Pest Management Regulatory Agency
Agence de réglementation de la lutte antiparasitaire

# Regulatory Note REG2000-06

## Propiconazole

The formulated product Mycostat P, containing the active ingredient propiconazole, has been granted temporary registration under section 17 of the Pest Control Products Regulations. Mycostat P is intended for the prevention of sapstain, mould and decay of freshly cut lumber.

This regulatory note provides a summary of data reviewed and the rationale for the regulatory decision concerning this product.

*(publié aussi en français)*

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## Foreword

The formulated product Mycostat P, containing the active ingredient propiconazole, has been granted temporary registration under section 17 of the Pest Control Products (PCP) Regulations. Mycostat P is intended for the prevention of sapstain, mould and decay of freshly cut lumber. The technical grade active ingredient (TGAI), propiconazole, is registered under the *Pest Control Products Act* (PCP No. 22474).

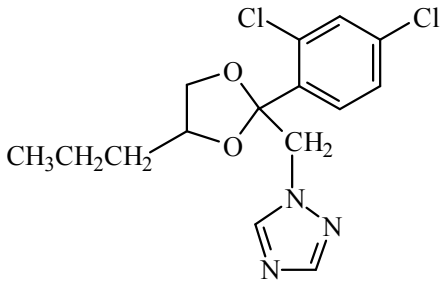
Methods of analysis of propiconazole residues in various environmental media can be provided to monitoring agencies and research institutions upon request to the Pest Management Regulatory Agency (PMRA).

Janssen Pharmaceutica will be carrying out additional studies as a condition of this temporary registration. Following the review of this new data, the PMRA will publish a Proposed Regulatory Decision Document and request comments from interested parties before proceeding with a final regulatory decision.

# Table of Contents

# 1.0 The active substance, its properties, uses, proposed classification and labelling

## 1.1 Identity of the active substance and preparation containing it

| | |
|---|---|
| Common name: | Propiconazole |
| Function: | Antisapstain fungicide |
| Chemical name: | |
| (International Union of Pure and Applied Chemistry): | (±)-1-[2-(2,4-dichlorophenyl)-4-propyl-1,3-dioxolan-2-ylmethyl]-1*H*-1,2,4-triazole |
| (Chemical Abstract Services (CAS)): | 1-[2-(2,4-dichlorophenyl)-4-propyl-1,3-dioxolan-2-ylmethyl]-1*H*-1,2,4-triazole |
| CAS number: | 60207-90-1 |
| Molecular formula: | $C_{15}H_{17}Cl_2N_3O_2$ |
| Molecular weight: | 342.22 |
| Structural formula: |  |

*cis + trans*

| | |
|---|---|
| Nominal purity of active: | 95% |
| Identity of relevant impurities of toxicological, environmental and other significance: | The technical active ingredient was analyzed for dioxins. 2,3,7,8-TCDD and 2,3,7,8-TCDF were not detected at a detection limit of 15 parts per trillion. The product does not contain any formulants identified as Toxic Substances Management Policy (TSMP) Track-1 substances. |

The end-use product, Mycostat P, contains the active ingredient propiconazole at 4.5%. The TGAI is registered under the *Pest Control Products Act* (PCP No. 22474).

## 1.2 Physical and chemical properties

### Physical and chemical properties of the technical material and the pure substance

| Property | Result |
|---|---|
| Colour and physical state | Clear, yellowish liquid |
| Odour | Very slight mild |
| Boiling point or range | Pure active ingredient: 180°C at 0.1 mm Hg |
| Specific gravity | TGAI: 1.27 |
| Vapour pressure at 20°C | $<3 \times 10^{-6}$ mm Hg |
| Solubility in water at 20°C | 110 parts per million (ppm) |
| Solubility in organic solvents | Miscible with methanol, acetone, methylene chloride, toluene, *n*-octanol, 6% in hexane |
| *n*-Octanol–water partition coefficient | log $K_{ow}$ = 3.65 ($K_{ow}$ = 4500) |
| Dissociation constant | p$K_a$ = 1 |
| Stability (temperature, metal) | Stable |

### Physical and chemical properties of the end-use product

| Property | Result |
|---|---|
| Colour | Yellowish |
| Physical state | Liquid |
| Odour | Weak |
| Formulation type | Emulsifiable concentrate |
| Container material and description | Plastic |
| Density or specific gravity | 0.907 |
| pH | 5.89 |
| Viscosity | 143 mPa |
| Storage stability data | Stable |
| Flammability | Flash point > 100°C |
| Explodability | Not explosive |

A storage study carried out in glass bottles showed no significant change in the amount of propiconazole in the product, which shows that the product is stable for 12 months or longer.

