Re-evaluation Decision RVD2016-01

Boric Acid and its Salts (Boron)

(publié aussi en français)

22 July 2016

This document is published by the Health Canada Pest Management Regulatory Agency. For further information, please contact:

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ISSN: 1925-1017 (print)
1925-1025 (online)

Catalogue number: H113-28/2016-1E (print version)
H113-28/2016-1E-PDF (PDF version)

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Re-evaluation Decision

After a re-evaluation of the non-antisapstain uses of boric acid and its salts, Health Canada's Pest Management Regulatory Agency (PMRA), under the authority of the *Pest Control Products Act*, is granting continued registration of most of these uses in Canada. This re-evaluation includes the active ingredients boric acid, borax (pentahydrate), borax (disodium tetraborate decahydrate), disodium octaborate tetrahydrate and zinc borate, hereafter referred to as boron.

The non-antisapstain uses of boron registered in Canada include the control of a broad range of insects and fungi in structures, wood and wood products. Zinc borate (a salt of boric acid) is registered for use as a wood composite preservative and as a material preservative in the manufacturing of paints, coatings, plastics and rubber.

An evaluation of available scientific information found that most of these uses of boron do not pose unacceptable risks to human health or the environment when used according to the revised label directions. As a requirement for the continued registration of these uses, label amendments are required for all end-use products. Appendix IV lists all the required label amendments.

In addition, certain uses are to be cancelled to address risks of concern to human health. These uses are:

- Commercial dust/soluble powder formulations applied to poultry houses and barns
- Commercial solution/soluble powder formulations applied by paintbrush
- Domestic dust and granular formulation products, as well as solutions which are not in enclosed bait stations.

Alternatives are readily available/registered for these affected products/uses.

As a result, the last date of sale of the affected domestic boron products and the commercial product currently registered for use in poultry houses and barns by the Registrants and Retail is 12 months and 24 months following the publication date of this document, respectively. The registration of these products will expire 36 months following the publication date of this document.

The regulatory approach for the re-evaluation of the non-antisapstain uses of boron was first presented in Proposed Re-evaluation Decision PRVD2012-03, *Boric Acid and its Salts (Boron)*, a consultation document.[1] This Re-evaluation Decision[2] describes this stage of the PMRA's regulatory process for the re-evaluation of boron as well as summarizes the Agency's decision and the reasons for it.

Comments, data and use information were received during the consultation period and taken into consideration. This resulted in changes in the regulatory decision that was proposed in PRVD2012-03. Appendix I summarizes the comments and provides the PMRA's responses to

[1] "Consultation statement" as required by subsection 28(2) of the *Pest Control Products Act*.
[2] "Decision statement" as required by subsection 28(5) of the *Pest Control Products Act.*

these comments. Appendix II lists products containing boron currently registered for non-antisapstain use. Appendix IV outlines the revised label statements.

To comply with this decision, the required mitigation measures must be implemented on all products labels sold by registrants no later than 24 months after the publication date of this document. Registrants of the products containing boric acid and its salts will be informed of the specific requirements affecting their product registration(s) and of the regulatory options available to them.

What Does Health Canada Consider When Making a Re-evaluation Decision?

The key objective of the *Pest Control Products Act* is to prevent unacceptable risks to people and the environment from the use of pest control products. Health or environmental risk is considered acceptable if there is reasonable certainty that no harm to human health, future generations or the environment will result from use of, or exposure to, the product under its conditions or proposed conditions of registration.[3] The *Pest Control Products Act* also requires that products have value[4] when used according to the label directions. Conditions of registration may include special precautionary measures on the product label to further reduce risk.

To reach its decisions, the PMRA applies hazard and risk-assessment methods as well as policies that are rigorous and modern. These methods consider the unique characteristics of sensitive subpopulations in both humans (for example, children) and organisms in the environment (for example, those most sensitive to environmental contaminants). These methods and policies also consider the nature of the effects observed and the uncertainties present when predicting the impact of pesticides. For more information on how the PMRA regulates pesticides, the assessment process and risk-reduction programs, please visit the Pesticides and Pest Management portion of Health Canada's website at healthcanada.gc.ca/pmra.

What is Boron?

Boron is a naturally occurring substance and is ubiquitous in environmental media present in food, drinking water, air, soil, and dust. It is also a common ingredient in a wide range of pesticidal and non-pesticidal products used by Canadians, all of which contribute to total daily exposure. The most common source of exposure to boron is from environmental background levels in food and drinking water.

Used as a pesticide, boron inhibits reproduction of fungi by acting on the general metabolism, and act as a stomach poison in insects. Boron products are formulated as soluble powders, dusts or dry powders, pastes, granular formulations, pressurized products, solutions or solid rods.

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3 "Acceptable risks" as defined by subsection 2(2) of the *Pest Control Products Act.*

4 "Value" as defined by subsection 2(1) of the *Pest Control Products Act*: "the product's actual or potential contribution to pest management, taking into account its conditions or proposed conditions of registration, and includes the product's (*a*) efficacy; (*b*) effect on host organisms in connection with which it is intended to be used; and (*c*) health, safety and environmental benefits and social and economic impact".

Boron products can be applied by a wide variety of application systems and can be applied by professional applicators or by homeowners.

Value Considerations

What Is The Value Of Boric Acid?

Boric acid is important to the structural pest management industry.

In Canada, boric acid is registered to control a wide range of structural insect pests making it valuable as an alternative active ingredient to the synthetic pyrethroids which account for the majority of products registered in Canada for the control of structural insect pests. There are few alternative active ingredients registered in Canada that, like boron, have a broad spectrum of control and are registered for use in an extensive range of locations. Specifically, silicon dioxide (diatomaceous earth and silica aerogel) is the only alternative active ingredient that is registered for control of a similar range of pests and uses as boron.

In recent years, the registrations of several carbamate and organophosphate insecticides that were used for structural treatment have been discontinued (such as bendiocarb, chlorpyrifos, diazinon) or their use patterns have been amended, limiting their use to specific sites or to specific application methods (such as dichlorvos, propetamphos). In terms of active ingredients the options available for rotation with the synthetic pyrethroids to delay insecticide resistance have decreased. As a result, boric acid is of value as a replacement to the carbamate and organophosphates for rotation with the synthetic pyrethroids for insecticide resistance management.

Health Considerations

Can Approved Uses of Boron Affect Human Health?

Boron is unlikely to affect human health when used according to the revised label directions.

