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

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OFFICE OF
PREVENTION, PESTICIDES, AND
TOXIC SUBSTANCES

MEMORANDUM

SUBJECT: REVISED OCCUPATIONAL AND RESIDENTIAL EXPOSURE ASSESSMENT FOR THE CHLOROTHALONIL REREGISTRATION ELIGIBILITY DECISION (RED)

FROM: Jeff Evans, Acting Section Head
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THRU: Edward Zager, Acting Branch Chief
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Health Effects Division (7509C)

Please find the OREB review of ....

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CHLOROTHALONIL

(RED SECTION III - TOXICITY, EXPOSURE, AND RISK)

(EXPOSURE)

An occupational and/or residential exposure assessment is required for chlorothalonil based on (1) adverse effects including carcinogenicity and (2) because there is potential exposure to handlers (mixers, loaders, applicators, etc.) during use of chlorothalonil and to persons reentering areas treated with chlorothalonil.

Use Summary

Use Patterns

Chlorothalonil is a broad spectrum fungicide applied to turfgrass, vegetables, stone fruits, peanuts, soybeans, ornamentals (including greenhouse grown), minor crops (cranberry) and conifers (forestry) to control plant diseases such as powdery mildew, botrytis, rhizoctonia, and phytophthora. Formulations of chlorothalonil include wettable powders, aqueous flowable concentrates, and solid flowables (water dispersable granules). Chlorothalonil is also formulated into paints for interior and exterior applications.

Occupational-Use and Homeowner-Use Products

Most chlorothalonil end-use products are intended primarily for occupational use. However, there are also products intended primarily for "homeowner" use.

Summary of Toxicity Concerns Impacting Occupational and Residential Exposures

Acute Toxicity

The acute toxicity of the chlorothalonil technical grade active ingredient (TGAI) is in Toxicity Category IV, for acute oral toxicity and skin irritation potential, and in Toxicity Category III for acute dermal toxicity. Chlorothalonil TGAI is in Toxicity Category I for primary eye irritation, and is in Toxicity Category II for acute inhalation toxicity. The Agency has determined that chlorothalonil is a non-sensitizer.

Other End-points of Concern

Chlorothalonil is classified as a probable human carcinogen (Group B2) based on evidence of carcinogenicity in rats and mice (kidney). For risk assessment purposes, a potency factor or Q^{1*} of 0.00766 (mg/kg/day) has been calculated.

In the Chlorothalonil Toxicology Endpoint Selection (TES) Document dated November 11, 1996[1], short-term, intermediate-term, and chronic endpoints of concern were identified for assessing occupational and residential exposures.

For short-term (1 - 7 days of exposure) and for intermediate-term (1 week to several months exposure) occupational or residential exposure, a no observed effect level (NOEL) of 600 mg/kg/day was selected (highest dose tested). The NOEL was identified in a recently submitted 21-day dermal toxicity study (rat), designed to establish an endpoint for adverse kidney effects, after dermal administrations of chlorothalonil. Previous endpoints for short-term exposure selected from oral studies indicated that the kidneys were the target organ. The results of this study, substantiate the kidneys are not target organs after dermal dosages of up to 600 mg/kg/day.

For chronic occupational or residential exposure (Non-carcinogenic), a NOEL (2 mg/kg/day) was identified in a two-year, rat feeding study used to establish the RfD. The NOEL is based on increased kidney weights, hyperplasia of the proximal convoluted tubule, forestomach hyperplasia and ulcers observed in animals at 4 mg/kg/day. However, according to the TES document, lesions observed in the forestomach were considered to be the result of chonic irritation of the gastric mucosa by chlorothalonil.

For inhalation exposure (any time period), an endpoint of 0.092 mg/L was selected. This value is the LC_{50} from the acute inhalation study, which places the chlorothalonil TGAI in Toxicity Category II. , Based on the Route-to-Route extrapolation method, this value is equivalent to 12.2 mg/kg/day. The TES document indicates that a 50 percent inhalation absorption value should be used in the exposure/risk analysis.

Based on a memorandum from R. Zenzian/Toxicology Branch I to M. Clock/Risk Characterization and Analysis Branch dated 9/15/95, an upper limit 5% of the chlorothalonil that contacts the skin during a working day is absorbed. It is assumed that this rate will over estimate human dermal absorption because the absorption rate is based on data derived from rat studies. However, when comparing human exposure to animal studies, in which the animals were dosed dermally (short-term and intermediate-term endpoints), **no adjustment for dermal absorption is made**. Therefore, occupational and residential exposures will only be adjusted for dermal absorption when comparing exposures to the Q* and the chronic endpoint.

To assess occupational and residential exposure to paints and stains containing chlorothalonil, a 1.22% dermal absorption rate (8 hour period) for latex based paints and a 1.34% dermal

absorption rate (8 hour period) for alkyd-based stains have been selected. The 8-hour rate was selected, since it is assumed that professional painters wash with soap and water after using latex paint and paint thinners after using the alkyd stains.

Hexachlorobenzene (HCB) is a potential degradate compound of chlorothalonil and is a carcinogen (HCB Q^{1*} = 1.02 mg/kg/day) The dermal penetration factor is estimated to be 26%, based on a previous Agency assessment for dacthal, which also is contaminated with HCB. In the past, the Agency has assumed HCB contamination to be approximately 0.05% to that of chlorothalonil. In foliar dislodgeable residue studies submitted to the Agency, HCB appears to represent approximately 0.02% of the dislodgeable residues.

Since the Agency is participating in a project through NAFTA to harmonize risk assessments for chlorothalonil, the following body weights are used in the occupational and residential exposure risk assessments: handler or worker: 75.9 kilograms; female worker: 61.5 kilograms.

Incidence Reports

California is the only state that requires physicians to report the treatment of illensses related to pesticide exposure. Between 1982 and 1992, 133 incident case reports involving chlorothalonil were received by the California Pesticide Illness Surveillance Program. In these reports, adverse health effects were attributed to exposure to chlorothalonil or chlorothalonil used in combination with other pesticides. In most cases, the incidents involved mixer/loaders and applicators and were the result of accidents such as splashes or carelessness such as not wearing protective eyewear. The reported symptoms attributed to chlorothalonil were primarily eye irritations and skin rashes.

For reentry workers, there were 13 incidents reported as "possible" or "probable" consisting of skin sensitization and eye irritation. Dermatitis has been reported resulting from contact with treated wood (Johnsson *et al.*, 1983; and Bach and pedersen, 1983). Symptoms of facial erythema and tightness in the chest was reported involving a female nursery worker (Maibach, 1990). The incident was reportedly investigated by Dannaker *et al.* (1995) in which a test comfirmed that a dilute concentration of 0.01 percent caused an anaphylactoid reaction in the worker. It has been suggested (Maibach *et al.* (1993)) that chlorothalonil be listed as a cause of contact urticaria syndrome. It should be noted however, that a dermal sensitzation study conducted using guinea pigs (MRID 40546001) was negative.

According to EPA's Recognition and Management of Pesticide Poisonings (March 1989), chlorothalonil has caused skin irritation and irritation of mucous membranes of the eye and

respiratory tract. Dermal sensitization is reportedly rare and no cases of human systemic poisoning have been reported.

Handler Exposures & Assumptions

The daily exposure for handlers is calculated using the following formula:

Daily exposure (mg ai/kg bw/day)

$$\frac{\text{unit exp. (mg ai/lb ai used) X lb ai/A X A/day X dermal absorption}}{\text{body weight (75.9 kg)}}$$

EPA has determined that there is an exposure potential for mixers, loaders, applicators, or other handlers during usual use-patterns associated with chlorothalonil. Handler exposure scenarios are as follows:

Large scale mixing/loading and applying chlorothalonil for airblast, ground-boom, and aerial application equipment;

Mixing/loading chlorothalonil for applications through irrigation equipment;

Mixer/loader and applicator exposure while using hand-held equipment such as backpack sprayers;

Flaggers supporting aerial applications;

Painting with airless sprayers and paint brushes while using paints and stains containing chlorothalonil.

Mixer/loader/applicator (M/L/A) exposure data were required during Phase IV of the reregistration process. Additional M/L/A data were required in 1991 for painters and greenhouse applicators. The registrant has submitted the following handler exposure monitoring studies to support the reregistration of chlorothalonil:

- A Mixer, Applicator, and Mower Exposure Study with Chlorothalonil for Golf Course Maintenance [MRID 424338-10];
- Potential Exposure of Workers to Chlorothalonil when Handling and Applying Paint containing Chlorothalonil [MRID 436001-02];
- Chlorothalonil Worker Exposure During application of Daconil 2787 Flowable Fungicide in Greenhouses [MRID 436232-01].

Surrogate data (unit exposures) provided in the Pesticide Handlers Exposure Database (PHED) are also available for estimating other handler exposure scenarios. These scenarios

include handling tasks associated with the use of aerial, chemigation, airblast, ground-boom, and hand-held equipment. Where appropriate, the data from handler exposure monitoring studies submitted by the registrant (backpack, paint sprayer, and golf course applications) have been merged with data contained in PHED. These scenarios are shown in Tables 1a,b to 4a,b presented at the end of this chapter. The clothing and PPE scenarios for each type of exposure reflect the clothing and PPE worn in the study from which the unit exposure values were derived. The crops listed with each exposure scenario are the crops with the higher application ranges representing reasonable and worst case exposure scenarios. Potential options available for mitigating handler exposure include the use of additional PPE are shown in Table 5a,b presented at the end of this chapter.

There are very limited data regarding professional lawn care applications to residential turf. An "Assessment of Lawn Care Worker Exposure to Dithiopyr" is available in the open literature (Cowell, J.E., Lottman, C.M., and Manning, M.J. 1991. Arch. Environ. Contam. Toxicol. 21:195-201). In this study, applicator exposure was measured using biological monitoring techniques. Since the dermal absorption rate of dithiopyr is known as is chlorothalonil, an estimation of exposure to handlers using chlorothalonil can be made using these surrogate data.

Post-Application Exposures and Assumptions

Chlorothalonil is a non-systemic fungicide. When applied to plant tissues, it is strongly bound to leaf and stem cuticular waxes. According to the registrant, dissipation is influenced primarily by rainfall and irrigation. In the absence of rain or irrigation, dissipation is influenced primarily by leaf expansion. For many crops, repeated applications are made because it is used as a preventative treatment rather than curative treatment.

Chlorothalonil is applied to several crops requiring hand-labor resulting in a significant potential for workers to be exposed to treated foliage. For many crops, frequent applications are made up-to, and throughout the harvest period.

Post-application exposure may be mitigated by the establishment of restricted entry intervals (REI). REI's allow sufficient time to pass for field residues to dissipate to levels that result in acceptable MOEs for reentry workers (100 or greater). Restricted Entry Intervals (REI) and post-application exposure for chlorothalonil was calculated by using the following data submitted by ISK Biosciences:

- Determination of Dislodgeable Foliar Residues of Chlorothalonil and HCB from Bravo 720 Treated Cherry Leaves [MRID 428759-02];

- Determination of Dislodgeable Foliar Residues of Chlorothalonil and HCB from Bravo 720 Treated Broccoli Plants [MRID 428759-03];

- Determination of Dislodgeable Foliar Residues of Chlorothalonil and HCB from Bravo 720 Treated Cucumber Plants [MRID 428759-04];

- A Tomato Harvester Exposure Study with Chlorothalonil [MRID 470025-045];

- A Golfer Exposure Study with Chlorothalonil Used for Golf Course Maintenance [MRID 424338-11];

- A Mixer, Applicator, and Mower Exposure Study with Chlorothalonil for Golf Course Maintenance [MRID 424338-10].

