



Novec[™]

Brand

3M[™] Novec[™] 5110 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 225 ppm for 3M[™] Novec[™] 5110 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 (675 ppm) of the TWA level for no more than 15 minutes at a time, on no more than four occasions spaced one hour apart during a workday, and under no circumstances should they exceed five times the value (1125 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 5110 Insulating Gas approaching the eight-hour TWA on a consistent, daily basis through an entire career. In fact, most workers would only handle 3M[™] Novec[™] 5110

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Insulating Gas through intermittent 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 5110 Insulating Gas mixed with other inert gases, further diluting the exposure to the worker. In these situations, a sufficient 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

If released to the environment, Novec 5110 gas is expected to partition primarily to the atmospheric compartment where it will undergo direct photolysis with a half-life of 16 days. Novec 5110 Insulating Gas does not contribute to ozone depletion in the stratosphere.

In the unlikely event that it is forced into contact with water, Novec 5110 gas will quickly hydrolyze. The primary hydrolysis product is trifluoroacetic acid (TFA), which is classified as persistent per EU and EPA definitions, in the aquatic and terrestrial compartments but will not bioaccumulate or bioconcentrate. Acute aquatic toxicity studies with daphnia magna show immediate conversion to TFA. Some ecotoxicity was observed, but could not be attributed to parent, reactive intermediate, or the primary degradation products. The substantial vapor pressure of Novec 5110 gas means that it is unlikely to be in the aquatic compartment long enough for ecotoxicity to occur. 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

The global warming potential (100-year integration time horizon) of Novec 5110 gas relative to carbon dioxide (CO₂) is <1 (as calculated using the IPCC 5th assessment report method). The ozone depletion potential (ODP) of Novec 5110 Insulating Gas is zero.

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 5110 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 additional 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.

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