As mentioned above, boron is a naturally occurring substance and is ubiquitous in the environment (present in food, drinking water, air, soil, and dust). The most common source of exposure to boron is from environmental background levels in food and drinking water. The estimated exposure for Canadians to boron from environmental sources ranges from 21 to 92 µg/kg bw/day. The revised risk assessment took into consideration the relative contribution of exposure to boron from background sources and the pesticidal uses. In this approach, uses with exposure estimates that are in the range of background levels from environmental sources were considered to be acceptable.

For the pesticidal uses of boron registered under the *Pest Control Products Act*, potential exposure to boron may occur while handling and applying the product or by entering treated sites. When assessing health risks, two key factors are considered: the levels at which no health effects occur in animal testing and the levels to which people may be exposed. The dose levels used to assess risks are established to protect the most sensitive human population (for example children and nursing mothers). Only those uses where exposure is below levels that cause no effects in animal testing are considered acceptable for continued registration.

Boron is a known developmental and reproductive toxicant. The most sensitive endpoint that could result from short and longer term exposures to boron is an effect on the testes (small testicles, tubular atrophy, arrest of spermatogenesis), which was observed in all mammalian species examined (mouse, rat, and dog).

Due to the nature of these endpoints and their potential implications for the health of the young, extra protective factors were applied during the risk assessment to further reduce the allowable level of exposure to boron.

Occupational Risks from Handling Boron

Occupational risks to handlers are not of concern for most uses when boron is used according to the revised label directions.

Risks to mixers, loaders, and applicators are not of concern for most uses of boron with the required revised label directions. Certain uses result in high exposure levels and will be cancelled.

The risk assessment was revised to take into consideration additional data submitted during the consultation period. The revised risk assessment for occupational handlers mixing, loading, and applying activities resulted in acceptable risk for certain key uses previously identified for cancellation in PRVD2012-03. It also demonstrated that exposure from the pesticidal uses of boron range from below background to above background levels. Additional details on the revised exposure assessments are presented in Appendix III.

Uses that exceed the background levels by a wide margin are to be cancelled. These uses include:

- Commercial dust/soluble powder formulations applied to poultry houses and barns
- Commercial solution/soluble powder formulations applied by paintbrush

Occupational risks for post-application scenarios are not of concern.

Occupational post-application risk assessments consider exposures to workers entering treated sites. Based on the current use pattern for boron and due to conservatisms in the risk assessment, exposure is not expected to be of concern. Additional details on the revised exposure assessments are presented in Appendix III.

Risks in Residential and Other Non-Occupational Environments

Residential and other non-occupational risks to handlers are not of concern for most uses when boron is used according to the revised label directions.

The revised risk estimates for residential handlers mixing, loading, and applying activities for boron are not of concern for most uses. Certain uses of boron result in high exposure levels and will be cancelled. These include:

- All domestic dust formulation products
- All domestic granular formulation products
- Domestic solution formulation products, with the exception of enclosed bait stations and spot treatment with gel formulations gel

Residential risks for post-application scenarios are not of concern for most uses when boron is used according to the revised label directions.

Most uses of boron are in areas that would not be frequented by persons and thus residential post-application exposure is expected to be minimal once risk-reduction measures are implemented. These measures include revised use directions and the cancellation of high exposure uses in residential areas.

Residues in Food

As mentioned above, boron is a naturally occurring substance, ubiquitous in the environment and the most common source of exposure to boron is from environmental background levels in food and drinking water. The estimated exposure for Canadians to boron from environmental sources ranges from 21 to 92 µg/kg bw/day.

The use of boron as a pesticide is not likely to pose dietary risks from food as there are no registered food uses.

Incident Reports

Since 26 April 2007, registrants have been required by law to report pesticide incidents to the PMRA that are related to their products. In addition, the general public, medical community, government and non-governmental organizations are able to report pesticide incidents directly to the PMRA. Incidents were reviewed for the active ingredients boric acid, borax, disodium octaborate tetrahydrate, borax pentahydrate, and zinc borate. As of 8 July 2015, there have been 49 human and 159 domestic animal incidents reported to the PMRA that involved at least one of these active ingredients.

Of the incidents that were considered to have at least some degree of association with exposure to the pesticide, the human incidents and most domestic animal incidents were minor or moderate in severity. There were five domestic animal incidents that were serious in nature.

For human incidents, dermal exposure was the most frequently reported and often occurred during application of the product. Dermal symptoms such as skin irritation occurred most frequently. Domestic animals (dogs or cats) generally ingested the product after it had been placed in or around the home. Gastrointestinal symptoms such as vomiting were most frequently reported.

These incidents were considered in the re-evaluation and as a result, updated label statements are required regarding the placement of boron products in and around the home (see Appendix IV).

Environmental Considerations

An environmental risk assessment was not conducted on the boron use patterns described in this document, as none of them result in significant environmental exposure. These uses include remedial treatment of wood utility poles and other wood structures. The exposure to the environment from these uses of boron is limited to a small area of soil in the immediate vicinity of the treated wood. Therefore, an environmental risk assessment is not required.

Measures to Minimize Risk

As a result of the revised human health risk assessment, for which further data and the most current exposure methodology were used, there is concern for uses which exceed the background levels by a wide margin (commercial dust/soluble powder formulations applied to poultry houses, commercial solution/soluble powder formulations applied by paintbrush, and all domestic formulations except for enclosed bait stations and spot treatment with gel formulations). These uses do not meet Health Canada's standards for human health protection and pose risks of concern to human health. As such, these uses will be cancelled, as additional mitigation measures to reduce exposure are not feasible.

For most other uses, the PMRA is requiring further risk-reduction measures. These measures, in addition to those already identified on existing boron product labels, are designed to further protect human health.

Registered pesticide product labels include specific instructions for use. Directions include risk-reduction measures to protect human and environmental health. These directions must be followed by law.

Revised label directions are required for most boron end use products. These fall into two categories:

1) Revised label statements to minimize exposure:

   Registrants of end use products will be required to specify use conditions to reduce potential exposures.

2) Conversion of registrations that cover multiple formulations and/or application methods to separate registrations:

   Certain boron end use product labels include more than one formulation and application method (for example, broadcast application, bait station and bait station refill uses; granular and powder formulations). Registrants are required to clarify the supported uses and formulations, and, where necessary, seek separate product registrations.

