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Proposed Registration Decision

PRD2025-14

# 2-Phenethyl Propionate, Nuranone, Geraniol, Eugenol, and Japanese Beetle Trap Refill

*(publié aussi en français)*

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For further information, please contact:

Publications  
Pest Management Regulatory Agency  
Health Canada  
2 Constellation Drive  
8<sup>th</sup> floor, A.L. 2608 A  
Ottawa, Ontario K1A 0K9

Internet: [canada.ca/pesticides](http://canada.ca/pesticides)  
[pmra.publications-arla@hc-sc.gc.ca](mailto:pmra.publications-arla@hc-sc.gc.ca)

Information Service:  
1-800-267-6315  
[pmra.info-arla@hc-sc.gc.ca](mailto:pmra.info-arla@hc-sc.gc.ca)

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## Overview

### Proposed registration decision for 2-phenethyl propionate, nuranone, geraniol, and eugenol

Health Canada's Pest Management Regulatory Agency (PMRA), pursuant to subsection 28(1) of the *Pest Control Products Act*, is proposing registration for the sale and use of 2-Phenethyl Propionate Technical, Nuranone Technical, Geraniol Technical, Eugenol Technical, and related end-use product, Japanese Beetle Trap Refill, containing the active ingredients 2-phenethyl propionate, nuranone, geraniol, and eugenol, to control Japanese beetles in outdoor domestic areas.

An evaluation of available scientific information found that, under the approved conditions of use, the health and environmental risks and the value of the pest control products are acceptable.

This Overview describes the key points of the evaluation, while the Science evaluation provides detailed technical information on the human health, environmental and value assessments of 2-phenethyl propionate, nuranone, geraniol, eugenol, and Japanese Beetle Trap Refill.

### What does Health Canada consider when making a registration decision?

The primary objective of the *Pest Control Products Act* is to prevent unacceptable risks to individuals and the environment from the use of pest control products. Health or environmental risk is considered acceptable<sup>1</sup> if there is reasonable certainty that no harm to human health, future generations or the environment will result from use or exposure to the product under its proposed conditions of registration. The Act also requires that products have value<sup>2</sup> when used according to the label directions. Conditions of registration may include precautionary measures on the product label to further reduce risk.

To reach its decisions, Health Canada's PMRA applies modern, rigorous risk-assessment methods and policies. These methods consider the unique characteristics of sensitive subpopulations in humans (for example, children). They also consider the unique characteristics of organisms in the environment. These methods and policies also consider the nature of the effects observed and the uncertainties when predicting the impact of pesticides. For more information on how Health Canada's PMRA regulates pesticides, the assessment process and risk-reduction programs, please visit the Pesticides and pest management portion of [Canada.ca](http://Canada.ca).

Before making a final registration decision on 2-phenethyl propionate, nuranone, geraniol, eugenol, and Japanese Beetle Trap Refill, Health Canada's PMRA will consider any written comments received from the public directly related to the proposed decision in this consultation

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<sup>1</sup> "Acceptable risks" as defined by subsection 2(2) of the *Pest Control Products Act*.

<sup>2</sup> "Value" as defined by subsection 2(1) of the *Pest Control Products Act*: "the product's actual or potential contribution to pest management, taking into account its conditions or proposed conditions of registration, and includes the product's (a) efficacy; (b) effect on host organisms in connection with which it is intended to be used; and (c) health, safety and environmental benefits and social and economic impact."

document.<sup>3</sup> Health Canada will then publish a Registration Decision<sup>4</sup> on 2-phenethyl propionate, nuranone, geraniol, eugenol, and Japanese Beetle Trap Refill, which will include the decision, the reasons for it, a summary of comments received on the proposed registration decision and Health Canada's response to these comments.

For more details on the information presented in this Overview, please refer to the Science evaluation of this consultation document.

## **What are 2-phenethyl propionate, nuranone, geraniol, and eugenol?**

2-Phenethyl propionate, geraniol, and eugenol are floral attractants, and nuranone is a Japanese beetle pheromone. These are non-conventional biopesticides that attract Japanese beetles.

## **Health considerations**

### **Can approved uses of 2-phenethyl propionate, nuranone, geraniol, and eugenol affect human health?**

#### **2-Phenethyl propionate, nuranone, geraniol, and eugenol are unlikely to affect human health when used according to label directions.**

Potential exposure to 2-phenethyl propionate, nuranone, geraniol, and eugenol may occur via the inhalation route when handling the Japanese Beetle Trap Refill cartridge during trap set up, hanging, and rebaiting, and disposal of the cartridge into the trash.

Toxicology studies in laboratory animals describe potential health effects from varying levels of exposure to a chemical and identify the dose where no effects are observed. When assessing health risks, two key factors are considered: the levels where no health effects occur and the levels to which people may be exposed. The levels used to assess risks are established to protect the most sensitive human population (for example, children and nursing mothers). As such, sex and gender are taken into account in the risk assessment. Only uses for which the exposure is well below levels that cause no effects in animal testing are considered acceptable for registration.

Publicly available toxicology information was assessed for 2-phenethyl propionate and its analogs, nuranone analogs, geraniol, and eugenol.

2-Phenethyl Propionate Technical is food grade edible. The active ingredient, 2-phenethyl propionate, is an aryl alkyl alcohol simple acid ester (AAASAE) that is also used as a Japanese beetle attractant. It is of low acute oral toxicity, slightly acutely toxic via the inhalation route of exposure, minimally irritating to the eyes, slightly irritating to the skin, and is not a skin sensitizer. Data on  $\alpha$ -methylbenzyl acetate, a similar compound to 2-phenethyl propionate, showed that repeated doses resulted in an increase in the mean intake of food and mean relative liver and kidney weights in male rats. In pregnant rats, oral administration of benzyl acetate,

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<sup>3</sup> "Consultation statement" as required by subsection 28(2) of the *Pest Control Products Act*.

<sup>4</sup> "Decision statement" as required by subsection 28(5) of the *Pest Control Products Act*.

another analog of 2-phenethyl propionate, resulted in fetal abnormalities and reduced fetal growth at a test dose that did not result in maternal toxicity, thus, suggesting sensitivity of the young. 2-Phenethyl propionate is not expected to be mutagenic or clastogenic.

Nuranone is a non-straight chain sex pheromone of the female Japanese beetle. It is considered to be of low acute oral toxicity, moderately irritating to the eyes, non-irritating to the skin, and not a skin sensitizer. The acute inhalation toxicity data requirement for nuranone was waived due to its very low volatility. Data on  $\gamma$ -undecalactone, a compound similar to nuranone, showed that rats, given repeated doses, did not experience adverse effects. In pregnant rats, oral administration of  $\gamma$ -butyrolactone, another analog of nuranone, also did not result in adverse effects. Nuranone is not expected to be mutagenic or clastogenic.

Geraniol is of low acute toxicity via the oral and dermal routes of exposure, expected to be of low acute toxicity via the inhalation route of exposure, severely irritating to the eyes, moderately irritating to the skin, and a skin sensitizer. There were no treatment-related findings when animals received multiple doses of geraniol. In pregnant animals, exposure to geraniol varied from no treatment-related effects to decreases in maternal body weight gain and food consumption, reductions in live births and fetal weights, increases in pup mortality, as well as temporary fetal delays in development. In an extended one-generation study, there were no reproductive effects in the parental animals, but exposure to geraniol led to olfactory epithelium degeneration, changes in blood chemistry parameters, and increases in organ weights and food consumption. There was indication that the young were more sensitive than the adult animal due to a reduction in pup survival. The qualitative risk assessment considered the very low exposure and mitigation measures to the end-use product. Geraniol is not considered to be mutagenic, genotoxic, or clastogenic.

Eugenol is of slight acute toxicity by the oral route of exposure, moderate acute toxicity by the dermal route of exposure, low acute toxicity by the inhalation route of exposure, moderately irritating to the eyes and skin, and is a skin sensitizer. Animals given repeated high doses of eugenol in the diet showed decreased body weight and body weight gain. Exposure to eugenol in pregnant animals showed decreases in maternal food consumption and fetal weights, and developmental effects. Fetal and maternal effects occurred at the same dose. Eugenol is not likely to be mutagenic or carcinogenic.

The end-use product, Japanese Beetle Trap Refill, is a cartridge containing beads embedded with a mixture of 2-phenethyl propionate, nuranone, geraniol, and eugenol that act as the attractant (bait) to lure adult Japanese beetles to the associated trap. Published scientific literature and publicly available information for the active ingredients were used to inform the toxicology profile of the attractant bait. Consequently, the beetle trap attractant is expected to be slightly acutely toxic by the oral and inhalation routes of exposure, moderately acutely toxic by the dermal route of exposure, severely irritating to the eyes, moderately irritating to the skin, and a potential skin sensitizer.

## **Residues in food and drinking water**

### **Dietary risks from food and drinking water are acceptable.**

The end-use product, Japanese Beetle Trap Refill, is not proposed for food or feed uses. Dietary exposure, including drinking water, is not expected from the proposed use of 2-phenethyl propionate, nuranone, geraniol, and eugenol combined as an insect attractant (bait). Consequently, health risks from dietary exposure are acceptable for all segments of the population, including infants, children, adults, and seniors.

## **Risks in residential and other non-occupational environments**

### **Estimated risk for residential and other non-occupational exposure is acceptable.**

Japanese Beetle Trap Refill is a domestic class product proposed for outdoor use on residential properties. It consists of a welded plastic cartridge containing beads embedded with the attractant mixture, which sits atop a reusable insect trap. The trap is manually emptied of beetles when full, rebaited with a new Japanese Beetle Trap Refill cartridge, and disposed of in the garbage at the end of the season.

The active ingredients are embedded in resin beads contained in the welded plastic cartridge, making the beads inaccessible to users. Therefore, users do not have direct contact with the active ingredients.

The end-use product label will include measures to reduce user and bystander (including children and companion animals) exposure, such as instructions to keep children away from the product and to not access beads in the cartridge.

Overall, residential and non-occupational exposure to Japanese Beetle Trap Refill is expected to be low when label directions are observed. Consequently, the health risk to residents and the general public is acceptable.

## **Occupational risk from handling Japanese Beetle Trap Refill**

### **An occupational risk assessment was not required for Japanese Beetle Trap Refill.**

Since Japanese Beetle Trap Refill is a domestic class product, an occupational risk assessment was not required.

## **Environmental considerations**

**What happens when 2-phenethyl propionate, nuranone, geraniol, and eugenol are introduced into the environment?**

**When used according to label directions, the environmental risks associated with 2-phenethyl propionate, nuranone, geraniol, and eugenol and their beetle trap end-use product are acceptable.**

Japanese Beetle Trap Refill contains 2-phenethyl propionate, nuranone, geraniol, and eugenol. 2-Phenethyl propionate, geraniol, and eugenol are fragrant chemicals produced by plants, while nuranone is a pheromone, that is, a scent signalling chemical, specific to Japanese beetles. In the beetle trap, they are present within solid beads that are in a sealed plastic cartridge attached to a plastic bag. The traps are hung outdoors in residential settings, nine metres away from flowers, fruits, vegetables, and lawns where Japanese beetle activity may occur. The chemicals gradually volatilize from the traps during the effective use period of eight weeks and are expected to not be persistent in air. The traps are disposed of in household trash after use. Considering the design and use of the product alongside the expectation that the active ingredients will readily degrade in the environment, there is low potential for exposure to non-target organisms in the environment. The environmental risks associated with Japanese Beetle Trap Refill are acceptable when it is used according to label directions.

