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OFFICE OF CHEMICAL SAFETY AND POLLUTION PREVENTION

MEMORANDUM

Date: September 30, 2010

Subject: **Clothianidin:** Occupational and Residential Exposure/Risk Assessment for Proposed Trunk Spray Use of Clothianidin in Ornamental Trees.

PC Code: 044309	**DP Barcode:** D375369
Decision No.: 428318	**Registration No.:** 59639-152
Petition No.: NA	**Regulatory Action:** Registration
Risk Assessment Type: ORE	**Case No.:** None
TXR No.: None	**CAS No.:** 210880-92-5
MRID No.: None	**40 CFR:** 180.586

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CONCLUSIONS

The potential occupational and residential exposures/risks resulting from the proposed trunk spray use in ornamental trees do not exceed the Health Effects Division's (HED's) level of concern.

BACKGROUND

The enclosed document is an assessment of potential occupational and residential exposures/ risks to support a new use of clothianidin (trunk spray) in ornamental trees.

Rec'd ARC 10/29/10

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1.0 Executive Summary

A new use is being requested by Valent Corporation for the end-use product Arena 50 WDG Insecticide (EPA Reg. No. 59639-152, clothianidin 50.0%, water-dispersible granule). The proposed use involves basal bark trunk application to ornamental trees using a spray solution of 1.2 to 4.8 oz product per gallon (0.15 lb ai/gal).

Toxicological points of departure (PODs) were selected from a two generation reproduction study. An oral NOAEL of 9.8 mg/kg/day (based on decreased body weight gain and delayed sexual maturation, decreased absolute thymus weights in F_1 pups and increase in stillbirths in both generations) was selected for assessing dermal and inhalation risks. The dermal and inhalation absorption rates were 1% and 100%, respectively. Daily dermal and inhalation doses associated with the proposed label amendments were combined to determine the margin of exposure (MOE), or risk for occupational workers because the same study (with the same effects) was used for each route of exposure. The level of concern (LOC) is an MOE of 100, i.e., MOEs greater than 100 are not of concern. Clothianidin is classified as "not likely to be carcinogenic to humans," and therefore cancer risk is not of concern.

No chemical-specific information was provided relative to the number of exposure days per year. Based on the frequency/interval of applications, EPA assumed that both occupational and residential handlers would be exposed for less than 6 months per year (short- and intermediate-term exposures). Long-term exposures are not expected and were not assessed.

Since no chemical-specific data for assessing exposures during pesticide handling activities were submitted to the Agency in support of the proposed label amendments, HED used surrogate data from the PHED Version 1.1 (PHED Surrogate Exposure Guide, 8/98) to assess occupational exposures. Defaults established by the HED Science Advisory Council for Exposure (Expo SAC) were used for gallons treated per day.

The occupational handlers' MOE is 83 at single layer + gloves level (as currently required in the label). Although the MOE for the mixer/loader/applicator scenario is 83, it is not considered to be a risk of concern since the exposure was estimated using surrogate unit exposure data for a wettable powder which results in significantly greater (more than 50% higher) exposure than expected from the proposed dry flowable formulation.

A quantitative occupational dermal post-application exposure and risk assessment was not performed since the applications are directed only towards the basal portion of the tree which presents limited dermal exposures to post-application workers. Based on the Agency's current practices, a quantitative occupational postapplication inhalation exposure assessment was not performed for clothianidin at this time.

Since a quantitative postapplication exposure assessment was not performed, the restricted entry interval (REI) is based on the acute toxicity of the technical material and the Worker Protection Standard (WPS). The 12-hour restricted entry interval (REI) appearing on the proposed label is appropriate.

Unit exposures from the Occupational and Residential Exposure Task Force (ORETF) data were used to assess exposures for residential handlers. The MOE for non-occupational/residential handler is 2,600 at long pants + long sleeves level. This MOE is greater than 100 and does not

exceed HED level of concern. A new non-occupational and residential post-application exposure and risk assessment was not performed for the same reasons cited above for occupational handlers. The non-occupational and residential post-application exposure and risk was based on a previous clothianidin assessment of existing uses. No MOEs exceed HED's level of concern.