Except for tomatoes, the above referenced FDR studies were conducted without concurrently monitoring worker exposure. Therefore, worker exposure ($\mu g/hr$) to those dislodgeable foliar residues ($\mu g/cm^2$) was estimated using estimated transfer factors (cm^2/hr). Transfer factors bridge worker exposure tasks to field measured residues (FDR's). The estimated transfer factors used in this chapter are based on professional judgment and discussions with personnel at the California Department of Pesticide Regulation. Generic transfer factors to address agricultural reentry exposure are being developed by the Agricultural Reentry Task Force (ARTF). The registrant is a member of this task force.

The above referenced data do not address post-application exposure to treated turfgrass in residential situations. Although two of the studies address post-application exposure of golfers and mowers following chlorothalonil treatments to golf courses, no measurements of foliar dislodgeable residues were made. By measuring both human exposure and available dislodgeable foliar residues concurrently, transfer factors can be calculated. The registrant asserts that chlorothalonil use on turfgrass is primarily limited to golf courses. The data gap addressing residential exposure to treated turfgrass is to be fulfilled by the Outdoor Residential Exposure Task Force (ORETF) of which the registrant is a member. Data for reentry to turfgrass treated with chlorothalonil was required in a recently issued DCI for products registered on turfgrass (3/31/95). According to the registrant, chlorothalonil is primarily applied to turfgrass on golf courses.

(RISK SECTION OF RED SECTION THREE)

Occupational and Residential

The toxicological endpoints of concern for occupational and residential exposure are selected from the available toxicity database for chlorothalonil. For the chlorothalonil risk assessment, human exposure from occupational and residential exposure is compared to the following endpoints:

Short-Term and Intermediate-Term Margins of Exposure (MOE) are calculted as follows:

$$\frac{\text{NOEL}}{\text{Dose}} = \frac{\text{600 mg/kg/day}}{\text{Daily Dermal Exposure}}$$

An MOE of 100 is required.

Inhalation Margin of Exposure is calculated as follows:

$$\frac{LC_{50}}{\text{DOSE}} = \frac{\text{12.2 mg/kg/day}}{\text{Daily Inhalation Exposure}}$$

An MOE of 100 is required.

Combined (Total) Inhalation and Short-Term or Intermediate-Term Margins of Exposure are calculated as follows:

$$MOE_T = \frac{1}{\frac{1}{MOE_{dermal}} + \frac{1}{MOE_{inhalation}}}$$

An MOE_T of 100 is required

Chronic (Non-cancer) MOE =

$$\frac{\text{NOEL}}{\text{Dose}} = \frac{\text{2 mg/kg/day}}{\text{Daily Exposure}}$$

An MOE of 100 is required.

Cancer: Risk from a lifetime of exposure to chlorothalonil and HCB with respect to their carcinogenicity =

$$\text{Daily exposure} \times \frac{\text{days exposure/yr}}{\text{365 days}} \times \frac{\text{40 years exposure}}{\text{75 years}} \times Q^*$$

Cancer risks of less than 1×10^{-4} are required for occupational exposure.

Risk From Handler Exposures

Daily exposure estimates for handlers are provided in Tables one through five.

Tables 1a,b present a summary of exposure values for large-scale mixing and loading for aerial, chemigation, ground-boom, and airblast applications. Table 1a addresses short-term, intermediate-term and inhalation end-points. Table 1b addresses cancer risk.

Tables 2a,b present a summary of exposure values for large-scale applications using aerial, ground-boom, and airblast equipment. Tables 1a,b and 2a,b are closely matched so that mixer/loader and applicator exposure can be calculated if the same person performs both tasks. These tasks are listed are separately since this is how the worker exposure was monitored, and to enable greater flexibility when mitigating risks. Table 2a addresses short-term, intermediate-term, and inhalation end-points. Table 2b addresses cancer risk.

Tables 3a,b present a summary of exposure values for smaller scale applications using hand-held equipment. The unit exposures represent the combined tasks of mixing/loading and application chlorothalonil. The application scenarios addressed in this table include the use of backpack sprayers, handgun sprayers (using water dispersable granules), push-type granular spreaders, hose-end sprayers, paint brushes, and airless paint sprayers. Table 3a addresses short-term, intermediate-term, and inhalation end-points. Table 3b addresses cancer risk.

Tables 4a,b present exposures of flaggers assisting aerial applicators. The use of a designated flagger is assumed to be the highest exposure. Table 4a addresses short-term, intermediate-term, and inhalation end-points. Table 5b addresses cancer risk.

Tables 5a,b presents risk mitigation options for each handler scenario having unacceptable MOE's or carcinogenic risks of concern respectively. Mitigation for handlers using chlorothalonil consist of requiring dust/mask respirators for mixer/loaders using wettable powder formulations for aerial applications and the use of gloves when using hand-held equpment and specialty airblast sprayers on golf courses.

The daily handler exposure is calculated using the following formula:

$$\frac{\text{unit exposure (mg ai/lb ai handled)} \times \text{lb ai/A} \times \text{acres/day} \times \text{dermal absorption}}{\text{body weight (75.9 kg)}}$$

Dermal exposure is not adjusted for dermal absorption when comparing dermal exposure to NOELs from toxicity studies in which the animals were dosed dermally. Exposures presented in Tables 1a, 2a, 3a, 4a, and 5a were not adjusted for dermal absorption. Exposure presented in Tables 1b, 2b, 3b, 4b, and 5b were adjusted for dermal absorption.

Other Uses

There are limited surrogate data available to address application of chlorothalonil by professional lawn care operators (LCO). These exposures are being addressed by the Outdoor Residential Exposure Task Force (ORETF). There is a study available in the literature that measured LCO exposure using biomonitoring techniques. Biomonitoring studies can be used as surrogates to estimate exposure for other chemicals if the dermal absorption rates for both chemicals are known. This coupled with establishing a ratio between the two chemical application rates can roughly estimate exposure for LCOs using chlorothalonil. The dermal absoprtion rate of dithiopyr is reportedly 0.08% and the dermal absorption rate of chlorothalonil is 5%. The absorbed dose from the published dithiopyr study is 4.6×10^{-5} mg/kg/pound active ingredient handled. Therefore, the absorbed dose of chlorothalonil from a similar application using dithiopyr can be estimated as follows:

$$\frac{0.000046 \text{ mg/kg/lb ai} \times 12.5 \text{ lb ai/A chlorothalonil} \times 2\text{A/da} \times 5\%}{1 \text{ lb ai/A dithiopyr} \times 0.08\% \text{ dermal absorption (da)}}$$

$$= 0.072 \text{ mg/kg/day}$$

$$= 1.44 \text{ mg/kg/day (uncorrected for dermal absorption)}$$

In a response to the draft RED for chlorothalonil regarding non-agricultural uses of chlorothalonil, the registrant stated that, "the non-agricultural uses of chlorothalonil also include uses on fresh cut lumber to control sapstain and molds (dip vats and sprayed-on), uses in caulks, sealants, grout and in pressure treatment of wood." In a memorandum dated August 8, 1996, the Agency responded by saying that 1) the use of chlorothalonil in caulks, sealants and grout is a registration action, and 2) that OREB was unaware of the wood treatment uses and those uses should be considered a datagap. The registrant has conducted a study addressing exposure during the application of paints and stains containing chlorothalonil. The painter study is assumed to represent a higher exposure than the use of chlorothalonil treated caulks.

Risk From HCB

An extensive risk assessment was not made for HCB as a contaminant in chlorothalonil. Based on the worst case exposure;

a mixer/loader using a wettable powder to support aerial applications to celery, a risk of 2.8×10^{-5} was estimated. Risk for the other senarios are assumed to be lower. This is a worst case estimate based on 0.05% HCB, Newer formulations contain lower concentrations 0.02%.

e 1a. Summary Exposure Values for Mixer/loaders Using Chlorothalonil - Not Corrected for Dermal Absorption

osure Scenario	Clothing and PPE Parameters	Unit Dermal Exposure (mg/lb ai)	Unit Inhalation Exposure (mg/lb ai)	Application Rate (lb ai/cycle)	Area Treated per Day	Daily Dermal Exposure (mg/kg/day)	Daily Inhalation Exposure (mg/kg/day)	Dermal Margin of Exposure	Inhalation Margin of Exposure	Combined Dermal and Inhalation Margin of Exposure
Mixer/Loader Exposure										
able Powder- n Bag (Aerial and migation lications to atoes)	Long-sleeved shirt, long pants, gloves	0.1737	0.0434	1.04 - 2.08	350 acres	0.83 - 1.67	0.104 - 0.208	359 - 723	59 - 117	57 - 101
able Powders- n Bag (Aerial and nigation lications to ry)	Long-sleeved shirt, long pants, gloves	0.1737	0.0434	0.78 - 2.21	350 acres	0.62 - 1.78	0.078 - 0.221	337 - 968	55 - 156	48 - 142
able Powders- n Bag (Ground lications to atoes)	Long-sleeved shirt, long pants, gloves	0.1737	0.0434	1.04 - 2.08	50 acres	0.12 - 0.24	0.015 - 0.03	2500 - 5000	407 - 813	175 - 350
able Powders- n Bag (Ground lications to ry)	Long-sleeved shirt, long pants, gloves	0.1737	0.0434	0.78 - 2.21	50 acres	0.09 - 0.25	0.011 - 0.032	2400 - 6666	381 - 1109	327 - 952
able Powders- n Bag (Ground lications to Stone s)	Long-sleeved shirt, long pants, gloves	0.1737	0.0434	2.34 - 4.16	20 acres	0.11 - 0.19	0.014 - 0.023	3158 - 5456	530 - 871	452 - 712
uid Flowable-Open r (Aerial and nigation plications to atoes)	Long-sleeved shirt, long pants, gloves	0.047	0.0012	1.04 - 2.08	350 acres	0.23 - 0.45	0.003 - 0.006	1333 - 2609	2033 - 4067	806 - 1598