## **Value considerations**

**What is the value of Japanese Beetle Trap Refill?**

**Japanese Beetle Trap Refill is a cartridge containing the active ingredients used to lure Japanese beetles away from flowers, fruits, vegetables, and lawns into a re-usable trap.**

Japanese Beetle Trap Refill contains three floral attractants and a Japanese beetle pheromone. It will provide users with access to a non-conventional domestic class product for trapping Japanese beetle adults outdoors. Due to the mode of action of this product, resistance is unlikely to occur; therefore, it may aid in reducing insecticide resistance in Japanese Beetle populations.

## **Measures to minimize risk**

Labels of registered pesticide products include specific instructions for use. Directions include risk-reduction measures to protect human health and the environment. These directions must be followed by law.

The key risk-reduction measures being proposed on the labels of 2-Phenethyl Propionate Technical, Nuranone Technical, Geraniol Technical, Eugenol Technical, and Japanese Beetle Trap Refill to address the potential risks identified in this assessment are as follows.

## **Key risk-reduction measures**

### **Human health**

The following signal words and hazard statements are required on the technical grade active ingredient labels:

- 2-Phenethyl Propionate Technical: “CAUTION POISON”;
- Nuranone Technical: “WARNING”, “POISON”, and “EYE IRRITANT”;
- Geraniol Technical: “DANGER – EYE IRRITANT and SKIN IRRITANT” and “POTENTIAL SKIN SENSITIZER”; and
- Eugenol Technical: “WARNING”, “POISON”, “EYE and SKIN IRRITANT”, and “POTENTIAL SENSITIZER”.

The following signal words and hazard statements are required on the end-use product label: “DANGER”, “POISON”, “EYE and SKIN IRRITANT”, and “POTENTIAL SENSITIZER”. Standard precautionary statements are also required on the label.

To limit user and bystander exposure, the end-use product label requires the precautionary statements “Do not access beads in the cartridge” and “Keep out of reach of children”.

### **Environment**

Label statements instructing disposal in household trash are required.

### **Next steps**

Before making a final registration decision on 2-phenethyl propionate, nuranone, geraniol, eugenol, and Japanese Beetle Trap Refill, Health Canada’s PMRA will consider any written comments received from the public that are directly related to this proposed decision, such as comments directed to the science evaluation, in response to this consultation document up to 30 days from the date of publication (by 4 January 2026) of this document. If more time is required to provide comments, a request for an extension of an additional 15 days can be made. Your request must be submitted in writing to the PMRA’s Publications Section ([pmra.publications-arla@hc-sc.gc.ca](mailto:pmra.publications-arla@hc-sc.gc.ca)) within the 30-day consultation period. Please forward all comments to PMRA Publications, through the Public Engagement Portal (Public Engagement Portal forms – Consultation Comment). Health Canada will then publish a Registration Decision, which will include its decision, the reasons for it, a summary of comments received on the proposed decision and Health Canada’s response to these comments.

### **Other information**

When Health Canada’s PMRA makes its registration decision, it will publish a Registration Decision on 2-phenethyl propionate, nuranone, geraniol, eugenol, and Japanese Beetle Trap Refill (based on the Science evaluation of this consultation document). In addition, the test data referenced in this consultation document will be available for public inspection, upon application, in the PMRA’s Reading Room. For more information or if you have questions, please contact the PMRA’s Pest Management Information Service.

## Science evaluation

### 2-Phenethyl propionate, nuranone, geraniol, eugenol, and Japanese Beetle Trap Refill

#### 1.0 The active ingredients, their properties and uses

##### 1.1 Identity of the active ingredients

###### 2-Phenethyl propionate:

Active substance 2-Phenethyl propionate

Function Insecticide

###### Chemical name:

1. International Union of Pure and Applied Chemistry (IUPAC) 2-phenylethyl propionate

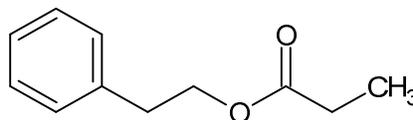
2. Chemical Abstracts Service (CAS) Propanoic acid, 2-phenylethyl ester

CAS number 122-70-3

Molecular formula  $C_{11}H_{14}O_2$

Molecular weight 178.2

Structural formula



Purity of the active ingredient 99.2%

###### Nuranone:

Active substance Nuranone

Function Insecticide

###### Chemical name:

1. IUPAC (1*Z*,5*R*)-5-dec-1-enyltetrahydrofuran-2-one

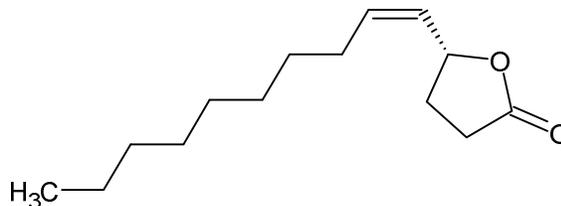
2. CAS (5*R*)-5-(1*Z*)-1-decen-1-ylidihydro-2(3*H*)-furanone

CAS number 64726-91-6

Molecular formula  $C_{14}H_{24}O_2$

Molecular weight 224.3

**Structural formula**



**Purity of the active ingredient**

94%

**Geraniol:**

**Active substance**

Geraniol

**Function**

Insecticide

**Chemical name:**

1. IUPAC

(2E)-3,7-dimethyl-2,6-octadien-1-ol

2. CAS

2,6-octadien-1-ol, 3,7-dimethyl-, (2E)-

**CAS number**

106-24-1

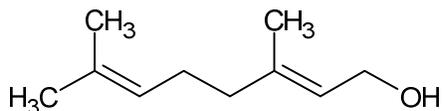
**Molecular formula**

C<sub>10</sub>H<sub>18</sub>O

**Molecular weight**

154.25

**Structural formula**



**Purity of the active ingredient**

99.1%

**Eugenol:**

**Active substance**

Eugenol

**Function**

Insecticide

**Chemical name:**

1. IUPAC

2-methoxy-4-(prop-2-en-1-yl)phenol

2. CAS

2-methoxy-4-(2-propen-1-yl)phenol

**CAS number**

97-53-0

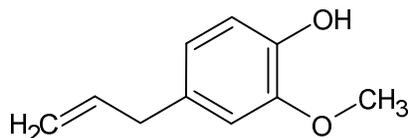
**Molecular formula**

C<sub>10</sub>H<sub>12</sub>O<sub>2</sub>

**Molecular weight**

164.2

**Structural formula**



**Purity of the active ingredient**

99.7%

## 1.2 Physical and chemical properties of the active ingredients and end-use product

### Technical product — 2-Phenethyl Propionate Technical

Property	Result
Colour and physical state	Colourless to pale yellow liquid
Odour	Floral, red rose, fruity, honey, balsam, styrax
Melting range	Product is a liquid at room temperature
Boiling point or range	245°C at 1 atm
Density	1.010–1.022 g/cm <sup>3</sup> at 20°C
Vapour pressure at 25°C	0.0514 mmHg (6.85 Pa) (estimated)
Ultraviolet (UV)-visible spectrum	No absorption expected at > 300 nm
Solubility in water	Insoluble
Solubility in organic solvents	Soluble in alcohol, dipropylene glycol, paraffin oil, and propylene glycol
<i>n</i> -Octanol-water partition coefficient ( <i>K</i> <sub>ow</sub> )	log <i>K</i> <sub>ow</sub> = 3.06
Dissociation constant ( <i>pK</i> <sub>a</sub> )	Does not contain a dissociable moiety
Stability (temperature)	Product is stable for 24 months or longer if stored in a cool, dry place in tightly sealed containers, protected from heat and light.

### Technical product — Nuranone Technical

Property	Result
Colour and physical state	Clear liquid
Odour	No characteristic odour
Melting range	Product is a liquid at room temperature
Boiling point or range	135–136°C at 27–33 Pa
Density	0.93–0.94 g/mL at 20°C
Vapour pressure at 25°C	Very low; 0.000159 mmHg (0.021 Pa) (estimated)
UV-visible spectrum	$\lambda_{\text{max}}$ at 276 nm (0.5 M in methanol); No absorption expected at > 300 nm
Solubility in water at 20°C	0.735 mg/100 mL
Solubility in organic solvents	Soluble in aliphatic and aromatic hydrocarbons
<i>K</i> <sub>ow</sub>	log <i>K</i> <sub>ow</sub> = 1.01
<i>pK</i> <sub>a</sub>	Does not contain a dissociable moiety
Stability (temperature)	Stable to heat and light; Stable when stored in glass container at 54°C for two weeks

**Technical product — Geraniol Technical**

Property	Result
Colour and physical state	Colourless clear liquid
Odour	Sweet, floral, fruity, rose, waxy
Melting range	15–16°C at 1 atm
Boiling point or range	229–230°C at 1 atm
Density	0.86–0.87 g/cm <sup>3</sup> at 20°C
Vapour pressure at 25°C	0.0159 mmHg (2.12 Pa) (estimated)
UV-visible spectrum	No absorption expected at > 300 nm
Solubility in water at 25°C	100 mg/L
Solubility in organic solvents	Soluble in alcohol, fixed oils, kerosene, paraffin oil, and propylene glycol; Insoluble in glycerin
$K_{ow}$	$\log K_{ow} = 3.56$
$pK_a$	Not provided; allylic alcohols such as geraniol are expected to have a $pK_a$ of 15–16 as per publicly consulted $pK_a$ tables
Stability (temperature)	Product is stable for 24 months or longer if stored in a cool, dry place in tightly sealed containers, protected from heat and light.

**Technical product — Eugenol Technical**

Property	Result
Colour and physical state	Pale yellow to dark yellow liquid
Odour	Sweet, spicy, clove, woody
Melting range	Product is liquid at room temperature; 10–11°C at 1 atm
Boiling point or range	252–253°C at 1 atm
Density	1.044–1.056 g/cm <sup>3</sup> at 20°C
Vapour pressure at 25°C	0.00948 mmHg (1.26 Pa) (estimated)
UV-visible spectrum	No absorption expected at > 300 nm
Solubility in water at 25°C	2460 mg/L
Solubility in organic solvents	Soluble in fixed oils and kerosene; Slightly soluble in warm paraffin oil
$K_{ow}$	$\log K_{ow} = 2.27$
$pK_a$	10.27
Stability (temperature)	Product is stable for 24 months or longer if stored in a cool, dry place in tightly sealed containers, protected from heat and light.

