

Annex to Question 2

Emission quantities are not fully known due to the lack of declaration/transparency regarding the quantities on PFAS used in products and materials, so that we limit ourselves to the use and the emission/disposal route.

Sector E.2.10: Applications of fluorinated gases

Subsector	Use	Properties	Waste/Emission	Type of waste treatment
Refrigeration	Central refrigeration system + plant-related, closed circuit	- Specific heat - Energy efficiency - High precision temperature control imparted by thermal stability	Exchange only if required, withdrawal by manufacturer/service	Partly recycling, rest not known
Air conditioning and heat pumps	Air conditioning clean room, closed circuit	- High precision temperature control imparted by thermal stability - Viscosity vs temperature characteristics - Specific heat - Electrical conductivity characteristics	Refill if required, take-away by manufacturer/service, only disposal of residual containers	Not known
New Sub-use: dry etching of photomasks/reticles	Etching processes	- Anisotropic etching capabilities	Are neutralized mainly via exhaust gas cleaning processes (combustion + wet scrubber) and then emitted to the air.	n/a

Sector E.2.11.: Electronics and semiconductor

Subsector	Use	Properties	Waste/Emission	Type of waste treatment
Wires and cables	Consumable Materials in semiconductor manufacturing support equipment (piping/tubing, replacement parts etc.)	- Inertness (no outgassing) - Chemical resistance - Mechanical stability - Purity - Low flammability - Temperature stability	Delivery to disposal companies	Recycling
Coating, solvents and cleaning (including water based materials)	Etching, coating, cleaning processes	- Anisotropic etching capabilities - Developing/developer capabilities	Are neutralized mainly via exhaust gas cleaning processes (combustion + wet scrubber) and then emitted to the air.	n/a
electronic components	Consumable Materials in photomask/reticle and semiconductor manufacturing support equipment (air and wet chemical filters, seals/o-rings, piping/tubing, embedded lubricants (oils, greases, solids), non-process chemicals, replacement parts etc.)	- Inertness (no outgassing) - Chemical resistance - Mechanical stability - Low pressure drop (filters) - Low volatility/high stability - Purity - Low flammability - Temperature stability - Resistance to chemical permeation	Delivery to disposal companies	Recycling (separation of the components)
Heat transfer fluids	Air conditioning clean room, closed loop	- High precision temperature control imparted by thermal stability - Viscosity vs. temperature characteristics - Specific heat - Electrical conductivity characteristics	Refill if required, take-away by manufacturer/service, only disposal of residual containers	Not known

Subsector	Use	Properties	Waste/Emission	Type of waste treatment
Advanced semiconductor packaging	Product protection box, specified by semiconductor industry	- Temperature resistance - Product protection - Low off-gassing and particle generation - Electrical non-conductivity	Remain at customer or delivery to disposal companies	Recycling (processing into granules)
Photolithography	Surface coating	Uniformity in coating with minimal effect on properties provided by other critical resist/chemical ingredients (i.e., without impact to refractive indexes)	Liquid chemicals are collected, partially enters exhaust air, small amounts enters waste water	Recycling (solvent waste is largely processed for the secondary market)
Photolithography	As both Lithographic protective film (pellicle / protective cover) membranes and AntiReflective (AR) coatings that are optically clear to specific wavelengths of light/radiation	- Low off-gassing and particle generation - Resistance to chemical permeation - Inertness - Optically clear to the wavelength of radiation/light used to print upon the customer's wafers. - Resistant to reflection that prevents the transfer of a clear image from the photomask/reticle to the wafer.	Remains on product, when discarding/exchanging residual waste	Waste incineration

Subsector	Use	Properties	Waste/Emission	Type of waste treatment
new Sub-use: tool parts & equipment	Semiconductor and photomaskmaking manufacturing infrastructure (production and storage, high purity water manufacturing/delivery systems, high purity chemical & gas delivery systems, air filtration systems, bulk chemical delivery systems treatment and distribution, planar chemical delivery systems, liquid waste collection system, abatement systems, semiconductor wastewater treatment and HVAC including corrosive exhaust ducting and treatment, facilities systems controls, gaskets for pipelines, etc.)	- Inertness (no outgassing) - Chemical resistance - Mechanical stability - Low pressure drop (filters) - Low volatility/high stability - Purity - Low flammability - Temperature stability - Resistance to chemical permeation (safety requirements of chemical installations)	Substitute if required	Not known

Sector E.2.14.: Lubricants

Subsector	Use	Properties	Waste/Emission	Type of waste treatment
Lubricants, Greases	- In clean room tools - semiconductor manufacturing infrastructure, e.g. oxygen plants or other installations, which require high standards on safety	- Inertness - Low off-gassing and particle generation - Resistance to chemical permeation (safety requirements of chemical installations)	Refill if required, take-away by manufacturer/service, disposal of (residual) containers and contaminated wipes	Not known, probably waste incineration