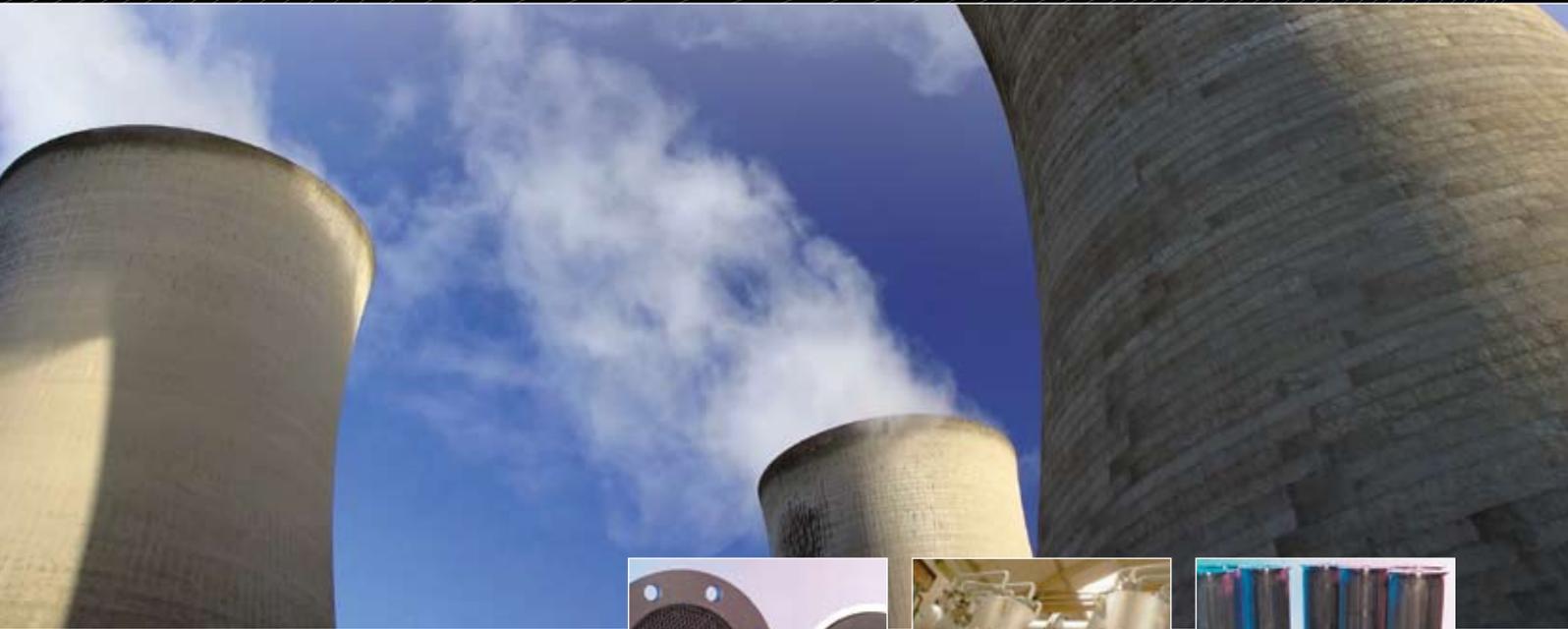


Nuclear Filtration

Power Generation, the Fuel Cycle, Decommissioning,
Decontamination, Waste Treatment and Waste Disposal



Porvair Filtration Group in the Nuclear Industry

Porvair Filtration Group is an international leader in the development and supply of materials and products for applications in filtration and separation.

