Office of Environmental Health Hazard Assessment

Proposition 65

Interpretive Guideline No. 2020-01

Residential exposure to dichlorvos (DDVP) in Naled bait stations and lures during invasive pest eradication program activities

Pesticide and Environmental Toxicology Branch
Reproductive and Cancer Hazard Assessment Branch
Office of Environmental Health Hazard Assessment
California Environmental Protection Agency

Primary Author

Rima Woods, Ph.D.
Staff Toxicologist
Pesticide and Environmental Toxicology Branch

Reviewers

Lori Lim, Ph.D.
David Ting, Ph.D.
Pesticide and Environmental Toxicology Branch

Feng Tsai, Ph.D.
Martha Sandy, Ph.D.
Reproductive and Cancer Hazard Assessment Branch

Allan Hirsch
Chief Deputy Director

Director

Lauren Zeise, Ph.D.

A. Summary

The Office of Environmental Health Hazard Assessment (OEHHA) conducted a screening analysis to evaluate the likelihood that residential exposure to dichlorvos (DDVP) in naled would exceed the Proposition 65 No Significant Risk Level (NSRL) for the compound when used in fruit fly bait stations and lures (collectively referred to as bait stations in this report) by the California Department of Food and Agriculture's (CDFA) invasive pest eradication programs. The screening analysis derived an upper-bound estimate of DDVP exposure and compared it to the NSRL. The analysis used the maximum application amounts used by CDFA and assumed no environmental degradation of the compound. Anticipated lifetime exposure for residents to DDVP in naled when used in bait stations by CDFA's invasive pest eradication programs does not pose a significant cancer risk for purposes of Proposition 65 to the average resident near treated areas. The estimated lifetime cancer risk is calculated to be well below one excess cancer case in an exposed population of 100,000, the risk level under Proposition 65 that represents no significant cancer risk.[1]

B. Scope of Interpretive Guideline

The Office of Environmental Hazard Assessment (OEHHA) may issue an Interpretive Guideline that interprets Proposition 65 and its implementing regulations, as applied to specific facts. The Interpretive Guideline reflects OEHHA's scientific interpretation of the available information as the lead agency for implementation of the Act.[2]

C. Proposition 65 Listing of DDVP and its No Significant Risk Level

DDVP was listed as a chemical known to cause cancer under Proposition 65 on January 1, 1989.[3] The Proposition 65 No Significant Risk Level (NSRL) for DDVP is 2 micrograms (µg) per day.[4] Daily exposure to this level of DDVP is estimated to cause a risk of one cancer per 100,000 people exposed. Businesses causing exposures at or below the NSRL are exempt from the Proposition 65 warning requirements.

This Interpretive Guideline applies only to the exposure of residents to DDVP from naled in fruit fly bait stations used in the invasive pest eradication programs managed by CDFA.

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[1] Title 27, California Code of Regulations, Section 25703(b). All further references are to Title 27, Cal. Code of Regs., unless indicated otherwise.
[2] Health and Safety Code section 25249.12
[3] California Proposition 65 list of chemicals known to cause cancer and reproductive toxicity. The complete list is available at http://oehha.ca.gov/proposition-65/chemicals
[4] https://oehha.ca.gov/media/downloads/crnr/12711acrylallylclanilinefsoroctober1990.pdf

D. Naled in Lures

Fruit fly bait stations are used to detect and control invasive fruit fly pests. The bait station is a small tent-like device, with a sticky board on the inside, containing a cotton wick with a chemical lure to attract the flies. The lure is a mixture of Dibrom®, a registered insecticide in which naled is the active ingredient, and a fruit fly attractant. Naled is an organophosphate pesticide. The attractant is either cuelure, a pheromone-like substance that attracts male flies, or methyl eugenol, a naturally occurring chemical. The bait station is hung in fruit and ornamental trees 6 to 8 feet above the ground. In areas with low-growing host plants and a lack of trees, bait stations may be hung on poles three to five feet above the ground. Male fruit flies are attracted to the lure and killed by the pesticide when they land on the wick, and are retained in the bait station by the sticky surfaces. The bait station also functions to suppress the breeding of fruit flies by removing males from the population. Over time, naled in the lure as well as naled released to the air can break down into DDVP (the listed Proposition 65 carcinogen), which is also an organophosphate pesticide. DDVP has a very short half life, in hours, and does not persist in the environment.

