# M E M O R A N D U M

TO: Anson Main, PhD, Manager
Surface Water Protection Program
Environmental Monitoring Branch

VIA: Shelley DuTeaux, PhD MPH, Chief
Human Health Assessment Branch

FROM: Chunbo Zhang, PhD, Staff Toxicologist
Pete Lohstroh, PhD, Senior Toxicologist
Toxicology and Dose Response Assessment Section

Svetlana Koshlukova, PhD, Senior Toxicologist
Risk Assessment Section

DATE: August 20, 2025

SUBJECT: HUMAN HEALTH REFERENCE LEVELS FOR CARFENTRAZONE-ETHYL IN SURFACE WATER

On September 18, 2023, the Department of Pesticide Regulation's (DPR) Surface Water Protection Program (SWPP) of the Environmental Monitoring Branch (EMB) requested the Human Health Assessment Branch (HHA) conduct a formal evaluation of the human health impacts from carfentrazone-ethyl residues in surface water as part of the registration evaluation for a new major use on added use sites in California including rice. HHA developed Human Health Reference Levels (HHRLs) for carfentrazone-ethyl in surface water to support SWPP's evaluation on whether anticipated carfentrazone-ethyl residues in drinking water might pose a risk to human health (DPR, 2024a).

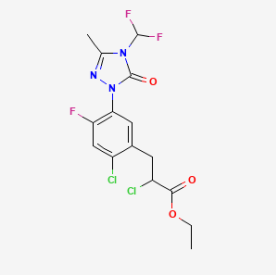
## Conclusions and Recommendations:

1. HHA calculated Human Health Reference Levels (HHRLs) to be used for detected or model-estimated concentrations of carfentrazone-ethyl in surface water using (1) acute and chronic consumption rates for drinking water from the National Health and Nutrition Examination Survey (NHANES) 2005–2010 database; and (2) toxicological endpoints established by the United States Environmental Protection Agency (US EPA).
2. Carfentrazone-ethyl and its degradates carfentrazone-chloropropionic acid and carfentrazone-ethyl cinnamic acid are the residues of concern in drinking water. They are considered toxicologically equivalent and should be summed when detected in the same samples.

3. A DPR Acute Surface Water HHRL of carfentrazone-ethyl at 2632 parts per billion (ppb) applies to the evaluation of **maximum** residue levels of carfentrazone-ethyl in surface water. Concentrations of carfentrazone-ethyl equal to or less than 2632 ppb are not expected to pose an acute risk to human health, including for sensitive subpopulations.
4. A DPR Chronic Surface Water HHRL at 60 ppb for carfentrazone-ethyl applies to the evaluation of **average** residue levels in surface water. Average concentrations of carfentrazone-ethyl in surface water equal to or less than 60 ppb are not expected to pose a chronic risk to human health, including for sensitive subpopulations.

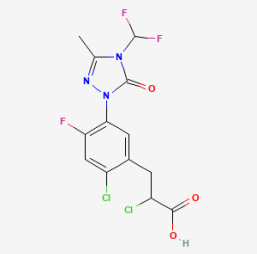
## Background

**Technical Name:** Carfentrazone-ethyl
**Chemical Name:** ethyl 2-chloro-3-[2-chloro-5-[4-(difluoromethyl)-3-methyl-5-oxo-1,2,4-triazol-1-yl]-4-fluorophenyl]propanoate
**Chemical Abstracts Service Registry Number (CAS #):** 128639-02-1
**Molecular Weight:** 412.2 g/mol (NIH, 2025a)
**Chemical Structure:**



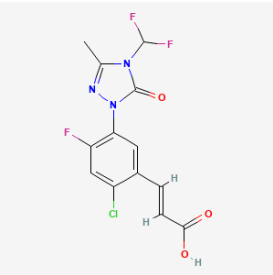
(NIH, 2025a)

