Target Corporation	65.32
TJX	TJX Companies Inc	104.90
WMT	Walmart Inc.	424.05
WHR	Whirlpool Corporation	6.69

Source: BofA US ESG Research, Bloomberg, Refinitiv

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We also screen for US listed apparel brands that scored at least a B- or better on the National Resource Defense Council's (NRDC) PFAS scorecard; a B- or better corresponds to the top third of the apparel brands that were scored.

Exhibit 35: Apparel screen
US listed apparel brands that received a score of B- or better on NRDC's PFAS scorecard

Bloomberg Ticker	Company Name	NRDC PFAS Grade	Market Cap (USD bn)
LEVI US	Levi Strauss & Co	A+	6.5
DECK US	Deckers Brands	A-	17.6
VSCO US	Victoria's Secret	A-	1.9
RL US	Ralph Lauren Corporation	B+	9.4
GPS US	Gap Inc.	B	8.0
AEO US	American Eagle Outfitters	B-	4.2
PVH US	PVH Corp	B-	7.2

Source: BofA US ESG Research, National Resource Defense Council (NRDC)

BofA GLOBAL RESEARCH

US Oil and Gas

Oil and gas companies can reduce risks associated with toxic chemicals by having strong environmental programs in place. Wastewater (effluent) management is also a critical process in the oil and gas industry, as oil and gas operations use large amounts of water, which is often contaminated with chemicals in the process. On this basis, we screen for S&P 500 Oil, Gas & Consumable Fuels companies with ratings of "adequate," "strong," or "very strong" for their environmental policies, environmental management systems, and effluent management per Sustainalytics ESG Risk Ratings (Exhibit 36).

Exhibit 36: Oil, Gas & Consumable Fuels screen
S&P 500 Oil, Gas & Consumable Fuels companies with a minimum rating of "adequate" for their environmental policies, environmental management systems, and effluent management (as per Sustainalytics ESG Risk Ratings)

BofA Ticker	Name	Strength of Environmental Policy	Strength of Environmental Management System	Strength of Effluent Management	Market Cap (USD bn)
CVX	Chevron Corporation	Adequate	Very strong	Adequate	279.90
COP	ConocoPhillips	Strong	Adequate	Adequate	134.82
EQT	EQT Corporation	Adequate	Strong	Adequate	15.63
XOM	Exxon Mobil Corporation	Adequate	Strong	Adequate	400.29
HES	Hess Corporation	Very strong	Very strong	Adequate	43.92
KMI	Kinder Morgan Inc Class P	Strong	Strong	Adequate	39.97
MRO	Marathon Oil Corporation	Adequate	Adequate	Adequate	13.79
MPC	Marathon Petroleum Corporation	Very strong	Strong	Strong	58.46
PSX	Phillips 66	Strong	Very strong	Adequate	58.34
PXD	Pioneer Natural Resources Company	Very strong	Strong	Adequate	52.34

