



RIFM fragrance ingredient safety assessment, *trans*-methylgeranate, CAS Registry Number 1189-09-9

A.M. Api^a, D. Belsito^b, D. Botelho^a, M. Bruze^c, G.A. Burton Jr.^d, J. Buschmann^e, M. A. Cancellieri^a, M.L. Dagli^f, M. Date^a, W. Dekant^g, C. Deodhar^a, A.D. Fryer^h, L. Jones^a, K. Joshi^a, M. Kumar^a, A. Lapczynski^a, M. Lavelle^a, I. Lee^a, D.C. Lieblerⁱ, H. Moustakas^a, M. Na^a, T.M. Penning^j, G. Ritacco^a, J. Romine^a, N. Sadekar^a, T.W. Schultz^k, D. Selechnik^a, F. Siddiqi^a, I.G. Sipes^l, G. Sullivan^{a,*}, Y. Thakkar^a, Y. Tokura^m

^a Research Institute for Fragrance Materials, Woodcliff Lake, NJ, 07677, USA

^b Member Expert Panel for Fragrance Safety, Columbia University Medical Center, Department of Dermatology, 161 Fort Washington Ave., New York, NY 10032, USA

^c Member Expert Panel for Fragrance Safety, Malmö University Hospital, Department of Occupational & Environmental Dermatology, Sodra Forstadsgatan 101, Entrance 47, Malmö, SE, 20502, Sweden

^d Member Expert Panel for Fragrance Safety, School of Natural Resources & Environment, University of Michigan, Dana Building G110, 440 Church St., Ann Arbor, MI 48109, USA

^e Member Expert Panel for Fragrance Safety, Fraunhofer Institute for Toxicology and Experimental Medicine, Nikolai-Fuchs-Strasse 1, 30625 Hannover, Germany

^f Member Expert Panel for Fragrance Safety, University of São Paulo, School of Veterinary Medicine and Animal Science, Department of Pathology, Av. Prof. Dr. Orlando Marques de Paiva, 87, São Paulo, CEP 05508-900, Brazil

^g Member Expert Panel for Fragrance Safety, University of Würzburg, Department of Toxicology, Versbacher Str. 9, 97078 Würzburg, Germany

^h Member Expert Panel for Fragrance Safety, Oregon Health & Science University, Portland, OR, USA

ⁱ Member Expert Panel for Fragrance Safety, Vanderbilt University School of Medicine, Department of Biochemistry, Center in Molecular Toxicology, 638 Robinson Research Building, 2200 Pierce Avenue, Nashville, TN 37232-0146, USA

^j Member of Expert Panel for Fragrance Safety, University of Pennsylvania, Perelman School of Medicine, Center of Excellence in Environmental Toxicology, 1316 Biomedical Research Building (BRB) II/III, 421 Curie Boulevard, Philadelphia, PA 19104-3083, USA

^k Member Expert Panel for Fragrance Safety, The University of Tennessee, College of Veterinary Medicine, Department of Comparative Medicine, 2407 River Dr., Knoxville, TN, 37996-4500, USA

^l Member Expert Panel for Fragrance Safety, Department of Pharmacology, University of Arizona, College of Medicine, 1501 North Campbell Avenue, P.O. Box 245050, Tucson, AZ 85724-5050, USA

^m Member Expert Panel for Fragrance Safety, The Journal of Dermatological Science (JDS), Editor-in-Chief, Professor and Chairman, Department of Dermatology, Hamamatsu University School of Medicine, 1-20-1 Handayama, Higashi-ku, Hamamatsu 431-3192, Japan

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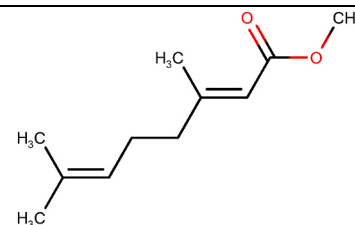
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Version: 101,121. Initial publication. All fragrance materials are evaluated on a five-year rotating basis. Revised safety assessments are published

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if new relevant data become available. Open access to all RIFM Fragrance Ingredient Safety Assessments is here: fragrancematerialsafetyresource.elsevier.com.



* Corresponding author.

E-mail address: gsullivan@rifm.org (G. Sullivan).

