Appendix K. Summary of human health effects data for dicofol

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

WASHINGTON, D.C. 20460

OFFICE OF
PREVENTION, PESTICIDES
AND TOXIC SUBSTANCES

Date: July 2, 1998

MEMORANDUM

SUBJECT: The Second Revised HED Chapter of the Reregistration Eligibility Decision Document (RED) for Dicofol (Case No. 00021; Chemical No. 010501).

FROM: Mary Rust, Biologist
Risk Characterization and Analysis Branch
Health Effects Division (7509C)

THRU: Steve Knizner, Senior Scientist
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TO: Robert McNally, Branch Chief
Special Review and Reregistration Division

And

Lois Rossi, Director
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Please find attached the Second Revised Human Health Assessment for the Dicofol Reregistration Eligibility Decision Document (RED). The HED chapter includes the most recent Hazard Assessment from Whang Phang in Reregistration Branch 1 (Attachment I), Product and Residue Chemistry Assessments from Steve Funk in Chemistry and Exposure Branch 1 (Attachment II), the Dietary Exposure Analysis from Brian Steinwand in the Science and Analysis Branch (Attachment III), and the Occupational and Residential Exposure Assessment from Tim Leighton in Chemistry and Exposure Branch 2 (Attachment IV).

cc (no attachments): Dicofol Team: W. Phang, S. Funk, B. Steinwand, T. Leighton

Executive Summary:

Background

The original HED Science Chapter for the Dicofol RED was completed May 13, 1996. In June, 1996, a rebuttal to the HED Chapter had been received from the primary registrant, Rohm and Haas, which covered toxicology, chemistry and exposure issues. In response to this rebuttal, the HED re-evaluated the Reference Dose; however, it remained unchanged. Reduced application rates were incorporated, new anticipated residues were generated and both dietary and occupational and residential exposure assessments were revised. The First Revised HED Science Chapter was completed January 26, 1998.

As part of the implementation of FQPA, HED's Hazard Identification Assessment Review Committee met to evaluate the toxicology data base, re-assess the doses and endpoints for acute dietary, chronic dietary, occupational and residential exposure assessments, as well as addressing the sensitivity of infants and children from exposure to dicofol as required by the Food Quality Protection Act of 1996 (HIARC, 12/17/97). The Committee's decision was to reduce the 10X FQPA Safety Factor to 3X. In April, 1998, OPP's Food Quality Protection Act Safety Factor Committee revaluated the hazard and exposure data for dicofol and also recommended reduction of the 10X FQPA Safety Factor to 3X. In response to the HIARC decision, the registrant submitted a rebuttal (MRID 44500301, 2/27/98). HED's response to the rebuttal has been incorporated into the toxicology section of this document.

In April, 1998, the registrant Rohm and Haas submitted another rebuttal to the First Revised HED Science chapter dated January 26, 1998. This most recent rebuttal included the registrant's comments and suggestions on all parts of the HED Chapter, from the toxicological endpoints selected for risk assessment and the FQPA safety factor decision to application rates. Additionally, an acute dietary Monte Carlo assessment was submitted and will be reviewed by HED scientists for incorporation into the Agency RED. The Second Revised HED Chapter has been revised to reflect changes resulting from HED's evaluation of the most recent rebuttal from the registrant . This document includes an updated: Tolerance Reassessment Summary; Codex Harmonization status; Anticipated Residues; chronic dietary risk estimates; occupational and residential exposure estimates; and other changes.

Hazard Identification and Dose Response

There are no data gaps for the Subdivision F Guideline Toxicology data requirements. However, HED's Hazard Identification Assessment Review Committee (HIARC) has determined that a developmental neurotoxicity study in rats is required since dicofol produces neurotoxic effects in adult rats.

The toxicological endpoints used for risk assessment have remained unchanged relative to the January 26, 1998 HED Chapter. A summary table of the endpoints is located on page 19. The FQPA Safety Factor Committee decided to reduce the FQPA Safety Factor to 3X and apply it to risk assessments including relevant populations. The FQPA Safety Factor is based on the requirement for a developmental neurotoxicity study in the rat, which is required because dicofol causes neurotoxic effects in adult rats. The FQPA Safety Factor was reduced (from 10X) to 3X because data show no indication of increased susceptibility of rats of rabbits to *in utero* or postnatal exposure, there are no data gaps for Subdivision F guidelines, and although dicofol is an endocrine disruptive chemical, no evidence of endocrine toxicity was noted in the offspring of a reproduction study in rats.

The Chronic Reference Dose for dicofol was established based on a NOEL of 0.12 mg/kg/day based on inhibition of adrenal cortisol trophic hormone (ACTH) - stimulated release of cortisol in male and female dogs. An uncertainty factor of 100 was used to account for inter and intra-species extrapolation, resulting in the RfD of 0.001 mg/kg/day. For all populations, the FQPA Safety Factor of 3X was applied resulting in a Chronic RfD of 0.0004 mg/kg/day.

The Acute Reference Dose was established based a NOEL of 15 mg/kg/day from an acute neurotoxicity study in rats, based on decreased body weight and reduced food consumption observed at the next highest dose, the LOEL of 75 mg/kg/day. An uncertainty factor of 100 was used to account for inter and intra-species extrapolation, resulting in the acute RfD of 0.15 mg/kg/day. For all populations, the FQPA Safety Factor was applied, resulting in an acute RfD of 0.05 mg/kg/day.

For dietary cancer risk, HED's Cancer peer Review Committee recommended for the purpose of risk assessment, the RfD approach be used for quantification of chronic human risk (HED report dated 6/24/92). Therefore, a quantitative dietary cancer risk assessment was not performed. Dietary risk concerns due to long-term consumption of dicofol residues are adequately addressed by the DRES chronic exposure analysis using the chronic RfD.

In the absence of an acceptable dermal absorption study, the default absorption rate of 100% will be assumed. This factor is supported by approximated dermal absorption demonstrated in an unacceptable dermal absorption study in rats.

For estimating short term dermal risk, the NOEL of 4 mg/kg/day was chosen from a developmental toxicity study in rats, based on an increased frequency of abortions observed at the LOEL of 40 mg/kg/day.

For estimating intermediate-term dermal risk, the NOEL of 0.29 mg/kg/day was chosen from an oral toxicity study in dogs, based on hormonal toxicity (ACTH-stimulated release of cortisol) observed at the LOEL of 3.3. mg/kg/day.

HED has determined that chronic exposure, or continuous exposure over several months, to dicofol is unlikely based on the use patterns included in this RED.

For estimating inhalation risk, the Hazard Identification Assessment Review Committee (HIARC) selected the oral NOELs of 4 mg/kg/day, 0.29 mg/kg/day and 0.12 mg/kg/day for Short-, Intermediate- and Long-Term, respectively for inhalation risk assessments. These doses were used in respective dermal risk assessments.

Dietary Risk Estimates from Food Sources

Using anticipated residues, acute dietary risk estimates for all populations exceeds HED's levels of concern (estimated risk ranges from 320-1000% of the acute RfD). However, the registrant, Rohm and Haas, has submitted an acute dietary Monte Carlo analysis which is currently under review.

Using anticipated residues and percent of crop treated information, chronic dietary risk for all populations does not exceed HED's level of concern (highest estimated risk occupies 38% of the chronic RfD).

Dietary Risk Estimates from Drinking Water Sources

Drinking water levels of concern (DWLOC's) were not calculated for acute dietary drinking water exposure because the estimated acute risk from food sources alone exceeds HED's level of concern. DWLOCS for chronic dietary risk from drinking water were calculated Estimated environmental concentrations (EEC's) from EFED for both surface and ground water did not exceed the chronic DWLOC's.

Occupational Risk Estimates

Occupational handler risk estimates for dicofol are of concern to HED. Exposure to handlers (mixer/loaders and applicators) wearing baseline personal protective equipment (PPE) results in a dermal and inhalation risk estimate for both short term and intermediate term periods which exceeds HED's level of concern (MOEs are below 100).

When handlers wear additional PPE consisting of a double layer of clothing, chemical resistant gloves, and an organic vapor-removing respirator, short-term risk estimates exceed HED's level of concern (MOE's are less than 100) for a significant number of mixer/loaders and applicators. There are **no** intermediate-term use scenarios for handlers wearing additional PPE which result in MOE's above 100 (See Tables 11 and 12).

With engineering controls consisting of closed mixing/loading systems (water soluble packaging for wettable powders and enclosed delivery systems for liquids) and closed cabs for all application and flagging scenarios, workers have reduced exposure but risk estimates for some short-term and intermediate-term use scenarios result in MOE's below 100. Risk estimates for all but one mixer/loader short-term scenario for workers handling wettable powders, and most of the mixer/loaders handling liquids, exceed HED's level of concern (Table 13). For

intermediate-term risk estimates, all scenarios except those for flaggers in enclosed cabs, exceed HED's level of concern (Table 14).

Postapplication occupational risks were estimated for workers doing routine hand-labor crop production tasks, such as hoeing, thinning, and harvesting and non-hand-labor tasks such as crop advisor and irrigation related activities. A Data-Call-In (DCI) for chemical-specific application exposure data (230 series guidelines) was issued 10/13/95, and data have not yet been submitted by the registrant in support of the reregistration of dicofol (see Section 4). Therefore, HED used surrogate data to estimate risk from postapplication exposure to treated areas. The resulting calculations indicate that restricted-entry intervals (REI's) of 44 to 79 days are required to protect these workers.

Residential Risk Estimates

The registrant has committed to the deletion of all residential turf uses; therefore, HED did not include estimated risks to homeowners from residential exposure in the exposure and risk summary tables (Tables 10-15). The only remaining registered residential use of dicofol is spot treatment of ornamentals. HED does not expect exposure from the ornamental use scenario to result in level of estimated risk which exceeds HED's level of concern. Likewise, residential postapplication exposure from the spot treatment of ornamentals is expected to be a minimal to negligible sources of dicofol exposure, and is thus not considered a risk concern at this time.

Aggregate Risk Estimates

Acute aggregate risk estimates from food and water sources was not calculated because the estimated acute risk from food sources alone exceeds HED's level of concern.

For chronic aggregate risk from food and water sources, HED concludes that risk estimates for the general U.S. population and all population subgroups are not of concern. Tier 2 estimated environmental concentrations (EEC's) from EFED do not exceed HED's chronic drinking water levels of concern (DWLOC's).

While there is one remaining residential use scenario for dicofol (spot treatment of ornamentals), HED considers the exposure from this use to be negligible. Therefore, a short-term or intermediate-term aggregate risk assessment is not warranted.

HED RED CHAPTER

DICOFOL

In this document, which is for use in EPA's development of the dicofol Reregistration Eligibility Decision (RED), HED presents the results of its risk assessment of the potential human health effects of dietary, and occupational and residential exposure to dicofol. Included is a discussion of the product chemistry, toxicological, and residue chemistry data that have been submitted as well as HED's recommendations for risk reduction and mitigation.

I. SCIENCE ASSESSMENT

A. PHYSICAL AND CHEMICAL PROPERTIES ASSESSMENT

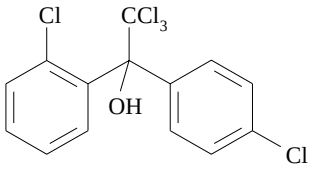
Additional data are required for the following product chemistry guidelines for dicofol: 830.1550; 830.6314; 830.6315; 830.6316; 830.6319; 830.7050. These data requirements are considered confirmatory.

All generic data requirements are fulfilled for the Rohm and Haas TGAI; however, product-specific data gaps exist for the Rohm and Haas and Agan MPs. Provided that the registrants either certify that the suppliers of starting materials and the manufacturing process for the dicofol products have not changed since the last comprehensive product chemistry review or submit complete updated product chemistry data packages, HED has no objections to the reregistration of dicofol with respect to product chemistry data requirements.

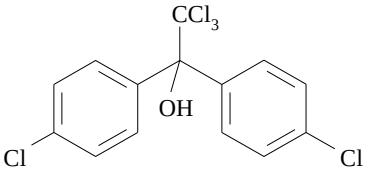
1. Description of Chemical

Dicofol [1,1-bis(4-chlorophenyl)-2,2,2-trichloroethanol and 1-(2-chlorophenyl)-1-(4-chlorophenyl)-2,2,2-trichloroethanol] is a miticide used on terrestrial food crops and non-food sites. Dicofol is structurally similar to DDT. Dicofol differs from DDT by the replacement of the hydrogen (H) on C-1 with hydroxyl (OH).

o, p'-dicofol



p, p'-dicofol



Empirical Formula: $C_{14}H_9Cl_5O$
Molecular Weight: 370.5
CAS Registry No.: 115-32-2
Shaughnessy No.: 010501

2. Identification of Active Ingredient

Technical dicofol is a reddish-brown extremely viscous non free-flowing liquid with a vapor pressure of about 4.0×10^{-7} mm Hg at 25 C. Dicofol is soluble in organic solvents (dichloromethane, methanol, n-heptane, and xylene) and virtually insoluble in water (~1 ppm for the pure active ingredient (PAI)).

B. HUMAN HEALTH ASSESSMENT

1. Hazard Assessment

a. Toxicology Data Base

The toxicological data base on dicofol is adequate to support reregistration eligibility.

b. Acute Toxicity

The following table summarizes the acute toxicity values and categories for technical dicofol.

Table 1: Acute Toxicity of Technical Dicofol.

TEST	RESULTS	CATEGORY
Oral LD_{50} - Rat	587 mg/kg	III
Dermal LD_{50} - Rabbit	2 - 5 g/kg	III
Inhalation LC_{50} - Rat	>4.2 mg/L	IV
Eye Irritation - Rabbit	Moderate irritation	III
Dermal Irritation- Rabbit	Moderate irritation	III
Dermal Sensitization - Guinea pig	Not sensitizing	--

Acute oral toxicity testing in CRCD rats found an LD_{50} of 587 mg/kg. This was toxicity category III (guideline 81-1; MRID 40731204). An acute dermal toxicity test with CRCD rats found the LD_{50} was greater than 5.0 g/kg. This was toxicity category IV (guideline 81-2; MRID

40731205). An acute dermal toxicity test with New Zealand white rabbits found the LD_{50} was between 2 and 5 g/kg. This was toxicity category III (guideline 81-2; MRID 40731205).

An acute inhalation toxicity study with rats found the LC_{50} to be greater than 4.2 mg/L, the only dose tested. This was toxicity category IV (guideline 81-3; MRID 00256514). Another acute inhalation study with rats found the LC_{50} to be greater than 5 mg/L, toxicity category IV (guideline 81-3; MRID 40731202).

An acute eye irritation study with rabbits found moderate irritation. This is toxicity category III (guideline 81-4; Bonin, 1985a). Rabbits treated with dicofol in a skin irritation study showed moderate irritation, which was toxicity category III (guideline 81-5; Bonin, 1985b).

A dermal sensitization study with guinea pigs did not find dicofol to be a sensitizer (guideline 81-6; MRID 40048506).

c. Subchronic Toxicity

In a 28-day dermal toxicity study (MRID 44099201), groups of CD rats (6/sex/dose) were dermally applied dicofol (44.8%) at doses of 0 (water control, 0 (formulation blank), 1.0, 2.5, 4.0, and 40.0 mg a.i./kg for 4 weeks. Each animal received 1 ml/kg of the test article. Under the conditions of the study, dicofol did not produce a treatment-related increase in clinical signs or mortality, and it did not affect food consumption, or hematology and clinical chemistry parameters. It produced a slight decrease in body weights and body weight gains in the highest dose males and an increase in the incidence of hepatocellular centrilobular hypertrophy. The increase in the incidence of liver hypertrophy in 40.0 mg/kg rats could be considered as a adaptive effect while the slight decrease in body weights and body weight gains appeared to be equivocal results. Under the conditions of this study, the highest dose (40 mg a.i./kg) could be conservatively considered as the "threshold" LEL, and 4.0 mg a.i. mg/kg as the NOEL. The study is acceptable, and meets the data requirements for 21-day dermal toxicity study (82-2).

In a subchronic oral toxicity study in dogs, groups of beagle dogs (6/sex/dose) received dicofol at dietary concentrations of 0, 10, 100, 300, or 1000 ppm (0, 0.29, 3.3, 9.9, or 26 mg/kg for males and 0, 0.31, 3.4, 9.8, or 27 mg/kg for females) for three months. The NOEL was 10 ppm (0.29 mg/kg/day). The LEL was 100 ppm (3.3 mg/kg/day), based on a decrease in cortisol release in response to ACTH administration, an increase in relative liver weights, and oligospermatogenesis in males. There were effects also on survival, testes, prostate, liver, gastrointestinal tract, and heart at the LEL and higher doses (guideline 82-1; MRID 40042043).

In a subchronic oral toxicity study in rats, groups of Crl:CD (SD)BR rats (10/sex/dose) received dicofol at dietary concentrations of 1, 10, 100, 500, and 1500 ppm for 90 days (0.07, 0.64, 6.49, 32.01, and 95.84 mg/kg/day for males and 0.08, 0.78, 7.84, 36.11, 105.91 mg/kg/day for females). The controls received untreated diet. Under the conditions of the study, dicofol

produced a wide range of effects in both sexes of rats. At 1500 ppm dicofol produced death and clinical signs such as lethargy and ataxia prior to death. Reduced body weights and food consumption were seen in 500 and 1500 ppm rats of both sexes. Most of the other effects were associated with toxicity seen in the liver (*increased liver weights, enhanced hepatic MFO activity, and hepatocellular hypertrophy*), adrenals (*diffuse adrenal cortical cell vacuolation & decrease corticosterone levels*), thyroid (*hypertrophy of the thyroid follicular epithelium*), and stomach (*focal chief-cell hyperplasia in the fundic mucosa*). The effects on the liver and thyroid were seen in dose levels as low as 100 ppm and 10 ppm, respectively. However, at 1 ppm, dicofol did not produced an effect in any of the parameters examined in this study. Based on the increase in the incidence of hypertrophy of the thyroid follicular epithelium, the LEL is 10 ppm (0.64 mg/kg); NOEL, 1 ppm (0.07 mg/kg). This study meets the data requirements for a subchronic feeding study in rodents (Guideline No. 82-1), and it is acceptable. However, the data on the analyses of the tissue residues of the test compound should be submitted (MRID 47015801).

In a 90-day feeding study in mice, groups of Crl:CD^{R}-1 (ICR) BR mice (10/sex/group) received dicofol in the diet for 3 months at concentrations of 10, 125, 250, 500, or 1000 ppm (1.6, 18.2, 38.2, 84.4, or 178.4 mg/kg for males and 2.1, 29.3, 56.2, 108.0, or 188.4 mg/kg for females). Under the conditions of this study dicofol did not produce any compound-related effects in 10 ppm male or female mice. Dicofol produced dose-related effects on the body weights, the liver (*increased liver weights, hepatic MFO activity, hepatocellular hypertrophy associated with necrosis and vacuolation*), kidney (*decrease in weight, granular and dilated kidneys, dilation and degeneration of cortical tubules of kidneys*), and the adrenal glands (*diffuse hypertrophy of adrenal cortical cells*) at dose levels as low as 125 ppm, 250 ppm and 500 ppm, respectively. The effects seen in 1000 ppm were more severe than any lower dose levels. Therefore, based on the decrease in body weights, increased hepatic MFO activity, and increase in liver weights, the LEL for subchronic toxicity of dicofol is established at 125 ppm (18.2 mg/kg); NOEL, 10 ppm (1.6 mg/kg). (MRID No. 40042044)

d. Chronic Toxicity/Carcinogenicity

In a one-year chronic toxicity study in dogs, groups of beagle dogs (6/sex/dose) were fed doses of 0, 5, 30, or 180 ppm (0, 0.12, 0.82, or 5.71 mg/kg for males and 0, 0.13, 0.85, or 5.42 mg/kg for females). The NOEL was 5 ppm (0.12 mg/kg/day in males and 0.13 mg/kg/day in females). The LEL was 30 ppm (0.85 mg/kg/day in females and 0.82 mg/kg/day in males), based on inhibition of ACTH-stimulated cortisol release in both sexes. There was increased mortality, increased alkaline phosphatase levels, increased liver weights, and hepatocyte hypertrophy in males and females at the high dose (guideline 83-1; MRID 40997101).

In a chronic feeding/carcinogenicity study in rats, groups of CRL:CD^{R} BR rats (60/sex/dose) received dicofol at dietary levels of 0, 5, 50, or 250 ppm (0, 0.22, 2.23, or 11.34 mg/kg/day for males and 0.27, 2.69, or 14.26 mg/kg/day for females) for 24 months. The NOEL for systemic toxicity was 5 ppm (0.27 mg/kg/day in females, 0.22 mg/kg/day in males). The LEL was 50 ppm (2.69 mg/kg/day in females, 2.23 mg/kg/day in males) based on decreased food

consumption, decreased body weight gain, reduced triglyceride levels, and increased hepatic mixed function oxidase activity, seen at or before 12 months. There were also histological changes: the liver showed centrilobular hepatocyte hypertrophy, vacuolation, and areas of necrosis in 50 and 250 ppm males and females, and the adrenal glands showed cortical cell vacuolation in 250 ppm males and females. No compound-related increases in tumor incidence were observed in this study (guideline 83-1; MRID 41150001).

Carcinogenic bioassays of dicofol were also carried out by the National Cancer Institute in rats and mice[1]. In the rat study, groups of Osborne-Mendel rats (50/sex/dose; control, 20/sex) were fed 0, 471, or 942 ppm (equivalent to 0, 23.6 or 47.1 mg/kg/day) in males and 0, 380, or 760 ppm (equivalent to 0, 19, or 38 mg/kg/day) in females for 78 weeks, followed by 34 weeks without treatment. Dose-related body weight depression was found in both sexes. No compound-related tumors were observed at either dose (MRID 41037801).

In the NCI mouse carcinogenicity study, groups of B6C3F1 mice (50/sex/dose; control, 20/sex) were given dicofol at dietary concentrations of 0, 264, or 528 ppm in males (equivalent to 0, 39.6, or 79.2 mg/kg/day) and 0, 122, or 243 ppm (equivalent to 0, 18.3 or 36.5 mg/kg/day) in females for 45 weeks, followed by 14-15 weeks without treatment. High dose females had decreased body weights. The incidences of hepatocellular adenomas and hepatocellular adenomas/carcinomas combined were significantly increased in males at both dose levels (39.6 and 79.2 mg/kg/day) (MRID 41037801).

Based on the increase in the incidence of liver adenomas and combined liver adenomas and carcinomas in male mice, the Carcinogenicity Peer Review Committee has classified dicofol as Group C-possible human carcinogen and has recommended that for the purpose of risk characterization the Reference Dose (RfD) approach be used for quantification of human risk (6/24/92).

e. Developmental Toxicity

In a developmental toxicity study in rats, groups of pregnant Crl:COBS CD rats (25/dose group) received dicofol by gavage at doses of 0, 0.25, 2.5 or 25 mg/kg/day on gestation days 6-15. The maternal toxicity NOEL was 0.25 mg/kg/day. The maternal LOEL was 2.5 mg/kg/day as a result of salivation, reduced food consumption and body weight gain, and increased relative liver weight accompanied by centrilobular hepatocyte hypertrophy. The developmental toxicity NOEL exceeded 25 mg/kg/day (guideline 83-3; MRID 40042046). The lack of developmental toxicity seen in this study is also confirmed by the results of a published developmental toxicity study in normal and malnourished pregnant Wistar rats exposed to dicofol at 10 mg/kg/day on gestation days 4 to 15 (Lemonica et al., 1993).

[1] The dietary concentrations for the NCI rat and mouse carcinogenicity studies (discussed below) indicate time-weighted concentrations.