Source: BofA US ESG Research, Sustainalytics

BofA GLOBAL RESEARCH

Further reading on PFAS

BofA Global Research Reports

Title: Subtitle	Primary Author	Date Published
Chemicals: Chem Weekly: Hydrogen costs for FC cars, Red Sea disruption, PFAS update	Steve Byrne, CFA	08 January 2024
3M Company: Dupont opt-outs levels a positive for 3M	Andrew Obin	04 January 2024
American Water Works: Valuation the main holdback. Improving near-term EPS on weather & int. rates	Julien Dumoulin-Smith	18 December 2023
3M Company: Insurance may help fund settlements	Andrew Obin	14 December 2023
Chemicals: Chem Weekly: PFOA carcinogenicity views, DOE call takeaways, EV tax credits	Steve Byrne, CFA	04 December 2023
Chemicals: Chem Weekly: Crop Chemical Litigation, Hydrogen deposits, EPA's PFAS scrutiny	Steve Byrne, CFA	30 October 2023
Columbia Sportswear: See headwinds from PFAS & continued retailer cautiousness	Alexander Perry	26 October 2023
Industrials/Multi-Industry: PFAS regulatory and remediation technology update	Andrew Obin	11 October 2023
Chemicals: PFAS update, El Nino forecasts impactful on Ag, another urea tender from India	Steve Byrne, CFA	09 October 2023
U.S. Insurance: Mass torts overview: Examining the past could shed light on future outcomes	Joshua Shanker	04 October 2023
Chemicals: Ammonia from bacteria, new PFAS destruction technology, PE inventories up	Steve Byrne, CFA	20 June 2023
Machinery, E&C and Waste: EPA steps up its game on PFAS – BofA event takeaways on what lies ahead	Michael Feniger	16 June 2022
Machinery, E&C and Waste: PFAS event takeaways: regulatory, treatment, and litigation update	Michael Feniger	15 June 2023
Chemicals: PFAS Settlement, Coatings Raw Mats Update, PVC Softer, LYB sustainability	Steve Byrne, CFA	05 June 2023
3M Company: Potential settlement a positive for 3M, experts bring down PFAS estimates	Andrew Obin	02 June 2023
US Chemicals: PFAS agreement on drinking water could clear big hurdle	Steve Byrne, CFA	02 June 2023
Chemicals: Chem Weekly: PFAS treatment costs, Coatings call, and Soybean crush outlook	Steve Byrne, CFA	27 March 2023
Life Sciences & Diagnostic Tools: New PFAS testing proposal a modest positive for LC/MS instrument vendors	Derik de Bruin	17 March 2023
Industrials/Multi-Industry: EPA proposes new PFAS drinking water regulations	Andrew Obin	15 March 2023
Industrial/Environmental Services: Landfill call takeaways: PFAS enters the waste conversation	Michael Feniger	21 January 2020
Engineering & Construction: PFAS call takeaways: a long-term environmental opportunity to monitor	Michael Feniger	26 November 2019

Table 1: Stocks mentioned
Prices and ratings for stocks mentioned in this report

BofA Ticker	Bloomberg ticker	Company name	Price	Rating
ACM	ACM US	AECOM	US$ 89.33	B-1-7
A	A US	Agilent	US$ 131.09	B-2-7
CWST	CWST US	Casella	US$ 83.28	B-3-9
DHR	DHR US	Danaher	US$ 229.64	B-2-7
DD	DD US	DuPont	US$ 76.18	B-1-7
ECL	ECL US	Ecolab Inc	US$ 197.39	B-3-7
GFL	GFL US	GFL Environmental	US$ 32.75	B-1-7
J	J US	Jacobs Eng.	US$ 131.95	B-2-7
MEG	MEG US	Montrose	US$ 29.1	C-1-9
NVEE	NVEE US	NV5 Global Inc.	US$ 103.78	C-2-9
RSG	RSG US	Republic Services	US$ 164.3	A-1-7
TMO	TMO US	Thermo Fisher	US$ 543.93	B-1-7
WCN	WCN US	Waste Connections	US$ 148.64	A-1-7

Source BofA Global Research

BofA GLOBAL RESEARCH

Price objective basis & risk

AECOM (ACM)
Our $95 PO is based on 12.5x our 2024E EBITDA. This multiple is moving more in line with professional services/design peers and defensive/infrastructure related peers given AECOM's improving balance sheet (net leverage of 1.1x, net debt free in 18 months) and portfolio transformation into a professional services firm. We believe the growth outlook is recovering given potential for infrastructure, transportation, and environmental spending initiatives.

Downside risks to our PO are 1) weaker-than-expected global construction growth, particularly public spending in the US, 2) higher-than-expected headwind from COVID-19, 3) shortfall in execution around CS divestiture or hitting FCF conversion target. Upside risks to our PO are 1) stronger-than-expected infrastructure spending by local, state, and federal agencies, 2) higher-than-forecast cost savings from the restructuring program, 3) better-than-expected free cash flow generation.