## End-use product — Japanese Beetle Trap Refill

Property	Result
Colour	Light blue
Odour	None
Physical state	Solid polyvinyl bead
Formulation type	Solid
Label concentration	Eugenol ... 15.48% Geraniol ... 6.622% 2-Phenethyl propionate ... 6.622% Nuranone ... 0.013%
Container material and description	Plastic bead and cartridge, 5–7 g
Density	0.61 g/cm <sup>3</sup> at 20°C
pH of 1% dispersion in water	5–6
Oxidizing or reducing action	The product does not contain a strong oxidizing or reducing agent.
Storage stability	Stable when stored in commercial container at 54°C for two weeks
Corrosion characteristics	Not corrosive to its commercial packaging material
Explodability	Not explosive

### 1.3 Directions for use

Japanese Beetle Trap Refill is intended to be used when Japanese beetles are present. It is a cartridge used together with a reusable insect trap that is attached tightly to a stake or pole with a twist-tie 1.25 metres above the ground and placed at least 9 metres from flowers, fruits, vegetables, and lawns to lure beetles away from the area where they may cause damage. No more than one trap per 1000 m<sup>2</sup> is permitted. Japanese Beetle Trap Refill is effective for a period of eight weeks.

### 1.4 Mode of action

Three floral attractants, 2-phenethyl propionate, geraniol, and eugenol, and a Japanese beetle pheromone, nuranone, attract Japanese beetles to the trap. The trap has four panels with a Japanese Beetle Trap Refill cartridge containing the active ingredients in the top middle of the panels; the beetles are lured to the trap, fly into the trap panels, and are stunned on impact, where they fall into the attached bag. The panels have side flaps that form a funnel inside the bag and restrict the opening, preventing the beetles from escaping. The trap can be manually emptied, when full, by opening the bottom of the trap and dumping the collected Japanese beetles into the garbage, and then it can be resealed to continue use. A separately sold Japanese Beetle Refill cartridge replaces a used cartridge in the reusable trap.

## **2.0 Methods of analysis**

### **2.1 Methods for analysis of the active ingredients**

The methods provided for the analysis of the active ingredients and impurities in the technical products have been validated and assessed to be acceptable.

### **2.2 Method for formulation analysis**

The method provided for the analysis of the active ingredients in the formulation has been validated and assessed to be acceptable for use as an enforcement analytical method.

### **2.3 Methods for residue analysis**

No methods were required to quantify residues of 2-phenethyl propionate, nuranone, geraniol, and eugenol because there are no proposed food uses.

## **3.0 Impact on human and animal health**

### **3.1 Toxicology summary**

A detailed review of toxicology information was conducted in support of the technical grade active ingredients, 2-Phenethyl Propionate Technical, Nuranone Technical, Eugenol Technical, and Geraniol Technical, and the end-use product, Japanese Beetle Trap Refill. The data package for the technical grade active ingredients is considered acceptable to assess the toxic effects that may result from exposure to 2-phenethyl propionate, nuranone, geraniol, and eugenol for use in the related end-use product.

The toxicological database for each of the technical grade active ingredients and the end-use product consists of publicly available information, published in vitro and in vivo toxicological studies, as well as Health Canada and foreign reviews. Short-term and chronic oral toxicity testing, prenatal developmental toxicity testing, genotoxicity/mutagenicity, and carcinogenicity testing data were assessed for the active ingredients when available. The combined data from the active ingredients and their pertinent analogs (for 2-phenethyl propionate and nuranone) form a weight of evidence that is considered sufficient to characterize the toxicity of the active ingredients for use in Japanese Beetle Trap Refill.

#### **3.1.1 2-Phenethyl propionate**

2-Phenethyl Propionate Technical is food grade edible. The active ingredient, 2-phenethyl propionate, is of low acute oral toxicity, slightly acutely toxic via the inhalation and dermal routes of exposure, minimally irritating to the eyes, slightly irritating to the skin, and is not a skin sensitizer.

Information on phenethyl propionate and its analogs from the European Chemicals Agency and the Research Institute for Fragrance Materials were primarily considered. Molecules that share structural similarity, belong in the same molecule category (in other words, another aryl alkyl alcohol simple acid ester (AAASAE)), and/or have a comparable metabolism profile to 2-

phenethyl propionate served as surrogate molecules. Results from pertinent studies that had the most conservative endpoints, and served as the basis to inform the toxicology profile of 2-phenethyl propionate, are summarized below.

In a 13-week oral study in rats treated with  $\alpha$ -methylbenzyl acetate, there were treatment-related increases in food mean intake and mean relative liver and kidney weights in males. The lowest observed adverse effect level (LOAEL) was 50 mg/kg bw/day and the no observed adverse effect level (NOAEL) was 15 mg/kg bw/day.

In a review by the Research Institute for Fragrance Materials of a prenatal developmental oral (gavage) toxicity study in rats treated with benzyl acetate, reduced fetal growth and fetal abnormalities were observed at a dose tested that did not cause maternal toxicity, suggesting sensitivity of the young. The maternal NOAEL was 500 mg/kg bw/day and the developmental NOAEL was 100 mg/kg bw/day. The qualitative risk assessment considered the very low exposure and mitigation measures to the end-use product.

The majority of results from bacterial mutation assays involving several 2-phenethyl propionate analogs were negative. The available in vitro genotoxicity tests on mammalian cells were inconclusive, reporting a mixture of positive/equivocal and negative results. Consequently, in vivo genotoxicity results for benzyl acetate were assessed. While two comet assays reported positive results at the highest dose tested (HDT), most of the studies examined, including several micronucleus assays, sister chromatid exchange assays, unscheduled DNA synthesis, and chromosomal aberrations assays, produced negative results. Overall, based on the collective evidence from the 2-phenethyl propionate analogs, 2-phenethyl propionate is not expected to be mutagenic or clastogenic.

### **3.1.2 Nuranone**

Nuranone is a non-straight chain sex pheromone of the female Japanese beetle. It is expected to be of slight acute oral toxicity, moderately irritating to the eyes, non-irritating to the skin, and not a skin sensitizer.

To determine the toxicological profile of nuranone, a similar approach to that used for 2-phenethyl propionate was taken. Information on nuranone and its analogs from the European Chemicals Agency, the Research Institute for Fragrance Materials, the World Health Organization, and the National Toxicology Program were primarily considered, and the results from suitable studies with the most conservative endpoint informed the toxicology profile of nuranone are summarized herein.

In a 90-day dietary study in rats treated with  $\gamma$ -undecalactone, no treatment-related adverse effects were observed. Therefore, the NOAELs were >14.6 mg/kg bw/day in males and >16.5 mg/kg bw/day in females.

In a prenatal developmental toxicity study in rats, administration of  $\gamma$ -butyrolactone did not result in treatment-related adverse effects; therefore, the maternal and developmental NOAEL were both >500 mg/kg bw/day.

Information from the World Health Organization and the National Toxicology Program on genotoxicity studies involving nuranone analogs was reviewed. Bacterial mutation assays involving several surrogate molecules were negative. In vitro mammalian cell gene mutation assays with nuranone analogs report both positive and negative mutagenic and clastogenic results. However, available information from in vivo cytogenetics studies on nuranone analogs suggests that nuranone is not likely to be genotoxic (specifically, not clastogenic) in both somatic and germ cells (sperm cells). Overall, based on the collective evidence from the nuranone analogs, nuranone is not expected to be mutagenic or clastogenic.

### 3.1.3 Geraniol

Toxicology information from the European Chemical Agency and the Research Institute of Fragrance Materials was relied upon to complete the toxicology review of geraniol.

Geraniol Technical is food grade edible. Geraniol is a natural constituent of essential oils (in other words, rose, citronella, lemon, and palmarosa) and is a non-cyclic primary terpene alcohol. Terpene alcohols are used as fragrance and flavour ingredients in products such as personal care products, as well as household cleaners and detergents.

Geraniol is of low acute toxicity via the oral and dermal routes of exposure, expected to be of low acute toxic via the inhalation route of exposure, severely irritating to the eyes, moderately irritating to the skin, and a skin sensitizer.

In three short-term (16 or 27–28 weeks) dietary rat studies, there were no treatment-related effects. The NOAELs were 1000 and 10 000 mg/kg/day for the two 16-week studies and 1000 mg/kg/day for the 27–28 week study.

In a reproductive/developmental toxicity screening study in rats dosed with geraniol, there were no treatment-related pup alterations. The parental, reproductive and developmental NOAELs were 300 mg/kg/day. In a second study with rats dosed with geraniol or a geraniol mixture, the reproductive NOAEL was 1000 mg/kg/day (the HDT). The NOAEL for developmental toxicity was considered to be 100 mg/kg/day based on a decrease in viability index and an increase in stillborn pups in the high-dosed group, thereby suggesting sensitivity of the young.

In a guideline prenatal developmental toxicity study in rats, the maternal NOAEL was 100 mg/kg bw/day based on significant decreases in body weight gain in the mid- and high-dose dams and a decrease in food consumption in the high-dose dams. The developmental NOAEL was 300 mg/kg/day based on a decrease in fetal weights and incidences of dilated renal pelvis and incomplete ossification of various skeletal elements. In a second guideline prenatal developmental toxicity study in rats, the maternal and developmental NOAEL were both >300 mg/kg/day.

In an extended one-generation reproductive toxicity study, the parental NOAEL was considered to be 200 mg/kg/day based on olfactory epithelium degeneration in parental animals (male). Additional effects were noted in behaviour, changes in blood chemistry parameters, and increases in organ weights and food consumption (female). The reproductive NOAEL was >800 mg/kg/day. The developmental NOAEL was 200 mg/kg/day based on reduced pup survival (lactation day 0–4).

Geraniol is not considered mutagenic or genotoxic in bacterial studies or in mammalian cell gene mutation assays. In vivo cytogenetic assay results included negative, inconclusive, equivocal, and positive. However, in an unpublished in vivo micronucleus test conducted according to guideline requirements, there was no increase in the incidence of micronucleated polychromatic erythrocytes. Consequently, considering the weight of evidence, geraniol is considered to be not clastogenic.

### 3.1.4 Eugenol

Information from the European Food Safety Authority, the United States Environmental Protection Agency, and the Environment and Climate Change Canada and Health Canada Chemicals Management Plan Screening Assessment Report for eugenol was relied upon to complete the toxicology review of eugenol.

Eugenol Technical is food grade edible. Eugenol is a naturally occurring component of the bud, leaf, and stem of clove (*Syzygium aromaticum*), and is reported as a constituent of other volatile oils (for example, laurel and cinnamon leaf oils). Eugenol is used as a fragrance ingredient in personal care, cleaning, and hair care products, and is naturally occurring in food. Eugenol administered by the oral route is rapidly absorbed from the gastrointestinal tract, efficiently extracted by the liver, and excreted quickly in the urine. In humans, 95% of ingested eugenol is excreted in conjugated form in the urine within 24 hours.

Eugenol is of slight acute toxicity by the oral route of exposure, moderate acute toxicity by the dermal route of exposure, low acute toxicity by the inhalation route of exposure, moderately irritating to the eyes and skin, and is a skin sensitizer.

In 13-week dietary toxicity studies, high doses of eugenol or clove oil resulted in decreased body weight or body weight gain in rats, with NOAELs ranging from 300 to 600 mg/kg bw/day. In mice, the NOAEL was 780 mg/kg bw/day (the HDT). Eugenol was administered to rats and mice via their diet for 103 weeks. Treatment-related decreases in mean body weight were observed in both studies. The NOAEL was 300 mg/kg bw/day in rats and 390 mg/kg bw/day in mice.

