

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
WASHINGTON, D.C. 20460



OFFICE OF CHEMICAL SAFETY  
AND POLLUTION PREVENTION


**MEMORANDUM**

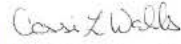

**DATE:** April 20, 2021

**SUBJECT:** **Saflufenacil:** Summary of the Hazard and Science Policy Council (HASPOC)  
E-Submission: Recommendations on the need for a Subchronic Inhalation Study.

**PC Code:** 118203  
**Decision No.:** N/A  
**Petition No.:** N/A  
**Risk Assessment Type:** N/A  
**TXR No.:** 0058170  
**MRID No.:** N/A

**DP Barcode:** N/A  
**Registration No.:** N/A  
**Regulatory Action:** N/A  
**Case No.:** N/A  
**CAS No.:** 372137-35-4  
**40 CFR:** N/A

**FROM:** Victoria Kurker, Executive Secretary   
Hazard and Science Policy Council (HASPOC)  
Health Effects Division (HED; 7509P)

**THROUGH:** Cassi Walls, Co-Chair   
Whang Phang, Co-Chair   
Hazard and Science Policy Council (HASPOC)  
Health Effects Division (HED; 7509P)

**TO:** Anwar Dunbar, Ph.D., Pharmacologist  
Rosanna Louie-Juzwiak, Acting Branch Chief  
Risk Assessment Branch I  
Health Effects Division (HED; 7509P)

**MEETING ATTENDEES:**

HASPOC Members: Whang Phang, Cassi Walls, Victoria Kurker, and Mike Metzger

Presenter: Anwar Dunbar  
Other Attendees: Lata Venkateswhara

## I. PURPOSE OF MEETING:

A waiver for a subchronic inhalation study for saflufenacil was previously recommended by the agency (TXR 0056720, A. Dunbar et al., 02-AUG-2013). Risk Assessment Branch 1 (RAB1) re-evaluated the saflufenacil inhalation exposure scenarios for registration review and determined that there were risks where the Margins of Exposure (MOEs) for some occupational scenarios were below 1,000 which is 10X of the level of concern (LOC) of 100 (draft ORE memo).

Risk Assessment Branch I (RAB I) is currently preparing an assessment for the active ingredient saflufenacil for registration review. Based on the current 40 CFR Part 158 Toxicology Data Requirements and the potential for repeated occupational exposure to saflufenacil, an inhalation toxicity study may be required. At the request of RAB I, the Hazard and Science Policy Council (HASPOC) conducted an e-review to determine the need for a 28-day inhalation toxicity study to support the registered uses of saflufenacil.

## II. SUMMARY OF USE PROFILE & PREVIOUS RISK ASSESSMENT:

Saflufenacil (2-Chloro-5-[3,6-dihydro-3-methyl-2,6-dioxo-4-(trifluoromethyl)-1(2*H*)-pyrimidinyl]-4-fluoro-*N*-[[methyl(1-methylethyl)amino]sulfonyl]benzamide) is a pre- and post-emergence herbicide that acts by inhibiting chlorophyll biosynthesis through inhibition of the enzyme protoporphyrinogen (PPO). Saflufenacil is currently registered in the U.S. for use on several raw agricultural commodities including legume vegetables, citrus fruit, pome fruit, stone fruit, tree nuts, cereal grains, cotton, oilseeds, grapes, grass forage/hay/grass grown for seed, olives, soybean, pomegranate, caneberry, fig and chia. Saflufenacil is currently formulated as a water dispersible granule (WDG), emulsifiable concentrate (EC), and soluble concentrate (SC). Applications are made by air, groundboom, chemigation, and hand-held equipment at application rates ranging from 0.0167 to 0.356 lb ai/A. Short- and intermediate-term occupational inhalation exposures are expected.

A route-specific repeated exposure subchronic inhalation toxicity study is not available for saflufenacil, except for the acute inhalation toxicity study (LC<sub>50</sub> study). In previous risk assessments, the rat prenatal developmental toxicity has been used for the short- and intermediate-term inhalation endpoints. The point of departure of 5 mg/kg bw/day ( the developmental no-observed adverse-effect level; NOAEL) was based on decreased fetal body weights and increased skeletal variations at the lowest-observed adverse-effect level (LOAEL) of 20 mg/kg/day. A LOC based on MOE<100 has been previously used for occupational uses. For all registered uses of saflufenacil, occupational short- and intermediate-term inhalation baseline (no respirator) MOEs range from 9,800 to 510,000. There is no long-term use; therefore, risk assessment for long-term inhalation exposure is not required.