Agilent Technologies (A)
Our $133 PO is based on about 17x our CY25E EV/EBITDA forecast. This is in-line with Agilent's closest life sciences tools peers. We think this target multiple is justified due to the company's strong execution, margin expansion, improving fundamentals, opportunities for capital deployment, and share gains.

Risks to our PO are economic risks, lingering COVID related headwinds, F/X risks, slower than expected uptake of new products or expansion into new markets, competitive risks, reductions in customer R&D spending, integration risks, geopolitical & trade war risks, and regulatory risks.

Casella (CWST)
Our 12-month price objective on Casella Waste is $89 per share. This is based on 19x 2023 EV/EBITDA, in the middle of the average range the last five years (11-25x). Our target multiple is a premium to our valuation framework in the waste sector given Casella's growth prospects are higher than the industry. We note CWST has lower liquidity and does not pay a dividend. On our $89 PO, CWST would trade on a 2.4% FCF yield (vs sector 2.5-4%) although we expect the company to deliver over double digit FCF growth rate over the next few years.

Upside risks:
i) Stronger than expected price gains across collection and disposal business lines.
ii) Higher than expected M&A activity.
iii) Expanding EBITDA margin and FCF conversion above expectations.

Downside risks:
i) Elevated costs and capex required to sustain growth.
ii) Labor, inflationary costs impact solid waste margin more than anticipated.
iii) Competitive pricing dynamics emerge in the Northeast disposal market.

Danaher Corporation (DHR)
Our $245 price objective (PO) is based on a discounted cash flow (DCF) analysis (assumes 9.0% weighted-average cost of capital-WACC, 3% terminal growth rate). We believe this discount rate is appropriate as several key acquisitions (e.g., GE Life Sciences, Aldevron, Cepheid) have significantly accelerated Danaher's organic revenue growth, enhanced margins, lowered the company's cyclical exposure, and increased the percentage of sales from recurring revenues.

Downside risks to our PO are F/X risks, economic & macro risks, cyclical exposure, geopolitical risks, reductions in R&D funding, customer consolidation, a slowdown in

bioprocess demand, competitive risks, deal integration risks, and headwinds from the COVID-19 pandemic. Upside risks are faster resolution of near-term bioprocessing headwinds, or favorable capital deployment by the company.

DuPont (DD)
Our price objective of $78 per share is based on an EV to EBITDA valuation of 13x our 2023 EBITDA estimate proforma for the Delrin divestiture and Spectrum acquisition. This multiple is derived from a comp-based sum-of-the-parts multiple. We then subtract off the Net Debt, which includes $1.4bn cash proceeds from the Delrin divestiture and $1.75bn in cash spent on Spectrum, and divide by our year-end 2023E Diluted Shares Outstanding.

Downside risks to our price objective are a further slowdown in the global economy, particularly in China, autos, and electronics, greater than expected litigation issues, failure of the Mobility & Materials divestiture to Celanese to complete on the terms announced, and failure of the Rogers acquisition to complete on the terms announced.

Ecolab Inc (ECL)
Our $185 price objective for Ecolab is based on an average of the DCF-derived present value utilizing a 8.5% WACC and a 4% terminal growth rate, and a valuation based on a P/E of 28.0x applied to our FY2024 EPS estimate.

Downside risks to our price objective are: 1) a weaker recovery in COVID-impacted end-markets and macro conditions, 2) sudden increases in commodity costs, 3) Institutional growth continuing to lag amid changing consumer preferences, and 4) merger and integration risks. Upside risks to our price objective are: 1) faster than expected recovery in COVID-19 impacted volumes, 2) better than expected market share gains, and 3) potentially accretive acquisitions.

GFL Environmental Inc (GFL)
Our 12-month price objective of C$46 (USD $35) is based on a target 2024E EV/EBITDA multiple of 11x, a discount to the public national waste operators due to higher leverage & more back end weighted FCF. We believe EV/EBITDA is the most comparable metric due to high debt levels. We rely on comparable company analysis with a group of publicly traded nonhazardous waste operators, all of which are larger and more liquid than GFL. While GFL's growth profile is significantly higher than the national players, the higher leverage ratio and M&A integration are risks.