## 1.3 Details of use and further information

Propiconazole was first registered (temporary registration, restricted class) in Canada in 1986 as the fungicide for cereal crops. In 1987, a discussion document (D87-05, *Propiconazole*) summarized the data reviewed for propiconazole and outlined a proposed regulatory decision for the active ingredient as a cereal crop fungicide. On the basis of the review of all available information and in consideration of wide ranging comments received, temporary restricted class registration was granted pending resolution of items including occupational exposure potential under Canadian use conditions and toxicity of the formulated product to algae. Once these items were addressed, the registration status of propiconazole as a cereal fungicide was converted to full (1992). The current uses of propiconazole include wheat, barley, hard red wheat, durum wheat, oat, rutabaga, canola, seed corn and turf grasses.

In 1995, two formulations containing propiconazole, Wocosen S and Wocosen WR, were granted temporary registration for the wood joinery use pending confirmatory data on occupational exposure. The Sapstain Industry Group is conducting a multiphase generic occupational exposure study for antisapstain chemicals. This information is applicable to wood joinery. Phase III of the study is complete and has been submitted to the Agency for review.

In 1995, Janssen Pharmaceutica submitted an application for Mycostat P, a product formulated as an emulsifiable concentrate, containing 4.5% weight per weight (w/w) propiconazole. It was proposed for use in the prevention of sapstain, mould and decay of freshly cut lumber. Bridging studies were used for toxicological evaluation.

Propiconazole has been registered for antisapstain use in the United States (U.S.) since 1996.

## 1.4 Classification and labelling

The personal protective equipment and clothing statements in the PRECAUTION section of the Mycostat P have been modified to read:

> When handling the concentrate, wear eye protection (goggles) and chemical-resistant gloves, apron and boots. Use a cartridge respirator if the area is not well ventilated and during clean-up, maintenance and repair activities. When working in the dip or spray area, or handling contaminated equipment, wear chemical-resistant gloves. Wear chemical-resistant aprons, boots and gloves if there is potential for getting wet by the treating solution or by

handling freshly treated lumber. Wear eye protection if there is a possibility of splashing. Once dry, the treated wood can be handled with cotton or leather gloves.

## 2.0 Methods of analysis

The analytical method was provided for the determination of the active ingredient. Chromatograms of the formulation and a formulation blank have been provided. The blank chromatogram indicates no interferences at the retention time of the active ingredient. The method was assessed to be specific, precise and accurate for use as an enforcement analytical method and can be applied to the determination of Mycostat P.

## 3.0 Impact on human and animal health

### 3.1 Integrated toxicology summary

Oral metabolism studies in rats with radiolabelled propiconazole indicated rapid urinary (21%) and fecal (69%) excretion within 24 hours (h) with negligible quantities in expired air. Recovery was almost complete by six days, with the highest levels found in the liver, blood, kidneys and lungs. Several metabolites were excreted but were not identified.

In acute testing, propiconazole was slightly toxic via the oral route and of low toxicity via the dermal route to rats. It was minimally irritating to the rabbit eye and mildly irritating to rabbit skin and was not a dermal sensitizer in a Buehler study in guinea pigs.

On the basis of acute testing with a similar end-use formulation, Mycostat P was considered to be slightly acutely toxic via the oral route of exposure and moderately acutely toxic via the dermal and inhalation routes of exposure. It was corrosive to rabbit eyes and extremely irritating to rabbit skin. The product was not considered a dermal sensitizer in guinea pigs (Buehler method).