This exposure/risk assessment relies in part on data from studies in which adult human subjects were intentionally exposed to a pesticide to determine their dermal and inhalation exposure. Many such studies, involving exposure to many different pesticides, comprise generic pesticide exposure databases such as the Pesticide Handlers Exposure Database (PHED) and Occupational & Residential Exposure Task Force (ORETF) Study Data. EPA has reviewed all the studies in these multi-pesticide generic exposure databases, and on the basis of available evidence has found them to have been neither fundamentally unethical nor significantly deficient relative to standards of ethical research conduct prevailing when they were conducted. There is no regulatory barrier to continued reliance on these studies, and all applicable requirements of EPA's Rule for the Protection of Human Subjects of Research (40 CFR Part 26) have been satisfied.

2.0 Hazard Information

The Health Effects Division (HED) selected points of departure (POD) for incidental oral (short & intermediate-terms), dermal (all durations), and inhalation (all durations) exposures to clothianidin. All PODs were selected from a two generation reproduction study. An oral NOAEL of 9.8 mg/kg/day (based on decreased body weight gain and delayed sexual maturation, decreased absolute thymus weights in F_1 pups and increase in stillbirths in both generations) was selected for assessing dermal and inhalation risks. HED has used a 60 kg body weight, in order to be protective of offspring effects, in the event that these were due to exposure *in utero* or during lactation. For the dermal route, the absorption rate was 1%. For the inhalation route, the absorption rate was assumed to be 100%.

The potential for increased susceptibility of infants and children from exposure to clothianidin was also evaluated as required by the Food Quality Protection Act (FQPA) of 1996. The FQPA safety factor has been reduced to 1x. The Cancer Assessment Review Committee (CARC) classified clothianidin as "not likely to be carcinogenic to humans," and therefore there is no cancer risk associated with clothianidin uses.

The acute toxicity categories for the technical material are summarized in **Table 1**. The doses and toxicological PODs for various exposure scenarios are summarized and presented in **Table 2** (A. Levy, 5/5/09).

Table 1. Acute Toxicity Profile - Clothianidin Technical.

Test Material	GDLN	Study Type	MRID	Results	Tox Category
Technical	870.1100	Acute Oral - rat	45422621	LD_{50} > 5000 mg/kg	IV
Technical	870.1200	Acute Dermal - rat	45422634	LD_{50} > 2000 mg/kg	III
Technical	870.1300	Acute Inhalation	45422636	LC_{50} (M & F): > 5.538 mg/L	IV
Technical	870.2400	Primary Eye Irritation	45422701	Slightly irritating to the eye	IV
Technical	870.2500	Primary Dermal Irritation	45422703	Not irritating to the skin	IV
Technical	870.2600	Dermal Sensitization	45422705	Is not a sensitizer under conditions of study.	N/A

Table 2. Summary of Toxicological Doses and Endpoints for Clothianidin.

Exposure/ Scenario	Point of Departure	Uncertainty/FQPA Safety Factors	Level of Concern for Risk Assessment	Study and Toxicological Effects
Dermal (all durations) (Adults)	Oral study NOAEL= 9.8 mg/kg/day (dermal absorption factor = 1%)	UF_A= 10x UF_H= 10x SF_{FQPA}=1	MOE= 100 (residential and occupational)	**2-Generation reproduction study** LOAEL = 31.2 mg/kg/day based on decreased body weight gains and delayed sexual maturation, decreased absolute thymus weights in F1 pups and increased stillbirths in both generations.
Inhalation (all durations)	Oral study NOAEL= 9.8 mg/kg/day (inhalation absorption factor = 100% of oral absorption)	UF_A= 10x UF_H= 10x SF_{FQPA}=1	MOE= 100 (residential and occupational)	**2-Generation reproduction study** LOAEL = 31.2 mg/kg/day based on decreased body weight gains and delayed sexual maturation, decreased absolute thymus weights in F1 pups and increased stillbirths in both generations.
Cancer (oral, dermal, inhalation)	**"Not Likely to be Carcinogenic to Humans"**.			

Point of Departure (POD) = A data point or an estimated point that is derived from observed dose-response data and used to mark the beginning of extrapolation to determine risk associated with lower environmentally relevant human exposures. NOAEL = no observed adverse effect level. LOAEL = lowest observed adverse effect level. UF = uncertainty factor. UF_A = extrapolation from animal to human (interspecies). UF_H = potential variation in sensitivity among members of the human population (intraspecies). FQPA SF = FQPA Safety Factor. MOE = margin of exposure. LOC = level of concern.