Flowable-Open Aerial and igation ations to)	Long-sleeved shirt, long pants, gloves	0.047	0.0012	0.78 - 2.21	350 acres	0.17 - 0.48	0.002 - 0.006	1250 - 3529	2033 - 6100	775 - 2237
l Flowable-Open Aerial and igation ations to mas Trees)	Long-sleeved shirt, long pants, gloves	0.047	0.0012	1.04 - 4.16	100 acres	0.064 - 0.26	0.001 - 0.002	2308 - 9375	6100 - 12200	1675 - 5305
d Flowable-Open (Ground cations to Stone s and Christmas s)	Long-sleeved shirt, long pants, gloves	0.047	0.0012	1.04 - 4.16	20 acres	0.013 - 0.005	insignificant	120000- 46153	--	--
d Flowable-Open (Ground cations to toes)	Long-sleeved shirt, long pants, gloves	0.047	0.0012	1.04 - 2.08	50 acres	0.032 - 0.13	0.0004 - 0.0008	4616 - 18750	12200 - 24400	3350 - 10610
d Flowable-Open (Ground cations to y)	Long-sleeved shirt, long pants, gloves	0.047	0.0012	0.78 - 2.21	50 acres	0.024 - 0.068	0.0003 - 0.0009	8824 - 25000	13556 - 40667	5348 - 15385
d Flowable-Open (Ground cations to Golf ses)	Long-sleeved shirt, long pants, gloves	0.047	0.0012	2.08 - 12.51	40 acres	0.052 - 0.31	0.0007 - 0.004	1935 - 11538	3050 - 17429	1184 - 6949
d Flowable-Open (Ground cations to Sod s)	Long-sleeved shirt, long pants, gloves	0.047	0.0012	2.08 - 12.51	100 acres	0.13 - 0.775	0.002 - 0.01	774 - 4615	1220 - 6100	500 - 2632
Flowable-Open (Aerial and igation ications to toes)	Long-sleeved shirt, long pants, gloves	0.08	0.0008	1.04 - 2.08	350 acres	0.384 - 0.767	0.002 - 0.004	782 - 1563	3050 - 6100	612 - 1244

lowable-Open (Aeria and gation ations to y)	Long-sleeved shirt, long pants, gloves	0.08	0.0008	0.78 - 2.21	350 acres	0.29 - 0.82	0.001 - 0.004	732 - 2070	3050 - 12200	592 - 1770
lowable-Open (Aerial and gation ations to nas Trees)	Long-sleeved shirt, long pants, gloves	0.08	0.0008	1.04 - 4.16	100 acres	0.11 0.44	0.0005 - 0.001	1364 - 5455	12200 - 24400	1227 4460
lowable-Open (Ground ations to Stone s and Christmas)	Long-sleeved shirt, long pants, gloves	0.08	0.0008	1.04 - 4.16	20 acres	0.022 - 0.088	0.0001 - 0.0002	6818 - 27272	61000 - 122000	4770 - 22371
lowable-Open (Ground ations to oes)	Long-sleeved shirt, long pants, gloves	0.08	0.0008	1.04 - 2.08	50 acres	0.055 - 0.11	0.0003 - 0.00055	5455 - 10909	22181 - 40667	4386 - 8621
lowable-Open (Ground ations to y)	Long-sleeved shirt, long pants, gloves	0.08	0.0008	0.78 - 2.21	50 acres	0.04 - 0.12	0.0002 - 0.0006	5000 - 15000	20333 - 61000	4016 - 12063
Flowable-Open (Ground ications to Golf ses)	Long-sleeved shirt, long pants, gloves	0.08	0.0008	2.08 - 12.51	40 acres	0.088 - 0.53	0.0005 - 0.003	1132 - 6818	886 - 24400	2689 - 5333
lowable-Open (Ground ations to Sod s)	Long-sleeved shirt, long pants, gloves	0.08	0.0008	2.08 - 12.51	100 acres	0.22 - 1.325	0.001 - 0.007	453 - 2727	1743 - 12200	361 - 2227

Summary Exposure Values for Mixer/loaders Using Chlorothalonil - Corrected for 5% Dermal Absorption

osure Scenario	Clothing and PPE Parameters	Unit Dermal Exposure (mg/lb ai)	Unit Inhalation Exposure (mg/lb ai)	Application Rate (lb ai/cycle)	Daily Amt. Treated	Absorbed Daily Dermal Exposure (mg/kg/day)	Daily Inhalation Exposure (mg/kg/day)	Combined Daily Dermal and Inhalation Exposure (mg/kg/day)	Amortized Combined Dermal and Inhalation Exposure (mg/kg/day) **days worked per year in bold**	Lifetime Average Daily Exposure (mg/kg/day)	Risk to chlorothalonil x 10^{-4}
					Mixer/Loader Exposure						
able Powder- n Bag (Aerial lications to atoes)	Long-sleeved shirt, long pants, gloves	0.1737	0.0434	1.04 - 2.08	350 acres	0.042 - 0.083	0.104 - 0.208	0.146 - 0.29	0.032 - 0.064 **80 days/year**	0.017 - 0.034	1.3 - 2.6
able Powders- n Bag (Aerial lications to ry)	Long-sleeved shirt, long pants, gloves	0.1737	0.0434	0.78 - 2.21	350 acres	0.031 - 0.089	0.078 - 0.221	0.109 - 0.31	0.024 - 0.068 **80 days/year**	0.013 - 0.036	1.0 - 2.78
able Powders- n Bag (Ground lications to atoes)	Long-sleeved shirt, long pants, gloves	0.1737	0.0434	1.04 - 2.08	50 acres	0.006 - 0.012	0.015 - 0.03	0.021 - 0.042	0.001 - 0.002 **20 days/year**	0.0005 - 0.001	0.038 - 0.08
able Powders- n Bag (Ground lications to ry)	Long-sleeved shirt, long pants, gloves	0.1737	0.0434	0.78 - 2.21	50 acres	0.005 - 0.013	0.011 - 0.032	0.016 - 0.045	0.00087 - 0.0025 **20 days/year**	0.00046 - 0.0013	0.035 - 0.1
able Powders- n Bag (Ground lications to Stone s)	Long-sleeved shirt, long pants, gloves	0.1737	0.0434	2.34 - 4.16	20 acres	0.005 - 0.01	0.014 - 0.023	0.019 - 0.033	0.00016 - 0.00027 **3 days/year**	0.00009 - 0.00014	0.006 - 0.01
id Flowable-Open ial Applications to atoes)	Long-sleeved shirt, long pants, gloves	0.047	0.0012	1.04 - 2.08	350 acres	0.011 - 0.023	0.003 - 0.006	0.014 - 0.029	0.003 - 0.0064 **80 days/year**	0.0016 - 0.0034	0.13 - 0.26

uid Flowable-Open r (Aerial plications to ery)	Long-sleeved shirt, long pants, gloves	0.047	0.0012	0.78 - 2.21	350 acres	0.008 - 0.024	0.002 - 0.006	0.01 - 0.03	0.002 - 0.0066 **80 days/year**	0.0012 - 0.0035	0.09 - 0.27
uid Flowable-Open r (Aerial plications to ristmas Trees)	Long-sleeved shirt, long pants, gloves	0.047	0.0012	1.04 - 4.16	100 acres	0.0032 - 0.013	0.001 - 0.002	0.0042 - 0.015	0.00023 - 0.00082 **20 days/year**	0.00012 - 0.00044	0.009 - 0.033
uid Flowable-Open r (Ground plications to Stone its and Christmas es)	Long-sleeved shirt, long pants, gloves	0.047	0.0012	1.04 - 4.16	20 acres	0.0007 - 0.003	0.0002 - 0.0005	0.0009 - 0.0035	0.0000073 - 0.0000287 **3 days/year**	0.0000038 - 0.0000153	0.0002 - 0.001
uid Flowable-Open r (Ground plications to natoes)	Long-sleeved shirt, long pants, gloves	0.047	0.0012	1.04 - 2.08	50 acres	0.002 - 0.003	0.0004 - 0.0008	0.0024 - 0.0038	0.00013 - 0.00021 **20 days/year**	0.00007 - 0.00012	0.005 - 0.008
uid Flowable-Open r (Ground plications to lery)	Long-sleeved shirt, long pants, gloves	0.047	0.0012	0.78 - 2.21	50 acres	0.001 - 0.003	0.0003 - 0.0009	0.0013 - 0.0039	0.00007 - 0.00021 **20 days/year**	0.00004 - 0.0001	0.002 - 0.008
uid Flowable-Open r (Ground plications to Golf urses)	Long-sleeved shirt, long pants, gloves	0.047	0.0012	2.08 - 12.51	40 acres	0.003 - 0.016	0.0007 - 0.004	0.0037 - 0.02	0.0002 - 0.0011 **20 days/year**	00.00011 - 0.00058	0.008 - 0.044
uid Flowable-Open r (Ground plications to Sod rms)	Long-sleeved shirt, long pants, gloves	0.047	0.0012	2.08 - 12.51	100 acres	0.007 - 0.039	0.002 - 0.01	0.009 - 0.049	0.00049 - 0.00268 **20 days/year**	0.00003 - 0.0014	0.02 - 0.11
ry Flowable-Open ur (Aerial plications to matoes)	Long-sleeved shirt, long pants, gloves	0.08	0.0008	1.04 - 2.08	350 acres	0.019 - 0.038	0.002 - 0.004	0.021 - 0.042	0.0046 - 0.0092 **80 days/year**	0.00245 - 0.0049	0.188 - 0.376

Flowable-Open (Aerial ications to ry)	Long-sleeved shirt, long pants, gloves	0.08	0.0008	0.78 - 2.21	350 acres	0.014 - 0.041	0.001 - 0.004	0.015 - 0.045	0.00328 - 0.00986 **80 days/year**	0.00175 - 0.00526	0.13 - 0.4
Flowable-Open (Aerial lications to stmas Trees)	Long-sleeved shirt, long pants, gloves	0.08	0.0008	1.04 - 4.16	100 acres	0.006 - 0.01	0.0005 - 0.001	0.0065 - 0.011	0.000365 - 0.0006 **20 days/year**	0.000189 - 0.00032	0.014 - 0.024
Flowable-Open (Ground lications to Stone ts and Christmas s)	Long-sleeved shirt, long pants, gloves	0.08	0.0008	1.04 - 4.16	20 acres	0.001 - 0.004	0.0001 - 0.0002	0.0011 - 0.0042	0.000009 - 0.000036 **3 days/year**	0.0000048 - 0.0000192	0.0003 - 0.001
Flowable-Open (Ground lications to atoes)	Long-sleeved shirt, long pants, gloves	0.08	0.0008	1.04 - 2.08	50 acres	0.003 - 0.005	0.0001 - 0.00055	0.0031 - 0.0056	0.000169 - 0.000304 **20 days/year**	0.00009 - 0.000162	0.006 - 0.012
Flowable-Open (Ground lications to ry)	Long-sleeved shirt, long pants, gloves	0.08	0.0008	0.78 - 2.21	50 acres	0.002 - 0.006	0.0002 - 0.0006	0.0022 - 0.0066	0.00012 - 0.00036 **20 days/year**	0.00006 - 0.00019	0.004 - 0.014
Flowable-Open (Ground lications to Golf rses)	Long-sleeved shirt, long pants, gloves	0.08	0.0008	2.08 - 12.51	40 acres	0.004 - 0.026	0.0005 - 0.003	0.0045 - 0.029	0.00025 - 0.0016 **20 days/year**	0.00013 - 0.00085	0.01 - 0.064
flowable-Open (Ground lications to Sod ns)	Long-sleeved shirt, long pants, gloves	0.08	0.0008	2.08 - 4.16	100 acres	0.011 - 0.066	0.001 - 0.007	0.012 - 0.073	0.00066 - 0.0039 **20 days/year**	0.00035 - 0.002	0.026 - 0.16

Summary Exposure Values for Applicators Using Chlorothalonil not corrected for dermal absorption

