



3M meeting with MSCA on upcoming PFAS Restriction under REACH

ONLINE MEETING

26 April 2021



AGENDA

INTRODUCTION TO 3M

RESPONSIBLE MANUFACTURING

EMAS

Water and Carbon-reduction goals

Upcycling of fluoropolymers

USES of PFAS

3M Fluoropolymers

3M Specialty Fluids

RMOA for PFAS

Who We Are & What We Do

Applying our science to improve every life



Safety & Industrial

Accelerating safety and industry performance by serving the industrial, electrical and safety markets.



Transportation & Electronics

Moving transportation and a connected world forward by serving automotive and electronic OEM customers.



Health Care

Connecting people, insights, science and technology to make better health possible around the world by serving the health care industry.

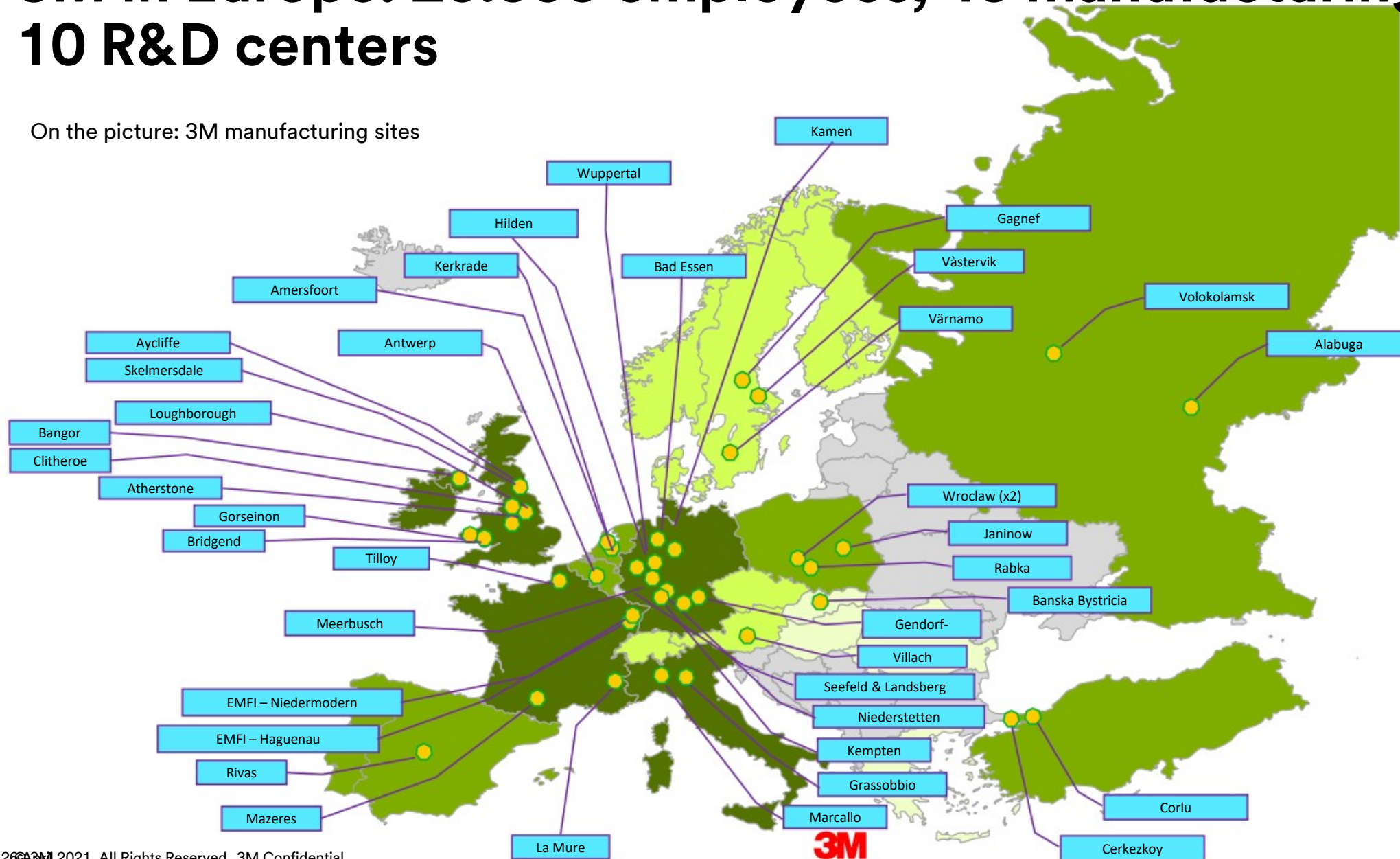


Consumer

Innovating to simplify life and work by serving global consumers.