For the purpose of conducting risk assessments for occupational workers, dermal and inhalation exposures may be combined because the same study (with the same effects) was used for each route of exposure for each of the respective exposure scenarios.

3.0 Product Use information/Application Timing

The new use requested by Valent Corporation for Arena 50 WDG Insecticide (EPA Reg. No. 59639-152, clothianidin 50.0%, water-dispersible granule) involves basal bark trunk application to ornamental trees using a spray solution of 1.2 to 4.8 oz product per gallon.

Proposed use pattern as shown in the label is summarized in **Table 3**.

Table 3. Proposed Use Pattern for Clothianidin.

Crop	Product, Formulation	Treatment Type	Applications Per Season [1]	Maximum Application Rate[2]		PHI[3] (days)
				Per Application	Per Season	
Ornamental Trees	EPA Reg. No. 59639-152 Arena 50 WDG Insecticide-clothianidin =50.0%	Basal Bark Trunk Spray Application	1	Spray Concentration 4.8 oz /gallon (0.15 lb ai/gal)	1	NA

[1] Maximum number of applications allowed on label.
[2] Rate = Maximum application rates as specified on proposed labels.
[3] PHI = Pre-harvest Interval.

According to the label, applicators and other handlers must wear long-sleeved shirt and long pants, shoes and socks and chemical-resistant gloves.

4.0 Non-Occupational/Residential Exposure

4.1 Handlers

The label does not indicate that the proposed use on tree trunks is to be made only by commercial applicators. Therefore, an exposure/risk assessment for non-occupational/residential handlers was performed.

Equations/Calculations

The following equations were used to calculate handler exposure and risk:

Dermal Dose (mg/kg/day) = $\frac{\text{Rate (lb ai/Gal) x UE (mg/lb ai) x DA x Gallons Treated (Gal/day)}}{\text{BW (kg)}}$

Inhalation Dose (mg/kg/day) = $\frac{\text{Rate (lb ai/Gal) x UE (mg/lb ai) x Gallons Treated (Gal/day)}}{\text{BW (kg)}}$

Where:

Rate (Application Rate)	=	Maximum application rate on product label (lb ai/gal)
UE (Unit Exposure)	=	Exposure value derived from ORETF Resident-Applicator Exposure Study (mg/lb ai handled)
DA (dermal absorption factor)	=	Factor to account for dermal absorption (1%)

Gallons Treated	=	Maximum number of gallons treated per day (gal/day)
BW	=	Body weight (60 kg)
Combined Daily Dose (mg/kg/day)	=	Dermal Dose (mg/kg/day) + Inhalation Dose (mg/kg/day)
MOE	=	NOAEL (9.8 mg/kg/day) / Combined Daily Dose (mg/kg/day)

Exposure Scenarios

Following scenario is expected to result in the highest exposure for the proposed use:

- Mixing/Loading/Applying Sprays with Low-Pressure Handwand Equipment

Application Rate

The maximum application rate listed on the proposed labels provided by the Registration Division was used for all exposure assessments. The maximum rate is 4.8 oz product/gallon (0.15 lb ai/gal).

Gallons or the Amount Treated

Based on HED's Exposure Science Advisory Council (Expo SAC) Policy Number 9.1, the following application capacity was assumed: 5 gallons/day for mixer/loader/applicator using low-pressure handwand equipment.

Body Weight

The female body weight (60 kg) was used for all assessments since the toxic effects were observed in offspring in the 2-generation reproduction study in rats.

Exposure Frequency

No data on the number of exposure days per year was provided. For this risk assessment, it was assumed that handlers would be exposed for less than 6 months per year (i.e., short- and intermediate-term exposures). Long-term exposures are not expected and were not assessed.

Unit Exposures

The unit exposures are based on the ORETF Residential-Applicator Exposure Study (MRID 445185-01). The following unit exposure values (long pants, long sleeves) were used:

Dermal Unit Exposure = 30 mg/lb ai handled
Inhalation Unit Exposure = 3.8 μg/lb ai handled

Handlers' Exposure and Risk

The MOE for non-occupational/residential handler is 2,600 at long pants + long sleeves level. This MOE is greater than 100 and does not exceed HED's level of concern.

Exposures/risks for non-occupational/residential handlers are presented in **Table 5**.