ıre Scenario	Clothing and PPE Parameters	Unit Dermal Exposure (mg/lb ai)	Unit Inhalation Exposure (mg/lb ai)	Application Rate (lb ai/cycle)	Daily Amt. Treated	Daily Dermal Exposure (mg/kg/day)	Daily Inhalation Exposure (mg/kg/day)	Dermal Margin of Exposure	Inhalation Margin of Exposure	Combined Dermal and Inhalation Exposure
Applicator Exposure										
Applications to oes	Long-sleeved shirt, long pants, no gloves	0.009	not a significant route of exposure	1.04 - 2.08	350 acres	0.043 - 0.086	--	6978 - 13953	--	--
Applications to	Long-sleeved shirt, long pants, no gloves	0.009	not a significant route of exposure	0.78 - 2.21	350 acres	0.032 - 0.092	--	9375 - 18750	--	--
Applications to mas Trees	Long-sleeved shirt, long pants, no gloves	0.009	not a significant route of exposure	1.04 - 4.16	100 acres	0.012 - 0.049	--	3061 - 12245	--	--
d-Boom cations to toes (Open Cab)	Long-sleeved shirt, long pants, no gloves	0.017	0.0007	1.04 - 2.08	50 acres	0.012 - 0.023	0.0002 - 0.0005	26087 - 50000	24400 - 61000	12626 - 27548
d-Boom cations to Celery Cab)	Long-sleeved shirt, long pants, no gloves	0.017	0.0007	0.78 - 2.21	50 acres	0.0087 - 0.025	0.0002 - 0.0005	24000 - 68966	24400 - 61000	12121 - 32573
st Applications ne Fruits and mas Trees Cab)	Long-sleeved shirt, long pants, no gloves	0.4	0.0045	1.04 - 4.16	20 acres	0.11 - 0.44	0.0006 - 0.0025	1364 - 5455	4880 - 20333	1066 - 4303

lty Airblast ations to Courses (Open	Long-sleeved shirt, long pants, no gloves	1.71	0.001	2.08 - 12.51	40 acres	1.87 - 11.27	0.0005 - 0.003	53 - 321	4067 - 24400	53 - 317
d-Boom cations to Golf es (Open Cab)	Long-sleeved shirt, long pants, no gloves	0.075	0.002	2.08 - 12.51	40 acres	0.082 - 0.49	0.001 - 0.007	1224 - 7317	1743 - 12200	719 - 4577
d-Boom cations to Sod (Open Cab)	Long-sleeved shirt, long pants, no gloves	0.017	0.0007	2.08 - 12.51	100 acres	0.046 - 0.28	0.001 - 0.006	2143 - 13043	2033 - 12200	1043 - 6309

Summary Exposure/Risk Values for Applicators Using Chlorothalonil Corrected for 5% Dermal Absorption

ure Scenario	Clothing and PPE Parameters	Unit Dermal Exposure (mg/lb ai)	Unit Inhalation Exposure (mg/lb ai)	Application Rate (lb ai/cycle)	Daily Amt. Treated	Absorbed Daily Dermal Exposure (mg/kg/day)	Daily Inhalation Exposure (mg/kg/day)	Combined Daily Dermal and Inhalation Exposure (mg/kg/day)	Ammortized Combined Dermal and Inhalation Exposure (mg/kg/day) **days worked per year in bold**	Lifetime Average Daily Exposure (mg/kg/day)	Risk to chlorothalonil x 10^{-4}
					Applicator Exposure						
l Applications to toes	Long-sleeved shirt, long pants, no gloves	0.009	--	1.04 - 2.08	350 acres	0.002 - 0.004	--	0.002 - 0.004	0.00047 - 0.00095 **80 days/year**	0.00025 - 0.0005	0.019 - 0.038
l Applications to y	Long-sleeved shirt, long pants, no gloves	0.009	--	0.78 - 2.21	350 acres	0.0016 - 0.0046	--	0.0016 - 0.0046	0.00035 - 0.001 **80 days/year**	0.00019 - 0.00054	0.014 - 0.041
l Applications to stmas Trees	Long-sleeved shirt, long pants, no gloves	0.009	--	1.04 - 4.16	100 acres	0.0006 - 0.0025	--	0.0006 - 0.0025	0.000033 - 0.00014 **20 days/year**	0.00002 - 0.00007	0.001 - 0.005
nd-Boom lications to atoes (Open Cab)	Long-sleeved shirt, long pants, no gloves	0.017	0.0007	1.04 - 2.08	50 acres	0.0005 - 0.001	0.00024 - 0.00048	0.00074 - 0.0015	0.00004 - 0.00008 **20 days/year**	0.00002 - 0.00004	0.001 - 0.003
nd-Boom lications to Celery en Cab)	Long-sleeved shirt, long pants, no gloves	0.017	0.0007	0.78 - 2.21	50 acres	0.0087 - 0.025	0.00018 - 0.0005	0.0088 - 0.0255	0.00049 - 0.0014 **20 days/year**	0.00026 - 0.00075	0.019 - 0.057
last Applications tone Fruits and istmas Trees en Cab)	Long-sleeved shirt, long pants, no gloves	0.4	0.0045	1.04 - 4.16	20 acres	0.005 - 0.022	0.0006 - 0.0024	0.0056 - 0.024	0.000003 - 0.000123 **3 days/year**	0.000016 - 0.000065	0.001 - 0.004

cialty Airblast lications to f Courses (Open)	Long-sleeved shirt, long pants, no gloves	1.71	0.001	2.08 - 12.51	40 acres	0.094 - 0.56	0.00055 - 0.0033	0.095 - 0.563	0.005 - 0.031 **20 days/year**	0.027 - 0.0017	0.21 - 1.26
und-Boom lications to Golf urses (Open Cab)	Long-sleeved shirt, long pants, no gloves	0.075	0.002	2.08 - 12.51	40 acres	0.004 - 0.024	0.001 - 0.0066	0.005 - 0.031	0.00027 - 0.00167 **20 days/year**	0.00014 - 0.00089	0.01 - 0.068
und-Boom lications to Sod ms (Open Cab)	Long-sleeved shirt, long pants, no gloves	0.017	0.0007	2.08 - 12.51	100 acres	0.002 - 0.014	0.00096 - 0.0058	0.003 - 0.046	0.00016 - 0.0025 **20 days/year**	0.00009 - 0.0013	0.006 - 0.1

: 3a. Summary Exposure Values for Mixer/Loader/Applicators Using Chlorothalonil not corrected for dermal absorption

Exposure Scenario	Clothing and PPE Parameters	Unit Dermal Exposure (mg/lb ai)	Unit Inhalation Exposure (mg/lb ai)	Application Rate (lb ai/cycle)	Daily Amt. Treated	Daily Dermal Exposure (mg/kg/day)	Daily Inhalation Exposure (mg/kg/day)	Dermal Margin of Exposure	Inhalation Margin of Exposure	Combined Margin of Exposure
Mixer/Loader/Applicator Exposure										
Backpack Sprayer (Greenhouse Application)	Long-sleeved shirt, long pants, gloves, respirator	2.19	0.006	1.04 - 4.16	2 acres	0.06 - 0.24	0.00008 - 0.00032	2500 - 10000	38125 - 152500	2346 - 9390
Backpack Sprayer (Outdoor Applications) - Forestry and Nursery Uses	Long-sleeved shirt, long pants, gloves	2.19	0.06	1.04 - 4.16	2 acres	0.06 - 0.24	0.0008 - 0.0032	2500 - 10000	3813 - 15250	1500 - 6042
Handgun Sprayer Using Water Dispersable Granules - Forestry and Nursery Uses	Long-sleeved shirt, long pants, no gloves	0.35	0.001	1.04 - 4.16	2 acres	0.01 - 0.038	0.001 - 0.005	15789 - 60000	2440 - 12200	2114 - 10152
Homeowner Push-Type Granular Spreader	Long-sleeves shirt, long pants, no gloves	4.7	0.006	1 - 1.8 lb ai/5,000 sq.ft	5,000 sq.ft	0.06 - 0.11	0.00004 - 0.00007	5455 - 10000	174286 - 305000	5291 - 9690
Homeowner Hose-End Sprayer	Total deposition	39.1	0.002	1 - 1.8 lb ai/5,000 sq.ft	5,000 sq.ft	0.52 - 0.93	0.00001 - 0.00002	645 - 1154	610000 - 1220000	644 - 1153
Paint Brush Application Using Chlorothalonil Treated Paint - Interior Latex	Long-sleeved shirt, long pants, no gloves	290	0.507	0.048 lb ai/gallon	2 gallons	0.367	0.0003	1635	40666	1601

t Brush lication Using orothalonil Treated t - Exterior Latex	Long-sleeved shirt, long pants, no gloves	290	0.507	0.096 lb ai/gallon	2 gallons	0.734	0.0006	817	20333	786
t Brush lication Using orothalonil Treated t - Exterior Alkyd	Long-sleeved shirt, long pants, no gloves	290	0.507	0.11 lb ai/gallon	2 gallons	0.84	0.0007	722	17429	714
oor Painting Using Airless Sprayer - ior Latex	Long-sleeved shirt, long pants, no gloves	36.22	2.35	0.048 lb ai/gallon	40 gallons	0.916	0.029	655	420	256
oor Painting Using Airless Sprayer - ior Latex	Long-sleeved shirt, long pants, gloves	12	2.35	0.048 lb ai/gallon	40 gallons	0.3	0.029	2000	420	347
loor Painting g an Airless ayer - Exterior d	Long-sleeved shirt, long pants, no gloves	33.33	0.433	0.11 lb ai/gallon	40 gallons	1.9	0.013	315	946	236
loor Painting g an Airless ayer - Exterior x	Long-sleeved shirt, long pants, no gloves	33.33	0.433	0.096 lb. ai/gallon	40 gallons	1.69	0.011	355	1109	269
loor Painting g an Airless ayer - Exterior d	Long-sleeved shirt, long pants, gloves	8.87	0.433	0.11 lb ai/gallon	40 gallons	0.514	0.0125	1167	976	532

3b. Summary Exposure/Risk Values for Mixer/Loader/Applicators Using Chlorothalonil

xposure Scenario	Clothing and PPE Parameters	Unit Dermal Exposure (mg/lb ai)	Unit Inhalation Exposure (mg/lb ai)	Application Rate (lb ai/cycle)	Daily Amt. Treated	Absorbed Daily Dermal Exposure (mg/kg/day)	Daily Inhalation Exposure (mg/kg/day)	Combined Daily Dermal and Inhalation Exposure (mg/kg/day)	Amortized Dermal and Inhalation Exposure (mg/kg/day) **days worked per year in bold**	Lifetime Average Daily Exposure (mg/kg/day)	Risk to chlorothalonil x 10^{-6}
Mixer/Loader/Applicator Exposure											
ckpack Sprayer Greenhouse pplication)	Long-sleeved shirt, long pants, gloves, respirator	2.19	0.006	1.04 - 4.16	2 acres	0.003 - 0.012	0.00008 - 0.00033	0.0031 - 0.0123	0.00025 - 0.001 **30 days/year**	0.00014 - 0.00054	0.01- 0.041
ckpack Sprayer Outdoor pplications) - orestry and Nursery ses	Long-sleeved shirt, long pants, gloves	2.19	0.06	1.04 - 4.16	2 acres	0.003 - 0.012	0.0008 - 0.0033	0.0038 - 0.0153	0.0002 - 0.00084 **20 days/year**	0.00011 - 0.00045	0.008 - 0.034
andgun Sprayer ing Water ispersable Granules - orestry and Nursery ses	Long-sleeved shirt, long pants, no gloves	0.35	0.001	1.04 - 4.16	2 acres	0.0005 - 0.002	--	0.0005 - 0.002	0.000027 - 0.00011 **20 days/year**	0.000014 - 0.000058	0.001 - 0.004
omeowner Push-ype Granular preader	Long-sleeves shirt, long pants, no gloves	4.7	0.006	1 - 1.8 lb ai/5,000 sq.ft	5,000 sq.ft	0.003 - 0.006	--	0.003 - 0.006	0.00004 - 0.000074 **5 days/year**	0.00002 - 0.00004	0.001 - 0.003
omeowner Hose-End prayer	Total deposition	39.1	0.002	1 - 1.8 lb ai/5,000 sq.ft	5,000 sq.ft	0.026 0.046	--	0.026 - 0.046	0.00035 - 0.00063 **5 days/year**	0.00018 - 0.00034	0.014 - 0.022

