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

OFFICE OF
PREVENTION, PESTICIDES
AND TOXIC SUBSTANCES

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Date: 11/10/2003

SUBJECT: Risk Assessment for Proposed Uses of Boscalid on Soybeans, Pome Fruit, and Hops

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I. Executive Summary

Boscalid (also known as nicobifen or BAS 510 F; PC Code 128008) is a fungicide belonging to the anilid class of fungicide chemicals, also known as carboxamide or oxathiin fungicides. Registrant BASF recently was granted registration of boscalid for use on turf, vegetables, canola, fruit and nut crops in the U.S. and Canada. A complete risk assessment for these uses can be found in the May 28, 2003 memo, "EFED Risk Assessment for Section 3 Registration of BAS 510 F (Nicobifen)" (DP Barcode D278387 and others).

Boscalid is a persistent compound with low mobility in most soils. The primary degradation pathway is aerobic soil metabolism, which proceeds slowly and results in the formation of intermediates which are relatively rapidly transformed into CO_2 or bound soil residues. Boscalid is stable to hydrolysis and to photolysis on soil and in water. The compound is also not transformed to any significant extent in either aerobic

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or anaerobic aquatic systems. Revised estimated drinking water concentrations (EDWCs) for the turf use, which reflect corrected input parameters for the Tier 1 FIRST surface water exposure model, are 87.53 and 25.77 ppb.

The proposed use of the fungicide boscalid on soybeans, pome fruit, and hops may pose a chronic risk to mammals. The potential for chronic risk to birds was identified for the previously registered turf use. However, in spite of the chronic toxicity of boscalid to birds, residues predicted from use on soybean, pome fruit and hops do not exceed the chronic avian LOC. Predicted exposure from the proposed uses does not exceed acute or chronic LOCs for aquatic animals or plants, nor to terrestrial plants.

This assessment includes an endangered species assessment due to the potential for chronic risk to mammals from the proposed uses of boscalid. A preliminary evaluation of endangered mammals that might be exposed to boscalid in soybean, pome fruit and hops growing areas is included below. Chronic reproductive effects in birds, such as decreased number of eggs laid, increased embryo mortality and decreased numbers of 14-day survivors, suggest that boscalid may impact endocrine activity. When the appropriate screening and/or testing protocols being considered under the Agency's Endocrine Disruptor Screening Program have been developed, boscalid may be subjected to additional screening and/or testing to better characterize effects related to endocrine disruption.

II. Introduction

Use Characterization

Boscalid is applied to the use sites listed above as a ground spray, aerial spray, or through sprinkler irrigation equipment, except for hops, for which aerial spray is not permitted. The maximum application rates (per application), maximum seasonal rates, application intervals, and pre-harvest intervals for the proposed new uses are listed below in **Table 1**.

Table 1: Proposed new label uses for boscalid

Crop Type	Maximum Rate per Application (lb a.i./A) and Max. Number of Applications	Maximum Seasonal Application Rate (lb a.i./A/season)	Application Interval (days)	Pre-Harvest Interval (days)
soybeans (Pristine)	0.25(3)	0.75	7-14	21
soybeans (Endura)	0.48 (2)	0.96	7-10	21
hops (Pristine)	0.44 (3)	1.32	10-21	14
pome fruit group (Pristine or Endura)[1]	0.29 (4)	1.16	7-14	0

[1] Pome fruit group includes apple, pear, oriental pear,quince, crabapple and loquat

III. Risk Characterization

Ecological Risk

The proposed use of the fungicide boscalid on soybeans, pome fruit, and hops may pose a chronic risk to mammals. The predicted residues for pome fruit and hops exceed the chronic level of concern (LOC) for small mammals consuming short grass, broad leaf and tall grass feed items (RQ range: 0.9 - 2.6). The soybean residues exceed for short grass only with the proposed Pristine label directions, and short grass and broad leaves with the proposed Endura label directions. The risk quotient for small mammals eating tall grass feed from application of Endura to soybeans is below the LOC of 1.0, but only barely (RQ = 0.99).

The residue levels on which these potential risks are based on maximum values identified in Hoerger and Kenaga (1972) as modified by Fletcher *et al.* (1994). Risk quotients based on the mean residues measured by these investigators do not exceed the chronic LOC. For instance, the highest chronic RQ, for exposure to small mammals consuming short grass from use on hops, falls from 2.8 to 0.98 when calculated using mean residues.

While boscalid caused chronic effects in bobwhite quail toxicity studies, estimated residues from the proposed uses do not appear to pose a chronic risk to birds. Terrestrial residues predicted from use on soybean, pome fruit and hops are less than those predicted for use on turf. As a result, while exposure from the turf use exceeds the chronic LOC for birds, residues predicted from use on soybean, pome fruit and hops do not. Predicted exposure from the proposed uses does not exceed acute LOCs for birds or mammals.

The proposed uses of boscalid should not pose a risk to terrestrial plants. The maximum offsite plant exposure from a single application to the proposed new crops was estimated by the TERR-PLANT model to be 0.05 lb ai/acre. This is well below the test level of 0.55 lb ai/acre, at which fewer than 25% of the test plants were affected (EC_{25} >0.55 lb ai/acre).

Predicted exposure from the proposed uses does not exceed acute or chronic LOCs for aquatic animals or plants. The estimated peak surface water concentration from the use on hops results in a risk quotient just below the endangered species LOC (i.e. RQ $\geq$ 0.05) for estuarine marine molluscs (based on oyster shell deposition). In the May, 2003 risk assessment the reviewers wrote that, "given the persistence of nicobifen and its tendency to partition on to sediments, EFED recommends that toxicity data be provided for a freshwater mollusc such as *Corbicula spp.*" This data gap remains, and precludes a more detailed assessment of the potential risk to endangered freshwater molluscs.