4.2 Post-application

The non-occupational and residential post-application exposure/risk was previously assessed (Mark Dow, 2/24/2004, **D296176**). The results are summarized below.

Clothianidin is registered for use on turf and golf courses. Treatment on turf is made by commercial applicators only; therefore, a residential handler assessment for use on turf was not performed. There is potential for residential or recreational post-application exposures from treated turf.

Based on the Agency's current practices, a quantitative postapplication inhalation exposure assessment was not performed for clothianidin at this time primarily because it has a very low vapor pressure (vapor pressure 1.3×10^{-10} Pa at 25°C), it is applied at low application rates (maximum rates range from 0.089 - 0.125 lbs ai/A depending on use site), and except for forestry uses, it is not projected to be applied via typically high inhalation exposure application equipment (e.g., airblast and aerial equipment). However, volatilization of pesticides may be a potential source of postapplication inhalation exposure to individuals nearby to pesticide applications. The Agency sought expert advice and input on issues related to volatilization of pesticides from its Federal Insecticide, Fungicide, and Rodenticide Act Scientific Advisory Panel (SAP) in December 2009. The Agency received the SAP's final report on March 2, 2010 (http://www.epa.gov/scipoly/SAP/meetings/2009/120109meeting.html). The Agency is in the process of evaluating the SAP report and may, as appropriate, develop policies and procedures to identify the need for and, subsequently, the way to incorporate postapplication inhalation exposure into the Agency's risk assessments. If new policies or procedures are put into place, the Agency may revisit the need for a quantitative postapplication inhalation exposure assessment for clothianidin.

The MOEs for the residential post-application exposures/risks ranged from 1,300 to 490,000 (**Table 4**). MOE values greater than 100 are considered adequate to protect adults and children from residential non-dietary post-application exposures to clothianidin. The estimated MOE's are based upon conservative assumptions and are >1000; therefore, the estimated risks from residential non-dietary post-application exposures do not exceed HED's level of concern.

Table 4. Summary of Residential Post-Application Exposures and Risks.		
Activity	Exposure (Dose) mg a.i./kg bw/day	MOE
Toddler oral hand to mouth from contacting treated turf	0.0059	1700
Toddler incidental oral ingestion of treated soil	0.00002	490000
Adult dermal post application turf contact	0.00108	9100
Toddler dermal post application turf contact	0.00155	6300
Toddler **combined** oral (except granules) and dermal exposures	treated turf + treated soil + dermal = 0.00747	1300
Adult golfer post application turf contact	0.000075	130000

Based on Mark Dow, 2/24/2004, D296176

Spray Drift

Spray drift is always a potential source of exposure to residents nearby to spraying operations. This is particularly the case with aerial application, but, to a lesser extent, could also be a potential source of exposure from the ground application method employed for clothianidin. The Agency has been working with the Spray Drift Task Force, EPA Regional Offices and State Lead Agencies for pesticide regulation and other parties to develop the best spray drift management practices. The Agency is now requiring interim mitigation measures for aerial applications that must be placed on product labels/labeling. The Agency has completed its evaluation of the new data base submitted by the Spray Drift Task Force, a membership of U.S. pesticide registrants, and is developing a policy on how to appropriately apply the data and the AgDRIFT computer model to its risk assessments for pesticides applied by air, orchard airblast and ground hydraulic methods. After the policy is in place, the Agency may impose further refinements in spray drift management practices to reduce off-target drift and risks associated with aerial as well as other application types where appropriate.

5.0 Occupational Exposures

5.1 Handlers

Based on the proposed use pattern, pesticide handlers (i.e., mixers, loaders and applicators) will be exposed to clothianidin when they apply the product in accordance with the proposed label. In general, clothianidin exposures for pesticide handlers were estimated using standard assumptions and equations, based on the proposed application rates and methods, and typical assumptions such as acres or gallons treated per day.