Additional Key Risk-Reduction Measures

Human Health

Risk-reduction measures to address potential risk are identified in this assessment. These measures, in addition to those already identified on existing boron product labels, are designed to further protect human health. The following additional key risk-reduction measures are required.

To protect commercial mixers, loaders, and applicators:

- All use scenarios involving brush application of a solution formulation for commercial class products will be cancelled.
- All dust/powder formulations for use in commercial poultry houses or barns will be cancelled.
- Additional personal protective equipment (chemical resistant coveralls and gloves) will be required for all paste, solution, soluble powder, pressurized product, and granular formulations. The addition of a dust mask to the above personal protective equipment will be required for all dust and powder formulations.

To protect children and pets:

- Use directions will be updated to specify that boron products can only be applied to areas inaccessible to children and pets.

- To protect residents and residential applicators: domestic dust, granular and solution (except for enclosed bait stations and spot treatment with gel formulations) formulations will be cancelled.

Label amendments to be implemented are found in Appendix IV.

What Additional Scientific Information Is Requested?

Human Health

The human health risks were found to be acceptable for the majority of uses of boron with the addition of mitigation measures. No further information is required at this time as a condition of continued registration or to address uncertainties in the risk assessments.

Other Information

Any person may file a notice of objection[5] regarding this decision within 60 days from the date of publication of this document. For more information regarding the basis for objecting (which must be based on scientific grounds), please refer to the Pesticides and Pest Management portion of Health Canada's website, Request a Reconsideration of Decision, or contact the PMRA's Pest Management Information Service.

[5] As per subsection 35(1) of the *Pest Control Products Act*.

Appendix I Comments and Responses

1.0 Comments Relating to Toxicology

1.1 Comment:

The PMRA did not consider more significant non-pesticidal applications of boron/boric acids and resulting exposure.

PMRA Response:
The PMRA, under the *Pest Control Products Act and Regulations*, is responsible for the assessment of chemicals that have pesticidal use claims. The PMRA does not regulate the non-pesticidal uses of chemicals. However, Environment Canada and Health Canada's Healthy Environments and Consumer Safety Branch (HECSB) are conducting an evaluation of the non-pesticidal uses of boron, and the HECSB Draft Screening Assessment of Boric Acid, its Salts and its Precursors under the Chemicals Management Plan is expected to be published in March 2016.

1.2 Comment:

The PMRA should align its review with the United States Environmental Protection Agency (USEPA) and the European Union assessments. (Also refer to Comment Section 6.)

PMRA Response:
While consideration is given to evaluations conducted by other regulatory authorities, differences in science policy and interpretation may result in differing outcomes with respect to individual studies, endpoint selection for risk assessment, and application of uncertainty factors. Furthermore, additional data not previously reviewed by either the USEPA Office of Pesticides or IRIS (Integrated Risk Information System) Programs were included in the PMRA assessment. Moreover, as discussed in PRVD2012-03, the PMRA noted critical errors in the published study by Wier and Fisher (1972) that is widely cited and relied upon internationally for reference dose determination.

> "… the PMRA noted that the original studies for both borax and boric acid showed consistent results with respect to testicular effects in dogs, and that these effects occurred at doses that were lower than what was reported by Weir and Fisher in their 1972 paper. Although the dog studies are dated and have been considered supplemental *because of their lack of ovarian pathology data, a provisional NOAEL can be established for the males based on testicular effects.* When the PMRA compared the paper by Weir and Fisher (1972) to the original study reports (also co-ordinated or supervised by Weir), many discrepancies were noted. Thus, where possible, the PMRA has relied on the data presented in the original borax and boric acid studies." (PRVD2012-03, page 19).

1.3 Comment:

Tissue Distribution: “Boric acid or boron does not accumulate in the fat as stated in the PRVD. The concentration of boron in adipose tissue is 20% of plasma levels, “…boron does not appear to accumulate in appreciable amount in adipose tissue” (Ku et al. 1991).”

PMRA Response:
The PRVD text in question (page 13) states: “Distribution, via passive diffusion, is uniform across the tissues, *with a higher accumulation found in the bone and fat.*” The sentence was not intended to suggest bioaccumulation and should be read as follows: “Distribution, via passive diffusion, is uniform across the tissues, with higher *levels* found in the bone and fat than in other tissues.”

2.0 Comments Relating to Zinc Borate

2.1 Comment:

Zinc Borate Toxicity: The toxicology of zinc borate is significantly different from boric acid and sodium borates, therefore, zinc borate should not be included in the PRVD. “The justification for not using read across from boric acid to zinc borate is demonstrated by the low acute toxicity of zinc borate (ZB). No mortality occurred in an acute toxicity study in rats dosed 10 g ZB/kg-bw, equivalent to 1492 mg B/kg bw (Daniels, 1969). The absence of mortality in the acute toxicity study of zinc borate is in contrast to disodium tetraborate pentahydrate with a LD50 value of 3.3 g/kg-bw, equivalent to 488 mg B/kg bw. Zinc borate and disodium tetraborate pentahydrate have equivalent boron concentrations. Furthermore, no toxic effects were observed in the testes of males administered 1000 mg ZB415/kg/day in a 28-day repeated dose oral gavage toxicity study, with an equivalent dose of 50 mg B/kg bw (PMRA document number 2531678). The LOAEL for testicular effects for boron is 26 mg B/kg body weight. This indicates that Zn interacts with boric acid in vivo reducing (if not eliminating) the toxic effects of boric acid.”

PMRA Response:
PRVD2012-03 stated that various forms of boron were considered toxicologically equivalent; all forms release boric acid under physiological conditions and each form was adjusted for boron equivalents. As such, zinc borate was included in the assessment of boron/boric acid.

At the time of the PMRA re-evaluation, the registrant-submitted toxicity studies for zinc borate consisted of acute toxicity studies and available published scientific literature. As there were no toxicity studies to address other potential toxicological effects of zinc borate (for example, short/long term, developmental, reproductive toxicity) and limited information in the public scientific literature, the hazard assessment and reference dose selection for zinc borate was based on a comparison of the available toxicity data for zinc salts and for boric acid, as individual compounds. Because the point of departure of boron is lower than that of zinc, the reference dose for boron was used for risk assessment of zinc borate, taking into account the boron content of zinc borate products.