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Name: <i>trans</i> -Methylgeranate	Abbreviation/Definition List:
CAS Registry Number: 1189-09-9	
2-Box Model - A RIFM, Inc. Proprietary <i>in silico</i> tool used to calculate fragrance air exposure concentration	
AF - Assessment Factor	
BCF - Bioconcentration Factor	
CNIH - Confirmation of No Induction in Humans test. A human repeat insult patch test that is performed to confirm an already determined safe use level for fragrance ingredients (Na et al., 2021)	
Crete RIFM Model - The Crete RIFM Model uses probabilistic (Monte Carlo) simulations to allow full distributions of data sets, providing a more realistic estimate of aggregate exposure to individuals across a population (Comiskey et al., 2017; Safford et al., 2015a, 2017; Comiskey et al., 2017) compared to a deterministic aggregate approach	
DEREK - Derek Nexus is an <i>in silico</i> tool used to identify structural alerts	
DRF - Dose Range Finding	
DST - Dermal Sensitization Threshold	
ECHA - European Chemicals Agency	
ECOSAR - Ecological Structure-Activity Relationships Predictive Model	
EU - Europe/European Union	
GLP - Good Laboratory Practice	
IFRA - The International Fragrance Association	
LOEL - Lowest Observed Effect Level	
MOE - Margin of Exposure	
MPPD - Multiple-Path Particle Dosimetry. An <i>in silico</i> model for inhaled vapors used to simulate fragrance lung deposition	
NA - North America	
NESIL - No Expected Sensitization Induction Level	
NOAEC - No Observed Adverse Effect Concentration	
NOAEL - No Observed Adverse Effect Level	
NOEC - No Observed Effect Concentration	
NOEL - No Observed Effect Level	
OECD - Organisation for Economic Co-operation and Development	
OECD TG - Organisation for Economic Co-operation and Development Testing Guidelines	
PBT - Persistent, Bioaccumulative, and Toxic	
PEC/PNEC - Predicted Environmental Concentration/Predicted No Effect Concentration	
Perfumery - In this safety assessment, perfumery refers to fragrances made by a perfumer used in consumer products only. The exposures reported in the safety assessment include consumer product use but do not include occupational exposures.	
QRA - Quantitative Risk Assessment	
QSAR - Quantitative Structure-Activity Relationship	
REACH - Registration, Evaluation, Authorisation, and Restriction of Chemicals	
RfD - Reference Dose	
RIFM - Research Institute for Fragrance Materials	
RQ - Risk Quotient	
Statistically Significant - Statistically significant difference in reported results as compared to controls with a $p < 0.05$ using appropriate statistical test	
TTC - Threshold of Toxicological Concern	
UV/Vis spectra - Ultraviolet/Visible spectra	
VCF - Volatile Compounds in Food	
VoU - Volume of Use	
vPvB - (very) Persistent, (very) Bioaccumulative	
WoE - Weight of Evidence	

The Expert Panel for Fragrance Safety* concludes that this material is safe as described in this safety assessment.

This safety assessment is based on the RIFM Criteria Document (Api et al., 2015), which should be referred to for clarifications.

Each endpoint discussed in this safety assessment includes the relevant data that were available at the time of writing (version number in the top box is indicative of the date of approval based on a 2-digit month/day/year), both in the RIFM Database (consisting of publicly available and proprietary data) and through publicly available information sources (e.g., SciFinder and PubMed). Studies selected for this safety assessment were based on appropriate test criteria, such as acceptable guidelines, sample size, study duration, route of exposure, relevant animal species, most relevant testing endpoints, etc. A key study for each endpoint was selected based on the most conservative endpoint value (e.g., PNEC, NOAEL, LOEL, and NESIL).

*The Expert Panel for Fragrance Safety is an independent body that selects its own members and establishes its own operating procedures. The Expert Panel is comprised of internationally known scientists that provide RIFM with guidance relevant to human health and environmental protection.