In a developmental toxicity study in rabbits, groups of artificially inseminated New Zealand white rabbits (20/dose group) received dicofol by gavage at doses of 0, 0.4, 4, or 40 mg/kg/day on gestation days 7-19. The maternal toxicity NOEL was 4 mg/kg/day. The LEL was 40 mg/kg/day, based upon findings of abnormal feces, reduced food consumption and body weight gain, and increased relative liver weight associated with hepatocyte cytoplasmic hyalinization and vacuolation. For the developmental toxicity, the NOEL and LEL were 4 mg/kg/day and 40 mg/kg/day, respectively. The LEL was based on an increased incidence of abortions in the does (guideline 83-3; MRID 40042047).

f. Reproductive Toxicity

In a two-generation reproduction study, groups of Crl:CD BR rats received dicofol at dietary concentrations of 0, 5, 25, 125, or 250 ppm. The systemic and reproductive NOELs were 5 ppm (0.5 mg/kg/day). The systemic toxicity and reproductive LELs were 25 ppm (2.5 mg/kg/day) due to vacuolation of the ovaries of P2 females and vacuolation and hypertrophy of centrilobular hepatocytes in P1 and P2 males and females at this and higher doses. Adrenal gland vacuolation and hypertrophy in parental females was found at the two higher doses. Dicofol effects on the offspring included reduced viability of pups, increased numbers of stillborn pups, pup deaths, total litter loss, and reductions in pup weight at the two higher dose levels. Vacuolation in the ovaries of P2 females was considered to be compatible with enhanced steroidogenic activity and thus an effect on reproductive physiology (guideline 83-4; MRID 41806601).

A special reproduction study has been submitted by the registrant and is currently under review and additional data on egg follicle counts (MRID 41806601).

g. Mutagenicity

Dicofol at doses ranging from 5 to 5000 μg/plate did not cause mutations in an Ames assay (guideline 84-2a) (MRID 40042048). In addition, dicofol did not induce mutations in the in vitro Chinese hamster ovary cell HGPRT assay in which concentrations of 3.0 to 6.0 μg/ml without metabolic activation and 4.5 to 20 μg/ml with metabolic activation were tested (guideline 84-2a)(MRID 40042049).

There were no indications that dicofol at concentrations ranging from 7.5 to 20 μg/ml (without metabolic activation) and 7.5 to 22.5 μg/ml (with metabolic activation) induced structural chromosomal aberrations in an in vitro cytogenetic assay using Chinese hamster ovary cells (guideline 84-2b)(MRID 40042051).

In an in vivo cytogenetic assay, groups of CRL:COBS-CD(SD) rats (30 males/dose) received dicofol at doses of 47.8, 191.2, and 478.0 mg/kg. Dicofol did not induce a clastogenic response in the chromosomes of bone marrow cells of the test animals (guideline 84-2b)(MRID No. 40042050).

Since the initial battery of mutagenicity studies (discussed above) demonstrate no mutagenic activity, additional mutagenicity testing on dicofol is not required.

h. Neurotoxicity

In an acute neurotoxicity screening study, groups of Crl:CD^{R}BR VAF/Plus^{R} rats (10/sex/group) received dicofol by gavage once at doses of 0, 15, 75, and 350 mg/kg. At 350 mg/kg/day, dicofol produced an increase in the incidence of ataxia and of uncoordinated landing in females. The 350 mg/kg/day females also showed signs of being asleep. Dicofol did not cause any histopathological changes in the central or peripheral nervous systems. Based on the decreases in body weights and reduced food consumptions, the LEL was 75 mg/kg; NOEL, 15 mg/kg (guideline 81-8)(MRID No. 42633303).

In a subchronic neurotoxicity study, groups of Crl:CD^{R}BR VAF/Plus^{R} rats (10/sex/group) received dicofol at dietary concentrations of 0, 5, 100, or 500 ppm, (0, 0.3, 5.6, or 27.8 mg/kg for males and 0, 0.3, 6.5, or 31.3 mg/kg for females). Dicofol did not cause any histopathological changes in the central or peripheral nervous systems. Based on the decreased motor activity and the increased liver weights, the LEL was 100 ppm (5.6 mg/kg); the NOEL was 5 ppm (0.3 mg/kg). A significant decrease in brain weight was also seen in 500 ppm males (guideline 82-7)(MRID No. 42971401).

In October, 1997, HED's Hazard Identification Assessment Review Committee (HIARC) determined that a developmental neurotoxicity study in rats is required since dicofol produces neurotoxic effects in adult rats.

I. Metabolism

Metabolism studies in male and female Sprague Dawley rats used a single oral dose of 50 mg/kg of ^{14}C-dicofol. The radiolabel was eliminated mainly in the feces and to a lesser extent in the urine. The parent compound was preferentially stored in adipose tissue. Also, when ^{14}C-dicofol was administered to female rats every day for 16 days at a dose of 0.5 mg/kg/day, the compound was eliminated mainly in feces and stored in adipose tissue (MRID No. 43070104). The metabolic pathways for dicofol were deduced, with the major one involving reductive halogenation to dichlorodicofol (DCD) and oxidation to dichlorobenzophenone (DCBP), dichlorobenzoic acid (DCBA), and dichlorobenzil (DCBH). This metabolic pathway is consistent with that proposed by Brown and Casida (1987). The analysis of metabolites revealed at most 0.2% of the radioactive residue was DDE which could be contributed by the presence of DDT (0.2%) and DDE (0.01%) in the test material. The data indicated that dicofol metabolized differently from that of DDT, which is metabolized to the purported carcinogen, DDE (guideline 85-1; MRID 00400420). This conclusion is also supported by the data of Brown and Casida (1987).

In two comparative disposition studies in rats which received orally equal doses of (0.5 mg/kg) dicofol and DDT, dicofol is consistently eliminated faster in the test animals. The tissue concentrations of radiolabel in fat, gonads, liver, adrenals, and muscle are not significantly different between dicofol- and DDT-treated rats which were given (by gavage) multiple doses of dicofol or DDT (MRID No. 43070104). However, in another study, rats received a single oral high dose (50 mg/kg) of either DDT or dicofol; more DDT was found in fat and adrenals than dicofol (MRID No. 43070103). In the blood, the radioactivity level is consistently higher in dicofol-treated rats than that in DDT-treated ones (MRID No. 43070104).

A metabolism study comparing o,p'-dicofol and p,p'-dicofol was conducted in female rats. Test animals received a single dose (50 mg/kg) by gavage. More radioactivity was eliminated by the o,p'-^{14}C-dicofol treated rats than that by the p,p'-^{14}C-dicofol treated rats. In general, the $t_{1/2}$ for the tissue elimination of radiolabel was greater in p,p'-^{14}C-dicofol treated rats than in the o,p'-^{14}C-dicofol treated group. At 10 days after dosing more ^{14}C-label was retained in the bodies of p,p'-^{14}C-dicofol females (≈22%) than in o,p'-^{14}C-dicofol treated ones (1%). Most of the sequestered ^{14}C was found in the fat (MRID 43070105).

j. Special Studies / Other Toxicological Considerations

Reproductive effects in alligators: A study of the effects of organochlorine contamination on the alligators in Lake Apopka, Florida is available. The study is contained in the report on the Testimony to U.S. House of Representatives Subcommittee on Health and the Environment (Guillette, 1993). In 1980, the Tower Company, which was adjacent to Lake Apopka, had a chemical spill. One of the major products in the spill was reported to be Kelthane^{R} (dicofol), which contained DDT at concentrations as high as 15% and its metabolites, DDD, DDE, and chloro-DDT. In summary, Guillette testified that, in his investigations, the alligator eggs and neonates from Lake Apopka differ from other Lakes in many significant ways. The following observations are most significant:

1. The embryos and the neonates within the first 10 days of life from Lake Apopka had high mortality rates.
2. The ratio of estradiol to testosterone was substantially higher in the neonates from Lake Apopka than those from other lakes in Florida (estradiol level was higher than the normal level while testosterone level was lower than the normal concentration).
3. The increase in estradiol level corresponded to the differences in the histological appearance of the gonads. "Females from Lake Apopka exhibit ovaries containing large numbers of polyovular follicles and polynuclear oocytes. Testes from males show poorly organized seminiferous tubules."(Guillette's testimony).
4. Alligator eggs from Lake Apopka were found to contain significant levels of DDE. When alligator eggs were experimentally injected with DDE, an abnormal testicular steroidogenesis was seen. Males produced elevated concentrations of estradiol and abnormally low levels of testosterone.

A published article by Heinz, Percival, and Jennings (1991) showed that there were elevated levels of several organochlorines in the alligator eggs from Lake Apopka collected in 1985. In those eggs, DDE was the most commonly found organochlorine, but dicofol itself was not detected.

In the registrant's 4/20/98 rebuttal, Rohm and Haas suggested that a source other than dicofol may be the cause of the reproductive effects seen in alligators, and that possible co-contamination with dibromochloropropane and/or ethylene dibromide may be responsible. However, no data were submitted to substantiate the registrant's claim.

2. Dose Response Assessment

a. FQPA Issues: Uncertainty/Safety Factor/Special Sensitivity

Under the Food Quality Protection Act (FQPA), P.L. 104-170, which was promulgated in 1996 as an amendment to the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) and the Federal Food, Drug and Cosmetic Act (FFDCA), the Agency was directed to "ensure that there is a reasonable certainty that no harm will result to infants and children" from aggregate exposure to a pesticide chemical residue. The law further states that in the case of threshold effects, for purposes of providing this reasonable certainty of no harm, "an additional tenfold margin of safety for the pesticide chemical residue and other sources of exposure shall be applied for infants and children to take into account potential pre- and post-natal toxicity and completeness of the data with respect to exposure and toxicity to infants and children. Notwithstanding such requirement for an additional margin of safety, the Administrator may use a different margin of safety for the pesticide residue only if, on the basis of reliable data, such margin will be safe for infants and children."

The HED FQPA Safety Factor Committee met on March 30, 1998 to evaluate the hazard and exposure data for dicofol and recommend application of the FQPA Safety Factor (as required by FQPA), to ensure the protection of infants and children from exposure to this chemical. The Committee requested guidance on this determination from the Division Directors of HED, EFED, RD and SRRD since a consensus was not reached by the FQPA Safety Factor Committee. The Division Directors of HED, EFED, RD and SRRD met on April 9, 1998 to determine the FQPA Safety Factor for dicofol.

<u>Determination of Susceptibility</u>

The Hazard Identification Assessment Review Committee (HIARC) determined that the data provided **no indication of increased susceptibility of rats or rabbits to *in utero* and/or postnatal exposure to dicofol** in the developmental and reproductive toxicity studies; however, there is a need for the re-evaluation of the length and periodicity of estrous cycle in the special

one-generation reproduction study (*Memorandum:* J. Rowland to B. Madden, dated December 17, 1997).

Adequacy of Database

There are **no data gaps** for the standard Subdivision F Guideline requirements for a food-use chemical by 40 CFR Part 158. However, the HIARC determined that a **postnatal developmental neurotoxicity study in rats is required for dicofol** (*Memorandum:* J. Rowland to B. Madden, dated December 17, 1997).

Determination of the Factor

It was determined that **the additional 10x Safety Factor** for enhanced sensitivity to infants and children (as required by FQPA) **should be reduced to 3x.**

Rationale for Selection of the FQPA Factor

The rationale for reducing the 10x factor to 3x are as follows:

- Data show no indication of increased susceptibility of rats or rabbits to *in utero* and/or postnatal exposure to Dicofol in the developmental and reproductive toxicity studies.

- There are no data gaps for the Subdivision F Guideline requirement. However, HED's HIARC has determined that a developmental neurotoxicity study in rats is required since Dicofol produces neurotoxic effects in adult rats.

- Although Dicofol is an endocrine disruptive chemical, no evidence of endocrine toxicity was noted in the offspring in the one-generation reproduction study in rats with a postnatal exposure phase.

- Although Dicofol was implicated in the reproductive failure of an alligator population following an accidental spill into Lake Apopka, Florida, DDT and metabolites were also present in the spill.

Identification of Population Subgroup

Acute Dietary: The FQPA Safety Factor will be applied to the General Population which include infants and children, because the dose and endpoint is based on neurotoxicity for this risk assessment.

Chronic Dietary Risk Assessment: The FQPA Safety Factor will be applied to the General Population which includes infants and children, because the dose and endpoint for this risk assessment is based on inhibition of adrenal cortical trophic hormone (ACTH) stimulated release of cortisol in male and female of dogs.

Residential Risk Assessments: The FQPA Safety Factor will be applied to all populations which include infants and children, because the dose and endpoint selected for this risk assessment is based on 1) a developmental effect (increase in frequency of abortions) for short-term exposure; and 2) inhibition of ACTH stimulated release of cortisol for intermediate-term exposure.

b. Chronic Reference Dose (RfD)

The HED RfD/Peer Review Committee recommended that an RfD be established on the basis of a NOEL of 0.12 mg/kg/day based on effects observed on cortisol release in both sexes at the LOEL (0.82 mg/kg/day) in a one year feeding study in dogs (MRID 40997101).

The RfD Committee met on May 23, 1997 to reconsider the RfD for dicofol. The Committee analyzed the materials submitted by the registrant and the results from the 1-year and the 90-day toxicity studies in dogs along with the special reproduction study. It was concluded that (1) the inhibition of cortisol release in females at 52 weeks was just as great as that which occurred in the 12-week examination period. (2) The control value for 90 minute cortisol level at 25 weeks for females appeared to be low when compared to those of the other times. (3) There was a slight inhibition of the ACTH stimulated cortisol release at 10 ppm (≈0.3 mg/kg/day) in both males and females of the 90-day feeding study in dogs, although the inhibition was not statistically significant. In addition, using the data from a chronic feeding study in dogs is also more relevant in terms of the duration of exposure.

Additional confirmatory data considered by the RfD PRC were organ weight findings from a postnatal study with dicofol (MRID 44253801, 44253802, & 44253803). The members of the Committee believed that the significant perturbations in organ weights seen in the confirmatory studies are indicative of endocrine disruption, even at the lowest level tested (5 ppm equivalent to 0.3 mg/kg/day), where no other histological or toxicological findings were reported. Therefore, the evidence of endocrine disruption at 0.3 mg/kg/day in this postnatal study in rats is supportive of the position of the Committee that the NOEL, which is most appropriate to use in establishing the RfD and which is based on the inhibition in ACTH stimulated cortisol release, is at 5 ppm (0.12 mg/kg/day) from the chronic dog study, rather than at 10 ppm (0.3 mg/kg/day) from the subchronic toxicity study in dogs.

Using a weight of the evidence approach, the Committee decided that revising the NOEL from 30 ppm to 5 ppm in the 1-year feeding study in dogs was appropriate and applying the NOEL of 5 ppm (0.12 mg/kg/day) for establishing a RfD was reasonable.

In December, 1997, the Hazard Identification Assessment Review Committee met to reconsider the Reference Dose for dicofol. The Committee decided that the study chosen as the basis for the RfD would not change; the RfD was chosen from the NOEL of 0.12 mg/kg/day from the chronic dog study. An uncertainty factor of 100 was applied to account for inter-species and intra-species variability.

Early in 1998, decisions regarding application of the FQPA Safety Factor were made by the newly formed OPP FQPA Safety Factor Committee. Pursuant to the language and intent of the FQPA directive regarding infants and children, the applicable toxicity and exposure database for dicofol was evaluated by the Hazard Identification Assessment Review Committee (HIARC). As noted above, the Committee concluded that the FQPA Safety Factor could be reduced to 3X.

The FQPA Safety Factor **will be applied to the General Population, which includes infants and children,** because the dose and endpoint for this risk assessment is based on inhibition of adrenal cortical trophic hormone (ACTH) stimulated release of cortisol in male and female dogs. **After incorporating the FQPA factor of 3X, the RfD is 0.0004 mg/kg/day** (Chronic RfD of 0.0012 mg/kg/day / 3 = 0.0004 mg/kg/day)

c. Carcinogenic Classification

Based on the increase in the incidence of liver adenomas and combined liver adenomas and carcinomas in male mice (MRID 41037801), the Carcinogenicity Peer Review Committee has classified dicofol as a **"Group C"**, possible human carcinogen. The Committee recommended for the purpose of risk assessment, the **RfD approach** be used for quantification of chronic human risk (HED report dated 6/24/92). The RfD approach was used to assess dietary cancer risk, and a quantitative dietary cancer risk assessment was not performed. Dietary risk concerns due to long-term consumption of dicofol residues are adequately addressed by the DRES chronic exposure analysis using the RfD.

d. Dermal Absorption

In the absence of an acceptable dermal absorption study, **the default absorption rate of 100% will be assumed**. This factor is supported by approximated dermal absorption demonstrated in an unacceptable dermal absorption study in rats.

The submitted dermal absorption study (MRID No. 44099202) was determined to be unacceptable because: 1) the dose was improperly applied (i.e., the 100 µL dose was applied to an unrestricted area of 4 cm^2; 2) only females were tested (i.e., Subdivision F Guidelines recommends the use of male rats; and 3) poor experimental design (i.e., rats were dosed for 6 hours, washed and then maintained on test for 7 days before termination thus grossly overestimating the availability of dicofol for systemic toxicity).

e. Summary of Toxicological Endpoints for Use in Human Risk Assessment

On the next page, Table 2 summarizes the endpoints selected for use in risk assessment for all populations. In cases where the FQPA Safety Factor applies, it is noted.

TABLE 2. Summary of Toxicological Endpoints for Use in Human Risk Assessment

Exposure Route	Duration	Population	Gln Study (MRID)	NOEL (mg/kg/day)	LOEL (mg/kg/day)	Effect	MOE or Percent of the RfD Required
Dietary (includes drinking water and food sources)	Acute Risk	General population including infants and children	Acute neurotoxicity study in rats; 42633303	15	75	Decreases in body weights and food consumption; Acute RfD with FQPA SF applied is 0.05 mg/kg/day.	Acute RfD= 0.05mg/kg/day; Risk estimates less than 100% of the RfD do not exceed HED's level of concern
	Chronic Risk	General population including infants and children	Chronic dog study; 40997101	0.12	0.82	Inhibition of adrenal cortical trophic hormone (ACTH) release in both sexes; RfD with FQPA SF applied is 0.0004 mg/kg/day.	Chronic RfD= 0.0004 mg/kg/day; Risk estimates less than 100% of the RfD do not exceed HED's level of concern
	Carcinogenic Risk	General population including infants and children	see Chronic Risk above				
Dermal (occupational and residential)	Short-Term Risk	All populations including infants and children	Develop. rabbit; §83 3b 40042047	4	40	Increase in frequency of abortions	MOE's greater than 300 are required so as not to exceed HED's level of concern
	Short-Term Risk	Adult Occupational	Develop. rabbit; §83 3b 40042047	4	40	Increase in frequency of abortions	MOE's greater than 100 are required so as not to exceed HED's level of concern
	Intermediate-Term Risk	General population including infants and children	90-day oral dog §82-1; 40042043	0.29	3.3	Inhibition of ACTH stimulated cortisol release and oligospermatogenesis	
	Intermediate-Term Risk	Adult Occupational	90-day oral dog §82-1; 40042043	0.29	3.3	Inhibition of ACTH stimulated cortisol release and oligospermatogenesis	

1) Dietary: Acute Reference Dose

To estimate acute (one day) dietary risk, the endpoint chosen was neurotoxicity. In an acute neurotoxicity study in rats (MRID 42633303), **the NOEL of 15 mg/kg/day was identified** based on decreased body weight and reduced food consumption observed at the next highest dose, the LOEL of 75 mg/kg/day. Other treatment-related effects observed included: urine or feces stained fur (both sexes at 350 mg/kg); change in air righting response as indicated by increased incidence of uncoordinated landing (females at 75 and 350 mg/kg); increased incidence of sleeping (females at 350 mg/kg) decrease in motor activity (both sexes at 350 mg/kg) and increased incidence of ataxia (both sexes at 350 mg/kg). To convert the NOEL of 15 into an acute RfD, it is divided by the uncertainty factor (300: 10 for interspecies and 10 for intraspecies, and a 3 for FQPA), **resulting in an acute RfD of 0.05 mg/kg/day.**

2) Dietary: Chronic Reference Dose

To estimate chronic dietary risk, the endpoint chosen was hormonal toxicity. In a chronic toxicity study in dogs (MRID 40997101), **the NOEL of 0.12 mg/kg/day** (5 ppm) was identified based on inhibition of adrenal cortical trophic hormone (ACTH) stimulated release of cortisol in both sexes seen at the next highest dose, the LOEL of 0.82 mg/kg/day (30 ppm).

As stated above, the FQPA Safety Factor **will be applied to the General Population which includes infants and children,** because the dose and endpoint for this risk assessment is based on inhibition of adrenal cortical trophic hormone (ACTH) stimulated release of cortisol in male and female dogs. **After incorporating the FQPA factor of 3X, the RfD for these population subgroups is 0.0004 mg/kg/day**.

3) Dietary: Carcinogenic

The Committee recommended for the purpose of risk assessment, the **RfD approach** be used for quantification of chronic human risk (HED report dated 6/24/92). Therefore, a quantitative dietary cancer risk assessment was not performed. Dietary risk concerns due to long-term consumption of dicofol residues are adequately addressed by the DRES chronic exposure analysis using the chronic RfD.

4) Dermal Absorption

In the absence of an acceptable dermal absorption study, **the default absorption rate of 100% will be assumed**. This factor is supported by approximated dermal absorption demonstrated in an unacceptable dermal absorption study in rats (MRID 44099202).

5) Dermal: Short-Term

For estimating short term dermal risk, the endpoint chosen was an increased frequency of abortions in a developmental toxicity study in rabbits (MRID 40042047). The **NOEL of 4 mg/kg/day** was identified based on an increase in the frequency of abortions at the LOEL of 40 mg/kg/day. As noted above, the FQPA Safety Factor will be applied to all populations which include infants and children because the doses and endpoints selected for this risk assessment is based on a developmental effect (increased frequency of abortions) for short-term exposure.

Although 28-day dermal toxicity studies were available in rats and rabbits with formulation products (44% active ingredient), the Hazard Identification Committee selected an oral dose because of the concern for effects (abortions) seen after a treatment of short duration (11 days), which is appropriate for this exposure period of concern. Since an oral NOEL was chosen, a dermal absorption rate of 100% should be used for risk assessments.

In the 28-day dermal toxicity study in rats, the NOEL was 4 mg/kg/day and the LOEL was 40 mg/kg/day based on slight decreases in body weights and body weight gains as well as an increase in the incidence of liver hypertrophy was also seen at this dose. Although this was considered as an adaptive effect, liver effects were also seen in rabbits via the oral route (MRID No. 44099201).

In the 28-day dermal toxicity study in rabbits, the NOEL was 4.1 mg a.i/kg/day and the LOEL was 10.2 mg a.i/kg/day based on decreased body weight gain (MRID No. 41077001).

In both species, the NOEL was 4 mg a.i/kg/day, the same value established in the oral developmental toxicity study in rabbits which supports the assumption of 100% dermal absorption. Therefore, the Committee considered the 28-day dermal toxicity studies to be co-critical (MRID No. 44099201).

6) Dermal: Intermediate-Term

For estimating intermediate-term dermal risk, the endpoint chosen was based on hormonal toxicity. In a 90-day oral toxicity study in dogs (MRID 40042043), the **NOEL of 0.29 mg/kg/day** was identified based on inhibition of ACTH stimulated cortisol release and oligospermatogenesis observed at the LOEL of 3.3. mg/kg/day.

As noted above, the FQPA Safety Factor will be applied to all populations which include infants and children.

Hormonal toxicity was also seen in the 1-year study in dogs at a comparable dose (0.12 mg/kg/day). Since an oral NOEL was selected, a dermal absorption rate of 100% should be used in risk assessments.