Upside risks: 1) driving stronger top line growth than the national players over the next 2-3 years, 2) expanding EBITDA margins (ie, driving profitable growth), 3) organically de-leveraging its balance sheet over the cycle via free cash flow generation, 4) higher than expected synergies from acquisitions.

Downside risks: 1) More cyclical waste stream tied to construction, Industrial activity, new project development impact earnings more than expected, 2) struggle to generate free cash flow, limiting ability to de-lever balance sheet organically, 3) struggle to price the business above rising costs, 4) challenges with integrating acquisitions.

Jacobs Eng. (J)
Our $137 PO is based on 12x 2024E EV/EBITDA. This is near the mid to high end of JEC's historical range of 9-16x, although we believe this is justified given the company's improved cost structure, less cyclical portfolio, and reduced exposure to riskier contracts. Additionally, we see evidence of momentum in certain areas of its portfolio including infrastructure, transportation, environmental services, and re-shoring. The valuation is more in line with other Government Services/IT players. Over time, we believe Jacobs' valuation discussion will likely shift away from E&Cs and more to steady compounders within industrials ranging from government services providers, business services,

consulting IT, and waste.

Downside risks to our PO are: 1) Weaker-than-expected public spending outlook due to DoTs, state, local budgets 2) Lack of organic FCF generation and integration risks following notable acquisitions 3) Overhang from ongoing dispute related to power project in Australia Upside risks to our PO are: 1) Bigger than expected infrastructure bill at the state and federal level 2) A more favorable outlook for Department of Defense and Energy 3) Higher than expected synergies following acquisitions and technology investments

Montrose Environmental Group, Inc. (MEG)
We base our $40 price objective on 24x EV/EBITDA of our 2025 estimates. This is at a premium to the peer group average trading at 10x on 2024E. We believe the premium is warranted capital allocation and secular growth trends from US environmental regulations/infrastructure stimulus.

Downside risks to our PO are 1) greater-than-expected y/y declines in the CTEH business, 2) inability to source or integrate deals, and 3) poor execution tied to ERP rollout and initiation of European operations.

NV5 Global Inc. (NVEE)
Our PO of $108 is based on applying a 9.5x EV/EBITDA multiple to '24 forecast, which is near the lower-end of the historical range (8-15x). While the multi-year outlook is improving across infrastructure, utilities, and buildings, the M&A outlook is more uncertain given rising competition for assets and higher rates weigh on certain areas of the portfolio (real estate transactions).

Downside risks to our PO are:

1) M&A is an inherently risky strategy reliant on acquisition target availability and successful integration. Closed its largest acquisition to date in December 2019.
2) Elevated leverage amidst COV-19 uncertainty and funding risks to state budgets
3) Low stock liquidity with high insider ownership creates volatility

Upside risks to our PO are:

1) Infrastructure Stimulus
2) More resilient customer spending outlook across public and private clients
3) Better than expected synergies with recent acquisitions (Quantum Spatial)

Republic Services (RSG)
Our $172 price objective is based on 13.5x EV/EBITDA for 2024E, near the high end of its historical valuation range and consistent with peer Waste Management. We believe the high end of the range is appropriate as earnings are likely to continue to recover in 2024, waste offers higher visibility than other sectors, pricing backdrop continues to improve, and FCF is likely to remain positive. Relative to history, higher multiple stems from an improving pricing discipline for the waste industry, sustainability initiatives and overall stability in an uncertain, global industrial backdrop, in our view.

Upside risks to our PO are: 1) stronger-than-expected housing data, 2) higher-than expected pricing trends, and 3) more aggressive cash return to shareholders than we currently envision. Downside risks to our PO are: 1) lower-than-expected CPI, 2) environmental liabilities. 3) Mix impact from higher waste generation at the home. 4) continued COVID-19 concerns.