**Technical Name:** Carfentrazone-chloropropionic acid (carfentrazone acid/carfentrazone)
**Chemical Name:** 2-chloro-3-[2-chloro-5-[4-(difluoromethyl)-3-methyl-5-oxo-1,2,4-triazol-1-yl]-4-fluorophenyl]propanoic acid
**Chemical Abstracts Service Registry Number (CAS #):** 128621-72-7
**Molecular Weight:** 384.13 g/mol (NIH, 2025b)
**Chemical Structure:**



(NIH, 2025b)

**Technical Name:** F8426-cinnamic acid (Carfentrazone-ethyl cinnamic acid)
**Chemical Name:** (E)-3-[2-chloro-5-[4-(difluoromethyl)-3-methyl-5-oxo-1,2,4-triazol-1-yl]-4-fluorophenyl]prop-2-enoic acid
**Chemical Abstracts Service Registry Number (CAS #):** NA
**Molecular Weight:** 347.68 g/mol (NIH, 2025c)
**Chemical Structure:**



(NIH, 2025c)

Carfentrazone-ethyl is a post-emergent and contact herbicide for control of broadleaf weeds on a variety of agricultural crops, turf (such as golf courses and residential lawns), aquatic areas (including water bodies and wetlands), and industrial and utility sites (US EPA, 2017a; US EPA, 2017b). Based on the herbicidal mode of action, carfentrazone-ethyl is classified as a protoporphyrinogen oxidase (PPO) inhibitor that disrupts chlorophyll and heme biosynthesis (US EPA, 2016e; US EPA, 2017e). As a member of the Light Dependent Peroxidizing Herbicides (LDPH) class, it can act via the light dependent peroxidizing (LDP) mode of action to enhance toxicity under solar ultraviolet light (US EPA, 2016e; US EPA, 2017b).

Carfentrazone-ethyl was first registered by US EPA in 1985 and by DPR for use in California in 1998 (DPR, 2025c; US EPA, 2025h). As of August 2025, there were 27 products actively registered for use in California (DPR, 2025e). According to the most recent available data from the DPR's Pesticide Use Reporting (PUR) database, 12,237 pounds of carfentrazone-ethyl active ingredient were used in 18,640 California agricultural applications in 2022 (DPR, 2022).

Residues of concern in drinking water are the parent carfentrazone-ethyl and its degradates carfentrazone-chloropropionic acid and carfentrazone-ethyl cinnamic acid (US EPA, 2015c; US EPA, 2016a). Based on the limited toxicity data, these degradates appear to be of equal toxicity to the parent carfentrazone-ethyl (EFSA, 2016). Carfentrazone-chloropropionic acid and carfentrazone-ethyl cinnamic acid are considered toxicologically equivalent to carfentrazone-ethyl (EFSA, 2016; US EPA, 2016a; eCFR, 2025).

## Review of Regulatory Documents and Databases

A review of pertinent regulatory documents was performed to ensure that the most scientifically supportable toxicological data were used for this evaluation (summarized in Table 1, below). A comprehensive systematic review was beyond the scope of the request.