Porvair manufacture in both the UK and USA and have an extensive network of sales offices and distribution channels throughout the world. Our expertise is wide and varied and its products are used in markets such as:

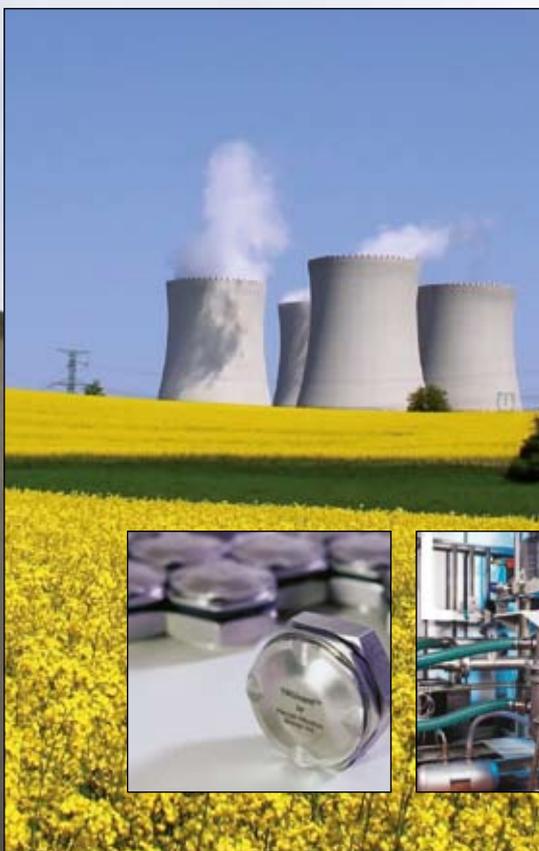
- Aerospace and Defence
- Nuclear and Energy
- Chemical Process
- Industrial Process
- Water Treatment
- Printing
- Sciences and Laboratory

Our ongoing success is based on a dedication to technical excellence and superior customer service. Our future will be built on our investment in research and development to provide innovative new products that exceed the expectations of our customers in solving the challenges that they face.

Within the nuclear industry there are ongoing operational challenges and potential hazards associated with environmental emissions and the protection of the workforce. Therefore the industry demands exceptional levels of technical expertise and quality, in conjunction with specific skills to solve many of its most intractable problems. Processes in the filtration sector, including high temperatures, high radioactivity, high solids loads and chemically aggressive environments, all present challenges.

Porvair offers both the engineering competence and quality infrastructure to meet those challenges and produce solutions to ensure the efficiency and safety of those processes, using a range of technologies, products and techniques. These include:

- high temperature off gas cleanup
- HEPA protection and pre-filtration
- pulsed jet self cleaning HEPA filtration
- metallic HEPA filtration for extreme conditions
- powder/product collection vent filtration
- waste package filter vent/breathers
- active effluent treatment packages
- containment venting and protection
- designed-for-purpose filtration and separation packages for the most demanding of applications.



Porvair Filtration Group have more than 25 years experience in supplying high quality filtration solutions to the nuclear industries of Europe, the USA and the UK. Working across the field, designing and supplying filtration and other equipment, we offer solutions to the power generation, fuel production, reprocessing, decontamination, decommissioning and waste packaging sectors.

As an engineering company in the filtration industry, we are able to take an initial discussion to a fully optimised solution, meeting material, code and technical requirements providing a total solution to a specific problem.

Porvair has the capability to provide everything from a single, specialised, retrofit element to a complete, packaged system to meet the precise needs of a complex application, together with on-site support and a complete after sales service. In addition to our acknowledged leadership in both engineering and quality, we also have the capability to offer the services of our extensive laboratory, development and testing facilities.

Additional Nuclear Services

In addition to our expertise in all aspects of liquid, gas and solids separation, **Porvair Filtration Group** has outstanding technical, engineering and quality capabilities available to adapt to other engineering projects in the nuclear field. Projects such as:

- skid mounted packages
- high specification machined parts
- specially designed fabrications like lifting frames, stillages and waste drums or containers
- gloveboxes



Nuclear Power Generation

Porvair Filtration Group is working with the nuclear generation and the new nuclear technology industries in the UK, the USA, Europe, China and South Africa. We are exploring the best technical and economic solutions to separation issues as varied as:

- spent fuel pond water clean up
- Caesium removal packages
- AGR CO₂ coolant line and vent clean up
- containment venting and relief valve protection
- Magnox and VVVR spent fuel processing for dry storage
- PWR coolant loop filtration
- HTGR He coolant cleanup
- innovative PWR fuel cleaning process,
- package venting for spent fuel disposal

We are committed to serving and supporting the existing and new-build nuclear power generation industries, by designing and supplying filtration systems to the highest technical and quality standards, in order to meet the exacting demands of the global nuclear power generation industry.