In prenatal developmental toxicity studies in both rats and rabbits, the parental NOAEL was 100 mg/kg bw/day based on clinical signs (both species) and reduced feed consumption (rabbit only). The developmental NOAEL was 250 mg/kg bw/day based on decreased fetal weight and delayed ossification (rat) and increased post-implantation loss (rabbit). Therefore, there is no evidence of sensitivity of the young.

Eugenol was not mutagenic in bacterial mutation assays and showed positive and negative results in in vitro mammalian gene mutation assays and in vivo cytogenetic assays. A review of the positive in vitro assays suggested that most assays were performed at concentrations that resulted in cytotoxicity or severe cell cycle delay and that in vivo assays mainly gave negative results even at very high doses of eugenol. Based on the collective evidence, eugenol is likely not mutagenic.

Four carcinogenicity studies conducted with eugenol (one in rat, three in mice) were reviewed by Health Canada under the Chemicals Management Plan (CMP). The overall conclusion of the CMP review was that eugenol is unlikely to be carcinogenic.

### **3.1.5 Japanese Beetle Trap Refill**

Acute toxicology information reviewed for the active ingredients was used to inform the toxicology profile of the attractant bait in the end-use product. Consequently, the beetle trap attractant mixture is expected to be slightly acutely toxic by the oral and inhalation routes of exposure, moderately acutely toxic by the dermal route of exposure, severely irritating to the eyes, moderately irritating to the skin, and a potential skin sensitizer.

## **3.2 Occupational, residential, and bystander exposure and risk assessment**

### **3.2.1 Use description**

Japanese Beetle Trap Refill is proposed for use as a domestic class insecticide together with a reusable insect trap. A maximum of one trap per 1000 m<sup>2</sup> is permitted on residential properties and is rebaited after eight weeks up to two times per year.

The Japanese Beetle Trap Refill cartridge weighs 5–7 g and contains the beads embedded with the active ingredients. Each cartridge contains a total of 1.44–2.02 g of active ingredients and sits atop the trap's plastic panels (flaps), which in turn, are attached to a large plastic bag. The trap requires assembling and loading. To bait the trap, the cartridge is taken out of its wrapper and inserted atop the expanded trap panels (in other words, flaps are open). The trap is then hung outside to attract Japanese beetles. As the beetles are lured to the attractants, they fly into the trap panels and are stunned, resulting in the beetles falling into the attached plastic bag. The side flaps of the plastic panels attached to the bag prevent the beetles from escaping. The trap is to be attached tightly with a twist-tie to a stake or pole 1.25 metres above the ground, at least 9 metres from flowers, fruits, vegetables, and lawns.

### **3.2.2 Occupational exposure and risk assessment**

There is no potential for occupational exposure since Japanese Beetle Trap Refill is a domestic class product.

### **3.2.3 Residential and bystander exposure and risk**

Japanese Beetle Trap Refill is proposed for domestic use only. When the cartridge is used according to label directions, exposure to residential users is characterized as short-term in duration. User exposure will occur primarily by the inhalation route when handling the Japanese Beetle Trap Refill cartridge during trap set up, hanging, and rebaiting, and disposal of the cartridge into the trash. Given the very low exposure anticipated from the use of Japanese Beetle Trap Refill, a qualitative exposure assessment was considered appropriate. Due to the closed design of the cartridge, there should not be direct contact with the bait ingredients. Additionally, a statement instructing users not to access the beads in the cartridge is required on the end-use product label to prevent exposure.

Precautionary statements on the end-use product label aimed at mitigating exposure are adequate to protect individuals from risk due to user exposure. Overall, health risks to residential users are acceptable when the precautionary statements on the label are followed.

Exposure to individuals in residential areas will be mitigated by the inclusion of the precautionary label statements that traps are to be hung outdoors and kept out of the reach of children. Additionally, residential exposure is expected to be low because there is no direct contact with the bait ingredients due to the closed design of the cartridge. Consequently, the health risks to individuals in residential areas and companion animals from the use of Japanese Beetle Trap Refill are acceptable.

### **3.3 Dietary exposure and risk assessment**

#### **3.3.1 Food**

Japanese Beetle Trap Refill is not proposed for food or feed use. Consequently, a dietary risk assessment was not required.

#### **3.3.2 Drinking water**

Based on the proposed use pattern (see Section 3.2.1), exposure from drinking water is not expected. The labels have the necessary mitigative measures to prevent contamination of drinking water from the proposed use of 2-phenethyl propionate, nuranone, geraniol, and eugenol. Consequently, health risks from residues of 2-phenethyl propionate, nuranone, geraniol, and eugenol in drinking water are acceptable.

#### **3.3.3 Acute and chronic dietary risks for sensitive subpopulations**

As noted above, when the end-use product is used as directed on the label, the health risk is acceptable for the general population, including infants and children.

### **3.4 Aggregate exposure and risk**

Aggregate exposure is the total exposure to a single pesticide that may occur from food, drinking water, residential and other non-occupational sources, and from all known or plausible exposure routes (oral, dermal, and inhalation).

In an aggregate risk assessment, the combined potential risk associated with food, drinking water, and various residential exposure pathways is assessed. A major consideration is the likelihood of co-occurrence of exposures. Additionally, only exposures from routes that share common toxicological endpoints can be aggregated.

The end-use product is limited to use as a domestic class product, is not proposed for food use, and will not be applied near, or to, drinking water. Furthermore, non-occupational exposure will be low when Japanese Beetle Trap Refill is used as directed on the label.

When the end-use product is used as labelled, there is reasonable certainty that no harm will result from aggregate exposure of residues of 2-phenethyl propionate, nuranone, geraniol, and eugenol. This includes all anticipated dietary (food and drinking water) exposures and all other non-occupational exposures (dermal and inhalation) for which there is reliable information.

### **3.5 Cumulative assessment**

The *Pest Control Products Act* requires that the PMRA consider the cumulative non-occupational exposure to pesticides with a common mechanism of toxicity, based on the likelihood that people may be exposed to more than one of these pesticides at the same time. Accordingly, assessments of potential common mechanisms of toxicity with other pesticides were undertaken for 2-phenethyl propionate, nuranone, geraniol, and eugenol.

Under the proposed conditions of use, there is no anticipated dietary exposure. Furthermore, due to the design of the end-use product, residential exposure will be low when it is used as directed on the label. 2-Phenethyl propionate, geraniol, and eugenol are food flavourants, and based on the proposed use pattern, all of the active ingredients that act as Japanese beetle attractants have a non-toxic pesticidal mode of action. The PMRA did not identify information indicating that 2-phenethyl propionate, geraniol, and eugenol share a common mechanism of toxicity with other registered pest control products. Therefore, a cumulative risk assessment was not required for 2-phenethyl propionate, geraniol, and eugenol.

While nuranone (a non-straight chain sex pheromone of the female Japanese beetle) may share structural similarities to components of other pheromone-based active ingredients, the potential risks from cumulative exposure to nuranone and other pheromone-based pest control products are acceptable due to the proposed use pattern.

### **3.6 Maximum residue limits**

The specification of maximum residue limits for 2-phenethyl propionate, nuranone, geraniol, and eugenol was not required for the proposed non-food use of the end-use product.

### **3.7 Health incident reports**

As of 22 April 2025, no human or domestic animal incidents involving 2-phenethyl propionate, nuranone, geraniol, or eugenol had been submitted to the PMRA.

## **4.0 Impact on the environment**

### **4.1 Fate and behaviour in the environment**

2-Phenethyl propionate, nuranone, geraniol, and eugenol are naturally occurring substances that are expected to degrade rapidly in the environment. Physical-chemical properties relevant to the environmental behaviour of these chemicals are in Appendix I, Tables 1 to 4. General summaries of the expected behavior of each active ingredient in the environment are provided below.

#### **4.1.1 2-Phenethyl propionate**

2-Phenethyl propionate is emitted as a fragrance by certain plants, including roses, eucalyptus, guava, peppermint, and peanuts. It is expected to have intermediate to high volatility under dry conditions and degrade quickly in air via reaction with hydroxyl radicals. In soil, it is expected that 2-phenethyl propionate will have moderate mobility and will volatilize when soil is moist. It is insoluble in water. In water bodies, it is expected to volatilize from water surfaces or sorb to suspended solids and sediment. Laboratory data indicate that hydrolysis followed by biotransformation may be a key dissipation pathway in both soil and water; both transformation processes occur rapidly. 2-Phenethyl propionate is not expected to bioaccumulate.

#### **4.1.2 Nuranone**

Nuranone, also known as japonilure, is a pheromone naturally produced by the female Japanese beetle to attract the male. It may be intermediately to highly volatile under dry conditions and is expected to dissipate quickly in air via reaction with hydroxyl radicals. It has low solubility in water and is predicted to be slightly mobile in soil. Nuranone is not expected to bioaccumulate.

#### **4.1.3 Geraniol**

Geraniol is found in the essential oils of several aromatic plants, such as rose and lemongrass. It is expected to have intermediate to high volatility under dry conditions and to be degraded rapidly in air by reaction with hydroxyl radicals. Geraniol is soluble in water and is expected to be highly mobile in soil. It may also volatilize to a moderate extent from moist soil and water surfaces. Rapid degradation observed during a ready biodegradability study indicates that geraniol will biotransform quickly in natural environments. Geraniol is not expected to bioaccumulate.

#### **4.1.4 Eugenol**

Eugenol is the main component of several essential oils, such as clove leaf oil and cinnamon leaf oil. It is expected to have intermediate to high volatility under dry conditions and to be degraded rapidly in air by reaction with hydroxyl radicals and ozone. Eugenol is very soluble in water and is expected to be slightly volatile from water surfaces. It is also expected to be moderately mobile in soil and slightly volatile when soil is moist. Rapid degradation observed during a ready biodegradability study with isoeugenol, which has a chemical structure similar to eugenol, suggests that eugenol will biotransform quickly in natural environments. Eugenol is not expected to bioaccumulate.

### **4.2 Environmental risk characterization**

The active ingredients are all natural substances, produced either by plants (2-phenethyl propionate, geraniol, eugenol) or by Japanese beetles (nuranone). The available ecotoxicological information for these chemicals indicates that they are practically non-toxic to moderately toxic to non-target terrestrial and aquatic organisms (Appendix I, Table 5). The potential for exposure of non-target organisms to the active ingredients and any potential transformation products is minimal due to the product design, use, and disposal. In the beetle trap, the active ingredients are contained within solid beads that are sealed in a plastic cartridge that is attached to the top of a

plastic bag. The traps are hung nine metres from flowers, fruits, vegetables, and lawns where Japanese beetles may cause damage. The active ingredients gradually volatilize over the effective use period of eight weeks and are expected to degrade rapidly in the atmosphere. Following the effective use period, the traps are emptied and the used cartridges are disposed in household trash. If the traps are not being re-used with a new cartridge, the plastic bags are also disposed in household trash. Considering the limited potential for environmental exposure and data suggesting minimal effects of the active ingredients on non-target organisms, the risks to non-target organisms are acceptable when Japanese Beetle Trap Refill is used according to label directions.

