CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF ENVIRONMENTAL HEALTH HAZARD ASSESSMENT



# MEMORANDUM

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**DATE:** March14, 2024

**SUBJECT:** HEALTH ASSESSMENT FOR 2021-2023 APPLICATION OF CHLORANTRANILIPROLE TO NON-COMMERCIAL TURF FOR JAPANESE BEETLE TREATMENT

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The Office of Environmental Health Hazard Assessment (OEHHA) is contracted with the California Department of Food and Agriculture (CDFA) to provide technical assistance and expertise in pesticide toxicology and exposure to support CDFA's efforts in eradicating invasive pests in California. As part of this contract, OEHHA works cooperatively with the California Department of Pesticide Regulation (DPR) to collect and evaluate environmental monitoring data following pesticide applications related to invasive pest management. OEHHA also uses the monitoring data to conduct human health risk assessments.

In February 2024, DPR released a memo detailing the results of environmental monitoring efforts related to CDFA's use of Acelepryn® and Acelepryn® G (liquid and granular forms of the same pesticidal product) on turf, soil, and ground cover for the eradication of Japanese Beetle (JB) in Sacramento County from 2021-2023 (DPR, 2024). For these treatments, DPR randomly collected air samples, turf dislodgeable residue samples, and turf and soil core samples from residential properties and school sites treated during the JB eradication program. These samples were analyzed for the

chemical chlorantraniliprole, the active ingredient in Acelepryn® products. The pesticide application tank was also sampled and analyzed to determine treatment concentrations. Following the release of DPR's memo, CDFA requested that OEHHA evaluate the potential exposure and health risk to the residents from chlorantraniliprole used in the treatments. Based on our evaluation, OEHHA does not anticipate any adverse health effects to residents from the use of Acelepryn® to eradicate JB by CDFA. The results of OEHHA's evaluation are summarized in this memo.

**METHODS**

In November 2020, OEHHA published a technical report evaluating earlier environmental monitoring efforts conducted by CDFA during JB treatments carried out in Sacramento and Santa Clara counties in 2016 (OEHHA, 2020). OEHHA recently conducted an updated toxicity review through October 2023 to cover the period since publication of that report and did not identify any new studies or evidence that would change the critical effect determinations and reference doses (RfDs) previously derived. There were also no updates to the assumptions and exposure parameters used. Thus, OEHHA used the 2020 technical report as the basis for the current evaluation.

Chlorantraniliprole is classified by the US Environmental Protection Agency (US EPA) as a "reduced risk" pesticide when used on certain fruits and produce. During our toxicity review, OEHHA did not find any evidence that chlorantraniliprole is genotoxic, neurotoxic, immunotoxic, carcinogenic or teratogenic. OEHHA (2020) derived a non-cancer oral reference dose (RfD) of 80 micrograms per kilogram body weight per day (µg/kg-day) and dermal non-cancer RfD of 533 µg/kg-day based on increased relative liver weight in female rats and decreased body weight gain in male rats, respectively. This included a composite uncertainty factor of 300 in the derivation of both RfDs (10 for animal-to-human extrapolation and 30 for variability in the human population).

Using the previously described approaches and assumptions from our technical report (OEHHA, 2020), and the results of the monitoring data released by DPR (DPR, 2024), OEHHA conducted a screening level exposure assessment to evaluate potential risk to residents of treated properties. We calculated high-end and mean dose estimates for three exposure pathways:

- dermal exposure to dislodgeable residue on turf
- hand-to-mouth ingestion of dislodgeable residue on turf
- incidental ingestion of turf and soil.

The inhalation pathway was not evaluated as all air samples collected during or following pesticide treatment were below sampling detection limits. An additional set of soil and turf samples collected four weeks after Acelepryn® application was also not quantitively evaluated. Mean and maximum chlorantraniliprole values for these samples

were 44% and 15%, respectively, of mean and maximum values for samples collected immediately following application. Thus, to use the most health protective approach, the data from the samples collected initially after application when concentrations were the highest were evaluated.