Drinking Water Exposure

In the May 2003 risk assessment, EFED performed a drinking water exposure assessment for the registration of the use of boscalid on turf, vegetable, canola, fruit, and nut crops. The drinking water assessment detailed in that memo used the Tier 1 surface-water model FIRST to simulate use on turf. The turf use still represents the highest annual application rate (2.1 lb ai/acre) for boscalid, even when considering the currently proposed uses. Revised estimated drinking water concentrations (EDWCs) for the turf use, which reflect corrected input parameters for the FIRST surface water exposure model, are 87.53 and 25.77 ppb.

V Environmental Fate

Boscalid is a slowly biodegradable compound with low mobility in most soils. The primary degradation pathway is aerobic soil metabolism, which proceeds slowly and results in the formation of intermediates which are relatively rapidly transformed into CO_2 or bound soil residues. The majority of the apparent degradation of the compound is actually due to its transformation to bound residues. Degradates of the compound include 2-chloronicotinic acid (M510F47), 2-hydroxy-N-(4'-chlorobiphenyl-2-yl)-nicotinamide (M510F49), and an unknown (M510F50). Boscalid is hydrolytically stable and is photolytically stable on soil and in water. The compound is not transformed to any significant extent in either aerobic or anaerobic aquatic systems, but is relatively rapidly transferred (dissipation half-lives of <2 weeks) from the water phase to the sediment phase by sorbing to the sediment.

Table 2 summarizes the physicochemical properties of boscalid. A full assessment of the environmental fate of boscalid can be found in the May 28, 2003 memo cited above.

Table 2. Physical-chemical properties of boscalid

PARAMETER	VALUE
Chemical name	2-chloro-*N*-(4'-chlorobiphenyl-2-yl)-nicotinamide (IUPAC name) 2-chloro-*N*-(4'chloro(1,1'-biphenyl)-2-yl-3-pyridinecarboxamide (CAS name)
Molecular Weight	343.2 g/mole
Solubility	6 mg/L (20°C)
Vapor Pressure	$<1 \times 10^{-8}$ mmHg ($<1 \times 10^{-6}$ Pa; 25°C)
Hydrolysis half life (pH 5)	stable (25°C)
Hydrolysis half life (pH 7)	stable (25°C)
Hydrolysis half life (pH 9)	stable (25°C)
Aqueous photolysis half life	stable (22°C)
Soil photolysis half life	stable (22°C)
Aerobic soil metabolism half life	96 (20°C) 182–578 days (27°C)[1]
Anaerobic soil metabolism half life	stable (20°C)
Aerobic aquatic half life	stable (20°C)

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Aqueous photolysis half life	stable (22°C)
Soil photolysis half life	stable (22°C)
Aerobic soil metabolism half life	96 (20°C) 182–578 days (27°C)[1]
Anaerobic soil metabolism half life	stable (20°C)
Anaerobic aquatic half life	stable (20°C)
Soil-water distribution coefficient (K_d)	3.3–28 mL/g [2]
Organic carbon partitioning coefficient (K_{oc})	507–1110

[1]Range for four soils. [2]Range for six soils.

VI. Water Resource Assessment

In May 2003, EFED performed a drinking water exposure assessment for the registration of the use of boscalid on turf, vegetable, canola, fruit, and nut crops. The drinking water assessment detailed in this memo used the Tier 1 surface-water model FIRST to simulate use on turf. The turf use still represents the highest annual application rate for boscalid (2.1 lb ai/acre), even when considering the currently proposed uses.

The acute and chronic estimated drinking-water concentrations (EDWCs) for turf derived previously from the FIRST model were 87.03 and 25.62 ppb, respectively. Since the completion of that risk assessment, however, the aerobic soil metabolism half-lives used as input parameters for the FIRST and SCI-GROW models have been revised (communication from Cheryl Sutton to Peter Takacs, attached). The environmental fate parameters used in this drinking water assessment are listed in Appendix A. The revised EDWC values from FIRST are 87.53 and 25.77 ppb. The SCI-GROW estimate for ground-water exposure has changed from 0.57 to 0.63 ppb.

The turf EDWCs are still recommended for use in the human health dietary risk assessment because the new proposed uses are predicted to result in lower surface-water concentrations. Results for FIRST on hops, for instance, are 58 and 17 ppb

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(Appendix B). If the turf values cause the first-tier human dietary risk assessment to exceed levels of concern, EFED will perform a Tier II drinking water assessment for boscalid.

A Tier I ground water assessment for boscalid has also been performed for the turf use, based on the EFED screening model SCI-GROW. The ground-water EDWC for boscalid on turf is 0.63 ppb. The results are attached as Appendix C.

VII. Ecological Risk

Terrestrial Assessment

Acute Risk to Terrestrial Animals

Acute risk to terrestrial animals from the proposed uses of boscalid is not anticipated. As reported in the May, 2003 new chemical risk assessment, boscalid is practically non-toxic to birds, mammals and honeybees. Avian acute oral toxicity data on bobwhite quail indicated that no mortality or sublethal signs of toxicity were observed up to the maximum dose tested (>2,000 mg/kg body weight) (MRID 45404922). Boscalid is practically nontoxic (LD_{50} > 5,000 mg/kg) to rats on an acute exposure basis.