7) Dermal: Chronic Occupational and Residential

HED has determined that chronic exposure, or continuous exposure over several months, to dicofol is unlikely based on the use patterns included in this RED.

However, if uses involving long term exposure do exist in the future, the long-term dermal risk can be estimated using the **NOEL of 0.12 mg/kg/day** based on inhibition of ACTH stimulated release of cortisol in both sexes of dogs observed at the LOEL of 0.82.

8) Inhalation: Any Time Period

Except for an acute inhalation toxicity study, for which Dicofol is placed in Toxicity Category IV (LC_{50} = >5.0 mg/L), no other toxicity studies are available via this route. Therefore, the HIARC selected the oral NOELs of 4 mg/kg/day, 0.29 mg/kg/day and 0.12 mg/kg/day for Short-, Intermediate- and Long-Term, respectively for inhalation risk assessments. These doses were used in respective dermal risk assessments. Since the doses identified for inhalation risk assessments are from oral studies the risk assessment should be as follows:

Step I. The inhalation exposure component (i.e., mg/L) using a 100% absorption rate (default value) should be converted to an equivalent oral dose (mg/kg/day)

Step II. The dermal exposure component (i.e., mg/kg/day) using a 100% dermal absorption rate should be converted to an equivalent oral dose. This dose should then be combined with the converted oral dose in Step I.

Step III To calculate the MOE's, the combined dose from Step II should then be compared to the (I) oral NOEL of 4 mg/kg/day for Short-Term exposure (ii) oral NOEL of 0.29 mg/kg/day for Intermediate-Term and (iii) oral NOEL of 0.12 mg/kg/day for Long-Term exposures.

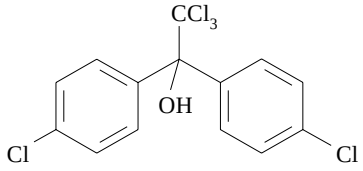
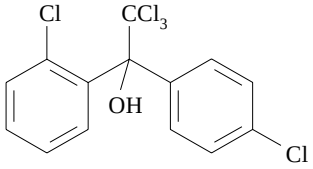
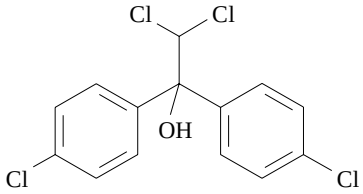
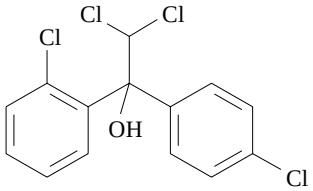
3. Dietary Exposure and Risk Assessment/Characterization

Dicofol [1,1-bis(4-chlorophenyl)-2,2,2-trichloroethanol and 1-(2-chlorophenyl)-1-(4-chlorophenyl)-2,2,2-trichloroethanol] is a miticide registered for foliar application to a variety of food/feed crops. End-use products registered for use on food/feed crops include emulsifiable concentrates (EC), wettable powders (WP), a flowable concentrate (FlC), and a wettable powder/dust (WP/D) that may be applied as dilute or concentrated ground or aerial sprays.

Tolerances for residues in/on food/feed crops are currently expressed in terms of dicofol *per se [Source: 40 CFR §180.163]*. There are no tolerances established for animal commodities. The HED Metabolism Committee (S. Funk, 9/29/92) determined that dicofol is the only residue of concern in/on plants and that dicofol and its metabolites 1,1-bis (4-chlorophenyl)-2,2-dichloroethanol and 1-(2-chlorophenyl)-1-(4-

chlorophenyl)-2,2,-dichloroethanol (FW-152) are the residues of concern in animals. The chemical structures of dicofol and metabolite FW-152 are depicted below in Figure A.

Figure A. The chemical structures of dicofol and the metabolites of concern.

Structure **Metabolite**: Chemical name	Structure **Metabolite**: Chemical name
 **p,p′-dicofol**: 1,1-bis(4-chlorophenyl)-2,2,2-trichloroethanol	 **o,p′-dicofol**: 1-(2-chlorophenyl)-1-(4-chlorophenyl)-2,2,2-trichloroethanol
 **p,p′-FW-152**: 1,1-bis(4-chlorophenyl)-2,2-dichloroethanol	 **o,p′-FW-152**: 1-(2-chlorophenyl)-1-(4-chlorophenyl)-2,2-dichloroethanol

a. Registered Food Uses

There are five end-use products currently registered to Rohm and Haas, the primary producer of dicofol. These end-use products are listed below.

Table 3. End-Use Products Registered to Rohm and Haas

EPA Reg. No.	Acceptance Date	Formulation	Product Name
707-201	6/8/89	4 lb/gal FlC	Kelthane 4F Flowable Agricultural Miticide
707-202	8/93	4 lb/gal EC [a]	Kelthane MF Agricultural Miticide
707-204	11/88	1.6 lb/gal EC	Kelthane EC Agricultural Miticide
707-205	8/93	35% WPD [b]	Kelthane 35 Agricultural Miticide
707-229	7/93	50% WP	Kelthane 50 Agricultural Miticide

[a] Includes SLN Nos. CA77005300, GA88000600, LA88000700, MS90000400, and TX93001800.
[b] Includes SLN Nos. AZ88001000, CA88002900, CA92002600, OR90001500, PA92000400, VA89000500, and WA90002200.

b) Summary of Science Findings

1) Summary of Residue Chemistry Guidelines

Additional residue data are required for the following residue chemistry guidelines: 860.1200; 860.1340; 860.1500, 860.1520. The additional data requirements for all guideline residue chemistry categories are considered confirmatory.

OPPTS 860.1200: Directions for Use

A comprehensive summary of the registered food/feed use patterns of dicofol, based on these product labels, is presented in Table A of Attachment 2 and reflects revisions proposed by the registrant and reviewed by the Agency. A summary of the residue chemistry science assessments for reregistration of dicofol is presented in Table B of Attachment 2. The conclusions listed in Table B regarding the reregistration eligibility of dicofol food/feed uses are based on the use patterns registered by the basic producer, Rohm and Haas Co.. When end-use product DCIs are developed (e.g., at issuance of the RED), RD should require that all end-use product labels (e.g., MAI labels, SLNs, and products subject to the generic data exemption) be amended such that they are consistent with the basic producer labels.

Additional label amendments are required. Strawberries must be removed from all EC formulation labels.

Limited field trial data have been submitted on caneberries (blackberry, raspberry). The data are adequate to support use on caneberries on an interim basis, but additional confirmatory field trial data are required.

The Wettable Powder/Dust (WP/D) formulation labels must be amended such that the application rate and PHI for strawberries are consistent with the field trial parameters (Attachment 2, Table A). The Emulsifiable Concentrate (EC) labels must be amended to delete use on strawberries.

OPPTS GLN 860.1300: Plant Metabolism

The qualitative nature of the residue in plants is adequately understood. Metabolism studies have been conducted with grapefruit, cottonseed, and tomato. Dicofol is not translocated and is not metabolized to an appreciable extent. A study on citrus seedlings indicated that <1% of leaf-applied [^{14}C]dicofol was translocated from the leaf and <0.05% of soil-applied chemical was taken up by the plant.

In a grapefruit metabolism study, fruit harvested up to 150 days after foliar application of uniformly ring-labeled [^{14}C]p,p′-dicofol at 4 lb ai/A contained >98% of the radioactivity in the peel, <1.4% in juice, and <0.6% in pulp. Dicofol accounted for >70% of the radioactivity in peel collected 60 days after treatment and 50-60% in 150-day samples. The metabolite p,p′-dichlorobenzophenone (DCBP) accounted for <2%.

In the cottonseed metabolism study, dicofol comprised ~60% of the radioactivity in whole seeds harvested 15 days following two foliar applications of [^{14}C]p,p′-dicofol totaling ~5 lb ai/A. DCBP accounted for 15% of the residues in whole cottonseed.

A tomato metabolism study showed dicofol at 86.5% of the radioactive residues in tomato fruits harvested 21 days after two foliar applications of [^{14}C]p,p′-dicofol at 2.4 lb ai/A. DCBP accounted for ~1% of the residue and evidence of dichlorobenzhydrol (DCBH) at ~1% was detected. In a parallel study with [^{14}C]o,p′-dicofol, DCBH and DCBP comprised 6.6 and 4.1% of the residue, respectively.

Metabolism in plants proceeds via hydrolysis and oxidation of the trichloroethanol moiety to form dichlorobenzophenone. However, the parent compound remains the predominant residue. The HED Metabolism Committee (S. Funk, 9/29/92) determined that dicofol is the only residue of concern in/on plants.

OPPTS GLN 860.1300: Animal Metabolism

The qualitative nature of the residue in livestock is adequately understood, based on acceptable studies with goats and hens. Goats were dosed with [^{14}C]dicofol at 15 ppm in the daily diet for 7 days and sacrificed 24 hours later. FW-152 was the major residue, comprising 27-67% of the radioactivity in milk and tissues; dicofol accounted for 10% in kidney and 24-46% in milk, fat, and muscle. Dicofol comprised <1% of the liver residues, whereas DCBP released by base hydrolysis constituted 15%. DCBP also comprised up to 17% of the residues in milk and 18% in fat.

In the poultry metabolism study, hens were dosed with [^{14}C]dicofol for 7 days at 10 ppm in the daily diet. Dicofol accounted for 13-27% of the residue in whole eggs and 63-77% in fat and muscle. FW-152 constituted up to 17% of the residue in eggs and fat, 22% in muscle, and 33% in liver. DCBP comprised up to 50% of the residues in eggs, but <10% in tissues.

The HED Metabolism Committee (S. Funk, 9/29/92) determined that dicofol and FW-152 are the residues of concern in animals.

OPPTS GLN 860.1340: Residue Analytical Methods-Plants and Animals

Three colorimetric methods for dicofol determination in/on plants are listed in Pesticide Assessment Methods (PAM), Vol. II (Methods A, B, and C). PAM, Vol. II also includes a reference to a gas/liquid chromatography (GLC) method in PAM, Vol. I for the determination of chlorinated hydrocarbons. PAM, Vol. I (Section 211.13H) includes an high performance liquid chromatography (HPLC) method for the determination of dicofol residues in milk. The GC/EC Method TR-310-86-74 for plant matrices is to be validated for cottonseed, tomatoes, and stone fruit by an independent laboratory for inclusion in PAM. An acceptable independent laboratory validation (ILV) for oranges has been submitted. After successful validation, the method will be validated by the Agency and will be submitted for inclusion in PAM for enforcement purposes. The current PAM method is colorimetric. This requirement is considered confirmatory, because multi residue methods have been shown adequate for recovery of dicofol from plant matrices.

A HPLC/GC method for the determination of dicofol and FW-152 in animal commodities has been validated by an independent laboratory for use as an enforcement method. The method will be subjected to Agency validation and then submitted for publication in PAM as an enforcement method. PAM contains a HPLC method for the determination of dicofol in milk.

p,p′-Dicofol and o,p′-dicofol are completely recovered (>80%) using FDA Multi residue Protocol D (Section 302). p,p′-Dicofol is partially recovered (50-80%) using Multi residue Protocol E for oily matrices (Section 304), whereas the recovery of the o,p′-isomer using this method is small (<50%). Recovery of both isomers using Protocol E for non-oily matrices (Section 303) is variable *[Source: PESTDATA, PAM, Vol. I Appendix I, 1994]*.

OPPTS GLN 860.1380: Storage Stability

Dicofol is stable in apples, string beans, and green peppers stored at -20 C for 24 months. Dicofol is stable in strawberries stored at -20 C for up to 12 months and is stable in melons stored at -20 C for up to 18 months. Dicofol is stable in citrus fruit, in cottonseed, in apples, in string beans, and in green peppers stored frozen for 2 years. Dicofol and FW-152 are stable in poultry and cattle tissues, milk, and eggs stored for up to 7 months at frozen temperatures. No additional storage stability data are required.

OPPTS GLN 860.1480: Magnitude of the Residue in Meat, Milk, Poultry, and Eggs

No tolerances have been established for dicofol residues in livestock commodities. However, animal metabolism studies indicate that tolerances are needed for residues of dicofol and FW-152 in meat, milk, poultry, and eggs.

The maximum theoretical dietary burden for dairy cattle is 22 ppm and that for beef cattle is 41 ppm. The existing ruminant feeding studies (10, 30, or 100 ppm feeding level) have been recently re-evaluated and found adequate for determining tolerance levels in meat, liver, kidney, meat byproducts, and milk.

The maximum theoretical dietary burden of dicofol for poultry is 0.02 ppm, based on residues in cottonseed meal (20% diet X 0.1 ppm residue). The existing poultry feeding studies (0.5 ppm feeding level) have been recently re-evaluated and found adequate for determining tolerance levels in poultry meat, liver, fat, meat byproducts, and eggs.

OPPTS GLN 860.1500: Magnitude of the Residue in Plants

All data requirements for magnitude of the residue in plants have been evaluated and deemed adequate to reassess the tolerances for residues of dicofol in raw plant commodities, with the exception of figs. IR-4 intends to provide data to support the use on caneberries and has submitted one field trial each for blackberries and raspberries; additional confirmatory data are required. The use on figs is not being supported.

Field trials are required for caneberries and cotton gin byproducts. There are limited data for caneberries to support the existing label use (S. Funk, CBRS 15104, DP Barcode D211756, 03/01/95). Additional trials are required, but are considered confirmatory. The requirement for cotton gin byproduct data is a recent development (*Pesticide Reregistration Rejection Rate Analysis Residue Chemistry: Follow-Up Guidance for Updated Livestock Feeds Tables* (06/94, EPA 738-K-94-001; revised 09/95)), and fulfillment of the requirement will be considered confirmatory.

OPPTS GLN 860.1520: Magnitude of the Residue in Processed Food/Feed

All data requirements for magnitude of the residue in processed food/feed have been evaluated and deemed adequate to determine the extent to which residues of dicofol concentrate in food/feed items upon processing of the raw agricultural commodity. Dicofol has been shown to concentrate in apple pomace, citrus oil, mint oil, dried tea, citrus pulp, cottonseed oil, raisins, and plum prunes. Tolerances will be needed for these processed commodities.

OPPTS 860.1850 and 860.1900 Confined/Field Rotational Crops

Based on the review of recently submitted data on confined rotational crops treated with dicofol, HED recommends that plantback intervals not be required for crops rotated with dicofol-treated crops since there was no quantifiable residue level at any interval. HED further recommends that tolerances not be required for inadvertent residues on crops rotated with dicofol-treated crops.

For purposes of the reregistration of dicofol, the data requirements for OPPTS 860.1850 and 860.1900 are fulfilled.

2) Tolerance Reassessment Summary

Tolerances for plant commodities should be expressed in terms of the combined residue of 1,2-bis(4-chlorophenyl)-2,2,2-trichloroethanol and 1-(2-chlorophenyl)-1-(4-chlorophenyl)-2,2,2-trichloroethanol. The listing should be designated 40 CFR §180.163(a).

Tolerances for animal commodities should be expressed as the combined residue of 1,1-bis(4-chlorophenyl)-2,2,2-trichloroethanol, 1-(2-chlorophenyl)-1-(4-chlorophenyl)-2,2,2-trichloroethanol, 1,1-bis(4-chlorophenyl)-2,2-dichloroethanol, and 1-(2-chlorophenyl)-1-(4-chlorophenyl)-2,2,-dichloroethanol. The listing should be designated 40 CFR §180.163(b).

<u>Tolerances Listed Under 40 CFR §180.163</u>:

The raw agricultural commodity tolerances listed under 40 CFR §180.163 are currently expressed in terms of dicofol *per se*. The listing of tolerances for residues in/on plant commodities should be designated 40 CFR §180.163(a); as a new section, 40 CFR §180.163(b), must be provided for the listing of animal tolerances expressed in terms of the combined residues of dicofol and its metabolite FW-152. Refer to Table C for modifications in commodity definitions.

Sufficient data are available to ascertain the adequacy of the established tolerances for the following commodities: apples, apricots, beans (dry), beans (succulent), beans (lima), bushnuts, butternuts, cantaloupes, cherries, chestnuts, cottonseed, crabapples, cucumbers, filberts, grapefruit, grapes, hazelnuts, hickory nuts, hops, kumquats, lemons, limes, melons, muskmelons, nectarines, oranges, peaches, pears, pecans, peppermint hay, peppers, pimentos, plums (fresh prunes), pumpkins, quinces, spearmint hay, strawberries, summer squash,

tangerines, tomatoes, walnuts, watermelons, and winter squash. Sufficient data exist to support the established tolerance for caneberries, but additional confirmatory data are required, and such will be supplied by IR-4.

There is no registered use for dicofol on figs; this tolerance should be revoked.

The established tolerances for bushnuts, butternuts, chestnuts, filberts, hazelnuts, hickory nuts, pecans, and walnuts can be lowered from 5 ppm to 0.1 ppm, based on nondetectable residues (<0.01 ppm) in/on pecans and walnuts following registered use.

The established tolerance for beans, dry, can be reduced from 5 to 0.5 ppm and the tolerance for beans, succulent, can be reduced from 5 ppm to 3 ppm. Maximum dicofol residues were 0.46 ppm in dry beans and 2.09 ppm in succulent beans following registered use. The established tolerance for lima beans should be revoked as lima beans are covered by the tolerance for beans, succulent.

The established tolerances for squash, cantaloupes, cucumbers, muskmelons, pumpkins and watermelons can be replaced by a cucurbit group tolerance of 2 ppm. Maximum residues were 1.05 ppm in/on summer squash, 0.45 ppm in/on cucumbers, and 0.35 ppm in melons from registered uses.

The registrant has requested a Group 8 (fruiting vegetable) tolerance, and a value of 2 ppm would be appropriate (PP#4E4366, 2/8/95). This group tolerance would encompass groundcherry, pepinos and tomatillos. The individual tolerances for tomatoes, peppers and eggplant should be revoked. The maximum residue in/on peppers was 1.15 ppm. The maximum residue in/on tomatoes from registered use was 0.46 ppm.

A stone fruit crop group tolerance of 5 ppm should be established, and the individual commodity tolerances (peach, nectarine, apricot and plum) should be revoked. The maximum residues in/on peaches was 3.79 ppm. The maximum residue in/on plums (fresh prunes) was 0.84 ppm. The maximum residue found in/on cherries was 3.08 ppm.

The established tolerance for oranges, tangerines, limes and other citrus fruits can be revoked and replaced with a citrus crop group tolerance of 6 ppm. The maximum residue in/on oranges was 3.55 ppm and the maximum residue in/on grapefruit was 5.26 ppm. The maximum field trial for lemons was 1.34 ppm.

The established tolerance for apples, crabapples, pears and quinces can be revoked and replaced with a pome fruit crop group tolerance of 10 ppm. The maximum field trial residue in/on apples was 6.7 ppm. The maximum residue found in/on pears was 10.8 ppm. This value was one of two duplicate samples. The other sample had a value of 6.8 ppm dicofol. The PHI was 6 days, whereas the label specifies 7 days, and three applications were made, whereas the label specifies a maximum of two applications per season. The group tolerance will adequately cover pears.

The currently established tolerance for hops is based on data for green hops. However, the Agency now considers the RAC for hops to be hops, dried (PR Notice 93-12, 12/23/93). The available residue data on dried hops (8.5% moisture) indicate dicofol residue levels of 5.52-64.3 ppm (CBRS No. 9968, DP Barcode D178940, 9/23/92, F. Fort). Therefore, the tolerance for hops, dried, as a RAC should be established at 65 ppm.

The established tolerance for strawberries should be raised from 5 ppm to 10 ppm to reflect the findings of new field trials.

HED now requires residue data for cotton gin byproducts (commonly called gin trash) which includes burrs, leaves, stems, lint, immature seeds, sand, and dirt. As these data requirements are based on the recently issued OPPTS Residue Chemistry Test Guidelines, 860.1000, Table 1, they are considered confirmatory data and should not impede the reregistration process.

HED recommended for establishment of a tolerances of 30 ppm for residues of dicofol on fresh plucked tea leaves and for 50 ppm for dicofol residues in/on dried tea.

Tolerances needed under 40 CFR §180.163(b). The available livestock feeding studies have been evaluated and the data indicate that tolerances are needed on livestock commodities. The maximum theoretical dietary burdens for cows and beef cattle, based on the reevaluated tolerances (Table C), are calculated to be 22 ppm and 41 ppm respectively. The theoretical diet is composed of apple pomace, citrus pulp, cottonseed, cottonseed meal, and cottonseed hulls. Apple pomace is the largest contributor to the exposure (86%of cow exposure, 93% of beef exposure).

Table 4

Maximum Dietary Burden for Cows and Beef Cattle

Commodity	Reassessed Dicofol Tolerance[1] (ppm)	% Dry Matter[2]	Cow		Beef	
			% in Diet[2]	Contribution (ppm)	% in Diet[2]	Contribution (ppm)
Apples, pomace, wet	38	40	20	19	40	38
Citrus, pulp, dried	12	91	20	2.6	25	3.3
Cottonseed	0.1	88	25	0.03	25	0.03
Cottonseed, meal	0.1	89	15	0.02	10	0.01
Cottonseed, hulls	0.1	90	15	0.02	-	-
Other	-	-	5	0	-	-
TOTAL			100%	22	100%	41

[1] Includes considerations of policy for revised treatment of processing studies and of need for feed tolerances (E. Zager, M. Metzger, 07/17/95 Memorandum).
[2] Table II Update (06/94) and revisions of 09/95.

Recommendations for ruminant commodity tolerances are based on the 10 ppm and 30 ppm feeding studies (~ 0.5 - 1.4X the maximum theoretical dietary intake for dairy cattle, 0.7X for beef cattle). Recommended poultry tolerances are based on data from a 0.5 ppm feeding study (~25x), adjusted for the difference between actual and theoretical feeding levels. A new section designated, 40 CFR §180.163(b), must be added to provide listings for the new tolerances required for the combined residues of dicofol and its metabolite FW-152 in meat, fat, and meat byproducts of cattle, goats, hogs, horses, sheep, and poultry, milk, and eggs. Sufficient data are available to determine appropriate tolerance levels for all animal commodities.

Tolerances Listed Under 40 CFR §185.410:

The food additive tolerance listed under 40 CFR §185.410 are currently expressed in terms of dicofol *per se*. EPA issued a Final Rule revoking the established food additive tolerance for residues of dicofol in dried tea (59 FR 10993, 3/9/94) to be effective 5/9/94. EPA stayed the effective date of the final rule (59 FR 23799, 5/9/94) owing to objections filed by the Dicofol Task force and the National Agricultural Chemical Association. HED recommended revocation of the food additive tolerance for dried tea (40 CFR §185.410) and the establishment of tolerances for plucked tea and dried tea.

Additional tolerances needed for processed commodities The available data from processing studies indicate that the following tolerances are needed: (I) prunes at 3 ppm, based on the highest average field trial residue of 0.79 ppm for dicofol on plums and an average concentration factor of 3.1x; (ii) raisins at 20 ppm, based on the

highest average field trial residue of 3.02 ppm on grapes and an average processing factor of 6.6x; (iii) citrus oil at 200 ppm, based on the highest average field trial residue of 3.16 ppm in oranges, and average processing factor of 62.8x for orange oil;(iv) dried tea leaves at 50 ppm, based on the highest average field trial residue of 29.1 ppm, an average processing factor of 1.6x; (iv) peppermint oil and spearmint oil at 30 ppm, based on the highest average field trial residue of 17.6 ppm and an average processing factor of 1.6; and cottonseed oil; and (v) cottonseed oil at 0.5 ppm, based on the concentration factor of 4.9X and the highest average field trial residue of 0.06 ppm.

Sufficient data are available to determine that the following feed tolerances are needed: (I) apple pomace (wet) at 38 ppm, based on the highest average field trial residue of 5.54 ppm and an average concentration factor of ~6.6x in wet pomace; and (ii) citrus pulp (dried) at 12 ppm, based on the highest average field trial residue of 3.16 ppm (orange) and an average concentration factor of 3.7X.