3M in Europe: 20.000 employees, 40 manufacturing sites & 10 R&D centers

On the picture: 3M manufacturing sites



Who We Are & What We Do

2 Fluorine materials manufacturing sites in Europe, approx. 1125 employees

ZWIJNDRECHT, BELGIUM



GENDORF, GERMANY



New Carbon & Water commitments

Building on 3M Sustainability Strategic Framework



Science for Circular

Our **water goals** will **reduce water use** by 25% in our facilities (10% by 2022, 20% by 2025 & **25% by 2030**), **and improve water quality** when returned to the environment after use in our manufacturing operations

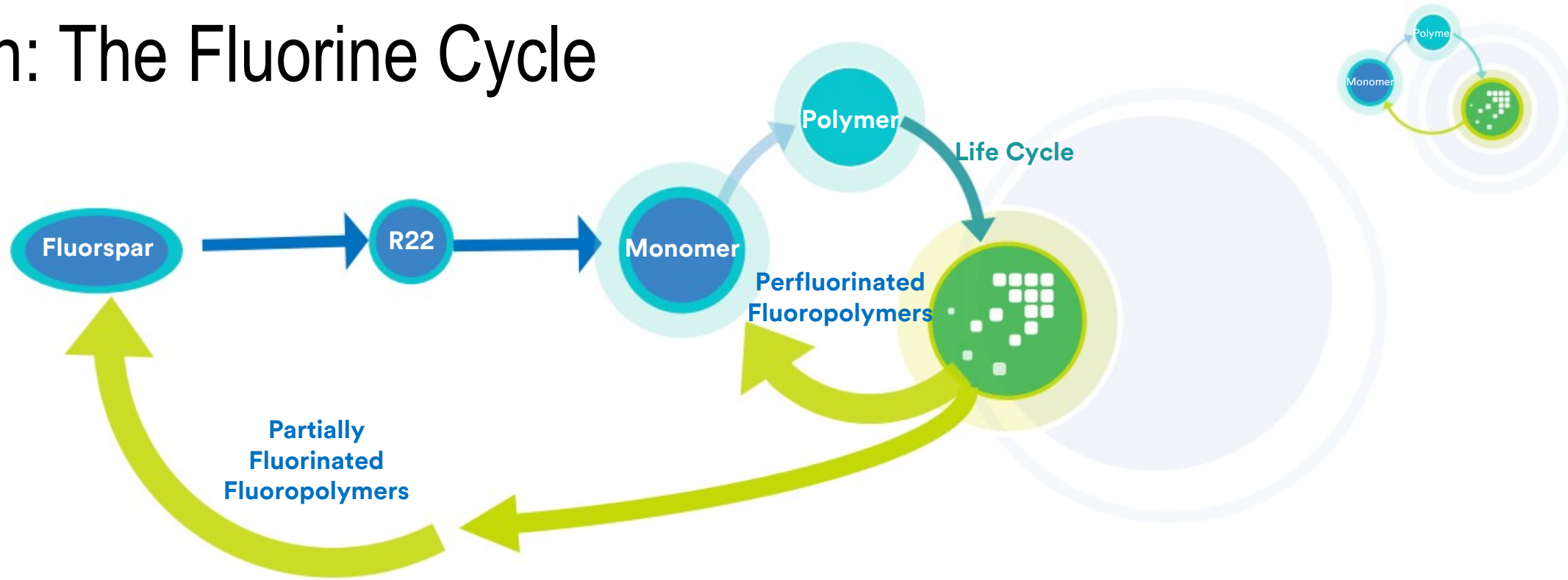
Science for Climate

Our **carbon goal** will make 3M achieve **carbon neutrality in operations by 2050** while aiming for a 50% reduction of carbon emissions by 2030 and 80% by 2040 (note: 2019 is the baseline measure year)