## III. STUDY WAIVER REQUESTS

### **a. Inhalation Study**

Previously, the Office of Pesticide Programs (OPP) used a set of criteria to determine whether or not an inhalation study could be waived. These criteria considered the scientific information available for the chemical, including its: 1) degree of irritation and corrosivity; 2) volatility; 3)

aerosol particle size; and 4) Acute Toxicity Category and extrapolated MOEs (e.g., MOEs 10 times higher than the target). In 2009, OPP developed an issue paper on risk assessment approaches for semi-volatile pesticides. As part of that issue paper, an analytical comparison was conducted of oral and inhalation experimental toxicology studies. In general, this analysis showed that the degree to which oral PODs were protective of potential inhalation toxicity varied. In many cases the oral POD was protective, but in some cases the inhalation PODs were significantly more protective. Currently, OPP uses a weight of the evidence (WOE) approach that builds upon OPP's experience using the criteria listed above and conclusions from the 2009 SAP. As approaches for route-to-route extrapolation continue to evolve and improve, OPP may incorporate additional considerations into the WOE analysis.

Inhalation exposure can be to vapors, droplets, and/or particles/dusts. The form of inhalation exposure is determined by a number of factors including physical-chemical properties, use pattern, and exposure scenarios. OPP's interim WOE approach considers:

- 1. Physical-Chemical Properties:** Vapor pressure and Henry's law constant are key considerations with respect to the volatilization after sprays have settled. Saflufenacil has a low vapor pressure ( $1.5 \times 10^{-11}$  mmHg at 25 °C) and is not likely to volatilize substantially, it also has a relatively low solubility in water. Volatilization from moist soil or water surfaces is not expected to be an important fate process for the neutral species based upon an estimated Henry's Law constant of  $4.01 \times 10^{-20}$  atm-m<sup>3</sup>/mole. However, low vapor pressure and/or Henry's law constant does not preclude exposure to aerosolized droplets or particles/dusts. Vapor pressure and Henry's law constant are key considerations with respect to volatilization after sprays have settled.
- 2. Use Pattern and Exposure Scenarios:** Any application scenario that leads to inhalation exposure to droplets needs to be considered in the WOE analysis for an inhalation toxicology study waiver request. Applications are made by air, ground boom, chemigation, and hand-held equipment at application rates ranging from 0.0167 to 0.356 lb ai/A. The following scenarios reached an MOE > 1000 with the addition of PF 10 respirator:
  - Mixing/loading/applying liquid formulation to nursery (ornamentals, vegetables, trees, container stock) at 0.0067 and 0.0285 lb ai/gallon solution with mechanically pressurized handgun.
- 3. Margins of Exposure (MOEs):** The MOE estimates for inhalation scenarios were calculated using an oral toxicity study and should be considered in the WOE analysis for an inhalation toxicology study waiver request. In the past, OPP has used MOEs of approximately 10 times higher than the LOC as a benchmark for granting waiver requests. The 2009 analysis suggests this approach is appropriate for most pesticides, but not all. Using this interim WOE approach, MOEs from 10-100 times greater than the LOC will be considered in combination with other factors discussed here. In the case of saflufenacil, the short- and intermediate-term occupational baseline (no respirator) inhalation MOEs range from 90 to 7,600,000. Saflufenacil's MOEs are mostly above 1000, which is 10X the LOC of 100, for inhalation risk assessment aside from the two

uses involving liquid formulation generating inhalation MOEs of 380 and 90 (0.0067 lb ai/gallon and 0.0285 lb ai/gallon, respectively) (mixing/loading/applying liquid formulation by mechanically pressurized handgun for nurseries). If a PF10 respirator requirement is added to the product labels for the liquid formulation, the inhalation MOEs increase to 3,800 and 900 (note, 900 is quantitatively close to HED's threshold of 1000). A summary table of the occupational exposures and MOEs for saflufenacil are provided in Appendix A.

- 4. Toxicity:** Saflufenacil has been classified as having low acute toxicity by oral, dermal, or inhalation routes of exposure (Categories III or IV). It is minimally irritating to the eyes but not to the skin and is not considered a skin sensitizer. The effects observed following repeated oral exposures to saflufenacil are consistent with the proposed mode of action involving inhibition of PPO in mammals, resulting in disruption of heme biosynthesis. Toxicological effects from subchronic and chronic toxicity studies in rats, mice and dogs consisted of decreased hematological parameters [red blood cell count (RBC), hematocrit (HCT), mean corpuscular/cell volume (MCV), mean cell hemoglobin (MCH), and mean corpuscular hemoglobin concentration (MCHC)] at about the same dose level (13-39 mg/kg/day). The hematological effects resulting from oral exposures to saflufenacil occurred around the same dose level from short- through long-term exposures without increasing in severity.