**Table 1. Review of Regulatory Documents and Databases**

| Regulatory Agency | Year | Title | Reference(s) |
|---|---|---|---|
| US EPA | 1997 | CARFENTRAZONE-ETHYL - 128712. Addendum to the July 15, 1997. Health Effects Division Risk Characterization Document for Use of Carfentrazone-ethyl (128712) in/on Corn and Wheat (PP#6G4615) | US EPA, 1997 |
| US EPA | 1998 | Pesticide Fact Sheet. Name of Chemical: Carfentrazone-ethyl. Reason for Issuance: New Chemical Registration. Date Issued: September 30, 1998 | US EPA, 1998 |
| US EPA | 2000 | Methodology for Deriving Ambient Water Quality Criteria for the Protection of Human Health (2000) | US EPA, 2000 |
| US EPA | 2001 | Water Holding Time for Rice Use of Carfentrazone-ethyl, and Protocol for Fish Early Life Stage Study, PC Code: 128712 | US EPA, 2001 |
| DPR | 2009 | Guidance for Dietary Exposure Assessment | DPR, 2009 |
| US EPA | 2010 | Carfentrazone Ethyl (128712) Screening Level Usage Analysis (SLUA) | US EPA, 2010 |
| US EPA | 2011 | Carfentrazone-ethyl Final Work Plan Registration Review Case# 7422 | US EPA, 2011a |
| US EPA | 2011 | Carfentrazone-ethyl Summary Document Registration Review: Initial Docket | US EPA, 2011b |
| US EPA | 2011 | Carfentrazone-ethyl. Corrected Human-Health Assessment Scoping Document in Support of Registration Review | US EPA, 2011c |
| US EPA | 2011 | Response to Public Comments on the Registration Review Preliminary Problem Formulation for Environmental Fate, Ecological Risk, Endangered Species, and Drinking Water Exposure Assessments for Carfentrazone-ethyl | US EPA, 2011d |
| US EPA | 2012 | Carfentrazone-ethyl. Section 3 Registration for Application to the Nongrass Animal Feed Crop Group 18. Human-Health Risk Assessment | US EPA, 2012 |
| US EPA | 2014 | Dietary Exposure Evaluation Model User's Guide | US EPA, 2014 |

**Table 1. Review of Regulatory Documents and Databases**

| Regulatory Agency | Year | Title | Reference(s) |
|---|---|---|---|
| US EPA | 2015 | Carfentrazone-ethyl. Section 3 Registration for Application to Globe Artichoke, Asparagus, Mint, Psyllium, Quinoa, and Teff and Updating the Crop Group (CG) or Subgroup (CSG) Designation for Bulb Vegetables (CG 3-07); Fruiting Vegetables (CG 8-10); Citrus (CG 10-10); Pome Fruit (CG 11-10); Stone Fruit (CG 12-12); Caneberry (CSG 13-07A); Bushberry (CSG 13-07B); Fruit, Small Vine Climbing, Except Fuzzy Kiwifruit (CSG 13-07F); Berry, Low Growing (CSG 13-07G); Tree Nuts (CG 14-12); and Oilseed (CG 20). Dietary Exposure Assessment | US EPA, 2015a |
| US EPA | 2015 | Carfentrazone-ethyl. Section 3 Registration for Application to Globe Artichoke, Asparagus, Mint, Psyllium, Quinoa, and Teff and Updating the Crop Group (CG) or Subgroup (CSG) Designation for Bulb Vegetables (CG 3-07); Fruiting Vegetables (CG 8-10); Citrus (CG 10-10); Pome Fruit (CG 11-10); Stone Fruit (CG 12-12); Caneberry (CSG 13-07A); Bushberry (CSG 13-07B); Fruit, Small Vine Climbing. Except Fuzzy Kiwifruit (CSG 13-07F); Berry, Low Growing (CSG 13-07G); Tree Nuts (CG 14-12); and Oilseed (CG 20). Summary of Analytical Chemistry and Residue Data | US EPA, 2015b |
| US EPA | 2015 | Carfentrazone-ethyl: Drinking Water Exposure Assessment of Section 3 Proposed Label Amendments for New Uses, Expansions from Representative Crops and Crop Group Conversions | US EPA, 2015c |
| US EPA | 2015 | Carfentrazone-ethyl: Human Health Risk Assessment in Support of Application to Globe Artichoke, Asparagus, Mint, Psyllium, Quinoa, and Teff and Updates to Several Crop Group (CG) or Subgroup (CSG) Designations | US EPA, 2015d |
| US EPA | 2015 | Human Health Ambient Water Quality Criteria: 2015 Update | US EPA, 2015e |
| EFSA | 2016 | Peer Review of the Pesticide Risk Assessment of the Active Substance Carfentrazone-ethyl | EFSA, 2016 |
| US EPA | 2016 | Carfentrazone-ethyl: Draft Human Health Risk Assessment for Registration Review | US EPA, 2016a |
| US EPA | 2016 | Carfentrazone-ethyl: Drinking Water Exposure Assessment for Registration Review | US EPA, 2016b |
| US EPA | 2016 | Carfentrazone-ethyl: Preliminary Ecological Risk Assessment for Registration Review | US EPA, 2016c |
| US EPA | 2016 | Environmental Protection Agency. 40 CFR Part 180 [EPA–HQ–OPP–2015–0030; FRL–9942–47]. Carfentrazone-ethyl; Pesticide Tolerances | US EPA, 2016d |
| US EPA | 2016 | Guidance on Light-Dependent Peroxidizing Herbicides: Use of the Molar Threshold Value for Adjusting Fish Chronic Endpoints to Account for Ultraviolet Light-enhanced Toxicity | US EPA, 2016e |