Chronic Risk to Terrestrial Animals

Terrestrial residues predicted from use on soybean, pome fruit and hops are less than those predicted for use on turf. As a result, while exposure from the turf use exceeds the chronic LOC for birds, residues predicted from use on soybean, pome fruit and hops do not.

Table 3. Chronic risk quotients for multiple applications of boscalid based on a bobwhite quail NOEC of 300 ppm.

Site	App. Rate (lbs ai/A)/# Apps.	Food Items	Maximum EEC (ppm)	NOEC (ppm)	Chronic RQ (EEC/ NOEC)
Hops	0.44 (3)	Short grass	263	300	0.93
		Tall grass	121	300	0.42
		Broadleaf plants/insects	148	300	0.52
		Seeds	16	300	0.06
Soybean (Endura)	0.48 (2)	Short grass	215	300	0.72

Site	App. Rate (lbs ai/A)/# Apps.	Food Items	Maximum EEC (ppm)	NOEC (ppm)	Chronic RQ (EEC/ NOEC)
		Tall grass	99	300	0.33
		Broadleaf plants/insects	121	300	0.40
		Seeds	13	300	0.04
Pome Fruit	0.29 (4)	Short grass	229	300	0.76
		Tall grass	105	300	0.35
		Broadleaf plants/insects	129	300	0.43
		Seeds	14	300	0.05

As with all of the recently registered uses described in the May, 2003 memo, the residues predicted from use on soybean, pome fruit and hops exceed the chronic LOC for mammals. Chronic toxicity data provided through a 2-generation rat reproduction study indicated that exposure to boscalid resulted in decreased body weight and decreased body weight gains in F_2 male pups (NOAEC = 100 ppm). The pome fruit and hops residues exceed the chronic LOC for small mammals consuming short grass, broad leaf and tall grass feed items. The soybean residues exceed for short grass only with the Pristine label directions, and short grass and broad leaves with the Endura label directions. The risk quotient for small mammals eating tall grass feed from application of Endura to soybeans is below the LOC of 1.0, but only barely (RQ = 0.99).

Table 4. Chronic mammalian risk quotients for multiple applications of boscalid, based on a rat NOEC of 100 ppm.

Crop and Application Type	Max. Applic. Rate in lbs a.i./A (No. of Applications)	Applic. Interval (days)	Short Grass ppm (RQ)	Tall Grass ppm (RQ)	Broadleaf plants/insects ppm (RQ)	Seeds ppm (RQ)
soybean (Pristine)	0.25 (3)	7	159 (1.6)[1]	73 (0.7)	89 (0.9)	10 (0.13)
soybean (Endura)	0.48 (2)	7	215 (2.2)[1]	99 (0.99)	121 (1.2)[1]	14 (0.14)
hops	0.44 (3)	10	263 (2.6)[1]	121 (1.2)[1]	148 (1.5)[1]	16 (0.16)
pome fruit	0.29 (4)	7	229 (2.3)[1]	104 (1.1)[1]	129 (1.3)[1]	14 (0.14)

[1] Exceeds chronic risk level of concern (RQ ≥1.0)

The residue levels on which these potential risks are based on maximum values identified in Hoerger and Kenaga (1972) as modified by Fletcher *et al.* (1994). Risk quotients based on the mean residues measured by these investigators do not exceed

the chronic LOC. For instance, the highest chronic RQ, for exposure to small mammals consuming short grass from use on hops, falls from 2.8 to 0.98 when calculated using mean residues. Results of the terrestrial residue screening models FATE and ELL-FATE are attached as Appendix D. The maximum and mean residue levels from Hoerger and Kenaga (1972) as modified by Fletcher *et al.* (1994) are shown in **Table 5.**

Table 5. Food Items	EEC (ppm) Predicted Maximum Residue[1]	EEC (ppm) Predicted Mean Residue[1]
Short grass	240	85
Tall grass	110	36
Broadleaf/forage plants, and small insects	135	45
Fruits, pods, seeds, and large insects	15	7

[1]Predicted maximum and mean residues for vegetation, insects, and fruit are for a 1 lb ai/a application rate and are based on Hoerger and Kenaga (1972) as modified by Fletcher *et al.* (1994).

Endocrine Disruption Potential

Chronic reproductive effects in birds, such as decreased number of eggs laid, increased embryo mortality and decreased numbers of 14-day survivors, suggest that boscalid may impact endocrine activity. EPA is required under the FFDCA, as amended by FQPA, to develop a screening program to determine whether certain substances (including all pesticide active and other ingredients) "*may have an effect in humans that is similar to an effect produced by a naturally occurring estrogen, or other such endocrine effects as the Administrator may designate.*" Following the recommendations of its Endocrine Disruptor Screening and Testing Advisory Committee (EDSTAC), EPA determined that there was scientific basis for including, as part of the program, the androgen and thyroid hormone systems, in addition to the estrogen hormone system. EPA also adopted EDSTAC's recommendation that the Program include evaluations of potential effects in wildlife. For pesticide chemicals, EPA will use FIFRA and, to the extent that effects in wildlife may help determine whether a substance may have an effect in humans, FFDCA authority to require the wildlife evaluations. As the science develops and resources allow, screening of additional hormone systems may be added to the Endocrine Disruptor Screening Program (EDSP). When the appropriate screening and/or testing protocols being considered under the Agency's EDSP have been developed, boscalid may be subjected to additional screening and/or testing to better characterize effects related to endocrine disruption.