Evidence for increased pre- and/or postnatal susceptibility was noted from the developmental toxicity studies in the rat and rabbit and in the 2-generation reproduction study in the rat. Decreased fetal body weights and increased skeletal variations occurred at doses (20 mg/kg/day) that were not maternally toxic in the developmental study in rats. Similarly, in rabbits, increased liver porphyrins in fetuses were observed at doses (200 mg/kg/day) that were not maternally toxic. In the 2-generation reproductive toxicity study in rats, there was evidence of increased qualitative susceptibility based on an increased number of stillborn pups, decreased pup viability and lactation indices, decreased pre-weaning body weight and/or body-weight gain, and changes in hematological parameters at the same dose level as less severe maternal effects consisting of decrements in food intake, body weight, body-weight gain, and changes in organ weights and hematological parameters indicative of anemia.

#### IV. HASPOC CONCLUSIONS:

**The HASPOC, based on a WOE approach, concludes that a subchronic inhalation toxicity study is waived for saflufenacil at this time.** This approach considered all of the available hazard and exposure information for saflufenacil, including: (1) except for two use scenarios, saflufenacil's MOEs are above HED's LOC of 1000 for inhalation risk assessment. As currently labelled (no respirator required) inhalation MOEs for mixing/loading/applying the liquid formulation via mechanically pressurized handgun for nursery crops are 380 and 90 at application rates of 0.0067 lb ai/gallon and 0.0285 lb ai/gallon, respectively. With the addition of a PF10 respirator, these inhalation MOEs increase to 3,800 and 900 (note: 900 is quantitatively close to HED's threshold of 1,000). Therefore, a PF10 respirator requirement should be added to the product labels for these nursery uses.

**In the absence of modified labels, a 10X database uncertainty factor will be applied to inhalation scenarios and an inhalation study will be required.**

## Appendix A

Appendix A Occupational Handler Non-Cancer Exposure and Risk Estimates for Saflufenacil.														
Exposure Scenario	Crop or Target	Dermal Unit Exposure <sup>1</sup> (µg/lb ai)	Level of PPE or Engineering control	Inhalation Unit Exposure <sup>1</sup> (µg/lb ai)	Level of PPE or Engineering control	Maximum Application Rate <sup>2</sup>	App Rate Unit	Area Treated or Amount Handled Daily <sup>3</sup>	Area Treated/Amount Handled Unit	Dermal		Inhalation		Total
										Dose <sup>4</sup> (mg/kg/day)	MOE <sup>5</sup> (LOC = 100)	Dose <sup>6</sup> (mg/kg/day)	MOE <sup>7</sup> (LOC = 100)	MOE <sup>8</sup> (LOC = 100)
<b>Mixer/Loader</b>														
Dry Flowable, Aerial, Broadcast	Field crop, typical	51.6	SL/G	8.96	No-R	0.0167	lb ai/acre	350	acres	0.000263	19000	0.000759	6600	4900
Liquid, Backpack, Broadcast	Rights-of-way (e.g., utilities, railroad, roadways)	37.6	SL/G	0.219	No-R	0.0285	lb ai/gallon solution	1000	gallons solution	0.00093	5400	0.0000904	55000	4900
Liquid, Mechanically-pressurized Handgun, Broadcast	Rights-of-way (e.g., utilities, railroad, roadways)	37.6	SL/G	0.219	No-R	0.0285	lb ai/gallon solution	1000	gallons solution	0.00093	5400	0.0000904	55000	4900
Dry Flowable, Aerial, Broadcast	Field crop, high-acreage	51.6	SL/G	8.96	No-R	0.0223	lb ai/acre	1200	acres	0.0012	4200	0.00348	1400	1100
Dry Flowable, Airblast, Broadcast	Orchard/Vineyard	51.6	SL/G	8.96	No-R	0.0875	lb ai/acre	40	acres	0.000157	32000	0.000455	11000	8200
Dry Flowable, Groundboom, Broadcast	Orchard/Vineyard	51.6	SL/G	8.96	No-R	0.0875	lb ai/acre	40	acres	0.000157	32000	0.000455	11000	8200
Dry Flowable, Groundboom, Broadcast	Field crop, typical	51.6	SL/G	8.96	No-R	0.0167	lb ai/acre	80	acres	0.0000599	83000	0.000174	29000	21000
Dry Flowable, Groundboom, Broadcast	Field crop, high-acreage	51.6	SL/G	8.96	No-R	0.0223	lb ai/acre	200	acres	0.0002	25000	0.00058	8600	6400
Liquid, Aerial, Broadcast	Roads, parking lots, etc. (pre-paving)	37.6	SL/G	0.219	No-R	0.134	lb ai/acre	60	acres	0.000263	19000	0.0000255	200000	17000
Liquid, Aerial, Broadcast	Nursery (ornamentals, vegetables, trees, container stock)	37.6	SL/G	0.219	No-R	0.134	lb ai/acre	60	acres	0.000263	19000	0.0000255	200000	17000