Thermo Fisher Scientific (TMO)

Our $500 PO is based on a discounted cash flow (DCF) model that assumes an 8% weighted-average cost of capital (WACC) and a 3% terminal growth rate. We believe this discount rate is appropriate due to TMO's leading position in the global life sciences market, given the size, market leadership, maturity, and stability of the company's consumables focused business. Our $500 PO implies a PE multiple of about 20x and an EV/EBITDA multiple of about 18x our FY25 ests, both of which are in-line with TMO's median over the last 10 years.

Risks to our price objective are headwinds and business disruption due to the COVID-19 pandemic, deal integration risks, lower-than-expected deal synergies, slower growth in emerging markets, pricing erosion, lower healthcare utilization trends, soft uptake of new products, competition, and weak R&D funding.

Waste Connections Inc (WCN)
Our $155 price objective values WCN on 16.5x 2024e EV/EBITDA, in line with the average of the valuation range the last 7 years (12-21x). Our PO implies 30x Price to FCF in 2024e, near the higher end of the historical range (20-32x), justified by Connection's sector leading profitability and FCF conversion, in our view. Our PO implies nearly a 0.8% dividend yield, in line with its current valuation over the last 12 months. Relative to history, our higher valuation stems from an improving pricing backdrop for the waste industry, more active M&A environment, and ability to improve margins and FCF generation (double digit growth) through the cycle.

Upside risks to our PO are: 1) stronger-than-expected housing data, 2) higher-than expected CPI trends, 3) more aggressive cash return to shareholders than we currently envision, and 4) stronger-than-expected recovery in Exploration and Production (oil and gas) activity.

Downside risks to our PO are: 1) lower-than-expected CPI, 2) environmental liabilities, 3) higher than expected inflationary costs, and 4) execution risk around acquisitions.

Analyst Certification

We, Andrew Obin, Derik de Bruin, Michael Feniger, Michael Ryskin and Steve Byrne, CFA, hereby certify that the views each of us has expressed in this research report accurately reflect each of our respective personal views about the subject securities and issuers. We also certify that no part of our respective compensation was, is, or will be, directly or indirectly, related to the specific recommendations or view expressed in this research report.

US - Chemicals Coverage Cluster

Investment rating	Company	BofA Ticker	Bloomberg symbol	Analyst
BUY				
	Axalta Coating Systems	AXTA	AXTA US	Steve Byrne, CFA
	Bunge Limited	BG	BG US	Salvator Tiano, CFA
	CF Industries	CF	CF US	Steve Byrne, CFA
	DuPont	DD	DD US	Steve Byrne, CFA
	Eastman Chemical Co	EMN	EMN US	Salvator Tiano, CFA
	Element Solutions Inc.	ESI	ESI US	Steve Byrne, CFA
	Green Plains	GPRE	GPRE US	Salvator Tiano, CFA
	Huntsman Corp	HUN	HUN US	Salvator Tiano, CFA
	Linde	LIN	LIN US	Steve Byrne, CFA
	Linde	LINGY	LIN GY	Steve Byrne, CFA
	Nutrien	NTR	NTR US	Steve Byrne, CFA
	Olin Corp	OLN	OLN US	Steve Byrne, CFA
	PPG Industries Inc.	PPG	PPG US	Steve Byrne, CFA
	Sigma Lithium	SGML	SGML US	Steve Byrne, CFA
	The Mosaic Company	MOS	MOS US	Steve Byrne, CFA
NEUTRAL				
	Air Products	APD	APD US	Steve Byrne, CFA
	Albemarle	ALB	ALB US	Steve Byrne, CFA
	Archer-Daniels-Midland Company	ADM	ADM US	Salvator Tiano, CFA
	Celanese Corporation	CE	CE US	Salvator Tiano, CFA
	Corteva	CTVA	CTVA US	Steve Byrne, CFA
	Dow Inc	DOW	DOW US	Steve Byrne, CFA
	FMC Corporation	FMC	FMC US	Steve Byrne, CFA
	International Flavors & Fragrances	IFF	IFF US	Salvator Tiano, CFA
	LyondellBasell Industries	LYB	LYB US	Steve Byrne, CFA
	Origin Materials	ORGN	ORGN US	Steve Byrne, CFA
UNDERPERFORM				
	Ecolab Inc	ECL	ECL US	Steve Byrne, CFA
	RPM International Inc	RPM	RPM US	Steve Byrne, CFA
	Sherwin-Williams Company	SHW	SHW US	Steve Byrne, CFA
	Westlake Chemical Partners, LP	WLKP	WLKP US	Steve Byrne, CFA
	Westlake Corp	WLK	WLK US	Steve Byrne, CFA