In two short-term dietary studies in beagle dogs, there were no effects observed at any dose tested. No observed effect levels (NOEL) were set, therefore, at the top doses of 10 mg/kg body weight (bw)/day (12-month study) and 35 mg/kg bw/day (three-month study). In SPF rats (90-day dietary study), a NOEL of 12 mg/kg bw/day was set on the basis of decreased body weight gain at 60 and 300 mg/kg bw/day (highest dose). At 300 mg/kg bw/day,  -glutamyl transpeptidase was increased. There were no effects observed in a 90-day SPF rat inhalation study with doses up to 191 mg/m$^3$ day. In a 21-day dermal study in New Zealand White rabbits, a systemic NOEL was set at 200 mg/kg bw/day on the basis of clinical signs (sedation, ruffled fur, dyspnea, tremor, ataxia, thickening of the skin) observed in a dose-related manner at the two top doses of 1000 and 5000 mg/kg bw. Slight dermal irritation occurred at all treatment levels.

Technical propiconazole did not demonstrate mutagenic potential in a battery of point mutation (in vitro) and chromosome aberration (in vitro and in vivo) studies.

In a long-term dietary study in Sprague–Dawley rats, NOELs of 3.6 (males) and 4.5 mg/kg bw/day (females) were established on the basis of reduced body weight gain at higher doses, and increased liver weights and enlarged hepatocytes at the top dose equivalent to 90 mg/kg bw/day. There was no evidence of tumour induction. In a long-term dietary study in CD-1 mice there was a significantly increased incidence of both benign and malignant hepatocellular tumours in the high-dose males (equivalent to 358 mg/kg bw/day). The finding of increased hepatocellular tumours was only at dose levels at which a disturbance of liver cell integrity occurred, characterized by elevated enzyme activity (GPT, GOT, SAP), increased liver weights and non-neoplastic liver morphology (hepatocyte enlargement and fat deposition). There was an indication of shortening of the life span caused by the tumours. The lowest dose tested (14.3 mg/kg bw/day) was considered to be a NOEL for chronic toxicity in mice, on the basis of transient liver weight changes at the next highest dose.

In an oral gavage Sprague–Dawley rat teratology study, no teratogenicity was observed. At the highest dose level of 300 mg/kg bw/day, maternal toxicity was evident (decreased body weight, increased mortality). Delayed fetal ossification (decreased ossification of the phalanges) at the mid dose of 100 mg/kg bw/day and higher resulted in a developmental NOEL of 30 mg/kg bw/day. In the oral Chinchilla rabbit study, no teratogenic or fetotoxic effects were observed. The NOEL of 90 mg/kg bw/day at the mid dose was based on maternal toxicity (decreased body weight gain) at the top dose of 180 mg/kg bw/day.

A two-generation (two-litter) dietary reproduction study in CD rats resulted in treatment-related effects on both parents (liver histology: hepatocyte swelling and clear cell change) and progeny (decreased body weight gain) at 500 ppm. The NOEL for general toxicity in the parents and offspring was set at the low dose of 100 ppm, equivalent to 5 mg/kg bw/day. At the highest dose of 2500 ppm equivalent to 125 mg/kg bw/day, decreased live litter size and decreased lactation and viability indices were observed, resulting in a reproductive NOEL of 500 ppm equivalent to 50 mg/kg bw/day.

In other toxicology studies, a rat tumour promotion study suggested the promoting ability of propiconazole but did not preclude its potential for tumour induction. It should be noted, however, that the long-term bioassay in the rat was negative with respect to liver tumours. In another 14-day oral rat study at doses of 20–320 mg/kg bw/day of propiconazole, an effect on increased relative liver weights that was accompanied by proliferation of the smooth endoplasmic reticulum and pronounced metabolizing enzyme activity was demonstrated.

As with other triazole fungicides, the primary target organ was the liver. At doses that induce severe liver toxicity such as in the chronic mouse study, hepatocellular tumours occurred, but this is considered a threshold response. Propiconazole is not mutagenic and not teratogenic, but fetotoxicity occurred in the form of decreased ossification at non-maternally toxic doses in the rat teratology study. Reproductive toxicity was evident as decreased viability and lactation indices at maternally toxic doses.