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| Regulatory Agency | Year | Title | Reference(s) |
|---|---|---|---|
| US EPA | 2017 | Benefits Assessment of Carfentrazone-ethyl (PC Code: 128712). | US EPA, 2017a |
| US EPA | 2017 | Carfentrazone-ethyl Interim Registration Review Decision Case Number 7226 | US EPA, 2017b |
| US EPA | 2017 | Carfentrazone-ethyl Proposed Interim Registration Review Decision Case Number 7422 | US EPA, 2017c |
| US EPA | 2017 | Response to Public Comments on the Carfentrazone-ethyl Preliminary Ecological Risk Assessment for Registration Review | US EPA, 2017d |
| US EPA | 2017 | Triazolones (Propoxycarbazone-sodium and Thiencarbazone-methyl): Screening Analysis of Toxicological Profiles to Consider Whether a Candidate Common Mechanism Group Can Be Established | US EPA, 2017e |
| US EPA | 2018 | 2018 Edition of the Drinking Water Standards and Health Advisories Tables | US EPA, 2018a |
| US EPA | 2018 | Label Review Manual, Chapter 7: Precautionary Statements | US EPA, 2018b |
| DPR | 2021 | Evaluating Risk from Exposure to Illegal Pesticides on Fresh Agricultural Commodities | DPR, 2021 |
| US EPA | 2021 | 2021 Human Health Benchmarks for Pesticides | US EPA, 2021a |
| US EPA | 2021 | Human Health Benchmarks for Pesticides: Updated 2021 Technical Document | US EPA, 2021b |
| DPR | 2022 | 2022 Annual Statewide Pesticide Use Report Chemical Totals | DPR, 2022 |
| DPR | 2023 | Evaluation Report - Pesticide: Carfentrazone-ethyl | DPR, 2023 |
| US EPA | 2023 | List of Conventional Registration Review Chemicals for Which an FFDCA Section 408(p)(6) Determination is Needed | US EPA, 2023 |
| DPR | 2024 | Evaluation Report - Pesticide: Carfentrazone-ethyl | DPR, 2024a |
| DPR | 2024 | Summary of Toxicology Data: Carfentrazone-ethyl | DPR, 2024b |
| USGS | 2024 | Health-Based Screening Levels for Evaluating Water-Quality Data | USGS, 2024 |
| DPR | 2025 | California Code of Regulations Title 3. Food and Agriculture Division 6. Pesticides and Pest Control Operations | DPR, 2025a |
| DPR | 2025 | California Pesticide Illness Query CalPIQ | DPR, 2025b |
| DPR | 2025 | CalPEST | DPR, 2025c |
| DPR | 2025 | Environmental Monitoring | DPR, 2025d |
| DPR | 2025 | Search for Chemical Ingredient by Partial Name, Chemical Code or CAS Number | DPR, 2025e |
| eCFR | 2025 | Code of Federal Regulation. § 180.515 Carfentrazone-ethyl; Tolerances for Residues | eCFR, 2025 |
| OEHHA | 2025 | The Proposition 65 List | OEHHA, 2025a |
| OEHHA | 2025 | Public Health Goals (PHGs) | OEHHA, 2025b |