nt Brush plication Using lorothalonil Treated nt - Interior Latex	Long-sleeved shirt, long pants, no gloves	290	0.507	0.048 lb ai/gallon	2 gallons	0.005	0.0003	0.0053	0.00015 **10 days/year**	0.000077	0.005
nt Brush plication Using lorothalonil Treated nt - Exterior Latex	Long-sleeved shirt, long pants, no gloves	290	0.507	0.096 lb ai/gallon	2 gallons	0.009	0.00669	0.0156	0.00429 **10 days/year**	0.00023	0.017
nt Brush plication Using lorothalonil Treated nt - Exterior Alkyd	Long-sleeved shirt, long pants, no gloves	290	0.507	0.11 lb ai/gallon	2 gallons	0.011	0.00073	0.0012	0.00032 **10 days/year**	0.00017	0.012
oor Painting Using Airless Sprayer - erior Latex	Long-sleeved shirt, long pants, no gloves	36.22	2.35	0.048 lb ai/gallon	40 gallons	0.011	0.03	0.041	0.0011 **10 days/year**	0.0006	0.037
oor Painting Using Airless Sprayer - erior Latex	Long-sleeved shirt, long pants, gloves	12	2.35	0.048 lb ai/gallon	40 gallons	0.004	0.03	0.034	0.00092 **10 days/year**	0.00049	0.08
tdoor Painting ing an Airless ayer - Exterior cyd	Long-sleeved shirt, long pants, no gloves	33.33	0.433	0.11 lb ai/gallon	40 gallons	0.026	0.0125	0.0385	0.00105 **10 days/year**	0.00056	0.043
tdoor Painting ing an Airless ayer - Exterior tex	Long-sleeved shirt, long pants, no gloves	33.33	0.433	0.096 lb ai/gallon	40 gallons	0.021	0.011	0.032	0.00088 **10 days/year**	0.00047	0.035
tdoor Painting ing an Airless ayer - Exterior cyd	Long-sleeved shirt, long pants, gloves	8.87	0.433	0.11 lb ai/gallon	40 gallons	0.007	0.0125	0.0195	0.00054 **10 days/year**	0.0003	0.021

e 4a. Summary Exposure/Risk Values for Flaggers Exposed to Chlorothalonil Sprays not corrected for dermal absorption

Exposure Scenario	Clothing and PPE Parameters	Unit Dermal Exposure (mg/lb ai)	Unit Inhalation Exposure (mg/lb ai)	Application Rate (lb ai/cycle)	Daily Amt. Treated	Daily Dermal Exposure (mg/kg/day)	Daily Inhalation Exposure (mg/kg/day)	Dermal Margin of Exposure	Inhalation Margin of Exposure	Combined Margin of Exposure
Flagger Exposure										
Flaggers	Long-sleeved shirt, long pants	0.011	0.0003	0.78 - 2.21	350 acres	0.04 - 0.11	0.0005 - 0.0015	5455 - 15000	8133 - 24400	3266 - 9302

[redacted]

[redacted]

mary Exposure/Risk Values for Flaggers Exposed to Chlorothalonil Sprays corrected for 5% dermal absorption

cenario	Clothing and PPE Parameters	Unit Dermal Exposure (mg/lb ai)	Unit Inhalation Exposure (mg/lb ai)	Application Rate (lb ai/cycle)	Daily Amt. Treated	Absorbed Daily Dermal Exposure (mg/kg/day)	Daily Inhalation Exposure (mg/kg/day)	Combined Daily Dermal and Inhalation Exposure (mg/kg/day)	Amortized Combined Dermal and Inhalation Exposure (mg/kg/day) **days worked per year in bold**	Lifetime Average Daily Exposure (mg/kg/day)	Risk to chlorothalonil **x 10^{-4}**
					Flagger Exposure						
	Long-sleeved shirt, long pants	0.022	0.0003	0.78 - 2.21	350 acres	0.004 - 0.011	0.00054 - 0.0015	0.0045 - 0.0125	0.00099 - 0.00274	0.0005 - 0.0014 **80 days/year**	0.04 - 0.11

Table 5a. Proposed Dermal and Inhalation Exposure Mitigation for Mixer/Loaders and Other Handlers (Dermal exposure has not been corrected for dermal absorption)

Exposure Scenario	Clothing and PPE Parameters	Unit Dermal Exposure (mg/lb ai)	Unit Inhalation Exposure (mg/lb ai)	Application Rate (lb ai/cycle)	Daily Amt. Treated	Daily Dermal Exposure (mg/kg/day)	Daily Inhalation Exposure (mg/kg/day)	Dermal Margin of Exposure	Inhalation Margin of Exposure	Combined Margin of Exposure
Handler Exposure										
Specialty Airblast Applications to Golf Courses (Open Cab)	Long-sleeved shirt, long pants, gloves	0.345	0.001	2.08 - 12.51	40 acres	0.378 - 2.27	0.0005 - 0.003	264 - 1587	4067 - 24400	248 - 1492
Wettable Powder-Open Bag, Mixer/loaders Supporting Aerial and Chemigation Applications for Tomatoes and Celery	Long-sleeved shirt, long pants, gloves, and dust masks (80% reduction)	0.1737	0.0087	0.78 - 2.21	350 acres	0.62 - 1.87	0.016 - 0.031	337 - 968	393 - 762	181 - 462

5b. Proposed Cancer Risk Mitigation for Mixer/loaders Supporting Aerial Applications Using Chlorothalonil

posure Scenario	Clothing and PPE Parameters	Unit Dermal Exposure (mg/lb ai)	Unit Inhalation Exposure (mg/lb ai)	Application Rate (lb ai/cycle)	Daily Amt. Treated	Absorbed Daily Dermal Exposure (mg/kg/day)	Daily Inhalation Exposure (mg/kg/day) with respirator	Combined Daily Dermal and Inhalation Exposure (mg/kg/day)	Amortized Dermal and Inhalation Exposure (mg/kg/day) **days worked per year in bold**	Lifetime Average Daily Exposure (mg/kg/day)	Risk to chlorothalonil **x 10^{-4}**
					Mixer/Loader Exposure						
able Powders- d Bag (Aerial and migation lications)	Long-sleeved shirt, long pants and gloves and a dust/mist mask (80% reduction)	0.1737	0.0087	0.78 - 2.21	350 acres	0.031 - 0.089	0.016 - 0.031	0.047 - 0.12	0.01 - 0.026 **80 days/year**	0.005 - 0.014	0.38 - 1.1

Risk From Post-Application Exposures

The current REI for chlorothalonil is an interim 48-hour restricted entry interval (REI) set by the Worker Protection Standard (WPS). REI's set by the WPS are based on the acute toxicity of the technical grade active ingredient (TGAI). For chlorothalonil, the interim, WPS, 48-hour REI is based on it being in Toxicity Category I for primary eye irritation. REI's do not apply to post application exposure from treatment of residential lawns or golf courses.

REI's may be increased or decreased in the REDs based on the results of the risk assessment. For chlorothalonil, the risk assessment is based on a 21-day dermal toxicity study (MRID 44119101), an acute inhalation study (MRID 00094942), and a chronic toxicity/carcinogenicity study (MRID 41250502). Chlorothalonil has been classified as a B2 (probable) carcinogen.

Risk From Short-Term and Intermediate-Term Exposure

The Agency has assumed that the post-application exposures to chlorothalonil for outdoor grown agricultural crops are seasonal and should be compared to the endpoints selected for short-term and intermediate-term periods; 1 to 7 days and 1 week to several months exposure respectively. To assess these exposures, the Agency has used the 21-dermal toxicity study - rat (MRID 4411901). A NOEL of 600 was identified in this study. Margins of Exposure (MOE).

Risk From Chronic Exposure

It is possible that chronic exposure, representing several months or more per year of exposure, may apply to greenhouse workers. This is because successive greenhouse crops can be continuously grown throughout the year. What is not known by the Agency, is the likelyhood of greenhouse crops being continuously treated with chlorothalonil. It would seem pruident from a pest management standpoint that greenhouse crops are treated with a variety of fungicides to prevent disease resistance. If alternate fungicides are used, then it is likely that greenhouse worker exposure is of a short-term or intermediate-term nature. This is an important factor because the NOEL for chronic exposure is 2 mg/kg/day. This low NOEL would have a a significant impact on the REI for harvesting cut flowers, increasing the REI from 48 hours to greater than 7 days. The risk assessment presented in this document was generated using data available in the published literature (Brouwer et al.) and data collected by the California Department of Pesticide Regulation. Due to the uncertainty of the assessment, it is recommended that the registrant submit a probability analysis of the greenhouse use of chlorothalonil addressing frequency of chlorothalinil applications and the variety of post-application work tasks associated with the cut flower industry.

Cancer Risk

A cancer assessment has been made for all post-application exposures regardless of worker exposure frequency. The Cancer risks are equal to or less than 1 x 10^{-4} for all reentry scenarios except for workers harvesting cut floral greenhouse crops. However, it is likely that the greenhouse exposure scenario is an over estimate.

Risk From Inhalation Exposure

Although there are limited data to address inhalation exposure to chlorothalonil, it does not appear that this is a significant route of exposure for reentry workers. In a study in which tomato harvesters were monitored while hand-harvesting tomatoes (MRID 470025-045), inhalation exposure was 0.82 µg/kg/day. This scenario, which represents significant worker exposure, results in an MOE of greater than 10,000. Worker exposure, to dusts contaminated with chlorothalonil, during the mechanical harvesting of bush tomatoes was measured by California Department of Pesticide Regulation personnel (Spencer et al., 1992). In that study, inhalation exposure was 0.02 mg/person per 8 hour day resulting in an MOE greater than 40,000.

Restricted-Entry Intervals (REIs)

In this section, REI's are proposed for crops based on the toxicological considerations discussed above. Tables 6 to 13 show the respective MOE's and cancer risks for postapplication/reentry workers for most agricultural and horticultural scenarios. Exposure calculations for greenhouse workers, are presented in Tables 14 and 15. Based on the exposure assessment, it appears that a 12 hour REI is adequate to protect workers from the systemic effects of chlorothalonil. What the reentry data do not address are the adverse eye effects of chlorothalonil. Based on the available eye incident data available, it appears that eye incidents can occur beyond the interim REI of 48 hours. It should also be noted that residues do not often dissipate significantly within 48 hours of application. In the absense of a model in which to assess reentry exposue to compounds that have adverse eye effects, the following label language/product stewardship is recommended in lieu of the interim 48 hour REI imposed by the WPS:

> "**Special Eye Irritation Provisions:** This product is a severe eye irritant. Do not enter or allow workers to enter a treated area within 7 days of application, unless the following safety measures have been taken:
> (1) At least one container designed specifically for flushing eyes must be available in operating condition at the WPS-required decontamination site intended for workers entering the treated area.
> (2) Workers must be informed, in a manner they can understand:
> -- that residues in the treated area may be highly irritating to their eyes,

--that they should take precautions, such as refraining from rubbing their eyes, to keep the residues out of their eyes,
-- that if they do get residues in their eyes, they should immediately flush their eyes using the eyeflush container that is located at the decontamination site or using other readily available clean water, and
-- how to operate the eyeflush container.