E. Inhalation Exposure to DDVP in Naled for Residents

Inhalation while outdoors is the most relevant route for residents exposure to DDVP released from the bait stations in the air. Indoor exposures are expected to be relatively low because bait stations are placed outside, the modelled maximum ambient air concentrations of DDVP are very low, and DDVP has a short half life. Since the bait stations are placed 3 to 8 feet off the ground and the lure is enclosed within the station, oral and dermal exposures are not expected.

Air concentration for inhalation exposure of released DDVP was based on the maximum amount of naled (molecular weight: 380.8 g) used in bait stations: 5 milliter (mL) of 25 percent concentration[5], or up to 1.25 grams (g), or 0.003 moles, of naled per station. The assumption is that all naled is converted to DDVP (molecular weight: 220.97 g); this would result in 0.003 moles, or 0.73 g of DDVP released per station.

E.1. Modeled DDVP Air Concentration

DDVP is volatile and evaporates from bait stations over the course of the treatment period. Treatment periods can last approximately three months per year for several years within a particular area and frequent re-application of bait stations is often required. The release rate of DDVP is dependent on temperature and wind speed, so

[5] CDPR (2017) FIFRA 24(c) Special Local Need Label for Dibrom 8 Emulsive (CA-090011) approved dilution rates with a maximum of 25% active ingredients

bait stations are generally effective for two to six weeks, with the highest release rate typically occurring over the first two weeks.

Assuming a maximum application amount of naled per bait station, full degradation (100%) of all naled to DDVP (0.73 g), no environmental degradation of DDVP, and a constant release of DDVP in the first 2 weeks, an average release rate can be calculated by the following:

Average DDVP release rate over the first two weeks:

= 0.73 g x 1/(2 weeks x 7 days/week x 24 hours/day) x 1 hour/3600 seconds

= 0.000000603 g/second or 0.603 µg/second

For modeling the one-hour air concentration of DDVP, OEHHA assumed that DDVP will be released from naled in the lure wick with a diameter of 0.025 meters (1 inch) and the resident is five meters from the bait station. Table 1 shows the input parameters used for the AERSCREEN[6] model.

Table 1. AERSCREEN Modeling Inputs

Parameter	Value	Description
Source type	"P"	Point source
Emission Rate (g/s)	0.000000603	Calculated 2 week release rate
Stack Height (m)	1	1 m (3 ft) high, conservative as the height can be 3-8 feet
Stack Diameter (m)	0.0254	=1 inch wick
Stack Temperature (ºK)	0	Enter 0 for ambient temperature
Exit Velocity (m/s)	0.001	Passive release
Rural or Urban	"U"	Urban setting
Population of Urban Area (ppl)	3000	Population estimate for a densely populated urban area[7]
Min distance to ambient air (m)	1	Default of 1 m
NO_2 chemistry	1	No need to model NO_2 or NOx
Building downwash	"N"	Not included
Terrain Height	"N"	Not included
Max distance to probe (m)	62	62 m between bait stations
Discrete distances (m)	"Y"	Ranges: 1-20 meters; 5m was chosen
Flagpole Receptor	"N"	Not included
Source elevation (m)	0	Default of 0 m

[6] AERSCREEN is US EPA's recommended screening-level air quality model based on AERMOD

[7] Based on 2010 Census for Los Angeles, the most densely populated urban area in California

Parameter	Value	Description
Ambient temperature (ºK)	Default	Ambient temp, 250 - 310ºK (equivalent to -10 – 98ºF)
Wind Speed (m/s)	0.5	Default of 0.5 m/s (1.1 miles/hour)
Anenometer Height (m)	10	Default of 10 m
Surface Characteristics	"2"	AERMET seasonal tables
Dominant Surface profile	"7"	Urban
Dominant Climate Profile	"1"	Average moisture
Debug option	"Y"	Enable debug option

Abbreviations: ft=feet, g = gram, km=kilometers, m=meters, ppl=people, s=second.