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Exposure Scenario	Crop or Target	Dermal Unit Exposure <sup>1</sup> (µg/lb ai)	Level of PPE or Engineering control	Inhalation Unit Exposure <sup>1</sup> (µg/lb ai)	Level of PPE or Engineering control	Maximum Application Rate <sup>2</sup>	App Rate Unit	Area Treated or Amount Handled Daily <sup>3</sup>	Area Treated/Amount Handled Unit	Dermal		Inhalation		Total
										Dose <sup>4</sup> (mg/kg/day)	MOE <sup>5</sup> (LOC = 100)	Dose <sup>6</sup> (mg/kg/day)	MOE <sup>7</sup> (LOC = 100)	MOE <sup>8</sup> (LOC = 100)
Liquid, Aerial, Broadcast	Orchard/Vineyard	37.6	SL/G	0.219	No-R	0.0445	lb ai/acre	350	acres	0.00051	9800	0.0000494	100000	8900
Liquid, Aerial, Broadcast	Field crop, typical	37.6	SL/G	0.219	No-R	0.134	lb ai/acre	350	acres	0.00153	3300	0.000149	34000	3000
Liquid, Aerial, Broadcast	Field crop, high-acreage	37.6	SL/G	0.219	No-R	0.134	lb ai/acre	1200	acres	0.00526	950	0.00051	9800	870
Liquid, Aerial, Broadcast	Conifer plantation	37.6	SL/G	0.219	No-R	0.134	lb ai/acre	1200	acres	0.00526	950	0.00051	9800	870
Liquid, Airblast, Broadcast	Nursery (ornamentals, vegetables, trees, container stock)	37.6	SL/G	0.219	No-R	0.134	lb ai/acre	20	acres	0.0000878	57000	0.00000851	590000	52000
Liquid, Airblast, Broadcast	Orchard/Vineyard	37.6	SL/G	0.219	No-R	0.0445	lb ai/acre	40	acres	0.0000582	86000	0.00000565	880000	78000
Liquid, Chemigation, Broadcast	Field crop, typical	37.6	SL/G	0.219	No-R	0.0891	lb ai/acre	350	acres	0.00102	4900	0.000099	51000	4500
Liquid, Chemigation, Broadcast	Field crop, high-acreage	37.6	SL/G	0.219	No-R	0.111	lb ai/acre	350	acres	0.00127	3900	0.000123	41000	3600
Liquid, Groundboom, Broadcast	Roads, parking lots, etc. (pre-paving)	37.6	SL/G	0.219	No-R	0.134	lb ai/acre	5	acres	0.0000219	230000	0.00000213	2300000	210000
Liquid, Groundboom, Broadcast	Golf course (tees and greens only)	37.6	SL/G	0.219	No-R	0.134	lb ai/acre	5	acres	0.0000219	230000	0.00000213	2300000	210000
Liquid, Groundboom, Broadcast	Golf course (fairways, tees, greens)	37.6	SL/G	0.219	No-R	0.134	lb ai/acre	40	acres	0.000176	28000	0.000017	290000	26000
Liquid, Groundboom, Broadcast	Field-grown ornamental crops	37.6	SL/G	0.219	No-R	0.134	lb ai/acre	40	acres	0.000176	28000	0.000017	290000	26000
Liquid, Groundboom, Broadcast	Nursery (ornamentals, vegetables, trees, container stock)	37.6	SL/G	0.219	No-R	0.134	lb ai/acre	60	acres	0.000263	19000	0.0000255	200000	17000
Liquid, Groundboom, Broadcast	Orchard/Vineyard	37.6	SL/G	0.219	No-R	0.0445	lb ai/acre	40	acres	0.0000582	86000	0.00000565	880000	78000

