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

OFFICE OF
PREVENTION, PESTICIDES AND
TOXIC SUBSTANCES

March 29, 2010

MEMORANDUM

SUBJECT: Summary of Product Chemistry, Environmental Fate, and Ecotoxicity Data for the 1,3,5-Triazine-2,4-Diamine, N-Cyclopropyl-N'-(1,1-Dimethylethyl)-6-(Methylthio)-Registration Review Decision Document

PC Code: 128996 **Case No.:** 5031
CAS No.: 28159-98-0 **DP Barcode:** 374982

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Attached is the summary of available product chemistry, environmental fate, and ecotoxicity data to support the registration review of 1,3,5-Triazine-2,4-Diamine, N-Cyclopropyl-N'-(1,1-Dimethylethyl)-6-(Methylthio)-.

1,3,5-Triazine-2,4-Diamine, N-Cyclopropyl-N'-(1,1-Dimethylethyl)-6-(Methylthio)-
REGISTRATION REVIEW DECISION

PRODUCT CHEMISTRY, ENVIRONMENTAL FATE AND ECOLOGICAL EFFECTS SUMMARY

PC Code: 128996; Case No. 5031

Introduction:

1,3,5-Triazine-2,4-diamine, N-cyclopropyl-N'-(1,1-dimethylethyl)-6-(methylthio)- better known under the trade names Irgarol® 1051 and Cybutryn is a chemical compound with a 1,3,5-triazine ring as the basic structure. Irgarol 1051 is an odorless, low volatile, yellowish to white solid granule (powder) which has a low vapor pressure of 6.6×10^{-7} mmHg at 25°C, very low water solubility of 7 mg/L (7 ppm) and a log P_{ow} of 3.95 at 25°C (moderately lipophilic).

Fouling can significantly increase water resistance to boats which can result in up to 40% higher fuel consumption. Fouling can also decrease maneuverability (a safety hazard) and it can damage the ship's body. In the process of fouling, algae form a substrate for macro-fouling. Irgarol 1051 is an algicide specifically designed for use in marine antifouling coatings. It is a highly specific and effective inhibitor of photosynthesis which can control fouling of marine surfaces caused by algae. Its very low water solubility contributes to very slow leaching rates and therefore extended antifouling action.

In antifouling paints Irgarol 1051 is often combined with copper, or copper compounds such as cuprous oxide or copper thiocyanate. While Irgarol 1051 effectively controls algae, copper is effective at controlling animals. Irgarol 1051 is a s-triazine herbicide used in combination with copper in antifoulant paint as a "booster" biocide, intended to diminish algae growth on ship hulls.

Products containing Irgarol 1051 as an active ingredient were first registered with the EPA for use in boat antifouling paints on January 1st1960. Currently, there are 41 active products under a single PC Code 128996 which are listed in Table 1. Registered products contain between 0.49 and 98.1% Irgarol 1051. The registered formulations are technical chemical, formulation intermediate, emulsifiable concentrate, liquid soluble concentrate, pressurized liquid, and ready-to-use solutions. Irgarol 1051 products are registered in combination with cuprous oxide (PC Code: 25601; CAS#1317-39-1), copper thiocyanate (PC Code: 025602; CAS# 1111-67-7), carbendazim (PC Code: 128872; CAS# 10605-21-7), chlorothalonil (tetrachloroisophthalonitrile) (PC Code: 81901; CAS# 1897-45-6), octhilinone (OIT; PC Code: 099901; CAS# 26530-20-1), 3(2H)-Isothiazolone, 4,5-dichloro-2-octyl- (DCOIT; PC Code: 128101; CAS# 64359-81-5), and carbamic acid, butyl, -3-iodo-2-propynyl ester (IPBC; PC Code: 107801; CAS# 55406-53-6).

Irgarol 1051 is a triazine herbicide possessing biocidal activity against algal and diatom fouling species and is used as a 'booster biocide' in approved antifouling products for use on

vessels of any size and on structures below the waterline. The major use sites for these products include antifouling coatings for boats and materials preservatives for exterior paints, coatings, building materials, vinyl roofing, stucco, grouting, spackling and joint cement. (Exterior Paints, Coatings, Stains, Building Materials, Latex and Solvent Based Paints, Semi Transparent Stains, Solid Stains, Vinyl Roofing, Elastomeric Roof, Wall Coatings, Mastics, Caulks, Sealants, Joint Cements, Spackling, Stucco, Grouting, Applied Film of Paint, Masonry Coatings, Wood Protective Stains, Adhesives, Caulks and Sealants, Roof Coatings, Plasters, Sealants and Fillers used for Architectural Products, Finishes and Special Purpose Coatings, Hulls on Ships, Boats, Barges, Yachts and Running Gear). For use as a biocide in manufacturing caulking compounds, sealants, joint compounds, stucco, coatings, paints, dry film paint, stains, grouts, adhesives, and wood preservatives. An algicide and slimicide to be formulated into marine and/or freshwater antifoulant paints for boats and/or vessels only.

Table 1. Registered Active Products of Irgarol

Registration #	Registration Name	Company Name	Formulation Type	% of Active Ingredient
707-304	Rocima 65 Industrial Microbicide	Rohm & Haas Co.	Emulsifiable Concentrate	3.5
707-312	Rocima 80	Rohm & Haas Co.	Soluble Concentrate	32.5
1258-1270	Densil CA	Arch Chemicals, Inc.	Soluble Concentrate	6.0
1529-38	Fungitrol 1075	International Specialty Products	Formulation Intermediate	15.0
1529-48	Fungitrol 2002	International Specialty Products	Formulation Intermediate	5.89
2693-170	Fiberglass Bottomkote With Biolux II - Black	International Paint LLC	Ready-to-Use Solution	0.49
2693-181	Tri-Lux III With Bio-Lux 5490 Blue	International Paint LLC	Ready-to-Use Solution	2.23
2693-183	Micron CSC Plus With Biolux Shark White	International Paint LLC	Ready-to-Use Solution	1.9
2693-189	Tri-Lux Blue	International Paint LLC	Ready-to-Use Solution	2.23
2693-190	Micron CSC Super With Bio-Lux Blue	International Paint LLC	Ready-to-Use Solution	2.0
2693-192	Ultra With Bio-Lux Blue	International Paint LLC	Ready-to-Use Solution	1.59
2693-197	VC 17M With Biolux Original	International Paint LLC	Ready-to-Use	2.38

Registration #	Registration Name	Company Name	Formulation Type	% of Active Ingredient
			Solution	
2693-198	VC 17M With Biolux Red	International Paint LLC	Ready-to-Use Solution	2.38
2693-199	Trilux With Biolux Black	International Paint LLC	Pressurized Liquid	0.86
2693-201	Ultra Plus - Blue	International Paint LLC	Ready-to-Use Solution	1.6
2693-202	CSC Plus - Blue	International Paint LLC	Ready-to-Use Solution	2.0
2693-204	CSC Plus - Blue	International Paint LLC	Ready-to-Use Solution	2.0
2693-205	Ultra Plus Blue	International Paint LLC	Ready-to-Use Solution	1.59
2693-208	Fiberglass Bottomkote With Biolux-Blue	International Paint LLC	Ready-to-Use Solution	0.98
2693-209	Fiberglass Bottomkote Act With Biolux-Blue	International Paint LLC	Ready-to-Use Solution	0.98
2693-212	Super Epoxycop With Irgarol - Blue	International Paint LLC	Ready-to-Use Solution	0.98
2693-213	Super KL Plus With Irgarol - Blue	International Paint LLC	Ready-to-Use Solution	0.98
2693-216	Prop & Drive Clear Aerosol	International Paint LLC	Pressurized Liquid	1.6
2693-218	Fiberglass Bottomkote Act With Biolux II - Black	International Paint LLC	Ready-to-Use Solution	0.49
2693-219	Super KL Plus With Irgarol II - Black	International Paint LLC	Ready-to-Use Solution	0.49
2693-224	Micron Extra Blue	International Paint LLC	Ready-to-Use Solution	1.96
5383-88	Troysan Polyphase 588	Troy Chemical Corp	Emulsifiable Concentrate	10.0
5383-102	Mergal S 90	Troy Chemical Corp	Ready-to-Use Solution	4.9
5383-105	Troysan ALF4	Troy Chemical Corp	Emulsifiable Concentrate	10.0

Registration #	Registration Name	Company Name	Formulation Type	% of Active Ingredient
5383-108	Polyphase 662	Troy Chemical Corp	Soluble Concentrate	4.0
9339-31	Aquagard II Antifouling Spray Paint For Outdrive & Outboards	Flexabar Corp	Ready-to-Use Solution	0.8
40810-11	Irgarol 1051	Ciba Corporation	Technical Chemical	98.1
40810-15	Irgarol 1071	Ciba Corporation	Ready-to-Use Solution	98.1
44891-13	Sea Hawk Premium Quality Tropikote Biocide Plus Slime Resistant Antifouling Coating	New Nautical Coatings Inc.	Ready-to-Use Solution	2.02
44891-14	Sea Hawk Premium Quality Cukote Biocide + Slime Resis. Antifoul. Coat.	New Nautical Coatings Inc.	Ready-to-Use Solution	2.0
60061-94	Pettit Marine Paint Ultima SR Biocide Antifouling	Kop-Coat, Inc.	Ready-to-Use Solution	2.0
60061-95	Petit Marine Paint Trinidad SR Antifouling	Kop-Coat, Inc.	Ready-to-Use Solution	2.0
60061-110	Petit Marine Paint SR-21 Fresh Water Antifouling	Kop-Coat, Inc.	Ready-to-Use Solution	2.0
60061-117	Pettit Marine Paint Ultima SR Antifouling Paint	Kop-Coat, Inc.	Ready-to-Use Solution	2.0
74681-4	Copper Pro SCX 67	Bluewater Marine Paint	Ready-to-Use Solution	1.96
74681-6	Copper Shield SCX 45	Bluewater Marine Paint	Ready-to-Use Solution	1.96

Use Patterns:

707-304:
Industrial Microbicide for Use in Exterior Paints, Coatings, and Building Materials.
Coatings: for use as a microbiocide to control bacteria, algae and fungi in exterior paints, coatings, and stains.
Building Materials: For use as a microbiocide to control bacteria, algae and fungi in exterior building materials, stucco, caulks, and sealants.
May not be used for food grade coatings or adhesives that may come in contact with food.

707-312:
Algicide for Use in Coatings and Building Materials.
Coatings: For use as an algicide to control algae in non-food use/non-food contact coatings such as latex, and solvent-based paints, semi-transparent stains and solid stains.
Building Materials: For use as an algicide to control algae in building materials such as vinyl roofing, elastomeric roof and wall coatings and mastics, caulks, sealants, joint cements, spackling, stucco, and grouting.
The manufactured products are for outdoor use only, are not to be used in products that my come in contact with water, and are not to be used on wood or any other treated material which is to be used for food, feed, potable water, livestock, dairy animals or living plants.

1258-1270:
For the Control of Fungal and Algal Growth on Exterior Paints, Caulks, Stucco and Stains.

It is an aqueous dispersion of a broad spectrum fungicide in combination with a broad spectrum algaecide, for control of fungal and algal growth on exterior paints, caulks, stucco, and stains. It provides excellent characteristics when used as a fungicide/algaecide in aqueous systems only, such as latex emulsion paints, stains, and coatings, stucco, and caulks.

Like natural substrates, coatings (if unprotected) can be susceptible to the growth of a wide range of fungi and algae. The uncontrolled growth of these organisms can lead to failure of coatings for their intended purpose of protecting expensive substrates. It is an effective fungicide/algaecide which provides long term protection from fungal and algal defacement of the paint film.

Some critical advantages of it are: synergistic biocidal action of the active agents, hydrolytic stability, extremely low water solubility, low vapor pressure, fine particle size, excellent pH stability, and endurance to UV radiation.