Risk to Terrestrial Plants

The proposed uses of boscalid should not pose a risk to terrestrial plants. The maximum offsite plant exposure from a single application to the proposed new crops was estimated by the TERR-PLANT model to be 0.05 lb ai/acre. This is well below the test level of 0.55 lb ai/acre, at which fewer than 25% of the test plants were affected (EC_{25} >0.55 lb ai/acre).

Table 6. EEC values for a single application of boscalid to soybeans at 0.48 lb ai/acre, derived using the TERR-PLANT Model

Application Method	Total loading to adjacent areas[1] (lb ai/acre)	Total loading to semi-aquatic areas[2] (lb ai/acre)	Drift EEC[3] (lb ai/acre)
Aerial application	0.0269	0.0528	0.0240

[1] EEC = Sheet Runoff +Drift
[2] EEC = Channelized Runoff + Drift
[3] for ground: application rate x 0.01; for aerial or airblast: application rate x 0.05

Aquatic Assessment

Boscalid does not appear to pose an acute or chronic risk to those freshwater or estuarine animals or plants for which the Agency has received data. Chronic studies for estuarine and marine fish and invertebrates have not been submitted. New aquatic exposure simulations using GENEEC2, attached as Appendix E, indicate that the proposed uses result in estimated exposures which do not exceed any LOC. For instance, the when the highest acute concentration of 40 ppb (from application to hops) is compared to the most sensitive acute endpoint (for oyster shell deposition), the resulting RQ of 0.04 is below all levels of concern.

Table 7. Summary of most sensitive acute and chronic aquatic toxicity tests for boscalid

Species	Study type	LC_{50} or EC_{50} mg/L	NOAEC & LOAEC mg/L
Rainbow Trout	freshwater fish acute	LC_{50} = 2.7	--
Rainbow Trout	freshwater fish early-life stage	--	0.116 & 0.241
Daphnia magna	freshwater invert. acute	EC_{50} = 5.33	--
Daphnia magna	freshwater invert. life-cycle	--	1.31 & 2.63
Sheepshead Minnow *Cyprinodon variegatus*	estuarine/marine fish acute	LC_{50} > 3.86	--
Mysid shrimp *Americamysis bahia*	estuarine/marine invert. acute	LC_{50} = >3.81	--
Eastern oyster *Crassostrea virginica*	shell-deposition	EC_{50} = 1.02	--
Lemna gibba	vascular aquatic plant acute	EC_{50} >3.9	--

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Pseudokirchneriella subcapitata[1]	non-vascular aquatic plant acute	EC_{50} = 1.34	–

Modeling of benthic exposure in the May, 2003 assessment, based on a closed farm-pond scenario over a 36-year period, did not exceed the chronic risk level of concern for sediment-dwelling animals. Since the EECs for the new uses are expected to be less than those for turf, chronic risk to sediment-dwelling animals is not expected for the proposed uses on pome fruit, hops and soybeans.

Only two aquatic plants species, *i.e.*, *Navicula pelliculosa* (EC_{50} = 1.8 mg/L) and *Pseudokirchneriella subcaptita* (EC_{50} = 1.34 mg/L), of the five tested were sensitive to boscalid; however, at the proposed application rates, boscalid is not likely to represent a risk to aquatic plants. EC_{50} values for aquatic plants other than these two nonvascular aquatic plants exceeded the solubility limit of boscalid in water. Risk quotients are shown below for the proposed use on hops, for which GENEEC2 simulated the highest peak surface water concentrations of the three proposed new uses.

Table 8. Acute risk quotients for aquatic plants based on maximum predicted residues of boscalid in surface water

Site/ Application Method	Test Species	EC_{50} Initial/Peak (mg/L)	EEC (mg/L)	RQ (EEC/ EC_{50})
Hops	duckweed	> 3.9	0.040	<0.01
	green algae	1.34	0.040	0.04

VIII. Endangered Species

The Agency's level of concern for endangered and threatened mammals is exceeded for the proposed use of boscalid on soybeans, pome fruit and hops. The registrant must provide information on the proximity of Federally listed mammals to the proposed use sites. The registrant must provide information on the proximity of Federally listed mammals to the proposed use sites. Since Dow AgroSciences is a member of the FIFRA Endangered Species Task Force (Pesticide Registration [PR] Notice 2000-2) that is in the process of establishing an extensive endangered species data base, they should provide the necessary information for use by the OPP Endangered Species Protection Program to develop recommendations to avoid adverse effects to listed species.

IX References

Hoerger, F., and E.E. Kenaga. 1972. Pesticide residues on plants: Correlation of representative data as a basis for estimation of their magnitude in the environment. In F. Coulston and F. Korte, *eds.*, Environmental Quality and Safety: Chemistry, Toxicology, and Technology, Georg Thieme Publ, Stuttgart, West Germany, pp. 9-28.

Appendix A

Table A1. FIRST (v1.0) input parameter values and results for boscalid applied to turf by ground spray.

Parameter	Value
Application Rate (lb a.i./A)	0.35
Number of Applications	6
Interval between Applications (days)	14
Organic Carbon Partitioning Coefficient (K_{oc})	655[1]
Aerobic Soil Metabolism Half-life (days)	401[2]
Wetted in?	No
Depth of Incorporation (inches)	0
Method of Application	ground spray
Percent Cropped Area	0.87
Solubility in Water (mg/L or ppm)	6
Aerobic Aquatic Metabolism Half-life (days)	stable
Hydrolysis Half-life @ pH 7 (days)	stable
Aquatic Photolysis Half-life @ pH 7 (days)	stable
FIRST Results (EEC for surface water drinking water sources)	**Acute Concentration (ppb): 87.5** **Chronic Concentration (ppb): 25.8**

[1]Represents the lowest K_{oc} for a non-sand soil. [2]The aerobic soil metabolism half-life used in the models represents the 90th percentile of the upper confidence bound on the mean half-life for four soils.