Appendix A Occupational Handler Non-Cancer Exposure and Risk Estimates for Saflufenacil.														
Exposure Scenario	Crop or Target	Dermal Unit Exposure <sup>1</sup> (µg/lb ai)	Level of PPE or Engineering control	Inhalation Unit Exposure <sup>1</sup> (µg/lb ai)	Level of PPE or Engineering control	Maximum Application Rate <sup>2</sup>	App Rate Unit	Area Treated or Amount Handled Daily <sup>3</sup>	Area Treated/Amount Handled Unit	Dermal		Inhalation		Total
										Dose <sup>4</sup> (mg/kg/day)	MOE <sup>5</sup> (LOC = 100)	Dose <sup>6</sup> (mg/kg/day)	MOE <sup>7</sup> (LOC = 100)	MOE <sup>8</sup> (LOC = 100)
Liquid, Groundboom, Broadcast	Field crop, typical	37.6	SL/G	0.219	No-R	0.134	lb ai/acre	80	acres	0.00035	14000	0.0000341	150000	13000
Liquid, Groundboom, Broadcast	Field crop, high-acreage	37.6	SL/G	0.219	No-R	0.134	lb ai/acre	200	acres	0.000878	5700	0.0000851	59000	5200
<b>Applicator</b>														
Spray (all starting formulations), Aerial, Broadcast	Roads, parking lots, etc. (pre-paving)	2.08	EC	0.0049	EC	0.134	lb ai/acre	60	acres	0.0000145	340000	0.000000571	8800000	330000
Spray (all starting formulations), Aerial, Broadcast	Nursery (ornamentals, vegetables, trees, container stock)	2.08	EC	0.0049	EC	0.134	lb ai/acre	60	acres	0.0000145	340000	0.000000571	8800000	330000
Spray (all starting formulations), Aerial, Broadcast	Orchard/Vineyard	2.08	EC	0.0049	EC	0.0445	lb ai/acre	350	acres	0.0000282	180000	0.00000111	4500000	170000
Spray (all starting formulations), Aerial, Broadcast	Field crop, typical	2.08	EC	0.0049	EC	0.134	lb ai/acre	350	acres	0.0000849	59000	0.00000333	1500000	57000
Spray (all starting formulations), Aerial, Broadcast	Field crop, high-acreage	2.08	EC	0.0049	EC	0.134	lb ai/acre	1200	acres	0.00029	17000	0.0000114	440000	16000
Spray (all starting formulations), Aerial, Broadcast	Conifer plantation	2.08	EC	0.0049	EC	0.134	lb ai/acre	1200	acres	0.00029	17000	0.0000114	440000	16000
Spray (all starting formulations), Airblast, Broadcast	Nursery (ornamentals, vegetables, trees, container stock)	1590	SL/G	4.71	No-R	0.134	lb ai/acre	20	acres	0.0037	1400	0.000183	27000	1300



Appendix A Occupational Handler Non-Cancer Exposure and Risk Estimates for Sulfufenail.														
Exposure Scenario	Crop or Target	Dermal Unit Exposure <sup>1</sup> (µg/lb ai)	Level of PPE or Engineering control	Inhalation Unit Exposure <sup>1</sup> (µg/lb ai)	Level of PPE or Engineering control	Maximum Application Rate <sup>2</sup>	App Rate Unit	Area Treated or Amount Handled Daily <sup>3</sup>	Area Treated/Amount Handled Unit	Dermal		Inhalation		Total
										Dose <sup>4</sup> (mg/kg/day)	MOE <sup>5</sup> (LOC = 100)	Dose <sup>6</sup> (mg/kg/day)	MOE <sup>7</sup> (LOC = 100)	MOE <sup>8</sup> (LOC = 100)
Spray (all starting formulations), Airblast, Broadcast	Orchard/Vineyard	1590	SL/G	4.71	No-R	0.0875	lb ai/acre	40	acres	0.00484	1000	0.000239	21000	950
Spray (all starting formulations), Groundboom, Broadcast	Roads, parking lots, etc. (pre-paving)	16.1	SL/G	0.34	No-R	0.134	lb ai/acre	5	acres	0.00000939	530000	0.0000033	1500000	390000
Spray (all starting formulations), Groundboom, Broadcast	Golf course (tees and greens only)	16.1	SL/G	0.34	No-R	0.134	lb ai/acre	5	acres	0.00000939	530000	0.0000033	1500000	390000
Spray (all starting formulations), Groundboom, Broadcast	Golf course (fairways, tees, greens)	16.1	SL/G	0.34	No-R	0.134	lb ai/acre	40	acres	0.000075	67000	0.0000264	190000	50000
Spray (all starting formulations), Groundboom, Broadcast	Field-grown ornamental crops	16.1	SL/G	0.34	No-R	0.134	lb ai/acre	40	acres	0.000075	67000	0.0000264	190000	50000
Spray (all starting formulations), Groundboom, Broadcast	Nursery (ornamentals, vegetables, trees, container stock)	16.1	SL/G	0.34	No-R	0.134	lb ai/acre	60	acres	0.000112	45000	0.0000396	130000	33000
Spray (all starting formulations), Groundboom, Broadcast	Orchard/Vineyard	16.1	SL/G	0.34	No-R	0.0875	lb ai/acre	40	acres	0.000049	100000	0.0000172	290000	74000
Spray (all starting formulations), Groundboom, Broadcast	Field crop, typical	16.1	SL/G	0.34	No-R	0.134	lb ai/acre	80	acres	0.00015	33000	0.0000528	95000	24000