Also consistent with our 2020 report, children between the ages of 1 and 2 were selected as the target population. Young children are considered the most sensitive and highly exposed to our identified exposure pathways due to their behavior, relatively high dermal contact, and body weight-adjusted ingestion rates. Maximum and mean monitoring levels and exposure parameters specific to 1- to 2-year-olds (1<2) were used in calculating the high-end and mean exposure estimates. Sample values below the detection limit (ND) were substituted with half the detection limit for the sample type, either 0.5 µg/sample for turf dislodgeable residue, or 0.005 part per million (ppm) for soil samples.

The addition of the granular formulation of Acelepryn® was new to the 2021-2023 JB eradication program. To ensure the safety of both formulations, the liquid Acelepryn® and granular Acelepryn® G were analyzed and results reported separately. Additionally, monitoring data were collected in two areas: Sacramento (Arden-Arcade), and Rancho Cordova. Evaluation of raw data provided by CDFA showed there were no statistically significant differences between the Sacramento and Rancho Cordova values, so samples from the two areas were combined for the analysis.

## RESULTS AND RISK CHARACTERIZATION

Mean monitoring levels and daily doses for each exposure pathway are calculated in Appendix 1. High-end and mean dose estimates for Acelepryn® and Acelepryn® G are presented in Tables 1 and 2, respectively.

One of the commonly used methods to evaluate non-cancer health risk to a chemical exposure is to use the hazard quotient approach. It compares the estimated dose with a level of exposure below which adverse health effects are not anticipated, also called a reference dose, or RfD. This approach can be represented by the following:

**Hazard quotient = DD ÷ RfD**

Where:

Hazard quotient ≤1 indicates no health effects are anticipated, and >1 indicates that there may be a health concern

DD = daily dose (µg/kg-day) associated with a specific route (i.e., oral or dermal)

RfD = reference dose (in mg/kg-day or µg/kg-day); this is an estimate of a daily dose at or below which adverse health effects are not likely to occur.

A hazard index is the sum of the hazard quotients for multiple chemicals and/or multiple exposure pathways. Like the hazard quotient, when the hazard index is ≤1, non-cancer health effects are not anticipated. When the number is >1, non-cancer health effects are possible, but not certain.

Using the RfDs and dose estimates developed in this assessment, we calculated hazard quotients for high-end and mean exposure scenarios and the results are presented in Tables 1 and 2. The calculated hazard quotients for the liquid formulation Acelepryn® were overall higher than those for granular Acelepryn® G, ranging from 1.8 times higher for mean incidental ingestion of turf dislodgeable residue to 5.7 times higher for high-end ingestion of turf dislodgeable residue. To assess risk from all exposure pathways, we also calculated the hazard index for both the liquid and granular formulations and the results are in Table 3. Although the hazard indexes from the liquid formulation were higher, all the hazard indexes were less than one, indicating the use of chlorantraniliprole on turf for the treatment of JB by CDFA is not likely to pose a health hazard to the residents.

It should be noted that several health-protective assumptions were used in the exposure assessment:

- We assumed the same level of exposure took place every day for an extended period of time. It is likely there are variations in behavior. For example, a child may not play on the treated lawn every day. It is unlikely that a child would be dermally exposed to dislodgeable residue on turf or ingest contaminated soil at the estimated rate every day.
- Exposures to residues on soil and turf were based on measurements taken shortly after treatment. We assumed there was no decrease in residue level over time (e.g., loss of dislodgeable residue due to human contact, photolysis), up to many weeks. While the chemical can have a relatively long (over 52 days) half-life in soil, samples taken by DPR (2024) showed an approximately 60% reduction four weeks post-application.
- Intake rates, dermal contact rate, and body weight of a child were used in the estimation of dermal and oral exposures of chlorantraniliprole. Children are considered a sensitive population because of their behavior and relatively high exposure rates after adjustment for body weight.