#### **4.2.1 Incident reports**

As of 22 April 2025, no environmental incident reports involving 2-phenethyl propionate, nuranone, or eugenol, had been submitted to the PMRA. One incident report mentioning geraniol had been submitted to the PMRA. The incident involved honey bee mortality and multiple other active ingredients. It was determined to be unlikely that geraniol contributed to the bee mortality. Thus, the incident was not considered further for the environmental risk assessment.

### **5.0 Value**

The Japanese beetle can be a destructive pest in a domestic setting. It is a large generalist herbivore that feeds on various fruits and foliage as an adult, and on turf and other plant roots as a larva.

Four field trials and one laboratory trial were submitted to support the efficacy of Japanese Beetle Trap Refill. The field trials demonstrated that the end-use product attracts similar numbers of male and female Japanese beetle adults, starts working within 5–10 minutes, and lures Japanese beetles away from vegetation. The laboratory trial demonstrated that the amount of active ingredient remaining in the Japanese Beetle Trap Refill after eight weeks is sufficient to attract Japanese beetles for an eight-week period.

The reviewed value information was sufficient to support that Japanese Beetle Trap Refill lures them from flowers, fruits, vegetables, and lawns, and that the product starts working immediately and lasts for eight weeks.

## **6.0 Pest Control Product Policy considerations**

### **6.1 Toxic Substances Management Policy considerations**

The Toxic Substances Management Policy (TSMP) is a federal government policy developed to provide direction on the management of substances of concern that are released into the environment. The TSMP calls for the virtual elimination of Track 1 substances, in other words, those that meet all four criteria outlined in the policy: persistent (in air, soil, water and/or sediment), bio-accumulative, primarily a result of human activity and toxic as defined by the *Canadian Environmental Protection Act*. The *Pest Control Products Act* requires that the TSMP be given effect in evaluating the risks of a product.

During the review process, 2-phenethyl propionate, nuranone, geraniol, and eugenol were assessed in accordance with the PMRA Regulatory Directive DIR99-03<sup>5</sup> and evaluated against the Track 1 criteria. Health Canada has reached the conclusion that 2-phenethyl propionate, nuranone, geraniol, and eugenol do not meet all of the TSMP Track 1 criteria because they are made from natural materials, are not expected to bioaccumulate (in accordance with the PMRA's *Guidance for the Registration of Non-Conventional Pest Control Uses* (24 March 2023)) and are not expected to form any transformation products that meet all of the TSMP Track 1 criteria.

## 6.2 Formulants and contaminants of health or environmental concern

During the review process, contaminants in the active ingredients as well as formulants and contaminants in the end-use products are compared against Parts 1 and 3 of the List of Pest Control Product Formulants and Contaminants of Health or Environmental Concern.<sup>6</sup> The list is used as described in the PMRA Science Policy Note SPN2020-01<sup>7</sup> and is based on existing policies and regulations, including the Toxic Substance Management Policy and Formulants Policy,<sup>8</sup> and taking into consideration the Ozone-depleting Substances and Halocarbon Alternatives Regulations under the Canadian Environmental Protection Act, 1999, (substances designated under the Montreal Protocol).

Health Canada has reached the conclusion that 2-Phenethyl Propionate Technical, Nuranone Technical, Geraniol Technical, and Eugenol Technical, and related end-use product, Japanese Beetle Trap Refill, do not contain any formulants or contaminants identified in the List of Pest Control Product Formulants and Contaminants of Health or Environmental Concern.

The use of formulants in registered pest control products is assessed on an ongoing basis through PMRA formulant initiatives and Regulatory Directive DIR2006-02.

## 7.0 Proposed regulatory decision

Health Canada's PMRA, pursuant to subsection 28(1) of the *Pest Control Products Act*, is proposing registration for the sale and use of 2-Phenethyl Propionate Technical, Nuranone Technical, Geraniol Technical, Eugenol Technical, and related end-use product, Japanese Beetle Trap Refill, containing the active ingredients 2-phenethyl propionate, nuranone, geraniol, and eugenol, to control Japanese beetles in outdoor domestic areas.

An evaluation of available scientific information found that, under the approved conditions of use, the health and environmental risks and the value of the pest control products are acceptable.

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<sup>5</sup> DIR99-03, *The Pest Management Regulatory Agency's Strategy for Implementing the Toxic Substances Management Policy*.

<sup>6</sup> SI/2005-114, last amended on June 24, 2020. See Justice Laws website, Consolidated Regulations, *List of Pest Control Product Formulants and Contaminants of Health or Environmental Concern*.

<sup>7</sup> PMRA's Science Policy Note SPN2020-01, *Policy on the List of Pest Control Product Formulants and Contaminants of Health or Environmental Concern* under paragraph 43(5)(b) of the *Pest Control Products Act*.

<sup>8</sup> DIR2006-02, *Formulants Policy and Implementation Guidance Document*.

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## List of abbreviations

$\alpha$	alpha
$\gamma$	gamma
$\lambda_{\max}$	wavelength of maximum absorption
=	equal to
>	greater than
%	percent
#	number
°C	degree Celsius
AAASAE	aryl alkyl alcohol simple acid ester
atm	atmosphere
bw	body weight
CAS	Chemical Abstracts Service
cm <sup>3</sup>	cubic centimetre
CMP	Chemicals Management Plan
DACO	data code
DIR	Regulatory Directive
DNA	deoxyribonucleic acid
E <sub>b</sub> C <sub>50</sub>	effective concentration resulting in 50% reduction in biomass growth
EC <sub>50</sub>	effective concentration resulting in 50% reduction in response
E <sub>y</sub> C <sub>50</sub>	effective concentration resulting in 50% reduction in yield
g	gram
HDT	highest dose tested
IUPAC	International Union of Pure and Applied Chemistry
kg	kilogram
K <sub>oc</sub>	organic carbon normalized adsorption coefficient
K <sub>ow</sub>	<i>n</i> -octanol-water partition coefficient
L	litre
LC <sub>50</sub>	lethal concentration resulting in mortality of 50% of test organisms
LD <sub>50</sub>	lethal dose resulting in mortality of 50% of test organisms
LOAEL	lowest observed adverse effect level
M	molar concentration
m <sup>2</sup>	square metre
m <sup>3</sup>	cubic metre
mg	milligram
mL	millilitre
mmHg	millimeters of mercury
nm	nanometres
NOAEL	no observed adverse effect level
Pa	Pascal
pK <sub>a</sub>	acid dissociation constant
PMRA	Pest Management Regulatory Agency
SI	Statutory Instrument
SPN	Science Policy Note
TSMP	Toxic Substances Management Policy
USEPA	United States Environmental Protection Agency
UV	ultraviolet

## Appendix I Tables

**Table 1 2-Phenethyl propionate: Physical-chemical properties relevant to the environment**

Property	Value	Comments	Reference
Vapour pressure at 25°C	0.0514 mmHg	Intermediate to high volatility under dry conditions.	Section 1.0
Gas-phase half-life in air	2 days	For reaction with hydroxyl radicals.	PMRA No. 3654322
Water solubility at 25°C	Insoluble	-	Section 1.0
Henry's law constant at 25°C	-	Considering vapour pressure and insolubility in water, likely volatile from moist soil and water surfaces.	-
Dissociation constant in water ( $pK_a$ )	-	Does not contain a dissociable moiety.	Section 1.0
UV/visible absorption	No absorption expected at > 300 nm	Low potential for direct photolysis.	Section 1.0
$\log K_{ow}$	3.06	Although the $\log K_{ow}$ is greater than 3, 2-phenethyl propionate is a non-conventional pest control product active ingredient derived from natural materials and bioaccumulation is not anticipated.	Section 1.0
Adsorption coefficient ( $K_{oc}$ )	476 L/kg	Medium mobility in soil.	PMRA No. 3654322

**Table 2 Nuranone: Physical-chemical properties relevant to the environment**

Property	Value	Comments	Reference
Vapour pressure at 25°C	Very low; 1.59E-4 mmHg	Estimates vary; may have intermediate to high volatility under dry conditions. See also comment below for Henry's law constant.	Section 1.0
Gas-phase half-life in air	1 to 2 hours	For reaction with hydroxyl radicals and ozone.	PMRA No. 3654328
Water solubility at 20°C	7.3 mg/L	Low solubility in water.	Section 1.0
Henry's law constant at 25°C	-	Available estimates (for example, from the USEPA's CompTox and EPI Suite*) vary across several orders of magnitude. The chemical has both low vapour pressure and	-

Property	Value	Comments	Reference
		low solubility in water. The function of the chemical as a pheromone to attract mates suggests there is some potential for volatilization from moist surfaces.	
Dissociation constant in water ( $pK_a$ )	-	Does not contain a dissociable moiety.	Section 1.0
UV/visible absorption ( $\lambda_{max}$ )	276 nm (basic pH) No absorption expected at > 300 nm	Low potential for direct photolysis.	Section 1.0
$\log K_{ow}$	1.01	Low potential for bioaccumulation.	Section 1.0
Adsorption coefficient ( $K_{oc}$ )	2412 L/kg	Slight mobility in soil.	PMRA No. 3654328

\* The CompTox Chemicals Dashboard provides public access to chemistry, toxicity, and exposure data. This information includes chemical structures, experimental and predicted physicochemical and toxicity data, hazard and bioassay data, and additional links to relevant websites and applications. EPI (Estimation Programs Interface) Suite is a suite of physical/chemical property and environmental fate estimation programs.