Acute Toxicity
It should also be noted that comparison of acute toxicity profiles of the various borate compounds is insufficient to exclude zinc borate from this cluster. As noted above, such a comparison does not inform the assessment of toxicities that may result from dosing over various periods of time, from short term to long term, or other potential toxicities such as reproductive, developmental or neurotoxicity. As part of the comments in response to PRVD2012-03, a 28-day oral gavage rat toxicity study and a toxicokinetic study were submitted and reviewed by the PMRA (PMRA document number2531678 and PMRA document number2531679, respectively).

In the 28-day rat study (PMRA#2531678), there were no dose related gross or histopathological effects in the testis, including atrophy; however, there was no indication that an assessment of spermiation in the testis was conducted. Although collected, epididymides and seminal vesicles were not examined histologically, and there was no assessment of sperm parameters. These are more sensitive indicators of toxicity than testicular atrophy and are expected to precede observations of gross testicular weight changes or atrophy.

Short Term Toxicity
The 28 day study (PMRA document number2531678) with a dose equivalent to 50 mg B/kg bw/day, may not have been of sufficient duration to demonstrate testicular effects. According to Ku et al., (1993) progression to atrophy is both dose and time dependent. A dose of 52 mg B/kg bw/d resulted in atrophy by week 9, whereas 68 mg B/kg bw/d induced atrophy by week 6. (PRVD2012-03, pg 15; PMRA document number 2077077).

Furthermore, there is no directly comparable study in the boron database with respect to this duration. Although the mode of action for testicular effects is unknown, the effect of boron on the testis is consistent across species. However, different mammalian species have differing sensitivities, with the dog being the most sensitive relative to rats and mice. Therefore, based on the above considerations, it is difficult to conclude zinc borate is less toxic than other borate compounds when adjusted for boron content.

2.2 Comment:

Purported Protective Properties of Zinc: “Zinc has been shown to protect against testicular toxicity of cobalt and cadmium (Anderson et al. 1993), and developmental toxicity of cadmium (Fernandez et al. 2003). A similar interaction with boron explains in part the absence of fertility and developmental effects in humans. There is evidence that zinc interacts with boric acid in the body reducing the toxicity of boric acid.”

PMRA Response:
While the referenced studies (Anderson et al., 1993, Fernandez, et al., 2003, PMRA # 2578856 and 2578857) established interactions between zinc, cobalt, and cadmium under specific ratios with respect to testicular toxicity, these studies did not include information on any potential interaction between zinc and boron, and no additional information on the potential interaction between zinc oxide and boric acid was found in the scientific literature. Since the mode of action for boron testicular effects is unknown, it is unclear if the findings for cobalt and cadmium can be extended to boron. In the absence of specific information, the purported protective effect of zinc in relation to boron-induced testicular toxicity cannot be supported.

3.0 Comments Relating to Developmental Toxicity

3.1 Comment:

HDACi and Hox Genes: Recent studies provide evidence that boric acid and sodium salycilate may act by similar mechanisms in causing developmental effects in mice. Sodium salycilate is the natural deacetylated form of aspirin and a rodent teratogen. Although aspirin is known to cause developmental effects in laboratory animals, controlled human studies have not demonstrated developmental effects in humans. Mechanisms likely include effects on Hox gene expression and inhibition of embryonic histone deacetylases.

Similar mechanisms of action of boric acid and aspirin, and the absence of developmental effects in humans ingesting aspirin suggest that boric acid related developmental effects in humans are unlikely.

PMRA Response:
Although developmental toxicity in rodents has been identified as an endpoint of concern for boron, and has been used by some regulatory authorities in reference dose selection, the PMRA considers testicular effects as the most sensitive endpoint. Furthermore, the effect of boron on the testis is consistent across mammalian species, although different species demonstrate differing sensitivities, with the dog being the most sensitive relative to rats and mice. With respect to testicular toxicity, the dog is considered the closest surrogate in predicting the potential for these effects in humans.

4.0 Comments Related to Human Data – Epidemiology

4.1 Comment:

Several comments indicated that PRVD2012-03 did not consider all available human epidemiological data relevant to boron.

PMRA Response:
The boron toxicology assessment was completed prior to the availability (publication) of more recent epidemiology studies. As such, the PMRA considered the totality of the epidemiology information in conjunction with other comments received in response to the PRVD consultation.

Recent comprehensive reviews of the epidemiology information related to boron have been conducted by the European Chemical Agency (ECHA, 2014, and Health Canada's HECSB (2016)). Both reviews agree that available epidemiology information is of insufficient quality to select points of departure for risk assessment due to study limitations, including a limited evaluation of health endpoints. The ECHA report noted that available epidemiological studies addressed effects of exposure to inorganic borates in general, rather than focusing specifically on potential reproductive effects in humans. A decreased male:female sex ratio was the most common finding in human studies, and a lower Y:X ratio in sperm cells was reported in boron exposed workers. Although no significant adverse effects on reproduction or reproductive outcome were reported in workers or highly exposed populations, all epidemiological studies exhibited methodological deficiencies (ECHA 2010, 2014). Furthermore, boron causes testicular

histopathology in many animal species, with dogs as the most sensitive species. However, as indicated in Health Canada's (HECSB) Draft Screening Report (2016), similar investigations were not available for humans. Although human studies demonstrated less overt toxicity than animal studies, human exposure levels were lower than those assessed in animal studies. Thus, epidemiological studies in humans were considered insufficient to demonstrate the absence of an adverse effect on fertility.

5.0 Comments Relating to Endpoint Selection

5.1 Comment:

The PMRA deviated significantly from the recommendations of the expert panel on the selection of the benchmark does level (BMDL) value generated from the results of two 90-day dog studies. The PMRA should accept the Panels recommended BMDL value of 14 mg/kg bw/day.

PMRA response:
The Panel Comment and PMRA Response provided in PRVD2012-03 are included here for ease of reference. In the Panel Comment it was noted that the Panel agreed with the PMRA that the testicular effects in the dog are of concern. The Panel combined the 90-day dog studies for boric acid and borax and calculated a benchmark dose (BMD) using testicular **weight** as the endpoint of concern. Using 4 models for continuous data, the following BMDLs were obtained: the Hill model (2.90 mg/kg bw/d), the Linear model (14.00 mg/kg bw/d), the Polynomial model (5.31 mg/kg bw/d) and the Power model (14.00 mg/kg bw/d). The Panel considered the Hill and Polynomial models to be less accurate and recommended using a BMDL of 14 mg/kg bw/d and an additional 3-fold for database uncertainty, since histological effects and sperm effects would likely occur at lower dose levels than those causing a decrease in testicular weight.