Table 5. Tolerance Reassessment Summary

Commodity	Current Tolerance (ppm)	Tolerance Reassessment (ppm)	Comment/Correct *Commodity/Definition*
Tolerances Listed Under 40 CFR §180.163 [a]			
Apples	5	Revoke	Replace with pome fruit tolerance (10 ppm.). New field trials[c].
Apricots	10	Revoke	Replace with stone fruit tolerance (5 ppm.). See peach[c].
Beans (dry form)	5	0.5	*Beans, dry.* New field trials[c].
Beans, snap (succulent form)	5	3	*Beans, succulent.* New field trials[c].
Beans, lima (succulent form)	5	Revoke	Covered by tolerance for beans, succulent[c].
Blackberries	5	Revoke	Additional data required. Replace with caneberry tolerance (5 ppm.).
Boysenberries	5	Revoke	Additional data required. Replace with caneberry tolerance (5 ppm).
Bushnuts	5	0.1	See pecan/walnut[c].
Butternuts	5	0.1	See pecan/walnut[c].
Cantaloupe	5	Revoke	New field trials[c]. Replace with cucurbit tolerance (2 ppm).
Caneberry	none	5	Crop group tolerance. Additional field trials required.
Cherries	5	Revoke	New field trials[c]. Replace with stone fruit tolerance (5 ppm).
Chestnuts	5	0.1	See pecan/walnut[c].
Citrus fruits	None	6	Crop group tolerance.
Cottonseed	0.1	0.1	*Cotton, seed*

Commodity	Current Tolerance (ppm)	Tolerance Reassessment (ppm)	Comment/Correct *Commodity/Definition*
Cotton Gin Byproducts	None	TBD[b]	Required by changes in Table II (06/94)[c].
Crabapples	5	Revoke	See apple[c]. Replace with pome fruit tolerance (10 ppm).
Cucumbers	5	Revoke	New field trials[c]. Replace with cucurbit tolerance (2 ppm).
Cucurbit Vegetables	None	2	Crop group tolerance.
Dewberries	5	Revoke	Additional data required. Replace with caneberry tolerance (5 ppm.).
Eggplants	5	Revoke	Replace with fruiting vegetables tolerance (2 ppm)[c].
Figs	5	Revoke	No registered use exists[c].
Filberts/Hazelnuts	5	0.1	See pecan/walnut[c].
Fruiting Vegetables Group	None	2	Crop group tolerance[c].
Grapefruit	10	Revoke	New field trials[c]. Replace with citrus tolerance (6 ppm).
Grapes	5	5	
Hickory nuts	5	0.1	See pecan/walnut.
Hops	30	65	*Hops, dried*. RAC redefined[c].
Kumquats	10	Revoke	See orange[c]. Replace with citrus tolerance (6 ppm).
Lemons	10	Revoke	New field trials[c]. Replace with citrus tolerance (6 ppm.).
Limes	10	Revoke	See orange[c]. Replace with citrus tolerance (6 ppm).
Loganberries	5	Revoke	Additional data required. Replace with caneberry tolerance (5 ppm).
Melons	5	Revoke	New field trials (cantaloupes, muskmelon)[c]. Replace with cucurbit tolerance (2 ppm).
Muskmelons	5	Revoke	New field trials[c]. Replace with cucurbit tolerance (2 ppm).
Nectarines	10	Revoke	See peach[c]. Replace with stone fruit tolerance (5 ppm.).
Oranges	10	Revoke	New field trials[c]. Replace with citrus tolerance (6 ppm).
Peaches	10	Revoke	New field trials[c]. Replace with stone fruit tolerance (5 ppm.).
Pears	5	Revoke	New field trials[c]. Replace with pome fruit tolerance (10 ppm.).

Commodity	Current Tolerance (ppm)	Tolerance Reassessment (ppm)	Comment/Correct *Commodity/Definition*
Pecans	5	0.1	New field trials[c].
Peppermint, tops	25	25	
Peppers	5	Revoke	Replace with fruiting vegetables tolerance (2 ppm)[c].
Pimentos	5	Revoke	Replace with fruiting vegetables tolerance (2 ppm) [c].
Plums (fresh prunes)	5	Revoke	New field trials[c]. Replace with stone fruit tolerance (5 ppm).
Pome fruits	None	10	Crop group tolerance.
Pumpkins	5	Revoke	See squash[c]. Replace with cucurbit tolerance (2 ppm).
Quinces	5	Revoke	See apple[c]. Replace with pome fruit tolerance (10 ppm).
Raspberries	5	Revoke	Additional data required. Replace with caneberry tolerance (5 ppm).
Spearmint, tops	25	25	
Stone fruits	None	5	Crop group tolerance.
Strawberries	5	10	New field trials[c].
Summer squash	5	Revoke	*Squash, summer*. New field trials[c]. Replace with cucurbit tolerance (2 ppm).
Tangerines	10	Revoke	See orange[c]. Replace with citrus tolerance (6 ppm).
Tea, plucked leaves	None	30	New RAC definition[c].
Tomatoes	5	Revoke	New field trials[c]. Replace with fruiting vegetable tolerance (2 ppm).
Walnuts	5	0.1	New field trials[c].
Watermelons	5	Revoke	See melons[c]. Replace with cucurbit tolerance (2 ppm.).
Winter squash	5	Revoke	*Squash, winter*. See summer squash, cucumber, melon[c]. Replace with cucurbit tolerance (2 ppm.).
Tolerances Needed Under 40 CFR §180.163(b)			
Cattle, meat	None	3	Feeding study[c].
Cattle, mbyp (excluding liver and kidney)	None	3	Feeding study[c].
Cattle, kidney	None	3	Feeding study[c].
Cattle, liver	None	5	Feeding study[c].

Commodity	Current Tolerance (ppm)	Tolerance Reassessment (ppm)	Comment/Correct *Commodity/Definition*
Cattle, fat	None	50	Feeding study[c].
Eggs	None	0.05	Feeding study[c]. Established at 0.05 for compatibility with Codex
Goats, meat	None	3	Feeding study[c].
Goats, mbyp (excluding liver and kidney)	None	3	Feeding study[c].
Goats, kidney	None	3	Feeding study[c].
Goats, liver	None	5	Feeding study[c].
Goats, fat	None	50	Feeding study[c].
Hogs, meat	None	3	Feeding study[c].
Hogs, mbyp (excluding liver and kidney)	None	3	Feeding study[c].
Hogs, kidney	None	3	Feeding study[c].
Hogs, liver	None	5	Feeding study[c].
Hogs, fat	None	50	Feeding study[c].
Horses, meat	None	3	Feeding study[c].
Horses, mbyp (excluding liver and kidney)	None	3	Feeding study[c].
Horses, kidney	None	3	Feeding study[c].
Horses, liver	None	5	Feeding study[c].
Horses, fat	None	50	Feeding study[c].
Milk	None	22	Reflecting 0.75 ppm in whole milk corrected by a 30X factor to account for concentration in milk fat. Feeding study[c].
Poultry, fat	None	0.1	Feeding study[c].
Poultry, liver	None	0.1	Feeding study[c].
Poultry, mbyp (excluding liver)	None	0.1	Feeding study[c].
Poultry, meat	None	0.1	Feeding study[c].
Sheep, meat	None	3	Feeding study[c].
Sheep, mbyp (excluding liver and kidney)	None	3	Feeding study[c].
Sheep, kidney	None	3	Feeding study[c].
Sheep, liver	None	5	Feeding study[c].
Sheep, fat	None	50	Feeding study[c].

Commodity	Current Tolerance (ppm)	Tolerance Reassessment (ppm)	Comment/Correct *Commodity/Definition*
Processed Commodity Tolerances			
Apples, pomace, wet	None	38	Processing study[c].
Citrus pulp, dried	None	12	Processing study[c].
Citrus oil	None	200	Processing study[c].
Cottonseed, oil, refined	None	0.5	Processing study[c].
Grapes, raisins	None	20	Processing study[c].
Mint oil	None	30	Processing study[c].
Tea, dried leaves	45	50	Processing study[c].

[a] The listing of tolerances for residues in/on plant commodities should be designated 40 CFR §180.163(a), as a new section, 40 CFR §180.163(b), must be provided for the listing of animal tolerances expressed in terms of the combined residues of dicofol and its metabolite FW-152.

[b] TBD = To be determined when all data requirements are satisfied.

[c] Reason for tolerance change.

3) Codex Harmonization

Several maximum residue limits (MRLs) for dicofol have been established by Codex in various commodities. Codex MRLs and corresponding U.S. tolerances, both currently expressed in terms of dicofol *per se*, for plant commodities and dicofol plus FW-152 for animal commodities are listed in Table 20.

The harmonization of Codex MRLs and US tolerances has been updated. The tolerance for eggs should be lowered to 0.05 ppm for compatibility with Codex.

Table 6: Codex MRLs and Applicable U.S. Tolerances

Commodity[1]	MRL (mg/kg)[2]	U.S. Tolerance (ppm)[3]	Recommendation/ Comment
Beans (dry)	0.1	0.5	Data do not support a lower US tolerance, with field trial residues as great as 0.4 ppm.
Cattle meat	3	3	
Cherries	5	5	U.S. tolerance is for stone fruit.
Citrus fruits	5	6	Data do not support a lower U.S. tolerance.
Common bean (pods and/or immature seeds)	2	3	Data indicate that a tolerance of 2 ppm for succulent beans is not acceptable, maximum field trial residue of 2.09 ppm.
Cotton seed	0.1	0.1	
Cotton seed oil, Edible	0.5	0.5	

Table 6: Codex MRLs and Applicable U.S. Tolerances			
Commodity[1]	MRL (mg/kg)[2]	U.S. Tolerance (ppm)[3]	Recommendation/ Comment
Cucumber	0.5	2	U.S. tolerance is for the cucurbit crop group. Data do support a 0.5 ppm tolerance for cucumber per se.
Eggs	0.05	0.05	
Fruits (except as otherwise noted)	5	5 caneberries 5 stone fruits 10 pome fruits 6 citrus fruits	The 1992 JMPR proposed withdrawal.
Grapes	5	5	
Hops, Dry	50	65	Data indicate that the tolerance cannot be decreased.
Melons, except watermelon	0.2	5	U.S. tolerance is for the cucurbit crop group. The maximum residue on melons was 0.35 ppm.
Milks	0.1	22	U.S. tolerance is based on milk fat. The corresponding value for whole milk is 0.75 ppm.
Peach	5	5	U.S. tolerance is for stone fruit.
Pecan	0.01 *	0.1	U.S. tolerance is set at the demonstrated limit of quantitation.
Peppers	1	2	U.S. tolerance is for the fruiting vegetables group. Field trial data for peppers indicate that a 1 ppm tolerance would not be adequate.
Plums (including prunes)	1	5	U.S. tolerance is for stone fruit. Data support a 1 ppm tolerance for plums per se.
Pome fruits	5	10	Apple data require a tolerance >5 ppm; maximum residue 6.7 ppm. Other pome fruits are adequately covered by a 5 ppm tolerance.
Poultry meat	0.1	0.1	
Prunes	3	5	Data support a tolerance of 3 ppm, but prunes are covered by the stone fruit group tolerance, at 5 ppm.
Squash, Summer	1	2	Data indicate that the maximum residue slightly exceeded 1 ppm.
Tea, Green, Black (dried)	50	50	Data do not support a lower tolerance.
Tomato	1	2	Tolerance is for the fruiting vegetables group. A tolerance of 1 ppm would be adequate for tomatoes per se.
Walnuts	0.01 *	0.1	Tolerance is set at the demonstrated limit of quantitation.

[1] Commodity definition is that of Codex.
[2] Only final MRLs (CXL) are listed.
[3] Revised proposed tolerances per the RED.

The following conclusions can be made regarding efforts to harmonize U.S. tolerances with the Codex MRLs:

- Compatibility currently exists between the Codex MRL for "Vegetables" and applicable U.S. tolerances. However, as the CCPR is considering deletion of this general CXL, CBRS is recommending for the lowering of the U.S. tolerances.

- Based on the currently registered use pattern, dicofol residues in/on dried hops would exceed the Codex MRL. The U.S. tolerance cannot be lowered to achieve compatibility.

- Compatibility currently exists between the Codex MRL for "Fruits" and some of the applicable U.S. tolerances. However, based on the currently registered use pattern, dicofol residues would exceed the Codex MRL in some fruits, e.g. fruits, pome, and these U.S. tolerances cannot be lowered to achieve compatibility.

- Compatibility exists between the Codex MRL for tea and the proposed US tolerance for dried tea, 50 ppm

c. Anticipated Residues

As part of the Reregistration Eligibility Decision process for dicofol, the anticipated residues of 1,1-bis(4-chlorophenyl)-2,2,2-trichloroethanol and 1-(2-chlorophenyl)-1-(4-chlorophenyl)-2,2,2-trichloroethanol in/on raw agricultural commodities and of these compounds plus the dicofol metabolite FW-152, isomers 1,1-bis(4-chlorophenyl)-2,2-dichloroethanol and 1-(2-chlorophenyl)-1-(4-chlorophenyl)-2,2-dichloroethanol, in animal commodities must be determined in order to perform dietary risk analyses. Table 2 within Attachment 2A lists the anticipated residues of dicofol in all DRES food items resulting from raw agricultural commodities with label uses for dicofol. Commodities with canceled registrations have not been included. Table 1 within Attachment 2A also lists the anticipated residues of dicofol plus the metabolite FW-152 in meat, milk, poultry, and eggs, resulting from the use of dicofol on animal feed items. The derivation of the anticipated residue values is discussed in detail by commodity following the table. US FDA monitoring data (1991 - mid 1994) and USDA PDP survey data (1991 -1994), field trial and processing data, and/or reassessed tolerances were used in arriving at the values. Quantitative usage information (percent crop treated based on acreage) information was obtained from the sources indicated in footnote #2 of Table 7.

Anticipated residues for chronic (cancer and non-cancer) dietary exposure considerations are based on survey data where an adequate sample size is available (> ca. 200 samples). The average value of all domestic and foreign FDA surveillance monitoring and all PDP monitoring samples is used for the chronic risk analysis anticipated residue value. In the absence of sufficient survey data, the average of all relevant field trial residues, corrected for percent crop treated, is used as the anticipated residue for chronic dietary risk analysis.

In the absence of both survey and field trial data, such as for raw agricultural commodities covered by translation of data from a very similar crop, the tolerance value, corrected for percent crop treated, is used as the anticipated residue.

For the determination of anticipated residues in livestock commodities for chronic dietary risk, average residues from monitoring data were used as the basis for the estimation of the dietary exposure of the livestock. Reasonable livestock diets were also used. For example, apple pomace and citrus pulp were not fed simultaneously. The practical dietary burden for dairy cattle was calculated to be 0.055 ppm; that for beef cattle, 0.11 ppm. These burdens were compared with the results of the cattle feeding study to estimate residues in milk, meat, fat and meat by-products.

Dicofol (two isomers) only is considered in the determination of anticipated residues in plant commodities. Dicofol and the FW-152 metabolite (two isomers) are considered in arriving at the anticipated residues for animal commodities.

Anticipated residues for dietary risk for acute and chronic exposure have been determined (S. Funk, CBRS 14225, DP Barcode D206745, 09/12/95) and subsequently refined (S. Funk, 03/18/96; S. Funk, 04/30/96; S. Funk, DP Barcode D235741, CBRS No. 17911, 06/03/97; S. Funk, DP Barcode D236612, 07/01/97; S. Funk DP Barcode D246234, 6/11/98). For purposes of incorporating the various changes and refinements, the anticipated residues are summarized in Table 7.

Dietary Risk Assessment Assumptions

The *apple juice* anticipated residue was based on the average processing factor (0.018) and the average field trial residue value (2.32 ppm). The registrant maintains that a more refined value is the monitoring data average for apples (0.014 ppm) multiplied by a processing factor of 0.01. HED agrees that the use of the monitoring data is appropriate. This is consistent with the approach previously used for animal feed items (S. Funk, D2336612, 07/01/97). The processing factor should remain at 0.018, the average of five processing studies (0.015, 0.010, 0.030, 0.012, and 0.020). There is no justification to discard 4 of the 5 processing factors. Thus, the anticipated residue is revised downward to

0.014 ppm X 0.018 = 0.00025 ppm.

Previously, DRES concentration factors were applied to the citrus raw agricultural commodity values (survey data or field trial data or tolerance values) to arrive at anticipated residues in *citrus juices*. The registrant maintains that this is inappropriate, as there are processing studies for oranges to show that residues decline from the raw agricultural commodity to the juice. HED agrees that studies do show a reduction in residue and that use of the default DRES factors are not, therefore, appropriate.

Two processing studies were conducted in 1986 in CA. Oranges with field-weathered residues of dicofol, 3.79 and 4.46 ppm, were processed into juice, molasses, oil, and peel. In both instances, the total dicofol residue in the juice was <0.02 ppm, corresponding to residue reduction factors of 190 and 223X, respectively, average factor 206X. Using this factor and the RAC field trial, tolerance,

or survey values (S. Funk, 01/21/98, DP D240042), the following chronic anticipated residues are calculated:

grapefruit- juice: 0.012 ppm [PDP + FDA survey mean, n = 1626] X 0.005 = 0.00006 ppm.

limes- juice: 6 ppm [group tolerance] X 0.005 = 0.030 ppm

lemon- juice: 0.6 ppm [field trial average] X 0.005 = 0.003 ppm

oranges- juice: 0.012 ppm [PDP + FDA survey mean, n = 2825] X 0.005 = 0.0006 ppm

tangerines- juice: 0.012 ppm [orange] X 0.005 = 0.0006 ppm.

For oranges the average survey residue value (0.012 ppm) was substituted for the average field trial value (3.16 ppm). These values differ slightly from those calculated by the registrant because the registrant used a reduction factor of 333X.

The *acute* anticipated residues would also be reduced through use of the orange processing factor to 0.03 ppm for grapefruit juice (highest field trial X 0.005), 0.007 ppm for lemon juice (highest field trial X 0.005), 0.03 ppm for lime and tangerine juices (6 ppm group tolerance X 0.005), and 0.02 ppm for orange juice (highest field trial X 0.005)..

Rohm and Haas Company maintains that more reasonable residue values can be obtained for *processed grape fractions* through the use of survey data and processing factors, rather than field trial data and processing data. There were 2237 PDP grape samples and 3121 FDA grape samples analyzed in 1991 - 1994, with an average residue of 0.016 ppm. Applying the average processing factors of 6.6X for raisins and 0.25X for juice, the chronic anticipated residues are 0.11 ppm in raisins and 0.004 ppm in juice. The registrant uses a factor of 0.027X for juice, but the data indicate factors of 0.1X and 0.4X, average 0.25X (Table I-42; S. Funk, DP D206745, 08/95).

The previous DRES calculation concentrated dicofol residues in both the fat and non-fat fractions of *milk*. This is not possible. The whole milk residue value of 0.0015 ppm (S. Funk, D236612, 07/01/98) would represent a conservative estimate for non-fat fractions. The 0.04 ppm value of Table D (S. Funk, 01/21/98, DP D240042) applies as stated to milk fat (only). The estimated concentration factor from whole milk to milk fat is 30X.

The anticipated residues indicated in Table 7 represent new estimates for citrus juices, apple juice, grape juice, raisins, and non-fat milk fractions. These new anticipated residues were used in DRES calculations.

Table 7
Anticipated Residues of Dicofol in Plant Commodities and of Dicofol Plus FW-152 in Animal Commodities for Dietary Risk Assessment[1]

Food Item	Food Code	Residue Data Source		% Crop Treated[2,3]	Chronic Anticipated Residue (ppm)	Acute Anticipated Residue (ppm)
		Chronic	Acute			
Apples	04001AA	Survey	Field Trial	4	0.014	7
Apples-dried[4]	04001DA	Survey[4]	Field Trial[4]	4	0.11	56
Apples-juice	04001JA	Survey/ Processing	Field Trial/ Processing	4	0.00025	0.05
Apricots	05001AA	Tolerance	Tolerance	1	5	5
Apricots-dried	05001DA	Tolerance[5]	Tolerance[5]	1	30	30
Beans-dry-Great Northern	15001AA	Field Trial	Tolerance	2	0.1	0.5
Beans-dry-Kidney	15001AB	Field Trial	Tolerance	2	0.1	0.5
Beans-dry-Lima	15001AC	Field Trial	Tolerance	2	0.1	0.5
Beans-dry-Navy	15001AD	Field Trial	Tolerance	2	0.1	0.5
Beans-dry- other	15001AE	Field Trial	Tolerance	2	0.1	0.5
Beans-dry-Pinto	15001AF	Field Trial	Tolerance	2	0.1	0.5
Beans, dry-hyacinth (mature seed)	15030AA	Field Trial	Tolerance	2	0.1	0.5
Peas, black-eyed	15031AA	Field Trial	Tolerance	2	0.1	0.5
Beans-dry-garbanzo (chick pea)	15032AA	Field Trial	Tolerance	2	0.1	0.5
Beans, lima, succulent	15002AA	Survey	Tolerance	2	0.01	3
Beans, snap-succulent-green	15003AA	Survey	Tolerance	2	0.01	3
Beans- succulent-other	15003AB	Survey	Tolerance	2	0.01	3
Beans-succulent-yellow wax	15003AC	Survey	Tolerance	2	0.01	3
Beans-succulent-broadbeans (immature seed)	15022AB	Survey	Tolerance	2	0.01	3
Beans-succulent-hyacinth (young pods)	15030AB	Survey	Tolerance	2	0.01	3
Blackberries	01002AA	Survey	Tolerance	1	0.023	5
Boysenberries	01003AA	Tolerance	Tolerance	1	5	5
Butternuts	03010AA	Tolerance	Tolerance	2	0.1	0.1

Food Item	Food Code	Residue Data Source		% Crop Treated[2,3]	Chronic Anticipated Residue (ppm)	Acute Anticipated Residue (ppm)
		Chronic	Acute			
Cantaloupes-pulp	10002AB	Survey	Field Trial	30	0.004	1
Casabas	10003AA	Survey	Tolerance	30	0.004	1
Cattle, MBYP (exc. kidney & liver)	53001BA	Feeding Study	Tolerance	N/A	0.005	3
Cattle, fat	53001FA	Feeding Study	Tolerance	N/A	0.05	50
Beef- kidney	53001KA	Feeding Study	Tolerance	N/A	0.004	3
Beef-liver	53001LA	Feeding Study	Tolerance	N/A	0.01	5
Cattle, meat	53001MA	Feeding Study	Tolerance	N/A	0.005	3
Cherries	05002AA	Survey	Field Trial	1	0.01	4
Cherries-dried	05002DA	Survey[6]	Field Trial[6]	1	0.04	16
Cherries-juice	05002JA	Survey[7]	Field Trial[7]	1	0.015	6
Chestnuts	03004AA	Tolerance	Tolerance	2	0.1	0.1
Chicken-MBYP	55015BA	Feeding Study	Tolerance	N/A	0.002	0.1
Chicken-flesh (+skin, w/o bones)	55015MB	Feeding Study	Tolerance	N/A	0.008	0.1
Chicken-flesh (w/o skin, w/o bones)	55015MA	Feeding Study	Tolerance	N/A	0.002	0.1
Chicken-giblets (liver)	55015LA	Feeding Study	Tolerance	N/A	0.002	0.1
Crenshaws	10004AA	Survey	Tolerance	30	0.004	1
Grapefruit-pulp	02002AA	Survey	Field Trial	16	0.012	6
Grapefruit-juice	02002JA	Survey/ Processing	Field Trial/ Processing	16	0.00006	0.03
Kumquats	02003AA	Tolerance	Tolerance	16	10	10
Lemons-pulp	02004AB	Field Trial	Field Trial	16	0.6	1.5
Lemons-juice	02004JA	Field Trial/ Processing	Field Trial/ Processing	16	0.003	0.007