Table A2. SCI-GROW2 input parameter values and results for nicobifen applied to turf.

Parameter	Value
Maximum Application Rate (lb a.i./A/application)	0.35
Maximum Number of Applications per Year	6
Aerobic Soil Metabolism Half-life (days)	407.5
Organic Carbon Partitioning Coefficient (K_{oc})	821[1]
Results (EEC for groundwater drinking water sources)	0.5708 ug/L (ppb) or 571 ng/L (parts per trillion)

[1]Represents the median value.

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Appendix B- *FIRST Output*

RUN No. 1 FOR boscalid ON Turf * INPUT VALUES *

RATE (#/AC) ONE (MULT)	No.APPS & INTERVAL	SOIL Koc	SOLUBIL (PPM)	APPL TYPE (%DRIFT)	%CROPPED AREA	INCORP (IN)
.350(1.978)	6 14	655.0	6.0	GROUND(6.4)	87.0	.0

FIELD AND RESERVOIR HALFLIFE VALUES (DAYS)

METABOLIC (FIELD)	DAYS UNTIL RAIN/RUNOFF	HYDROLYSIS (RESERVOIR)	PHOTOLYSIS (RES.-EFF)	METABOLIC (RESER.)	COMBINED (RESER.)
401.00	2	N/A	.00- .00	.00	.00

UNTREATED WATER CONC (MICROGRAMS/LITER (PPB)) Ver 1.0 AUG 1, 2001

PEAK DAY (ACUTE) CONCENTRATION	ANNUAL AVERAGE (CHRONIC) CONCENTRATION
87.533	25.771

RUN No. 1 FOR Boscalid ON Hops * INPUT VALUES *

RATE (#/AC) ONE (MULT)	No.APPS & INTERVAL	SOIL Koc	SOLUBIL (PPM)	APPL TYPE (%DRIFT)	%CROPPED AREA	INCORP (IN)
.440(1.298)	3 10	655.0	6.0	GROUND(6.4)	87.0	.0

FIELD AND RESERVOIR HALFLIFE VALUES (DAYS)

METABOLIC (FIELD)	DAYS UNTIL RAIN/RUNOFF	HYDROLYSIS (RESERVOIR)	PHOTOLYSIS (RES.-EFF)	METABOLIC (RESER.)	COMBINED (RESER.)
401.00	2	N/A	.00- .00	.00	.00

UNTREATED WATER CONC (MICROGRAMS/LITER (PPB)) Ver 1.0 AUG 1, 2001

PEAK DAY (ACUTE) CONCENTRATION	ANNUAL AVERAGE (CHRONIC) CONCENTRATION
57.289	16.851

Appendix C - *SCI-GROW Output*

SCIGROW
VERSION 2.3
ENVIRONMENTAL FATE AND EFFECTS DIVISION
OFFICE OF PESTICIDE PROGRAMS
U.S. ENVIRONMENTAL PROTECTION AGENCY
SCREENING MODEL
FOR AQUATIC PESTICIDE EXPOSURE

SciGrow version 2.3
chemical:Boscalid
time is 8/27/2003 8:58:12

Application rate (lb/acre)	Number of applications	Total Use (lb/acre/yr)	Koc (ml/g)	Soil Aerobic metabolism (days)
0.350	6.0	2.100	8.21E+02	407.5

groundwater screening cond (ppb) = 6.34E-01

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Appendix D

RUN No. 1 FOR Boscalid ON Hops *** INPUT VALUES ***

RATE(#/AC) ONE(MAX)	APPLICATIONS NO.-INTERVAL	HALF-LIFE (DAYS)	AVIAN(ppm) LC50	AVIAN(ppm) NOAEC	MAMMALIAN(mg/kg) LD50	MAMMALIAN(mg/kg) NOAEL
.440(1.097)	3 10	35.0	*******	300.000	*******	100.000

MAXIMUM KENAGA/FLETCHER RESIDUES: 95th% (mean) in ppm

	SHORT GRASS	BROADLEAF & INSECTS	TALL GRASS	SEED FRUIT
MAX	263.29(93.25)	148.10(49.37)	120.68(39.49)	16.46(7.68)

ENDPOINT	SHORT GRASS RQ	BR LEAF&INS RQ	TALL GRASS RQ	SEED FRUIT RQ
AV CHRON	.88(.31)	.49(.16)	.40(.13)	.05(.03)
MA CHRON	2.63(.93)	1.48(.49)	1.21(.39)	.16(.08)

Appendix E- GENEEC2 Output

RUN No. 1 FOR Boscalid ON Hops * INPUT VALUES *

RATE (#/AC) ONE (MULT)	No.APPS & INTERVAL	SOIL Koc	SOLUBIL (PPM)	APPL TYPE (%DRIFT)	NO-SPRAY (FT)	INCORP (IN)
.440(1.298)	3 10	655.0	6.0	GRHIFI(6.6)	.0	.0

FIELD AND STANDARD POND HALFLIFE VALUES (DAYS)

METABOLIC (FIELD)	DAYS UNTIL RAIN/RUNOFF	HYDROLYSIS (POND)	PHOTOLYSIS (POND-EFF)	METABOLIC (POND)	COMBINED (POND)
401.00	2	N/A	.00-	.00	.00