The PMRA Response to the above Panel Comment indicated that although the Panel was made aware of the differences in nominal to actual dose levels for each dog, this was not taken into account in their BMD assessment. The PMRA, using the same criteria as the Panel, calculated BMDs for each individual study. Both individual studies gave lower BMDL values than the combined studies. A BMDL value of 2.9 mg/kg bw/d was chosen by the PMRA, based on combined study data and model selection criteria from USEPA guidance (Nov. 2008). While the Panel chose a value of 14 mg/kg bw/d, basing their selection on the smallest difference between the BMD and BMDL values, the PMRA maintains that since the BMDL estimates are not sufficiently close (range 2.90 - 14.0 mg/kg bw/d), the model with the lowest BMDL value should be used for the risk assessment. The 2.90 mg/kg bw/d value is also more consistent with the expected dose-response profile in the mid- and long-term dog studies.

The PMRA agreed with the Panel that an additional 3-fold factor should be applied to the BMDL to account for database uncertainty regarding testicular histopathological effects that are expected to occur at doses below those doses causing a decrease in testicular weight. This gives a projected value of approximately 1 mg/kg bw/d, which is similar to the potential NOAEL in the 2 year dog toxicity studies.

6.0 Comments Relating to Uncertainty Factors

6.1 Comment:

The PRVD incorrectly summarizes the Third Party Review Panel by stating "The panel referenced the EPA IRIS document and stated that there was less concern for pregnant women because of increased glomerular filtration (GFR)". The panel made no such statement in the report. The panel does reference the EPA IRIS which in turn derived the intra-species TK value from three human studies of GFR in various sensitive population that included women with preeclampsia and diabetes.

PMRA Response:
The affected paragraph in the PRVD has been modified as follows by incorporating the bolded text:

"**Panel Comment:**
For the intraspecies variability factor, the Panel recommended dividing the10-fold factor into 3.2-fold for toxicokinetics and 3.2-fold for toxicodynamics. Similar to the interspecies factor, the Panel recommended decreasing the toxicokinetic portion from 3.2-fold to 2.0-fold. The total intraspecies factor proposed was 6.4-fold. The Panel referenced the USEPA IRIS document and stated that basing the TK intraspecies variability uncertainty factor on the pregnant human is appropriate because this '… is the population associated with B's [boron] critical effect [developmental toxicity] and thus, its choice fulfills several criteria for endpoint selection from the existing guidelines.' 'Furthermore, B's elimination is the kinetic area with the most variability— absorption and distribution of B are expected to be very similar among humans and B is not metabolized.'"

6.2 Comment:

Several comments noted differences between evaluation outcomes by other international regulators with respect to the applied uncertainty factors. These comments further recommended that the PMRA align its review with the USEPA and the European Union assessments. Specifically, it was felt that PMRA inappropriately diverged from the Panels recommended adjustment of the inter-species (10-fold) and intra-species (10-fold) factors (100-fold together) to a total factor of 53-fold, and that the application of an additional 3-fold uncertainty factor for database uncertainties was excessive.

PMRA Response:
While consideration is given to evaluations conducted by other regulatory authorities, differences in science policy and data interpretation may result in differing outcomes with respect to individual studies, endpoint selection for risk assessment, and application of uncertainty factors. (Please also refer to PMRA Response to Section 1, Comment 1.2)

The Panel Comments and PMRA Response provided in PRVD2012-03 are included below for ease of reference, with added text (bold) for clarification, or as per the modification in Response 6.1.

Adjustment of inter-species uncertainty factor:
As noted in PRVD2-12-03, the Panel divided the standard inter-species extrapolation factor of 10-fold into 4-fold for interspecies toxicokinetics and 2.5-fold for interspecies toxicodynamics, based on the USEPA International Programme on Chemical Safety (IPCS) default values. Taking into consideration what the Panel referred to as 5 "acceptable" core studies (mouse oncogenicity, reproduction toxicity in mice, and developmental toxicity in mice, rats and rabbits), and published toxicokinetic data from pregnant women and rats, the Panel recommended decreasing the toxicokinetic factor from 4.0-fold to 3.3-fold (total extrapolation factor of 8.3-fold). The PMRA indicated to the Panel that data for pregnant women and rats were highly variable; that the rat appears to have a one-compartment metabolism and humans a 3 compartment metabolism, and that humans tend to clear boron 3-4 times **slower** than the rat. The Panel responded that these "known" differences were taken into consideration in the extrapolation factor of 8.3-fold, referencing the USEPA IRIS risk assessment to support their response.

The PMRA Response to the above provided the following rationale for retaining a full 10-fold factor for inter-species extrapolation:

- Of the 5 core studies referenced by the Panel in support of decreasing the interspecies extrapolation factor, 3 of the studies were conducted in the mouse, the species that is least sensitive to the effects of boron. Moreover, there were numerous limitations in these studies.

- Although the Panel cited the USEPA IRIS document to support their interspecies extrapolation factor reduction, they do not explain that this assessment did not, in fact, divide the interspecies factor into 4.0-fold and 2.5-fold. The USEPA IRIS assessment divided the 10 fold factor into 3.3-fold for toxicokinetics and 3.16-fold for toxicodynamics. Also of note is the fact that the USEPA IRIS assessment did not decrease the total interspecies factor, but rather maintained a total factor of 10.4-fold (3.3-fold × 3.16-fold). This is in close agreement with USEPA Office of Pesticide Programs (USEPA OPP), which also maintained a full 10-fold for interspecies extrapolation.

Adjustment of the intra-species uncertainty factor
For the intra-species variability factor, the Panel recommended dividing the10-fold factor into 3.2-fold for toxicokinetics and 3.2-fold for toxicodynamics, based on the USEPA default values. Similar to the inter-species factor, the Panel recommended decreasing the toxicokinetic portion from 3.2-fold to 2.0-fold. The total intra-species factor proposed was 6.4-fold. The Panel referenced the USEPA IRIS document and stated that basing the TK intra-species variability uncertainty factor on the pregnant human is appropriate because this is the population associated with B's [boron] critical effect [developmental toxicity] and thus, its choice fulfills several criteria for endpoint selection from the existing guidelines. "Furthermore, B's elimination is the kinetic area with the most variability— absorption and distribution of B are expected to be very similar among humans and B is not metabolized."