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Exposure Scenario	Crop or Target	Dermal Unit Exposure <sup>1</sup> (µg/lb ai)	Level of PPE or Engineering control	Inhalation Unit Exposure <sup>1</sup> (µg/lb ai)	Level of PPE or Engineering control	Maximum Application Rate <sup>2</sup>	App Rate Unit	Area Treated or Amount Handled Daily <sup>3</sup>	Area Treated/Amount Handled Unit	Dermal		Inhalation		Total
										Dose <sup>4</sup> (mg/kg/day)	MOE <sup>5</sup> (LOC = 100)	Dose <sup>6</sup> (mg/kg/day)	MOE <sup>7</sup> (LOC = 100)	MOE <sup>8</sup> (LOC = 100)
Spray (all starting formulations), Groundboom, Broadcast	Field crop, high-acreage	16.1	SL/G	0.34	No-R	0.134	lb ai/acre	200	acres	0.000375	13000	0.000132	38000	9700
Spray (all starting formulations), Mechanically-pressurized Handgun, Broadcast	Rights-of-way (e.g., utilities, railroad, roadways)	2050	SL/G	8.68	No-R	0.0285	lb ai/gallon solution	1000	gallons solution	0.0508	98	0.00358	1400	92
Spray (all starting formulations), Mechanically-pressurized Handgun, Broadcast	Rights-of-way (e.g., utilities, railroad, roadways)	1360	DL/G							0.0337	150			
<b>Flagger</b>														
Spray (all starting formulations), Aerial, Broadcast	Nursery (ornamentals, vegetables, trees, container stock)	12	SL/G	0.202	No-R	0.134	lb ai/acre	60	acres	0.0000839	60000	0.0000235	210000	47000
Spray (all starting formulations), Aerial, Broadcast	Orchard/Vineyard	12	SL/G	0.202	No-R	0.0445	lb ai/acre	350	acres	0.000163	31000	0.0000457	110000	24000
Spray (all starting formulations), Aerial, Broadcast	Field crop, typical	12	SL/G	0.202	No-R	0.134	lb ai/acre	350	acres	0.00049	10000	0.000137	36000	7800
Spray (all starting formulations), Aerial, Broadcast	Field crop, high-acreage	12	SL/G	0.202	No-R	0.134	lb ai/acre	350	acres	0.00049	10000	0.000137	36000	7800

Appendix A Occupational Handler Non-Cancer Exposure and Risk Estimates for Sulfufenacil.														
Exposure Scenario	Crop or Target	Dermal Unit Exposure <sup>1</sup> (µg/lb ai)	Level of PPE or Engineering control	Inhalation Unit Exposure <sup>1</sup> (µg/lb ai)	Level of PPE or Engineering control	Maximum Application Rate <sup>2</sup>	App Rate Unit	Area Treated or Amount Handled Daily <sup>3</sup>	Area Treated/Amount Handled Unit	Dermal		Inhalation		Total
										Dose <sup>4</sup> (mg/kg/day)	MOE <sup>5</sup> (LOC = 100)	Dose <sup>6</sup> (mg/kg/day)	MOE <sup>7</sup> (LOC = 100)	MOE <sup>8</sup> (LOC = 100)
<b>Mixer/Loader/Applicator</b>														
Dry Flowable, Backpack, Ground/soil-directed	Orchard/Vineyard	8260	SL/G	2.58	No-R	0.000438	lb ai/gallon solution	40	gallons solution	0.000126	40000	0.000000655	7600000	40000
Dry Flowable, Mechanically-pressurized Handgun, Broadcast (foliar)	Orchard/Vineyard	2050	SL/G	8.68	No-R	0.00875	lb ai/gallon solution	1000	gallons solution	0.0156	320	0.0011	4500	300
Dry Flowable, Mechanically-pressurized Handgun, Drench/Soil-/Ground-directed	Orchard/Vineyard	2050	SL/G	8.68	No-R	0.000438	lb ai/gallon solution	1000	gallons solution	0.000781	6400	0.0000551	91000	6000
Dry Flowable, Mechanically-pressurized Handgun, Broadcast (foliar)	Field crop, typical	2050	SL/G	8.68	No-R	0.00334	lb ai/gallon solution	1000	gallons solution	0.00596	840	0.00042	12000	790
Dry Flowable, Mechanically-pressurized Handgun, Drench/Soil-/Ground-directed	Field crop, typical	2050	SL/G	8.68	No-R	0.00334	lb ai/gallon solution	1000	gallons solution	0.00596	840	0.00042	12000	790
Liquid, Backpack, Ground/soil-directed	Orchard/Vineyard	8260	SL/G	2.58	No-R	0.0089	lb ai/gallon solution	40	gallons solution	0.00256	2000	0.0000133	380000	2000