Mode of Action:

2,4,5,6-Tetrachloroisophthalonitrile is a multisite protective fungicide. The mode of action is the binding of the active molecule to the glutathion moiety, thus preventing completion of the energy cycle of the fungal species, and ultimately controlling fungal growth. Unlike many other systemic fungicides, this is not a site specific activity. Hence there is no known resistance to the fungal control.

N-Cyclopropyl-N'-(1,1-dimethylethyl)-6-(methylthio)-1,3,5-triazine-2,4-diamine is a broad spectrum algaecide, it has activity against both fresh water and sea water algae. The mode of action of this active agent is that of an inhibitor of photosynthesis.

An effective fungicide/algaecide in most aqueous products.

It is the responsibility of the manufacturer to test DENSIL CA for optimum dosage levels and to determine compatibility and suitability for intended use.

It is recommended that DENSIL CA be added during or after letdown stage. If desired DENSIL CA can be added as a post-add to the finished paint. This is especially useful for base paints. It is important to ensure thorough mixing of DENSIL CA into the formulated paint.

When an in-can preservative is used in .combination with DENSIL CA, it should be tested first for compatibility. DENSIL CA is compatible with latex paints containing zinc oxide. Further information is available from our Technical Service personnel.

1529-38:
FOR INDUSTRIAL USE ONLY

FUNGITROL 1075 is intended only for protecting the applied film of paint, coating, stucco, stain and caulk itself from algal growth. It is not intended to protect the substrate to which the preserved material is applied. Products that incorporate FUNGITROL® 1075 in their manufacture, may not make claims on their labels regarding protection of the substrate from algal growth.

An algicide for use in the manufacture of the following aqueous and solvent compositions only: paints, coatings, stucco, stains and caulks to protect the applied paint film, coating, stucco, stain and caulk itself from algal growth. The manufactured products are for outdoors uses only, are not to be used in products that may come in contact with water, and are not to be used on wood or any other treated material which is to be used for food, feed, potable water, livestock, dairy animals or living plants.

1529-48:
FOR INDUSTRIAL USE ONLY

For use as a biocide in manufacturing caulking compounds, sealants, joint compounds, stucco, coatings, paints, dry film paint, stains, grouts, adhesives, and wood preservatives.

2693-170:
Irgarol Improves Antifouling Performance by Reducing Slime.
Proven All Purpose Antifouling Protection.

It is a hard modified-epoxy antifouling paint that provides excellent season long protection. It contains cuprous oxide and Irgarol. The Irgarol works to control weed, slime and algae fouling while cuprous oxide works to control shell fouling such as barnacles and Zebra mussels. This keeps the bottom of boat cleaner longer.

2693-181:
Formulated for Use on Aluminum, Fiberglass or Wood
Slime Resistance
Contains Petroleum Distillates
Antifoulant paint for use on aluminum boats, outdrives and outboards.

Cuprous thiocyanate works against shell fouling such as barnacles and zebra mussels while Irgarol prevents slime and algae growth.
Do Not Apply Above True Waterline.

2693-183:
Irgarol Controls Slime
Use on fiberglass, wood and steel hulls.
Irgarol Improves Antifouling Performance by Reducing Slime.
Contains cuprous oxide
Cuprous oxide works against shell fouling and Irgarol protect against weed, slime, and algae growth.
For use below waterline on fiberglass, wood and properly primed metal, boat hulls and parts, in fresh, salt and brackish waters.
Do not use on aluminum.
This product contains cuprous oxide and Irgarol. The Irgarol works to control weed, slime and algae fouling while the cuprous oxide works to control shell fouling such as barnacles and zebra mussels. This keeps the bottom of your boat cleaner longer. It provides excellent protection against all forms of marine fouling in waters with moderate to heavy fouling and can be used in fresh, salt and brackish waters.

2693-189:
Biolux Blocks Slime. Biolux boosts performance by controlling slime. It is a hard antifouling paint specifically developed for use on aluminum boats, outdrives and outboards. It uses a resin system containing two biocides - Cuprous Thiocyanate and an organic bàoster called Biolux. The Cuprous Thiocyanate works best against shell fouling such as barnacles and zebra mussels while the Biolux booster helps prevent slime and algae growth. This blend of resins and biocides offer, when properly applied over primer, excellent antifouling protection. It has been specifically developed for use on primed aluminum, but it can also be applied to fiberglass, wood and other underwater metals on boats. It is for use below the waterline in fresh, salt and brackish water. It can be applied by brush, roller or spray. V.O.C.: Less than 400 grams /liter (3.34 lbs/gallon).

2693-190:
Biolux Blocks Slime. Biolux boosts performance by controlling slime. Biolux® is a multi-season, controlled solubility copolymer antifouling paint that is specially formulated with two biocides - cuprous oxide and a booster called Biolux®. The cuprous oxide works best against shell fouling, while the Biolux® booster helps protect against weed, slime and algae growth.

2693-192:
Contains Biolux to resist slime. High copper antifouling for ultimate protection. Teflon® added for durability and easy cleaning. Biolux boosts antifouling performance by controlling slime. Biolux resists slime. Contains petroleum distillates, xylene or xylene range aromatic solutions. Provides excellent long-term protection from shell and weed fouling. Ultra with Blolux® contains a very high loading of Cuprous Oxide and uses Biolux® technology to control slime.

2693-197:
Biolux Blocks Slime. Biolux Boosts Performance by Controlling Slime. Complete protection against zebra mussels, teredo worms, weed, algae and slime fouling. This is especially helpful in freshwater or low fouling saltwater.

2693-198:
Biolux Blocks Slime. Biolux Boosts Performance by Controlling Slime. Complete protection against zebra mussels, teredo worms, weed, algae and slime fouling. This is especially helpful in freshwater or low fouling saltwater.

2693-199:
Control slime growth. For use in fresh, salt and brackish water.

2693-201:
Resist slime. Control Slime. Long term protection from shell and weed fouling.
Best against shell fouling such as barnacles and zebra mussels and works to control slime and algae fouling. Can be used in fresh, salt and brackish water on fiberglass, wood and properly primed metal boat hulls and parts. Do not use on aluminum.

2693-202:
Blocks Slime. Control slime. Works against shell fouling, protect against weed, slime and algae growth.

2693-204:
Blocks Slime. Control slime. Works against shell fouling, protect against weed, slime and algae growth.

2693-205:
Resist Slime. Control slime. Best against shell fouling such as barnacles and zebra mussels and works to control slime and algae fouling. Can be used in fresh, salt and brackish water on fiberglass, wood and properly primed metal boat hulls and parts. Do not use on aluminum.

2693-208:
Control slime. Works to control weed, slime and algae fouling and control shell fouling such as barnacles and zebra mussels.

2693-209:
Fight slime. Works to control shell fouling such as barnacles and zebra mussels. Can be used in fresh, salt and brakish waters.

2693-212:
Blocks Slime. Control slime. Anti slime additive. Antifouling protection against barnacles, zebra mussels, hydroids, algae and slime for boats in salt or fresh water on boat bottoms.

2693-213:
Use in high fouling salt or fresh water areas. Algaecide. Provides resistance to barnacles, slime, algae and hydroids.

2693-216:
Prop & Drive Clear Aerosol antifouling paint is formulated specifically for aluminum outboards, outdrives and aluminum hulls in underwater areas. Prop & Drive Clear Aerosol dries quickly so that it can be painted and launched the same day. Prop & Drive Clear Aerosol uses Biolux® Technology to control slime growth. Prop & Drive Clear Aerosol is for use in fresh, salt and brackish water. Prop & Drive Clear Aerosol also contains Teflon® for added durability and easy cleaning.

FOR ALUMINUM OUTBOARDS, OUTDRIVES AND HULLS

Do not apply primer or Prop & Drive Clear Aerosol above the true waterline.

Do not apply to tin-based paint such as Micron®33, Micron 33 Aerosol, Micron 44 or Tri-Lux lIT. Do not use above the true waterline.

2693-218:
Reduces slime
Fights slime
The lrgarol works to control weed, slime and algae fouling while the cuprous oxide works to control shell fouling such as barnacles and zebra mussels.

It provides excellent protection against all forms of marine fouling in waters with moderate to heavy fouling and can be used in fresh, salt and brackish waters.

A multi-season, antifouling paint that is formulated with two biocides that provides effective protection against barnacles, slime, algae and hydroids. It is recommended for boats that are used in high fouling salt or fresh water areas, or which remain in the water for prolonged periods between haul outs.

It is for use below the waterline on fiberglass, wood and properly primed metal boat hulls and parts, in fresh, salt and brackish waters.

2693-219:
Contain Organic Boosting Biocide to Combat Slime.
Contain a Specially Formulated Boosting Algaecide to Combat Slime.
Use on wood, fiberglass and steel hulls.
Provides effective protection for boats that are used in high fouling salt or fresh water areas, or which remain in the water for prolonged periods between haul outs. The high load of cuprous oxide and a specially formulated boosting algaecide provides excellent resistance to barnacles, slime, algae and hydroids.
Resistant to algae, barnacles and other marine fouling.

Blocks slime growth.
2693-224:
Blocks slime.

Boosts Performance by Controlling Slime.

Antifouling Protection for All Conditions.

Contains Petroleum Distillates

5383-88:
A Fungicide/Algicide For Exterior Paints, Masonry Coatings, Wood Protective Stains, Adhesives, Caulks and Sealants.

Sold for industrial use only in the final use products: Exterior paint, wood protective stain, adhesives, caulks & sealants, Joint cements, roof coatings, and stucco.

5383-102:
Industrial Biocide for Use in Paints, Coatings, Plasters, Stuccos, Sealants, Caulks and Fillers.

An antimicrobial preservative for control of fungi and algae growing on paints, coatings, plasters, sealants, and fillers used for architectural products, finishes and special purpose coatings.

5383-105:
A Preservative for Exterior Paints and Coatings, Wood Protective Stains, Adhesives, Caulks and Sealants and Exterior Plaster Coatings.
Applications: Paints and stains, wood protective stain, adhesives, caulks, grouts and sealants, stucco.

5383-108:
A Broad Spectrum Biocide for use in Exterior Paint and Stains, Masonry Coatings, Adhesives, Caulks and Sealants, Roof Coatings, Stucco and Joint Cements.

It is a water dispersion of biocides effective against a wide variety of fungal and algal organisms. Its primary application is in water-based products where VOC is a major concern.

It is not to be used in formulations intended for food contact paper coatings or food contact adhesive uses.

It should be added to paints and coatings, exterior paints, wood protective stains, masonry coatings, and roof coatings at the end of the manufacturing cycle, after the final pH adjustment has been made.

It may be added to exterior caulks and sealants at the end of the production cycle with good agitation.

It may be added to stucco and to joint cements.

9339-31:
Contains cuprous thiocyanate.

Outboard & lower unit anti-fouling paint.

Controls slime & other fouling organisms.

For use on aluminum & other non-ferrous materials.

Ideal for use on stern drives and other lower units.

40810-11
An Algicide/Slimicide for Use In Formulating Antifouling Paints.

For Industrial Use Only.

An algicide and slimicide to be formulated into marine and/or freshwater antifoulant paints for boats and/or vessels only.

40810-15

An Algicide for Use in the Manufacturing of the Following Aqueous and Solvent Compositions Only: paints, coatings, stucco, stains and caulks to inhibit or control the growth of algae on the treated surfaces.

An algicide for use in the manufacture of the following aqueous and solvent compositions only: pants, coatings, stucco, stains and caulks to inhibit or control the growth of algae on the treated surfaces. The manufactured products are for outdoor use only, are not to be used in products that may come in contact with water, and are not to be used on wood or any other treated material which is to be used for food, feed, potable water, livestock, dairy animals or living plants.

44891-13:
Biocide Plus Slime Resistant Antifouling Coating.

Hard epoxy-based antifoulant with over 73% copper in every color. This product is designed to control barnacles, algae and other marine foulings in salt or fresh water. This product is designed for use on the surfaces of hulls on ships, boats, barges, yachts, or running gear.