The PMRA Response to the above provided the following rationale for retaining a full 10-fold factor for intra-species variability factor:

- The Panel cited the USEPA IRIS document as their support for why the intra-species toxicokinetic factor could be decreased. However, with respect to pregnant females, USEPA IRIS states that, "Lack of controls on exposure magnitude and timing would be expected to contribute substantially to the variance of the measurements. The high variability reported by Pahl et al. (2001), therefore, is attributed to experimental 'noise' and should not be included in the estimate of true population variability." To support this position, USEPA IRIS states, "In contrast, in the controlled infusion exposure study of Jansen et al., (1984), the boron clearance coefficient of variation (CV) was 0.09." USEPA IRIS states that the Jansen study shows little variance in clearance. However, two of the eight men in the Jansen study were excluded from the study because they either had highly variable plasma ½ lives or they did not fit the predicted 3-compartment pharmacokinetic model. Thus, 25% of the men had to be excluded because of their high pharmacokinetic variability. These two men were not included in the USEPA IRIS assessment of variability. Although the PMRA informed the Panel of this discrepancy, it was not addressed in the final justification for decreasing the intraspecies toxicokinetic variability factor.

- The majority of pregnant animals, including humans, have increased GFR because the kidney undergoes volume expansion, vasodilation and decreased resorption during pregnancy. Although pregnant rats had increased GFR, this did not protect the fetus from developmental effects of boron (malformations), which were observed at maternally non-toxic doses. This fact must be taken into consideration when assessing potential risk to the unborn child, by ensuring adequate margins between potential exposure levels and the noted malformations in the developmental rat study.

- The studies used by USEPA IRIS included small sample groups of individuals of similar age, sex (all males), health (free of any disease), weight, and ethnicity. Consideration of the variability within the human population needs to be taken into account. For example, gestational diabetes would likely have a significant effect on the toxicokinetics of boron since the kidneys are often a target organ of diabetes.

- In their most recent assessment the USEPA OPP retained a full 10× for intraspecies variation.

With regard to the total suggested factor of 53 in Comment 6.2, it should also be noted that the Panel mixed USEPA OPP and IPCS guidance when recommending the selection of factors. While the Panel applied IPCS guidance to allocation the toxicokinetic and toxicodynamic portions of the inter-species factor, they applied OPP guidance to the intra-species factor. No rationale was provided by the Panel for this divergence.

Additional database uncertainty factor

The Panel considered the database to be adequate for conducting risk assessment. The application of an additional 3× for database uncertainty, pertaining to testicular toxicity and quality of the database, is sufficient protection.

PMRA Response (from PRVD2012-03, with added detail): The PMRA concurs with the Panel that, although many of the animal toxicology studies do not meet current regulatory standards and have limitations, and although the human data has limitations, the toxicology database as a whole is sufficient to derive endpoints to conduct a risk assessment. In determining a reference dose level for risk assessment, the application of intra-species and inter-species uncertainty factors, and an additional uncertainty factor to address other uncertainties in the toxicology database is necessary.

7.0 Comments Relating to Acute Hazard Classification

7.1 Comment:

Acute Eye and Skin Hazard Labeling: Boric acid is not classified as an eye or skin irritant under UN GHS. In a primary eye irritation study conducted in New Zealand White Rabbits, boric acid induced conjunctivae redness and chemosis and minor effects on the iris. The effects were reversible within 7 days (Doyle, 1989). Average eye irritation scores were 0 for the cornea, 0.11 for the iris, 0.94 for conjuctiva redness and 0.56 for conjunctiva chemosis. Classification is based scores ≥ 1 based on mean scores at 24, 48 and 72 hours.

PMRA Response:
The PMRA hazard level for labelling purposes was determined based on data submitted to the Agency and current PMRA labelling guidance.

7.2 Comment:

Acute Inhalation Hazard Labeling**:** The PRVD lists boric acid as moderate toxicity via inhalation with a LC50 > 0.16 mg/L, however the classification as moderate toxicity is incorrect. No mortality was observed at the maximum achievable exposure of 0.16 mg/L. Neither boric acid nor sodium borates have been shown to cause mortality in acute inhalation toxicity testing. In an inhalation study in which rats were exposed to boric acid at actual concentrations of 2.12 mg/L (highest attainable concentration) for 4 hours no deaths were observed (Wnorowski, 1997).

PMRA Response:
Although the Wnorowski study (unpublished) was sponsored by a registrant, it was not submitted to the PMRA for review. In the studies available to the PMRA, the highest dose tested for LC50 determination was 0.16 mg/L, and as such, the labeling statements are based on that dose, as the true LC50 is not known.

8.0 Comments Relating to Occupational / Residential Exposure

Updates to the Risk Assessment

Additional data was submitted to the PMRA during the consultation period for the proposed re-evaluation decision for boron (PRVD2012-03). An update to the risk assessment was conducted that took into consideration this additional information, which also included new use information provided to the PMRA by stakeholders, the 2012 USEPA Residential SOPs, as well as data pertaining to dermal absorption. The result of the review of this additional information and

updated risk assessment is reflected in the following responses.

8.1 Comment:

There is concern with the 50% dermal absorption value used in the proposed re-evaluation decision for boron (PRVD2012-03).

PMRA Response:
The proposed re-evaluation decision for boron (PRVD2012-03) documented the rationale for applying the default dermal absorption value for use in the exposure assessments of domestic and commercial end-use products containing boron. As studies had not been submitted by the applicant in support of the boron pesticide products, the studies available in the literature at the time were reviewed and limitations were identified for all of them. Given that guideline dermal absorption studies were not available, a weight-of-evidence approach was used in conjunction with considerations of the physical-chemical properties. Based on these data, a dermal absorption factor of 50% was selected for the risk assessments of pesticides containing boron (non-antisapstain uses) as reported in the proposed re-evaluation decision for boron (PRVD2012-03).

After the publication of the proposed re-evaluation decision for boron (PRVD2012-03), the registrant responded with comments and provided additional data to PMRA to refine the dermal absorption estimate. This included the full study reports for two concurrent dermal absorption studies: a human in vivo study and a human in vitro study. These two dermal absorption studies were previously considered by PMRA as part of the data available in literature reviews, however, the actual studies and raw data were not available to PMRA at that time. Given the availability of the full study protocol and study report, PMRA was able to examine more closely the study results of those studies. As well, a review of a pig in vitro dermal absorption study (Hoyu Co, Ltd., 2009) was made available by the European Commission and PMRA has summarized the limitations of the study below. Ultimately, it was determined that more weight could be given to the human in vivo study results, in the selection of a dermal absorption value.