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Summary: The existing information supports the use of this material as described in this safety assessment.

trans-Methylgeranate was evaluated for genotoxicity, repeated dose toxicity, reproductive toxicity, local respiratory toxicity, phototoxicity/photoallergenicity, skin sensitization, and environmental safety. Data show that *trans*-methylgeranate is not genotoxic. The repeated dose, reproductive, and local respiratory toxicity endpoints were evaluated using the Threshold of Toxicological Concern (TTC) for a Cramer Class I material, and the exposure to *trans*-methylgeranate is below the TTC (0.03 mg/kg/day, 0.03 mg/kg/day, and 1.4 mg/day, respectively). The skin sensitization endpoint was completed using the Dermal Sensitization Threshold (DST) for non-reactive (900 µg/cm²); exposure is below the DST. The phototoxicity/photoallergenicity endpoints were evaluated based on data and ultraviolet/visible (UV/Vis) spectra; *trans*-methylgeranate is not expected to be phototoxic/photoallergenic. The environmental endpoints were evaluated; *trans*-methylgeranate was found not to be Persistent, Bioaccumulative, and Toxic (PBT) as per the International Fragrance Association (IFRA) Environmental Standards, and its risk quotients, based on its current volume of use in Europe and North America (i.e., Predicted Environmental Concentration/Predicted No Effect Concentration [PEC/PNEC]), are <1.

Human Health Safety Assessment

Genotoxicity: Not genotoxic (RIFM, 2014a; RIFM, 2014b)

Repeated Dose Toxicity: No NOAEL available. Exposure is below the TTC

Reproductive Toxicity: No NOAEL available. Exposure is below the TTC

Skin Sensitization: Not a concern for skin sensitization under the declared use levels; exposure is below the DST.

Phototoxicity/Photoallergenicity: (UV/Vis Spectra; RIFM Database; RIFM, 1981)

Not phototoxic/photoallergenic.

Local Respiratory Toxicity: No NOAEC available. Exposure is below the TTC.

Environmental Safety Assessment

Hazard Assessment:

Persistence:

Screening-level: 2.9 (EPI Suite v4.11; US EPA, 2012a)
(BIOWIN 3)

Bioaccumulation:

Screening-level: 197 L/kg (EPI Suite v4.11; US EPA, 2012a)

Ecotoxicity:

Screening-level: Fish LC50: 4.66 mg/L (RIFM Framework; Salvito et al., 2002)

Conclusion: Not PBT or vPvB as per IFRA Environmental Standards

Risk Assessment:

Screening-level: PEC/PNEC (North America and Europe) < 1 (RIFM Framework; Salvito et al., 2002)

Critical Ecotoxicity (RIFM Framework; Salvito et al., 2002)

Endpoint: Fish LC50: 4.66 mg/L

RIFM PNEC is: 0.00466 µg/L

• **Revised PEC/PNECs (2015 IFRA VoU):** North America and Europe: not applicable; cleared at the screening-level

1. Identification

- Chemical Name:** *trans*-Methylgeranate
- CAS Registry Number:** 1189-09-9
- Synonyms:** Geranic acid methyl ester; Methyl (E)-3,7-dimethylocta-2,6-dienoate; 2,6-Octadienoic acid, 3,7-dimethyl-, methyl ester, (E)-; シン脂脂肪酸(C = 10 ~ 18)列基(C = 1 ~ 2); Methyl 3,7-dimethylocta-2,6-dienoate; E-Methylgeranate; Methyl geranate; *trans*-Methylgeranate
- Molecular Formula:** C₁₁H₁₈O₂
- Molecular Weight:** 182.26 g/mol
- RIFM Number:** 5229
- Stereochemistry:** Stereoisomer not specified. One geometric center present, and a total of 2 stereocenters possible.

2. Physical data

- Boiling Point:** 230.97 °C (EPI Suite)
- Flash Point:** 99 °C (Globally Harmonized System)
- Log K_{OW}:** 3.98 (EPI Suite)
- Melting Point:** -16.99 °C (EPI Suite)
- Water Solubility:** 21.24 mg/L (EPI Suite)

6. **Specific Gravity:** Not Available
7. **Vapor Pressure:** 0.0483 mm Hg at 20 °C (EPI Suite v4.0), 0.0743 mm Hg at 25 °C (EPI Suite)
8. **UV Spectra:** No absorbance between 290 and 700 nm; molar absorption coefficient is below the benchmark ($1000 \text{ L mol}^{-1} \cdot \text{cm}^{-1}$)
9. **Appearance/Organoleptic:** Not Available

3. Volume of use (worldwide band)

1. 1–10 metric tons per year (IFRA, 2015)

4. Exposure to fragrance ingredient (Crema RIFM aggregate exposure model v3.1.1)

1. **95th Percentile Concentration in Fine Fragrance:** 0.0018% (RIFM, 2020)
2. **Inhalation Exposure*:** 0.0000053 mg/kg/day or 0.00043 mg/day (RIFM, 2020)
3. **Total Systemic Exposure**:** 0.000034 mg/kg/day (RIFM, 2020)

*95th percentile calculated exposure derived from concentration survey data in the Crema RIFM Aggregate Exposure Model (RIFM, 2015; Safford et al., 2015a; Safford et al., 2017; and Comiskey et al., 2017).