44891-14:
Biocide Plus Slime Resistant Antifouling Coating.

Ablative, self-polishing antifoulant. This product is designed to control barnacles, algae and other marine foulings in salt or fresh water. This product is designed for use on the surfaces of hulls on ships, boats, barges, yachts, or running gear.

60061-94:
Marine Paint
Oblative Dual Biocide Antifouling Bottom Paint
• High copper content.
• Multi-season technology.
• Self-polishing.
• Reduces paint build-up through controlled erosion.
• Excellent for fiberglass, wood & steel boats.
• Slime resistant.
Commercial and Non-Commercial Use
Do No Apply this Product on Aluminum Hulls or Outdrives.
Marine Paint

60061-95:
Antifouling Bottom Paint
• Slime resistant.
• Very high copper content.
• Long-term protection.
• Effective In worst tropical conditions.
Hard finish, easily burnished.
• Excellent for fiberglass, wood and steel boats.
COMMERCIAL AND PRIVATE CONSUMER USE

60061-110:
Marine Paint
Fresh water antifouling Paint
• Super Slick Finish
• Dual- Biocide Controls Hard and Soft Fouling
• Ultra-Thin Film Thickness Prevents Paint Build-Up
• Contains Moly-Disulfide & PTFE for Reducing Friction
• No Sanding Required
• Excellent for Fiberglass, Wood and Steel Boats
THIS PRODUCT IS A TWO-COMPONENT PRODUCT.
TO ONLY BE MIXED WITH POWDER PORTION
LOCATED UNDER THE LID OF THIS CONTAINER
BEFORE USING.

60061-117:
Marine Paint
Slime resistant.
Multi-season technology

Self-polishing.
Reduces paint build-up through controlled erosion
Excellent for fiberglass, wood & steel boats.
COMMERCIAL AND NON-COMMERCIAL USE
DO NOT USE THIS PRODUCT ON ALUMINUM HULLS OR OUTDRIVES

74681-4:
Contains cuprous oxide

Marine Paint

Slime control

Tremendous Protection for Extreme Fouling Conditions.

It provides extended antifouling protection against barnacles, algae and hydroids in salt and fresh water on boat bottoms only. It acts like a sunscreen to prevent slime and algae. Its ablative copolymer base renders a smooth- finish with durability and abrasion resistance. It releases biocide by the constant exposure of new paint film to the water. It has universal application over all types of properly prepared bottom paints (except aluminum). For use on fast fiberglass boats, as well as wood and steel hulls, extended protection is possible, since performance is directly proportional to the amount of paint applied.

Do not use on aluminum.

For use on boats below the true waterline.

74681-6:
Contains cuprous oxide

Marine Paint

Slime control

It provides extended antifouling protection against barnacles, algae and hydroids in salt and fresh water on boat bottoms only. It acts like a sunscreen to prevent slime and algae. Its ablative copolymer base renders a smooth- finish with durability and abrasion resistance. It releases biocide by the constant exposure of new paint film to the water. It has universal application over all types of properly prepared bottom paints (except aluminum). For use on fast fiberglass boats, as well as wood and steel hulls, extended protection is possible, since performance is directly proportional to the amount of paint applied.

Do not use on aluminum.

Science Findings

The Agency has conducted a review of the available product chemistry, environmental fate, and ecotoxicity data for Irgarol 1051. The findings are summarized below.

Product Chemistry Summary

The data submitted pertaining to the physical and chemical characteristics of the active ingredient Irgarol 1051 are adequate. All product chemistry data requirements have been fulfilled for the active ingredient Irgarol 1051. Therefore, the Agency does not anticipate needing additional product chemistry data for Irgarol 1051 at this time. Tables 2 and 3 contain the complete product chemistry information for the active ingredient Irgarol 1051.

Table 2. Chemical Identity of Irgarol 1051

Chemical Name	1,3,5-Triazine-2,4-diamine, N-cyclopropyl-N'-(1,1-dimethylethyl)-6-(methylthio)-
Common Names	N-Cyclopropyl-N'-(1,1-dimethylethyl)-6-(methylthio)-1,3,5-triazine-2,4-diamine
Synonyms	2-(tert-Butylamino)-4-(cyclopropylamino)-6-(methylthio)-1,3,5-triazine s-Triazine, 2-(tert-butylamino)-4-(cyclopropylamino)-6-(methylthio)- 2-(tert-Butylamino)-4-(cyclopropylamino)-6-(methylthio)-s-triazine Cybutryne Irgarol
Trade Name	Irgarol 1051 Irgarol 1071
IUPAC Name	2-methylthio-4-tert-butylamino-6-cyclopropylamino-s-triazine N'-tert-butyl-N-cyclopropyl-6-(methylthio)-1,3,5-triazine-2,4-diamine
Molecular Weight	253.37 g/mole
PC Code	128996
CAS Registry Number	28159-98-0
Molecular Formula	$C_{11}H_{19}N_5S$
Registration Review Case No. Registration Review Case Name	5031 1,3,5-Triazine-2,4-diamine, N-cyclopropyl-N'-(1,1-dimethylethyl)-6-(methylthio)-

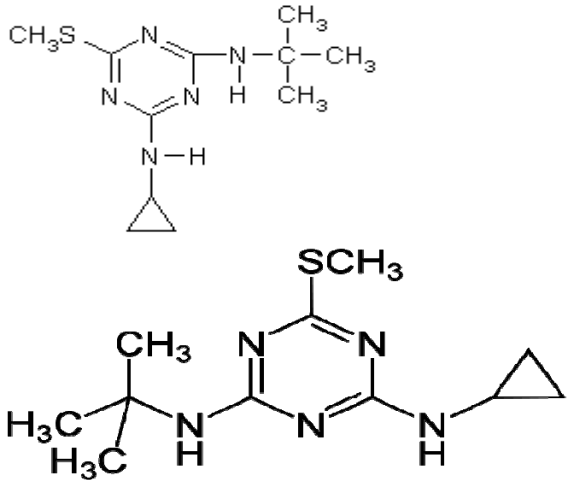
Table 2. Chemical Identity of Irgarol 1051	
Chemical Family	Thio Triazine Amine Cyclo
Molecular Structure:	

Table 3. Product Chemistry Data Summary of Irgarol 1051 (TGAI 98.1%)

Guideline No.	Physical and Chemical Properties	Value
830.1550	Product identity and composition	Refer to Table 2.
830.1600	Description of materials used to produce the product	CBI
830.1620	Description of production process	CBI
830.1650	Description of formulation process	CBI
830.1670	Discussion of formation of impurities	CBI
830.1700	Preliminary analysis	CBI
830.1750	Certified limits	CBI
830.1800	Enforcement analytical method	HPLC and Gas Chromatography
830.1900	Submittal of samples	NA
830.6302	Color	Yellowish to white granules
830.6303	Physical State	Solid granules
830.6304	Odor	No odor. No distinguishable odor.
830.6313	Stability to sunlight, normal and elevated temperature, metals/metal ions	Stable under normal and elevated temperatures. Not sensitive to metal. Does not degrade. No decomposition expected under normal storage conditions. Stability: Stable.

Guideline No.	Physical and Chemical Properties	Value
		The product is not sensitive to metal ions and metal.
830.6314	Oxidation/Reduction: Chemical Incompatibility	No oxidizing or reducing agents in product. Based upon chemistry of this product, it is neither an oxidizing nor reducing agent. Incompatibility: Strong oxidizing agents, strong acids, strong bases.
830.6315	Flammability	Data not required; product is not a combustible liquid. Flash point: > 200°C (392°F)
830.6316	Explodability	Data not required; product contains no explosive ingredient
830.6317	Storage Stability	Unchanged
830.6319	Miscibility	Data not required; product is not an emulsifiable liquid.
830.6320	Corrosion Characteristics	During storage, no change in packaging material was observed. During storage of this product in various types of material, including PVC, plastic, cardboard, aluminum, and tinplates, no change in the packaging material was observed.
830.6321	Dielectric breakdown voltage	Data not required.
830.7000	pH	Data not required; product not dispersible with water
830.7050	UV/visible light absorption	
830.7100	Viscosity	Data not required; product is not a liquid.
830.7200	Melting point	127-130°C Decomposition Temperature: > 200°C (392°F)
830.7220	Boiling point	Data not required. N.A.
830.7300	Density	Sp Gr 1.10 (H20 =1)
830.7370	Dissociation Constant	Data not relevant. 5.16 Mean value @pH 4-6
830.7550	Partition coefficient (*n*-octanol/water)	log Pow 3.95 at 25°C
830.7840	Solubility in water	7 ppm @ 20-25ºC
830.xxxx	Solubility in organic solvents	Organic solvent, g/100 ml Xylene, 5.0 Shell—sol A, 8.0 Solvent naphtha, 5.0 Butyl acetate, 15.0 Methyl isobutyl ketone, 12.0 Butylene glycol, 15.0 Propylene glycol, 1.0 Octanol, 5.0 Methyl cellosolve, 10.0
830.7950	Vapor pressure	6.6×10^{-7} torr at 25°C (77ºF)
Nitrosamines		Less than 0.12 ppm

N/A = Not applicable; TGAI=Technical Grade Active Ingredient; CBI= Confidential Business Information

Environmental Fate Summary

The Agency has reviewed eleven environmental fate studies for Irgarol 1051. The submitted environmental fate studies were all found to be acceptable. The environmental fate guideline studies and the results are summarized in Table 6. The chemical structures and identities of degradates are listed in Table 7. The Agency's conclusions for the degradation, metabolism, mobility, bioaccumulation, and special leaching studies are as follows.

a. Degradation Studies (Abiotic)

Hydrolysis: Irgarol 1051 not hydrolyze in either sterile aqueous buffered solutions at pH 5, 7, and 9 or in sterile synthetic seawater at pH 8. Irgarol 1051 was hydrolytically stable.

Photodegradation in Water: Irgarol 1051 is stable to photodegradation in sterile, buffered pH 7 water and in sterile synthetic seawater at pH 8. At pH 7 sterile buffered solution it has a photolytic half-life of 148 days when calculated through least square regression and 723 days if calculated by conventional method; at pH 8 sterile buffered seawater solution its half life is 273 days through least square regression and becomes 281 days when calculated by conventional methods. It is a persistent and stable molecule in aqueous medium.

b. Metabolism Studies (Biotic)

Aerobic Soil Metabolism: The aerobic soil metabolism ha1f-1ife was 101 days in sandy 1oam soi1. Three metabolism degradates were identified in the aerobic soil metabolism study; GS 26575 (half life: 273 days), GS 28620 (half life: 273 days), and CA 30-0155 (half life: 122 days). The parent (Irgarol 1051) and its degradates are essentially stable and resistant to microbes.

Aerobic Aquatic Metabolism: Under aerobic aquatic conditions, Irgarol 1051 degraded with half-lives of >800 days in the marine loamy sand sediment:seawater slurry system and 192 days in the loamy sand sediment:lake water (freshwater) slurry system. These data indicate that Irgarol 1051 is stable and not readily metabolized in sediment/water systems incubated under aerobic conditions. Three metabolism degradates were identified in the aerobic aquatic metabolism study; GS 26575, CGA 234576, and CA 30-0156.

Anaerobic Aquatic Metabolism: Under anaerobic aquatic conditions, half-1ives were 2050 and 8503 days for flooded 1oamy sand sediment: freshwater and loamy sand sediment: seawater systems, respectively. These data indicate that Irgarol 1051 may be extremely persistent in marine/estuarine sediments. Irgarol 1051 is stable and not readily metabolized in sediment/water systems incubated under anaerobic conditions. No degradates were found in the anaerobic aquatic metabolism study.