As a result of the analysis, a value of 10% was determined for use in the risk assessment. This value was mainly determined using the human in vivo study but was adjusted to account for the uncertainties in the study and for using a single dermal absorption value for all forms of boron.

8.2 Comment:

There is concern with the use restriction of zinc borate as stated in the boron PRVD (PRVD2012-03).

PMRA Response:
The scenario described in the proposed re-evaluation decision for boron (PRVD2012-03) for the material preservative scenario pertained to zinc borate and was based on the Pesticide Handlers Exposure Database (PHED) wettable powder open mix/load scenario (single layer, no gloves). The limit of 410 kg/day was established to meet the target MOE.

Due to new use information received during the consultation period for the proposed re-evaluation decision for boron (PRVD2012-03), handling higher amounts of zinc borate was determined to be acceptable in bulk “supersack” packaging provided that a closed mixing and

loading system is used. Refer to Appendix IV for label amendments for the required PPE in this scenario to help reduce boron exposure.

Also, as noted previously, the antisapstain and millwork/joinery scenarios were excluded from the re-evaluation and will be assessed in a separate process.

8.3 Comment:

Boron treated wood is typically used for internal framing jobs, not for outdoor exposed wood like decks because wetness causes boron to leach. Due to this, the requested DACO 5.6 and 5.7 data are not necessary.

PMRA Response:
PMRA agrees with this comment. As part of the re-evaluation decision, end use product labels relevant to this use must be updated to specify that treated wood is sealed or used in locations where post-application exposure will not occur. Under these conditions, the post-application exposure scenarios are no longer of concern and the requested data is no longer required.

8.4 Comment:

PHED paintbrush application data should not be used to calculate the exposure to brush/trowel or putty knife application with the paste formulation.

PMRA Response:
PHED data were used as stated in the proposed re-evaluation decision for boron (PRVD2012-03) as it represents the most reliable information available for assessing exposure. There are limitations with PHED as it does not contain exposure scenarios that correspond with all of the boron uses however; it is the best data available.

Based on consideration of the additional data submitted to the PMRA during the consultation period for the proposed re-evaluation decision for boron (PRVD2012-03), the crack and crevice application of commercial class products containing boron in paste formulations is no longer of concern when proper PPE is utilized.

See Appendix IV for the required label amendments.

9.0 Comments Pertaining to Value

9.1 Comment:

The availability of pest management tools has recently decreased as a result of re-evaluation (such as carbamates and organophosphates). While alternative tools are available in the US, market size precludes or delays access to structural pest control tools in Canada. The cost of generation of data may not pose a viable business case for such a small (Canadian) market. The borates and synthetic pyrethroids have replaced the organophosphates and carbamate pest control tools which have been removed from the market. Removing borates from the market will further

increase the use of synthetic pyrethroids. This will place additional selective pressure for the development of resistance to the synthetic pyrethroids.

Borates fill a niche for structural pest control. Borates are registered for use where food is present. There are few or no alternatives for use in these areas. Borates are considered a “green” or low risk pesticide and are on the Organic Materials Review Institute (OMRI) list. Therefore, they are permitted for use in organic food processing plants. The only other alternative is diatomaceous earth which is ineffective in some environments (that is, damp environments). The borates are suitable for use as a bait treatment, whereas diatomaceous earth and the synthetic pyrethroids are not.

Limiting use of the borates to Commercial Class products and adding use restrictions to mitigate the risks should be implemented on the borate labels rather than discontinuation (such as to allow use only where children and pets will not be exposed such as wall voids and within cracks and crevices) as there are few alternative tools available to pest management professionals.

PMRA Response:
The PMRA acknowledges the value of borates as alternatives to synthetic pyrethroids and diatomaceous earth for control of structural insect pests. The PMRA also recognizes the value of boric acid for rotation with silicon dioxide to delay the development of insecticide resistance in organic food production facilities. For other areas, there are other active ingredients available for control of ants and cockroaches for use as baits including imidacloprid (MoA group 4A), abamectin (MoA group 6) and hydramethylnon (MoA group 20).

9.2 Comment:

Synthetic pyrethroids have repellent properties which cause pest infestations to disperse to other areas upon treatment, necessitating a larger surrounding area (for example, adjacent units) be treated prior to targeting the infestation. Boric acid can control infestations by treating just the infested area. Borates have a very long residual action and do not have repellent properties which are critical for effective bait treatment.

PMRA Response:
The PMRA acknowledges the value of non-repellent products for structural insect pest management, including the use of borates in ant and cockroach baits. Other non-repellent products are available for control of ants and cockroaches including the use of abamectin, hydramethylnon and imidacloprid in baits and German cockroach extract as an attractant for German cockroaches.

9.3 Comment:

Borates are the only effective long term non-soil application strategy to protect wood from termites in Canada.

There are no viable alternative to zinc borate for composite wood products for termites and other wood pests.

PMRA Response:
Termites are a significant problem in some areas within Canada although these areas tend to be limited geographically. The PMRA acknowledges that there are no alternative active ingredients to boron registered for use on oriented strand board as of December 2015.

9.4 Comment:

The proposed mitigation measures would negatively impact the treated wood industry which comprises 13% of Canada's consumed lumber and 100% of the Canadian utility pole production. Wood would need to be replaced between 5 to 10 times more frequently and increase log harvest by 12.5% to meet the increased consumer needs.

PMRA Response:
The pressure-treated wood industry in Canada is dominated by a number of water-based and solvent-based wood preservative systems (for example, CCA, ACQ, copper azole, creosote, pentachlorophenol). While there are valuable niche uses for borate wood preservatives, such as pressure-treated sill plates, the volume of borate-treated wood is small relative to the other wood preservatives. Borates also have value as a remedial treatment of utility poles in service. However, it is difficult to estimate the extent of the increase in service life for a utility pole due to a remedial treatment with borates.

9.5 Comment:

Borates are the only effective remedial product for wood decay. It is standard practice to remove and replace wood that shows loss of strength and treat the surrounding wood to prevent further decay due to nascent growth of decay fungi. Loss of paint-on and spray applications of borate solutions would result in higher long term costs due to the need for more extensive or more frequent renovations.

PMRA Response:
The PMRA acknowledges the value of borates as remedial wood preservatives and in particular the paint and spray applications to protect wood within buildings. There are other active ingredients registered for remedial wood preservation, but these tend to have more limited uses (for example, copper naphthenate, metam sodium).