### 3.2 Determination of acceptable daily intake

An acceptable daily intake (ADI) of 0.04 mg/kg bw is recommended for propiconazole. This is based on the NOEL of 3.6 mg/kg bw/day obtained in the chronic toxicity and oncogenicity study in the rat and a 100-fold safety factor (SF). In addition, this NOEL provides an approximately 10-fold additional margin of exposure (MOE) for the fetotoxicity NOEL of 30 mg/kg bw/day established in the rat teratology study.

### 3.3 Acute reference dose

Acute toxicity was observed in the rabbit teratology study. A clinical sign of sedation was observed in the high-dose (180 mg/kg bw/day) females during the first three days of treatment. This clinical sign was also observed in a short-term dermal toxicity study in the rabbit, and some other studies at higher doses. Thus, this finding is used in the determination of the acute reference dose (ARfD). The NOEL for this acute effect was 90 mg/kg bw/day. Calculation of the ARfD is based on an SF of 100. The ARfD is calculated according to the following formula:

ARfD = NOEL/safety factor

= (90 mg/kg bw/day)/100

= 0.9 mg/kg bw/day of propiconazole

### 3.4 Toxicology end-point selection for occupational risk assessment

As occupational exposure to Mycostat P can be chronic in nature, the relevant toxicology study is the chronic rat study, in which a NOEL of 3.6 mg/kg bw/day was derived on the basis of liver toxicity. In addition, this NOEL provides an approximately 10-fold additional MOE for the fetotoxicity observed in the rat teratology study.

### 3.5 Impact on human and animal health arising from exposure to active substance or to impurities contained in it

#### 3.5.1 Operator exposure assessment

Mycostat P is an emulsifiable formulation for use in the prevention of sapstain, mould and decay of freshly cut lumber, using conventional application equipment.

Prior to the late 1980s, chlorophenate compounds were used extensively in Canadian sawmills and planer mills to control moulds and sapstain fungi on export lumber. Qualitative studies available for mostly chlorophenate compounds can be used to provide a comparative qualitative assessment of exposure. On the basis of these studies of chlorophenate exposure, the job categories receiving highest exposure were graders, chain sorters and dip tank carrier drivers in both the sawmills and the planer mills.

Two surveys have been conducted of sawmills and shipping terminals where antisapstain products are used. These surveys characterized the occupational exposure scenario (e.g., job tasks, range of application equipment). These surveys identified several types of application systems, including forklift dip tank, forklift and elevator dip tank, automated elevator dip tank, sorting chain (trough) dip tank, linear spray box, cross chain (transverse) spray box and carwash spray box. On the basis of the survey results, workers could be grouped according to potential for exposure, and include the following categories: workers who handle wet wood (e.g., graders, pullers); forklift drivers who dip lumber and elevator dip tank operators; maintenance workers who work on the treatment systems; and workers who handle dried treated wood.

There is potential for dermal and inhalation exposure. Exposure can be long-term, as applications take place on a regular basis throughout the year.

No quantitative exposure data were submitted for Mycostat P. The registrant, however, is a member of the Sapstain Industry Group, which is conducting a multiphase generic occupational exposure study for antisapstain chemicals. Phase III of the study is complete and has been submitted to the Agency for review.

A risk assessment for the use of Mycostat P as an antisapstain chemical cannot be conducted in the absence of an appropriate exposure assessment. It is recognized that, in the absence of the occupational exposure study, personal protective clothing and equipment currently specified on the label is an important exposure reduction measure. Upon submission of the final phase of the occupational exposure study, a review will provide the basis for an occupational risk assessment and a final regulatory decision.

## 4.0 Fate and behaviour in the environment

In view of the proposed antisapstain use for propiconazole, and its expected leaching from treated wood and movement in stormwater runoff, the environmental risk assessment of propiconazole was limited to aquatic ecosystems. Propiconazole is resistant to hydrolysis and to phototransformation. Propiconazole is moderately persistent in aerobic environments and persistent in anaerobic environments. Although propiconazole is water soluble, the compound will partition readily into sediment, where it is expected to persist and accumulate under anaerobic conditions.