**Table 3 Geraniol: Physical-chemical properties relevant to the environment**

Property	Value	Comments	Reference
Vapour pressure at 25°C	0.0159 mmHg	Intermediate to high volatility under dry conditions.	Section 1.0
Gas-phase half-life in air	2 hours	For reaction with hydroxyl radicals.	PMRA No. 3654321
Water solubility at 25°C	100 mg/L	Soluble in water.	Section 1.0
Henry's law constant at 25°C	2.12E-5 atm·m <sup>3</sup> /mole	Slightly volatile to volatile from moist soil and water surfaces. Calculated using vapour pressure and water solubility.	-
Dissociation constant in water ( $pK_a$ )	-	Not provided. However, as geraniol is an allylic alcohol, it likely will have minimal dissociation at typical environmental pH of 5 to 9.	Section 1.0
UV/visible absorption	No absorption expected at > 300 nm	Low potential for direct photolysis.	Section 1.0

Property	Value	Comments	Reference
log $K_{ow}$	3.56	Although the log $K_{ow}$ is greater than 3, geraniol is a non-conventional pest control product active ingredient derived from natural materials and bioaccumulation is not anticipated.	Section 1.0
Adsorption coefficient ( $K_{oc}$ )	90 L/kg	High mobility in soil.	PMRA No. 3654321

**Table 4 Eugenol: Physical-chemical properties relevant to the environment**

Property	Value	Comments	Reference
Vapour pressure at 25°C	0.00948 mmHg, 0.022 mmHg	Intermediate to high volatility under dry conditions.	Section 1.0, PMRA No. 3654317
Gas-phase half-life in air	6 hours, 23 hours	For reaction with hydroxyl radicals and ozone, respectively.	PMRA No. 3654317
Water solubility at 25°C	2460 mg/L	Very soluble in water.	Section 1.0
Henry's law constant at 25°C	1.92E-6 atm·m <sup>3</sup> /mole	Slightly volatile from moist soil and water surfaces. Calculated using vapour pressure and water solubility.	-
Dissociation constant in water at 25°C ( $pK_a$ )	10.27	Mostly in unionized form at typical environmental pH of 5 to 9.	Section 1.0
UV/visible absorption	No absorption expected at > 300 nm	Low potential for direct photolysis.	Section 1.0
log $K_{ow}$	2.27, 2.49	Low potential for bioaccumulation.	Section 1.0, PMRA No. 3654317
Adsorption coefficient ( $K_{oc}$ )	340 L/kg	Moderate mobility in soil.	PMRA No. 3654317

**Table 5 Toxicity of 2-phenethyl propionate, nuranone, geraniol, and eugenol to non-target species**

Organism	Test substance	Endpoint value	Degree of toxicity <sup>1</sup>	Reference
Rat	2-Phenethyl propionate	Oral LD <sub>50</sub> : 2168 mg/kg bw	Practically non-toxic	PMRA No. 3641697
Rainbow trout, <i>Oncorhynchus mykiss</i>	2-Phenethyl propionate/ Eugenol (7:3)	96-hour LC <sub>50</sub> < 13 mg/L (static)	-	PMRA No. 3654327

Organism	Test substance	Endpoint value	Degree of toxicity <sup>1</sup>	Reference
Bluegill sunfish, <i>Lepomis macrochirus</i>	ratio)	96-hour LC <sub>50</sub> : 12 mg/L (static)	Slightly toxic	
Rat	γ-butyrolactone (structural analogue for nuranone)	Oral LD <sub>50</sub> : 1245 mg/kg bw	Slightly toxic	PMRA No. 3615203, 3472293
Rat	Geraniol	Oral LD <sub>50</sub> : 3600 mg/kg bw	Practically non-toxic	PMRA No. 3471780, 3713242, 3471697
Water flea, <i>Daphnia magna</i>		48-hour LC <sub>50</sub> : 7.75 mg/L (static-renewal)	Moderately toxic	PMRA No. 3471779
		48-hour LC <sub>50</sub> : 10.8 mg/L (static)	Slightly toxic	
Zebrafish, <i>Danio rerio</i>		96-hour LC <sub>50</sub> : 22 mg/L (static)	Slightly toxic	
		96-hour LC <sub>50</sub> : 14.0 mg/L (semi-static)	Slightly toxic	
Green alga, <i>Raphidocelis subcapitata</i>		72-hour E <sub>b</sub> C <sub>50</sub> : 3.32 mg/L	Moderately toxic	
Green alga, <i>Desmodesmus subspicatus</i>	72-hour E <sub>y</sub> C <sub>50</sub> : 6.42 mg/L	Moderately toxic		
Rat	Eugenol	Oral LD <sub>50</sub> : 1930 mg/kg bw	Slightly toxic	PMRA No. 3718767
Water flea, <i>Daphnia magna</i>		48-hour EC <sub>50</sub> : 1.13 mg/L (static)	Moderately toxic	PMRA No. 3471744
		48-hour EC <sub>50</sub> : 1.32 mg/L (static-renewal)		
Zebrafish, <i>Danio rerio</i>		96-hour LC <sub>50</sub> : 13 mg/L (semi-static)	Slightly toxic	PMRA No. 3471744
Rainbow trout, <i>Oncorhynchus mykiss</i>		96-hour LC <sub>50</sub> : 60.8 mg/L (static)	Slightly toxic	PMRA No. 3654318
Coho salmon, <i>Oncorhynchus kisutch</i>		96-hour LC <sub>50</sub> : 66.1 mg/L (static)	Slightly toxic	PMRA No. 3654318
Green alga, <i>Desmodesmus subspicatus</i>		72-hour E <sub>y</sub> C <sub>50</sub> : 23 mg/L (static)	Slightly toxic	PMRA No. 3471744

<sup>1</sup> USEPA classification, where applicable.

## References

### A. List of studies/Information submitted by Registrant

#### 1.0 Chemistry

PMRA Document Number	Reference
3279827	2007, 2-Phenethyl Propionate: Identity and Physical-Chemical Chemistry Data Summary, DACO: 2.14.1,2.14.13,2.14.15,2.14.2,2.14.3,2.14.4,2.14.5,2.14.6,2.14.7,830.7000 CBI
3279828	2007, 2-Phenethyl Propionate: Boiling Point and Vapor Pressure, DACO: 2.14.4,2.14.5,2.14.9 CBI
3279829	2007, 2-Phenethyl Propionate: Product Identity, Composition and Analysis, DACO: 2.4,2.5,2.6,2.7,2.8,2.9 CBI
3279938	2007, Geraniol: Product Identity, Composition and Analysis, DACO: 2.11.1,2.11.2,2.11.3,2.11.4,2.12.1,2.13.1,2.13.2,2.13.3,2.13.4 CBI
3279939	2007, Geraniol: Identity and Physical-Chemical Characteristic Data Summary, DACO: 2.14.1,2.14.13,2.14.15,2.14.2,2.14.3,2.14.4,2.14.5,2.14.6,2.14.7,830.7000 CBI
3279940	2007, Geraniol: Melting Point, Boiling Point and Vapor Pressure, DACO: 2.14.4,2.14.5,2.14.9 CBI
3280005	2021, PART 3 Chemistry-Japanese Trap-04oct2021, DACO: 3.1.1,3.1.2,3.1.3,3.1.4,3.2,3.2.1,3.2.2,3.2.3,3.3.1,3.4,3.4.1,3.4.2,3.5,3.5.1,3.5.10,3.5.11,3.5.12,3.5.13,3.5.14,3.5.15,3.5.16,3.5.2,3.5.3,3.5.4,3.5.5,3.5.6,3.5.7,3.5.8,3.5.9 CBI
3280006	2007, Bull Run Japanese & Oriental Beetle Trap Attractant: Product Identity, Description of Starting Materials Formulation Process, Discussion of Formation of Impurities, and Certified Limits, DACO: 3.2.1,3.2.2,3.2.3,3.3.1 CBI
3280007	2007, Bull Run Japanese & Oriental Beetle Trap Attractant: Product Identity, Description of Starting Materials Formulation Process, Discussion of Formation of Impurities, and Certified Limits, DACO: 3.2.1,3.2.2,3.2.3,3.3.1 CBI
3280011	2007, Bull Run Japanese Beetle Trap Attractant: Physical State, pH and Bulk Density, DACO: 3.5.2,3.5.6,3.5.7
3280252	2007, Eugenol: Identity and Physical-Chemical Chemistry Data Summary, DACO: 2.14.1,2.14.13,2.14.15,2.14.2,2.14.3,2.14.4,2.14.5,2.14.6,2.14.7,830.7000 CBI
3280253	2007, Eugenol: Boiling Point and Vapor Pressure, DACO: 2.14.5,2.14.9 CBI
3367272	2007, 2-Phenethyl Propionate: Product Identity, Composition and Analysis, DACO: 2.11.1 CBI
3367273	2022, Phenylethyl IR Report No. U204088, DACO: 2.13.2 CBI
3367280	2022, Determination of [CBI Removed] Impurity Content on Five Batches of the Test Item "Geraniol", DACO: 2.13.1,2.13.2,2.13.4 CBI

3367281	2022, Geraniol IR Report No. U204086, DACO: 2.13.2 CBI
3367821	2021, Analytical Method Validation for the Identification and Quantification of [CBI Removed] Impurity in the Test Item "Eugenol", DACO: 2.13.4 CBI
3381178	2022, 2021-5647-Geraniol Technical-Letter of Intent-16august2022-Batch Production Address, DACO: 2.13 CBI
3466404	2022, Determination of [CBI Removed] Impurity Content on Five Batches of the Test Item "Geraniol", DACO: 2.13.4 CBI
3471773	2023, Determination of [CBI Removed] Impurity Content on Five Batches of the Test Item Synthetic Eugenol, DACO: 2.13.4 CBI
3500923	2023, Analytical Method Validation for Identification and Quantification of the Active Ingredients in RESCUE! Japanese Beetle Trap/Refill (Lure), DACO: 3.4.1 CBI
3500924	2023, RESCUE! Japanese Beetle Trap/Refill (Lure) Storage Stability Study, DACO: 3.5.10,3.5.14 CBI
3500953	2023, Analytical Method Validation for the Identification and Quantification of the Active Substance, Nuranone, in the Test Item "Nuranone Technical", DACO: 2.13.1 CBI
3500954	2023, Determination of Technical Grade Active Ingredient Content on Five Batches of the Test Item "Nuranone Technical", DACO: 2.13.3 CBI
3500955	2023, Rationale Supporting Data Waiver Request for Testing for [CBI Removed] in Nuranone Final Product, DACO: 2.13.4 CBI
3500956	2023, Supporting Study, Data, and Description to Address the Deficiencies Listed in DACO 2.14 (Chemical and Physical Properties of Nuranone), DACO: 2.14.1,2.14.10,2.14.11,2.14.12,2.14.13,2.14.14,2.14.3,2.14.4,2.14.5,2.14.6,2.14.7,2.14.8,2.14.9 CBI
3510451	2022, Nuranone Technical: Product Identity and Composition, and Description of Starting Materials, DACO: 2.11.2
3510452	2023, Nuranone Technical: Product Identity and Composition, and Description of Starting Materials, DACO: 2.11.2 CBI
3510453	2022, Nuranone Technical: Description of the Manufacturing Process and Discussion of Formation of Impurities, DACO: 2.11.3,2.11.4 CBI
3510454	2022, Nuranone Technical: Description of the Manufacturing Process and Discussion of Formation of Impurities, DACO: 2.11.3,2.11.4

## 2.0 Human and Animal Health

### Human and Animal Health

<b>PMRA Document Number</b>	<b>Reference</b>
3280013	2021, Part 5 Exposure-Japanese Beetle Trap-04october2021, DACO: 5.2
3280255	2007, Acute Toxicity and Prenatal Developmental Toxicity, DACO: 4.2.1, 4.2.2,4.2.3,4.2.4,4.2.5,4.2.6
3466405	2023, Toxicology Data Requirements for Geraniol, DACO: 4.1,4.2.1,4.2.3, 4.2.4,4.2.5,4.2.6,4.3.1,4.5.2,4.5.4,4.5.5