The Nuclear Fuel Cycle

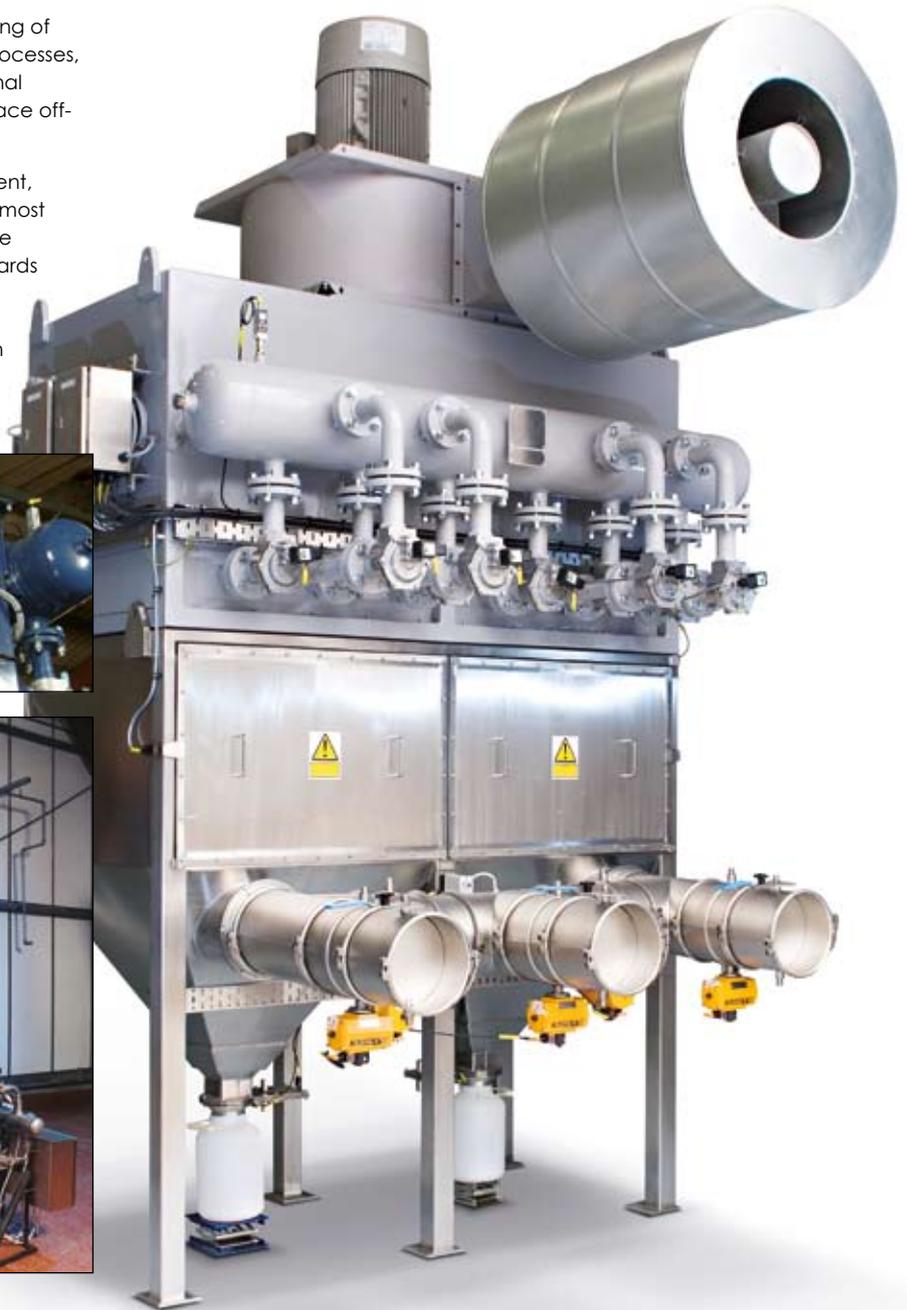
Porvair Filtration Group is actively involved in virtually every stage of fuel production including:

- Uranium concentrate processing,
- spent fuel reprocessing
- the production of UF₄ and UF₆
- the production of Uranium and Plutonium Oxides
- the treatment of off-gases from conversion and sintering processes
- the protection of HEPA banks

Our innovative products are also used in venting of fluidised bed and other thermal conversion processes, powder transport and collection, fuel pellet final grinding, glove box venting and sintering furnace off-gas purification.