Equations/Calculations

The following equations were used to calculate handler exposure and risk:

Dermal Dose (mg/kg/day) = $\frac{\text{Rate (lb ai/Gal) x UE (mg/lb ai) x DA x Gallons Treated (Gal/day)}}{\text{BW (kg)}}$

Inhalation Dose (mg/kg/day) = $\frac{\text{Rate (lb ai/Gal) x UE (mg/lb ai) x Gallons Treated (Gal/day)}}{\text{BW (kg)}}$

Where:

Rate (Application Rate)	=	Maximum application rate on product label (lb ai/gal)
UE (Unit Exposure)	=	Exposure value derived from August 1998 PHED Surrogate Exposure Table (mg/lb ai handled)
DA (dermal absorption factor)	=	Factor to account for dermal absorption (1%)
Gallons Treated	=	Maximum number of gallons treated per day (gal/day)
BW	=	Body weight (60 kg)

Combined Daily Dose (mg/kg/day) = Dermal Dose (mg/kg/day) + Inhalation Dose (mg/kg/day)

MOE = $\frac{\text{NOAEL (9.8 mg/kg/day)}}{\text{Combined Daily Dose (mg/kg/day)}}$

Exposure Scenarios

Following scenario is expected to result in the highest exposure for the proposed use:

- Mixing/Loading/Applying Sprays with Low-Pressure Handwand Equipment

Application Rate

The maximum application rate listed on the proposed labels provided by the Registration Division was used for all exposure assessments. The maximum rate is 4.8 oz product/gallon (0.15 lb ai/gal).

Gallons or the Amount Treated

Based on HED's Exposure Science Advisory Council (Expo SAC) Policy Number 9.1, the following application capacity was assumed: 40 gallons/day for mixer/loader/applicator using low-pressure handwand equipment.

Body Weight

The female body weight (60 kg) was used for all assessments since the toxic effects were observed in offspring in the 2-generation reproduction study in rats.

Exposure Frequency

No data on the number of exposure days per year was provided. For this risk assessment, it was assumed that handlers would be exposed for less than 6 months per year (i.e., short- and intermediate-term exposures). Long-term exposures are not expected and were not assessed.

Unit Exposures

The unit exposures are based on the PHED Version 1.1 as presented in the August 1998 PHED Surrogate Exposure Guide.

There are three basic risk mitigation approaches considered appropriate for controlling occupational exposures. These include administrative controls, the use of personal protective equipment or PPE, and the use of engineering controls. Occupational handler exposure assessments may be completed by HED using baseline, PPE, and engineering controls. [Note: Administrative controls available generally involve altering application rates for handler exposure scenarios. These are typically not utilized for completing handler exposure assessments.] The baseline clothing level scenario for occupational exposure scenarios is generally an individual wearing long pants, a long-sleeved shirt, no chemical resistant gloves, and no respirator. The first level of mitigation generally applied is PPE. PPE may involve the use of an additional layer of clothing, chemical-resistant gloves, and a respirator. The next level of mitigation considered in the risk assessment process is the use of appropriate engineering controls which, by design, attempt to eliminate the possibility of human exposure. The occupational assessments in this document were done at the PPE (baseline + gloves) level.

Following HED's general practice, the unit exposures for dry flowable were used to estimate exposures to the proposed water-dispersible granule product. Because there are no unit exposures available for mixer/loader/applicator when a water-dispersible granule or dry flowable product is used with low-pressure handwand equipment, the unit exposures for a wettable powder were used to estimate the exposures to water-dispersible granule product using low-pressure handwand. However, HED notes that the mixer/loader unit exposures for a wettable powder product are much higher than those for a dry flowable product as shown in the PHED mixer/loader unit exposure tables (wettable powder vs dry flowable ratios are 3.7 vs 0.066 (baseline, no gloves), 0.17 vs 0.066 (with gloves) mg/lb ai handled for dermal exposure, and 43.42 vs 0.77 µg/lb ai handled for inhalation exposure). Hence, the exposure value presented for mixer/loader/applicator in this assessment should be considered as a very conservative (more than 50% higher) estimate for the proposed formulation and equipment type.

Handlers' Exposure and Risk

The handlers' MOE is 83 at single layer + gloves level (as currently required on the label). Although the MOE of **83** is below 100, it does not exceed HED's level of concern. As noted in the previous discussion, the exposure values presented for mixer/loader/applicator in this assessment are very conservative estimates (more than 50% higher than actual exposures). Therefore, the MOE of 83 is an overestimate of risk, and is considered not to exceed HED's level of concern.

Exposures/risks for occupational handlers are presented in **Table 5**.

5.2 Post-application

Occupational post-application dermal exposure and risk were not calculated because the application is directed to the basal portion of the tree which results in limited dermal exposure to post-application workers.