GENERIC EECs (IN MICROGRAMS/LITER (PPB)) Version 2.0 Aug 1, 2001

PEAK GEEC	MAX 4 DAY AVG GEEC	MAX 21 DAY AVG GEEC	MAX 60 DAY AVG GEEC	MAX 90 DAY AVG GEEC
39.61	39.50	38.83	37.37	36.33

Appendix F : Endangered Species in Potential Boscalid New Use Areas

Endangered Species Potentially at Risk

The 19 species of endangered mammals known to occur in areas of soybean production are listed in Table F1. The determination of potential risk or potentially not adversely affected from the use of boscalid was made using data from the Fish and Wildlife Service, Field and External Affairs Division, EPA, and EPA regional endangered species listings. These reference materials were used in Table F2 and F3 as well. A more detailed listing by state with the number of counties affected in each state follows in Appendix G. There are 971 counties in 35 states with known endangered mammal listings in areas of soybean production.

Endangered species LOC exceedences occurred in the short grass category for soybean application rates with the Pristine formulation and short grass and broadleaf plants/insects categories for use of the Endura formulation on soybeans. Since the affected categories are herbivores and insectivores, those mammals that do not include those food items as their main diet should not be directly adversely affected by the proposed uses of boscalid on soybeans. The American black bear, Louisiana black bear, black-footed ferret, jaguarundi, West-Indian manatee, ocelot, Florida panther, gray wolf, and red wolf all fall into this category.

Table F1. Listed endangered mammals in areas of soybean production.

Common Name	Scientific Name	Status	Comments[1]
BAT, GRAY	Myotis grisescens	E	b
BAT, INDIANA	Myotis sodalis	E,CH	b
BAT, OZARK BIG-EARED	Plecotus townsendii ingens	E	b
BAT, VIRGINIA BIG-EARED	Plecotus townsendii virginianus	E,CH	b
BEAR, AMERICAN BLACK	Ursus americanus	T,SA	a
BEAR, LOUISIANA BLACK	Ursus americanus luteolus	T,CH	a
FERRET, BLACK-FOOTED	Mustela nigripes	E,XN	a
JAGUARUNDI	Felis yagouaroundi tolteca	E	a
MANATEE, WEST INDIAN (FLORIDA)	Trichechus manatus	E,CH	a
MOUSE, ALABAMA BEACH	Peromyscus polionotus ammobates	E,CH	c
MOUSE, CHOCTAWHATCHEE BEACH	Peromyscus polionotus allophrys	E,CH	c
MOUSE, PERDIDO KEY BEACH	Peromyscus polionotus trissyllepsis	E,CH	c
OCELOT	Felis pardalis	E	a
PANTHER, FLORIDA	Felis conconcolor coryi	E	a
SQUIRREL, CAROLINA NORTHERN FLYING	Glaucomys sabrinus coloratus	E	c
SQUIRREL, DELMARVA PENINSULA FOX	Sciurus niger cinereus	E,XN	b
SQUIRREL, VIRGINIA NORTHERN FLYING	Glaucomys sabrinus fuscus	E	c
WOLF, GRAY	Canis lupus	E,T,CH	a

WOLF, RED	Canis rufus	E,XP	a

[1] a = denotes species potentially not adversely affected by proposed use of boscalid due to diet
b = denotes species potentially at risk from proposed use of boscalid
c = denotes species, while occurring in counties where soybeans are grown, they do not occur in proximity to fields in production

The 37 species of endangered mammals known to occur in areas of pome fruit production are listed in Table F2. A more detailed listing by state with the number of counties affected in each state follows in Appendix H. According to the endangered species database, there are 987 counties in 41 states with known endangered mammal listings in areas of pome fruit production.

Table F2. Listed endangered mammals in areas of pome fruit production.

Common Name	Scientific Name	Status	Comments[1]
BAT, GRAY	Myotis grisescens	E	b
BAT, INDIANA	Myotis sodalis	E,CH	b
BAT, LESSER (=SANBORN'S) LONG-NOSED	Leptonycteris sanborni	E	b
BAT, OZARK BIG-EARED	Plecotus townsendii ingens	E	b
BAT, VIRGINIA BIG-EARED	Plecotus townsendii virginianus	E,CH	b
BEAR, GRIZZLY	Ursus arctos (=U.a. horribilis)	T	a
BEAR, LOUISIANA BLACK	Ursus americanus luteolus	T,CH	a
CARIBOU, WOODLAND	Rangifer tarandus caribou	E	c
DEER, COLUMBIAN WHITE-TAILED	Odocoileus virginianus leucurus	E	c
FERRET, BLACK-FOOTED	Mustela nigripes	E,XN	a
FOX, SAN JOAQUIN KIT	Vulpes macrotis mutica	E	a
JAGUAR	Panthera onca	E	a
JAGUARUNDI	Felis yagouaroundi tolteca	E	a
KANGAROO RAT, FRESNO	Dipodomys nitratoides exilis	E,CH	a
MANATEE, WEST INDIAN (FLORIDA)	Trichechus manatus	E,CH	a
MOUNTAIN BEAVER, POINT ARENA	Aplodontia rufa nigra	E	c
MOUSE, ALABAMA BEACH	Peromyscus polionotus ammobates	E,CH	c
MOUSE, PACIFIC POCKET	Perognathus longimembris pacificus	E	c
MOUSE, PERDIDO KEY BEACH	Peromyscus polionotus trissyllepsis	E,CH	c
MOUSE, PREBLE'S MEADOW JUMPING	Zapus udsonius preblei	T	b
MOUSE, SALT MARSH HARVEST	Reithrodontomys raviventris	E	c
OCELOT	Felis pardalis	E	a
OTTER, SOUTHERN SEA	Enhydra lutris nereis	T,XN	a
PRAIRIE DOG, UTAH	Cynomys parvidens	T	b
RABBIT, RIPARIAN BRUSH	Sylvilagus bachmani riparius	E	c
SEAL, GUADALUPE FUR	Arctocephalus townsendi	T	a
SHEEP, PENINSULAR BIGHORN	Ovis canadensis	T, CH	c
SHEEP, SIERRA NEVADA BIGHORN	Ovis canadensis califoniana	E	c
SQUIRREL, CAROLINA NORTHERN FLYING	Glaucomys sabrinus coloratus	E	c
SQUIRREL, DELMARVA PENINSULA FOX	Sciurus niger cinereus	E,XN	b

