



NovecTM

Brand

3MTM NovecTM 4710 Insulating Gas

Environmental, Health and Safety Summary

Introduction

3M endeavors to develop solutions that optimize the widest margins of safety, for both 3M manufacturing plant workers and our customers, combined with the best performance possible.

Occupational Exposure

To achieve this outcome, 3M toxicologists carefully develop peer-reviewed, health-based occupational exposure limits (OELs) for 3M manufactured chemical products. 3M's OEL derivation process is conducted using established methodologies consistent with those used by other authoritative, OEL-setting bodies such as the TERA-OARS¹, WEEL² Committee [note: formally under the auspices of the AIHA³], ACGIH⁴ and the European Union's (EU) SCOEL⁵ Committee. These OELs are designed to "... represent conditions

under which it is believed that nearly all workers may be repeatedly exposed ... over a working lifetime without adverse health effects." The most common OEL is an eight-hour time weighted average (TWA) that is derived to be protective of human health based on airborne occupational exposure for eight hours a day, five days a week, 52 weeks a year for an occupational working lifetime (typically >30 years).

3M conducted a series of single- and repeat-dose inhalation toxicity experiments to determine safe use; the results of these studies indicated low toxicity and were the basis for establishing an OEL eight-hour TWA of 65 ppm for 3MTM NovecTM 4710 Insulating Gas. Intermittent exposures above the TWA are acceptable, provided they fall within the following excursion

guidance which has been published by the ACGIH³: transient increases in workers' exposure levels may exceed three times the value (195 ppm) of the TWA level for no more than 15 minutes at a time, on no more than four occasions spaced 1 hour apart during a workday, and under no circumstances should they exceed five times the value (325 ppm) of the eight-hour TWA level. Additional detail can be found on www.ACGIH.org.

In the electrical power utility industry, very few if any workers would be exposed to concentrations of Novec 4710 Insulating Gas approaching the eight-hour TWA on a consistent, daily basis through an entire career.

In fact, most workers would only handle 3MTM NovecTM 4710 Insulating Gas through intermittent

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maintenance, gas extracting or refilling operations, with events sometimes occurring weeks or even months apart. And the gas handled by workers would typically include only a small fraction of Novec 4710 Insulating Gas mixed with other inert gases, further diluting the exposure to the worker. In these situations, a wide margin of worker safety is achieved through the use of good industrial hygiene practices and following the recommended handling and operational guidelines of the product.

A material toxicity summary sheet (MTSS) is available from 3M by request, which summarizes the toxicology of the product. 3M uses criteria that are recognized as conservative for environmental and mammalian assessment in order to provide a wide margin of safety.

Environmental Assessment

3M conducts environmental assessments on its chemical products by a process utilizing standard international guidelines, including: those from the United States Environmental Protection Agency (EPA); the EU's Registration, Evaluation, Authorization and Restriction of Chemicals (REACH); and conventional environmental terrestrial, aquatic and atmospheric parameters and criteria. The process utilizes an approach that creates a standard hazard assessment derived from all available test data and models endpoints for critical hazards where applicable. The hazard assessment may then be utilized in conjunction with known and modeled environmental fate and exposure parameters to complete an environmental risk assessment which characterizes the probability of the hazard actually causing harm.

Environmental Hazard Summary

Novec 4710 gas is a fluorinated gas and if released directly to the environment, it will partition exclusively into the atmospheric compartment where it is expected to degrade via reaction with hydroxyl radical. The atmospheric lifetime is 30 years. The global warming potential (100-year integrated time horizon) relative to carbon dioxide (CO₂) is 2090 (as calculated using the IPCC 5th assessment report method). The ozone depletion potential (ODP) of Novec 4710 gas is zero.

In the unlikely event that Novec 4710 Insulating Gas is forced into the aquatic compartment under high pressure, the gas will hydrolyze. Due to its very low water solubility and rapid partitioning to the atmosphere, deposition to the aquatic compartment is not likely. Extremely low concentrations of trifluoroacetic acid (TFA) may also form in the atmosphere from releases of Novec 4710 Insulating Gas. Very low concentrations of TFA have been found in the environment for decades and have been reported to be primarily from natural sources. The minor contribution from industrial sources is not believed to present a risk to human health or the environment.⁶ In the vapor phase Novec 4710 Insulating Gas does not have a detectable hydrolysis rate. When forced into aqueous media, hydrolysis occurs within minutes and the resulting fluorinated amide of Novec 4710 insulating gas is moderately soluble and is persistent. This Novec 4710 gas hydrolysis product was not found to be toxic to aquatic invertebrates or to green algae.

Novec 4710 Insulating Gas is not expected to bioaccumulate.

Additional Environmental,

Health, and Safety information is communicated to our customers in a variety of media that include the Globally Harmonized System (GHS) classification and labels on our products, sections 11 and 12 of the safety data sheets (SDSs), and topic specific product bulletins, MTSSs, publications or public databases such as the European Chemicals Agency (ECHA) database of registered substances.

Life Cycle

Considerations

3M engineers products such as Novec 4710 Insulating Gas that provide sustainable solutions for our customers' needs. We carefully assess the life cycle of our products, including whether they are safe for their intended uses. We evaluate risks to human health and the environment – not only to wildlife, but climate impact and energy consumption as well. As a matter of philosophy, we strive to minimize, and as much as possible eliminate, any footprint from products that are persistent (or products that degrade into persistent materials). While 3M advocates a common sense approach to the management of these products, taking into account such aspects as economic feasibility, technological capability, recyclability and end-of-life considerations, 3M does not support uses of these kinds of products where substantial amounts of the product are intentionally released as a matter of course during the handling, use or disposal of the product.

1 Toxicology Excellence for Risk Assessment- Occupational Assessment for Risk Sciences

2 Workplace Environmental Exposure Level

3 American Industrial Hygiene Association

4 American Conference of Governmental Industrial Hygienists

5 Scientific Committee on Occupational Exposure Levels

6 Journal of Toxicology and Environmental Health, Part B, 2016, Vol. 19, No. 7, 289-304

For additional information

For information on 3M™ Novec™ Insulating Gases, visit our web site at: 3M.com/novec

Smart. Safe. Sustainable.

The 3M™ Novec™ Brand Family

The Novec brand is the hallmark for a variety of proprietary 3M products. Although each has its own unique formula and performance properties, all Novec products are designed in common to address the need for smart, safe and sustainable solutions in industry-specific applications. These include precision and electronics cleaning, heat transfer, fire protection, protective coatings, immersion cooling, advanced insulation media replacement solutions and several specialty chemical applications.

3M™ Novec™ Engineered Fluids ■ 3M™ Novec™ Aerosol Cleaners ■ 3M™ Novec™ 1230 Fire Protection Fluid ■ 3M™ Novec™ Electronic Grade Coatings ■ 3M™ Novec™ Electronic Surfactants ■ 3M™ Novec™ Insulating Gases

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Safety Data Sheet: Consult safety data sheet (SDS) before use.

Regulatory: For regulatory information about this product, contact your 3M representative.

Technical Information: The technical information, recommendations and other statements contained in this document are based upon tests or experience that 3M believes are reliable, but the accuracy or completeness of such information is not guaranteed.

Product Use: Many factors beyond 3M's control and uniquely within user's control can affect the use and performance of a 3M product in a particular application. Given the variety of factors that can affect the use and performance of a 3M product, user is solely responsible for evaluating the 3M product and determining whether it is fit for a particular purpose and suitable for user's method of application.

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Issued: 6/17 12633HB
60-5005-0036-2

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