**95th percentile calculated exposure; assumes 100% absorption unless modified by dermal absorption data as reported in Section V. It is derived from concentration survey data in the Crema RIFM Aggregate Exposure Model and includes exposure via dermal, oral, and inhalation routes whenever the fragrance ingredient is used in products that include these routes of exposure (RIFM, 2015; Safford et al., 2015a; Safford et al., 2017; and Comiskey et al., 2017).

Expert Judgment	Toxtree v3.1	OECD QSAR Toolbox v4.2
I	I	I

5. Derivation of systemic absorption

1. **Dermal:** Assumed 100%
2. **Oral:** Assumed 100%
3. **Inhalation:** Assumed 100%

6. Computational toxicology evaluation

1. **Cramer Classification:** Class I, Low
2. **Analogs Selected:**
 - a. **Genotoxicity:** None
 - b. **Repeated Dose Toxicity:** None
 - c. **Reproductive Toxicity:** None
 - d. **Skin Sensitization:** None
 - e. **Phototoxicity/Photoallergenicity:** None
 - f. **Local Respiratory Toxicity:** None
 - g. **Environmental Toxicity:** None
3. **Read-across Justification:** None

7. Metabolism

No relevant data available for inclusion in this safety assessment.

Additional References: None.

8. Natural occurrence

Trans-Methylgeranate is reported to occur in the following foods by the VCF*:

Cape gooseberry (*Physalis peruviana* L.)
Grape (*Vitis* species).
Guava and feyoa

Passion fruit (*Passiflora* species).

Wine.

*VCF (Volatile Compounds in Food): Database/Nijssen, L.M.; Ingen-Visscher, C.A. van; Donders, J.J.H. (eds). – Version 15.1 – Zeist (The Netherlands): TNO Triskelion, 1963–2014. A continually updated database containing information on published volatile compounds that have been found in natural (processed) food products. Includes FEMA GRAS and EU-Flavis data.

9. REACH dossier

Pre-registered for 2010; no dossier available as of 10/09/21.

10. Conclusion

The existing information supports the use of this material as described in this safety assessment.

11. Summary

11.1. Human health endpoint summaries

11.1.1. Genotoxicity

Based on the current existing data, *trans*-methylgeranate does not present a concern for genotoxicity.

11.1.1.1. Risk assessment. *Trans*-Methylgeranate was assessed in the BlueScreen assay and found negative for both cytotoxicity (positive: <80% relative cell density) and genotoxicity, with and without metabolic activation (RIFM, 2013). BlueScreen is a human cell-based assay for measuring the genotoxicity and cytotoxicity of chemical compounds and mixtures. Additional assays were considered to fully assess the potential mutagenic or clastogenic effects of the target material.

The mutagenic activity of *trans*-methylgeranate has been evaluated in a bacterial reverse mutation assay conducted in compliance with GLP regulations and in accordance with OECD TG 471 using the standard plate incorporation. *Salmonella typhimurium* strains TA98, TA100, TA1535, TA1537, and *Escherichia coli* strain WP2uvrA were treated with *trans*-methylgeranate in dimethyl sulfoxide (DMSO) at concentrations up to 5000 µg/plate. No increases in the mean number of revertant colonies were observed at any tested concentration in the presence or absence of S9 (RIFM, 2014a). Under the conditions of the study, *trans*-methylgeranate was not mutagenic in the Ames test.

The clastogenic activity of *trans*-methylgeranate was evaluated in an *in vitro* micronucleus test conducted in compliance with GLP regulations and in accordance with OECD TG 487. Human peripheral blood lymphocytes were treated with *trans*-methylgeranate in DMSO at concentrations up to 1825 µg/mL in the presence and absence of metabolic activation (S9) for 3 h and in the absence of metabolic activation for 24 h. *Trans*-Methylgeranate did not induce binucleated cells with micronuclei when tested up to cytotoxic levels in either the presence or absence of an S9 activation system (RIFM, 2014b). Under the conditions of the study, *trans*-methylgeranate was considered to be non-clastogenic in the *in vitro* micronucleus test.