**Table 1. Review of Regulatory Documents and Databases**

| Regulatory Agency | Year | Title | Reference(s) |
|---|---|---|---|
| US EPA | 2025 | CompTox Chemicals Dashboard: Carfentrazone-ethyl | US EPA, 2025a |
| US EPA | 2025 | CompTox Chemicals Dashboard: Carfentrazone | US EPA, 2025b |
| US EPA | 2025 | Endocrine Disruptor Screening Program (EDSP) Estrogen Receptor Bioactivity | US EPA, 2025c |
| US EPA | 2025 | Human Health Water Quality Criteria and Methods for Toxics | US EPA, 2025d |
| US EPA | 2025 | Incident Data System (IDS) - Incidents Submitted in Aggregate | US EPA, 2025e |
| US EPA | 2025 | Integrated Risk Information System (IRIS) Glossary | US EPA, 2025f |
| US EPA | 2025 | National Primary Drinking Water Regulations | US EPA, 2025g |
| US EPA | 2025 | Pesticide Chemical Search: Carfentrazone-ethyl | US EPA, 2025h |
| US EPA | 2025 | Provisional Peer-Reviewed Toxicity Values (PPRTVs) Assessments | US EPA, 2025i |

DPR: Department of Pesticide Regulation; eCFR: online version of Code of Federal Regulation; EFSA: European Food Safety Authority; OEHHA: Office of Environmental Health Hazard Assessment; US EPA: United States Environmental Protection Agency; USGS: United States Geological Survey.

## Summary of Toxicology

Carfentrazone-ethyl has an acute Toxicity Category[1] value of IV for oral and inhalation hazards and Toxicity Category III for dermal hazards based on median lethal doses. It is not a skin sensitizer nor a skin or eye irritant (Toxicity Category IV) (US EPA, 2015d). US EPA classified carfentrazone-ethyl as "not likely to be carcinogenic to humans" based on negative data in carcinogenicity studies in rats and mice and in mutagenicity studies (US EPA, 2015d).

Carfentrazone-ethyl is not included on the Proposition 65 (the California Safe Drinking Water and Toxic Enforcement Act of 1986) list for chemicals known to cause cancer, reproductive toxicity, or developmental toxicity (OEHHA, 2025a).

Like other PPO inhibitor pesticides, carfentrazone-ethyl's primary toxicity targets are the hematopoietic system and liver (US EPA, 2015d; US EPA, 2017e). Subchronic oral toxicity studies in rats, mice, and dogs showed hematopoietic changes (decreased mean corpuscular hemoglobin and mean corpuscular volume), liver lesions (increased liver weights, hepatic

[1] Acute Toxicity Categories. US EPA Label Review Manual Chapter 7: Precautionary Statements. US Environmental Protection Agency, Office of Pesticide Programs, Registration Division. Revised March 2018. Available at https://www.epa.gov/sites/default/files/2018-04/documents/chap-07-mar-2018.pdf.

pigment deposition, hepatocytomegaly, cell necrosis, and/or cell mitosis), and increased urinary porphyrin excretion (US EPA, 2011c; US EPA, 2015d). Similarly, increased urinary porphyrin excretion was observed in chronic studies in rats and dogs and liver histopathology in rats and mice (US EPA, 2015d).

DPR's Pesticide Illness Surveillance Program (PISP) maintains a database of pesticide-related illnesses and injuries reported in California from 1992 to 2022 (the most recent data available). There were thirty-three reported cases involving exposure to carfentrazone-ethyl in combination with other active ingredients and one case for carfentrazone-ethyl alone (DPR, 2025b). In the case with carfentrazone-ethyl alone, the person experienced facial itchiness and a headache (DPR, 2025b).