In summary, Irgarol 1051 does not readily metabolize in soi1:water systems. Irgarol 1051 was stable towards aerobic soil, anaerobic aquatic (freshwater and seawater), and aerobic aquatic

(freshwater and seawater) metabolism. The results of these studies do clearly demonstrate that Irgarol 1051 is persistent in the environment.

c. Mobility Studies

Adsorption/Desorption: Unaged lrgarol moderately adsorbs to soil/sediment particles. The mobility of lrgarol was studied using four soils, a freshwater sediment, and a saltwater sediment. Freundlich K_{ads} values ranged from 2.59 in a sand to 7.12 in a clay loam which indicate moderate mobility in soil systems while K_{des} ranged between 2.34 to 7.65 which shows that Irgarol gets desorbed from soil systems quite easily (Table 4). The percent lrgarol adsorbed to the test soils ranged from 21.2% for the sand to 43.3% for the clay loam. Both adsorption and desorption K values strongly point toward the possibility that the molecule is moderately mobile in the soil system and has a potential of leaching to ground water and runoff to surface water. Moreover, equilibrium batch studies of the Irgarol degradates, namely CA-30-0228, CA-30-0232, and CA-30-0155 have been conducted for various soil types. These studies indicate that K_{ads} for CA-30-0228 ranges from 1.10 to 3.38 while K_{des} varies from 1.83 to 5.32; and for the degradate CA-30-0232, K_{ads} varies from 0.716 to 3.38 while K_{des} ranges from 0.296 to 0.962. All these values indicate that the two degradates are highly mobile in the soil systems and may pose a problem of ground water contamination and surface water run off. For degradate CA-30-0155 K_{ads} is between 1.52 to 6.17 while K_{des} are between 15.6 to 17.3, a strong indication that it is not released from the soil system easily.

Table 4. Adsorption/Desorption of Irgarol 1051 in Soil

Soil / Sediment Type	% Organic Carbon	Adsorption		Desorption	
		K_d	K_{oc}	K_d	K_{oc}
Sand	0.10	2.59	2,590	2.34	2,340
Loamy Sand (fresh water sediment)	0.25	3.12	1,248	4.22	1,688
Silt Loam	0.40	6.29	1,573	7.95	1,988
Loamy Sand (marine sediment)	0.70	6.93	990	7.08	1,011
Sandy Loam	0.80	6.56	820	7.65	956
Clay Loam	1.30	7.12	548	6.53	502

d. Bioconcentration Study:

Bioaccumulation in Fish: Fish accumulation data demonstrated that Irgarol 1051 accumulated in blue gill sunfish with maximum mean bioconcentration factors o f 62x, 290x, and 160x for edible, nonedible, and whole fish tissues, respectively. In the edible tissues, Irgarol 1051 was the major residue identified. In the viscera, the degradate CGA 234576 predominated. Depuration was rapid, with 62, 92, and 85% of the accumulated [^{14}C] residues eliminated from the edible, nonedible, and whole fish tissues, respectively, by day 14 of the depuration period (Table 5). Strong indication that most of the pesticide does not stay in the tissues.

Table 5. Bioconcentration and Elimination by Bluegill Sunfish (*Lepomis macrochirus*)

Tissue	BCF	Time To Reach (90 %) Steady State (d)	Depuration $t_{½}$ (d)	Elimination By Day 40 (%)
Edible (muscle)	62	14	7-11	62
Non-edible	290	14	1-3	92
Whole body	160	14	1-3	85

e. Antifoulant Special Leaching Studies:

Leach rate test of 16 end-use products (boat bottom antifoulant paints) established release rates ranging from 0.24 to 16.6 ug Irgarol 1051/cm^2/day.

Table 6. Environmental Fate Data Summary for Irgarol 1051

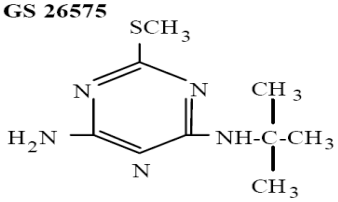
OPP Guideline	Fate Studies	Half-Life	Degradates	Study Status
161-1	Hydrolysis (Buffer) pH 5 pH 7 pH 9	Stable	None.	Acceptable
161-1	Hydrolysis (Seawater) pH 8	Stable	None.	Acceptable
161-2	Photolysis (Buffer) pH 7	Stable 148 days (by least squares regression) or 723 days (by conventional methods)	None.	Acceptable
161-2	Photolysis (Seawater) pH 8	Stable 273 days (by least sq. regression) or 281 days (by conventional method)	None.	Acceptable
162-1	Aerobic Soil Metabolism	Stable/Persistent Not Readily Metabolized 101 days in sandy loam soil (calculated) **Half-life of Degradates:** GS 26575: 273 days GS 28620: 273 days CA 30-0155:122day	GS 26575 GS 28620 CA 30-0155	Acceptable

OPP Guideline	Fate Studies	Half-Life	Degradates	Study Status
162-3	Anaerobic Aquatic Metabolism (sediment:freshwater and sediment:seawater)	Stable/Persistent Not Readily Metabolized 2050 days (freshwater) 8503 days (Seawater)	None	Acceptable
162-4	Aerobic Aquatic Metabolism (sediment:freshwater and sediment:seawater)	Stable/Persistent Not Readily Metabolized 192 days (freshwater) >800 days (Seawater)	GS 26575 CGA 234576 CA 30-0156	Acceptable
163-1	Leaching and Adsorption/Desorption	Irgarol 1051 does not readily adsorb to soil particles and has moderate mobility in soils **Soil Type / Kads / Kdes / %ads** sand: 2.59 / 2.34 / 21.2 loamy sand (freshwater sediment): 3.12 / 4.22 / 24.6 silt loam: 6.29 / 7.95 / 40.5 loamy sand (marine sediment): 6.93 / 7.08 / 42.5 sandy loam: 6.56 / 7.65 / 41.1 clay loam: 7.12 / 6.53 / 43.3		Acceptable
163-1	Equilibrium batch studies (degradates)	**Degradates / Kads / Kdes** CA 30-0228: 1.10-3.38 / 1.83-5.32 CA 30-0232: 0.716-3.38 / 0.296-0.962 CA 30-0155: 1.52-6.17 / 15.6-17.3		Acceptable

OPP Guideline	Fate Studies	Half-Life	Degradates	Study Status
165-4	Bioaccumulation in Bluegill sunfish	**Fish Tissues** / **Mean BCF** / **Depuration (14 days)** Edible 62x 62% Non edible 290x 82% Whole body fish tissue 160x 85% Irgarol 1051 does not stay in the tissues.	No Bioaccumulation No bioconcentration	Acceptable
ASTM D5108–90	Antifoulant Leach Rate Test	Release rates ranging from 0.24 to 16.6 ug Irgarol 1051/cm^2/day		Acceptable

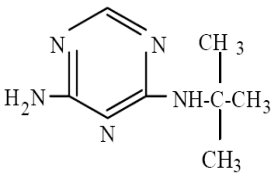
Table 7. Degradates of Irgarol 1051

GS 26575



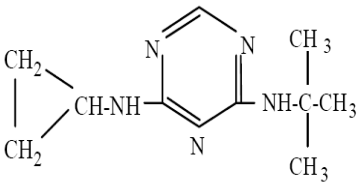
N'-(1,1-dimethylethyl)-6-(methylthio)-1,3,5-triazine-2,4-diamine (M1) (parent minus cyclopropyl group)

CGA 234575

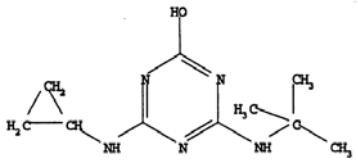


N'-(1,1-dimethylethyl)-1,3,5-triazine-2,4-diamine (parent minus methylthio and cyclopropyl groups)

CGA 234576

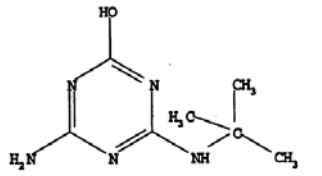
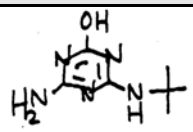
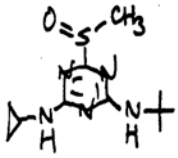
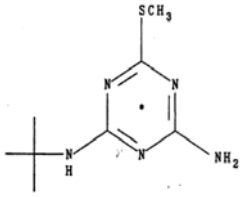


N-Cyclopropyl-N'-(1,1-dimethylethyl)-1,3,5-triazine-2,4-diamine (parent minus thiomethyl group)



t-Butylamino-4-cyclopropylamino-6-hydroxy-s-triazine (CA 30-0155)

4-[(1,1-dimethylethyl)amino-6-(cyclopropylamino)-1,3,5-triazine-2-(1H)-one
(parent minus thiomethyl group replaced with hydroxyl group)

Table 7. Degradates of Irgarol 1051	
 Hydroxy-4-amino-6-t-butylamino-s-triazine (CA 30-0232) (parent minus cyclopropyl and methylthio groups with substituted hydroxyl in place of methylthio)	 GS 28620 1,3,5-Triazin-2(1H)-one, 4-amino-6-[(1,1-dimethylethyl)amino]- (parent minus cyclopropyl, dimethylethyl, and thiomethyl groups with hydroxyl group in place of methylthio)
 CA 30-0156 1,3,5-Triazine, 2,4-diamine, N-cyclopropyl-N'-(1,1-dimethylethyl)-6-(methylsulfinyl)- (parent minus dimethylethyl group with oxygenated methylthio group)	 CA 30-0228 2-amino-4-methylthio-6-t-butylamino-s-triazine (parent minus cyclopropyl group)

The Agency did not conduct an environmental fate assessment for Irgarol 1051. However, the Agency needs to conduct an environmental fate assessment for material preservatives used in exterior paints, coatings, and building materials that potentially pass through waste water treatment plants (WWTPs) and may be discharged into terrestrial and aquatic environments. Also, the Agency anticipates conducting an environmental fate assessment for Irgarol 1051 used in wood preservatives (outdoor)) and antifouling coatings. For this assessment the Agency anticipates needing those data outlined on page 30 of this document.

Water Quality

Irgarol 1051 is not identified as a cause of impairment for any water bodies listed as impaired under section 303(d) of the Clean Water Act, based on information provided at http://iaspub.epa.gov/tmdl_waters10/attains_nation_cy.cause_detail_303d?p_cause_group_id=885 . In addition, no Total Maximum Daily Loads (TMDL) have been developed for Irgarol 1051, based on information provided at http://iaspub.epa.gov/tmdl_waters10/attains_nation.tmdl_pollutant_detail?p_pollutant_group_id=885&p_pollutant_group_name=PESTICIDES . More information on impaired water bodies and TMDLs can be found at http://www.epa.gov/owow/tmdl/. The Agency invites submission of water quality data for this pesticide. To the extent possible, data should conform to the quality standards in Appendix A of the *OPP Standard Operating Procedure: Inclusion of Impaired Water Body and Other Water Quality Data in OPP's Registration Review Risk Assessment and Management Process* (see: http://www.epa.gov/oppfead1/cb/ppdc/2006/november06/session1-sop.pdf), in order to ensure they can be used quantitatively or qualitatively in pesticide risk assessments.

Ecological Effects Summary

The Agency has reviewed 43 ecotoxicology studies for Irgarol 1051. The 43 studies submitted on the 88.54 - 100% Irgarol 1051 and its degradates were all found to be acceptable for use in a hazard assessment. Ecotoxicity guideline studies and the results are summarized in Table 6. The Agency's conclusions for the avian and aquatic effects studies are as follows.

- Irgarol 1051 is practically non-toxic to avian species in the diet and by single oral dose ingestion.

- Irgarol 1051 is highly toxic to moderately toxic to freshwater fish on an acute basis.

- Irgarol 1051 causes chronic toxic effects on freshwater fish at low levels (9 ppb).

- Irgarol 1051 is moderately to slightly toxic to freshwater aquatic invertebrates on an acute basis.

- Irgarol 1051 causes chronic toxic effects on freshwater invertebrates at levels as low as 560 ppb.

- Irgarol 1051 is moderately toxic to estuarine/marine fish on an acute basis.