During the first two weeks, a one-hour maximum screening DDVP concentration (C_{air}) of 0.035 µg/m^3 was estimated for potential inhalation exposure to a resident five meters from the source based on AERSCREEN model.

E.2. Exposure Level

Proposition 65 regulations address how to calculate the exposure to chemicals listed as known to cause cancer:

> "For purposes of Section 25249.10(c) of the Act, the level of exposure to a chemical listed as causing cancer, assuming lifetime exposure at the level in question, shall be determined by multiplying the level in question (stated in terms of a concentration of a chemical in a given medium) times *the reasonably anticipated rate of exposure* for an individual to the given medium of exposure measured over a lifetime of seventy years…"[8] (emphasis added)

By this provision, the reasonably anticipated rate of exposure to a chemical for the average resident was used in the exposure calculations. The amount of DDVP from naled that the average resident might be exposed to during a lifetime from living near a bait station was calculated using the modeled maximum one-hour air concentration (C_{air}), and an average adult breathing rate of 20 cubic meters of air per day (m^3/day) (Table 2). The resident was assumed to be outdoors at or near their residence for an average time of 4.7 hours per day[9] for 3 months (90 days) each year. CDFA eradication efforts in a particular area are assumed at maximum to be 10 years.

[8] Section 25721(c)

[9] US EPA Exposure Factors Handbook: 2011 Edition, Table 16-22. Value of 281 minutes/day (= 4.7 hours/day) is for mean total time outdoors for 18-64 year-old adults is conservative compared to mean time spent outdoors at residence, 136.4 minutes/day

Table 2. Parameter values used to calculate the average resident's inhalation exposure to DDVP in naled

Parameters	Value
Adult breathing rate	20 m^3/day
Modeled maximum one-hour air concentration at an average distance of 5 meters from nearest bait station	0.035 µg/m^3
Time spent outdoors[a]	4.7 hours/day
Treatment duration in a year	90 days/year
Maximum length of eradication efforts in a particular area	10 years
Average lifetime	70 years

[a] US EPA Exposure Factors Handbook (2011)

The estimated lifetime average daily inhalation dose (LADID) for DDVP in naled from a bait station was calculated as:

$$\text{LADID} = C_{air} \times \text{Breathing Rate} \times \text{Lifetime Averaging Adjustment Factor}$$

Therefore,

$$\text{LADID} = \frac{0.035\ \mu g}{m^3} \times \frac{20\ m^3}{day} \times \left(\frac{4.7\ \text{hours}}{24\ \text{hours}} \times \frac{90\ \text{days}}{365\ \text{days}} \times \frac{10\ \text{yrs}}{70\ \text{yrs}}\right)$$

Thus, using the parameter values in Table 2, the LADID estimated for residents exposed to DDVP in naled from a bait station is 0.005 µg/day. This is less than the Proposition 65 NSRL of 2 µg/day.

The LADID is considered a high-end exposure estimate for residents for the following reasons:

- Naled is gradually degraded into DDVP over time. We conservatively assumed all of the naled is converted to DDVP on the first day of the application and there is no degradation of DDVP. Naled itself has low volatility.
- The modeled air concentration from AERSCREEN is likely to be a high-end estimate. In reality, the average resident is likely much further away (i.e., greater than five meters) from the nearest bait station at least some of the time

and thus exposed to a much lower concentration. Changes in wind direction and increases in wind speed could also reduce the air concentration.

- The average resident may not be outdoors near the bait stations 4.7 hours per day for 90 days each year and for 10 years. Furthermore, a different treatment method may be used in the same area during the 10-year time period.

F. Conclusion

Inhalation exposure to DDVP in naled in the bait stations by the average resident (0.005 µg/day) does not result in exposures that exceed the Proposition 65 NSRL of 2 µg/day for the chemical, when it is converted from naled in the bait stations.

This interpretive guideline is intended to provide information for the general public. It is limited to the facts and assumptions contained herein. Further information can be obtained from the OEHHA website at: https://oehha.ca.gov/proposition-65/interpretive-guidelines-proposition-65.