In every aspect of fuel process off-gas treatment, we have engineered solutions to some of the most difficult separation problems whilst meeting the highest reliability, efficiency and quality standards required of this industry. Our pulsed jet self cleaning gas filtration systems are used across the industry in the UK, USA and Europe, in both Uranium Oxide and Plutonium/Uranium Oxide (MOX) fuel processes.

Porvair can supply everything from single, special filter elements for retrofit applications to complete self cleaning, removable (for cleaning) and disposable filter systems in a range of polymeric, glass fibre and metallic filter media including 316L stainless steel, high nickel alloys, Monel® and FeCrAlloy®.



Decommissioning and Decontamination

Porvair Filtration Group is a major player in every aspect of nuclear decommissioning and decontamination. As processes are developed to deal with legacy wastes, and legislation is introduced to define storage conditions, we are at the forefront of developing novel solutions to meet increasingly complex filtration problems associated with decommissioning and decontamination facilities around the world.

Porvair has engineered solutions to meet the most intractable problems including:

- the clean-up of liquid wastes
- the decomposition, reduction and reformation of organic and other wastes
- the drying and storage of spent fuel
- the venting of waste tanks and storage
- effluent treatment packages

Our capabilities also extend to:

- the collection of mechanically generated demolition debris
- spent fuel transport cask washing
- high temperature and chemical attack resistant HEPA and THE filters



Decommissioning and decontamination is a rapidly developing field of study, demanding new and challenging questions which press at the very boundaries of current engineering expertise. With our pan-industrial experience and track record across the industries of the UK, Europe and the USA, we work with engineers and technologists to develop solutions to the most extreme problems of temperature, chemical aggression and high dirt loading.



Waste Disposal and Storage

Porvair Filtration Group actively supports the nuclear waste treatment and storage industry. As processes are developed to deal with legacy wastes and legislation is introduced to define storage conditions, we are at the forefront of developing novel solutions to meet increasingly complex filtration problems through our extensive research programme.

Vent Breathers

Using a range of metallic filter media in a variety of metal types, **Porvair** has developed the expertise to supply waste package breathers that are precisely tailored to the individual needs of any application. Available with defined separation efficiencies, defined gas diffusion and defined flow/ ΔP characteristics.

Specially designed vent breathers, supplied to nuclear storage users in Europe, the UK and the USA, include:

- HEPA (THE) grade shielded vent breathers for spent fuel drying and storage
- WIPP compliant TrU waste package vent breathers
- 500 litre drum breathers
- 3m³ box breathers

In addition, we are working with the nuclear industry to improve the efficiency, safety and cleanliness of cementation, vitrification and disposal technologies including:

- drum filling, cement dust collection pulsed jet system
- vitrification plant, high temperature, pour and drain vent filters
- bulk vitrification pre-treatment evaporator filter systems



Pulsed Jet Self Cleaning Air and Gas Filters

Pulsed jet cleaning is a process developed by **Porvair Filtration Group** for the effective removal of collected solids from the surface of a filter element. The process is typically undertaken whilst the filter is in operation on-line and, apart from a very small pressure spike (or 'overpressure'), it does not interrupt or interfere with the process flow.

This technique is widely used across a wide range of processes in areas as diverse as:

- **fuel production**
including fuel pellet grinding, furnace off-gas venting, powder transport and conversion oven/fluidised bed venting at temperature
- **power generation**
including spent fuel and debris vault venting and protection and spent fuel drying processes
- **decommissioning**
including mechanically generated dust collection, smoke removal, ceramic membrane crushing and cementation drum fill operations
- **waste deposition**
including vitrification and waste solidification processes, drum filling and drum venting

Pulse jet filtration allows a properly designed system to reach a stable operating pressure differential in the long term, returning to the user all the solids collected for effective, minimum volume disposal or re-use.