In terms of acute toxicity, propiconazole is moderately toxic to fish (lethal concentration 50% [$LC_{50}$] = 1–10 mg/L) and moderately to highly toxic to aquatic invertebrates ($LC_{50}$ = 0.10–1.0 mg/L). Chronic exposure to propiconazole causes reproductive toxicity in freshwater and marine aquatic invertebrates and in fish. Propiconazole is also toxic to algae and diatoms.

On the basis of a leaching study using lumber treated with Mycostat P, the mean estimated stormwater runoff concentration of propiconazole was 0.45 mg/L, which exceeds the most sensitive indicator of toxicity (chronic no observed effect concentration

[NOEC] of 0.054 mg/L to mysid shrimp [*Mysidopsis bahia*]) by about eight times. This stormwater runoff concentration represents the concentration of propiconazole at the end of the discharge pipe and is likely to undergo dilution by receiving water that will reduce the actual water-borne concentration of propiconazole to which aquatic organisms will be exposed. The rate of input through runoff into aquatic systems will depend on the frequency of rainfall events.

**Environmental chemistry and fate**

Propiconazole is soluble in water (110 mg/L) but has a log $K_{ow}$ of 3.65, indicating some potential to bioconcentrate. A vapour pressure of $1.3 \times 10^{-4}$ Pa and a Henry's Law Constant of $3.99 \times 10^{-9}$ atm $m^3$/mol indicate little potential for volatilization.

Propiconazole does not undergo hydrolysis and is resistant to phototransformation. A first order half-life of 249 days for phototransformation in aqueous systems indicates that this process will not be a major transformation pathway.

Under aerobic aquatic conditions, propiconazole is expected to be moderately persistent (dissipation time 50% [$DT_{50}$] of 112 days for water; $DT_{50}$ of 91 days for sediment) on the basis of a laboratory study using a water-and-sediment system under ideal conditions (i.e., 20°C, low sediment content and agitation to maintain aerobicity). Such an aerobic system, however, may not be representative of the many less oxygenated aquatic ecosystems. Propiconazole is expected to partition readily from the water column to sediment and, where anaerobic conditions exist, is expected to be persistent. Data indicated that the $DT_{50}$, under anaerobic conditions, would exceed one year. Transformation products are not expected to be problematic, being present in amounts less than 10% of parent compound levels.

Leachability of propiconazole from green, British Columbia (B.C.) hemlock fir, treated with Mycostat P at a targeted retention of 30 Fg active ingredient (a.i.)/$cm^2$, is estimated to represent a loss of 1% of the compound from treated lumber. Estimated stormwater runoff concentration for typical antisapstain facilities in B.C. is estimated to be 0.45 mg propiconazole/L (range of 0.28–1.13 mg a.i./L).

## 5.0 Effects on nontarget species

Propiconazole has minimal toxicity to wild birds and mammals and is unlikely to pose a direct hazard to these organisms as a consequence of its use as a sapstain control agent. Propiconazole has been reported to be nontoxic to terrestrial invertebrates and terrestrial microorganisms.

Propiconazole is toxic to diatoms, on the basis of median effective concentration ($EC_{50}$) values of 0.021 mg/L for *Skeletonema costatum* (a marine species) and 0.093 mg/L for *Navicula seminulum* (a freshwater species) but is less toxic to other freshwater algae, as

indicated by $EC_{50}$ values of 1.5 mg/L for *Selenastrum capricornutum* (a green alga) and 13.58 mg/L for *Anabaena flos-aquae* (a blue-green species).

Moderate acute toxicity of propiconazole to water flea (*Daphnia magna*) is indicated by 48-h $EC_{50}$ values in the range of 1–11.5 mg/L, while chronic toxicity studies to evaluate reproduction and survival in this daphnid provided a NOEC of 0.31 mg/L. High acute toxicity of propiconazole to mysid shrimp is indicated by a 96-h $LC_{50}$ of 0.51 mg/L, while chronic toxicity studies with respect to the survival and reproduction of this shrimp provided NOEC values of 0.054 mg/L and 114 mg/L, respectively.