US - Machinery Coverage Cluster

Investment rating	Company	BofA Ticker	Bloomberg symbol	Analyst
BUY				
	AECOM	ACM	ACM US	Michael Feniger
	Blue Bird Corp	BLBD	BLBD US	Sherif El-Sabbahy
	Caterpillar Inc	CAT	CAT US	Michael Feniger
	CNH Industrial NV	CNHI	CNHI US	Michael Feniger
	Construction Partners Inc.	ROAD	ROAD US	Michael Feniger
	ESAB Corp	ESAB	ESAB US	Sherif El-Sabbahy
	Finning International Inc.	YFTT	FTT CN	Sherif El-Sabbahy
	GFL Environmental Inc	GFL	GFL US	Michael Feniger
	GFL Environmental Inc	YGFL	GFL CN	Michael Feniger
	H&E Equipment Services Inc	HEES	HEES US	Sherif El-Sabbahy
	Knife River Corp	KNF	KNF US	Sherif El-Sabbahy
	Republic Services	RSG	RSG US	Michael Feniger
	Techtronic Industries Co Ltd	TTNDF	669 HK	Michael Feniger
	Techtronic Industries Co Ltd	TTNDY	TTNDY US	Michael Feniger
	United Rentals Inc	URI	URI US	Michael Feniger
	Vulcan Materials	VMC	VMC US	Michael Feniger
	Waste Connections Inc	WCN	WCN US	Michael Feniger
	WillScot Mobile Mini	WSC	WSC US	Sherif El-Sabbahy
NEUTRAL				
	AGCO Corp	AGCO	AGCO US	Michael Feniger
	Cummins Inc	CMI	CMI US	Michael Feniger
	Deere & Co	DE	DE US	Michael Feniger
	Fluor	FLR	FLR US	Michael Feniger

US - Machinery Coverage Cluster

Investment rating	Company	BofA Ticker	Bloomberg symbol	Analyst
	Jacobs Eng.	J	J US	Michael Feniger
	Kennametal Inc.	KMT	KMT US	Michael Feniger
	Martin Marietta Materials	MLM	MLM US	Michael Feniger
	NV5 Global Inc.	NVEE	NVEE US	Michael Feniger
	RB Global, Inc	RBA	RBA US	Michael Feniger
	Terex Corp.	TEX	TEX US	Michael Feniger
	Waste Management	WM	WM US	Michael Feniger
UNDERPERFORM				
	Allison Transmission Holdings Inc.	ALSN	ALSN US	Sherif El-Sabbahy
	Casella	CWST	CWST US	Michael Feniger
	Herc Holdings Inc	HRI	HRI US	Sherif El-Sabbahy
	IPG Photonics	IPGP	IPGP US	Michael Feniger
	Oshkosh Corp.	OSK	OSK US	Michael Feniger
	PACCAR Inc	PCAR	PCAR US	Michael Feniger
	Timken Company	TKR	TKR US	Michael Feniger