Science for Community

Our **social goals** expand opportunities for underrepresented communities to participate and succeed in the future workplace, and make 3M **lead in social equity and justice**

Vision: The Fluorine Cycle



- Circular technology
- Can be used for Fluoropolymers
- Manufacturing waste or post-use industrial material is decomposed back to key raw materials
- Raw materials can be used to produce new PTFE
- Pilot scale for perfluorinated Fluoropolymers demonstrated in Gendorf, Germany

Reduced Environmental Impact for Perfluoropolymers per 1,000 t TFE produced:

(5,000 t) Chlorine
(10,000 t) CO₂
(10,000 t) Acid byproduct
(2,000 t) Sulfuric acid
(3,000 t) Gypsum



Our PFAS-enabled* applications:

~25,000 products. Some examples:

- ✓ Certain medical devices
- ✓ Certain personal protective equipment
- ✓ Energy-efficient window films
- ✓ Renewable energy products (= 3M Wind Blade Protective Coating)
- ✓ Road safety products (= road & pavement markings, reflective traffic signs)
- ✓ Products used in electronics, automotive, aerospace and construction:
 - high-performance adhesives for automotive and aerospace
 - high-performance double sided acrylic foam tapes
 - coated masking paper
 - adhesive transfer tapes
 - enhancing and shielding tapes



PFAS-enabled products contain or use PFAS(s) in manufacturing processes, leveraging the chemistry's technical function to perform as intended

Our fluorinated materials:

- ❑ Fluoropolymers
 - ❑ Fluoroelastomers
 - ❑ Fluorothermoplastics
- ❑ Specialty chemicals (C1/C4 additives)



3M™ Dyneon™ PTFE



3M™ Dyneon™ Fluoroelastomers

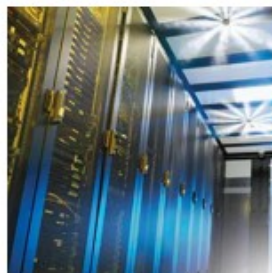


3M™ Ionomers



3M™ Dyneon™
Fluorothermoplastics

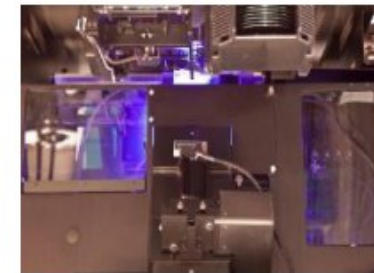
- ❑ Specialty Fluids
 - ❑ 3M™ Novec™ Engineered Fluids
 - ❑ 3M™ Fluorinert™ Electronic Liquids
 - ❑ 3M™ Performance Fluids
 - ❑ 3M™ FA-188 Foam Additive



3M™ Novec™ 1230
Fire Protection Fluid



3M™ Novec™
Engineered Fluids



3M™ Fluorinert™
Electronic Liquids



3M™ Novec™ 4710 &
5110 Insulating Gases



Where our fluorinated materials are sold today

Markets

- Aerospace
- Automotive
- Construction
- Data Centers
- Electronics
- Energy
- Industrial
- Medical
- Personal Safety
- Semiconductor

Select Applications

- Coatings for aerospace wires that help prevent interference
- High temp seals and hoses that help lower emission for autos
- High transparency, long lived architectural films for stadiums
- Immersion cooling of data center IT hardware
- High temperature seals that enable modern electronics production
- Conductive coatings that allow zero emission fuel cells
- Corrosion resistant lining for industrial pipes
- Medical device packaging
- Additives for flame retardant computer screens
- Heat transfer and testing fluids in semiconductor processing