- Freshwater fish early life-stage testing show that Irgarol 1051 causes chronic toxic effects on marine/estuarine fish at levels as low as 330 ppb.

- Irgarol 1051 is highly to moderately toxic to estuarine/marine invertebrates on an acute basis. The degradates are moderately toxic.

- Marine/estuarine invertebrate life-cycle testing results show that Irgarol 1051 causes chronic toxic effects on marine/estuarine invertebrates at levels as low as 250 ppb.

- Irgarol 1051 is very highly toxic to algae and aquatic plants. The major degradates are less toxic, but are still predominantly in the highly toxic range.

Whole Sediment Acute Invertebrate, Freshwater and Marine/Estuarine (OPPTS 850.1735)

The data generated during this study established that freshwater amphipod survival was not affected by exposure to lrgarol 1051 at a nominal concentration of 120 mg a.i./kg sediment. The Lowest-Observed-Effect Concentration (LOEC) for Irgarol 1051 was > 120 mg a.i./kg sediment. The No-Observed-Effect Concentration (NOEC) established for this study was 120mg a.i./kg sediment.

Whole Sediment Acute Invertebrate, Freshwater and Marine/Estuarine (OPPTS 850.1740)

The data generated during this study established that marine/estuarine amphipod survival was not affected by exposure to Irgarol 1051 at a nominal concentration of 240 mg a.i./kg sediment. The Lowest-Observed-Effect Concentration (LOEC) for Irgarol 1051 was 240mg a.i./kg sediment. The No-Observed-Effect Concentration (NOEC) established for this study was 120 mg a.i./kg sediment.

Bioavailability/Bioaccumulation (OPPTS 850.1730)

Bioavailability/bioaccumulation testing was required for Irgarol due to its persistence in water and sediments and potential for cumulative effects (Kow of 2399). A fish bioconcentration factor study on Irgarol was submitted; results of this test are provided below:

> Maximum BCF of 62X, 290X and 160X for edible, non-edible and whole fish tissues, respectively. Depuration for 14 days resulted in elimination of 62%, 92% and 85% for these same tissues, respectively.

The results show that Irgarol does not significantly bioconcentrate in fish tissues. The Guideline for fish bioaccumulation (850.1730/old 72-6/165-4) is fulfilled.

Estuarine and Marine Field Studies (OPPTS 850.1950)

A marine microcosm was submitted to the Agency to address the rate of degradation of Irgarol 1051 from seawater under quasi-natural conditions (light, temperature, evaporation, precipitation, measure the partitioning of Irgarol 1051 between seawater and sediment and measure the change in toxicity to algae as Irgarol 1051 degrades from seawater. Irgarol 1051 dissipated from the microcosm water with an approximate 23-day half-life. The metabolite GC 26575 accumulated for the first 30 days of the study, and then declined at the same rate of Irgarol 1051, a 23-day half-life. Neither the parent compound nor the metabolite accumulated in the sediment. Irgarol 1051 was toxic to the marine diatom (71% growth inhibition after 21 days), *Skeletonema costatum*, at the high concentrations found in the beginning of the study (nominal concentration of 560 ng a.i./L). However, as the Irgarol 1051 concentration declined over the first 57 days of the study (measured concentrations of 31 and 44 ng a.i./L), so did the growth inhibition of the test diatom (9.0 and 10% growth inhibition at 57 days, declining to 0% inhibition at 77 days) . The study was classified as acceptable, fulfilling Guideline 850.1950/old 72-7.

Table 8. Ecotoxicity Data Summary for Irgarol 1051 (TGAI) and Irgarol 1051 Degradates

CHEMICAL	GUIDE LINE	COMMON NAME	TAXONOMIC NAME	TEST TYPE	% AI	STUDY TIME	DOSE TYPE	TOXICITY	TOX LEVEL	NOEL	TOX CATEGORY
Avian Acute Oral Toxicity											
Irgarol 1051	850.2100 71-1	Bobwhite quail	*Colinus virginianus*	O	98	14 D	LD50	>2250	MGK	810	Core Practically non-toxic
Avian Subacute Dietary Toxicity											
Irgarol	580.2200	Bobwhite	*Colinus*	D	98	8 D	LC50	>5620	PPM	1780	Core

CHEMICAL	GUIDE LINE	COMMON NAME	TAXONOMIC NAME	TEST TYPE	% AI	STUDY TIME	DOSE TYPE	TOXICITY	TOX LEVEL	NOEL	TOX CATEGORY
1051	71-2a	quail	*virginianus*								Practically non-toxic
Irgarol 1051	580.2200 71-2b	Mallard duck	*Anas platyrhynchos*	D	98	8 D	LC50	>5620	PPM	1000	Core Practically non-toxic
Freshwater Fish Acute Toxicity											
Irgarol 1051	850.1075 72-1a	Bluegill sunfish	*Lepomis macrochirus*	S	98.6	96 hr	LC50	2.6	PPM	<1.0	Core Moderately toxic
Irgarol 1051	850.1075 72-1c	Rainbow trout	*Oncorhynchus mykiss*	S	98.6	96 hr	LC50	0.84	PPM	<0.26	Core Highly toxic
Irgarol 1051	850.1075 72-1c	Rainbow trout	*Oncorhynchus mykiss*	F	98.6	96 hr	LC50	0.75	PPM	<0.15	Core Highly toxic
Freshwater Fish Early Life-Stage (Chronic)Toxicity											
Irgarol 1051	850.1400 72-4a	Rainbow trout	*Oncorhynchus mykiss*	F	98	95 D	LOEC	0.009	PPM	0.004	Core Chronic toxic effects
Freshwater Invertebrate Acute Toxicity											
Irgarol 1051	850.1010 72-2	Water flea	*Daphnia magna*	S	98.6	24 hr	EC50	66	PPM	7.8	Supplemental Moderately toxic
Irgarol 1051	850.1010 72-2	Water flea	*Daphnia magna*	S	98	48 hr	EC50	5.3	PPM	0.3	Core Slightly toxic
Freshwater Invertebrate Life-Cycle (Chronic) Toxicity											
Irgarol 1051	850.1300 72-4b	Water flea	*Daphnia magna*	F	99	21 D	LOEC	<0.56	PPM	<0.56	Supplemental Chronic toxic effects
Estuarine/Marine Fish Acute Toxicity											
Irgarol 1051	850.1075 72-3	Sheepshead minnow	*Cyprinodon variegatus*	F	98	96 hr	LC50	3.5	PPM	0.82	Core Moderately toxic
Irgarol 1051	850.1075 72-3	Inland silverside	*Menidia beryllina*	S	98	96 hr	LC50	1.58	PPM	0.6	Core Moderately toxic
Irgarol 1051 (GS26575 degradate)	850.1075 72-3	Sheepshead minnow	*Cyprinodon variegatus*	S	100	96 hr	LC50	11.0	PPM	5.2	Core Moderately toxic
Irgarol 1051 (GS28620 degradate)	850.1075 72-3	Sheepshead minnow	*Cyprinodon variegatus*	S	88.54	96 hr	LC50	>13	PPM	13	Core Moderately toxic
Irgarol 1051 CA30-0155 degradate)	850.1075 72-3a	Sheepshead minnow	*Cyprinodon variegatus*	S	93.4	96 hr	LC50	>4.6	PPM	>4.6	Core Moderately toxic
Estuarine/Marine Fish Early Life-Stage Toxicity											

CHEMICAL	GUIDE LINE	COMMON NAME	TAXONOMIC NAME	TEST TYPE	% AI	STUDY TIME	DOSE TYPE	TOXICITY	TOX LEVEL	NOEL	TOX CATEGORY
Irgarol 1051	850.1400 72-4a	Sheepshead minnow	*Cyprinodon variegatus*	F	99	33 D	LOEC	0.33	PPM	0.17	Supplemental Chronic toxic effects
Estuarine/Marine Bivalve (Oyster) Acute Toxicity (embryo larval) - Invertebrates											
Irgarol 1051	850.1055 72-3b	Eastern oyster EmbLrv	*Crassostrea virginica*	S	98.6	48 hr	EC50	3.2	PPM	0.76	Core Moderately toxic
Estuarine/Marine Mysid Acute Toxicity - Invertebrates											
Irgarol 1051	850.1035 72-3	Mysid	*Americamysis bahia*	S	98.6	96 hr	LC50	0.40	PPM	<0.13	Core Highly toxic
Irgarol 1051 (GS26575 degradate)	850.1035 72-3	Mysid	*Americamysis bahia*	S	100	96 hr	LC50	1.5	PPM	0.88	Core Moderately toxic
Irgarol 1051 (GS28620 degradate)	850.1035 72-3	Mysid	*Americamysis bahia*	S	88.54	96 hr	LC50	>13	PPM	13	Core Slightly toxic
Irgarol 1051 (CA300155 degradate)	850.1035 72-3	Mysid	*Americamysis bahia*	S	93.4	96 hr	LC50	>6.0	PPM	3.9	Core Moderately toxic
Estuarine/Marine Mysid Life-Cycle (Chronic) Toxicity - Invertebrates											
Irgarol 1051	850.1350 72-4b	Mysid	*Americamysis bahia*	F	98	28 D	LOEC	0.26	PPM	0.11	Core Chronic toxic effects
Freshwater/Marine Invertebrate Irgarol-Treated Sediment Acute Toxicity											
Irgarol 1051	850.1735 73-1	Freshwater Amphipod	*Hyalella azteca*	SR	99	10 D	LOEC LC50	>120 sedimt	MGK	120	Core Survival was not affected
Irgarol 1051	850.1740 73-2	Marine Amphipod	*Ampelisca abdita*	SR	99	10 D	LOEC LC50	>240 sedimt	MGK	120	Core Survival was not affected
Aquatic Vascular Plant Toxicity											
Irgarol 1051	850.4400 123-2	Duckweed	*Lemna gibba*	S	98.2	14 D	EC50	1.6	PPB	0.67	Core
Algal toxicity											
Irgarol 1051	850.5400 123-2	Freshwater Bluegreen algae	*Anabaena flos-aquae*	S	98.2	5 D	EC50	1.9	PPB	0.5	Core Detrimental effects
Irgarol 1051	850.5400 123-2	Freshwater Green algae	*Selenastrum capricornutum*	S	98.2	5 D	EC50	1.3	PPB	<0.65	Core Detrimental effects
Irgarol 1051	850.5400 123-2	Marine diatom	*Skeletonema costatum*	S	98.2	5 D	EC50	0.45	PPB	0.14	Core Detrimental effects
Irgarol	850.5400	Freshwater	*Scenedesmus*	S	N.R.	72 hr	EC50	2.4	PPB	0.74	Suppl

CHEMICAL	GUIDE LINE	COMMON NAME	TAXONOMIC NAME	TEST TYPE	% AI	STUDY TIME	DOSE TYPE	TOXICITY	TOX LEVEL	NOEL	TOX CATEGORY
1051	123-2	Green algae	*subspicatus*								Detrimental effects
Irgarol 1051	850.5400 123-2	Freshwater Green algae	*Selenastrum capricornutum*	S	N.R.	72 hr	EC50	1.47	PPB	<1.0	Suppl Detrimental effects
Irgarol 1051	850.5400 123-2	Freshwater diatom	*Navicula pelliculosa*	S	98.2	5 D	EC50	0.1	PPB	<0.05	Core Detrimental effects
Irgarol 1051	850.5400 123-2	Green algae	*Chlorococcum sp.*	S	99.6	5 D	EC50	0.42	PPB	0.10	Supplemental Detrimental effects
Irgarol 1051	850.5400 123-2	Golden-brown alga	*Isochrysis galbana*	S	99.6	5 D	EC_{50}	0.44	PPB	0.11	Supplemental Detrimental effects
Irgarol 1051	850.5400 123-2	Green algae	*Dunaliella tertiolecta*	S	99.6	5 day	EC50	0.56	PPB	0.13	Supplemental Detrimental effects
Irgarol 1051 (GS26575 degradate)	850.5400 123-2	Freshwater diatom	*Navicula pelliculosa*	S	100	5 D	EC50	0.19	PPM	<0.077	Core Detrimental effects
Irgarol 1051 (GS28620 degradate)	850.5400 123-2	Freshwater diatom	*Navicula pelliculosa*	S	88.54	5 D	EC50	14	PPM	1.3	Core
Irgarol 1051 (CA30-0155 degradate)	850.5400 123-2	Freshwater diatom	*Navicula pelliculosa*	S	93.41	5 D	EC50	100	PPB	10	Core Detrimental effects
Irgarol 1051 (GS26575 degradate)	850.5400 123-2	Marine diatom	*Skeletonema costatum*	S	99.94	5 D	EC50	0.016	PPM	0.00018	Core Detrimental effects
Irgarol 1051 (GS28620 degradate)	850.5400 123-2	Marine diatom	*Skeletonema costatum*	S	88.54	5 D	EC50	>21	PPM	1.2	Core
Irgarol 1051 (CA30-0155 degradate)	850.5400 123-2	Marine diatom	*Skeletonema costatum*	S	93.41	5 D	EC50	81	PPB	13	Supplemental Detrimental effects

Ecotoxicity data are adequate to provide the Agency with sufficient information to determine appropriate label precautions.