SQUIRREL, MOUNT GRAHAM RED	Tamiasciurus hudsonicus grahamensis	E,CH	c
SQUIRREL, VIRGINIA NORTHERN FLYING	Glaucomys sabrinus fuscus	E	c
VOLE, AMARGOSA	Microtus californicus scirpensis	E,CH	c
VOLE, HUALAPAI MEXICAN	Microtus mexicanus hualpaiensis	E	c
WOLF, GRAY	Canis lupus	E,T,CH	a
WOLF, RED	Canis rufus	E,XP	a
WOODRAT, RIPARIAN	Neotoma fuscipes riparia	E	c

[1] a = denotes species potentially not adversely affected by proposed use of boscalid due to diet
b = denotes species potentially at risk from proposed use of boscalid
c = denotes species, while occurring in counties where pome fruits are grown, they do not occur in proximity to orchards in production

There were endangered species LOC exceedences in the short grass, tall grass, and broadleaf plants/insects categories. Some of those species listed, however, do not include those food items as their main diet and therefore, should not be directly adversely affected by the proposed uses of boscalid on soybeans. The grizzly bear, Louisiana black bear, woodland caribou, Columbian white-tailed deer, black-footed ferret, San Joaquin kit fox, jaguar, jaguarundi, West Indian manatee, southern sea otter, Guadalupe fur seal, gray wolf and red wolf all fall into this category.

The endangered mammalian species occurring in hop growing areas (Oregon and Washington) are listed in Table F3. No mammal species were found in the database for Oregon. There were endangered species LOC exceedences in the short grass, tall grass, and broadleaf plants/insects categories. The two species occurring in Washington (grizzly bear and gray wolf) would not be affected by the proposed use of boscalid due to their diet not consisting of those categories.

Table F3. Listed endangered mammals in areas of hop production.

Common Name	Scientific Name	Status	Comments[1]
BEAR, GRIZZLY	Ursus arctos (=U.a. horribilis)	T	a
WOLF, GRAY	Canis lupus	E,T,CH	a

[1] a = denotes species potentially not adversely affected by proposed use of boscalid due to diet

EFED has determined that the endangered bats (Indiana bat, gray bat, Ozark big-eared bat, Virginia big-eared bat and lesser long-nosed bat) may be at risk of adverse effects from the use of boscalid should exposure occur. The Indiana bat, gray bat, Ozark big-eared bat, Virginia big-eared bat and lesser long-nosed bat are active nocturnally in areas often associated with the proposed uses of boscalid on soybeans and pome fruit. To avoid bat exposure to boscalid during its application, the pesticide should not be applied during the nocturnal activity times of the animals. The following label statement has been used in other registration actions to address concerns for these species :

> **To protect the Indiana bat, gray bat, Ozark big-eared bat, Virginia big-eared bat and lesser long-nosed bat do not apply from one-half-hour before dusk to one-half-hour after dawn**

The Preble's meadow jumping mouse is a shy, largely nocturnal mouse that lives primarily in heavily vegetated, shrub-dominated riparian habitats and immediately adjacent upland habitats along the foothills of southeastern Wyoming south to Colorado Springs along the eastern edge of the Front Range of Colorado. The Preble's range includes Adams, Arapahoe, boulder, Denver, Douglas, El Paso, Elbert, Jefferson, Larimer, and Weld counties in Colorado; and Albany, Laramie, Platte, Goshen, and Converse counties in Wyoming. This area is undergoing rapid residential, commercial, agricultural, and industrial development that can impact their habitat. The diet of the Preble's changes seasonally and consists of insects, seeds, fungus, fruit and more. EFED has concluded that this species may be at risk due to the proposed use of boscalid on pome fruit in these areas. (U.S. Fish and Wildlife Service, Mountain - Prairie Region, Endangered Species Program

The Delmarva peninsula fox squirrel can be found in hardwood trees and nearby areas in sections of Delaware, Maryland and Virginia. Although these animals nest in trees, they are ground-oriented. Their diet consists of fruits, nuts, tree fungi, buds, and insects. Because their diet includes insects, and because of proximity to soybean and pome fruit production, EFED is concerned that this species is at risk due to these proposed uses of boscalid. (U.S. Fish and Wildlife Service, Northeast region, Ecological Services)

The Utah prairie dog can be found in mainly in central Utah and part of southern Utah. It is associated mostly with rangeland areas, but can be found very near alfalfa and probably hay. The prairie dog is herbivorous feeding off of green grasses and forbs. They consume up to two pounds per a week of these materials. Grass makes up 70-95% of their diet. In fall, forbs become more important. They also eat seeds and insects to prepare for the colder weather. The USDA 1997 Census of Agriculture indicates that pesticides have been applied in central Utah to suppress disease in pome fruits. The areas of prairie dog habitation and pome fruit production may overlap. Therefore, the Utah prairie dog may be exposed to boscalid applied to pome fruits. More information is needed to delineate the proximity of the Utah prairie dog's habitat to pome fruit production. (consultation with Field and External Affairs Division, endangered and threatened mammals of the U.S. relative to cultivated crops)