3M sells broadly into non-consumer markets and supports hundreds of applications with high societal value

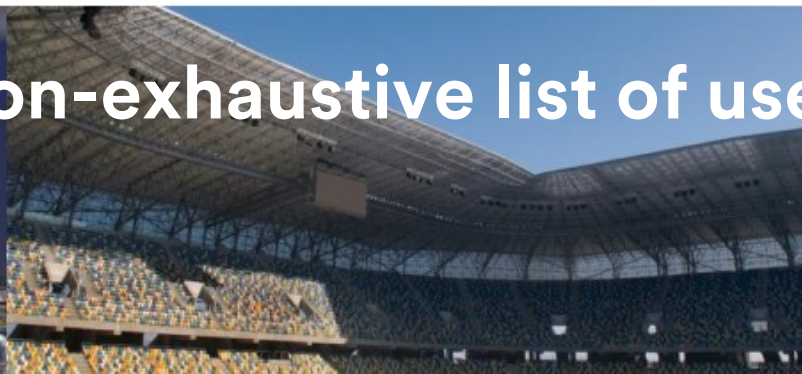
3M Fluoropolymers

3M Fluoropolymers

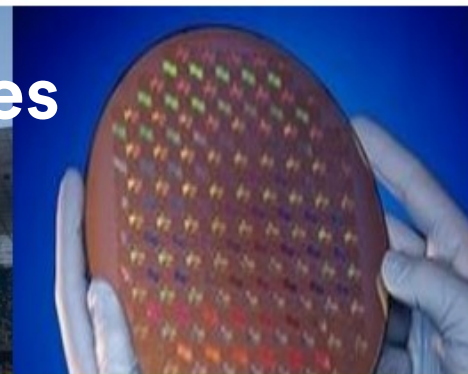
Non-exhaustive list of uses



Corrosion protection & emission reduction in chemical & power plants



Fire-safe, durable roof for large events



Enabling semiconductor and pharmaceutical manufacturing



Medical applications



Low emission transportation



Renewables

- ✓ Highly stable high molecular weight materials.
- ✓ They have no bio-availability and no mobility in the environment.
- ✓ Indispensable in many applications with high societal value.

3M Fluoropolymers exhibit important and unique performance characteristics and provide important value, often with performance that cannot be achieved with other solutions.

The background of the slide is an abstract geometric pattern composed of numerous triangles of varying sizes. The color palette is dominated by shades of green and blue, with some triangles appearing in a lighter cyan or turquoise hue. The triangles are arranged in a way that creates a sense of depth and movement, with some pointing towards the center and others towards the edges.

3M Specialty Fluids

3M Specialty Fluids

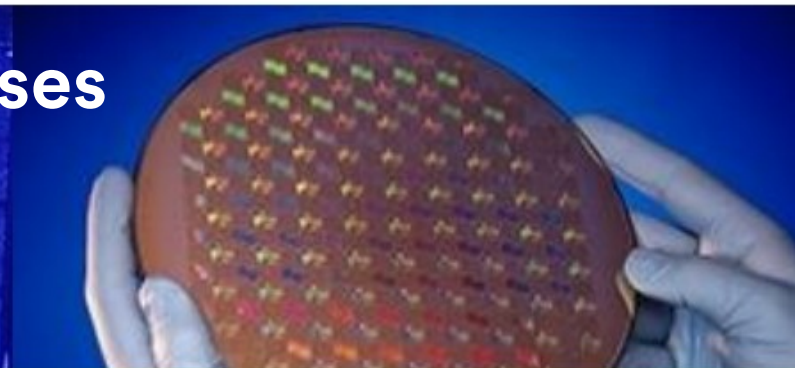
Non-exhaustive list of uses



Protecting valuable assets
from fire



Cooling data centers



Enabling semiconductor
manufacturing



Reducing climate impact
in the energy sector



Addressing thermal management
applications in EVs

3M

3M NOVEC™ ENGINEERED FLUIDS ARE
OFTEN USED IN REPLACEMENT OF
OZONE DEPLETING CHEMICALS,
CHEMICALS WITH MUCH HIGHER GWP
VALUES, HAZARDOUS CHEMICALS OR
SUBSTANCES OF VERY HIGH CONCERN