Table 1. Calculation of hazard quotients for various exposure pathways for children aged 1-2 years: liquid formulation Acelepryn®

| Exposure pathway | Estimate | Daily Dose (µg/kg-day)* | Reference Dose or RfD (µg/kg-day)* | Hazard Quotient |
|---|---|---|---|---|
| Dermal exposure to dislodgeable residue on turf | High-end | 98 | 533.3 | 0.18 |
| Dermal exposure to dislodgeable residue on turf | Mean | 15 | 533.3 | 0.028 |
| Hand-to-mouth ingestion of dislodgeable residue on turf | High-end | 2.0 | 80 | 0.025 |
| Hand-to-mouth ingestion of dislodgeable residue on turf | Mean | 0.31 | 80 | 0.0039 |
| Incidental ingestion of turf and soil | High-end | 0.0096 | 80 | 0.00012 |
| Incidental ingestion of turf and soil | Mean | 0.0025 | 80 | 0.000032 |

*µg/kg-day = micrograms per kilogram body weight per day

Table 2. Calculation of hazard quotients for various exposure pathways for children aged 1-2 years: granular formulation Acelepryn® G

| Exposure pathway | Estimate | Daily Dose (µg/kg-day)* | Reference Dose or RfD (µg/kg-day)* | Hazard Quotient |
|---|---|---|---|---|
| Dermal exposure to dislodgeable residue on turf | High-end | 17 | 533.3 | 0.032 |
| Dermal exposure to dislodgeable residue on turf | Mean | 4.9 | 533.3 | 0.0092 |
| Hand-to-mouth ingestion of dislodgeable residue on turf | High-end | 0.35 | 80 | 0.0044 |
| Hand-to-mouth ingestion of dislodgeable residue on turf | Mean | 0.10 | 80 | 0.0013 |
| Incidental ingestion of turf and soil | High-end | 0.0027 | 80 | 0.000034 |
| Incidental ingestion of turf and soil | Mean | 0.0014 | 80 | 0.000018 |

*µg/kg-day = micrograms per kilogram body weight per day

Table 3. Calculation of hazard index for all exposure pathways for children aged 1-2 years for liquid and granular formulations of Acelepryn®

| Chemical formulation | Dose Estimate | Hazard Index |
|---|---|---|
| Acelepryn® (Liquid) | High-end | 0.21 |
| Acelepryn® (Liquid) | Mean | 0.032 |
| Acelepryn® G (Granular) | High-end | 0.036 |
| Acelepryn® G (Granular) | Mean | 0.011 |

OEHHA thanks DPR for providing the monitoring data and CDFA for providing treatment information. If you have any questions, please contact me at (916) 322-4250 or katherine.sutherland-ashley@oehha.ca.gov.

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## APPENDIX 1

### Calculated Mean Pesticide Values of Chlorantraniliprole from Acelepryn® Treatments

We calculated mean pesticide residues following treatment using environmental monitoring data provided by DPR (2024). Maximum observed values were used for high end exposure estimates. Samples were divided into liquid formulation treatments or granular formulation treatments. Results for turf dislodgeable residue samples are in Table A1 and soil samples are in Table A2.

Table A1. Mean and highest observed pesticide values for turf dislodgeable residue

| Turf dislodgeable residue pesticide residue values | Value (µg/sample) |
|---|---|
| Mean turf dislodgeable residue, liquid treatment | 13.5 |
| Mean turf dislodgeable residue, granular treatment | 4.29 |
| Highest turf dislodgeable residue, liquid treatment | 86.5 |
| Highest turf dislodgeable residue, granular treatment | 15.0 |