There are no data to address reentry exposure to residential lawns treated with chlorothalonil. However, there are limited exposure monitoring data for golfers and persons mowing fairways and greens on golf courses. The monitoring data are not applicable to other turfgrass scenarios. This is because dislodgeable foliar residue (DFR) data were not collected. Thus, exposures to individuals other than mowers and golfers can not be calculated. Table 16 presents these exposures.

Post-application/reentry daily exposure (mg/kg/day) is calculated as follows:

$$\frac{\text{DFR } (\mu g/cm^2) \times \text{transfer factor } (cm^2/hr) \times 8 \text{ hours/day}}{\text{body weight } (75.9 \text{ kg})} \times \text{dermal absorption}$$

Please Note: Tables 6 through 15 show exposures ranging from 5 to 14 days post-application. These tables came from the original assessment and included the number of days needed to reach an MOE of 100 when the intermediate-term endpoint was 1.5 mg/kg/day. OREB decided to leave the tables at their original length, if concern for cancer risks warranted extending the REI.

Table 6 presents the daily exposures for workers reentering treated papaya and stone fruit orchards, conifer nurseries (not seedlings), and Christmas tree plantations.

TASKS: For stone fruits, most applications are made early in the growing season (early bloom and shuck-split), except cherries which is treated after harvest. Hand labor tasks include pruning and topping cherry trees, pruning conifers and Christmas trees, balling and burlapping conifers.

ASSUMPTIONS: Eight hour work days (30 work days per year), dislodgeable foliar residue data from a cherry study, application rates of 2.34 - 4.16 lb ai/acre, a transfer factor of 3,800 cm^2/hr, and a body weight of 75.9 kg.

INCIDENCE: 1990, one possible case involving a worker thinning nectarines for three days - eye irritation. The field was treated with chlorothalonil and triforine.

Table 6

Day after application	Field residue ($\mu g/cm^2$)	Daily exposure (mg/kg/day)	Daily exposure corrected for dermal absorption (mg/kg/day)
0	1.81	0.72	0.036
1	1.48	0.6	0.03
2	1.20	0.48	0.024
3	0.98	0.4	0.02
4	0.80	0.32	0.016
5	0.65	0.26	0.013

Lifetime cancer risk to these residues ranges from 4.3×10^{-6} to 1.21×10^{-5}, and MOE's for short-term and intermediate term exposure are greater than 800.

Table 7 presents the daily exposures for workers reentering treated tomato fields.

TASKS: Hand harvesting tomatoes (not mechanical) and staking.

ASSUMPTIONS: Eight hour work days (120 work days per year), dislodgeable foliar residue data from a tomato study, application rates of 1.04 - 2.08 lb ai/acre, a transfer factor of 1,300 cm^2/hr from a tomato harvester study, and a body weight of 75.9 kg. There is no preharvest interval for tomatoes.

INCIDENCE: 1989, one possible case involving a worker hoeing weeds - conjunctivitis. The field treated with chlorothalonil, sulfur, and metalaxyl.

1990, one possible case where a worker got rash while harvesting tomatoes treated 12 days prior with an adjuvant, chlorothalonil, esfenvalerate, methomyl, and sulfur.

1990, one worker developed a rash on forearm while moving tomato vines in a field treated with an adjuvant, chlorothalonil, esfenvalerate, methomyl, and sulfur.

Table 7

Day after application	Field residue ($\mu g/cm^2$)	Daily exposure (mg/kg/day)	Daily exposure corrected for dermal absorption
0	4.19	0.58	0.029
1	4.01	0.56	0.028
2	3.83	0.52	0.026
3	3.66	0.5	0.025
4	3.50	0.48	0.024
5	3.34	0.46	0.023
6	3.19	0.44	0.022
7	3.05	0.42	0.021
14	2.22	0.3	0.015

Lifetime cancer risk to these residues ranges from 2.01 to 3.89×10^{-5} and MOE's for short-term and intermediate-term exposure are greater than 1,000.

Table 8 presents the daily exposures for workers reentering treated cucurbits, snap beans fields.

TASKS: Hand harvesting, vine turning, covering watermelons with vines to prevent sunburn. Hand harvesting snap beans.

ASSUMPTIONS: Eight hour work days (120 days worked per year), dislodgeable foliar residue data from a cucumber study, application rates of 1.17 - 2.2 lb ai/acre, a transfer factor of 1,000 cm^2/hr, and a 75.9 kg body weight. There is no preharvest interval for cucumbers and a 7 day preharvest interval for snap beans.

INCIDENCE: 1989, one possible case involving a worker developing a rash while picking cucumbers. The rash occurred when the worker removed their plastic picking gloves. These gloves are worn by some workers because the fuzz on cucumbers can cause skin irritation. The field was treated with chlorothalonil and oxydemeton-methyl.

Table 8

Day after application	Field residue ($\mu g/cm^2$)	Daily exposure (mg/kg/day)	Daily exposure corrected for dermal absorption (mg/kg/day)
0	7.74	0.82	0.041
1	5.95	0.64	0.032
2	4.58	0.48	0.024
3	3.52	0.38	0.019
4	2.71	0.3	0.015
5	2.09	0.22	0.011
7	1.23	0.14	0.007

Lifetime cancer risk to these residues ranges from 9.3×10^{-6} tq 5.51×10^{-5} to and MOE's for short-term and intermediate-term exposure are greater than 731.

Table 9 presents the daily exposures for workers reentering treated cole crop fields.

TASKS: Hand harvesting (cutters and packers), terminal point removal (Brussels sprouts), leaf removal (Brussels sprouts), head wrapping (cauliflower).

ASSUMPTIONS: Eight hour work day (120 work days per year) dislodgeable foliar residue data from a broccoli study, application rates of 1.17 - 1.43 lb ai/acre, a transfer factor of 700 cm^2/hr, and a body weight of 75.9 kg. Chinese cabbage and Chinese broccoli have a 7 day preharvest interval. Packer exposure is expected to be lower.

INCIDENCE: 1985, one possible case involving a worker developing a rash while harvesting cauliflower. The field was treated with chlorothalonil, oxydemeton-methyl, and mevinphos.

1988, one possible case involving a worker developing hives. The field was treated with chlorothalonil and metalaxyl.

Table 9

Day after application	Field residue ($\mu g/cm^2$)	Daily exposure (mg/kg/day)	Daily exposure corrected for dermal absorption
0	1.84	0.14	0.007
1	1.51	0.12	0.006
2	1.25	0.01	0.005
3	1.03	0.08	0.004
4	0.84	0.06	0.003
5	0.69	0.06	0.003
7	0.47	0.04	0.002

The study from which these data were taken is considered supplemental. This is because it rained on the day following the last application. This represents a best case scenario. Lifetime cancer risk to these residues ranges from 4 to 9.4 x 10^{-6} and MOE's for short-term and intermediate-term exposure are greater than 4000.

Table 10 presents the daily exposures for workers reentering treated corn fields (sweet and grown for seed).

TASKS: Hand harvesting sweet corn. Removing tassels and performing other tasks associated with seed corn production.

ASSUMPTIONS: Eight hour work day (60 work days per year), dislodgeable foliar residue data from the cucumber study, adjusted for an application rate of 0.59 - 1.43 lb ai/acre, a transfer factor of 1,000 cm^2/hr, and a body weight of 75.9 kg. Sweet corn has a 14 day preharvest interval.

INCIDENCE: None.

Table 10

Day after application	Field residue ($\mu g/cm^2$)	Daily exposure (mg/kg/day)	Daily exposure corrected for dermal absorption (mg/kg/day)
0	5.16	0.54	0.027
1	3.97	0.42	0.021
2	3.05	0.32	0.016
3	2.35	0.26	0.013
4	1.81	0.2	0.01
5	1.39	0.16	0.008
14	0.13	0.02	0.001

Lifetime cancer risk to these residues ranges from 6.0×10^{-7} to 1.8×10^{-5} and MOE's for short-term and intermediate-term exposure are greater than 1,000.

Table 11 presents the daily exposures for workers reentering treated celery fields:

TASKS: Celery cutting and field packing; moving irrigation pipe.

ASSUMPTIONS: Eight hour work days (120 work day per year), dislodgeable foliar residue data from a cucumber study, application rates of 1.17 - 2.2 lb ai/acre, a transfer factor of 700 cm^2/hr, and a 75.9 kg body weight. Celery has a seven day preharvest interval. Packer exposure is expected to be lower than cutter exposure.

INCIDENCE: 1987, one possible case involving an irrigation worker getting dizzy and feeling itchy around the neck. The worker was wearing rubber pants, jacket, and gloves and had entered the field 2 hours after bacillus thuringiensis, chlorothalonil, mevinphos, and permethrin.

Table 11

Day after application	Field residue ($\mu g/cm^2$)	Daily exposure (mg/kg/day)	Daily exposure corrected for dermal absorption (mg/kg/day)
0	7.75	0.58	0.029
1	5.96	0.44	0.022
2	4.58	0.34	0.017
3	3.52	0.26	0.013
4	2.71	0.2	0.01
5	2.08	0.16	0.008
6	1.60	0.12	0.006
7	1.23	0.1	0.005

Lifetime cancer risk to these residues ranges from 6.7×10^{-6} to 3.9×10^{-5} and MOE's for short-term and intermediate-term exposure are greater than 1,000.

Table 12 presents the daily exposures for workers reentering treated conifer nurseries (seedlings).

TASKS: Packing, and moving irrigation equipment. Other non-hand labor tasks.

ASSUMPTIONS: Eight hour work days (120 work days per year), dislodgeable foliar residue data from a cherry study, application rates of 2.34 - 4.16 lb ai/acre, a transfer factor of 700 cm^2/hr, and a body weight of 61.5 kg. This reduced body weight was chosen to reflect female exposure since many nursery workers are women.

INCIDENCE: 1989, one probable case involving a nursery worker handling treated conifer seedlings damp form a recent irrigation. The worker was wearing gloves. However, during unloading, some seedlings brushed against the workers face. The seedlings had been treated with chlorothalonil. (300 ppm of chlorothalonil were detected on the seedlings)

Table 12

Day after application	Field residue ($\mu g/cm^2$)	Daily exposure (mg/kg/day)	Daily exposure corrected for dermal absorption (mg/kg/day)
0	1.81	0.16	0.008
1	1.48	0.14	0.007
2	1.20	0.12	0.006
3	0.98	0.1	0.005
4	0.80	0.08	0.004
5	0.65	0.06	0.003

Lifetime cancer risk to these residues ranges from 4.0×10^{-6} to 1.1×10^{-5} and MOE's for short term risk are greater than 3,500.

Table 13 presents daily exposures showing daily exposure for greenhouse workers following the use of a high application rate.

TASKS: Cutting and bundling field and greenhouse grown flowers.

ASSUMPTIONS: In the Brouwer study, an application rate of 0.6 lb ai/@ 80 - 100 gallons of water/0.25 acre (@ 2.4 lb ai/A) was applied to carnation sprays and carnations grown for cut flowers. Because greenhouse application rates are expressed in terms of pounds per 100 gallons, the amount of ai applied per acre depends on the density of the crop. Exposure for reentry workers cutting and bundling flowers was 14.4 mg/hour and a transfer factor of 2,900 cm^2/hour was calculated. Based on the worker exposure (μg/hr) and the transfer factor (cm^2/hr) reported by Brouwer, dislodgeable residues in that study are estimated to be @4.97 $\mu g/cm^2$, single sided (2.5 $\mu g/cm^2$ double sided). These measurements were taken from sampling conducted 35 hours after treatment. It should be noted that Brouwer et al. reported that the chlorothalonil residues did not dissipate.