Acute toxicity of propiconazole to fish is moderate, as indicated by 96-h $LC_{50}$ values that range from 1 to 7 mg a.i./L, depending on formulation and species tested. Results of chronic toxicity studies with propiconazole on sheepshead minnow (*Cyprinodon variegatus*) indicate that the compound does not affect the hatching success, survival or growth of fish that were exposed to propiconazole concentrations up to 0.60 mg/L throughout their egg-to-adult development. The reproductive success of these sexually mature fish, however, was shown to be compromised (NOEC of 0.068 mg/L), as was the hatching success of their spawned eggs (NOEC of 0.15 mg/L). Post-hatch survival and growth of larval offspring from these parents were unaffected by continued exposure to propiconazole. The underlying cause of reproduction effects in fish and aquatic invertebrates has not been established.

On the basis of bioconcentration factors (BCF) of 24–516 (mean of 257) associated with 98% depuration of accumulated residues within 14 days, reported for bluegill sunfish (*Lepomis macrochirus*), bioaccumulation through aquatic foodchains is not expected to occur.

**Environmental risk assessment**

The potential concentration of propiconazole in the receiving water is unknown. The risk assessment, therefore, is based on a comparison of the mean estimated concentration of propiconazole in end-of-pipe stormwater runoff with the most sensitive indicator of toxicity to generate a margin of safety (MOS).

$$\text{MOS} = \frac{\text{28-day NOEC for most-sensitive species (}\textit{M. bahia}\text{)}}{\text{Estimated concentration in (end-of-pipe) runoff}}$$

$$= \frac{0.054 \text{ mg/L}}{0.45 \text{ mg/L}}$$

$$= 0.12$$

The calculated MOS is less than one, indicating that, *if* exposed continuously to end-of-pipe stormwater runoff, there would be a potential for adverses effects on aquatic biota. Because this scenario is unlikely, however, biota in natural aquatic habitats are expected to be exposed to propiconazole concentrations much lower than 0.45 mg/L.

Propiconazole is expected to partition into sediment and, because the compound is persistent under anaerobic conditions, there is a potential for accumulation in anaerobic sediment.

# 6.0 Efficacy data and information

## 6.1 Intended use

Freshly cut unseasoned lumber will suffer attack by stain, mould and decay fungi during storage and in transit. This results in unsightly discoloration and a significant reduction in product value. To prevent such biodeterioration following sawing, lumber must be chemically treated or kiln dried.

## 6.2 Mode of action

Propiconazole is a systemic fungicide with a broad range of activity. It inhibits fungi by interfering with ergosterol biosynthesis, an essential part of the metabolism process in fungi.

## 6.3 Efficacy

Data were provided on an acceptable surrogate product, Wocosen 50 SL. Wocosen 50 SL outperformed the commercial standard on Douglas-fir and hemlock fir. A target retention rate of 15-20 Fg/cm$^2$ propiconazole up to a maximum of 40 Fg/cm$^2$, is recommended.

### 6.3.1 Small scale trials

Two field trials were conducted at Vancouver, B.C., and in Oregon. These trials were conducted using Douglas-fir and hemlock fir.

| | |
|---|---|
| Product name: | Wocosen 50SL (Test material used as surrogate for Mycostat P) Janssen has confirmed that these products are identical. |
| Active ingredient: | Propiconazole 4.5% |
| Mode of application: | Spray and dip one minute |
| Rates: | Applied at 10% dilution (hemlock fir) 20 Fg/cm$^2$ propiconazole on wood and 20% dilution (Douglas-fir) 30–40 Fg/cm$^2$ |

| | |
|---|---|
| Controls: | Untreated and commercial standard deposition rate analyzed by high performance liquid chromatography Forintek |
| Wood species: | Douglas-fir and hemlock fir |
| Sample size: | Forintek study, 80 pieces not end matched |
| | Oregon study, Douglas-fir 100 pieces end matched per group |
| Other variables: | disease pressure (wood inoculated with various fungal spores, wood not inoculated) |
| | inspection time (6 weeks, 14 weeks and one year) |
| | chemical analysis confirmed the levels of active(s) for propiconazole and commercial standard on wood |
| Rating system: | visual, subjective 0–5 (pass is 2), does not take into account industrial acceptable overall rating of 80% stain free |

The target deposition level for propiconazole for Mycostat P is 20 Fg/cm$^2$ for hemlock fir and 30–40 Fg/cm$^2$ for Douglas-fir.