Food Item	Food Code	Residue Data Source		% Crop Treated[2,3]	Chronic Anticipated Residue (ppm)	Acute Anticipated Residue (ppm)
		Chronic	Acute			
Limes	02005Ab	Tolerance	Tolerance	16	6	6
Limes-juice	02004JA	Tolerance/ Processing	Tolerance/ Processing	16	0.03	0.03
Oranges-pulp	02006AB	Survey	Field Trial	16	0.012	4
Oranges-juice	02006JA	Survey /Processing	Field Trial/ Processing	16	0.0006	0.02
Tangerines	02008AA	Survey (orange)	Field Trial	16	0.012	5
Tangerines-juice	02008JA	Survey (orange) /Processing (orange)	Tolerance /Processing (orange)	16	0.0006	0.03
Citrus, oil	90999AB	Field Trial /Processing (orange)	Tolerance/ Processing	16	200	200
Cotton, seed, meal	27003WA	Field Trial/ Processing	Field Trial/ Processing	10	0.03	0.03
Cotton, seed, oil	270030A	Filed Trial/ Processing	Field Trial/ Processing	10	0.3	0.3
Crabapples	04002AA	Tolerance	Tolerance	4	10	10
Cucumbers	10010AA	Survey	Field Trial	1	0.003	0.5
Dewberries	01004AA	Tolerance	Tolerance	100	5	5
Eggplant	11001AA	Survey	Tolerance	100	0.01	2
Eggs	55014AA	Feeding Study	Tolerance	N/A	0.002	0.05
Filberts (Hazelnuts)	03005AA	Tolerance	Tolerance	2	0.1	0.1
Peppers, Bell	11003AA	Survey	Survey/ Tolerance	5	0.007	2
Peppers, Chili	11003AB	Survey	Survey/ Tolerance	5	0.007	2
Peppers, Other	11003AD	Survey	Survey/ Tolerance	5	0.007	2
Pimentos	11004AA	Survey	Survey/ Tolerance	5	0.007	2

Food Item	Food Code	Residue Data Source		% Crop Treated[2,3]	Chronic Anticipated Residue (ppm)	Acute Anticipated Residue (ppm)
		Chronic	Acute			
Tomatoes	11005AA	Survey	Field Trial	3	0.004	1
Tomatoes-juice	11005JA	Field Trial/ Processing	Tolerance/ Processing	3	0.07	0.2
Tomatoes-puree	11005RA	Field Trial/ Processing	Tolerance/ Processing	3	0.3	1
Tomatoes-paste	11005TA	Field Trial/ Processing	Tolerance/ Processing	3	0.6	2
Tomatoes-catsup	11005UA	Field Trial/ Processing	Tolerance/ Processing	3	0.4	1.2
Goats, MBYP (exc. kidney & liver)	53002BA	Feeding Study	Tolerance	N/A	0.005	3
Goats, fat	53002FA	Feeding Study	Tolerance	N/A	0.05	50
Goats, kidney	53002KA	Feeding Study	Tolerance	N/A	0.004	3
Goats, liver	53002LA	Feeding Study	Tolerance	N/A	0.01	5
Goats, meat (boneless, lean)	53002HA	Feeding Study	Tolerance	N/A	0.005	3
Grapes-fresh	01014AA	Survey	Field Trial	3	0.016	3.5
Grapes-raisins	01014DA	Survey/ Processing	Tolerance	3	0.11	20
Grapes-juice	01014JA	Survey/ Processing	Tolerance/ Processing	3	0.004	1.3
Hickory Nuts	03006AA	Tolerance	Tolerance	2	0.1	0.1
Hogs, MBYP (exc. kidney & liver)	53006BA	Feeding Study	Tolerance	N/A	0.005	3
Hogs, fat	53006FA	Feeding Study	Tolerance	N/A	0.05	50
Hogs, kidney	53006KA	Feeding Study	Tolerance	N/A	0.004	3
Hogs, liver	53006LA	Feeding Study	Tolerance	N/A	0.01	5
Hogs, meat	53006MA	Feeding Study	Tolerance	N/A	0.005	3

Food Item	Food Code	Residue Data Source		% Crop Treated[2,3]	Chronic Anticipated Residue (ppm)	Acute Anticipated Residue (ppm)
		Chronic	Acute			
Honeydew Melons	10005AA	Survey	Field Trial	24	0.004	1
Hops, dried	08020AA	Field Trial	Tolerance	6	25	65
Horses, MBYP (exc. kidney & liver)	53003AA	Feeding Study	Tolerance	N/A	0.005	3
Horses, fat	53003AA	Feeding Study	Tolerance	N/A	0.05	50
Horses, kidney	53003AA	Feeding Study	Tolerance	N/A	0.004	3
Horses, liver	53003AA	Feeding Study	Tolerance	N/A	0.001	5
Horses, meat	53003AA	Feeding Study	Tolerance	N/A	0.005	3
Loganberries	01005AA	Tolerance	Tolerance	100	5	5
Milk, fat	50000FA	Feeding Study	Tolerance	N/A	0.04	22
Milk, non-fat		Feeding Study	Tolerance Derived	N/A	0.0015	0.75
Mint, oil, peppermint	28080AA	Field Trial/ Processing	Tolerance	30	30	30
Mint, oil, spearmint	28081AA	Field Trial/ Processing	Tolerance	30	30	30
Nectarines	05003AA	Survey	Tolerance	100	0.01	5
Peaches	05004AA	Survey	Field Trial	1	0.013	4
Peaches-dried	05004DA	Survey[8]	Field Trial[8]	1	0.091	28
Pears	04003AA	Survey	Field Trial	4	0.01	10
Pears-dried	04003DA	Survey[9]	Field Trial[9]	4	0.05	45
Pecans	03008AA	Tolerance	Tolerance	2	0.1	0.1
Persian Melons	10007AA	Survey	Tolerance	24	0.004	1
Plums	05005AA	Survey	Field Trial	1	0.01	1
Plums, Prunes-dried	05005DA	Field Trial/ Processing	Field Trial/ Processing	1	2.5	3

Food Item	Food Code	Residue Data Source		% Crop Treated[2,3]	Chronic Anticipated Residue (ppm)	Acute Anticipated Residue (ppm)
		Chronic	Acute			
Plums, Prune-juice	05005JA	Survey[10]	Field Trial[10]	1	0.02	1.4
Poultry, other byproducts	55013BA	Feeding Study	Tolerance	N/A	0.002	0.1
Poultry, other-giblets (liver)	55013LA	Feeding Study	Tolerance	N/A	0.002	0.1
Poultry, other-flesh (+skin, w/o bones)	55013MA	Feeding Study	Tolerance	N/A	0.002	0.1
Pumpkins	10011AA	Field Trial	Field Trial	2	1	1
Quinces	04004AA	Field Trial	Field Trial	4	7	7
Raspberries	01006AA	Tolerance	Tolerance	1	5	5
Sheep, MBYP	53005BA	Feeding Study	Tolerance	N/A	0.005	3
Sheep, kidney	53005KA	Feeding Study	Tolerance	N/A	0.004	3
Sheep, liver	53005LA	Feeding Study	Tolerance	N/A	0.012	5
Sheep, fat	53005FA	Feeding Study	Tolerance	N/A	0.05	50
Sheep, meat	53005MA	Feeding Study	Tolerance	N/A	0.005	3
Squash, summer	10013AA	Survey	Field Trial	1	0.004	1
Squash, winter	10014AA	Survey	Field Trial	1	0.004	1
Strawberries	01016AA	Survey	Tolerance	10	0.014	10
Tea	07003AA	Tolerance/ Brewing Study	Tolerance	10	0.005	45
Turkey-MBYP	55008BA	Feeding Study	Tolerance	N/A	0.008	0.1
Turkey-flesh (w/o skin, w/o bones)	55008MA	Feeding Study	Tolerance	N/A	0.002	0.1
Turkey-giblets (liver)	55008LA	Feeding Study	Tolerance	N/A	0.002	0.1
Walnuts	03009AA	Tolerance	Tolerance	2	0.1	0.1

Food Item	Food Code	Residue Data Source		% Crop Treated[2,3]	Chronic Anticipated Residue (ppm)	Acute Anticipated Residue (ppm)
		Chronic	Acute			
Watermelons	10008AA	Survey	Field Trial	11	0.004	1
Wine and Sherry	43058AA	Field Trial/ Processing	Tolerance/ Processing	6	0.3	0.5

[1] Dicofol is a mixture of 1,1-bis(4-chlorophenyl)-2,2,2-trichloroethanol and 1-(2-chlorophenyl)-1-(4-chlorophenyl)-2,2,2-trichloroethanol. FW-152 is a mixture of 1-(2-chlorophenyl)-1-(4-chlorophenyl)-2,2-dichloroethanol and 1,1-bis(4-chlorophenyl)-2,2-dichloroethanol.

[2] Most percent crop treated data were not obtained from BEAD, but were obtained from *Pesticide Use in U.S. Crop Production*, National Center for Food and Agricultural Policy, 02/95, from *Battelle Worldwide Pesticide Program, Insecticides IV*, 1990, from *Agricultural Chemical Usage, Vegetables*, USDA, 06/93, from *USDA Agricultural Statistics 1991*, from SRI International, *Deciduous Tree and Vine Crop Markets: U.S. Pacific States, 1990*, and from *1988 Specialty Crop Pesticide Study- Fruit, Grapes, and Nuts*, Doane Marketing Research, Inc. Where conflicting numbers were found, the highest percent crop treated value was used. Data for peaches, apricots, cotton, mint, plums, grape wine, cherries, tea, blackberries, and raspberries were from a 11/05/92 Memorandum, John Faulkner (BEAD), listing 1990 usage information. If no data were available, 100% crop treated was assumed.

[3] Per cent crop treated should be used in the DRES analysis of chronic anticipated residues ONLY where the entry is redlined (in the original memo).

[4] DRES concentration factor applied to apple survey or field trial data (8)..

[5] Apricot rac values multiplied by the DRES concentration factor (6).

[6] Cherry rac values multiplied by the DRES concentration factor (4).

[7] Cherry rac values multiplied by the DRES concentration factor (1.5).

[8] Peach rac values multiplied by the DRES concentration factor (7).

[9] Pear rac values multiplied by the DRES concentration factor (4.4).

[10] Plum rac values multiplied by the DRES concentration factor (1.4).

4) Dietary Risk From Food Sources

Residues

Tolerances for dicofol residues in/on food and feed crops are published in 40 CFR Section 180.163. There are no tolerances established for animal commodities. However, due to an update of the Tolerance Reassessment Summary (See Table II of S. Funk memo, 9/12/95), and a revised approach to processed commodity tolerances specified in the memo of 7/17/95 (M. Metzger & E. Zager), tolerances for animal commodities are now needed and have been included in the chronic analysis.

The Tolerance Reassessment Summary and anticipated residues were most recently updated in a memo summarizing revisions to the residue chemistry chapter based upon evaluation of the Rohm and Haas rebuttal (see S. Funk memo, 6/11/98). Anticipated residues were provided for most of the commodities used in the analysis. Default concentration factors were generally turned off for this analysis because specific anticipated residues were given for most food forms.

Chronic Exposure:

A summary of the residue information considered in the chronic analysis is attached (Attachment 3).

A DRES chronic exposure analysis was performed using anticipated residues and other recommendations provided by CEB 1 (6/11/98 memo) and percent of crop treated if applicable. Estimated chronic dietary risk for the U.S. general population and the highest subgroups are given in the table below.

Table 8: Chronic Dietary Exposure and Risk to Dicofol

Population	Exposure (mg/kg/day)	Percent of the RfD
U.S. Population	0.000076	**19**
Children (1-6 years)	0.000150	**38**
Non-Nursing Infants(< 1 year)	0.000129	**32**
Children (7-12 years)	0.000104	**26**

Dietary exposures from almost all food commodities were based on refined residues, such as anticipated residues or tolerance level residues with percent of crop treated information applied. These estimates are not worst-case and are not expected to represent gross over-estimates of chronic dietary risk to dicofol. The FQPA Safety Factor of 3X has been applied to the RfD for this analysis (RfD = 0.0004 mg/kg/day), because the RfD is based on inhibition of adrenal cortisol trophic hormone (ACTH) stimulated-release. Generally, HED is not concerned about dietary risk if the risk estimate results in less than 100% of the RfD. Estimated chronic dietary risk for the U.S. general population and all subgroups are below HED's level of concern.

Acute Exposure:

The DRES detailed acute analysis estimates the distribution of single-day exposures for the overall U.S. population and certain subgroups. The analysis evaluates individual food consumption as reported by respondents in the USDA 1977-78 Nationwide Food Consumption Survey (NFCS) and accumulates exposure to the chemical for each commodity. Each analysis assumes uniform distribution of dicofol in the commodity supply.

The percent of the acute reference dose is a measure of how close the high end exposure comes to the Reference Dose, and is calculated as the ratio of exposure (mg/kg/day) to the acute RfD (mg/kg/day). In this case, the FQPA Safety Factor has been incorporated into the acute RfD for use with the dietary risk assessment for the U.S. population including infants and children because the endpoint is based on neurotoxicity. The resulting acute RfD is 0.05 mg/kg/day. Generally, acute dietary risk greater than 100 percent of the Acute RfD results in dietary concern.

This analysis was conducted in January, 1998 for the First Revised HED Science Chapter. Since then, the acute anticipated residues have been updated but no acute analysis was performed because the Agency's mainframe computer is under repair and HED is unable to conduct acute dietary risk assessments at this time. Therefore, the risk estimates below are directly from the last HED Science chapter.

An acute dietary Monte Carlo analysis was submitted by the registrant recently and is currently under review. When completed, the results of the Monte Carlo will be used to estimate Agency acute dietary risk.

Table 9: Acute Dietary Exposure to Dicofol

Population	High End Exposure (mg/kg/day)	% Acute RfD
U.S. Population	0.30	**600**
Infants (< 1 year)	0.50	**1000**
Children (1-6 years)	0.40	**800**
Females (13+ years)	0.16	**320**
Males (13+ years)	0.16	**320**

The highest percentage of the acute RfD for high end exposure in this analysis is 1000 for infants less than one year old. **Acute dietary risk for the U.S. general population and all population subgroups are at a level which cause concern (>100%)**. The results of this analysis indicate that dicofol residues in the diet represents a risk concern for acute exposure for all subgroups.

e. Dietary Risk From Drinking Water Sources

There is no established Maximum Contaminant Level (MCL) for residues of dicofol in drinking water. No health advisory levels for dicofol in drinking water have been established.

Ground Water

A tier 1 assessment that provides estimates of the concentration of dicofol in ground water was conducted. This tier 1 assessment used SCI-GROW, an empirical model based on actual ground-water monitoring data from small-scale prospective ground-water monitoring studies, to estimate upper bound concentrations of a chemical in vulnerable ground water. The SCI-GROW model estimated a 90-day peak average concentration of 0.069 ppb for dicofol in ground water. This value was compared to drinking water levels of concern (DWLOCs) calculated for both acute and chronic effects of dicofol. Because the concentration of pesticides in ground water is not expected to fluctuate widely, a single value was selected for acute and chronic exposure assessments.

Surface Water

EFED calculated tier 2 (PRZM-EXAMS) estimated environmental concentrations (EECs) for dicofol in potential surface water sources. The EEC's are based on the environmental fate data for p,p'-dicofol since it occurs in the greatest proportion (4.5:1 ratio with o,p'-dicofol) and is more persistent of the two isomers. The EEC's were revised in June, 1998 to reflect the overall mean EECs for surface water. EFED has characterized the surface water estimates by stating that further revision and refinement of the numbers would not result in lower values, and that even the available monitoring data is in the same general range as the model estimates. The estimated overall mean concentration of dicofol in surface water is 0.5 ppb.

Drinking Water Risk

The Agency has calculated drinking water levels of concern for acute and chronic exposures to dicofol in drinking water for the adult general U.S. population and non-nursing infants (< 1 year old), respectively.

Acute Dietary Risk from Drinking Water

For acute exposure to dicofol, the drinking water level of concern (DWLOCs) for all subpopulations is zero. **Because the exposure to residues from food alone exceeds HED's level of concern for acute dietary exposure, any additional exposure to dicofol in drinking water would lead to risk estimates that further exceed HED's level of concern.**

Chronic Dietary Risk from Drinking Water

For chronic exposure to dicofol, the drinking water levels of concern (DWLOCs) for the U.S. general population, children (1-6 years), non-nursing infants and children (1-7 years) are 11.34, 2.5, 2.71 and 2.96 ug/L, respectively.

For chronic exposure to the U.S. population excluding infants and children, HED uses a body weight of 70 kg and 2 liter consumption of water per day for adults and a body weight of 10 kg and 1 liter consumption of water for infants and children.

The estimated overall mean concentration of dicofol in surface water (from PRZM-EXAMS) is **0.5 ppb** and **0.069 ppb** for ground water (from SCI-GROW). The estimated average concentration of dicofol in either surface or ground water is less than HED's drinking water levels of concern for dicofol for the adult U.S. general population, and all population subgroups.

4. Occupational and Residential Exposure and Risk Characterization

An occupational and/or residential exposure assessment is required for an active ingredient if (1) certain toxicological criteria are triggered and (2) there is potential exposure to handlers (mixers, loaders, applicators, etc.) during use or to persons entering treated sites after application is complete.

Based on information currently available to HED, there are two end-use products containing dicofol that is available for home use (EPA Reg. No. 239-2574 and 239-2575). Both of these products are emulsifiable concentrates (ECs) containing 3% active ingredient, and both are registered to Monsanto. In the residential setting, dicofol is used primarily on ornamental plants. All other products containing dicofol are intended primarily for non-residential uses.

a. Use Pattern and Formulation Summary

Applications of dicofol can be made using either ground-based or aerial equipment. Ground-based application methods include high volume sprays, low volume sprays, and spot treatments, among others. Aerial application methods include low volume sprays only. Soil incorporation is not required for any of these uses. The timing of applications is generally not restricted to specific time periods during the growing season of each crop/target with the exception of any previously established pre-harvest intervals. Based on the types of crops/targets to which dicofol can be applied, the use of several types of application equipment is possible. Application rates for the emulsifiable concentrate and flowable concentrate formulations can range up to 4 lb ai/acre (air and ground-based) while the application rate for the wettable powder formulations can range up to 3 lb ai/acre. Ground-based application volumes range from 20 to 1,600 gallons per acre while aerial application volumes range from 3 to 10 gallons per acre.

The registrant has proposed the following reduced maximum application rates (Rohm and Haas rebuttals dated 6/18/96 and 4/20/98): 4 lb ai/acre for citrus; 3 lb ai/acre for apples and pears; 2 lb ai/acre for pecans and walnuts; 1.5 lb ai/acre for cotton; 2.4 lb ai/acre for strawberries; 1.3 lb ai/acre for grapes; 1.5 lb ai/acre for stonefruits; 0.63 lb ai/acre for cucurbits; 1.5 lb ai/acre for beans; 0.75 lb ai/acre for tomatoes and peppers; and 0.55 lb ai/acre for lawns and ornamentals.

Based on information currently available (REFS search 12/97), there are two end-use products containing dicofol that are available for home use (EPA Reg. No. 239-2574, 239-2575). All other products containing dicofol are intended primarily for occupational use.

Based on the use patterns and potential exposures described above, 14 major exposure scenarios were identified for dicofol: (1) mixing/loading wettable powder for aerial application; (2) mixing/loading wettable powder for ground-based application; (3) mixing/loading liquid for aerial application; (4) mixing/loading liquid for ground-based application; (5) mixing/loading liquids for high pressure handwand application; (6) applying the liquid formulation with groundboom; (7) applying the liquid formulation with aerial equipment; (8) applying the liquid formulation with airblast sprayer; (8) applying the liquid formulation with high pressure handwand sprayer; (10) applying sprays with a handgun (lawn) sprayer ; (11) flagging during the application of the liquid formulation with aerial equipment; (12) mixing, loading, and applying the liquid formulation with backpack sprayer; (13) mixing, loading, and applying the liquid formulation with hose-end sprayer; and (14) mixing, loading, and applying the liquid formulation with low pressure handwand sprayer.

HED has determined that there is potential exposure to persons entering sites previously treated with dicofol. Postapplication exposures may occur to agricultural workers following applications to the crops identified in the use summary during routine hand-labor crop-production tasks, such as hoeing, thinning, and harvesting activities and non-hand-labor tasks, such as crop-advisor and irrigation-related activities. Since there are dicofol products registered for home use, there is potential for post application exposure in residential settings.

b. Assumptions

Total exposure was calculated by summing the oral dose equivalents of inhalation and dermal exposure, then this value was compared to the appropriate NOEL for risk assessment. Application rates, daily maximum area treated and daily baseline exposure (for workers wearing baseline protection: long pants, long sleeved shirt, shoes and socks) are provided in Table 11 below. Crop-specific application rates and acreage information were provided by Rohm and Haas in order to determine a more refined, accurate exposure assessment (6/97). Unit exposure data were derived from the Pesticide Handlers Exposure Database (PHED), Version 1.1. Exposure scenario details, such as level of confidence, PPE, engineering controls and standard assumptions are presented in Tables 11-16.

Handler Exposure Data

Data for the dicofol handler exposure assessment was obtained from the Pesticide Handlers Exposure Database (PHED), Version 1.1. Confidence levels in the available data (ranging from low to high) and other details are provided in Table 16.

Handler (Mixer/Loader/Applicator) Exposure Scenarios

HED has determined that there is a potential exposure to mixers, loaders, applicators, or other handlers during usual use-patterns associated with dicofol. In particular, HED is concerned with exposures to handlers during the treatment of crops by ground and aerial equipment, and to ornamentals using hand-held equipment.

Exposure Calculations

The following calculations are used to assess the risk to handlers.

Daily Exposure (mg ai/day) is calculated using the following equation:

$$Daily\ Exposure\left(\frac{mg\ AI}{Day}\right) = Unit\ Exposure\left(\frac{mg\ AI}{lb\ AI}\right) \cdot Max.\ Appl.\ Rate\left(\frac{lb\ AI}{Acre}\right) \cdot Max.\ Area\ Treated\left(\frac{Acres}{Day}\right)$$

Exposure was calculated under the assumption of 100% dermal absorption.

Daily Systemic Dose due to Dermal Exposure (mg/kg/day) is calculated using the following formula:

$$Daily\ Systemic\ Dose\left(\frac{mg}{Kg\ Day}\right) = Daily\ Exposure\left(\frac{mg}{Day}\right) \cdot \left(\frac{1}{Body\ Weight\ (Kg)}\right) \cdot Dermal\ Absorption$$

Short Term and Intermediate Term Risk/Margin of Exposure (MOE) was calculated using the following formula:

$$MOE = \frac{NOEL\left(\frac{mg}{kg\ day}\right)}{Absorbed\ Daily\ Dose\left(\frac{mg}{kg\ day}\right)}$$

Exposure and risk for the short term and intermediate term uses of dicofol are summarized in the tables below. Short-term occupational risk was calculated using the endpoint of 4.0 mg/kg/day, with an MOE of at least 100 required. Intermediate-term occupational risk was calculated using the 0.29 mg/kg/day NOEL (Hazard Identification Assessment Review Committee Report, 12/17/98) with a required MOE of 100 or more.