Appendix A Occupational Handler Non-Cancer Exposure and Risk Estimates for Saflufenacil.														
Exposure Scenario	Crop or Target	Dermal Unit Exposure <sup>1</sup> (µg/lb ai)	Level of PPE or Engineering control	Inhalation Unit Exposure <sup>1</sup> (µg/lb ai)	Level of PPE or Engineering control	Maximum Application Rate <sup>2</sup>	App Rate Unit	Area Treated or Amount Handled Daily <sup>3</sup>	Area Treated/Amount Handled Unit	Dermal		Inhalation		Total
										Dose <sup>4</sup> (mg/kg/day)	MOE <sup>5</sup> (LOC = 100)	Dose <sup>6</sup> (mg/kg/day)	MOE <sup>7</sup> (LOC = 100)	MOE <sup>8</sup> (LOC = 100)
Liquid, Backpack, Broadcast (foliar)	Christmas Tree farm	30500	SL/G	69 1	No-R	0.0268	lb ai/gallon solution	40	gallons solution	0.0284	180	0.00107	4700	170
Liquid, Backpack, Ground/soil-directed	Christmas Tree farm	8260	SL/G	2.58	No-R	0.0285	lb ai/gallon solution	40	gallons solution	0.00819	610	0.0000426	120000	610
Liquid, Backpack, Ground/soil-directed	Conifer plantation	8260	SL/G	2.58	No-R	0.0285	lb ai/gallon solution	40	gallons solution	0.00819	610	0.0000426	120000	610
Liquid, Backpack, Broadcast	Rights-of-way (e.g., utilities, railroad, roadways)	30500	SL/G	69 1	No-R	0.00536	lb ai/gallon solution	40	gallons solution	0.00569	880	0.000214	23000	850
Liquid, Backpack, Broadcast (foliar)	Nursery (ornamentals, vegetables, trees, container stock)	30500	SL/G	69 1	No-R	0.0067	lb ai/gallon solution	15	gallons solution	0.00267	1900	0.000101	50000	1800
Liquid, Backpack, Ground/soil-directed	Nursery (ornamentals, vegetables, trees, container stock)	8260	SL/G	2.58	No-R	0.0285	lb ai/gallon solution	15	gallons solution	0.00307	1600	0.0000159	310000	1600
Liquid, Backpack, Broadcast	Rights-of-way (e.g., utilities, railroad, roadways)	2500	SL/G	27.6	No-R	0.0285	lb ai/gallon solution	40	gallons solution	0.00248	2000	0.000457	11000	1700
Liquid, Manually-pressurized Handwand, Broadcast (foliar)	Christmas Tree farm	430	SL/G	23.6	No-R	0.0268	lb ai/gallon solution	40	gallons solution	0.000401	12000	0.000367	14000	6500
Liquid, Manually-pressurized Handwand, Broadcast (foliar)	Nursery (ornamentals, vegetables, trees, container stock)	430	SL/G	23.6	No-R	0.0067	lb ai/gallon solution	15	gallons solution	0.0000376	130000	0.0000343	150000	70000