Based on the data available, *trans*-methylgeranate does not present a concern for genotoxic potential.

Additional References: None.

Literature Search and Risk Assessment Completed On: 06/04/21.

11.1.2. Repeated dose toxicity

There are insufficient repeated dose toxicity data on *trans*-methylgeranate or any read-across materials. The total systemic exposure to *trans*-methylgeranate is below the TTC for the repeated dose toxicity endpoint of a Cramer Class I material at the current level of use.

11.1.2.1. Risk assessment. There are no repeated dose toxicity data on *trans*-methylgeranate or any read-across materials that can be used to support the repeated dose toxicity endpoint. The total systemic exposure to *trans*-methylgeranate (0.034 µg/kg/day) is below the TTC (30 µg/kg/day; Kroes et al., 2007) for the repeated dose toxicity endpoint of a Cramer Class I material at the current level of use.

Additional References: None.

Literature Search and Risk Assessment Completed On: 06/02/21.

11.1.3. Reproductive toxicity

There are insufficient reproductive toxicity data on *trans*-methylgeranate or any read-across materials. The total systemic exposure to *trans*-methylgeranate is below the TTC for the reproductive toxicity endpoint of a Cramer Class I material at the current level of use.

11.1.3.1. Risk assessment. There are no reproductive toxicity data on *trans*-methylgeranate or on any read-across materials that can be used to support the reproductive toxicity endpoint. The total systemic exposure to *trans*-methylgeranate (0.034 µg/kg/day) is below the TTC (30 µg/kg/day; Kroes et al., 2007; Laufersweiler et al., 2012) for the reproductive toxicity endpoint of a Cramer Class I material at the current level of use.

Additional References: None.

Literature Search and Risk Assessment Completed On: 06/02/21.

11.1.4. Skin sensitization

Based on existing data and the application of DST, *trans*-methylgeranate does not present a safety concern for skin sensitization under the current, declared levels of use.

11.1.4.1. Risk assessment. Limited skin sensitization studies are available for *trans*-methylgeranate. The chemical structure of this material indicates that it would be expected to react with skin proteins directly (Roberts et al., 2007; Toxtree v3.1.0). However, based on expert judgement, the structural alert is ignored, and the target chemical is not expected to react with skin proteins. In a Confirmation of No Induction in Humans test (CNIH) with 20% of *trans*-methylgeranate in white petrolatum, no reactions indicative of sensitization were observed in any of the 50 volunteers (RIFM, 1981). Due to the limited data, the reported exposure was benchmarked utilizing the non-reactive DST of 900 µg/cm² (Safford, 2008; Safford et al., 2011; Roberts et al., 2015; Safford et al., 2015b). The current exposure from the 95th percentile concentration is below the DST for non-reactive materials when evaluated in all QRA categories. Table 1 provides the maximum acceptable concentrations for *trans*-methylgeranate that present no appreciable risk for skin sensitization based on the non-reactive DST. These levels represent maximum acceptable concentrations based on the DST approach. However, additional studies may show it could be used at higher levels.

Additional References: None.

Literature Search and Risk Assessment Completed On: 06/02/21.

11.1.5. Phototoxicity/photoallergenicity

Based on the available UV/Vis absorption spectra, *trans*-methylgeranate would not be expected to present a concern for phototoxicity or photoallergenicity.

11.1.5.1. Risk assessment. There are no phototoxicity studies available for *trans*-methylgeranate in experimental models. UV/Vis absorption spectra indicate no absorption between 290 and 700 nm. The corresponding molar absorption coefficient is below the benchmark of concern for phototoxicity and photoallergenicity (Henry et al., 2009). In a photo-CNIH, 20% *trans*-methylgeranate did not result in phototoxic or photoallergenic reactions in 20 volunteers (RIFM, 1981). Based on the

Table 1

Maximum acceptable concentrations for *trans*-methylgeranate that present no appreciable risk for skin sensitization based on non-reactive DST.