Endangered Species in Proposed Boscalid Use Area Less Likely to Be At Risk

The Fresno kangaroo rat, like other species of kangaroo rats, can be found often near agriculture and this species feeds almost exclusively on seeds. Although they are not expected to be found in the orchards, they may occur around them. While they may share proximity to the crops where boscalid is proposed to be used, their diet of seeds decreases their risk of exposure (RQ = 0.14). EFED has concluded that this species is not at risk from the proposed use of boscalid on pome fruits. (consultation with Field and External Affairs Division, endangered and threatened mammals of the U.S. relative to cultivated crops)

According to the Endangered Species Recovery Program at California State University, riparian brush rabbits feed at the edges of shrub cover rather than in large openings. Their diet consists of herbaceous vegetation, bark, and leaves of woody plants. For the most part, riparian brush rabbits remain hidden under protective shrub cover. They seldom venture more than one meter from cover and refrain from too much movement. These rabbits are known to have occurred in riparian forests along the San Joaquin River and Stanislaus River in CA. Today, the only extant population are found along the Stanislaus River in Caswell Memorial State Park, San Joaquin County, CA. No other sightings of this rabbit outside the park have been reported in over 40 years. Based on this information, riparian brush rabbit exposure appears unlikely for the proposed uses of boscalid.

The Carolina northern flying squirrel and Virginia northern flying squirrel can subsist on lichens and fungi over much of its range, but also eat certain seeds, buds, fruit, staminate cones, insects and other animal material. Both species occur primarily in the vegetation transition zone between conifers and northern hardwood forests. Both forest types are used in the search for food, while the hardwood areas are needed for nesting sites. The Carolina northern flying squirrel is known from five isolated localities, three in the western mountains of North Carolina and two in the eastern mountains of Tennessee. Due to their restricted habitat and range, EFED concludes that exposure is unlikely for the proposed uses of boscalid.

Both the Perdido Key beach mouse and the Choctawatchee beach mouse are restricted to the mature barrier sand dunes along the Gulf of Mexico. The depth of the habitat extending inland may vary depending on the configuration of the sand dune system and the vegetation present. The distribution of the Choctawatchee beach mouse is limited to two areas: (1) approximately 4.9 miles of beach around Morrison Lake, and (2) Shell Island at St. Andrews Bay in Bay County, Florida. The distribution of the Perdido Key beach mouse is currently the western part of Perdido Key, including Gulf State Park, Baldwin County, Alabama and on the eastern part of the key at the Gulf Islands National Seashore, Escambia County, Florida. The Alabama beach mouse shares a similar habitat. The main negative pressures on these species are habitat loss due to coastal development and tropical storm damage to the dune system. The proposed new uses of boscalid will not likely result in exposure to these mice as neither soybeans or pome fruits are cultivated on coastal sand dunes.

In consultation with Field and External Affairs Division, EFED has concluded that the Peninsular bighorn sheep, Sierra Nevada bighorn sheep, Mount Graham red squirrel, Pacific pocket mouse, salt marsh harvest mouse, Amargosa vole, Hualapai Mexican vole and riparian woodrat are not associated with cultivated crops. While these species may occur in counties where pome fruits are produced, they do not occur in close proximity to the orchards in production. Additionally, the Pacific pocket mouse is known to occur only on privately-owned land near Dana Point and at two sites on Camp Pendleton, CA.

Appendix G
Endangered mammals listed for soybeans

Mammal Species in Counties with over [100] Acres of Crop
Crop: Soybeans for beans (bushels), harvested **Crop # 17**

	Species	Status	No. of Counties
ALABAMA			
MAMMAL			
	BAT, GRAY	E	12
	BAT, INDIANA	E,CH	9
	MOUSE, ALABAMA BEACH	E,CH	1
	MOUSE, PERDIDO KEY BEACH	E,CH	1
ARKANSAS			
MAMMAL			
	BAT, GRAY	E	3
	BAT, INDIANA	E,CH	1
CONNECTICUT			
MAMMAL			
	BAT, INDIANA	E,CH	2
DELAWARE			
MAMMAL			
	SQUIRREL, DELMARVA PENINSULA FOX	E,XN	1
FLORIDA			
MAMMAL			
	BAT, GRAY	E	1
	BAT, INDIANA	E,CH	1
	MANATEE, WEST INDIAN (FLORIDA)	E,CH	3
	MOUSE, CHOCTAWHATCHEE BEACH	E,CH	1
	MOUSE, PERDIDO KEY BEACH	E,CH	1
	PANTHER, FLORIDA	E	1
GEORGIA			
MAMMAL			
	BAT, GRAY	E	9
	BAT, INDIANA	E,CH	29
	MANATEE, WEST INDIAN (FLORIDA)	E,CH	3
ILLINOIS			
MAMMAL			
	BAT, GRAY	E	6
	BAT, INDIANA	E,CH	97
INDIANA			
MAMMAL			
	BAT, GRAY	E	3
	BAT, INDIANA	E,CH	92
IOWA			
MAMMAL			
	BAT, INDIANA	E,CH	43
KANSAS			
MAMMAL			
	BAT, GRAY	E	4
	FERRET, BLACK-FOOTED	E,XN	25