US - Multi-Industrials/Engineering and Construction Coverage Cluster

Investment rating	Company	BofA Ticker	Bloomberg symbol	Analyst
BUY				
	APi Group	APG	APG US	Andrew Obin
	AspenTech	AZPN	AZPN US	Andrew Obin
	Atmus Filtration	ATMU	ATMU US	Andrew Obin
	Dover Corp	DOV	DOV US	Andrew Obin
	Eaton Corp PLC	ETN	ETN US	Andrew Obin
	Emerson Electric Co	EMR	EMR US	Andrew Obin
	Flowserve	FLS	FLS US	Andrew Obin
	General Electric Company	GE	GE US	Andrew Obin
	Honeywell International Inc.	HON	HON US	Andrew Obin
	ITT Inc.	ITT	ITT US	Andrew Obin
	Montrose Environmental Group, Inc.	MEG	MEG US	Andrew Obin
	Parker Hannifin Corporation	PH	PH US	Andrew Obin
	PTC Inc.	PTC	PTC US	Andrew Obin
	Rush	RUSHA	RUSHA US	Andrew Obin
	Vertiv	VRT	VRT US	Andrew Obin
NEUTRAL				
	3M Company	MMM	MMM US	Andrew Obin
	AMETEK Inc	AME	AME US	Andrew Obin
	Fortive Corporation	FTV	FTV US	Andrew Obin
	Johnson Controls International PLC	JCI	JCI US	Andrew Obin
	Rockwell	ROK	ROK US	Andrew Obin
	Trane Technologies PLC	TT	TT US	Andrew Obin
	Vontier	VNT	VNT US	Andrew Obin
UNDERPERFORM				
	Allegion	ALLE	ALLE US	Andrew Obin
	Ansys, Inc.	ANSS	ANSS US	Andrew Obin
	Carrier Global Corp.	CARR	CARR US	Andrew Obin
	Core & Main	CNM	CNM US	Andrew Obin
	Illinois Tool Works	ITW	ITW US	Andrew Obin
	John Bean Technologies	JBT	JBT US	Andrew Obin
	Keysight	KEYS	KEYS US	David Ridley-Lane, CFA
	Pentair plc	PNR	PNR US	Andrew Obin

US - Life Science, Diagnostic Tools and Animal Health Coverage Cluster

Investment rating	Company	BofA Ticker	Bloomberg symbol	Analyst
BUY				
	Avantor, Inc.	AVTR	AVTR US	Michael Ryskin
	Bruker Corporation	BRKR	BRKR US	Derik de Bruin

US - Life Science, Diagnostic Tools and Animal Health Coverage Cluster

Investment rating	Company	BofA Ticker	Bloomberg symbol	Analyst
	Certara	CERT	CERT US	Michael Ryskin
	Charles River Laboratories	CRL	CRL US	Derik de Bruin
	Elanco Animal Health	ELAN	ELAN US	Michael Ryskin
	Exact Sciences	EXAS	EXAS US	Derik de Bruin
	Guardant Health	GH	GH US	Derik de Bruin
	ICON plc	ICLR	ICLR US	Derik de Bruin
	IQVIA Holdings Inc	IQV	IQV US	Derik de Bruin
	LabCorp	LH	LH US	Derik de Bruin
	Maravai	MRVI	MRVI US	Michael Ryskin
	Qiagen	QGEN	QGEN US	Derik de Bruin
	Qiagen N.V.	XQGNF	QIA GY	Derik de Bruin
	Quest Diagnostics	DGX	DGX US	Derik de Bruin
	Stevanato Group S.p.A.	STVN	STVN US	Derik de Bruin
	Thermo Fisher Scientific	TMO	TMO US	Derik de Bruin
	West Pharmaceutical Services	WST	WST US	Derik de Bruin
	Zoetis Inc.	ZTS	ZTS US	Michael Ryskin
NEUTRAL				
	10x Genomics, Inc.	TXG	TXG US	Michael Ryskin
	Agilent Technologies	A	A US	Derik de Bruin
	Danaher Corporation	DHR	DHR US	Michael Ryskin
	Evotec SE	EVO	EVO US	Michael Ryskin
	Hologic, Inc.	HOLX	HOLX US	Derik de Bruin
	IDEXX Laboratories	IDXX	IDXX US	Michael Ryskin
	Mettler-Toledo	MTD	MTD US	Derik de Bruin
	NeoGenomics Inc.	NEO	NEO US	Derik de Bruin
	Revvity Inc	RVTY	RVTY US	Derik de Bruin
	Schrodinger, Inc.	SDGR	SDGR US	Michael Ryskin
	Waters Corp.	WAT	WAT US	Derik de Bruin
UNDERPERFORM				
	Align Technology	ALGN	ALGN US	Michael Ryskin
	Catalent, Inc.	CTLT	CTLT US	Derik de Bruin
	Fortrea	FTRE	FTRE US	Derik de Bruin
	Ginkgo Bioworks Holdings, Inc	DNA	DNA US	Derik de Bruin
	Illumina, Inc.	ILMN	ILMN US	Michael Ryskin
	Myriad Genetics	MYGN	MYGN US	Derik de Bruin
	Phibro Animal Health	PAHC	PAHC US	Michael Ryskin