HHA has evaluated all required toxicity data submitted as part of registration for carfentrazone-ethyl in California but has not conducted a human health risk assessment (DPR, 2024b). For purposes of this evaluation, HHA reviewed relevant regulatory documents (Table 1) and adopted toxicological endpoints established by US EPA (US EPA, 2011c; US EPA, 2015d). US EPA has not published an acute point of departure (POD[2]) for carfentrazone-ethyl (US EPA, 2015d). Therefore, HHA adopted the incidental oral POD (short- and intermediate-term) established by US EPA for the acute POD. This value was a no observed effect level (NOEL) of 50 mg/kg/day based on decreased bodyweight gains and increased urinary porphyrin levels at the lowest observed effect level (LOEL) of 150 mg/kg/day in a 90-day oral toxicity study in dogs (US EPA, 2015d). The NOEL was divided by a total uncertainty factor ($UF_{TOTAL}$) of 100 to calculate an acute reference dose (aRfD[3]) of 0.50 mg/kg/day. The $UF_{TOTAL}$ included 10x for interspecies extrapolation ($UF_A$) and 10x for intraspecies variation ($UF_H$) (US EPA, 2011c; US EPA, 2015d). HHA also uses this carfentrazone-ethyl aRfD for evaluating risk from illegal residues on fresh produce for the California Pesticide Residue Monitoring Program (DPR, 2021). The chronic POD established by US EPA was a NOEL of 3 mg/kg/day based on liver histopathology (increases in microscopic red fluorescence and pigmentation) and increased urinary porphyrin levels at the LOEL of 12 mg/kg/day in a combined chronic/carcinogenicity study in rats (US EPA, 2011c; US EPA, 2015d; US EPA, 2015a; DPR, 2024b). This chronic POD was divided by 10x for $UF_A$ and 10x for $UF_H$ to calculate a chronic RfD (cRfD) of 0.03 mg/kg/day (US EPA, 2011c; US EPA, 2015d).

[2] Point of departure (POD) is the dose-response point that marks the beginning of a low-dose extrapolation. A POD can be the lower bound dose for an estimated incidence or from a dose-response model (BMD), or a NOAL/NOAEL. Available at https://www.epa.gov/iris/iris-glossary.

[3] An RfD is an estimate of a daily oral exposure for specific duration (acute or chronic) to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects during a lifetime. Available at https://www.epa.gov/iris/iris-glossary.

## Calculation of Human Health Reference Levels

An HHRL is the threshold pesticide residue level for a maximum water intake that results in the maximum safe oral exposure. HHRLs were calculated using the acute and chronic RfDs for carfentrazone-ethyl as the maximum safe exposure, and the acute (95$^{th}$ percentile) and chronic (mean) drinking water intake rates for non-nursing infants as the maximum water intake. Non-nursing infants are the population identified as having the highest consumption of drinking water per kilogram of bodyweight among the standard populations that HHA evaluates, including the general US population and other sensitive subpopulations such as children 1–2 years of age and women of childbearing age (13–49 years). The water consumption rates were extracted from the Dietary Exposure Evaluation Model - Food Commodity Intake Database (DEEM-FCID, version 4.02, 05-10-c) and the What We Eat in America (WWEIA) database. WWEIA is the dietary intake interview component of the National Health and Nutrition Examination Survey (NHANES). It is a collection of two-day dietary survey data (including drinking water consumption) from 2005 to 2010 for the US population and select subgroups (US EPA, 2014). HHA uses the 95$^{th}$ percentile exposure levels for each population subgroup as the default upper bound for acute exposures, while two-day nonconsecutive food intake is used as a surrogate for chronic consumption patterns (DPR, 2009).