- 3466422 2023, Toxicology Data Requirements for 2-Phenyl Ethyl Propionate, DACO: 4.2.1,4.2.3,4.2.4,4.2.5,4.2.6,4.3.1,4.5.2,4.5.4,4.5.5
- 3466423 2023, Toxicology Data Requirements for 2-Phenyl Ethyl Propionate, DACO: 4.2.1,4.2.3,4.2.4,4.2.5,4.2.6,4.3.1,4.5.2,4.5.4,4.5.5
- 3466765 2023, Toxicology Data Requirements for Nuranone, DACO: 4.2.1,4.2.3,4.2.4,4.2.5,4.2.6,4.3.1,4.5.2,4.5.4,4.5.5
- 3466766 2023, Toxicology Data Requirements for Nuranone, DACO: 4.2.1,4.2.3,4.2.4,4.2.5,4.2.6,4.3.1,4.5.2,4.5.4,4.5.5
- 3471697 P. M. Jenner, E. C. Hagan, Jean M. Taylor, E. L. Cook, O. G. Fitzhugh, 1964, Food Flavorings and Compounds of Related Structure I. Acute Oral Toxicity, Food and Cosmetics Toxicology, 2: 327-343, DACO: 4.2.1,4.2.2,4.2.3,4.2.4,4.2.5,4.2.6,4.3.1,4.5.2,4.5.4,4.5.5,9.7
- 3471706 D. McGinty, D. Vitale, C. S. Letizia, A. M. Api, 2012, Fragrance Material Review on Phenethyl Propionate, Food and Chemical Toxicology, 50: S430-S434, DACO: 4.2.1,4.2.2,4.2.3,4.2.4,4.2.5,4.2.6,4.3.1,4.5.2,4.5.4,4.5.5
- 3471708 European Chemicals Agency (ECHA), 2023, Phenethyl Propionate, DACO: 4.2.1,4.2.2,4.2.3,4.2.4,4.2.5,4.2.6,4.3.1,4.5.2,4.5.4,4.5.5
- 3471745 A. M. Api, D. Belsito, S. Bhatia, M. Bruze, P. Calow, M. L. Dagli, W. Dekant, A. D. Fryer, L. Kromidas, S. La Cava, J. F. Lalko, A. Lapczynski, D. C. Liebler, Y. Miyachi, V. T. Politano, G. Ritacco, D. Salvito, T. W. Schultz, J. Shen, I. G. Sipes, B. Wall, D. K. Wilcox, 2016, RIFM Fragrance Ingredient Safety Assessment, Eugenol, CAS Registry Number 97-53-0, Food and Chemical Toxicology, 97: S25-S37, DACO: 4.1,4.2.1,4.2.3,4.2.4,4.2.5,4.2.6,4.3.1,4.5.2,4.5.4,4.5.5
- 3471768 Joint FAO/WHO Expert Committee on Food Additives (JECFA), 2006, Evaluation of Certain Food Additives: Sixty-Fifth Report of the Joint FAO/WHO Expert Committee on Food Additives, WHO Technical Report Series 934, 65: 1-145, DACO: 12.5.4,4.1,4.2.1,4.2.3,4.2.4,4.2.5,4.2.6,4.3.1,4.5.2,4.5.4,4.5.5,4.5.9
- 3471769 Joint FAO/WHO Expert Committee on Food Additives (JECFA), 2006, Safety Evaluation of Certain Food Additives, WHO Food Additives Series, 56: 1-441, DACO: 12.5.4,4.1,4.2.1,4.2.3,4.2.4,4.2.5,4.2.6,4.3.1,4.4.2,4.4.3,4.5.2,4.5.4,4.5.5,4.5.9
- 3471774 2023, Toxicology Data Requirements for Eugenol, DACO: 4.1,4.2.1,4.2.3,4.2.4,4.2.5,4.2.6,4.3.1,4.5.2,4.5.4,4.5.5
- 3471776 National Industrial Chemicals Notification and Assessment Scheme (NICNAS), 2016, Geraniol and Related Compounds: Human Health Tier II Assessment, IMAP Group Assessment Report, DACO: 4.1,4.2.1,4.2.2,4.2.3,4.2.4,4.2.5,4.2.6,4.3.1,4.5.2,4.5.4,4.5.5
- 3471777 Mihwa Na, Devin O'Brien, Maura Lavelle, Isabelle Lee, G. Frank Gerberick, Anne Marie Api, 2022, Weight of Evidence Approach for Skin Sensitization Potency Categorization of Fragrance Ingredients, Dermatitis, 33(2): 161-175, DACO: 4.1,4.2.1,4.2.2,4.2.3,4.2.4,4.2.5,4.2.6,4.3.1,4.5.2,4.5.4,4.5.5
- 3471779 A. M. Api, D. Belsito, D. Botelho, M. Bruze, G. A. Burton Jr., M. A. Cancellieri, H. Chon, M. L. Dagli, M. Date, W. Dekant, C. Deodhar, A. D. Fryer, L. Jones, K. Joshi, M. Kumar, A. Lapczynski, M. Lavelle, I. Lee, D. C. Liebler, H. Moustakas, M. Na, T. M. Penning, G. Ritacco, J. Romine, N.

- Sadekar, T. W. Schultz, D. Selechnik, F. Siddiqi, I. G. Sipes, G. Sullivan, Y. Thakkar, Y. Tokura, 2022, RIFM Fragrance Ingredient Safety Assessment, Geraniol, CAS Registry Number 106-24-1, Food and Chemical Toxicology, 167: 113341, DACO: 4.1,4.2.1,4.2.2,4.2.3,4.2.4,4.2.5,4.2.6,4.3.1,4.5.2,4.5.4, 4.5.5,9.3.1,9.5.1,9.8.1
- 3471780 The Research Institute of Fragrance Materials (RIFM) Expert Panel, D. Belsito, D. Bickers, M. Bruze, P. Calow, H. Greim, J. M. Hanifin, A.E. Rogers, J. H. Saurat, I. G. Sipes, H. Tagami, 2008, A Toxicologic and Dermatologic Assessment of Cyclic and Non-Cyclic Terpene Alcohols When Used as Fragrance Ingredients, Food and Chemical Toxicology, 46(suppl 11), S1-S71, DACO: 4.1,4.2.1,4.2.2,4.2.3,4.2.4,4.2.5,4.2.6,4.3.1,4.5.2,4.5.4,4.5.5, 9.7
- 3471793 A. Lapczynski, S. P. Bhatia, R. J. Foxenberg, C. S. Letizia, A. M. Api, 2008, Fragrance Material Review on Geraniol, Food and Chemical Toxicology, 46: S160-S170, DACO: 4.1,4.2.1,4.2.2,4.2.3,4.2.4,4.2.5,4.2.6,4.3.1,4.5.2,4.5.4, 4.5.5
- 3472293 Joint FAO/WHO Expert Committee on Food Additives (JECFA), 1998, Safety Evaluation of Certain Food Additives and Contaminants: WHO Food Additive Series, 40, DACO: 4.2.1,4.2.2,4.2.3,4.2.4,4.2.5,4.2.6,4.3.1,4.5.2, 4.5.4,4.5.5,4.5.7,9.7
- 3472295 National Toxicology Program, 1992, Toxicology and Carcinogenesis Studies of gamma-Butyrolactone (CAS No. 96-48-0) in F344/N Rats and B6C3F1 Mice (Gavage Studies), National Toxicology Program Technical Report Series, 406: 1-232, DACO: 4.2.1,4.2.2,4.2.3,4.2.4,4.2.5,4.2.6,4.3.1,4.5.2, 4.5.4,4.5.5
- 3472296 B. L. Oser, S. Carson, Mona Oser, 1965, Toxicological Tests on Flavouring Matters, Food and Cosmetics Toxicology, 3(4): 563-569, DACO: 4.1,4.2.1, 4.2.2,4.2.3,4.2.4,4.2.5,4.2.6,4.3.1,4.5.2,4.5.4,4.5.5
- 3472297 Tony Kronevi, Bo Holmberg, Sivonne Arvidsson, 1988, Teratogenicity Test of gamma-Butyrolactone in the Sprague-Dawley Rat, Pharmacology & Toxicology, 62(1): 57-58, DACO: 4.5.2
- 3472298 J. D. Heck, T. A. Vollmuth, M. A. Cifone, D. R. Jagannath, B. Myhr, R. D. Curren, 1989, An Evaluation of Food Flavouring Ingredients in a Genetic Toxicity Screening Battery, The Toxicologist, 9(1): 257-272, DACO: 4.5.4, 4.5.5
- 3472299 Fernanda Marcelia dos Santos, Pricila Fernandes Pfüger, Leticia Lazzarotto, Mariana Uczay, Wesley Roberto de Aguida, Lisiane Santos da Silva Fernanda Brião Menezes Boaretto, Jayne Torres de Sousa, Jaqueline Nascimento Picada, Iraci Lucena da Silva Torres, Patrícia Pereira, 2021, Gamma-Decanolactone Alters the Expression of GluN2B, A1 Receptors, and COX-2 and Reduces DNA Damage in the PTZ-Induced Seizure Model After Subchronic Treatment in Mice, Neurochemical Research, 46: 2066-2078, DACO: 4.5.7
- 3472317 Stefan Schulz, Susann Hotling, 2015, The Use of the Lactone Motif in Chemical Communication, Natural Products Reports, 32(7): 1042-1066, DACO: 4.2.1,4.2.2,4.2.3,4.2.4,4.2.5,4.2.6,4.3.1,4.5.2,4.5.4,4.5.5

- 3500925 2023, Supporting Study and Data to Address the Deficiencies Listed in DACO 5.2.4: Use Description Scenario (Application and Post-Application), DACO: 5.2
- 3615203 E. W. Schafer, Jr., W. A. Bowles, Jr., 1985, Acute Oral Toxicity and Repellency of 933 Chemicals to House and Deer Mice, Archives of Environmental Contamination and Toxicology, 14(1): 111-129, DACO: 4.2.1,9.7
- 3615207 2024, Request to Waive Acute Inhalation Toxicity for Nuranone Technical, DACO: 4.2.3
- 3615208 E. C. Hagan, W. H. Hansen, O. G. Fitzhugh, P. M. Jenner, W. I. Jones, Jean M. Taylor, Eleanor L. Long, A. A. Nelson, J. B. Brouwer, 1967, Food Flavourings and Compounds of Related Structure. II. Subacute and Chronic Toxicity, Food and Cosmetics Toxicology, 5: 141-157, DACO: 4.3.1
- 3615222 Douglas B. McGregor, Alison Brown, Pamela Cattanach, Ian Edwards, Douglas McBride, Colin Riach, William J. Caspary, 1988, Responses of the L5178Y tk+/tk- Mouse Lymphoma Cell Forward Mutation Assay: III. 72 Coded Chemicals, DACO: 4.5.4,4.5.5,4.5.7
- 3626683 G. Klecak, 1985, The Freund's Complete Adjuvant Test and the Open Epicutaneous Test. A Complementary Test Procedure for Realistic Assessment of Allergenic Potential, Current Problems in Dermatology, 14: 152-171, DACO: 4.2.6
- 3641697 European Chemicals Agency (ECHA), 2024, Phenethyl Propionate, DACO: 4.2.1,4.2.2,9.7
- 3648409 The Research Institute of Fragrance Materials (RIFM) Expert Panel, D. Belsito, D. Bickers, M. Bruze, P. Calow, M. L. Dagli, A. D. Fryer, H. Greim, Y. Miyachi, J. H. Saurat, I. G. Sipes, 2012, A Toxicological and Dermatological Assessment of Aryl Alkyl Alcohol Simple Acid Ester Derivatives When Used as Fragrance Ingredients, Food and Chemical Toxicology, 50(suppl 2): S269-S313, DACO: 4.2.1,4.2.3,4.2.4,4.2.5,4.2.6, 4.3.1,4.5.2,4.5.5,4.5.7
- 3648410 Morton Beroza, M. N. Inscoe, P. H. Schwartz, Jr., M. L. Keplinger, C. W. Mastri, 1975, Acute Toxicity Studies with Insect Attractants, Toxicology and Applied Pharmacology, 31: 421-429, DACO: 4.2.1,4.2.3,4.2.4,4.2.5
- 3712677 I. F. Gaunt, P. L. Mason, Joan Hardy, A. B. G Lansdown, S. D. Gangolli, 1974, Short-Term Toxicity of Methylphenylcarbonyl Acetate in Rats, Food and Cosmetics Toxicology, 12: 185-194, DACO: 4.3.1
- 3713242 European Chemicals Agency (ECHA), 2025, Registration Dossier - ECHA Endpoint Summary, DACO: 4.2.3,9.7
- 3713243 European Chemicals Agency (ECHA), 2025, Registration Dossier - ECHA Acute Inhalation, DACO: 4.2.3
- 3713244 European Chemicals Agency (ECHA), 2025, Registration Dossier - ECHA Endpoint Summary Skin and Eye 20240226, DACO: 4.2.4,4.2.5
- 3715489 European Chemicals Agency (ECHA), 2025, Registration Dossier - ECHA Skin Irritation, DACO: 4.2.5
- 3715490 European Chemicals Agency (ECHA), 2025, ECHA Registration Dossier Eye Irritation, DACO: 4.2.4
- 3715513 European Chemicals Agency (ECHA), 2025, Eye Irritation for gamma-