IFRA Category ^a	Description of Product Type	Maximum Acceptable Concentrations in Finished Products Based on Non-reactive DST	Reported 95th Percentile Use Concentrations in Finished Products
1	Products applied to the lips	0.069%	$7.2 \times 10^{-7}\%$
2	Products applied to the axillae	0.021%	$1.9 \times 10^{-4}\%$
3	Products applied to the face using fingertips	0.41%	$3.0 \times 10^{-4}\%$
4	Fine fragrance products	0.39%	0.0019%
5	Products applied to the face and body using the hands (palms), primarily leave-on	0.10%	$1.5 \times 10^{-4}\%$
6	Products with oral and lip exposure	0.23%	NRU ^b
7	Products applied to the hair with some hand contact	0.79%	$1.4 \times 10^{-4}\%$
8	Products with significant anogenital exposure	0.041%	No Data ^c
9	Products with body and hand exposure, primarily rinse-off	0.75%	$3.7 \times 10^{-4}\%$
10	Household care products with mostly hand contact	2.7%	$3.0 \times 10^{-4}\%$
11	Products with intended skin contact but minimal transfer of fragrance to skin from inert substrate	1.5%	No Data ^c
12	Products not intended for direct skin contact, minimal or insignificant transfer to skin	No Restriction	0.077%

Note.

^a For a description of the categories, refer to the IFRA/RIFM Information Booklet.

^b No reported use.

^c Fragrance exposure from these products is very low. These products are not currently in the Creme RIFM Aggregate Exposure Model.

lack of absorbance and the human study data, *trans*-methylgeranate does not present a concern for phototoxicity or photoallergenicity.

11.1.5.2. UV spectra analysis. UV/Vis absorption spectra (OECD TG 101) were obtained. The spectra indicate no absorbance in the range of 290–700 nm. The molar absorption coefficient is below the benchmark of concern for phototoxic effects, 1000 L mol⁻¹ • cm⁻¹ (Henry et al., 2009).

Additional References: None.

Literature Search and Risk Assessment Completed On: 05/26/21.

11.1.6. Local Respiratory Toxicity

The margin of exposure could not be calculated due to a lack of appropriate data. The exposure level for *trans*-methylgeranate is below the Cramer Class I TTC value for inhalation exposure local effects.

11.1.6.1. Risk assessment. There are no inhalation data available on

trans-methylgeranate. Based on the Creme RIFM Model, the inhalation exposure is 0.00043 mg/day. This exposure is 3256 times lower than the Cramer Class I TTC value of 1.4 mg/day (based on human lung weight of 650 g; Carthew et al., 2009); therefore, the exposure at the current level of use is deemed safe.

Additional References: None.

Literature Search and Risk Assessment Completed On: 06/04/21.

11.2. Environmental endpoint summary

11.2.1. Screening-level assessment

A screening-level risk assessment of *trans*-methylgeranate was performed following the RIFM Environmental Framework (Salvito et al., 2002), which provides 3 tiered levels of screening for aquatic risk. In Tier 1, only the material's regional VoU, its log K_{OW}, and its molecular weight are needed to estimate a conservative risk quotient (RQ), expressed as the ratio Predicted Environmental Concentration/Predicted No Effect Concentration (PEC/PNEC). A general QSAR with a high uncertainty factor applied is used to predict fish toxicity, as discussed in Salvito et al. (2002). In Tier 2, the RQ is refined by applying

	LC50 (Fish) (mg/L)	EC50 (Daphnia) (mg/L)	EC50 (Algae) (mg/L)	AF	PNEC (µg/L)	Chemical Class
RIFM Framework Screening-level (Tier 1)	4.66			1000000	0.00466	

a lower uncertainty factor to the PNEC using the ECOSAR model (US EPA, 2012b), which provides chemical class-specific ecotoxicity estimates. Finally, if necessary, Tier 3 is conducted using measured biodegradation and ecotoxicity data to refine the RQ, thus allowing for lower PNEC uncertainty factors. The data for calculating the PEC and PNEC for this safety assessment are provided in the table below. For the PEC, the range from the most recent IFRA Volume of Use Survey is reviewed. The PEC is then calculated using the actual regional tonnage, not the extremes of the range. Following the RIFM Environmental Framework, *trans*-methylgeranate was identified as a fragrance material with no potential to present a possible risk to the aquatic environment (i.e., its screening-level PEC/PNEC <1).