Postapplication Exposure Data

Significant potential for exposure exists for workers after application of dicofol. Chemical-specific post-application exposure or environmental fate data (as regulated by Subdivision K) have not been submitted in support of the reregistration of dicofol. Therefore, a surrogate range-finding post-application exposure assessment was performed for occupational settings. In the study, dissipation is assumed at 10% per day. Environmental fate data were not reviewed for the surrogate assessment. The study indicates that prolonged restricted-entry intervals are necessary to protect workers. Although exposure at residential sites is likely to be

lower than for occupational use sites, a post-application residential risk assessment was not conducted because restricted entry intervals are not feasible in residential settings. HED has concerns regarding post-application exposure for occupational use sites, and requests that the registrant submit the required data (see Section 4) as soon as possible. Until these data are submitted and evaluated, the post-application use scenarios remain a concern.

c. Occupational Handler (Mixer/Loader and Applicator) Exposure and Risk Assessment/Characterization

In a recent rebuttal (MRID 44552801, 4/20/98) to the HED Science Chapter (1/26/98), the registrant cited risk reduction measures including revised use patterns, application rates for citrus (4 lbs ai), water soluble packaging for all wettable powder formulation products, and additional personal protective equipment.

Another suggestion made by the registrant in the rebuttal (MRID 44552801) was to add gloves, coveralls, and respirators to labels for mixer/loaders using water soluble packets. In response, HED has stated that it has reservations about requiring additional PPE such as double layers of clothing and respirators in addition to engineering controls (closed mixing loading systems, such as water-soluble packets), and **does not recommend that particular mitigation measure.**

Short-term estimated risks, based on the exposure values in Table 10 are presented in Table 11 for workers with baseline clothing and with additional PPE. Intermediate-term estimated risks, based on the exposure values in Table 10 are presented in Table 12 for workers wearing baseline clothing in addition to PPE. Tables 13 and 14 present the estimated risk for workers when engineering controls are implemented in addition to PPE.

The registrant, Rohm and Haas, has indicated that water soluble packaging will be implemented for all wettable powder formulations in an effort to reduce exposure. Therefore, risk to mixer/loaders handling wettable powder formulations of dicofol was only calculated for workers using water soluble packaging-a closed system (engineering controls), so the risk estimates for these workers appears only in Tables 13 and 14.

Occupational Handler Risk Estimates

The estimated risks for short-term and intermediate-term exposure for all handlers wearing baseline personal protective equipment (long sleeved shirt, long pants, shoes and socks), are **all of concern**.

With additional PPE consisting of a double layer of clothing, chemical resistant gloves, and an organic vapor-removing respirator, workers have reduced exposure but risks for some short-term and intermediate-term use scenarios result in MOE's below 100.

The following short-term use scenarios result in MOE's above 100 and **do not exceed HED's level of concern** for occupational risk with additional PPE consisting of a double layer of clothing, chemical resistant gloves, and an organic vapor-removing respirator: (from Table 11):

- Mixing/loading Liquids for Groundboom Application to Peppers and Tomatoes

- Groundboom Application to Beans, Peppers and Tomatoes
- High Pressure Handwand Application to Ornamentals
- Flagging for Application to Grapes, Cucurbits, Tomatoes and Peppers

All other short-term exposure scenarios result in MOE's below 100 and are above HED's level of concern.

There are no intermediate-term use scenarios which result in MOE's above 100. All other short-term exposure scenarios result in MOE's which are below 100 and above HED's level of concern.

With engineering controls consisting of closed mixing/loading systems (water soluble packaging for wettable powders and enclosed delivery systems for liquids) and closed cabs for all application and flagging scenarios, workers have exposure reduced further but risks for some short-term and intermediate-term use scenarios result in MOE's below 100.

The following short-term use scenarios for workers using engineering controls result in MOE's above 100 and **do not exceed HED's level of concern** for occupational risk:

- Mixing/Loading Wettable Powders for Groundboom Application to Peppers and Tomatoes
- Mixing/Loading Liquids for Aerial Application to Cucurbits and Peppers and Tomatoes
- Mixing Loading Liquids for Groundboom Application to Strawberries, Mint and Beans
- All Groundboom Application Scenarios
- Aerial Application to Pecans, Walnuts, Grapes, Cucurbits, Peppers and Tomatoes
- All Airblast Application Scenarios
- All Flagging Scenarios
- All Other Scenarios With MOE's Above 100 as Mentioned Above

All other use scenarios result in MOE's below 100 and exceed HED's level of concern.

The following intermediate-term use scenarios for workers using engineering controls result in MOE's above 100 and do not exceed HED's level of concern for occupational risk:

- All Flagger Use Scenarios
- All Other Scenarios With MOE's Above 100 as Mentioned Above

All other intermediate-term use scenarios result in MOE's below 100 and exceed HED's level of concern.

HED assumes that by wearing an organic vapor removing cartridge respirator, workers can reduce inhalation exposure by an estimated 90 percent. Likewise, HED assumes that fabric coveralls worn over baseline protection can reduce dermal exposure by 50 percent. The PHED exposure data used to calculate risk estimates for handlers wearing baseline clothing, with PPE, and with engineering controls varies from poor quality ("low confidence") to high quality ("high confidence"). Generally, if at least 15 PHED data records are available and

the data quality are graded A and/or B, the source is considered with high confidence. If fewer than 15 PHED data records are available or the data quality is low, the source is considered with low confidence.

The registrant has asserted in the 4/20/98 rebuttal that, ”Dicofol users will not be handling this product exclusively on an all-day basis for more than a few days at most in any given season.” HED agrees and acknowledges that the occupational handler risk assessment is conducted using assumptions which attempt to account for the inherent variability in use practices and human behavior. Some of the assumptions used in the handler risk assessment may be too conservative and not representative of the real uses of dicofol, such as the dermal absorption rate of 100% or the number of acres treated per day. However, others may argue that some of these assumptions are not conservative enough. For this reason, generally HED conducts risk assessments using default assumptions when data are unavailable.

TABLE 10: HANDLER AND FLAGGER EXPOSURE FOR DICOFOL								
Exposure Scenario (Scenario #)	Baseline Dermal Unit Exposure[a] (mg/lb ai)	Baseline Inhalation Unit Exposure[b] (μg/lb ai)	Crop[c]	Proposed Maximum Application Rate[c] (lb ai/acre)	Daily Max. Treated[d] (acres)	Daily Dermal Exposure[e] (mg/day)	Daily Inhalation Exposure[f] (mg/day)	Daily Total Exposure[g] (mg/day)
Mixer/Loader								
Mixing/Loading Wettable Powder for Aerial Application (1)	3.8	43.4	Citrus	4	480	See Engineering Controls- Tables 14 and 15		
			Apples/Pears	3	200			
			Pecans/Walnuts	2	200			
			Cotton	1.5	480			
			Strawberries	2.4	250			
			Grapes	1.3	250			
			Stonefruit	1.5	250			
			Cucurbits	0.63	320			
			Beans	1.5	320			
			Tomatoes/Peppers	0.75	320			
Mixing/Loading Wettable Powder for Groundboom Application (2)	3.8	43.4	Cotton	1.5	200	See Engineering Controls- Tables 14 and 15		
			Strawberries	2.4	90			
			Mint	1.3	140			
			Beans	1.5	90			
			Peppers/Tomatoes	0.75	90			
Mixing/Loading Liquid for Aerial Application (3)	2.9	1.2	Citrus	4	480	5600	2.3	5600
			Apples/Pears	3	200	1700	0.72	1700
			Pecans/Walnuts	2	200	1200	0.48	1200
			Cotton	1.5	480	2100	0.86	2100
			Strawberries	2.4	250	1700	0.71	1700
			Grapes	1.3	250	910	0.38	910
			Stonefruit	1.5	250	1100	0.45	1100
			Cucurbits	0.63	320	580	0.24	580
			Beans	1.5	320	1400	0.58	1400
			Tomatoes/Peppers	0.75	320	700	0.29	700
Mixing/Loading Liquid for Groundboom Application (4)	2.9	1.2	Cotton	1.5	200	870	0.36	870
			Strawberries	2.4	90	620	0.26	620
			Mint	1.3	140	510	0.21	510
			Beans	1.5	90	390	0.16	390

TABLE 10: HANDLER AND FLAGGER EXPOSURE FOR DICOFOL

Exposure Scenario (Scenario #)	Baseline Dermal Unit Exposure[a] (mg/lb ai)	Baseline Inhalation Unit Exposure[b] (μg/lb ai)	Crop[c]	Proposed Maximum Application Rate[c] (lb ai/acre)	Daily Max. Treated[d] (acres)	Daily Dermal Exposure[e] (mg/day)	Daily Inhalation Exposure[f] (mg/day)	Daily Total Exposure[g] (mg/day)
			Peppers/Tomatoes	0.75	90	200	0.081	200
Mixing/Loading Liquid for High Pressure Handwand Application (5)	2.9	1.2	Lawn/Ornamental	0.55	10 (H)	16	0.007	16
					20 (O)	32	0.013	32
Applicator Exposure								
Groundboom (6)	0.015	0.7	Cotton	1.5	200	4.5	0.21	4.7
			Strawberries	2.4	90	3.2	0.15	3.4
			Mint	1.3	140	2.6	0.12	2.7
			Beans	1.5	90	2.0	0.095	2.1
			Peppers/Tomatoes	0.75	90	1.0	0.047	1.1
Aerial (7)	See Engineering Controls		Citrus	4	480	See Engineering Controls- Tables 14 and 15		
			Apples/Pears	3	200			
			Pecans/Walnuts	2	200			
			Cotton	1.5	480			
			Strawberries	2.4	250			
			Grapes	1.3	250			
			Stonefruit	1.5	250			
			Cucurbits	0.63	320			
			Beans	1.5	320			
			Tomatoes/Peppers	0.75	320			
Airblast (8)	0.4	4.5	Citrus	4	24	38	0.43	38
			Pecans/Walnuts	2	60	48	0.54	49
			Hops	1.2	64	31	0.35	31
			Stonefruit	1.5	64	38	0.43	39
			Grapes	1.3	24	12	0.14	12
			Cucurbits	0.63	90	23	0.26	23
High Pressure Handwand (9)	1.8	79	Ornamentals	0.03 lbs/1000ft^2	1000 ft^2	0.05	0.002	0.052
Applying sprays with a handgun (lawn) sprayer (10)	See PPE	1.4	PCO Lawns	0.55	5	See PPE Tables 12, 13	0.0039	See PPE Tables 12, 13

TABLE 10: HANDLER AND FLAGGER EXPOSURE FOR DICOFOL

Exposure Scenario (Scenario #)	Baseline Dermal Unit Exposure[a] (mg/lb ai)	Baseline Inhalation Unit Exposure[b] (μg/lb ai)	Crop[c]	Proposed Maximum Application Rate[c] (lb ai/acre)	Daily Max. Treated[d] (acres)	Daily Dermal Exposure[e] (mg/day)	Daily Inhalation Exposure[f] (mg/day)	Daily Total Exposure[g] (mg/day)
Flagger								
Flagging (11)	0.01	0.3	Citrus	4	480	19	0.58	20
			Apples/Pears	3	200	6	0.18	6.2
			Pecans/Walnuts	2	200	4	0.12	4.1
			Cotton	1.5	480	7.2	0.22	7.4
			Strawberries	2.375	250	5.9	0.18	6.1
			Grapes	1.25	250	3.1	0.094	3.2
			Stonefruit	1.5	250	3.8	0.11	3.9
			Cucurbits	0.63	320	2	0.06	2.1
			Beans	1.5	320	4.8	0.14	4.9
			Tomatoes/Peppers	0.75	320	2.4	0.072	2.5
Mixer/Loader/Applicator								
Backpack Sprayer (12)	4.99	30	Non Residential Lawns/Ornamentals	0.01 lb/1000 ft^2 or 0.55	(O) 5	14	0.083	14
Hose-End (13)	30.55	9.5	Non-Residential Lawns/Ornamentals	0.55	(O) 5	84	0.026	84
Low Pressure Handwand Sprayer (14)	103	31	Non-Residential Lawns/Ornamentals	0.01 lb/1000 ft^2 or 0.55	(O) 5	280	0.085	280

(H) = homeowner; (O) = occupational

a Baseline Protection = Long pants, long sleeve shirts, no gloves, shoes and socks, open mixing/loading, open cockpit, open cab tractor; see Table 8 for details.

b Baseline Protection = No respirator; see Table 8 for details.

c Proposed crops and maximum application rates are based on Rohm and Haas (Susan S. Hurt) rebuttal dated June 18, 1996.

d Values represent the maximum area which can be used in a single day based on Rohm and Haas Company's (Susan S. Hurt) rebuttal dated June 18, 1996.

e Daily dermal exposure (mg/day) = Exposure (mg/lb ai) * Max. Appl. Rate (lb ai/acre) * Max. Treated

f Daily inhalation exposure (mg/day) = Exposure (μg/lb ai) * (1mg/1,000 μg) conversion * Max Appl Rate (lb ai/A) * Max Treated

g Daily total exposure (mg/day) = Daily dermal exposure + Daily inhalation exposure

TABLE 11: SHORT TERM RISK FOR DICOFOL HANDLERS AND FLAGGERS WITH BASELINE AND ADDITIONAL PPE

Exposure Scenario (Scenario #)	Crop	Baseline Total Dose (mg/kg/day)[a]	Baseline Total MOE[b]	Risk Mitigation Measure					
				Additional PPE[c]					
				Dermal Unit Exposure (mg/lb ai)	Inhalation Unit Exposure (μg/lb ai)	Daily Dermal Dose (mg/kg/day)[d]	Daily Inhalation Dose (mg/kg/day)[e]	Daily Total Dose (mg/kg/day)[a]	Total MOE[b]
Mixer/Loader Risk									
Mixing/Loading Wettable Powder for Aerial Application (1)	Citrus	See Engineering Controls Tables 14 and 15							
	Apples/Pears								
	Pecans/Walnuts								
	Cotton								
	Strawberries								
	Grapes								
	Stonefruit								
	Cucurbits								
	Beans								
	Tomatoes/Peppers								
Mixing/Loading Wettable Powder for Groundboom Application (2)	Cotton								
	Strawberries								
	Mint								
	Beans								
	Peppers/Tomatoes								
Mixing/Loading Liquid for Aerial Application (3)	Citrus	93	0.04	0.025	0.12	0.8	0.004	0.804	5
	Apples/Pears	29	0.14			0.25	0.012	0.25	16
	Pecans/Walnuts	19	0.21			0.17	0.0080	0.18	22
	Cotton	35	0.11			0.30	0.014	0.31	13
	Strawberries	29	0.14			0.25	0.012	0.26	15
	Grapes	15	0.26			0.13	0.0065	0.14	29
	Stonefruit	18	0.22			0.16	0.0075	0.17	24
	Cucurbits	9.7	0.41			0.083	0.0040	0.087	46
	Beans	23	0.17			0.20	0.0096	0.21	19
	Tomatoes/Peppers	12	0.34			0.10	0.0048	0.10	40
Mixing/Loading Liquid for Groundboom Application (4)	Cotton	15	0.28			0.13	0.00060	0.13	32
	Strawberries	10	0.39			0.089	0.00043	0.089	45

TABLE 11: SHORT TERM RISK FOR DICOFOL HANDLERS AND FLAGGERS WITH BASELINE AND ADDITIONAL PPE

Exposure Scenario (Scenario #)	Crop	Baseline Total Dose (mg/kg/day)[a]	Baseline Total MOE[b]	Risk Mitigation Measure					
				Additional PPE[c]					
				Dermal Unit Exposure (mg/lb ai)	Inhalation Unit Exposure (μg/lb ai)	Daily Dermal Dose (mg/kg/day)[d]	Daily Inhalation Dose (mg/kg/day)[e]	Daily Total Dose (mg/kg/day)[a]	Total MOE[b]
	Mint	8.5	0.47			0.073	0.00036	0.073	55
	Beans	6.5	0.61			0.056	0.00027	0.056	71
	Peppers/Tomatoes	3.3	1.2			0.028	0.00014	0.028	140
Mixing/Loading Liquid for High Pressure Handwand Application (5)	Lawn/Ornamentals @10 acres	0.23	17	N/A	N/A	N/A	N/A	N/A	N/A
	@20 acres	0.46	9						
Applicator Risk									
Groundboom (6)	Cotton	0.079	51	0.01	0.07	0.05	0.00035	0.050	79
	Strawberries	0.056	72			0.053	0.00025	0.053	75
	Mint	0.046	87			0.044	0.00021	0.044	91
	Beans	0.035	113			0.023	0.00016	0.023	170
	Peppers/Tomatoes	0.018	226			0.011	0.000079	0.011	360
Aerial (7)	See Engineering Controls Table for all crops								
Airblast (8)	Citrus	0.64	6.3	0.12	0.45	0.19	0.00072	0.19	21
	Pecans/Walnuts	0.81	4.9			0.24	0.00090	0.24	17
	Hops	0.52	7.7			0.15	0.00058	0.15	26
	Stonefruit	0.65	6.2			0.19	0.00072	0.19	21
	Grapes	0.2	20			0.06	0.00023	0.06	66
	Cucurbits	0.39	10.3			0.11	0.00043	0.11	36
High Pressure Handwand (9)	Lawns/Ornamentals	0.17	23	0.31	7.9	0.028	0.00072	0.029	140
		0.34	12			0.056	0.0014	0.057	70
Applying Sprays with a handgun (lawn) sprayer (10)	PCO Lawns	See PPE		0.19	1.4 (no respirator)				
Flagger Risk									
Flagging (11)	Citrus	0.33	12	0.007	0.03	0.224	0.00096	0.22	18
	Apples/Pears	0.1	39			0.070	0.00030	0.070	57
	Pecans/Walnuts	0.069	58			0.047	0.00020	0.047	85
	Cotton	0.12	32			0.084	0.00036	0.084	47

TABLE 11: SHORT TERM RISK FOR DICOFOL HANDLERS AND FLAGGERS WITH BASELINE AND ADDITIONAL PPE

Exposure Scenario (Scenario #)	Crop	Baseline Total Dose (mg/kg/day)[a]	Baseline Total MOE[b]	Risk Mitigation Measure					
				Additional PPE[c]					
				Dermal Unit Exposure (mg/lb ai)	Inhalation Unit Exposure (μg/lb ai)	Daily Dermal Dose (mg/kg/day)[d]	Daily Inhalation Dose (mg/kg/day)[e]	Daily Total Dose (mg/kg/day)[a]	Total MOE[b]
	Strawberries	0.1	39			0.069	0.00030	0.069	58
	Grapes	0.054	75			0.036	0.00016	0.036	110
	Stonefruit	0.064	62			0.044	0.00019	0.044	91
	Cucurbits	0.034	120			0.023	0.00010	0.023	170
	Beans	0.082	49			0.056	0.00024	0.056	71
	Tomatoes/Peppers	0.041	97			0.028	0.00012	0.028	140
Mixer/Loader/Applicator									
Backpack Sprayer (12)	Lawns/Ornamentals	(O) 0.23	17	1.3	3	0.058	0.00014	0.058	69
Hose-End (13)	Lawns/Ornamentals	(O) 1.4	2.9	4.6	0.95	0.21	0.000044	0.21	19
Low Pressure Handwand (14)	Lawns/Ornamentals	(O) 4.7	0.85	3.2	3.1	0.15	0.00014	0.15	27

(O) = occupational; Use of dicofol on residential lawns is no longer a use site.

a Baseline total dose = (daily dermal exposure + daily inhalation exposure)/60 kg. (Note: Exposure values are from Table 3.)

b Total MOE = NOEL (short-term NOEL = 4 mg/kg/day) / daily total dose (mg/kg/day).

c Additional PPE = Double layer of clothing, chemical resistant gloves, and an organic/vapor removing respirator. Unit inhalation exposures for respirators are based on the unit inhalation exposures on Table 10 adjusted by a 10-fold protection factor.

d Daily dermal dose = Dermal unit exposure (mg/lb ai) x Appl. rate (lb ai/A) x Acres/60 kg. (Note: Appl. rate and acres treated are from Table 3.)

e Daily Inhalation Dose (mg/kg/day) = Inhalation unit exposure (μg/lb ai) x $\left(\frac{1\ mg}{1{,}000\mu g\ conversion}\right)$ x Appl. rate (lb ai/A) x Acres/60 kg. (Note: Appl. rate and acres treated are from Table 3.)

N/A - Not applicable; homeowners are not required to use PPE.

TABLE 12: INTERMEDIATE-TERM RISK FOR HANDLERS AND FLAGGERS FOR DICOFOL WITH BASELINE AND ADDITIONAL PPE

Exposure Scenario (Scenario #)	Crops	Baseline Total Dose (mg/kg/day)[a]	Baseline Total MOE[b]	Risk Mitigation Measure					
				Additional PPE[c]					
				Dermal Unit Exposure (mg/lb ai)	Inhalation Unit Exposure (μg/lb ai)	Daily Dermal Dose (mg/kg/day)[d]	Daily Inhalation Dose (mg/kg/day)[e]	Daily Total Dose (mg/kg/day)[a]	Total MOE[b]
Mixer/Loader Risk									
Mixing/Loading Wettable Powder for Aerial Application (1)	Citrus	See Engineering Controls Tables 14 and 15							
	Apples/Pears								
	Pecans/Walnuts								
	Cotton								
	Strawberries								
	Grapes								
	Stonefruit								
	Cucurbits								
	Beans								
	Tomatoes/Peppers								
Mixing/Loading Wettable Powder for Groundboom Application (2)	Cotton								
	Strawberries								
	Mint								
	Beans								
	Peppers/Tomatoes								
Mixing/Loading Liquid for Aerial Application (3)	Citrus	93	0.04	0.025	0.12	0.8	0.004	0.804	0.36
	Apples/Pears	29	0.01			0.25	0.012	0.25	1.2
	Pecans/Walnuts	19	0.016			0.17	0.0080	0.18	1.8
	Cotton	35	0.0086			0.30	0.014	0.31	1
	Strawberries	29	0.01			0.25	0.012	0.26	1.2
	Grapes	15	0.02			0.13	0.0065	0.14	2.3
	Stonefruit	18	0.017			0.16	0.0075	0.17	1.9
	Cucurbits	9.7	0.031			0.083	0.0040	0.087	3.6
	Beans	23	0.013			0.20	0.0096	0.21	1.5
	Peppers/Tomatoes	12	0.026			0.10	0.0048	0.10	3
Mixing/Loading Liquid for Groundboom Application (4)	Cotton	15	0.021	0.025	0.12	0.13	0.00060	0.13	2.4
	Strawberries	10	0.029			0.089	0.00043	0.089	3.4
	Mint	8.5	0.035			0.073	0.00036	0.073	4.1
	Beans	6.5	0.046			0.056	0.00027	0.056	5.3