For estimating worker exposure while cutting and bundling flowers an eight hour work day is assumed (248 work days per year). A body weight of 61.5 kg was assumed since large numbers of women work in greenhouses.

INCIDENCE: 1982, a probable incident occurred when a worker was cutting lilies still wet with spray. Liquid from a stem splashed into the workers eye. The lilies were treated with chlorothalonil.

1991, a possible incident occurred when a worker developed symptoms (not specified) while handling plants treated with chlorothalonil and vinclozolin.

1991, a possible incident involving a flower cutter developing a rash after working with irises. The field was treated either 6 - 14 days prior with an adjuvant, chlorothalonil, and iprodione.

Table 13

Hours after application	Field residue ($\mu g/cm^2$)	Daily exposure (mg/kg/day)	Daily exposure corrected for dermal exposure (mg/kg/day)
35	2.5	1.89	0.095

Table 14 presents daily exposures for greenhouse workers following the application of a lower application rate.

TASKS: Cutting and bundling.

ASSUMPTIONS: In California, 1.83 lb ai/100 gallons of water per acre were applied to poinsettias. The dislodgeable foliar residues measured ranged from 0.54 to 0.74 $\mu g/cm^2$ at 3 to 36 hours after treatment. Because greenhouse application rates are expressed in terms of pounds per 100 gallons, the amount of ai applied per acre depends on the density of the crop. OREB used the transfer factor 5,800 cm^2/hr (double sided) which is based on the transfer factor generated by the Brouwer study. A body weight of 61.5 kg was used.

Table 14

Hours after application	Field residue ($\mu g/cm^2$)	Daily exposure (mg/kg/day)	Daily exposure corrected for dermal absorption (mg/kg/day)
3	0.54	0.4	0.02
4	0.74	0.58	0.029
6	0.7	0.52	0.026
12	0.62	0.46	0.023
24	0.55	0.42	0.021
36	0.6	0.46	0.023

Lifetime cancer risk to the residues presented in Tables 13 and 14 range from 5.4×10^{-5} to 2.6×10^{-4} and MOE's for short-term and intermediate-term exposure are greater than 6,000.

Table 15 presents lifetime risks from applications to golf courses.

ASSUMPTIONS: For golfers OREB assumed 30 days of golf per year and 50 years of golfing.

For mowers, OREB assumed 60 days of mowing per year and 40 years of mowing.

Table 15

Activity	Daily Exposure (mg/kg/day)	Lifetime Average Daily Exposure (mg/kg/day)	RISK $\times 10^{-4}$
Golfer - walking	0.001	0.00005	0.004
Greens mower (2 acres/day)	0.006	0.0006	0.045
Fairways mower (20 acres/day)	0.002	0.0002	0.015

Risks for other golfing scenarios such as using a golf cart are much lower and not included in this table. Short-term and intermediate-term MOE's for mowers and golfers are greater than 10,000.

Additional Occupational/Residential Exposure Studies

Handler Studies

There are few data addressing handler exposure when treating residential turf. The registrant is a member of the Outdoor Residential Exposure Task Force (ORETF). Data for mixer/loader/applicator treating turfgrass with chlorothalonil were required in a recently issued DCI for products registered on turfgrass (3/31/95). These data will be used to re-evaluate chlorothalonil handler exposure when they are submitted by the Task Force.

Post-Application Studies

The registrant must submit post-application exposure studies as confirmatory data.

Postapplication/reentry exposure studies are required as confirmatory data to determine definitive REIs for all cole crops and floral crops. The interim REIs established in this document for these crops will be adjusted accordingly upon submission of the additional data. In addition, post-application/reentry exposure studies are required for reregistration of uses on turfgrass at residential sites.

Requirements for such post-application exposure studies are addressed by Subdivision K of the Pesticide Assessment Guidelines. The required data include:

Guidelines:	132-1(a)	Foliar Residue Dissipation
	*133-3	Postapplication Dermal Passive Dosimetry Exposure
	*133-4	Postapplication Inhalation Passive Dosimetry Exposure

*Guidelines 133-3 and 133-4 may be reserved at this time pending completion of the databases on agricultural and residential postapplication/reentry exposure currently being developed by the Agricultural Reentry Task Force and Outdoor Residential Exposure Task Force, since the registrant is a member of both Task Forces.

(SECTION IV - REGULATORY POSITION AND LABELING RATIONALE)

Occupational and Residential Labeling Rationale/Risk Mitigation

At this time, some products containing chlorothalonil are intended primarily for occupational use and some are intended primarily for homeowner use.

The Worker Protection Standard (WPS)

The Agency has issued the Worker Protection Standard for Agricultural Pesticides (WPS) affecting all pesticide products whose labeling reasonably permits use in the commercial or research production of agricultural plants on any farm, forest, nursery, or greenhouse. In general, WPS products had to bear WPS-complying labeling when sold or distributed after April 21, 1994. The WPS labeling requirements pertaining to personal protective equipment (PPE), restricted entry intervals (REI), and notification are interim. These requirements are to be reviewed and revised, as appropriate, during reregistration and other Agency review processes.

At this time some of the registered uses of chlorothalonil are within the scope of the WPS and some uses are outside the WPS scope.

Requirements for Handlers

For each end-use product, personal protective equipment and engineering control requirements for pesticide handlers are set during reregistration as follows:

- *Based on risks posed to handlers by the active ingredient, EPA may establish active-ingredient-specific ("a-i specific") handler requirements for end-use products containing that active ingredient. If the risks to handlers posed by the active ingredient are minimal, EPA may establish no a-i-specific handler requirements.*

- *Based on the acute toxicity characteristics of the end-use product, EPA usually establishes handler PPE requirements for each end-use product.*

- *If a-i-specific requirements have been established, they must be compared to the end-use-product-specific PPE and the more stringent choice for each type of PPE (i.e., bodywear, hand protection, footwear, eyewear, etc.) must be placed on the label of the end-use product. Engineering controls are more stringent than PPE requirements.*

Occupational-Use Products

EPA is establishing a-i-specific requirements for some occupational handlers for chlorothalonil. Chlorothalonil is classified as a probable human carcinogen (Group B2) based on evidence of carcinogenicity in rats and mice (kidney). In addition, for short- and intermediate-term dermal exposure, a no observed effect level (NOEL) of 600 mg/kg/day was identified, for chronic (non-carcinogenic) exposure, a NOEL (2 mg/kg/day) was identified, and for short- and intermediate-term inhalation exposure, an endpoint of 12.2 mg/kg/day was identified. The MOE's for short- and intermediate-term dermal exposure were a concern for occupational mixers, loaders, and applicators using specialty airblast equipment unless chemical-resistant gloves are used. The MOE's for inhalation exposure were a concern for mixers and loaders handling wettable powder formulations to support aerial and chemigation applications unless a dust/mist filtering respirator is used. EPA is requiring active-ingredient-based PPE for handlers of chlorothalonil in these exposure situations.

In addition, the handlers participating in the exposure studies upon which the risks were calculated wore chemical-resistant gloves in some scenarios and respirators in some scenarios. Since the risks to handlers were calculated as acceptable based on the use of the PPE worn in the studies, the Agency will require such PPE in those scenarios.

The Pesticide Handlers Exposure Database (ver1.1) does not contain sufficient data to estimate exposure to applicators using aircraft with open cockpits. Therefore, the exposure and risk assessment for aerial applicators was estimated using enclosed cockpits. Although the vast majority of aerial applicators use aircraft with enclosed cockpits, EPA does not have concerns for handlers who may apply chlorothalonil using aircraft with open cockpits, since the MOEs for enclosed cockpits are in the thousands.

WPS and NonWPS Uses:

Since potential handler exposure is similar for WPS and nonWPS uses, the a-i-specific handler requirements (specified in Section V) are the same for WPS and nonWPS occupational uses of chlorothalonil end-use products.

Homeowner-Use Products

EPA is not establishing a-i-specific requirements for homeowner handlers for chlorothalonil. The exposure and risk assessment for homeowner handlers indicates the risks are acceptable without the use of PPE.

Post-Application/Entry Restrictions

Occupational-Use Products (WPS Uses)

NOTE: THIS SECTION HAS BEEN COMPLETED BASED ON THE ASSUMPTION THAT THE CANCER RISKS ARE ACCEPTABLE ON THE DAY OF APPLICATION (NOT ALWAYS 10^{-6}). THE ENTRY RESTRICTIONS ARE BASED SOLELY ON THE SHORT-TERM DERMAL EXPOSURES AND RISKS. THE ENTRY RESTRICTIONS FOR GREENHOUSE USES IS DEFERRED PENDING THE OUTCOME OF ADDITION (MONTE CARLO) POST-APPLICATION RISK ASSESSMENTS FOR POSSIBLE CHRONIC EXPOSURES.

Restricted-Entry Intervals, Early-Entry PPE, and "Double" Notification:

The interim Worker Protection Standard (WPS) restricted-entry intervals (REIs) for agricultural workers are based solely on the acute dermal toxicity and skin and eye irritation potential of the active ingredient. In addition, the WPS retains two types of REI's established by the Agency prior to the promulgation of the WPS: (1) product-specific REI's established on the basis of adequate data, and (2) interim REI's that are longer than those that would be established under the WPS. The WPS prohibits routine entry to perform hand labor tasks during the REI and requires PPE to be worn for other early-entry tasks that require contact with treated surfaces. "Double" notification is the statement on the labels of some WPS pesticide products requiring employers to notify workers about pesticide-treated areas orally as well as by posting of the treated areas. The interim WPS "double" notification requirement was imposed if the active ingredient is classified as toxicity category I for acute dermal toxicity or skin irritation potential.

During the reregistration process, EPA establishes REIs, early-entry PPE, and double notification requirements based on consideration of all available relevant information about the active ingredient, including acute toxicity, other adverse effects, epidemiological information, and post-application data. EPA is establishing a 12-hour REI and the following early-entry PPE for all in-scope WPS uses of products containing chlorothalonil: coveralls, chemical-resistant gloves, shoes plus socks, and protective eyewear. EPA has determined that double notification is not required. The basis for these decisions is that the reregistration evaluation of the short- and intermediate-term and carcinogenic effects of chlorothalonil has resulted in the EPA's determination that the risks from post-application exposures to chlorothalonil by workers are adequately mitigated by a 12-hour REI and minimum early-entry PPE and that no double notification requirement is warranted.

Under the Worker Protection Standard, a 48-hour restricted-entry interval was established for chlorothalonil, since the active ingredient is classified as toxicity category I for eye irritation potential. During the reregistration evaluation, the Agency considered whether to retain the 48-hour REI due to eye irritation concerns. However, by the end of the 48-hour interval, the residues from chlorothalonil would not necessarily have dissipated to a level where eye irritation is no longer a concern. Depending on plant growth, rainfall, and the timing and type of irrigation, residues of eye irritation concern might exist for seven days or more following application. In one

indoor study (Brower), it was noted that the residues of chlorothalonil did not dissipate over the time of the study. Due to the uncertainties in determining a set time interval when eye irritation from residues are no longer a concern and the economic urgency for the use chlorothalonil at a time that coincides with necessary hand-labor tasks, such as harvesting, the Agency sought an alternative to a 48-hour (or other length) REI as a means of adequately mitigating eye irritation concerns. To mitigate eye irritation concerns from post-application exposures, the Agency is requiring that, for at least seven days following the application of chlorothalonil:

- at least one container designed specifically for flushing eyes is available in operating condition at the WPS-required decontamination site for workers entering the area treated with chlorothalonil, and

- workers are informed orally, in a manner they can understand:
  -- that residues in the treated area may be highly irritating to their eyes,
  --that they should take precautions, such as refraining from rubbing their eyes, to keep the residues out of their eyes,
  -- that if they do get residues in their eyes, they should immediately flush their eyes with the eyeflush container that is located at the decontamination site, and
  -- how to operate the eyeflush container.