Ecological Effects Risk Assessment

An ecological risk assessment was not conducted on the Irgarol 1051 use patterns described in this document. Irgarol 1051 uses that have potential for environmental exposure are exterior or outdoor uses of material preservatives (in exterior paints, coatings, and building materials). The Agency needs to conduct environmental fate and ecological risk assessments for exterior or outdoor uses of material preservatives that potentially pass through waste water treatment plants (WWTPs) and may be discharged into terrestrial and aquatic environments. Also, the Agency needs to conduct an ecological risk assessment for Irgarol 1051 used in wood preservatives and antifouling coatings. For this ecological risk assessment, including an endangered species assessment for all uses, the Agency anticipates needing the ecotoxicity data outlined on page 30 of this document.

The Agency has not conducted a risk assessment that supports a complete endangered species determination. The ecological risk assessment planned during registration review will allow the Agency to determine whether Irgarol 1051's use has "no effect or "may affect" federally listed threatened or endangered species (listed species) or their designed critical habitats. When an assessment concludes that a pesticide's use "may affect" a listed species or its designated critical habitat, the Agency will consult with the U.S. Fish and Wildlife Service and/or National Marine Fisheries Services (the Services), as appropriate.

Environmental Fate and Ecotoxicity Data Gaps and Anticipated Work

Environmental fate and ecological risk assessments have not been conducted for Irgarol 1051. Irgarol 1051 is intended for use in formulating non-aquatic, non-crop use aqueous and solvent coating systems including paints, coatings, stucco, stains, and caulks for outdoor uses to inhibit or control the growth of algae on the coating surfaces. The Agency needs to conduct environmental fate and ecological risk assessments for outdoor uses of material preservatives [(to inhibit or control the growth of algae on the coating surfaces (such as exterior paints, coatings, stains, building materials such as vinyl roofing, elastomeric roof and wall coatings and mastics, caulks, sealants, joint cements, spackling, stucco, and grouting)] that potentially pass through waste water treatment plants (WWTPs) and may be discharged into terrestrial and aquatic environments. Therefore, the Agency anticipates needing the proposed environmental fate and ecotoxicity data for Irgarol 1051 and/or any of its major degradation products that are of potential concern for registered outdoor material preservative uses of Irgarol 1051. Also, the Agency needs to conduct an ecological risk assessment for Irgarol 1051 used in wood preservatives and antifouling coatings. The following environmental fate and ecotoxicity data are needed to conduct an environmental fate and ecological risk assessment:

- The Agency anticipates needing the following data in order to conduct a complete environmental fate and ecological risk assessment, including an endangered species assessment for antifoulant coatings use pattern of Irgarol 1051:

  Anticipated Ecological Effects Data Needs:
  (GLN 850.1045) Acute Penaeid;
  (GLN 850.4225) Seedling emergence - dose response using rice (*Oryza sativa*);
  (GLN 850.4250) Vegetative vigor - dose response using rice (*Oryza sativa*);
  (GLN 850.1500) Fish (freshwater and/or estuarine/marine species) life cycle study;
  (GLN 850.1710) Oyster BCF;
  (GLN 850.1850) Aquatic organism bioavailability/biomagnifications, toxicity tests;
  (GLN 850.2300) Avian reproductive studies with bobwhite quail and/or mallard duck
  (GLN 850.4300) Terrestrial Plants Field Study;
  (GLN 850.4450) Aquatic Plants Field Study; and
  (GLN None) (Special study) Whole sediment - chronic invertebrates (freshwater and/or estuarine/marine)

  Anticipated Environmental Fate Data Needs:
  (GLN 850.6800) modified activated sludge respiration inhibition;
  (GLN 835.1110) activated sludge sorption isotherm;
  (GLN 835.3110) ready biodegradability;
  (GLN 835.6200) Aquatic (sediment) Field Dissipation;
  (GLN None) (Special study) Leachability of Irgarol 1051 used in coating systems for outdoor materials such as vinyl roofing, elastomeric roof and wall coatings; and mastics, caulks, sealants, joint cements, spackling, stucco, and grouting. A special leaching study is anticipated as being

needed which would be conducted with various typical end-use products that have been treated with Irgarol 1051.

(GLN None) (Special study) Monitoring of representative U. S. waters (residue of concern).

Anticipated Ecological Effects and Environmental Fate Data Requirements for Outdoor Wood Preservative Uses of Irgarol 1051

Irgarol 1051 is listed as a biocide for use in manufacturing wood preservatives. For Igrarol 1051 registered for treatment of wood products used in outdoor scenarios (e.g., decks, decking materials, aquatic uses), the Agency anticipates requiring the following data in order to conduct the environmental fate and ecological risk assessments, including an endangered species assessment. However, note that expected data needs may depend on factors such as the quantities of Irgarol 1051 (and/or major degradates or metabolites) leaching from wood (e.g., parent compound, major degradates or metabolites); the outdoor use scenarios in which Irgarol 1051 treated wood may be used; and the Agency's evaluation of the leaching data along with the available use, effects, and exposure information for Irgarol 1051:

Ecological Effects and Environmental Fate Studies:[1]

For use in this registration review, the following ecological effects and environmental fate data are anticipated as being needed:

Anticipated Ecological Effects Data Needs:

(GLN 850.4225) Seedling emergence - dose response using rice (*Oryza sativa*);
(GLN 850.4250) Vegetative vigor - dose response using rice (*Oryza sativa*);
(GLN 850.1045) Acute Penaeid;
(GLN 850.1500) Fish (freshwater and/or estuarine/marine species) life cycle study;
(GLN 850.1710) Oyster BCF;
(GLN 850.1850) Aquatic organism bioavailability/biomagnifications, toxicity tests;
(GLN 850.2300) Avian reproductive studies with bobwhite quail and/or mallard duck;
(GLN 850.3020) Honeybee acute contact LD_{50};
(GLN 850.3030) Toxicity of residues to honeybees, “Honey Bee Toxicity of Residues on Foliage”;
(GLN 850.4300) Terrestrial Plants Field Study;
(GLN 850.4450) Aquatic Plants Field Study; and
(GLN None) (Special study) Whole sediment - chronic invertebrates (freshwater and/or estuarine/marine)

Anticipated Environmental Fate Data Needs:

(GLN 835.2410) Photodegradation in soil;
(GLN 835.4200) Anaerobic soil metabolism;

[1] Test material for anticipated studies would depend in part on what chemicals are leaching from Irgarol 1051-treated wood.

(GLN 835.6200) Aquatic (sediment) Field Dissipation;
(GLN None) (Special study) Leachability of Wood Preservatives (AWPA E11-06);
(GLN None) (Special study) Soil leaching from wood study (AWPA E20-04); and
(GLN None) (Special study) Monitoring of representative U. S. waters (residue of concern).

APPENDICES

Appendix A. Environmental Fate Guideline Study Justifications

Guideline	Study Title	Practical Utility of the Data
850.6800	Modified Activated Sludge, Respiration Inhibition	**1) What is the value of the study?** The modified activated sludge, respiration inhibition test would allow EPA to identify antimicrobial pesticides which could harm microorganisms found in biological wastewater treatment systems and would also help establish correct concentrations for use in the ready biodegradability test. **2) How would the data be used?** The data would be used to determine the potential of Irgarol 1051 to directly harm the nontarget organisms and/or to microbial treatment processes present in a WWTP and to determine suitable noninhibitory concentrations of Irgarol 1051 to be used in biodegradability tests. **3) How could the data affect the risk assessment?** If the data shows that Irgarol 1051 is toxic to nontarget organisms and/or to microbial process found in WWTPs then, the Agency may need Tier II environmental fate data to evaluate potential adverse effects on WWTPs. **4) What is triggering the need for this data?** Studies are needed to conduct environmental fate assessment and to determine the potential exposure of Irgarol 1051 to waste water treatment plants (WWTPs) (via effects on WWTP microbes).
835.1110	Activated Sludge Sorption Isotherm	**1) What is the value of the study?** The results from activated sludge sorption study would allow EPA to assess the distribution of the antimicrobial among the solid, aqueous, and vapor phases of WWTPs. Specifically, this study identifies those chemicals which sorb to sludge biomass. **2) How would the data be used?** The data would be used to determine the sorption potential of Irgarol 1051 to activated sludge biomass and in biological wastewater treatment systems. **3) How could the data affect the risk assessment?** If Irgarol 1051 is not sorbed or biodegraded then, it would pass through a biological treatment system unaffected and it may contaminate surface and drinking waters and also may have potential adverse effects to

Appendix A. Environmental Fate Guideline Study Justifications		
Guideline	**Study Title**	**Practical Utility of the Data**
		nontarget organisms. **4) What is triggering the need for this data?** Studies are needed to conduct environmental fate assessment and to determine the sorption potential of activated sludge for the removal of specific chemical compounds in biological wastewater treatment systems.
835.3110	Ready Biodegradability	**1) What is the value of the study?** The ready biodegradability study would enable the Agency to determine the likelihood that the antimicrobial pesticide of biodegrading in aquatic environments under aerobic conditions. **2) How would the data be used?** The results from the data would be used to determine the rate and extent of aerobic biodegradation of Irgarol 1051 when it is released into aquatic environments and would help establish if Irgarol 1051 is stable or not stable under real environmental conditions. **3) How could the data affect the risk assessment?** If the result shows low biodegradability then, Irgarol 1051 would occur in significant quantities in WWTP effluents (water and biosolids) and in environmental compartments (e.g., surface waters) such that potential adverse effects to nontarget organisms, found in such environmental compartments, may occur. **4) What is triggering the need for this data?** Data are needed to conduct environmental fate assessment and to determine the ready biodegradability of Irgarol 1051.
835.2410	Photodegradation in soil	**1) What is the value of the study?** Pesticides are applied to the surface of soil and/or on the exposed surfaces of plants, are then subject to photodegradation. This study will provide data on photolytic pesticide dissipation and on the nature and persistence of photoproducts formed by soil surface catalyzed photolysis. Biocides introduced into the surface of soil in the environment can undergo photolytic transformation by sunlight. Results from the soil photolysis study will indicate the stability and persistence of Irgarol 1051 and potential degradates in the soil environment when exposed to sunlight. For outdoor wood preservative uses, Irgarol 1051 can reach surface soil through direct contact or discharge to WWTPs. Irgarol 1051 may also reach

Appendix A. Environmental Fate Guideline Study Justifications

Guideline	Study Title	Practical Utility of the Data
		surface soil or groundwater through run-off or leaching processes. The Agency will evaluate the potential risks of concern. **2) How would the data be used?** The data would establish the significance of chemical photolysis as a route for degradation and identify, if possible, the photolytic degradation products formed that may adversely affect non-target organisms and may contaminate water and food source of aquatic organisms. The data would also help establish the photolytic half-life of Irgarol 1051 and possibly degradates, and assist in developing a degradation pathway. **3) How could the data affect the risk assessment?** The results of photolysis data would indicate if Irgarol 1051 is persistent or if it degrades into degradation products that may adversely affect nontarget organisms and may contaminate their food. The Agency requires the photodegradation in soil study for wood preservatives. Leaching of wood preservatives (both the parent or transformation products) from preservative-treated wood could contaminate the surrounding soils. This would provide data on the dissipation, nature and persistence of wood preservative degradation products formed by soil surface catalyzed photolysis. Using these data the Agency can assess the extent and duration of human (e.g., children playing below decks) and/or nontarget organism exposures to soils adjacent to preservative treated wood structures. Such soils may contain the parent compound and/or transformation products, which could include those formed via photodegradation processes. **4) What is triggering the need for this data?** Soil photodegradation data is needed to conduct the fate assessment to support indoor and outdoor wood preservative uses for Irgarol 1051.
835.4200	Anaerobic soil metabolism	**1) What is the value of the study?** The purpose of an anaerobic soil metabolism study is to determine the nature and extent of microbial degradation under anaerobic conditions in soil, and characterize the formation and decline of degradates. This information is used to ascertain effects of flooding or water logging on a well-aerated soil, a condition that can have an effect on many oxidation-reduction systems and, in turn, may indirectly affect biocide metabolism and fate. This information will determine the persistence and concentrations of Irgarol 1051 and potential degradates over time in representative soils. The Agency will evaluate the potential risks of concern.