Appendix A Occupational Handler Non-Cancer Exposure and Risk Estimates for Salfufenacil.														
Exposure Scenario	Crop or Target	Dermal Unit Exposure <sup>1</sup> (µg/lb ai)	Level of PPE or Engineering control	Inhalation Unit Exposure <sup>1</sup> (µg/lb ai)	Level of PPE or Engineering control	Maximum Application Rate <sup>2</sup>	App Rate Unit	Area Treated or Amount Handled Daily <sup>3</sup>	Area Treated/Amount Handled Unit	Dermal		Inhalation		Total
										Dose <sup>4</sup> (mg/kg/day)	MOE <sup>5</sup> (LOC = 100)	Dose <sup>6</sup> (mg/kg/day)	MOE <sup>7</sup> (LOC = 100)	MOE <sup>8</sup> (LOC = 100)
Liquid, Manually-pressurized Handwand, Broadcast	Industrial/commercial (tires, rail yards, junk yards, etc.)	430	SL/G	23.6	No-R	0.0285	lb ai/gallon solution	40	gallons solution	0.000426	12000	0.00039	13000	6200
Liquid, Mechanically-pressurized Handgun, Broadcast (foliar)	Orchard/Vineyard	2050	SL/G	8.68	No-R	0.0089	lb ai/gallon solution	1000	gallons solution	0.0158	320	0.00112	4500	300
Liquid, Mechanically-pressurized Handgun, Drench/Soil-/Ground-directed	Orchard/Vineyard	2050	SL/G	8.68	No-R	0.0089	lb ai/gallon solution	1000	gallons solution	0.0158	320	0.00112	4500	300
Liquid, Mechanically-pressurized Handgun, Broadcast	Rights-of-way (e.g., utilities, railroad, roadways)	880	SL/G	1.9	No-R	0.134	lb ai/acre	5	acres	0.000513	9700	0.0000184	270000	9400
Liquid, Mechanically-pressurized Handgun, Broadcast	Golf course (tees and greens only)	880	SL/G	1.9	No-R	0.134	lb ai/acre	5	acres	0.000513	9700	0.0000184	270000	9400
Liquid, Mechanically-pressurized Handgun, Broadcast (foliar)	Christmas Tree farm	2050	SL/G	8.68	No-R	0.0268	lb ai/gallon solution	1000	gallons solution	0.0477	100	0.00338	1500	94
		1360	DL/G							0.0317	160			140
Liquid, Mechanically-pressurized Handgun, Broadcast (foliar)	Nursery (ornamentals, vegetables, trees, container stock)	3610	SL/G	448	No-R	0.0067	lb ai/gallon solution	300	gallons solution	0.00631	790	0.013	380	260
				44.8	PF10 R							0.0013	3800	650

Appendix A Occupational Handler Non-Cancer Exposure and Risk Estimates for Sulfufenacil.														
Exposure Scenario	Crop or Target	Dermal Unit Exposure <sup>1</sup> (µg/lb ai)	Level of PPE or Engineering control	Inhalation Unit Exposure <sup>1</sup> (µg/lb ai)	Level of PPE or Engineering control	Maximum Application Rate <sup>2</sup>	App Rate Unit	Area Treated or Amount Handled Daily <sup>3</sup>	Area Treated/Amount Handled Unit	Dermal		Inhalation		Total
										Dose <sup>4</sup> (mg/kg/day)	MOE <sup>5</sup> (LOC = 100)	Dose <sup>6</sup> (mg/kg/day)	MOE <sup>7</sup> (LOC = 100)	MOE <sup>8</sup> (LOC = 100)
Liquid, Mechanically-pressurized Handgun, Drench/Soil-/Ground-directed	Nursery (ornamentals, vegetables, trees, container stock)	3610	SL/G	448	No-R	0.0285	lb ai/gallon solution	300	gallons solution	0.0269	190	0.0555	90	61
				44.8	PF10 R							0.00555	900	160
<b>Loader/Applicator</b>														
Liquid, Backpack, Broadcast	Rights-of-way (e.g., utilities, railroad, roadways)	30500	SL/G	69 1	No-R	0.0285	lb ai/gallon solution	40	gallons solution	0.0303	170	0.00114	4400	160

1 Based on the "Occupational Pesticide Handler Unit Exposure Surrogate Reference Table" (<https://www.epa.gov/pesticide-science-and-assessing-pesticide-risks/occupational-pesticide-handler-exposure-data>); Level of PPE: Baseline, PPE, Eng. Controls.

2 Based on registered labels (see Table 4.1).

3 Exposure Science Advisory Council Policy #9.1.

4 Dermal Dose = Dermal Unit Exposure (µg/lb ai) × Conversion Factor (0.001 mg/µg) × Application Rate (lb ai/acre or gal) × Area Treated or Amount Handled (A or gal/day) × DAF (6%) ÷ BW (69 kg).

5 Dermal MOE = Dermal NOAEL (5 mg/kg/day) ÷ Dermal Dose (mg/kg/day).

6 Inhalation Dose = Inhalation Unit Exposure (µg/lb ai) × Conversion Factor (0.001 mg/µg) × Application Rate (lb ai/acre or gal) × Area Treated or Amount Handled (A or gal/day) ÷ BW (69 kg).

7 Inhalation MOE = Inhalation NOAEL (5 mg/kg/day) ÷ Inhalation Dose (mg/kg/day).

8 Total MOE = NOAEL (5 mg/kg/day) ÷ Dermal Dose + Inhalation Dose OR Total MOE = 1 ÷ (1/Dermal MOE + 1/Inhalation MOE)