The technique and its associated equipment can be designed to be used in high temperature, high solids, high pressure, chemically aggressive and highly active environments to provide filtration down to very fine levels, with continuous operation and consistent pressure loss, allowing the accurate specification of complementary equipment around the filter.

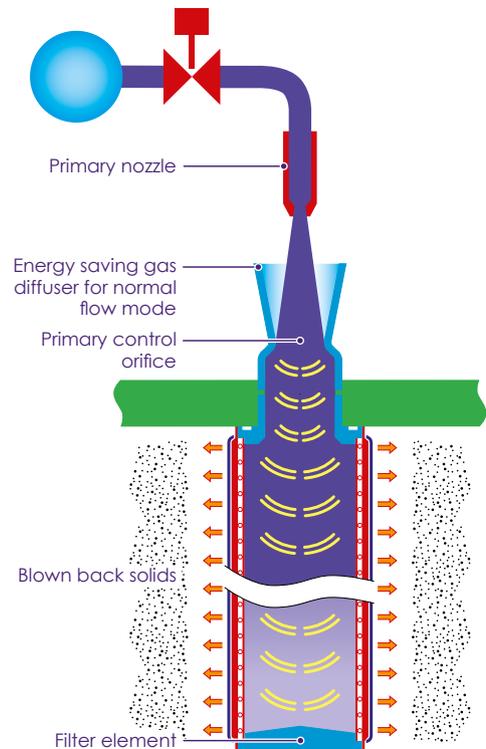
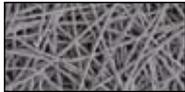


Figure 1 Moving across the photograph from left to right: the metal fibre element loaded with dust; the dust is removed from the surface by the pulsed jet action; the dust is carried away; the dust begins to settle; and quickly falls to the bottom of the vessel leaving a clean element. The sequence time is less than half a second. The cleaning pulse is made whilst process flow continues.

Porvair Filtration Group can provide custom designed filtration solutions using a wide range of metallic and non-metallic filtration media. Also available are a range of media surface treatments to further enhance the chemical, temperature and solids abrasion resistance of the media within a particular application.

Porvair also manufacture a range of metallic filtration media including;



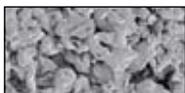
Sinterflo® F Sintered Metal Fibre

- High permeability.
- Low clean and operating pressure drops.
- Excellent cleanability, particularly in pulsed jet operation.
- Pleatable, offering higher filtration area per element.
- Available in 316L stainless and a range of alloys.
- True HEPA air and gas filtration possible (with pulsed jet cleaning if necessary).



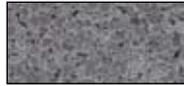
Sinterflo® M Sintered Metal Mesh

- Available in a wide range of mesh sizes and separation ratings.
- Available in various metal types.
- Sintered, layered mesh that can be designed to meet specific needs in a range of plate sizes and other shapes.
- Widely used in fluidised bed and packed bed laterals, distributors and bed plates.



Sinterflo® P Sintered Metal Powder

- Low permeability, but extremely robust.
- Pressure drops typically higher than sintered metal fibre.
- Primarily a depth filter, so cleanability is not as effective as Sinterflo® F Sintered Metal Fibre.
- Robust structure permitting successful use in properly designed liquid filtration backwashable systems.
- Available in a wide range of stainless steels and other alloys.



Sinterflo® PM Sintered Powder Membrane

An advanced patented metallic filter media that combines the strength of the sinter bonded metal powder with the levels of filtration efficiency associated with membranes. An ultra-thin layer of fine, narrow distribution, metallic, carbide and/or ceramic powder is applied producing a highly resistant membrane. The membrane generated is available as both micronic and sub-micronic pore structures for surface filtration at HEPA+ levels of filtration. Ideal when combined with pulse jet blowdown cleaning for uninterrupted operation.