Table A2. Mean and highest observed pesticide values for soil samples

| Soil pesticide residue values | Value (ppm) |
|---|---|
| Mean soil concentration, liquid treatment | 0.72 |
| Mean soil concentration, granular treatment | 0.40 |
| Highest soil concentration, liquid treatment | 2.8 |
| Highest soil concentration, granular treatment | 0.76 |

### Dermal exposure to dislodgeable residue on turf

For residents exposed to chlorantraniliprole through dermal contact with residue on turf, the dermal daily dose, $DD_{dermal}$ (µg/kg-day), can be calculated using Equation 1:

$$\mathbf{DD_{dermal} = (TDR \times TC \times ET)/BW \quad (Equation\ 1)}$$

Where:

TDR = turf dislodgeable residue (µg/cm$^2$) reported by the monitoring study (DPR, 2024)

TC = transfer coefficient, for children 1<2 years old, assumed to be 49,000 cm$^2$/hour

ET = exposure time, for children 1<2 years old, assumed to be 1.5 hour/day

BW = body weight, for children 1<2 years old, assumed to be 11.4 kg.

The input values selected for TC, ET, and BW followed the standard procedure of US EPA (2012). DPR collected turf dislodgeable residue (TDR) post-treatment samples using the Modified California Roller method. The method uses a weighted cylinder rolling back and forth five times over a cotton fabric held in place on a turf surface, transferring the chemical residues to the fabric.

The estimated mean and high-end values for dermal exposure to TDR in children 1<2 years old, for liquid and granular treatments, are listed in Table A3.

Table A3. Calculation of dermal daily dose of turf disloadgeable residue for children aged 1-2 years following Acelepryn® treatment

| Dermal exposure to turf dislodgeable residue (Children 1<2 yrs) | Turf Dislodgeable Residue ($\mu g/cm^2$) | Transfer Coefficient ($cm^2/hr$) | Exposure Time (hr/day) | Body Weight (kg) | Daily Dose ($\mu g/kg$-day) |
|---|---|---|---|---|---|
| Liquid treatment mean estimate | 0.0024 | 49,000 | 1.5 | 11.4 | 15.5 |
| Liquid treatment high-end estimate | 0.015 | 49,000 | 1.5 | 11.4 | 97.0 |
| Granular treatment mean estimate | 0.00075 | 49,000 | 1.5 | 11.4 | 4.84 |
| Granular treatment high-end estimate | 0.0026 | 49,000 | 1.5 | 11.4 | 16.8 |

**Hand-to-mouth ingestion of dislodgeable residue on turf**

Dose from hand-to-mouth ingestion of chlorantraniliprole residues from the treated turf was calculated for children 1<2 years based on the behavioral characteristics of this potentially exposed life-stage. The daily dose absorbed through the oral route is $DD_{oral\text{-}abs}$. The equation and input parameters used for the calculation followed the guideline of US EPA (2012) as shown in Equation 2:

$$\mathbf{DD_{oral\text{-}abs} = [(HR \times F_M \times SA_H \times ET \times N\_Replen \times (1-(1-SE)^{Freq_{HtM}/N\_Replen})] \div BW \quad (Eq.\ 2)}$$

Where:

HR = average residue available on the hands ($\mu g/cm^2$), estimated by Equation 3

$$\mathbf{HR = (Fai_{hands} \times DE) \div (2 \times SA_H) \quad (Equation\ 3)}$$

Where:

$Fai_{hands}$ = fraction of the active ingredient on hands from dermal transfer coefficient study (unitless) for liquid formulation, assumed to be 0.06

DE = dermal exposure (µg) for one day, calculated by Equation 4

$SA_H$ = typical surface area of one hand, for children 1<2 years old, assumed to be 150 $cm^2$

**DE = TDR × TC × ET × 1 day (Equation 4)**

Where:

TDR = turf dislodgeable residue (µg/$cm^2$) reported by the monitoring study (DPR, 2024)

TC = transfer coefficient for child 1<2 years old, 49,000 $cm^2$/hour

ET = exposure time, 1.5 hours/day

Other terms:

$F_M$ = fraction hand surface area mouthed, assumed to be 0.127 fraction/event

N_Replen = replenishment intervals per hour, assumed to be 4 intervals/hour

SE = saliva extraction factor, assumed to be 0.48 (unitless)

Freq_HtM = hand-to-mouth events per hour, assumed to be 13.9 events/hour

BW = body weight for children 1<2 years old, assumed to be 11.4 kg

Hand-to-mouth exposure used the same monitoring data as the dermal exposure due to TDR. The estimated mean and high-end dose values for hand-to-mouth exposure to TDR in children 1<2 years old, for liquid and granular treatments, are listed in Table A4.

Table A4. Calculation of hand-to-mouth ingestion daily dose of turf dislodgeable residue for children aged 1-2 years following Acelepryn® treatment

| Hand-to-mouth exposure to turf dislodgeable residue (Children 1 < 2 yrs) | Turf Dislodgeable Residue (µg/$cm^2$) | Dermal Exposure (µg) | Hand Residue (µg/cm2) | Daily Dose (µg/kg-day) |
|---|---|---|---|---|
| Liquid treatment mean estimate | 0.0024 | 178 | 0.036 | 0.32 |
| Liquid treatment high-end estimate | 0.015 | 1,117 | 0.22 | 2.0 |
| Granular treatment mean estimate | 0.0008 | 56 | 0.011 | 0.10 |
| Granular treatment high-end estimate | 0.0026 | 194 | 0.039 | 0.35 |

**Incidental ingestion of turf and soil**

To estimate exposures through incidental soil ingestion, the absorbed daily dose through the oral route, $DD_{oral\text{-}abs}$ (µg/kg-day), can be calculated using Equation 5:

$$\mathbf{DD_{oral\text{-}abs} = (C_{Soil} \times IR_{Soil} \times GA \times CF) \div BW \quad (Equation\ 5)}$$

Where:

$C_{Soil}$ = residues detected in turf plugs and soil cores (µg/g or ppm) reported by the monitoring study (DPR, 2024)

$IR_{Soil}$ = ingestion rate of soil (mg/day), assumed to be 40 mg/day

GA = gastrointestinal absorption factor of chlorantraniliprole, assumed to be 100%

CF = weight unit conversion factor ($1 \times 10^{-3}$ g/mg)

BW = body weight, for children 1<2 years old, assumed to be 11.4 kg

We followed US EPA guidelines for evaluating residential pesticide exposure (US EPA, 2012) and assumed that pesticide residues in soil could be ingested by children 1<2 years old when playing on treated areas with normal mouthing activities. US EPA recommended using 40 mg/day as the $IR_{Soil}$ of children 1<2 years old (US EPA, 2017). Body weight for children 1<2 years old was assumed to be 11.4 kg. The estimated values for incidental ingestion exposure to chlorantraniliprole in turf and soil for children 1<2 years old, for liquid and granular treatments, are listed in Table A5.

Table A5. Calculation of incidental ingestion daily dose for turf and soil exposure for children aged 1-2 years following Acelepryn® treatment

| Incidental ingestion of turf and soil exposure (Children 1 < 2 yrs) | Soil Concentration (µg/g) | Soil Ingestion Rate (mg/day) | GI Absorption Factor | Body Weight (kg) | Daily Dose (µg/kg-day) |
|---|---|---|---|---|---|
| Liquid treatment mean estimate | 0.72 | 40 | 1 | 11.4 | 0.0025 |
| Liquid treatment high-end estimate | 2.8 | 40 | 1 | 11.4 | 0.0098 |
| Granular treatment mean estimate | 0.40 | 40 | 1 | 11.4 | 0.0014 |
| Granular treatment high-end estimate | 0.76 | 40 | 1 | 11.4 | 0.0027 |

**REFERENCES**

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