Appendix A. Environmental Fate Guideline Study Justifications

Guideline	Study Title	Practical Utility of the Data
		2) How would the data be used? The data would establish the significance of anaerobic microbial degradation of Irgarol 1051 as a route for degradation and identify, if possible, the degradation products formed that may adversely affect non-target organisms and may contaminate water and food sources of aquatic organisms. The data would also help establish the anaerobic microbial half-life of Irgarol 1051 in soil, and possibly it's degradates, and assist in developing a degradation pathway. **3) How could the data affect the risk assessment?** The results would indicate the nature and extent of formation and decline under anaerobic conditions of Irgarol 1051 and its degradates to which rotational crops and nontarget organisms will be exposed, and to facilitate assessment of potential disposal problems. The study helps to determine the degradation rate (half-life) of Irgarol 1051 in the presence of microorganisms in different natural soils and determines what metabolites are formed under anaerobic (oxygen-poor) conditions in the laboratory. **4) What is triggering the need for this data?** Anaerobic soil metabolism data is needed to conduct the fate assessment to support indoor and outdoor wood preservative uses for Irgarol 1051.
835.6200	Aquatic field dissipation study	**1) What is the value of the study?** The purpose of an aquatic field dissipation study for biocides for aquatic uses is to determine the nature and extent of dissipation and mobility of the biocide and its residues under actual use conditions. These dissipation studies will generate on-site data for evaluating potential hazards of a biocide under actual use conditions (e.g., mobility, formation of metabolites, and disappearance of parent compound) and provide information with respect to mechanisms of dissipation in various aquatic environments. An aquatic field dissipation study is also required because biocide dissipation may proceed at a different rate in the aquatic environment than in laboratory aquatic studies. The results will indicate the potential for Irgarol 1051 to contaminate the aquatic environment that may come in contact with the effluent discharge since biocide residues may be taken up by irrigated crops and passed on to other parts of the aquatic food web. The Agency will evaluate the potential risks of concern. **2) How would the data be used?** The data would establish the significance of aquatic microbial degradation along with mobility of Irgarol 1051

Appendix A. Environmental Fate Guideline Study Justifications		
Guideline	**Study Title**	**Practical Utility of the Data**
		as a route for dissipation under actual use conditions and identify, if possible, the degradation products formed that may adversely affect non-target organisms and may contaminate water and food sources of aquatic organisms. The data would also help establish the aerobic aquatic microbial half-life of Irgarol 1051 in aquatic field systems, and possibly it's degradates, and assist in developing a degradation pathway. **3) How could the data affect the risk assessment?** The results would indicate the nature and extent of leaching and persistence of Irgarol 1051 and its degradates in an aquatic field system under actual use conditions. The results would also facilitate assessment of potential disposal problems. The study helps to determine the degradation rate (half-life) of Irgarol 1051 in an aquatic field system under actual use conditions. **4) What is triggering the need for this data?** Aquatic field study data is needed to conduct the fate assessment to support slimicide uses in once-through industrial cooling tower water systems for Irgarol 1051. Also data are needed in order to conduct an ecological risk assessment for antifoulant coatings, outdoor wood preservative, and aquatic areas use pattern of Irgarol 1051.
AWPA E11-06	Leachability of Wood Preservatives	**1) What is the value of the study?** The results from the wood preservative leaching study would allow measurement of the leaching rate of Irgarol 1051 from treated wood windows, doors, and engineered components used in construction application where decay resistance is necessary. The purpose is to provide information on relative permanency of wood preservatives. The method is designed for waterborne preservatives and may not be applicable to other types of preservatives. For outdoor wood preservative uses, Irgarol 1051 can reach surface water through direct contact or discharge to WWTPs. Irgarol 1051 can also reach surface water or groundwater through run-off or leaching processes. The Agency will evaluate the potential risks of concern. **2) How would the data be used?** The data would be used to determine the leachability of wood preservatives expressed as a percentage of the original preservative retention. The amount of preservative leached is expressed as the ratio of the preservative contained in the leachate to the total preservative present. **3) How could the data affect the risk assessment?**

Appendix A. Environmental Fate Guideline Study Justifications

Guideline	Study Title	Practical Utility of the Data
		If Irgarol 1051 is leached from the wood in large percentage, then it may contaminate surface and drinking waters and also have potential adverse effects to nontarget organisms and the aquatic environment. **4) What is triggering the need for this data?** For wood preservatives, an aquatic leaching study is required. This study is also needed to conduct the ecological effects assessment, to determine the leachability of wood preservatives expressed as a percentage of the original preservative retention and to confirm that ion levels in the leachate would be of no toxicological concern.
AWPA E20-06	Leachability of Wood Preservatives in Soil Contact	**1) What is the value of the study?** The results from the wood preservative leaching study would allow measurement of the leaching rate of Irgarol 1051 from treated wood resulting from physical/chemical reactions during exposure to wet soil. The purpose is to provide information on the relative permanency of wood preservatives designed for treating wood that will be exposed to soil contact. The results are based on the moisture content of the treated wood after removal from the soil and the amount of biocide(s) loss from the treated wood for each specimen. For some outdoor non-aquatic wood preservative uses (i.e., decks and decking material), the wood will be in direct contact with the soil. Irgarol 1051 can reach surface water through direct contact or discharge to WWTPs. Irgarol 1051 can also reach surface water or groundwater through run-off or leaching processes. The Agency will evaluate the potential risks of concern. **2) How would the data be used?** The data would be used to determine the leachability of wood preservatives expressed as a percentage of the original preservative retention. The amount of preservative leached is expressed as the ratio of the preservative contained in the leachate to the total preservative present. **3) How could the data affect the risk assessment?** If Irgarol 1051 is leached from the wood in large percentage then, it may contaminate surface and drinking waters and also may have potential adverse effects to nontarget organisms and the aquatic environment. **4) What is triggering the need for this data?** For wood preservatives, a soil leaching study is required if human or environmental exposures are likely to occur from leachates that contain the active ingredient or principal transformation products from wood treated

Appendix A. Environmental Fate Guideline Study Justifications		
Guideline	**Study Title**	**Practical Utility of the Data**
		with a preservative product. Leachability of wood preservatives in soil contact data is needed to conduct the fate assessment to support indoor and outdoor wood preservative uses for Irgarol 1051. This study is also needed to conduct the ecological effects assessment, to determine the leachability of wood preservatives expressed as a percentage of the original preservative retention and to confirm that ion levels in the leachate would be of no toxicological concern.
(GLN None)	Monitoring of representative U. S. waters (residue of concern)	Monitoring of representative U. S. waters is required because environmental fate study results listed in Table 6 indicate that the active ingredient and principal transformation products are likely to occur in nontarget freshwater, estuarine, or marine waters such that human or environmental exposures are likely to occur.

Appendix B: Ecological Guideline Study Justifications

Guideline	Study Title	Practical Utility of the Data:
Aquatic Organism Testing		
850.1035 or 850.1045	Acute LC_{50} with an estuarine/marine shrimp species	**1) What is the value of the study?** Shrimp are important economic species to the United States as are lobsters, crabs, and other crustaceans. Shrimp are used as surrogate for all other crustaceans. These acute toxicity tests measure mortality of estuarine/marine shrimp species, including mysids (OPPTS 850-1035) and penaeids (OPPTS 850-1045) across a range of concentrations to determine if survival is inhibited by short-term (96-h) exposure to Irgarol 1051 in estuarine/marine waters. **2) How would the data be used?** Data would be used to describe the concentration-response curves and determine 48- and 96-h LC_{50}'s (concentrations calculated to kill 50% of the population) along with 95% confidence intervals. **3) How could the data affect the risk assessment?** *Mysidopsis bahia* is considered as a surrogate species to represent all estuarine/marine invertebrates in the risk assessment process. As part of the acute risk assessment for aquatic animals, the lowest EC_{50} or LC_{50} for estuarine/marine invertebrates is used in the RQ method for expressing risk. An acute RQ > 0.5 would indicate an acute LOC, defined as the potential for acute risk to non-target aquatic organisms which may warrant regulatory action in addition to restricted use classification. An acute RQ > 0.1 would result in an acute restricted use LOC, defined as the potential for acute risk to non-target organisms, which may be mitigated through restricted use classification. An acute RQ > 0.05 would fall under the LOC for acute endangered species. **4) What is triggering the need for this data?** Data are needed in order to conduct an ecological risk assessment for the use of Irgarol 1051 as an antifoulant coating, and outdoor wood preservative and determine the acute toxicity of Irgarol 1051 to estuarine/marine shrimp.
850.1500	Fish (freshwater and/or estuarine/ marine species) life	**1) What is the value of the study?** This study allows the Agency to determine if a pesticide is toxic to fish offspring, reproductive functions and ultimate survival. The fish life cycle toxicity study is required: if the estimated environmental

Appendix B: Ecological Guideline Study Justifications

Guideline	Study Title	Practical Utility of the Data:
	cycle study	concentration is equal to or greater than one-tenth of the NOAEC in the fish early life-stage or invertebrate life-cycle tests; or if studies of other organisms indicate that the reproductive physiology of fish may be affected. Fish are exposed to the pesticide from one stage of the life cycle to at least the same stage in the next generation (e.g., egg to egg), This duration allows examination not only of effects on survival, but also on reproduction (spawning, egg numbers, fertility, and fecundity), locomotion, behavior, physiology, and pathology. **2) How would the data be used?** Data would be used to establish an LC_{50} for mortality and EC_{50}s for selected sublethal (e.g. reproductive) parameters, in addition to NOAECs. Sublethal parameters include embryo hatch rate, time to hatch, growth (length), exposed adult egg production, second generation hatch rate, and second generation growth. **3) How could the data affect the risk assessment?** As part of the chronic risk assessment for aquatic animals, the lowest NOAEC for estuarine/marine fish is used as inputs to the RQ equation. A chronic LOC is defined by an RQ > 1, and would indicate that there is the potential for chronic risk that may warrant regulatory action and that endangered species may potentially be affected through chronic exposure. **4) What is triggering the need for this data?** Data are needed in order to conduct an ecological risk assessment for the use of Irgarol 1051 as an antifoulant coating, and outdoor wood preservative and determine the chronic toxicity of Irgarol 1051 to freshwater and marine fish using life-cycle studies.
850.1710 850.1730 850.1850	Aquatic organism bioconcentration/ biomagnification/ toxicity tests	**1) What is the value of the study?** The value of these studies is that freshwater and/or marine aquatic species of invertebrates and vertebrates can be examined to determine if a pesticide has the potential to accumulate in body tissues directly through bioconcentration from the water and/or indirectly through biomagnification via food transfer up the food chain. **2) How would the data be used?** In the oyster (850.1710) and fish (850.1730) BCF tests, parameters include mortality, abnormalities,