Pasteurization did not result in a significant difference in performance levels. The moisture from pasteurization may increase the risk slightly.

Untreated control samples all showed severe degradation with none meeting the industrial acceptable level of 80% stain free. Pasteurized samples were more severely attacked, possibly owing to the increased moisture content from the pasteurization process.

During the Forintek trial, Mycostat P (retention = 17.0–18.4 Fg a.i./cm$^2$) outperformed the commercial standard at its recommended retention on both hemlock fir and Douglas-fir. On hemlock fir, the commercial standard was not effective at twice its recommended retention (highest retention tested), while on Douglas-fir, the percentage of pieces rating acceptable were comparable to the commercial standard's performance at the higher retention value.

The rating levels are designed for a passing grade of 2.0 for construction material. Douglas-fir and hemlock fir account for approximately 90% of the B.C. lumber treated with sapstain control products. Target retentions on other wood species and high dollar value lumber should be determined in small scale mill trials.

The review of the studies confirmed the following for traditional spray booth technology:

(a) Target deposition rate of 20 Fg/cm$^2$ (10 percent by weight of concentrate or 0.45% propiconazole in the treating solution) for hemlock fir.

(b) Target deposition rate of 30–40 Fg/cm$^2$ (approximately 1.7 % a.i. or 20–30% weight of concentrate) for Douglas-fir.

(c) Douglas-fir one-minute dip treatments were performed in a sawmill in Oregon. The results indicated that 1:50 dilution was adequate for Douglas-fir, using a one-minute dip for 90-day protection. This is a short period and confirms that 2.0% of concentrate might be adequate for this mode of application compared with the higher concentrations required for a linear spray box.

On the basis of the study information above, there appears to be sufficient information to establish target deposition levels of propiconazole on Douglas-fir and hemlock fir.

### 6.3.2 Operational trials

Traditionally a shipping (operational) trial was required from the applicant to simulate actual use and to determine commercial viability of this formulation.

According to two independent sources, all the trials corroborated field tests done at testing laboratories with very little difference between the wood shipped and the replicate wood kept back at the saw mill (Forintek, 1995; MB Research, 1995).

The PMRA is promoting, where possible, industry self reliance. The burden of economic risk is undoubtedly borne by those in the industry making judgements as to whether or not products meet individual mill site needs. One alternative might be to test each individual product at each unique mill site prior to granting a temporary registration. In the PMRA's view, that would be unrealistic.

In addition, the sawmilling industry performance needs can vary greatly. The use of a single test criteria (e.g., shipping trials, field trials, *or* laboratory trials), therefore, may not result in documenting all of the potential benefits or product limitations for each mill user. Under a temporary registration, additional experience gained from actual commercial use under different operating conditions can be developed. The actual benefits and practical limitations gained could then be used, if needed, for any improvements to product labeling. Additional efficacy data are not required prior to registration.

The Agency has also suggested to applicants seeking temporary registration that known "Product Limitations" (e.g., if only two species have been tested) could be indicated on the label to ensure the user industry is well informed before making a decision to use the product.

## 6.4 Economics

During a recent meeting (May 1998), the Coast Forest Lumber Association indicated the following industry perspective.

(a) B.C. coastal industry:

- 70% exported overseas (primarily to Japan)
- mostly green construction lumber requiring antisapstain treatment for overseas shipping
- 1.9 billion board-feet/year
- $2 billion/year in 1997; probably less in 1998 owing to current Asian economic situation

(b) B.C. interior industry:

- most lumber exported to the U.S.
- requires antisapstain treatment but less so than for Japanese market
- more B.C. lumber is being kiln-dried, but antisapstain treatment is still required for early storage

(c) Decreasing global competitiveness has become a major issue for Canadian lumber industry.