A screening-level hazard assessment using EPI Suite v4.11 (US EPA, 2012a) did not identify *trans*-methylgeranate as possibly being persistent or bioaccumulative based on its structure and physical-chemical properties. This screening-level hazard assessment considers the potential for a material to be persistent and bioaccumulative and toxic, or very persistent and very bioaccumulative as defined in the Criteria Document (Api et al., 2015). As noted in the Criteria Document, the screening criteria applied are the same as those used in the EU for REACH (ECHA, 2012). For persistence, if the EPI Suite model BIOWIN 3 predicts a value < 2.2 and either BIOWIN 2 or BIOWIN 6 predicts a value < 0.5, then the material is considered potentially persistent. A material would be considered potentially bioaccumulative if the EPI Suite model BCFBAF predicts a fish BCF ≥ 2000 L/kg. Ecotoxicity is determined in the above screening-level risk assessment. If, based on these model outputs (Step 1), additional assessment is required, a WoE-based review is then performed (Step 2). This review considers

available data on the material's physical-chemical properties, environmental fate (e.g., OECD Guideline biodegradation studies or die-away studies), fish bioaccumulation, and higher-tier model outputs (e.g., US EPA's BIOWIN and BCFBAF found in EPI Suite v4.11).

11.2.1.1. Risk assessment. Based on the current Volume of Use (2015), *trans*-methylgeranate presents no risk to the aquatic compartment in the screening-level assessment.

11.2.1.2. Key studies

11.2.1.2.1. Biodegradation. No data available.

11.2.1.3. Ecotoxicity. No data available.

11.2.1.4. Other available data. *Trans*-Methylgeranate has been pre-registered for REACH with no additional data at this time.

11.2.1.5. Risk assessment refinement. Ecotoxicological data and PNEC derivation (all endpoints reported in mg/L; PNECs in µg/L).

Endpoints used to calculate PNEC are underlined.

Exposure information and PEC calculation (following RIFM Environmental Framework: Salvito et al., 2002).

Exposure	Europe (EU)	North America (NA)
Log K _{OW} Used	3.98	3.98
Biodegradation Factor Used	0	0
Dilution Factor	3	3
Regional Volume of Use Tonnage Band	<1	<1
Risk Characterization: PEC/PNEC	<1	<1

Based on available data, the RQ for this material is < 1. No additional assessment is necessary.

The RIFM PNEC is 0.00466 µg/L. The revised PEC/PNECs for EU and NA are not applicable. The material was cleared at the screening-level; therefore, it does not present a risk to the aquatic environment at the current reported VoU.

Literature Search and Risk Assessment Completed On: 06/04/21.

12. Literature Search*

- **RIFM Database:** Target, Fragrance Structure-Activity Group materials, other references, JECFA, CIR, SIDS
- **ECHA:** <https://echa.europa.eu/>
- **NTP:** <https://ntp.niehs.nih.gov/>
- **OECD Toolbox:** <https://www.oecd.org/chemicalsafety/risk-assessment/oecd-qsar-toolbox.htm>

- **SciFinder:** <https://scifinder.cas.org/scifinder/view/scifinder/scifinderExplore.jsf>
- **PubMed:** <https://www.ncbi.nlm.nih.gov/pubmed>
- **National Library of Medicine's Toxicology Information Services:** <https://toxnet.nlm.nih.gov/>
- **IARC:** <https://monographs.iarc.fr>
- **OECD SIDS:** <https://hvpchemicals.oecd.org/ui/Default.aspx>
- **EPA ACToR:** <https://actor.epa.gov/actor/home.xhtml>
- **US EPA HPVIS:** https://ofmpub.epa.gov/opthpv/public_search_publicdetails?submission_id=24959241&ShowComments=Yes&sqlstr=null&recordcount=0&User_title=DetailQuery%20Results&EndPointRpt=Y#submission
- **Japanese NITE:** https://www.nite.go.jp/en/chem/chrip/chrip_search/systemTop
- **Japan Existing Chemical Data Base (JECDB):** http://dra4.nihs.go.jp/mhlw_data/jsp/SearchPageENG.jsp
- **Google:** <https://www.google.com>
- **ChemIDplus:** <https://chem.nlm.nih.gov/chemidplus/>

Search keywords: CAS number and/or material names.

*Information sources outside of RIFM's database are noted as appropriate in the safety assessment. This is not an exhaustive list. The links listed above were active as of 10/02/21.

Research Institute for Fragrance Materials, Inc.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper. We wish to confirm that there are no known conflicts of interest associated with this publication and there has been no significant financial support for this work that could have influenced its outcome. RIFM staff are employees of the Research Institute for Fragrance Materials, Inc. (RIFM). The Expert Panel receives a small honorarium for time spent reviewing the subject work.

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