At this time, chlorothalonil is not a candidate for a 4-hour REI, since it is classified as a probable human carcinogen (group B2), and there are short-term, intermediate-term and chronic dermal endpoints of concern.

Occupational-Use Products (NonWPS Uses)

EPA is not establishing entry restrictions at this time for nonWPS occupational uses of chlorothalonil in paint products, since the anticipated frequency, duration, and degree of dermal exposure following paint applications do not warrant special risk mitigation measures and it is not anticipated that offgassing of vapors will be significant.

However, EPA is establishing entry restrictions at this time for nonWPS chlorothalonil applications to plants (e.g., uses on golf courses, on turfgrass in residential and commercial settings). The Agency has determined that restricting entry into treated areas until sprays have dried is a prudent safety practice applicable in such settings.

Homeowner-Use Products

EPA is establishing entry restrictions at this time for chlorothalonil end-use products that are intended primarily for

homeowner use. The Agency has determined that restricting entry into treated areas until sprays have dried is a prudent safety practice applicable in residential settings at the use-sites where chlorothalonil will be applied.

Other Labeling Requirements

The Agency is also requiring other use and safety information to be placed on the labeling of all end-use products containing chlorothalonil. For the specific labeling statements, refer to Section V of this document.

(RED SECTION V - LABELING REQUIREMENTS)

LABELING REQUIREMENTS FOR END-USE PRODUCTS

The labels and labeling of all products must comply with EPA's current regulations and requirements as specified in 40 CFR 156.10 and other applicable notices. All end-use product labels [e.g. multiple active ingredient (MAI) labels, SLN's, and products subject to generic data exemption] must be amended such that they are consistent with the basic producer labels. See Appendix A for appropriate rates and restrictions for those supported uses.

OCCUPATIONAL/HOMEOWNER PROTECTION

PPE/Engineering Control Requirements for Pesticide Handlers

For **sole-active-ingredient** end-use products that contain chlorothalonil, the product labeling must be revised to adopt the handler personal protective equipment and/or engineering control requirements set forth in this section. Any conflicting PPE requirements on the current labeling must be removed.

For **multiple-active-ingredient** end-use products that contain chlorothalonil, the handler personal protective equipment and/or engineering control requirements set forth in this section must be compared to the requirements on the current labeling and the more protective must be retained. For guidance on which requirements are considered more protective, see PR Notice 93-7.

Products Intended Primarily for Occupational Use

Active-Ingredient-Specific PPE or Engineering Control Requirements

EPA is not establishing active-ingredient-specific engineering controls for chlorothalonil end-use products.

EPA is establishing the following active-ingredient-specific PPE for some occupational uses of chlorothalonil end-use products.

For all end-use products intended primarily for occupational use, except chlorothalonil-containing paint products:

> "Applicators and other handlers must wear:
> --long-sleeved shirt and long pants, and
> --shoes plus socks.
> In addition, applicators using handheld equipment or specialty turfgrass airblast equipment and all mixers and loaders must wear:
> --chemical-resistant gloves*."

* For the glove statement, use the statement established for chlorothalonil through the instructions in Supplement Three of PR Notice 93-7.

For wettable powder formulations (except wettable powder formulations contained in water-soluble packaging) that permit aerial or chemigation applications, add:
"In addition, mixers and loaders supporting aerial or chemigation applications must wear a dust/mist filtering respirator (MSHA/NIOSH approval number prefix TC-21C)."

For end-use products that contain directions for use on plants and do not prohibit use in a greenhouse, add:
"In addition, persons handling (mixing, loading, applying, etc) in a greenhouse or other enclosed area must wear a dust/mist filtering respirator (MSHA/NIOSH approval number prefix TC-21C)."

Determining PPE Requirements for End-use Product Labels

The PPE that would be established on the basis of the acute toxicity category of the end-use product must be compared to the active-ingredient-specific personal protective equipment specified above. The more protective PPE must be placed on the product labeling. For guidance on which PPE is considered more protective, see PR Notice 93-7.

Placement in Labeling

The personal protective equipment requirements must be placed on the end-use product labeling in the location specified in PR Notice 93-7, and the format and language of the PPE requirements must be the same as is specified in PR Notice 93-7.

Products Intended Primarily for Homeowner Use

Active-Ingredient-Specific PPE Requirements

Concentrated chlorothalonil end-use products that are intended primarily for homeowner use must state:

"Uses should wear protective eyewear, such as shielded safety glasses, because this product is a severe eye irritant."

Determining PPE Requirements for End-Use Product Labels

The PPE, if any, that would be established on the basis of the acute toxicity category of each end-use product must be compared to the active-ingredient-specific personal protective equipment specified above. The more protective PPE must be placed

on the product labeling. A requirement is considered more protective than a recommendation (e.g., "must wear" is more protective than "should wear"). For guidance on which PPE is considered more protective, see PR Notice 93-7.

Placement in Labeling

The personal protective equipment requirements and recommendations must be placed on the end-use product labeling immediately following the precautionary statements in the labeling section "Hazards to Humans (and domestic animals)."

Entry Restrictions

For **sole-active-ingredient** end-use products that contain chlorothalonil, the product labeling must be revised to adopt the entry restrictions set forth in this section. Any conflicting entry restrictions on the current labeling must be removed.

For **multiple-active-ingredient** end-use products that contain chlorothalonil the entry restrictions set forth in this section must be compared to the entry restrictions on the current labeling and the more protective must be retained. A specific time period in hours or days is considered more protective than "sprays have dried" or "dusts have settled."

Products Intended Primarily for Occupational Use

WPS Uses **NOTE! THIS SECTION DOES NOT REFLECT THE ENTRY RESTRICTIONS FOR GREENHOUSE USES. THOSE RESTRICTIONS ARE PENDING.**

Restricted-entry interval:

A 12-hour restricted-entry interval (REI) is required for all uses within the scope of the WPS.

Early-entry personal protective equipment (PPE):

The PPE required for early entry is:
-- coveralls,
-- chemical-resistant gloves,
-- shoes plus socks, and
-- protective eyewear.

Eye Irritation Warnings:

The following statements must be placed on the labeling of every chlorothalonil end-use product that contains directions for WPS uses.

"**Special Eye Irritation Provisions:** This product is a severe eye irritant. Do not enter or allow workers to enter a treated area within 7 days of application, unless the following safety measures have been taken:
(1) At least one container designed specifically for flushing eyes must be available in operating condition at the WPS-required decontamination site intended for workers entering the treated area.
(2) Workers must be informed, in a manner they can understand:

-- that residues in the treated area may be highly irritating to their eyes,
--that they should take precautions, such as refraining from rubbing their eyes, to keep the residues out of their eyes,
-- that if they do get residues in their eyes, they should immediately flush their eyes using the eyeflush container that is located at the decontamination site or using other readily available clean water, and
-- how to operate the eyeflush container.

Placement in labeling:

The REI must be inserted into the standardized REI statement required by Supplement Three of PR Notice 93-7. The PPE required for early entry must be inserted into the standardized early-entry PPE statement required by Supplement Three of PR Notice 93-7. The eye irritation statements must be placed into the Agricultural Use Requirements box immediately following the early-entry personal protective equipment requirements.

NonWPS uses

Entry restrictions:

There are no entry restrictions for uses of chlorothalonil in paint products.

The Agency is establishing the following entry restrictions for nonWPS occupational uses on plants, such as golf course turfgrass or residential/commercial turfgrass):

"Do not enter or allow others to enter the treated area until sprays have dried."

Placement in labeling:

If WPS uses are also on label -- Follow the instructions in PR Notice 93-7 for establishing a Non-Agricultural Use Requirements box, and place the appropriate nonWPS entry restrictions in that box.

If no WPS uses are on the label -- Place the appropriate nonWPS entry restrictions in the Directions for Use, under the heading "Entry Restrictions."

Products Intended Primarily for Homeowner Use

Entry restrictions:

"Do not allow people or pets to touch treated plants until the sprays have dried."

Placement in labeling: Place the appropriate entry restrictions in the Directions for Use, under the heading "Entry Restrictions."

Other Labeling Requirements

Products Intended Primarily for Occupational Use

The Agency is requiring the following labeling statements to be located on all end-use products containing chlorothalonil that are intended primarily for occupational use.

Application Restrictions

"Do not apply this product in a way that will contact workers or other persons, either directly or through drift. Only protected handlers may be in the area during application."

Engineering Controls

"When handlers use closed systems, enclosed cabs, or aircraft in a manner that meets the requirements listed in the Worker Protection Standard (WPS) for agricultural pesticides (40 CFR 170.240(d)(4-6), the handler PPE requirements may be reduced or modified as specified in the WPS."

User Safety Requirements

1. {Select this if coveralls are required for pesticide handlers on the end-use product label:}

Discard clothing or other absorbent materials that have been drenched or heavily contaminated with this product's concentrate, Do not reuse them.

2. {Select this always:}

Follow manufacturer's instructions for cleaning/maintaining PPE. If no such instructions for washables, use detergent and hot water. Keep and wash PPE separately from other laundry.

User Safety Recommendations

- "Users should wash hands before eating, drinking, chewing gum, using tobacco, or using the toilet."
- "Users should remove clothing immediately if pesticide gets inside. Then wash thoroughly and put on clean clothing."
- "Users should remove PPE immediately after handling this product. Wash the outside of gloves before removing. As soon as possible, wash thoroughly and change into clean clothing."

Products Intended Primarily for Home Use

Application Restrictions

"Do not apply this product in a way that will contact any person or pet, either directly or through drift. Keep people and pets out of the area during application."

User Safety Recommendations

- "Users should wash hands before eating, drinking, chewing gum, using tobacco, or using the toilet."
- "Users should remove clothing immediately if pesticide gets inside. Then wash thoroughly and put on clean clothing."

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Chemical file

Follow manufacturer's instructions for cleaning/maintaining PPE. If no such instructions for washables, use detergent and hot water. Keep and wash PPE separately from other laundry.

User Safety Recommendations

- "Users should wash hands before eating, drinking, chewing gum, using tobacco, or using the toilet."
- "Users should remove clothing immediately if pesticide gets inside. Then wash thoroughly and put on clean clothing."
- "Users should remove PPE immediately after handling this product. Wash the outside of gloves before removing. As soon as possible, wash thoroughly and change into clean clothing."

Products Intended Primarily for Home Use

Application Restrictions

"Do not apply this product in a way that will contact any person or pet, either directly or through drift. Keep people and pets out of the area during application."

User Safety Recommendations

- "Users should wash hands before eating, drinking, chewing gum, using tobacco, or using the toilet."
- "Users should remove clothing immediately if pesticide gets inside. Then wash thoroughly and put on clean clothing."

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Chemical file

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