Polymeric Disposable Filters

We provide a comprehensive range of filters for use as prefilters, filters and sub-micron membrane filters. They are suitable for use in new installations or as replacement cartridges in existing systems.

With a broad range of quality filtration products, tested and guaranteed to international standards, **Porvair** is recognised as a leading supplier of filtration systems for critical applications. Our filters are in service in applications as diverse as the biotechnology, pharmaceutical, electronics, nuclear, chemical, food and beverage industries. This supports our proven capability in the field of high efficiency filtration by satisfying the particular requirements of each customer, while meeting the most exacting industry standards.



Porvair Filtration Group has a policy of continuous improvement in all areas of its business. Listening to the customers' present and future requirements is a vital part of our operations and a key part of driving change.

We understand that product development involves building multidiscipline teams, not only within the company, but often in partnership with our customers, improving project efficiency and ensuring complete customer satisfaction. This continuous development of products and materials is vital, to enable us to offer new and better solutions to applications. **Porvair** has implemented various methodologies to drive out waste and process variance across the company to achieve the ultimate goal of zero defects.

We have a dedicated team of scientists, engineers, production and quality professionals working towards the best possible filtration solutions for our customers. We have a fully equipped test house and laboratory, and our experienced design engineers use the latest AutoCAD® technology, with 3D solid modelling, integrated with a finite element analysis system to give full structural assurance capability.

Quality is at the heart of every stage of our operation and a fundamental part of our culture. We are ISO9001 approved at a number of our manufacturing facilities and hold many other accreditations for the various industries we serve.

Research and Development

Continuous development of products and materials are vital to enable **Porvair** to offer new and better solutions to applications. Development plays a fundamental part in our operations and, as a result, we have developed a number of new bespoke products based on our established porous polymeric materials (Vyon®) and sintered metal media (Sinterflo®).

Although we operate across many filtration and separation markets there is significant interaction between each division in terms of product research and development. The new product development team is drawn from scientists and engineers from across all divisions encouraging new ideas and new solutions. The success of this approach has been in the interaction of chemists and engineers working together to find practical solutions to some extremely complex scientific challenges identified in the chosen market areas.

Engineering

From initial concept design through manufacture and validation to in service support, our highly experienced team of dedicated engineers work to develop the optimal filtration solution. Our team utilises the latest engineering tools of 3D AutoCAD®, Finite Element Stress Analysis, Computational Fluid Dynamics (CFD) and bespoke pressure vessel design software (PD5500, ASME VIII, EN13445). This is combined with over 30 years of proven experience and a knowledge and strong ethos of working closely with our customers, ensuring filtration solutions that meet customers requirements.



Manufacturing

Porvair Filtration Group produce filters and filtration systems, as well as a range of porous materials based on sintered polymers and metals, at production sites within the UK and the USA. We manufacture for a wide variety of industrial, pharmaceutical and biomedical applications, as well as supplying filtration solutions for extreme conditions of temperature, pressure and corrosion for the aerospace and nuclear markets.

Our production capabilities include the complete element or cartridge construction, along with the build of entire tubeplate and vessel assemblies. We boast specialist fabrication skills and techniques in all of our manufacturing sites around the world as well as extensive ISO Class 5 cleanroom facilities.

Testing and Laboratory

Our dedicated test, development and laboratory services underpin our design and development activity, from filtration media and material characterisation, product verification testing to customer systems simulation trials and in service performance evaluation. Our capabilities include filtration characterisation, environmental testing and analysis.

Quality

Our policy is to provide products and services that consistently satisfy the commitments made to our customers by complying with their requirements, working together as a team and by achieving continual improvement in our skills, systems, processes and performance.

We have a dedicated team of quality professionals with many years experience in definition, implementation and maintenance of quality management systems meeting multiple industry requirements. This extends across the workforce through a strong quality culture and a philosophy of 'getting it right first time' driven from the top of the organisation.

Our quality management systems are regularly audited internally and by customers and regulatory bodies. We hold ISO9001 at a selection of our manufacturing sites along with, EN 9100 and EASA Part 21 Subpart G at our Segensworth facility. We are NQA1 capable subject to specific project requirements.





porvair
filtration group

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