TABLE 12: INTERMEDIATE-TERM RISK FOR HANDLERS AND FLAGGERS FOR DICOFOL WITH BASELINE AND ADDITIONAL PPE

Exposure Scenario (Scenario #)	Crops	Baseline Total Dose (mg/kg/day)[a]	Baseline Total MOE[b]	Risk Mitigation Measure					
				Additional PPE[c]					
				Dermal Unit Exposure (mg/lb ai)	Inhalation Unit Exposure (μg/lb ai)	Daily Dermal Dose (mg/kg/day)[d]	Daily Inhalation Dose (mg/kg/day)[e]	Daily Total Dose (mg/kg/day)[a]	Total MOE[b]
	Peppers/Tomatoes	3.3	0.092			0.028	0.00014	0.028	11
Mixing/Loading Liquids for High Pressure Handwand Application (5)	Lawn/Ornamentals @10 acres	0.23	1.3	N/A	N/A	N/A	N/A	N/A	N/A
	@20 acres	0.46	0.63						
Applicator Risk									
Groundboom (6)	Cotton	0.079	4	0.01	0.07	0.050	0.00035	0.050	6
	Strawberries	0.056	5			0.036	0.00025	0.036	8.4
	Mint	0.046	7			0.029	0.00021	0.029	10
	Beans	0.035	8			0.023	0.00016	0.023	13
	Peppers/Tomatoes	0.018	17			0.011	0.000079	0.011	26
Aerial (7)	See Engineering Controls Table for All Crops								
Airblast (8)	Citrus	38	0.008	0.12	0.45	0.19	0.00072	0.19	1.6
	Pecans/Walnuts	0.81	0.37			0.24	0.00090	0.24	1.2
	Hops	0.52	0.58			0.15	0.00058	0.15	1.9
	Stonefruit	0.65	0.46			0.19	0.00072	0.19	1.6
	Grapes	0.2	1.5			0.06	0.00023	0.06	5
	Cucurbits	0.39	10.3			0.11	0.00043	0.11	2.6
High Pressure Handwand (9)	Ornamentals	0.17	1.7	0.31	7.9	0.028	0.00072	0.029	10
		0.34	0.87			0.056	0.0014	0.057	5.2
Applying Sprays with a handgun (lawn) sprayer (10)	PCO Lawns	See PPE	See PPE	0.19	1.4 (no respirator)				
Flagger Risk									
Flagging (11)	Citrus	20	0.15	0.007	0.03	0.224	0.00096	0.225	1.3
	Apples/Pears	0.1	2.9			0.070	0.00030	0.070	4.3
	Pecans/Walnuts	0.069	4.4			0.047	0.00020	0.047	6.4
	Cotton	0.12	2.4			0.084	0.00036	0.084	3.6
	Strawberries	0.1	2.9			0.069	0.00030	0.069	4.3
	Grapes	0.054	5.6			0.036	0.00016	0.036	8.2
	Stonefruit	0.064	4.7			0.044	0.00019	0.044	6.8
	Cucurbits	0.034	8.7			0.023	0.00010	0.023	13

TABLE 12: INTERMEDIATE-TERM RISK FOR HANDLERS AND FLAGGERS FOR DICOFOL WITH BASELINE AND ADDITIONAL PPE

Exposure Scenario (Scenario #)	Crops	Baseline Total Dose (mg/kg/day)[a]	Baseline Total MOE[b]	Risk Mitigation Measure					
				Additional PPE[c]					
				Dermal Unit Exposure (mg/lb ai)	Inhalation Unit Exposure (μg/lb ai)	Daily Dermal Dose (mg/kg/day)[d]	Daily Inhalation Dose (mg/kg/day)[e]	Daily Total Dose (mg/kg/day)[a]	Total MOE[b]
	Beans	0.082	3.6			0.056	0.00024	0.056	5.3
	Tomatoes/Peppers	0.041	7.3			0.028	0.00012	0.028	11
Mixer/Loader/Applicator									
Backpack Sprayer (12)	Lawns/Ornamentals	(O) 0.23	1.3	1.3	3	0.058	0.00014	0.058	5.2
Hose-End (13)	Lawns/Ornamentals	(O) 1.4	0.21	4.6	0.95	0.21	0.000044	0.21	1.4
Low Pressure Handwand (14)	Lawns/Ornamentals	(O) 4.7	0.064	3.2	3.1	0.15	0.00014	0.15	2

(O) = occupational; Homeowner use of dicofol for ornamentals is not expected to occur for seven or more consecutive days and is therefore excluded.

a Baseline total dose = (daily dermal exposure + daily inhalation exposure)/60 kg. (Note: Exposure values are from Table 3.)

b Total MOE = NOEL (intermediate-term NOEL = 0.29 mg/kg/day) / daily total dose (mg/kg/day). The NOEL of 0.29 mg/kg/day was rounded to 0.3 mg/kg/day.

c Additional PPE = Double layer of clothing, chemical resistant gloves, and an organic/vapor removing respirator. Unit inhalation exposures for respirators are based on the unit inhalation exposures on Table 3 adjusted by a 10-fold protection factor.

d Daily dermal dose = Dermal unit exposure (mg/lb ai) x Appl. rate (lb ai/A) x Acres/60 kg. (Note: Appl. rate and acres treated are from Table 3.)

e Daily Inhalation Dose (mg/kg/day) = Inhalation unit exposure (μg/lb ai) x $\left(\frac{1\ mg}{1{,}000\mu g}conversion\right)$ x Appl. rate (lb ai/A) x Acres/60 kg. (Note: Appl. rate and acres treated are from Table 3.)

N/A - Not applicable; homeowners are not required to use PPE.

TABLE 13: SHORT-TERM RISK FOR DICOFOL WITH ENGINEERING CONTROLS

Exposure Scenario (Scen. #)	Crop	Proposed Maximum Application Rate (lb ai/acre)	Risk Mitigation Measure					
			Engineering Controls[a]					
			Dermal Unit Exposure (mg/lb ai)	Inhalation Unit Exposure (μg/lb ai)	Daily Dermal Dose (mg/kg/day)[b]	Daily Inhalation Dose (mg/kg/day)[c]	Daily Total Dose (mg/kg/day)[d]	Total MOE[e]
Mixer/Loader Risk								
Mixing/Loading Wettable Powder for Aerial Application (1)	Citrus	4	0.02	0.2	0.64	0.0064	0.65	6.2
	Apples/Pears	3			0.20	0.0020	0.2	20
	Pecans/Walnuts	2			0.13	0.0013	0.13	30
	Cotton	1.5			0.24	0.0024	0.24	17
	Strawberries	2.4			0.20	0.0020	0.2	20
	Grapes	1.3			0.1	0.0010	0.11	38
	Stonefruit	1.5			0.13	0.0013	0.13	32
	Cucurbits	0.63			0.067	0.00067	0.067	59
	Beans	1.5			0.16	0.0016	0.16	25
	Tomatoes/Peppers	0.75			0.08	0.0008	0.081	50
Mixing/Loading Wettable Powder for Groundboom Application (2)	Cotton	1.5			0.10	0.0010	0.10	40
	Strawberries	2.4			0.071	0.00071	0.072	56
	Mint	1.3			0.058	0.00058	0.059	68
	Beans	1.5			0.045	0.00045	0.045	88
	Peppers/Tomatoes	0.75			0.023	0.00023	0.023	180
Mixing/Loading Liquid for Aerial Application (3)	Citrus	4	0.009 (Gloves)	0.08	0.29	0.0026	0.29	13.7
	Apples/Pears	3			0.09	0.00080	0.091	44
	Pecans/Walnuts	2			0.06	0.00053	0.061	66
	Cotton	1.5			0.11	0.00096	0.11	37
	Strawberries	2.4			0.089	0.00080	0.090	45
	Grapes	1.3			0.047	0.00043	0.047	85
	Stonefruit	1.5			0.056	0.00050	0.057	70
	Cucurbits	0.63			0.03	0.00027	0.03	130
	Beans	1.5			0.072	0.00064	0.073	55
	Tomatoes/Peppers	0.75			0.036	0.00032	0.036	110
Mixing/Loading Liquid for Groundboom Application (4)	Cotton	1.5	0.009 (Gloves)	0.08	0.045	0.00040	0.045	88
	Strawberries	2.4			0.032	0.00029	0.032	120
	Mint	1.3			0.026	0.00024	0.026	150
	Beans	1.5			0.020	0.00018	0.020	200

TABLE 13: SHORT-TERM RISK FOR DICOFOL WITH ENGINEERING CONTROLS								
Exposure Scenario (Scen. #)	Crop	Proposed Maximum Application Rate (lb ai/acre)	Risk Mitigation Measure					
			Engineering Controls[a]					
			Dermal Unit Exposure (mg/lb ai)	Inhalation Unit Exposure (μg/lb ai)	Daily Dermal Dose (mg/kg/day)[b]	Daily Inhalation Dose (mg/kg/day)[c]	Daily Total Dose (mg/kg/day)[d]	Total MOE[e]
	Peppers/Tomatoes	0.75			N/A	N/A	N/A	N/A
Mixing/Loading Liquids for High Pressure Handwand Application (5)	Lawn/Ornamentals	0.55	N/A	N/A	N/A	N/A	N/A	N/A
Applicator Risk								
Groundboom (6)	Cotton	1.5	0.0067	0.04	0.034	0.00020	0.034	120
	Strawberries	NA			0.024	0.00014	0.024	167
	Mint	NA			0.020	0.00012	0.020	200
	Beans	NA			0.015	0.00009	0.015	267
	Peppers/Tomatoes	NA			NA	N/A	NA	NA
Aerial (7)	Citrus	4	0.005	0.068	0.16	0.0022	0.16	25
	Apples/Pears	3			0.05	0.00068	0.051	79
	Pecans/Walnuts	2			0.033	0.00045	0.034	120
	Cotton	1.5			0.060	0.00082	0.061	66
	Strawberries	2.4			0.049	0.00068	0.050	80
	Grapes	1.3			0.026	0.00037	0.026	150
	Stonefruit	1.5			0.031	0.00043	0.031	129
	Cucurbits	0.63			0.017	0.00023	0.017	240
	Beans	1.5			0.040	0.00054	0.041	99
	Tomatoes/Peppers	0.75			0.020	0.00027	0.020	200
Airblast (8)	Citrus	4	0.016 (Gloves)	0.4	0.026	0.00064	0.027	150
	Citrus	6			0.038	0.00080	0.039	100
	Pecans/Walnuts	2			0.032	0.00051	0.033	120
	Hops	1.2			0.020	0.00064	0.021	190
	Stonefruit	1.5			0.026	0.00021	0.026	150
	Grapes	1.3			0.008	0.00021	0.0082	490
	Cucurbits	0.63			0.015	0.00038	0.015	266
High Pressure Handwand (9)	Lawns/Ornamentals	0.55	N/A	N/A	N/A	N/A	N/A	N/A
Applying Sprays with a Handgun (lawn) Sprayer (10)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

TABLE 13: SHORT-TERM RISK FOR DICOFOL WITH ENGINEERING CONTROLS

Exposure Scenario (Scen. #)	Crop	Proposed Maximum Application Rate (lb ai/acre)	Risk Mitigation Measure					
			Engineering Controls[a]					
			Dermal Unit Exposure (mg/lb ai)	Inhalation Unit Exposure (μg/lb ai)	Daily Dermal Dose (mg/kg/day)[b]	Daily Inhalation Dose (mg/kg/day)[c]	Daily Total Dose (mg/kg/day)[d]	Total MOE[e]
Flagger Risk								
Flagging (11)	Citrus	4	0.0002	0.006	0.0064	0.0002	0.0066	606
	Apples/Pears	3			0.0020	0.000060	0.0021	1900
	Pecans/Walnuts	2			0.0013	0.000040	0.0013	3100
	Cotton	1.5			0.0024	0.000072	0.0025	1600
	Strawberries	2.375			0.0020	0.000059	0.002	2000
	Grapes	1.25			0.0010	0.000031	0.0010	4000
	Stonefruit	1.5			0.0013	0.000038	0.0013	3100
	Cucurbits	0.625			0.00067	0.000020	0.00069	5800
	Beans	1.5			0.0016	0.000048	0.0016	2400
	Tomatoes/Peppers	0.75			0.00080	0.000024	0.00082	4900
Mixer/Loader/Applicator								
Backpack Sprayer (12)	Lawns/Ornamentals	0.55	N/A	N/A	N/A	N/A	N/A	N/A
Hose-End (13)	Lawns/Ornamentals	0.55	N/A	N/A	N/A	N/A	N/A	N/A
Low Pressure Handwand (14)	Lawns/Ornamentals	0.55	N/A	N/A	N/A	N/A	N/A	N/A

N/A Not applicable since previous MOE was over 300 or engineering controls not possible (e.g., backpack sprayer).

a Engineering Controls = Single layer clothing; no gloves, and no respirator while using water soluble packets for WP, closed mixing/loading systems for liquid formulations, and enclosed cockpit/cabs for aerial, groundboom, airblast, and flaggers. Note: The liquid closed mixing/loading and airblast applicator scenarios include chemical resistant gloves because the no glove scenarios are not available. The only data available for aerial applicators are for enclosed cockpits.

b Daily dermal dose = Dermal unit exposure (mg/lb ai) x Appl. rate (lb ai/A) x Acres/60 kg. (Note: Appl. rate and acres treated are from Table 3.)

c Daily Inhalation Dose (mg/kg/day) = Inhalation unit exposure (μg/lb ai) x $\left(\frac{1\ mg}{1{,}000\mu g}conversion\right)$ x Appl. rate (lb ai/A) x Acres/60 kg. (Note: Appl. rate and acres treated are from Table 3.)

d Total Dose = (daily dermal dose + daily inhalation dose)

e Total MOE = NOEL (intermediate-term NOEL = 4 mg/kg/day) / daily total dose (mg/kg/day)

TABLE 14: INTERMEDIATE-TERM RISK FOR DICOFOL WITH ENGINEERING CONTROLS								
Exposure Scenario (Scenario #)	Crop	Proposed Maximum Application Rate (lb ai/acre)	Risk Mitigation Measure					
			Engineering Controls[a]					
			Dermal Unit Exposure (mg/lb ai)	Inhalation Unit Exposure (μg/lb ai)	Daily Dermal Dose (mg/kg/day)[b]	Daily Inhalation Dose (mg/kg/day)[c]	Daily Total Dose (mg/kg/day)[d]	Total MOE[e]
Mixer/Loader Risk								
Mixing/Loading Wettable Powder for Aerial Application (1)	Citrus	4	0.02	0.2	0.64	0.0064	0.65	0.46
	Apples/Pears	3			0.2	0.0020	0.2	1.5
	Pecans/Walnuts	2			0.13	0.0013	0.13	2.2
	Cotton	1.5			0.24	0.0024	0.24	1.2
	Strawberries	2.4			0.2	0.0020	0.2	1.5
	Grapes	1.3			0.1	0.0010	0.11	2.9
	Stonefruit	1.5			0.13	0.0013	0.13	2.4
	Cucurbits	0.63			0.067	0.00067	0.067	4.5
	Beans	1.5			0.16	0.0016	0.16	1.9
	Tomatoes/Peppers	0.75			0.08	0.0008	0.081	3.7
Mixing/Loading Wettable Powder for Groundboom Application (2)	Cotton	1.5			0.1	0.0010	0.1	3
	Strawberries	2.4			0.071	0.0071	0.072	4.2
	Mint	1.3			0.058	0.00058	0.059	5.1
	Beans	1.5			0.045	0.00045	0.045	6.6
	Peppers/Tomatoes	0.75			0.023	0.00023	0.023	13
Mixing/Loading Liquid for Aerial Application (3)	Citrus	4	0.009 (Gloves)	0.08	0.29	0.0026	0.29	1
	Apples/Pears	3			0.09	0.00080	0.091	3.3
	Pecans/Walnuts	2			0.06	0.00053	0.061	5
	Cotton	1.5			0.11	0.00096	0.11	2.8
	Strawberries	2.4			0.089	0.00080	0.09	3.3
	Grapes	1.3			0.047	0.00043	0.047	6.3
	Stonefruit	1.5			0.056	0.00050	0.057	5.3
	Cucurbits	0.63			0.03	0.00027	0.03	9.9
	Beans	1.5			0.072	0.00064	0.073	4.1
	Tomatoes/Peppers	0.75			0.036	0.00032	0.036	8.3
Mixing/Loading Liquid for Groundboom Application (4)	Cotton	1.5	0.009 (Gloves)	0.08	0.045	0.00040	0.045	6.6
	Strawberries	2.4			0.032	0.00029	0.032	9.3
	Mint	1.3			0.026	0.00024	0.026	11

TABLE 14: INTERMEDIATE-TERM RISK FOR DICOFOL WITH ENGINEERING CONTROLS								
Exposure Scenario (Scenario #)	Crop	Proposed Maximum Application Rate (lb ai/acre)	Risk Mitigation Measure					
			Engineering Controls[a]					
			Dermal Unit Exposure (mg/lb ai)	Inhalation Unit Exposure (μg/lb ai)	Daily Dermal Dose (mg/kg/day)[b]	Daily Inhalation Dose (mg/kg/day)[c]	Daily Total Dose (mg/kg/day)[d]	Total MOE[e]
	Beans	1.5			0.02	0.00018	0.020	15
	Peppers/Tomatoes	0.75			0.01	N/A	0.01	29
Mixing/Loading Liquids for High Pressure Handwand Application (5)	Lawn/Ornamentals	0.55	N/A	N/A	N/A	N/A	N/A	N/A
Applicator Risk								
Groundboom (6)	Cotton	1.5	0.0067	0.04	0.034	0.00020	0.034	8.9
	Strawberries	2.4			0.024	0.00014	0.024	12
	Mint	1.3			0.02	0.00012	0.020	15
	Beans	1.5			0.015	0.00009	0.015	20
	Peppers/Tomatoes	0.75			0.0075	N/A	0.0075	40
Aerial (7)	Citrus	4	0.005	0.068	0.16	0.0022	0.16	1.8
	Apples/Pears	3			0.05	0.00068	0.051	5.9
	Pecans/Walnuts	2			0.033	0.00045	0.034	8.9
	Cotton	1.5			0.06	0.00082	0.061	4.9
	Strawberries	2.4			0.049	0.00068	0.050	6
	Grapes	1.3			0.026	0.00037	0.026	11
	Stonefruit	1.5			0.031	0.00043	0.031	9.7
	Cucurbits	0.63			0.017	0.00023	0.017	18
	Beans	1.5			0.04	0.00054	0.041	7.4
	Tomatoes/Peppers	0.75			0.02	0.00027	0.020	15
Airblast (8)	Citrus	4	0.016 (Gloves)	0.4	0.026	0.00064	0.027	11.5
	Pecans/Walnuts	2			0.032	0.00051	0.033	9.1
	Hops	1.2			0.02	0.00064	0.021	14
	Stonefruit	1.5			0.026	0.00021	0.026	11
	Grapes	1.3			0.008	0.00021	0.0082	37
	Cucurbits	0.63			0.015	0.00038	0.015	19.3
High Pressure Handwand (9)	Lawns/Ornamentals	0.55	N/A	N/A	N/A	N/A	N/A	N/A
Applying Sprays with a Handgun (lawn) Sprayer (10)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

TABLE 14: INTERMEDIATE-TERM RISK FOR DICOFOL WITH ENGINEERING CONTROLS

Exposure Scenario (Scenario #)	Crop	Proposed Maximum Application Rate (lb ai/acre)	Risk Mitigation Measure					
			Engineering Controls[a]					
			Dermal Unit Exposure (mg/lb ai)	Inhalation Unit Exposure (μg/lb ai)	Daily Dermal Dose (mg/kg/day)[b]	Daily Inhalation Dose (mg/kg/day)[c]	Daily Total Dose (mg/kg/day)[d]	Total MOE[e]
Flagger Risk								
Flagging (11)	Citrus	4	0.0002	0.006	0.0064	0.0002	0.0066	45
	Apples/Pears	3			0.002	0.000060	0.0021	150
	Pecans/Walnuts	2			0.0013	0.000040	0.0013	230
	Cotton	1.5			0.0024	0.000072	0.0025	120
	Strawberries	2.375			0.002	0.000059	0.002	150
	Grapes	1.25			0.0010	0.000031	0.0010	300
	Stonefruit	1.5			0.0013	0.000038	0.0013	230
	Cucurbits	0.625			0.00067	0.000020	0.00069	440
	Beans	1.5			0.0016	0.000048	0.0016	180
	Tomatoes/Peppers	0.75			0.0008	0.000024	0.00082	360
Mixer/Loader/Applicator								
Backpack Sprayer (12)	Lawns/Ornamentals	0.55	N/A	N/A	N/A	N/A	N/A	N/A
Hose-End (13)	Lawns/Ornamentals	0.55	N/A	N/A	N/A	N/A	N/A	N/A
Low Pressure Handwand (14)	Lawns/Ornamentals	0.55	N/A	N/A	N/A	N/A	N/A	N/A

N/A Not applicable since previous MOE was over 300 or engineering controls not possible (e.g., backpack sprayer).

a Engineering Controls = Single layer clothing; no gloves, and no respirator while using water soluble packets for WP, closed mixing/loading systems for liquid formulations, and enclosed cockpit/cabs for aerial, groundboom, airblast, and flaggers. Note: The liquid closed mixing/loading and airblast applicator scenarios include chemical resistant gloves because the no glove scenarios are not available. The only data available for aerial applicators are for enclosed cockpits.

b Daily dermal dose = Dermal unit exposure (mg/lb ai) x Appl. rate (lb ai/A) x Acres/60 kg. (Note: Appl. rate and acres treated are from Table 3.)

c Daily Inhalation Dose (mg/kg/day) = Inhalation unit exposure (μg/lb ai) x $\left(\frac{1\ mg}{1{,}000\mu g}conversion\right)$ x Appl. rate (lb ai/A) x Acres/60 kg. (Note: Appl. rate and acres treated are from Table 3.)

d Baseline Total Dose = (daily dermal dose + daily inhalation dose)

e Total MOE = NOEL (intermediate-term NOEL = 0.29 mg/kg/day) / daily total dose (mg/kg/day). The NOEL of 0.29 mg/kg/day was rounded to 0.3 mg/kg/day.

TABLE 15: EXPOSURE SCENARIO DESCRIPTIONS FOR USES OF DICOFOL		
Exposure Scenario (Number)	Data Source	Comments[a]
Mixer/Loader Exposure		
Mixing Wettable Powder (1,2)	PHED Version 1.1	**Baseline:** Dermal and inhalation acceptable grades. Dermal = 7 to 24 replicates; Inhalation = 44 replicates; Low confidence in dermal data; Medium confidence inhalation data. **PPE:** Dermal A,B,C grades and inhalation acceptable grades. Dermal = 22 to 45 replicates; Inhalation = 44 replicates; Medium confidence in dermal and inhalation data. **Engineering Control:** Dermal grades acceptable; inhalation all grades. Dermal = 5 to 15 replicates. Inhalation = 15 replicates. PHED data used for baseline and engineering controls no PFs were necessary. Maximum PPE values calculated from PHED data using 50% PF for the addition of coveralls. 90% PF for the addition of organic vapor removing (O/V) respirator.
Mixing / Loading Liquids (3,4,5)		**Baseline:** Dermal and inhalation acceptable grades. Dermal = 53 to 122 replicates; Inhalation = 85 replicates; high confidence in both dermal and inhalation data. **PPE:** Dermal and inhalation acceptable grades. Dermal = 59 to 122 replicates; Inhalation = 85 replicates; high confidence in dermal and inhalation data. **Engineering Control:** Dermal and inhalation grades acceptable; Dermal = 0 to 22 replicates. Inhalation = 27 replicates. Low confidence in dermal data; high confidence in inhalation data. PHED data used for baseline and engineering controls no PFs were necessary. Maximum PPE values calculated from PHED data using 50% PF for the addition of coveralls, 90% PF for the addition of O/V respirator.
Applicator Exposure		
Groundboom (6)	PHED Version 1.1	**Baseline:** Dermal and inhalation acceptable grades. Dermal = 23 to 42 replicates; Inhalation = 22 replicates; High confidence in dermal and inhalation data. **PPE:** Dermal and inhalation acceptable grades. Dermal = 8 to 42 replicates; Inhalation = 85 replicates; high confidence in inhalation data and low confidence in dermal data. **Engineering Control:** Dermal and inhalation grades acceptable; Dermal = 5 to 16 replicates. Inhalation = 16 replicates. Low confidence in dermal data; high confidence in inhalation data. PHED data used; no PFs were necessary, except a 90% PF for O/V respirator.

