

Substituting PFAS in Chemical Manufacturing Equipment

A typical chemical manufacturing plant in Europe is estimated to contain around 20,000 individual components (excluding piping) that incorporate PFAS to perform critical functions.

The [2025 Cefic-Accenture study](#) on the use of per- and polyfluoroalkyl substances (PFAS) in chemical manufacturing plant equipment examined alternatives to PFAS—primarily fluoropolymers—in key equipment components across chemical manufacturing plants. The assessment considered thermal, chemical and mechanical properties, as well as operational safety and feasibility for both existing and new plants.



What are the key equipment components with PFAS?

Gaskets

Critical function: Creating leak-free seals between pipe flanges and equipment joints. Gaskets must maintain integrity under high pressure, high temperatures and corrosive environments, making them essential for pharmaceutical, food-grade and ultra-pure chemical production.

Why PFAS are used: Polytetrafluoroethylene (PTFE) combines excellent chemical resistance, thermal stability and mechanical reliability. Its low-friction, non-stick properties reduce wear and fouling, while chemical inertness and low extractables support high purity and contamination control.

WHY ALTERNATIVES FALL SHORT

Alternatives show limitations in chemical or temperature resistance, brittleness, or hygiene and safety performance. As a result, they are generally more suitable for less demanding applications, but not for critical or regulated processes.



O-rings

Critical function: Providing sealing in valves, pumps and moving joints to prevent leaks. O-rings must maintain elasticity and chemical resistance under dynamic operating conditions.

Why PFAS are used: PTFE and FEP offer chemical inertness, durability and stable performance under mechanical stress. Their low-friction properties reduce wear during repeated movement and pressure cycling.

WHY ALTERNATIVES FALL SHORT

Alternatives generally degrade more quickly and exhibit reduced elasticity or a narrower chemical tolerance. As a result, their long-term reliability cannot always be ensured in critical applications.



Expansion joints

Critical function: Absorbing thermal expansion, vibration and mechanical movement. Expansion joints protect piping systems from stress and damage, helping to maintain system integrity.

Why PFAS are used: PTFE provides the necessary flexibility combined with excellent chemical resistance, maintaining sealing integrity during movement and under demanding operating conditions.

WHY ALTERNATIVES FALL SHORT

Alternatives are less suitable because they are either less flexible, less resistant to corrosion, or able to tolerate only lower temperature and chemical ranges.



Valves

Critical function: Controlling the flow of liquids and gases safely and reliably within pipes and equipment.

Why PFAS are used: PFAS linings and seals ensure long service life, high chemical resistance and operational reliability. Their low-friction, non-stick properties reduce wear, fouling and actuation forces, supporting safe and efficient operation.

WHY ALTERNATIVES FALL SHORT

Alternatives face limitations including brittleness, manufacturing constraints, higher costs or lower chemical resistance. In addition, stringent health, safety and environmental requirements significantly constrain their suitability as substitutes in critical applications.



Pipes

Critical function: Safely transporting chemicals or high-temperature fluids over long periods of time.

Why PFAS are used: Fluoropolymer linings provide effective corrosion protection and low permeability, helping to prevent leaks, contamination and material degradation over the lifetime of the system.

WHY ALTERNATIVES FALL SHORT

Alternative non-PFAS materials currently available are heavier, less chemically resistant, or require significant design changes. Full substitution is therefore feasible only under less demanding operating conditions.



Linings and coatings

Critical function: Protecting vessels, pipes and reactors against chemical attack, corrosion and high temperatures.

Why PFAS are used: PFAS offer broad chemical compatibility and long-term durability. Their non-flammability and thermal stability also support high fire-safety standards.

WHY ALTERNATIVES FALL SHORT

Alternatives are often costly, complex to apply, or chemically incompatible with certain substances. In addition, conventional coatings tend to degrade more quickly and require frequent reapplication.



Lubricants

Critical function: Reducing friction and wear in moving mechanical parts such as pumps and circuit breakers. Lubricants must ensure long-term reliability, particularly in extreme operating environments.

Why PFAS are used: PFAS-based lubricants perform reliably under extreme temperatures, high loads and chemical exposure. Their low flammability and chemical stability support both operational safety and fire safety.

WHY ALTERNATIVES FALL SHORT

Alternatives can only replace PFAS lubricants in a limited share of applications without significant performance loss. Switching to alternatives would often require equipment redesign to avoid reduced reliability or an increased risk of failure.



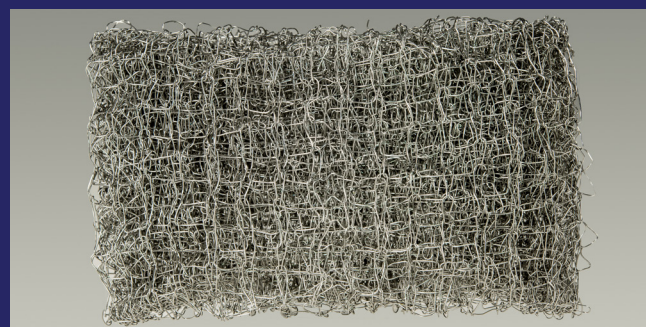
Column packing

Critical function: Enabling efficient separation in distillation and absorption processes.

Why PFAS are used: PFAS-based packing materials withstand highly corrosive process environments. Their low surface energy reduces fouling and helps improve separation efficiency.

WHY ALTERNATIVES FALL SHORT

Alternatives are generally less durable or more brittle. PFAS are therefore used selectively where alternatives cannot ensure reliable and consistent performance.



Membranes

Critical function: Enabling separation, filtration and concentration in process operations.

Why PFAS are used: PFAS combine high chemical resistance, mechanical strength and low permeability, enabling long service life and reliable performance in demanding process conditions.

WHY ALTERNATIVES FALL SHORT

No viable alternatives currently exist for critical applications that require a combination of operational safety, high performance and extreme durability.



Batteries, electric wires and circuit breakers

Critical function: Ensuring chemical and thermal stability in batteries, particularly for backup power systems; insulating electric wires to provide thermal stability and chemical resistance in harsh industrial environments; and reducing friction to ensure the long-term reliability of circuit breakers.

Why PFAS are used: PFAS provide chemical and thermal stability, electrical insulation and long-term reliability. Their non-flammability and dielectric properties support both fire and electrical safety.

WHY ALTERNATIVES FALL SHORT

Alternatives generally offer lower durability, performance or safety margins. Transitioning to alternatives would also require significant equipment redesign and long implementation timelines.



Conclusions

PFAS are deeply embedded in industrial systems, and the challenges associated with substitution are driven by technical and safety requirements. PFAS play a critical role in ensuring safety, durability, reliability and high performance across a wide range of applications.

While alternatives are being explored, none currently match the full range of properties provided by PFAS. As a result, substitution must be assessed on a case-by-case basis for each individual application. Restrictions introduced without viable alternatives risk higher costs and substantial operational challenges, including performance limitations and reduced safety. Overall, this could undermine the competitiveness of Europe's chemical industry.



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The Accenture logo is on the left and the Cefic logo is on the right, both in white. The background is a dark blue and red gradient with abstract light patterns.

Study on uses of PFAS in chemical manufacturing plant equipment

Read online >

A square QR code is located in the lower half of the graphic, intended for scanning to access the study online.

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