Appendix B: Ecological Guideline Study Justifications

Guideline	Study Title	Practical Utility of the Data:
		steady-state or maximum bioconcentration factors (BCF) and uptake and depuration rate constants. Additionally, the major degradates can be identified and quantified at steady state. In the aquatic food chain transfer study (850.1850), a hierarchy of organisms at different trophic levels is included to assess biomagnification. Typically, the categories include insect nymphs, crustaceans, mollusks, and fish (bottom-feeding, cold-water, and warm-water or marine). **3) How could the data affect the risk assessment?** In the risk assessment process, direct effects LOCs for each taxonomic group are used to make inferences concerning the potential for indirect effects upon listed species that rely upon non-endangered organisms. Information on the bioconcentration from water and biomagnification via the food chain would assist risk assessors in making the inferences about indirect effects. **4) What is triggering the need for this data?** Data are needed in order to conduct an ecological risk assessment for the use of Irgarol 1051 as an antifoulant coating, and outdoor wood preservative and determine any potential bioconcentration from the water or biomagnification via food transfer.
Sediment Testing		
None	Whole sediment - chronic invertebrates (freshwater and/or estuarine/marine)	**1) What is the value of the study?** Some pesticides tend to build up in sediments over time. Some pesticides are released from sediments into water and some are bound to sediments. The value in these non-guideline chronic studies is that they provide longer-term toxicity data than the acute whole sediment freshwater and estuarine/marine invertebrate studies. These studies use natural sediment spiked with different concentrations of test chemical to determine the toxicity and bioaccumulation potential of chemicals in sediments and freshwater and estuarine/marine invertebrates. Whole sediment toxicity tests may include the freshwater amphipod, *Hyalella azteca*, and the midge, *Chironomus tentans*, for freshwater tests and the estuarine/marine amphipods, *Ampelisca abdita*, *Eohaustorius estuarius, Rhepoxynius abronius, and Leptocheirus plumulosus* for salt water tests. **2) How would the data be used?** Reported endpoints from whole sediment chronic toxicity tests may include the LC_{50}, EC_{50}, NOAEC, or the LOAEC. Results from the sediment toxicity tests can be used to determine causal relationships

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Guideline	Study Title	Practical Utility of the Data:
		between the chemical and biological responses within the sediment and the organisms. **3) How could the data affect the risk assessment?** While other studies address the aquatic toxicity and/or bioconcentration of invertebrates in the water column, this whole sediment acute toxicity test can provide valuable information on the toxicity of Irgarol 1051 to freshwater invertebrates in and/or on the sediment. In addition to the interface with the overlying water, these invertebrates are exposed via the sediment pore water, for which the water chemistry is often significantly different. Furthermore, freshwater amphipods and midges and estuarine/marine amphipods serve important ecological roles as food sources for vertebrates and larger invertebrates. **4) What is triggering the need for this data?** Sediment testing with estuarine/marine test species is required because the log Kow is greater than 3 and the Koc is equal to or greater than 1,000. These values indicate that there is a high potential for Irgarol 1051 to preferentially partition to aquatic sediment. Data are needed in order to conduct an ecological risk assessment for the use of Irgarol 1051 as an antifoulant coating and outdoor wood preservative and determine chronic toxicity and bioaccumulation potential of chemicals in sediments and freshwater and estuarine/marine invertebrates.
Avian Testing		
850.2300	Avian reproductive studies with bobwhite quail and/or mallard duck	**1) What is the value of the study?** Birds eat certain insects and plants, wade in contaminated water, and ingest residue by preening. Over time, the residues build up to toxic levels. The value of this study is that it provides data on the reproductive effects of Irgarol 1051 via dietary exposure on the bobwhite and mallard. The test consists of three phases. In the initial phase, hens are fed the test diets for 6 to 8 weeks. During the second phase, the photoperiod is manipulated to bring the hens into laying condition, and this phase ends with the onset of egg-laying. The final phase comprises 8-10 weeks of egg-laying. **2) How would the data be used?** Results of this study will be used to measure any possible reproductive risks to birds from exposure to Irgarol 1051 by examining the numbers of eggs laid, eggs cracked, viable embryos (fertility), embryos alive at 18 days, and chicks surviving to 14 days. Additionally, hatchability and eggshell thickness are reported.

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Guideline	Study Title	Practical Utility of the Data:
		3) How could the data affect the risk assessment? These bird species act as surrogate species for reptiles and terrestrial-phase amphibians, in addition to all other birds in the risk assessment process. There are many avian, reptile, and amphibian species that are listed as threatened and endangered in the United States. Amphibian declines, in particular, are a recent concern. As part of the chronic risk assessment for terrestrial animals, the lowest NOAEC for avian toxicity is used in the RQ equation. A chronic LOC is defined by an RQ > 1, and would indicate that there is the potential for chronic risk that may warrant regulatory action and that endangered species may potentially be affected through chronic exposure. **4) What is triggering the need for this data?** Data are needed in order to conduct an ecological risk assessment for the use of Irgarol 1051 as an antifoulant coating and outdoor wood preservative and determine the effects of Irgarol 1051 on avian reproduction.
Insect Pollinator Testing		
850.3020 850.3030	Honeybee acute contact LD_{50} Honey Bee Toxicity of Residues on Foliage (Toxicity of residues to honeybees)	**1) What is the value of the study?** Pesticide treated wood is sometimes used to make bee hives resulting in bee exposure to pesticide residues. The honey bee acute contact toxicity test provides data on the acute toxicity (following a single exposure via microapplicator or dusting) followed by a 48-h observation period. **2) How would the data be used?** Results of this study will be used to assess risks to honeybees (nontarget insects) from exposure to Irgarol 1051. Mortality, signs of intoxication, and other abnormal behavior (e.g., ataxia, lethargy, hypersensitivity) are reported. The LD_{50} with 95% confidence interval is calculated from the dose-response curve data. **3) How could the data affect the risk assessment?** Data are needed for future regulatory decisions and for an endangered species assessment in particular. There are many terrestrial invertebrates that are listed as threatened and endangered. The data would allow the Agency better characterize the potential risk to insects (including beneficial pollinators) from the use of Irgarol 1051.

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Guideline	Study Title	Practical Utility of the Data:
		4) What is triggering the need for this data? This study has been added to the battery of studies that EPA requires to support outdoor uses when honeybees are likely to be exposed to pesticides. The proposed use of Irgarol 1051 for potential outdoor use as a wood preservative would likely allow bees to be exposed to the pesticide.
Plant Testing		
850.4225	Seedling emergence, Tier II - dose response using rice (*Oryza sativa*)	**1) What is the value of the study?** Plants prevent erosion and provide animals with food and shelter. The rooted aquatic plant, rice is used to represent exposure to all vascular rooted plants. Tier II (Definitive Studies) tests are initiated following a determination that a greater than 25% adverse effect occurred in the Tier I (Initial Screening Study) seedling emergence study for one or more plant species. These Tier II terrestrial nontarget plant phytotoxicity tests evaluate the acute toxicity of pesticides to 10 crop plant species, including six Dicots and four Monocots. Although rice (*Oryza sativa*) is not one of the surrogate terrestrial crop plants typically tested, its semiaquatic environment is applicable to run-off scenarios. If conducting tests under TSCA, the test material is applied daily with each watering for the duration of the study. Observations are carried out for at least 14 days after seedling emergence. **2) How would the data be used?** Along with vegetative vigor studies, results of these studies will be used to assess risks to of Irgarol 1051 exposure to terrestrial, semiaquatic, and aquatic nontarget plants. Parameters of plant growth include percent emergence, number of emerged plants, seedling height, seedling dry weight, root length, root dry weight, and signs of phytotoxicity. Results are reported as EC_{05} (NOAEC), EC_{25}, and EC_{50}. **3) How could the data affect the risk assessment?** Because Irgarol 1051 would not be directly applied to the field, information on environmental fate and transport would affect the risk identification and characterization to non-target plants. Nontarget plants include plants outside the area of intended application (which would typically include food and cover vegetation for animals, food, fiber, fuel, and ornamental plants for humans, and endangered and threatened plants). Terrestrial plants serve as food and shelter for fish and wildlife, help control erosion, and serve as air pollution filters. Shoreline vegetation buffers reduce siltation and provide an environment in which aquatic invertebrates can contribute to the food supply of fish, reptiles, and amphibians. Vegetation adjacent to streams serves to regulate water temperature, which in turn

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Guideline	Study Title	Practical Utility of the Data:
		contributes to improved aquatic life. Decaying vegetation provides nutrients essential for the aquatic food chain. Hedgerows, woodlots, and other similar nontarget areas provide food and cover to mammalian and avian species. There are many terrestrial plants that may be affected where Irgarol 1051 is used as an antifoulant coating and outdoor wood preservative. If EPA is unable to evaluate the potential risks to terrestrial plants associated with the new use of Irgarol 1051, these risks must be presumed. As part of the risk assessment for terrestrial plants (non-endangered and endangered), the lowest EC_{25} for monocots and dicots is used in the RQ equation. The LOC for endangered and non-endangered plants is defined as a RQ > 1. **4) What is triggering the need for this data?** Data are needed in order to conduct an ecological risk assessment for the use of Irgarol 1051 as an antifoulant coating and outdoor wood preservative and determine the effects of Irgarol 1051 on seedling emergence.
850.4250	Vegetative vigor, Tier II - dose response using rice (*Oryza sativa*)	**1) What is the value of the study?** Plants prevent erosion and provide animals with food and shelter. The rooted aquatic plant, rice is used to represent exposure to all vascular rooted plants. Tier II (Definitive Studies) tests are initiated following a determination that a greater than 25% adverse effect occurred in the Tier I (Initial Screening Study) vegetative vigor study for one or more plant species. These Tier II terrestrial nontarget plant phytotoxicity tests evaluate the acute toxicity of pesticides to 10 crop plant species, including six Dicots and four Monocots. Although rice (*Oryza sativa*) is not one of the surrogate terrestrial crop plants typically tested, its semiaquatic environment is applicable to both leaching and run-off scenarios. The test material is applied 2 to 4 weeks after the plants have emerged from the soil, and observations are carried out for at least 14 days. **2) How would the data be used?** Along with the seedling emergence studies, results of these studies will be used to assess risks to terrestrial and aquatic plants from exposure to Irgarol 1051. Parameters of plant growth include plant height, plant dry weight, root length, root dry weight, and signs of phytotoxicity. Results are reported as EC_{05} (NOAEC), EC_{25}, and EC_{50}.

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Guideline	Study Title	Practical Utility of the Data:
		3) How could the data affect the risk assessment? Because Irgarol 1051 would not be directly applied to the field, information on environmental fate and transport would affect the risk identification and characterization to non-target plants. There are many terrestrial plants that are listed as threatened and endangered in the United States where Irgarol 1051 is used as an antifoulant coating and outdoor wood preservative. If EPA is unable to evaluate the potential risks associated with the antifoulant coating and outdoor wood preservative uses of Irgarol 1051, these risks must be presumed. As part of the risk assessment for terrestrial plants (non-endangered and endangered), the lowest EC_{25} for monocots and dicots is used in the RQ equation. The LOC for endangered and non-endangered plants is defined as a RQ > 1. **4) What is triggering the need for this data?** Data are needed in order to conduct an ecological risk assessment for the use of Irgarol 1051 as an antifoulant coating and outdoor wood preservative and determine the effects of Irgarol 1051 on vegetative vigor.