Disclosures

Important Disclosures

Equity Investment Rating Distribution: Chemicals Group (as of 31 Dec 2023)

Coverage Universe	Count	Percent	Inv. Banking Relationships [R1]	Count	Percent
Buy	66	47.83%	Buy	33	50.00%
Hold	33	23.91%	Hold	16	48.48%
Sell	39	28.26%	Sell	20	51.28%

Equity Investment Rating Distribution: Engineering & Construction Group (as of 31 Dec 2023)

Coverage Universe	Count	Percent	Inv. Banking Relationships [R1]	Count	Percent
Buy	9	42.86%	Buy	5	55.56%
Hold	7	33.33%	Hold	3	42.86%
Sell	5	23.81%	Sell	3	60.00%

Equity Investment Rating Distribution: Health Care Group (as of 31 Dec 2023)

Coverage Universe	Count	Percent	Inv. Banking Relationships [R1]	Count	Percent
Buy	234	60.94%	Buy	115	49.15%
Hold	80	20.83%	Hold	36	45.00%
Sell	70	18.23%	Sell	29	41.43%

Equity Investment Rating Distribution: Industrials/Multi-Industry Group (as of 31 Dec 2023)

Coverage Universe	Count	Percent	Inv. Banking Relationships [R1]	Count	Percent
Buy	45	50.56%	Buy	25	55.56%
Hold	26	29.21%	Hold	13	50.00%
Sell	18	20.22%	Sell	7	38.89%

Equity Investment Rating Distribution: Machinery/Diversified Manufacturing Group (as of 31 Dec 2023)

Coverage Universe	Count	Percent	Inv. Banking Relationships [R1]	Count	Percent
Buy	27	42.19%	Buy	8	29.63%
Hold	17	26.56%	Hold	8	47.06%
Sell	20	31.25%	Sell	8	40.00%

Equity Investment Rating Distribution: Global Group (as of 31 Dec 2023)

Coverage Universe	Count	Percent	Inv. Banking Relationships [R1]	Count	Percent
Buy	1895	53.62%	Buy	1083	57.15%
Hold	832	23.54%	Hold	454	54.57%
Sell	807	22.84%	Sell	383	47.46%

[R1] Issuers that were investment banking clients of BofA Securities or one of its affiliates within the past 12 months. For purposes of this Investment Rating Distribution, the coverage universe includes only stocks. A stock rated Neutral is included as a Hold, and a stock rated Underperform is included as a Sell.

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Investment rating	Total return expectation (within 12-month period of date of initial rating)	Ratings dispersion guidelines for coverage cluster[R2]
Buy	≥ 10%	≤ 70%
Neutral	≥ 0%	≤ 30%
Underperform	N/A	≥ 20%

[R2] Ratings dispersions may vary from time to time where BofA Global Research believes it better reflects the investment prospects of stocks in a Coverage Cluster.

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