(d) Canadian industry (unlike U.S. industry) is limited to one major antisapstain product. For example, multinational forest firms operating in the U.S. have access to four antisapstain products that are unavailable to their Canadian counterparts, yet they are able to import into Canada propiconazole-treated lumber from their U.S. operations.

## 6.5 Sustainability

Although there are numerous other products registered as antisapstain products, the commercial standard (that is based on a combination of DDAC and IPBC) is used by the majority of mills in B.C.

Other chemicals (azaconazole, TCMTB, Borax) are used by some mills but are not favoured by the majority of them, owing to some drawback (such as the dermal sensitization that occurs with TCMTB).

More B.C. lumber is being kiln-dried, but antisapstain treatment is still required for early storage before the lumber is dried.

The potential end-users of propiconazole based formulations (some of these companies are using these products in the U.S.) have indicated their satisfaction with these products

because of the superior activity of Mycostat P compared with the commercial standard at lower retention values.

## 7.0 Toxic Substances Management Policy considerations

During the review of Mycostat P, the PMRA has taken into account *The Pest Management Regulatory Agency's Strategy for Implementing the Toxic Substances Management Policy* (Dir99-03)[1]. It has been determined that this product does not meet TSMP Track-1 criteria because of the following:

- Propiconazole does meet the TSMP criteria for persistence on the basis of its half-lives in anaerobic soil (363 days) and anaerobic sediment (>365 days), which are at or above the TSMP Track-1 cut-off criteria for soil (≥182 days) and sediment (≥365 days).

- Propiconazole is not bioaccumulative, on the basis of a log $K_{ow}$ of 3.65 and a mean BCF of 257, which are below the TSMP Track-1 cut-off criteria for log $K_{ow}$ (≥5.0) and BCF (≥5000).

- The toxicity of propiconazole is described in chapters 3 and 5.

- Propiconazole does not contain any by-products or microcontaminants and does not form any degradation products that meet the TSMP Track-1 criteria. Impurities of toxicological concern are not expected to be present in the raw materials nor are they expected to be generated during the manufacturing process.

The formulated product does not contain any formulants that are known to contain TSMP Track-1 substances.

## 8.0 Overall conclusions and regulatory decision

The formulated product Mycostat P, containing the active ingredient propiconazole, has been granted temporary registration under section 17 of the PCP Regulations subject to the generation of and submission to the PMRA of the following data:

(a) data from chronic studies using representative sediment-dwelling invertebrates (*Hyallela* sp. recommended) exposed to technical propiconazole;

(b) data to derive estimates of occupational exposure; and

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[1] *The Pest Management Regulatory Agency's Strategy for Implementing the Toxic Substances Management Policy*, Dir99-03, is available through the Publications Coordinator or our web site at www.hc-sc.gc.ca/pmra-arla.

(c) data from monitoring studies that allow the determination of propiconazole concentrations in water and in sediments likely to be affected by lumber treatment sites using Mycostat P.

# List of Abbreviations

| | |
|---|---|
| ADI | acceptable daily intake |
| a.i. | active ingredient |
| ARfD | accute reference dose |
| B.C. | British Columbia |
| BCF | bioconcentration factors |
| bw | body weight |
| $DT_{50}$ | dissipation time 50% |
| $EC_{50}$ | median effective concentration |
| h | hour |
| $K_{ow}$ | *n*-octanol–water partition coefficient |
| $LC_{50}$ | lethal concentration 50% |
| MOE | margin of exposure |
| MOS | margin of safety |
| NOEC | no observed effect concentration |
| NOEL | no observed effect level |
| PCP | Pest Control Products |
| pH | –log hydrogen ion concentration |
| p$K_a$ | dissociation constant |
| PMRA | Pest Management Regulatory Agency |
| ppm | parts per million |
| SF | safety factor |
| TGAI | technical grade active ingredient |
| TSMP | Toxic Substances Management Policy |
| U.S. | United States |
| w/w | weight per weight |