3M Specialty Fluids exhibit important and unique performance characteristics owing to their chemistries and provide important value, often with performance that cannot be achieved with other solutions

3M™ Novec™ Engineered Fluids: Fluoroketones

- 3M™ Novec™ 1230 Fire Protection Fluid
- 3M™ Novec™ 5110 Insulating Gas
- 3M™ Novec™ 612 Magnesium Protection Fluid
- 3M™ Novec™ 649 Engineered Fluid

- ✓ Global warming potential (GWP) <1 & non-ozone depleting
 - ✓ Novec 1230 is used as a clean agent in fire suppression systems to protect high value assets in applications such as electrical control rooms, underground substations, data centers, telecommunications switch rooms, computer control rooms, airport control towers, clean rooms, computer-controlled manufacturing operations as well as in archives and museums with paper archives, historical documents, priceless works of art and antiquities where other fire protection fluids cannot be used. Used in replacement of Halons and HFCs with much higher GWP.
 - ✓ Novec 5110 is used in gas-insulated electrical equipment. Existing installations using gas mixtures with Novec 5110 are demonstrating the potential to reduce greenhouse gas emissions of up to 99.99% compared to installations using SF₆
 - ✓ Novec 612 is used as an alternative to SF₆ as a cover gas to prevent molten magnesium from burning during casting processes. Reductions in GHG emissions of more than 99% can be achieved compared to use of SF₆
 - ✓ Novec 649 is an advanced heat transfer fluid with ultralow GWP used in Organic Rankine Cycles (ORC) and electronics cooling applications
-
- ✓ Not considered to be bio-accumulative, not classified for human health hazards in the European Classification, Labeling and Packaging Regulation, not classified as CMR under CLP
 - ✓ Novec 1230 fluid has the highest margin of safety for human occupancy among clean fire suppression agents, including inert gas.
 - ✓ Short atmospheric lifetime (1-2 weeks or shorter)¹
 - ✓ These fluoroketones degrade through natural processes in the atmosphere and do not redistribute to soil or water to any meaningful degree
 - ✓ Expected degradation products of these fluoroketones have been studied. Some sources are listed below.

1) Taniguchi, et.al., J. Phys. Chem. A, 107 (2003), 2674-2679

SOURCES: 1) Taniguchi, et.al., J. Phys. Chem. A, 107 (2003), 2674-2679, 2) Jackson, et al. Environ Sci Tech, 45 (2011), 8030-8036.

3M™ Novec™ Engineered Fluids: Segregated Hydrofluoroethers

- 3M™ Novec™ Engineered Fluids 7000, 7100, 7100DL, 7200, 7200DL, 7300, 7500*, 7700, 8200
- 3M™ Novec™ Engineered Fluids 71DA, 71DE, 71IPA, 72DA, 72DE, 72FL, 73DE
- 3M™ Novec™ Electronic Coatings 1700, 1702, 1710, 1720, 1908, 2202, 2704, 2708

- ✓ Lower GWP (57-530) & non-ozone depleting
- ✓ Novec engineered fluids are used in a variety of applications including:
 - ✓ Cleaning and vapor degreasing of electronic components, medical device parts such as implants, metal components for automotive or aerospace and precision machine parts; these fluids are often used in replacement of substances of very high concern (SVHC) such as trichloroethylene (TCE), n-propyl bromide (nPB) and high GWP and/or ODP substances such as hydrochlorofluorocarbons (HCFCs) and hydrofluorocarbons (HFCs)
 - ✓ Solvents in coating formulas and industrial cleaning solutions and for lubricant deposition and silicone deposition in applications in electronics, automotive and medical devices; they are often used in replacement of trichloroethylene (TCE), n-propyl bromide (nPB), hydrochlorofluorocarbons (HCFCs) and hydrofluorocarbons (HFCs)
 - ✓ Heat transfer fluids in semiconductor processing equipment, industrial and medical equipment, freeze drying applications in the manufacture of pharmaceuticals and as testing fluids in semiconductor, electronics and electrical applications
 - ✓ Reaction media or inert media and in microfluidics applications for medical testing applications
- ✓ Novec electronic coatings are used for electronic device component protection and for easy-clean and anti-smudge properties on device screens and glass
- ✓ Not considered to be bio-accumulative, not classified for human health hazards in the European Classification, Labeling and Packaging Regulation, not classified as CMR under CLP
- ✓ These segregated hydrofluoroethers degrade over time through natural processes in the atmosphere and do not redistribute to soil or water to any meaningful degree
- ✓ Expected degradation products of these segregated hydrofluoroethers have been studied. Some sources are listed below.