### *Formulae Used to Calculate Acute and Chronic Surface Water HHRLs*

$$\text{Acute Surface Water HHRL (ppb)} = \frac{\text{acute RfD}}{\text{acute DWI}} \times 1000$$

$$\text{Chronic Surface Water HHRL (ppb)} = \frac{\text{chronic RfD}}{\text{chronic DWI}} \times 1000 \times \text{RSC}$$

DWI, drinking water intake, is 95$^{th}$ percentile (acute) or mean (chronic) water consumption rates for non-nursing infants as described above. Acute and Chronic DEEM-FCID results for a residue level of 1 ppm consumption defaulted to the DWI rates by dimensional analysis (acute = 0.194566 L water/kg BW and chronic = 0.099559 L water/kg BW/day) (US EPA, 2014). These DWI values were then rounded to two decimal points for the calculation of HHRLs (0.19 and 0.10 L water/kg BW) (Table 2).

DPR Chronic Surface Water HHRLs incorporate a relative source contribution (RSC) factor of 0.2. The RSC factor accounts for the possibility that exposure to a pesticide residue may come from sources other than drinking water (*i.e.*, food and air). A default RSC of 0.2 assumes that the exposure from water sources will be 20% of the total exposure while other intakes will make up the remainder (80%). The RSC is routinely used by regulatory agencies for deriving chronic drinking water screening levels (US EPA, 2000; US EPA, 2015e; US EPA, 2025d).

***DPR Acute Surface Water Human Health Reference Level for Carfentrazone-ethyl***

A DPR Acute Surface Water HHRL is for screening maximum pesticide residue levels in surface water. HHA calculated a DPR Acute Surface Water HHRL of **2632** ppb for carfentrazone-ethyl in surface water (Table 2). Maximum residue concentrations of carfentrazone-ethyl in surface water equal to or less than 2632 ppb are not expected to pose an acute risk to human health, including for sensitive subpopulations.

***DPR Chronic Surface Water Human Health Reference Level for Carfentrazone-ethyl***

A DPR Chronic Surface Water HHRL applies to the evaluation of average pesticide residue levels in a surface water body. HHA calculated a DPR Chronic Surface Water HHRL of **60** ppb for screening average carfentrazone-ethyl concentrations in surface water (Table 2). Average residue concentrations in surface water equal to or less than 60 ppb are not expected to pose a chronic risk to human health, including for sensitive subpopulations.

**Table 2. DPR Surface Water HHRLs[a] for Carfentrazone-ethyl[b]**

| Residue | Acute or Chronic | Water Consumption Rates for Non-Nursing Infants (L water/kg BW) | RfD (mg/kg/day) | HHRL (ppb) | US EPA Chronic HHBP[c] (ppb) |
|---|---|---|---|---|---|
| Carfentrazone-ethyl | Acute (maximum residues) | 0.19 | 0.50 | **2632** | 200 (General Population) |
| | Chronic (average residues) | 0.10 | 0.03 | **60** | |

BW: bodyweight; DPR: Department of Pesticide Regulation; HHBP: Human Health Benchmark for Pesticides; HHRL: Human Health Reference Level; L: liter; RfD: reference dose; ppb: parts per billion; US EPA: United States Environmental Protection Agency.

[a] The formulae for HHRL calculation are shown in the text.

[b] The residues of concerns in drinking water are the parent carfentrazone-ethyl and its degradates carfentrazone-chloropropionic acid and carfentrazone-ethyl cinnamic acid. They are considered toxicologically equivalent and should be summed if they are detected in the same samples (EFSA, 2016; US EPA, 2016a; eCFR, 2025).

[c] In 2021, US EPA provided Human Health Benchmark for Pesticides (HHBPs) containing 430 pesticides that currently have no federal drinking water standards. HHBPs are not legally enforceable, but rather are provided by US EPA for pesticides that have no drinking water standards or health advisories (US EPA, 2021a). Chronic HHBP for General Population (ppb) = [chronic RfD (mg/kg/day) x 1000 x 0.2 RSC] / [0.0338 (L/kg/day) of drinking water intake-BW ratio].