TABLE 15: EXPOSURE SCENARIO DESCRIPTIONS FOR USES OF DICOFOL		
Exposure Scenario (Number)	Data Source	Comments[a]
Aerial equipment (liquids) (7)		**Baseline:** Dermal grades A, B, C; inhalation all grades. Dermal = 1 to 17 replicates; Inhalation = 17 replicates. Low confidence for dermal and inhalation data. **PPE:** Dermal and inhalation acceptable grades. Dermal = 59 to 122 replicates; Inhalation = 85 replicates; high confidence in dermal and inhalation data. **Engineering Control:** Dermal and inhalation grades acceptable; Dermal = 0 to 22 replicates. Inhalation = 27 replicates. Low confidence in dermal data; high confidence in inhalation data. PHED data used for baseline, no PFs were necessary. For PPE a 50% PF was used for coveralls.
Airblast (8)		**Baseline:** Dermal and inhalation acceptable grades. Dermal = 22 to 49 replicates; Inhalation = 47 replicates; High confidence in dermal and inhalation data. **PPE:** Dermal and inhalation acceptable grades. Dermal = 18 to 49 replicates; Inhalation = 47 replicates; High confidence in dermal and inhalation data. **Engineering Control:** Dermal grades acceptable; inhalation all grades. Dermal = 5 to 15 replicates. Inhalation = 9 replicates. Low confidence in dermal and inhalation data. PHED data used for baseline and engineering controls no PFs were necessary. 90% PF for the addition of O/V respirator.
High Pressure Handwand (9)		**Baseline:** Dermal and inhalation all grades. Dermal = 2 to 11 replicates; Inhalation = 11 replicates; Low confidence in dermal and inhalation data. **PPE:** Dermal and inhalation all grades. Dermal = 9 to 11 replicates; Inhalation = 11 replicates; Low confidence in dermal and inhalation data. PHED data used for baseline; no PFs were necessary. Maximum PPE values calculated from PHED data using 50% PF for the addition of coveralls. 90% PF for the addition of O/V respirator.
Applying Sprays with a Handgun (lawn) Sprayer (10)		
Flagger		

TABLE 15: EXPOSURE SCENARIO DESCRIPTIONS FOR USES OF DICOFOL		
Exposure Scenario (Number)	Data Source	Comments[a]
Liquids (11)	PHED Version 1.1	**Baseline**: Dermal and inhalation grades acceptable. Dermal = 16 to 18 replicates; inhalation = 18 replicates. High confidence in dermal data and inhalation data. **PPE:** Dermal and inhalation acceptable grades. Dermal = 59 to 122 replicates; Inhalation = 85 replicates; high confidence in dermal and inhalation data. **Engineering Control:** Dermal and inhalation grades acceptable; Dermal = 0 to 22 replicates. Inhalation = 27 replicates. Low confidence in dermal data; high confidence in inhalation data. PHED data used for baseline values, no PFs were necessary. For PPE a 50% PF was used for coveralls, while a 90% PF was used for chemical resistant gloves.
Mixer/Loader Applicator		
Backpack Sprayer (12)	PHED Version 1.1	**Baseline and PPE:** Dermal grades A,B,C and inhalation acceptable grades. Dermal = 9 to 11 replicates; Inhalation = 11 replicates; Low confidence in dermal and inhalation data. PHED data used for baseline. Maximum PPE values calculated from PHED data using 50% PF for the addition of coveralls. 90% PF for the addition of O/V respirator.
Hose-End Sprayer (13)	PHED Version 1.1	**Baseline and PPE:** Dermal all grades and inhalation C grade. Dermal = 8 replicates; Inhalation = 8 replicates; Low confidence in dermal and inhalation data. PHED data used for baseline. Maximum PPE values calculated from PHED data using 50% PF for the addition of coveralls. 90% PF for the addition of O/V respirator.
Low Pressure Handwand (14) Sprayer		**Baseline and PPE:** Dermal and inhalation all grades. Dermal = 25 to 96 replicates; Inhalation = 96 replicates; Low confidence in dermal and inhalation data. PHED data used for baseline. Maximum PPE values calculated from PHED data using 50% PF for the addition of coveralls. 90% PF for the addition of O/V respirator.

a "Acceptable grades," as defined by HED SOP for meeting Subdivision U Guidelines are grades A and B. All grades that do not meet HED's SOP are listed individually.

d. Occupational Post Application Exposure and Risk Assessment/Characterization

Post Application Summary

HED is concerned about postapplication exposure and risk to agricultural workers following applications to the crops identified in the use summary during routine hand-labor crop-production tasks, such as hoeing, thinning, and harvesting activities and non-hand-labor tasks, such as crop-advisor and irrigation-related activities. Since there are dicofol products registered for home use, there is also potential for post application exposure in residential settings.

A Data-Call-In (DCI) for chemical-specific post-application exposure and/or environmental fate data (as regulated by Subdivision K, guidelines 132-1(a), 133-3, and 133-4) was issued 10/13/95, and have not yet been submitted by the registrant in support of the reregistration of dicofol (see Section 4). In lieu of these data, a surrogate range-finder post-application exposure assessment was performed for occupational or residential settings.

The range finder assessment in Table 17 is based on the minimum and maximum application rates of 0.63 lb ai/A and 4 lb ai/A, respectively. The transfer coefficients (Tc) range from low exposure potentials (500 cm^2/hr), such as hoeing, to high exposure potentials (10,000 cm^2/hr), such as citrus harvesting. The restricted entry interval (REI) ranges from 44 days to 79 days.

Table 17. Dicofol Intermediate-Term Postapplication Agricultural Surrogate Assessment (Range Finder)

DAT[a]	DFR (µg/cm,^{2})[b]		Dermal Dose (mg/kg/day)[c]				MOE[d]			
			Min. Rate		Max. Rate		Min. Rate		Max. Rate	
	Min. Rate	Max. Rate	Low	High	Low	High	Low	High	Low	High
0	1.41	8.97	0.094	1.88	0.598	11.96	3	<1	<1	<1
44	0.014	0.087	0.001	0.018	0.006	0.116	318	16	50	3
65	0.001	0.010	N/A	0.002	0.001	0.013	N/A	145	460	23
72	0.001	0.005	N/A	0.001	N/A	0.006	N/A	303	N/A	48
94	N/A	0.002	N/A	N/A	N/A	0.003	N/A	N/A	N/A	100

a DAT = Days after treatment.

b DFR (µg/cm^2) = Appl. rate (lb ai/A) x 11.209 (µg per cm^2/lb ai per acre conversion) x 0.2 (fraction of ai retained on foliage). Dissipation is assumed at 10% per day (environmental fate data were not reviewed for this surrogate assessment).

c Dermal Dose (mg/kg/day) = DFR (µg/cm^2) x T_c (cm^2/hr) x 1 mg/1000 µg conversion) x 1 (100% dermal absorption) x 8 (hrs/day) / 60 kg BW. Where LOW = 500 cm^2/hr and High = 10,000 cm^2/hr.

d MOE = NOEL (mg/kg/day) / Dermal Dose (mg/kg/day). Where NOEL = 0.29 mg/kg/day.

HED has concerns regarding post-application exposure, and requests that the registrant submit the required data as soon as possible. Until these data are submitted and evaluated, the post-application use scenarios remain a concern. Based on the findings of the surrogate agricultural assessment, residential postapplication risks are also of concern.

e. Residential and Other Non-Occupational Exposures and Risks

As stated earlier, the registrant has offered to voluntarily remove all residential lawn treatments from dicofol label (rebuttal, 4/30/98). In response to the removal of lawn uses, HED has recommended that *all* lawn uses be removed from dicofol labels, including those administered by Pest Control Operators (PCOs) to reduce the chance of post-application exposure to infants and children from treated lawns.

The registrant has committed to the deletion of all residential turf uses; therefore, HED did not include estimated risks to homeowners from residential exposure in the exposure and risk tables (Tables 10-15). However, Pest Control Operator (PCO) uses on non-residential lawns is still a registered use, and for this reason, PCO uses are included.

The only remaining registered residential use of dicofol is spot treatment of ornamentals. HED does not expect exposure from the ornamental use scenario to result in level of estimated risk which exceeds HED's level of concern. Likewise, residential postapplication exposure from the spot treatment of ornamentals is expected to be a minimal to negligible sources of dicofol exposure, and is thus not considered a risk concern at this time. Therefore, the risk from this use was not calculated.

HED requires that all residential turf uses be removed from all dicofol labels, even if the residential turf is treated by a Pest Control Operator (PCO), until new data can be collected and the risks evaluated. PCO-treated residential turf would still have the potential for infant and children postapplication exposures (i.e. playing on lawn and hand-to-mouth activities).

f. Incidence Reports

Cases of dicofol poisonings were reported to the following data bases as of October 10, 1995.

OPP Incident Data System: Nine incidents involving dicofol were received since the inception of the data base in 1992. Eight of these involved exposure to multiple pesticides; the cause of the reported illnesses (mostly dermal irritation) could not be determined. The only incident in which dicofol was used alone involved fish and wildlife effects.

California Department of Food and Agriculture (CDFA): A total of 38 incidents involving exposure to dicofol alone were reported from years 1982-1992, inclusively. The following types of illnesses were reported for these cases: systemic - 19 (50%); skin - 10 (26%); eye - 8 (21%);

and eye/skin - 1 (3%). One person was hospitalized as a result of the illness. The activity categories most frequently affected were applicator and field residue exposure. The number of incidents per 1000 applications of dicofol for years 1990-1992, inclusively, was calculated. (As of 1990, information is available for all agricultural uses; prior to that, only data on restricted use applications were required to be reported.) The number of incidents/1000 applications for all illnesses ranged from 0.11 to 0.21. The number of systemic illnesses/1000 applications ranged from 0.09 to 0.11. These values are about one-half the median of those reported for 28 organophosphate and carbamate pesticides involved in a Data Call-In (DCI) for pesticides of risk to agricultural workers.

National Pesticide Telecommunications Network (NPTN): This data base collected reports from 1984 to 1991 (inclusive) showing 91 human, 9 animal, and 31 other poisoning incidents for a total of 131 incidents involving dicofol from 571 phone calls made to the hotline.

5. Food Quality Protection Act (FQPA) Considerations

a. Cumulative Effects

Dicofol is a member of the organochlorine class of pesticides. Other members of this class include DDT, methoxychlor, chlorobenzilate and ethylan. Less closely related members of the class include lindane, dieldrin, endrin, chlordane, heptachlor, aldrin, endosulfan kepone and toxaphene (George W. Ware, Fundamentals of Pesticides, Thomson Publications, 1982).

Section 408(b)(2)(D)(v) of the Food Quality Protection Act requires that, when considering whether to establish, modify, or revoke a tolerance, the Agency consider "available information" concerning the cumulative effects of a particular pesticide's residues and "other substances that have a common mechanism of toxicity". The Agency believes that "available information" in this context might include not only toxicity, chemistry, and exposure data, but also scientific policies and methodologies for understanding common mechanisms of toxicity and conducting cumulative risk assessments. For most pesticides, although the Agency has some information in its files that may turn out to be helpful in eventually determining whether a pesticide shares a common mechanism of toxicity with any other substances, EPA does not at this time have the methodologies to resolve the complex scientific issues concerning common mechanism of toxicity in a meaningful way. EPA has begun a pilot process to study this issue further through the examination of particular classes of pesticides. The Agency hopes that the results of this pilot process will increase the Agency's scientific understanding of this question such that EPA will be able to develop and apply scientific principles for better determining which chemicals have a common mechanism of toxicity and evaluating the cumulative effects of such chemicals. The Agency anticipates, however, that even as its understanding of the science of common mechanisms increases, decisions on specific classes of chemicals will be heavily dependent on chemical-specific data, much of which may not be presently available.

Although at present the Agency does not know how to apply the information in its files concerning common mechanism issues to most risk assessments, there are pesticides as to which the common mechanism issues can be resolved. These pesticides include pesticides that are toxicologically dissimilar to existing chemical substances (in which case the Agency can conclude that it is unlikely that a pesticide shares a common mechanism of activity with other substances) and pesticides that produce a common toxic metabolite (in which case common mechanism of activity will be assumed).

HED does not have, at this time, available data to determine whether dicofol has a common mechanism of toxicity with other substances or how to include this pesticide in a cumulative risk assessment. For the purposes of this tolerance action, therefore, HED has not assumed that dicofol has a common mechanism of toxicity with other substances.

b. Endocrine Disruptor Effects

EPA is required to develop a screening program to determine whether certain substances (including all pesticides and inerts) "may have an effect in humans that is similar to an effect produced by a naturally occurring estrogen, or such other endocrine effect..." The Agency is currently working with interested stakeholders, including other government agencies, public interest groups, industry and research scientists in developing a screening and testing program and a priority setting scheme to implement this program. Congress has allowed 3 years from the passage of FQPA (August 3, 1999) to implement this program. At that time, EPA may require further testing of this active ingredient and end use products for endocrine disruptor effects.

c. Special Sensitivity of Infants and Children

Recommendation for a Developmental Neurotoxicity Study

The HED RfD Peer Review Committee (10/16/94) had placed the requirement for a developmental neurotoxicity study in rats in *reserve* status, pending completion of the acute and subchronic rat neurotoxicity studies. These studies have since been received and reviewed by the Agency. The developmental neurotoxicity study had been requested by Data-Call-In prior to the RfD decision. Based on a weight-of-the-evidence evaluation, the Hazard Identification Assessment Committee *reaffirmed the need for a developmental neurotoxicity study* in rats. The protocol should ensure that equilibrium maternal blood levels of Dicofol are achieved at least prior to implantation.

Determination of Susceptibility

There is no indication of additional sensitivity to young rats or rabbits following pre-and/or postnatal exposure to Dicofol in the developmental and reproductive toxicity studies; however,

there is a need for the re-evaluation of the length and periodicity of estrous cycle in the special one-generation reproduction study.

Uncertainty Factor

The Committee determined that for Dicofol, the **10 x factor** to account for enhanced sensitivity of infants and children (as required by FQPA) **should be reduced to 3 x.** This conclusion was based on the following factors.

- Data show no indication of increased susceptibility of rats or rabbits to *in utero* and/or postnatal exposure to Dicofol in the developmental and reproductive toxicity studies.

- There are no data gaps for the Subdivision F Guideline requirement. However, HED's HIARC has determined that a developmental neurotoxicity study in rats is required since Dicofol produces neurotoxic effects in adult rats.

- Although Dicofol is an endocrine disruptive chemical, no evidence of endocrine toxicity was noted in the offspring in the one-generation reproduction study in rats with a postnatal exposure phase.

- Although Dicofol was implicated in the reproductive failure of an alligator population following an accidental spill into Lake Apopka, Florida, DDT and metabolites were also present in the spill.

The FQPA Safety Factor will be applied to the General Population which include Infants and Children because the dose and endpoint is based on neurotoxicity for the acute dietary risk assessment.

The FQPA Safety Factor will be applied to the General Population which include Infants and Children because the dose and endpoint for the chronic risk assessment is based on inhibition of adrenal cortical trophic hormone (ACTH) stimulated release of cortisol in male and female of dogs.

All Populations which include Infants and Children because the dose and endpoint selected for the residential risk assessment is based on 1) a developmental effect (increase in frequency of abortions) for short-term exposure; and 2) inhibition of ACTH stimulated release of cortisol for intermediate-term exposure.

d. Aggregate Risk

In examining aggregate exposure, FQPA directs EPA to take into account available information concerning exposures from pesticide residues in food and other exposures for which there is

reliable information. These other exposures include drinking water and non-occupational exposures, e.g., to pesticides used in and around the home. Risk assessments for aggregate exposure consider both short-term and long-term (chronic) exposure scenarios considering the toxic effects which would likely be seen for each exposure duration.

Acute Aggregate Risk

The acute aggregate risk assessment for dicofol will include risks associated with dietary exposure through food and water only. Because exposure to dicofol from food sources alone exceed HED's level of concern for acute dietary risk, any additional exposure through drinking water would lead to risk estimates that further exceed HED's level of concern. HED defers a calculation of aggregate risk as a result of exposures to dicofol in food and water until exposures through food alone have been reduced to an acceptable level. At that time, the OPP can reconsider the extent of the contribution, if any, of dicofol residues in drinking water to the acute expsoure and aggregate risk.

Chronic Aggregate Risk

The chronic aggregate risk assessment for dicofol includes risks associated with dietary exposure through food, water, and any registered residential uses with the potential for chronic exposure. Anticipated residues and percent crop-treated data for commodities with published tolerances result in an exposure to dicofol through food which represents 19% of the RfD for the U.S. general population. The highest subgroup, children (1-6 years), occupies 38% of the RfD. Dietary risk for non-nursing infants occupies 32% of the RfD, and dietary risk for children (1-7 years) occupies 26% of the RfD. Tier 2 estimated average concentrations in ground water (0.069 ppb) or surface water (0.5 ppb) do not exceed drinking water levels of concern (DWLOCs) for the general U.S. population or any of the population subgroups. The registered residential uses of dicofol do not present a chronic residential exposure scenario. HED thus concludes that aggregate chronic exposure and risk estimates do not excceed HED's level of concern.

Short Term and Intermediate Term Aggregate Risk

Aggregate risk estimates were not calculated for use scenarios involving residential dicofol application. While there is one remaining residential use scenario for dicofol (spot treatment of ornamentals), HED considers the exposure from this use to be negligible. Therefore, no short-term or intermediate-term aggregate risk assessment was conducted.

6. HED Recommendations for Risk Mitigation

a. Occupational/Residential Labeling

HED has concerns for handler exposure and post-application exposure to dicofol. The registrant is strongly encouraged to propose mitigation which should be implemented immediately as an interim measure until handler and postapplication data (see below) are submitted.

In the rebuttal dated 4/20/98, the registrant indicated that water soluble packaging would be implemented for all wettable powder formulated products. For this reason, HED has only calculated exposure and risk for workers handling wettable powders in water soluble packages, which is considered a closed mixing/loading system. HED recommends that water soluble packaging be implemented on all dicofol wettable powder products immediately.

b. Required Occupational/Residential Exposure Studies and Recommendations

Handler Studies: Handler (mixer/loader and/or applicator) exposure data for dicofol were required during Phase IV of the reregistration process since one or more toxicological criteria had been triggered at that time. However, no occupational or residential exposure (handler) data have been submitted to the Agency to support the reregistration of dicofol.

The following handler exposure studies are required for reregistration. Requirements for handler (mixer/loader/applicator) exposure studies are addressed in Subdivision U of the Pesticide Assessment Guidelines.

Table 18: Reregistration Mixer/Loader/Applicator Data Requirements for Dicofol

Guideline Series	Study Category (Title)	(May Change) Required Scenarios
231	Estimation of Dermal Exposure at Outdoor Sites	(1) Open Mixing with Wettable Powder/Liquid Formulation (2) High Pressure Handwand Applications to Ornamentals and/or Agricultural Crops (3) Knapsack/Backpack, or Hose-End Sprayer Application to Ornamentals and/or Agricultural Crops (4) Enclosed cab airblast application to citrus or grapes (5) Low pressure handwand application to ornamentals and/or agricultural crops
232	Estimation of Inhalation Exposure at Outdoor Sites	(1) Open Mixing with Wettable Powder/Liquid Formulation (2) High Pressure Handwand Applications to Ornamentals and/or Agricultural Crops (3) Knapsack/Backpack, or Hose-End Sprayer Application to Ornamentals and/or Agricultural Crops (4) Enclosed cab airblast application to citrus or grapes (5) Low pressure handwand application to ornamentals and/or agricultural crops
233	Estimation of Dermal Exposure at Indoor Sites	(1) Applications for high pressure handwand to ornamentals (2) Applications for low pressure handwand to ornamentals
234	Estimation of Inhalation Exposure at Indoor Sites	(1) Applications for high pressure handwand to ornamentals (2) Applications for low pressure handwand to ornamentals

Post-Application Studies: The following post-application exposure studies are required for reregistration. Requirements for post-application exposure studies are addressed by Subdivision K of the Pesticide Assessment Guidelines.

Table 19: Reregistration Post-Application Data Requirements for Dicofol

Guideline Series	Study Category (Title)	Required Scenarios
132-1(a)	Foliar Dislodgeable Dissipation	(1) Orchard type crops (i.e., oranges, apples, etc.) (2) Mid level crops (i.e., grapes, tomatoes, etc.) (3) Low level crops (i.e., melons, strawberries, etc.) (4) Lawns/turf (residential turf, sod farms, etc.) (5) Greenhouse ornamentals (6) Outdoor ornamentals
133-3	Estimation of Dermal Exposure	(1) Harvest and maintenance of orchard type crops including at least apples and/or citrus (i.e., oranges) (2) Harvest and maintenance of mid level crops including at least grapes and/or tomatoes (3) Harvest and maintenance of low level crops including at least melons and/or strawberries (4) Ornamental propagation activities
133-4	Estimation of Inhalation Exposure	(1) Harvest and maintenance of orchard type crops including at least apples and/or citrus (i.e., oranges) (2) Harvest and maintenance of mid level crops including at least grapes and/or tomatoes (3) Harvest and maintenance of low level crops including at least melons and/or strawberries (4) Ornamental propagation activities

Due to reported incidences, the severity of effects and low MOE's for handlers, an extra day would usually be added to all REIs based on the Worker Protection Standard for products containing dicofol as the active ingredient until the above data have been submitted and reviewed. However, based on the surrogate assessment, an extra day would be insufficient to protect workers. For dicofol products containing active ingredients with a longer REI, the more stringent REI requirement should be imposed.

c. Required Residue Chemistry and Product Chemistry Data and Recommendations

Product Chemistry: Additional data are required for the following product chemistry guidelines for dicofol: 830.1550; 830.6314; 830.6315; 830.6316; 830.6319; 830.7050. These data requirements are considered confirmatory. The current status of product chemistry data requirements for the Rohm and Haas and Agan Ts is presented in the attached data summary

tables (Appendix 1). Refer to these tables for listings of the outstanding product chemistry data requirements.

Residue Chemistry: Additional residue data are required for the following residue chemistry guidelines: 860.1200; 860.1340; 860.1500, 860.1520. The additional data requirements for all guideline residue chemistry categories are considered confirmatory. A comprehensive summary of the registered food/feed use patterns of dicofol, based on these product labels, is presented in Attachment 2 (Table A) and reflects revisions proposed by the registrant and reviewed by the Agency. A summary of the residue chemistry science assessments for reregistration of dicofol is presented in Appendix 2. The conclusions listed in Appendix 2 regarding the reregistration eligibility of dicofol food/feed uses are based on the use patterns registered by the basic producer, Rohm and Haas Co. When end-use product DCIs are developed (e.g., at issuance of the RED), RD should require that all end-use product labels (e.g., MAI labels, SLNs, and products subject to the generic data exemption) be amended such that they are consistent with the basic producer labels.

The Wettable Powder/Dust (WP/D) formulation labels must be amended such that the application rate and PHI for strawberries are consistent with the field trial parameters (Attachment 2, Table A). The Emulsifiable Concentrate (EC) labels must be amended to delete use on strawberries.

Tolerances have been reevaluated for numerous plant commodities. Additionally, tolerances, not before established, are need for ruminant and poultry commodities.

HED supports the reregistration of dicofol for use on beans, fruiting vegetable group (eggplant, peppers, pimentos, tomatoes, etc.), cucumbers, melons, pumpkins, squash, citrus, apples, crabapples, pears, quince, apricots, cherries, nectarines, peaches, nuts (excluding almonds), caneberries, strawberries, cottonseed, hops, tea, and mint. Confirmatory data are required for cotton (gin trash). **Additional field trial data are required for dicofol use on caneberries**.

Limited field trial data have been submitted on caneberries (blackberry, raspberry) in the period following the initial *RED Chemistry Chapter (8/19/94)*. The data are adequate to support use on caneberries on an interim basis, but **additional confirmatory field trial data are required.**

Attachments:
1. Hazard Assessment
2. Residue and Product Chemistry Assessment
3. Dietary Risk Analysis
4. Occupational and Residential Risk Asssessment

Appendices:
1. Product Chemistry Data Summary

2. Residue Chemistry Science Assessments Summary