*NOTE: Due to the use of the OECD305 bioconcentration factor (BCF) test as indication of bioaccumulation, 3M expects that Novec 7500 will be labeled as vPvB. 3M does not agree that the results of this test are relevant in the determination of the risk of bioaccumulation for these chemistries. 3M is currently working on potential modifications to the protocol that will be proposed to reduce the uncertainty in the measured result. Reference: Newsted, et. al, Environ. Sci. Technol. 36 (2002), 4761-4769

SOURCES: 1) Ninomiya, et.al., Environ. Sci. Technol 34, (2000), 2973-2978, 2) Wallington, et. al., Journal of Physical Chemistry A, 101 (1997) 8264-8274, 3) Christensen, et. al., Journal of Physical Chemistry A, 102 (1998) 4839-4845, 4) Rodriguez, et.al., Atm Environ, 96 (2014) 145-153, 5) Goto, et. al., Env Sci Tech, 36 (2002) 2395-2402

3M™ Novec™ Engineered Fluids: Fluoronitrile

- 3M™ Novec™ 4710 Insulating Gas

- ✓ GWP = 2100 & non-ozone depleting
 - ✓ Used in medium-voltage and high voltage gas insulated power generation and distribution equipment including gas insulated switch gear and gas insulated lines
 - ✓ Used in gas mixtures with other gases (CO₂, CO₂/O₂) in place of sulfur hexafluoride, SF₆, a potent greenhouse gas with GWP of 23,500
 - ✓ Existing installations using gas mixtures with Novec 4710 are demonstrating the potential to reduce GHG emissions by more than 99% compared to installations using SF₆
-
- ✓ Not considered to be bio-accumulative, classified at the lowest level category for human health hazards in the European Classification, Labeling and Packaging Regulation, not classified as CMR under CLP
 - ✓ The fluoronitrile degrades over time through natural processes in the atmosphere and does not redistribute to soil or water to any meaningful degree
 - ✓ Expected degradation products of this fluoronitrile have been studied. Sources are listed below.

SOURCE: 1) Sulbaek Andersen, et.al., Environ Sci Tech, 51 (2017) 1321–1329.

Highlighted applications and comparison to alternatives

Fire suppression application with 3M™ Novec™ 1230 Fire Protection Fluid

Non-PFAS fire protection agents include water, carbon dioxide, dry chemical and inert gases. These non-PFAS fire protection agents can cause corrosion, can damage equipment or valuable artifacts, can be electrically conductive, are slower drying, can leave a residue, may have higher toxicity, may require high operating pressures and may result in higher maintenance costs.

Inert gas systems work through a different extinguishing mechanism than HFCs and Novec 1230 fluid by displacing oxygen in an enclosure rather than cooling the fire. As a result, the volume of gas necessary for extinguishment and the pressure at which inert gas systems operate are far greater. As a result, there are extra costs associated with storing the additional volume of gas needed and extra costs required to make the system safe including extra ventilation and extra structural strength to support the weight of the system as well as more expensive testing and checkout costs.