- 3715514 Butyrolactone, DACO: 4.2.4  
European Chemicals Agency (ECHA), 2025, Skin Irritation/Corrosion for Nonan-4-olide, DACO: 4.2.5
- 3715515 European Chemicals Agency (ECHA), 2025, Skin Sensitization for Nonan-4-olide, DACO: 4.2.6
- 3715516 Hao Xu, Shuo-Ning Li, Yan-Qing Yang, Yun Zhou, Qian-Zhen Yang, Qing-Hua Bian, Jiang-Chun Zhong, Min Wang, 2014, Catalytic Asymmetric Synthesis of Japonilure and Its Enantiomer, *Tetrahedron: Asymmetry*, 25(20-21): 1372-1375, DACO: 4.2.1,4.2.3,4.2.4,4.2.5,4.2.6,4.3.1,4.5.2,4.5.4,4.5.5, 4.5.7

### 3.0 Environment

PMRA Document Number	Reference
3279832	2021, Parts 8,9-Phenyl Ethyl Propionate Technical-04october2021, DACO: 8.1,9.1
3279833	2007, 2-Phenethyl Propionate: Toxicity to Non-Target Organisms, DACO: 9.2.4,9.3,9.4,9.5.2,9.6.2,9.8
3279944	2021, Parts 8,9-Geraniol Technical-04october2021, DACO: 8.1,9.1
3279945	2007, Geraniol: Toxicity to Non-Target Organisms, DACO: 9.2.4,9.3,9.4, 9.5.2,9.6.2,9.8
3280014	2021, Parts 8,9-Japanese Beetle Trap-04october2021, DACO: 8.1,9.1
3280254	2007, Eugenol: Toxicity to Non-Target Organisms, DACO: 9.2.4,9.3,9.4, 9.5.2,9.6.2,9.8
3280267	2021, Parts 8,9-Eugenol Technical-04october2021, DACO: 8.1,9.1
3471697	P. M. Jenner, E. C. Hagan, Jean M. Taylor, E. L. Cook, O. G. Fitzhugh, 1964, Food Flavorings and Compounds of Related Structure I. Acute Oral Toxicity, <i>Food and Cosmetics Toxicology</i> , 2: 327-343, DACO: 4.2.1,4.2.2,4.2.3,4.2.4, 4.2.5,4.2.6,4.3.1,4.5.2,4.5.4,4.5.5,9.7
3471744	A.M. Api, D. Belsito, D. Botelho, M. Bruze, G.A. Burton Jr., J. Buschmann, M.A. Cancellieri, M.L. Dagli, M. Date, W. Dekant, C. Deodhar, A.D. Fryer, L. Jones, K. Joshi, M. Kumar, A. Lapczynski, M. Lavelle, I. Lee, D.C. Liebler, H. Moustakas, M. Na, T.M. Penning, G. Ritacco, J. Romine, N. Sadekar, T.W. Schultz, D. Selechnik, F. Siddiqi, I.G. Sipes, G. Sullivan, Y. Thakkar, Y. Tokura, 2022, Update to RIFM Fragrance Ingredient Safety Assessment, Eugenol, CAS Registry Number 97-53-0, <i>Food and Chemical Toxicology</i> , 163: 113027, DACO: 4.1,4.2.1,4.2.3,4.2.4,4.2.5,4.2.6,4.3.1, 4.5.2, 4.5.4,4.5.5,9.3.1,9.5.1,9.8.1
3471779	A. M. Api, D. Belsito, D. Botelho, M. Bruze, G. A. Burton Jr., M. A. Cancellieri, H. Chon, M. L. Dagli, M. Date, W. Dekant, C. Deodhar, A. D. Fryer, L. Jones, K. Joshi, M. Kumar, A. Lapczynski, M. Lavelle, I. Lee, D. C. Liebler, H. Moustakas, M. Na, T. M. Penning, G. Ritacco, J. Romine, N. Sadekar, T. W. Schultz, D. Selechnik, F. Siddiqi, I. G. Sipes, G. Sullivan, Y. Thakkar, Y. Tokura, 2022, RIFM Fragrance Ingredient Safety Assessment, Geraniol, CAS Registry Number 106-24-1, <i>Food and Chemical Toxicology</i> ,

- 167: 113341, DACO: 4.1,4.2.1,4.2.2,4.2.3,4.2.4,4.2.5,4.2.6,4.3.1,4.5.2,4.5.4, 4.5.5,9.3.1,9.5.1,9.8.1
- 3471780 The Research Institute of Fragrance Materials (RIFM) Expert Panel, D. Belsito, D. Bickers, M. Bruze, P. Calow, H. Greim, J. M. Hanifin, A.E. Rogers, J. H. Saurat, I. G. Sipes, H. Tagami, 2008, A Toxicologic and Dermatologic Assessment of Cyclic and Non-Cyclic Terpene Alcohols When Used as Fragrance Ingredients, Food and Chemical Toxicology, 46(suppl 11), S1-S71, DACO: 4.1,4.2.1,4.2.2,4.2.3,4.2.4,4.2.5,4.2.6,4.3.1,4.5.2,4.5.4,4.5.5, 9.7
- 3472293 Joint FAO/WHO Expert Committee on Food Additives (JECFA), 1998, Safety Evaluation of Certain Food Additives and Contaminants: WHO Food Additive Series, 40, DACO: 4.2.1,4.2.2,4.2.3,4.2.4,4.2.5,4.2.6,4.3.1,4.5.2, 4.5.4,4.5.5,4.5.7,9.7
- 3615203 E. W. Schafer, Jr., W. A. Bowles, Jr., 1985, Acute Oral Toxicity and Repellency of 933 Chemicals to House and Deer Mice, Archives of Environmental Contamination and Toxicology, 14(1): 111-129, DACO: 4.2.1,9.7
- 3641697 European Chemicals Agency (ECHA), 2024, Phenethyl Propionate, DACO: 4.2.1,4.2.2,9.7
- 3713242 European Chemicals Agency (ECHA), 2025, Registration Dossier - ECHA Endpoint Summary, DACO: 4.2.3,9.7

#### 4.0 Value

PMRA Document Number	Reference
3280003	2021, 10.1-Japanese Beetle Trap Value Summary-04oct2021, DACO: 10.1, 10.2.1,10.2.2,10.2.3.1,10.2.4,10.3.1,10.3.2,10.4,10.5,10.5.2,10.5.3,10.5.4
3280004	2021, Trapping Efficacy of Rescue Japanese Beetle Traps: How Fast do the Traps Start Catching the Beetles?, DACO: 10.2.3.3(C)
3280008	2007, Bull Run Japanese Beetle Trap Attractant: Field Bioassays to Evaluate Storage Stability and Effects on Non-Target Organisms and Laboratory Evaluation of Corrosion Characteristics, DACO: 10.2.3.3(C),3.5.10,3.5.14
3500925	2023, Supporting Study and Data to Address the Deficiencies Listed in DACO 5.2.4: Use Description Scenario (Application and Post-Application), DACO: 5.2,10.2

**B. Additional Information Considered****i) Published Information****1.0 Chemistry**

<b>PMRA Document Number</b>	<b>Reference</b>
3744614	Lewis, K.A., Tzilivakis, J., Warner, D. and Green, A., 2016, An International Database for Pesticide Risk Assessments and Management, DACO: 2.14.10

**2.0 Human and Animal Health**

<b>PMRA Document Number</b>	<b>Reference</b>
3713034	European Food Safety Authority (EFSA), 2012, Conclusion on the Peer Review of the Pesticide Risk Assessment of the Active Substance Plant Oils/Clove Oil, EFSA Journal 10(1): 2506, DACO: 12.5,4.2.1,4.2.4,4.2.5, 4.2.6,4.3.1,4.5.2,4.5.9
3713037	European Chemicals Agency (ECHA), 2022, ECHA Registration Dossier 2022. Review of Clark et al., 1988, DACO: 4.2.3
3713106	European Chemicals Agency (ECHA), 2016, ECHA Registration Dossier 2016. Summary of prenatal developmental toxicity study, DACO: 4.5.2

**3.0 Environment**

<b>PMRA Document Number</b>	<b>Reference</b>
3654317	PubChem, 2024, Eugenol - Environmental Fate, DACO: 8.6
3654318	PubChem, 2024, Eugenol - Ecotoxicity, DACO: 9.9
3654321	PubChem, 2024, Geraniol - Environmental Fate, DACO: 8.6
3654322	PubChem, 2024, 2-Phenethyl Propionate - Environmental Fate, DACO: 8.6
3654326	Dingfei Hu, Joel Coats, 2008, Evaluation of the Environmental Fate of Thymol and Phenethyl Propionate in the Laboratory, Pest Management Science, 64: 775-779, DACO: 8.6
3654327	PubChem, 2024, 2-Phenethyl Propionate - Ecotoxicity, DACO: 9.9
3654328	2024, US Environmental Protection Agency & Syracuse Research Corporation, Nuranone - Atmospheric Half-lives (AOPWIN v1.92) and K <sub>OC</sub> (KOCWIN v2.00), DACO: 8.6
3718767	Sober, H., Hollander, F., and Sober, E. K., 1950, Toxicity of Eugenol: Determination of LD <sub>50</sub> on Rats, Proceedings of the Society for Experimental Biology and Medicine, 83(1): 148-151, DACO: 4.2.1,9.7