Based on the Agency's current practices, a quantitative occupational postapplication inhalation exposure assessment was not performed for clothianidin at this time. However, there are multiple potential sources of postapplication inhalation exposure to individuals performing postapplication activities in previously treated fields. These potential sources include volatilization of pesticides and resuspension of dusts and/or particulates that contain pesticides. The Agency sought expert advice and input on issues related to volatilization of pesticides from its Federal Insecticide, Fungicide, and Rodenticide Act Scientific Advisory Panel (SAP) in December 2009. The Agency received the SAP's final report on March 2, 2010 (http://www.epa.gov/scipoly/SAP/meetings/2009/120109meeting.html). The Agency is in the process of evaluating the SAP report as well as available postapplication inhalation exposure data generated by the Agricultural Reentry Task Force and may, as appropriate, develop policies and procedures, to identify the need for and, subsequently, the way to incorporate occupational postapplication inhalation exposure into the Agency's risk assessments. If new policies or procedures are put into place, the Agency may revisit the need for a quantitative occupational postapplication inhalation exposure assessment for clothianidin.

The technical material has a Toxicity Category IV for eye irritation/skin irritation, and a Category III for acute dermal toxicity. Per the Worker Protection Standard (WPS), a 12-hr restricted entry interval (REI) is required. The 12 hour REI appearing on the proposed label is appropriate.

6.0 REVIEW OF HUMAN RESEARCH

This exposure/risk assessment relies in part on data from studies in which adult human subjects were intentionally exposed to a pesticide to determine their dermal and inhalation exposure. Many such studies, involving exposure to many different pesticides, comprise generic pesticide exposure databases such as the Pesticide Handlers Exposure Database (PHED) and Occupational & Residential Exposure Task Force (ORETF) Study Data. EPA has reviewed all the studies in these multi-pesticide generic exposure databases, and on the basis of available evidence has found them to have been neither fundamentally unethical nor significantly deficient relative to standards of ethical research conduct prevailing when they were conducted. There is no regulatory barrier to continued reliance on these studies, and all applicable requirements of EPA's Rule for the Protection of Human Subjects of Research (40 CFR Part 26) have been satisfied.

Table 5. Non-Cancer Risk for Clothianidin Handlers.

Exposure Scenario (Scenario #)	Mitigation Level[a]	Dermal Unit Exposure[b] (mg/lb ai)	Inhalation Unit Exposure[c] (ug/lb ai)	Crop	Application Rate (lb ai/Gal)	Amount Treated[d] (Gal/day)	Daily Dermal Dose[e] (mg/kg/day)	Daily Inhalation Dose[f] (mg/kg/day)	Combined Daily Dose[g] (mg/kg/day)	MOE[h]
Non-Occupational/Residential Mixer/Loader/Applicator										
M/L/A with Low-pressure handwand	Long Pants, Long Sleeves	30	3.8	Ornamental Trees	0.15	5	0.00375	0.0000475	0.003798	2,600
Occupational Mixer/Loader/Applicator										
M/L/A with Low-pressure handwand	PPE (Baseline + gloves)	8.6	1100	Ornamental Trees	0.15	40	0.0086	0.11	0.1186	**83**

a Baseline consists of long-sleeve shirt, long pants, shoes, and socks and no respirator. PPE consists of long-sleeve shirt, long pants, shoes, socks, chemical-resistant gloves, and no respirator.

b Residential Dermal Unit Exposure represents long pants, long sleeved shirt, no gloves, and open mixing/loading based on ORETF data. Occupational Dermal Unit Exposure also includes gloves and is based on PHED.

c Inhalation Unit Exposures represent no respiratory protection and open mixing/loading. Residential and occupational inhalation Unit Exposures are based on data from ORETF and PHED, respectively.

d Daily amount treated values are from EPA estimated volume handled in a single day for each exposure scenario of concern, based on the application method and formulation/packaging type.

e Daily dermal dose (mg/kg/d) = [unit dermal exposure (mg/lb ai) * dermal absorption (0.01) * application rate (lb ai/gallon) * daily gallons treated / body weight (60 kg).

f Daily inhalation dose (mg/kg/d) = (unit exposure (µg/lb ai) * (1mg/1000 µg) conversion * application rate (lb ai/gallon) * daily gallons treated / body weight (60 kg).

g Combined daily dose = daily dermal dose + daily inhalation dose.

h MOE = NOAEL (9.8 mg/kg/d) / combined daily dose. UF = 100.

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