Cleaning applications with 3M™ Novec™ Engineered Fluids

Non-PFAS cleaning solvents include water, alcohol, n-propyl bromide (nPB), trichloroethylene (TCE) and hydrocarbons. These non-PFAS cleaning solvents and solvents can cause corrosion, have longer drying and processing times and thus use more energy, may be flammable, can have higher levels of toxicity, may have lower material compatibility and/or may be ozone-depleting substances. Unlike aqueous solutions, Novec fluids do not support biological growth and are less equipment and energy intensive and dry quickly with less chance for corrosion.

Heat transfer & testing applications with 3M™ Novec™ Engineered Fluids

Non-PFAS heat transfer agents include water, ethylene glycol and alcohols, these non-PFAS heat transfer agents can be electrically conductive, can create corrosion, use more energy to reach low temperatures, can be flammable and/or explosive and can have higher levels of toxicity

Non-PFAS testing fluids include mineral oil and silicone oils, these other testing fluids may have less efficient heat transfer properties, may be flammable and/or combustible, may have limited operating temperature ranges and can use more energy to reach the required low temperatures and/or high temperatures

Insulating gases with 3M™ Novec™ Insulating Gases 4710 & 5110

Non-PFAS electrical insulation includes vacuum, interrupter/air-based technology. However, it unclear if the full voltage range can be covered by this technology. Furthermore, the increased space requirements of this technology when used in high voltage applications results in an overall worse life cycle management assessment compared to equipment using Novec insulating gas mixtures. Novec gases remain in place for the useful life of the equipment.

Sum up

- ✓ 3M's direct and PFAS-enabled products are used in many critical, mainly industrial, applications.
 - ✓ Fluoropolymers and 3M Novec Fluids do not present significant health or environmental risks. The absence of these substances' manufacturing or availability in Europe will conflict with the EU's objectives to decarbonize, digitalize and keep people safe.
 - ✓ New technologies and processes will reduce further potential releases of any PFAS substance in the environment.
-
- ➔ REACH restrictions should only be adopted if the authorities demonstrate that the substances present an unacceptable risk to human health or the environment. We believe this is not the case for all PFAS substances and products.
 - ➔ Measures based on 'precautionary principle' need to be temporary and proportionate to risks.
 - ➔ Those PFAS substances or uses that do not present significant health or environmental risks, and where emissions can be managed, should not fall within the restriction scope.

RMOA for PFAS

RMOA should consider exempting both PFAS uses and manufacturing processes where emissions can be managed, controlled or minimized



RMOA for 3M Novec fluids

3M Novec fluids, which are enabling the European Green Deal, should not fall under the scope of the proposed PFAS restriction.



3M™ Novec™1230 Fire Protection Fluid will be produced at our EMAS-certified site in Belgium (as of 2021).



3M Novec fluids are used in applications of high societal value. They are helping to achieve EU climate objectives and digital agenda.



3M Novec fluids are typically used in closed applications or in applications in which users manage and minimize emissions. In many applications, the fluids are filtered in situ and can be recycled and reused.



Any non-PFAS alternative is expected to exhibit inferior performance and added cost. A life cycle assessment (LCA) would need to demonstrate whether use of non-PFAS alternatives would result in a lower potential impact on the environment.



RMOA for Fluoropolymers

Fluoropolymers, which are enabling the European Green Deal, should not fall under the scope of the proposed PFAS restriction.



3M Fluoropolymers are produced at an EMAS-certified site in Gendorf, Germany.



Fluoropolymers are used in applications of high societal value. They are helping to achieve EU climate objectives and digital agenda.



Circular technologies can be used to address manufacturing waste or post-use industrial fluoropolymers by refreshing them back to raw materials. These raw materials can be used to produce new fluoropolymers, reducing the waste production of the site and its environmental impacts.



Any non-PFAS alternative is expected to exhibit inferior performance and added cost. A life cycle assessment (LCA) would need to demonstrate whether use of non-PFAS alternatives would result in a lower potential impact on the environment.



The background is a complex, abstract geometric pattern composed of numerous overlapping triangles. The triangles are in various shades of blue and cyan, creating a sense of depth and movement. The overall effect is a modern, low-poly aesthetic.

THANK YOU