The recommended HHRLs for screening carfentrazone-ethyl residues in surface water are **bolded**.

**Other Reference or Regulatory Levels for Carfentrazone-ethyl in Drinking Water**

DPR considers other reference and regulatory levels for drinking water in the development of HHRLs, especially with regards to maintaining current best practices for dietary and drinking water exposure assessments. Common federal reference levels for drinking water include US EPA enforceable Maximum Contaminant Levels (MCLs[4]), non-legally enforceable Health Advisories (HAs[5]), and Human Health Benchmark for Pesticides (HHBPs[6]), and United States Geological Survey (USGS) Health-Based Screening Levels (HBSLs[7]) (US EPA, 2018a; US EPA, 2021a; USGS, 2024). For carfentrazone-ethyl, US EPA issued a chronic HHBP of 200 ppb for the general population (US EPA, 2021a). Although the chronic HHBP and the DPR Chronic Surface Water HHRL for carfentrazone-ethyl are both based on the same chronic POD, their values differ because they were calculated using different parameters/assumptions such as water consumption rates.

[4] Maximum Contaminant Levels (MCLs) are used for the protection of public drinking water systems and do not apply to privately owned wells or any other individual water system. Available at https://www.epa.gov/system/files/documents/2022-01/dwtable2018.pdf.

[5] Health Advisories (HAs) are estimated acceptable drinking water levels for chemicals based on information of adverse health effects and are not legally enforceable federal standards, but rather serve as technical references to be used by federal, state, and local officials. Available at https://www.epa.gov/system/files/documents/2022-01/dwtable2018.pdf.

[6] The 2021 US EPA Human Health Benchmark for Pesticides (HHBPs) contain 430 pesticides that currently have no federal drinking water standards. HHBPs are not legally enforceable, but rather are provided by US EPA for pesticides that have no drinking water standards or health advisories (HAs). Available at https://www.epa.gov/system/files/documents/2021-07/hh-benchmarks-technical-document-2021.pdf.

[7] Health-Based Screening Levels (HBSLs) are "non-enforceable water-quality benchmarks" that were developed using (1) the latest US EPA Office of Water methods for establishing drinking-water guidelines and (2) the most recent US EPA peer-reviewed publicly available toxicity information. Available at https://water.usgs.gov/water-resources/hbsl/.

**Conclusions**

HHA calculated Human Health Reference Levels (HHRLs) to be used for carfentrazone-ethyl in surface water. Maximum residue concentrations of carfentrazone-ethyl equal to or less than the DPR Acute Surface Water HHRL of 2632 ppb, or average residue concentrations equal to or less than the DPR Chronic Surface Water HHRL of 60 ppb in surface water are not expected to pose a risk to human health, including for sensitive subpopulations. Carfentrazone-ethyl and its degradates carfentrazone-chloropropionic acid and carfentrazone-ethyl cinnamic acid are the residues of concern in drinking water, are considered toxicologically equivalent, and should be summed when they are detected in the same samples.

Chunbo Zhang

**Chunbo Zhang, PhD**
**Staff Toxicologist, Toxicology and Dose Response Assessment Section**

Peter N. Lohstroh

**Peter N. Lohstroh, PhD**
**Senior Toxicologist, Toxicology and Dose Response Assessment Section**

Svetlana Koshlukova

**Svetlana Koshlukova, PhD**
**Senior Toxicologist, Risk Assessment Section**

**References**

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DPR 2021. Evaluating Risk from Exposure to Illegal Pesticides on Fresh Agricultural Commodities. Department of Pesticide Regulation, California Environmental Protection Agency, Sacramento, CA.

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DPR 2023. Evaluation Report - Pesticide: Carfentrazone-ethyl. Human Health Assessment Branch. Department of Pesticide Regulation, California Environmental Protection Agency, Sacramento, CA.

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