9.6 Comment:

Brush on treatment with borate paste is critical for use on utility poles. Brush-on alternatives such as pentachlorophenol, sodium fluoride and copper naphthenate have been discontinued. As a result, boric acid application using a wrap or bandage is the only option available. The disadvantages to the wrap application are that it is 5 to 8 times more expensive to apply and it is more difficult to obtain thorough coverage which reduces the effectiveness. Metam sodium is available for pole preservation but is much more toxic.

PMRA Response:
In addition to paste applications, borates as a remedial ground-line treatment for poles can be applied as a wrap, bandage or as solid rods. Sodium fluoride and copper naphthenate are still

available as a remedial pole treatment that can be applied by brush. Other registered alternative active ingredients to the borates for use on utility poles are listed below.

Table 1 Registered Alternatives

Registered alternatives	Comments
Fumigants: chloropicrin, metam sodium, metam potassium	Applied by injection into drill holes
copper naphenate	Applied by brush, spray or injection and treated wrap.
sodium fluoride	Applied by treated wrap
sodium fluoride/copper naphthenate	Applied by brush, treated wrap or injection

Appendix II Products Containing Boron Registered for Non-Antisapstain Use as of 9 December 2015, Excluding Discontinued Products or Products with a Submission for Discontinuation

Table 1 Products Containing Boron Registered for Non-Antisapstain Use as of 9 December 2015, Excluding Discontinued Products or Products with a Submission for Discontinuation

Registration number	Marketing Class	Registrant	Product Name	Formulation type	Guarantee
28921	Commercial	753146 AB LTD. O/A ULTRASOL INDUSTRIES	GO GREEN DOKTOR DOOM GRNULAR BAIT C	Granular	Boric acid 5%
28922	Domestic		GO GREEN DOKTOR DOOM GRANULAR BAIT D		
26687	Domestic	9272-9771 QUEBEC INC.	AEROKURE ANT TRAP	Paste	Borax (sodium tetraborate decahydrate) 5%
28231			INSECT STOP CRAWLING INSECT DESTROYER POWDER	Dust or powder	Boric acid 100%
30037			AEROKURE ANT KILLER LIQUID	Solution	Borax (sodium tetraborate pentahydrate) 5%
22379	Commercial	ACUITY HOLDINGS, INC.	BORID WITH BORIC ACID	Dust or powder	Boric acid 99%
21996	Domestic		R VALUE'S ROACH KIL		
19480	Commercial	AGRIUM ADVANCED TECHNOLOGIES RP INC.	PRO BORADUST INSECTICIDE DUST		Boric acid 99%
20468			FARM & RANCH BRAND DARKLING BEETLE INSECTICIDE DUST		Boric acid 98%
19919	Domestic		PRO ROACH POWDER INSECTICIDE DUST		Boric acid 96%
27023	Commercial	BASF CANADA INC.	PRESCRIPTION TREATMENT BRAND PERMA DUST PRESSURIZED BORIC ACID DUST	Pressurized product	Boric acid 35.5%
23338	Manufacturing Concentrate	CANADA COLORS AND CHEMICALS LTD.	BORIC ACID MANUFACTURING CONCENTRATE	Soluble powder	Boric acid 100%
23339			10 MOL BORAX MANUFACTURING		Borax (sodium tetraborate decahydrate)

Registration number	Marketing Class	Registrant	Product Name	Formulation type	Guarantee
			CONCENTRATE INSECTICIDE		100%
23351			5 MOL BORAX MANUFACTURING CONCENTRATE		
26973	Domestic	CANADIAN BUILDING RESTORATION PRODUCTS INC.	PRE-SER-VOR 25-3	Solution	Disodium octaborate tetrahydrate 5.29%
31856	Commercial	DCG VISION MARKETING & SALES INTERNATIONAL LTD.	POWER SHOT UNI-PRO BORIC INSECTICIDE DUST	Dust or powder	Boric acid 100%
25360	Commercial	ECOLAB INC.	ECO2000-XP COCKROACH BAIT	Paste	Boric acid 51.4%
20478	Commercial	FMC CORPORATION	DRAX ANT KIL GEL		Boric acid 5%
25353			DRAX II ANT KIL GEL		
26399			DRAX ANT KIL PF		
27751			CB ATTRAX ROACH BAIT WITH CARBOHYDRATES		Boric acid 50%
27752			CB ATTRAX ROACH BAIT WITH PROTEINS		
30533			BORADICATE INSECTICIDE	Dust or powder	Boric acid 99%
25580	Commercial	GENICS INC.	COBRA (TM) ROD	Solid	Copper (present as copper hydroxide) 1.8%; Disodium octaborate tetrahydrate 90.6%; Boric acid 4.7%
27553			COBRA (TM) CRUSH MDT WOOD PRESERVATIVE	Soluble powder	Copper (present as copper hydroxide) 6.1%; Disodium octaborate tetrahydrate 80.43%; Boric acid 7.93%
28154			GENBOR RTU	Solution	Disodium octaborate tetrahydrate 23.6%
29940			BO-ROD	Solid	Disodium octaborate tetrahydrate 98%
29941			CAN-BOR	Soluble powder	

Registration number	Marketing Class	Registrant	Product Name	Formulation type	Guarantee
31807			COBRA WRAP BD	Paste	Copper (present as copper naphthenate) 1.6%; Borax (sodium tetraborate decahydrate) 38.98%
27214	Domestic		GENICS POSTGUARD	Solid	Copper (present as copper hydroxide) 1.71%; Disodium octaborate tetrahydrate 88.9%; Boric acid 4.7%
28155			GENBOR RTU-2	Solution	Disodium octaborate tetrahydrate 23.6%
28298			CANADIAN SHIELD		
22083	Commercial	IBC MANUFACTURING COMPANY	CURAP 20 WOOD PRESERVATIVE PASTE	Paste	Copper (present as copper naphthenate) 2%; Borax (sodium tetraborate decahydrate) 40%
27026			CURAP 20 PAK WOOD PRESERVATIVE WRAP		Copper (present as mixed copper ethanolamine complexes or as bis-2-aminoethanolate) 1.60; Borax (sodium tetraborate decahydrate) 38.98%
29055	Commercial	INNOVATIVE PEST CONTROL PRODUCTS	GOURMET LIQUID ANT BAIT-C	Liquid	Borax (sodium tetraborate decahydrate) 5.4%
29056			GOURMET LIQUID ANT BAIT-CR		
29345			GREENWAY LIQUID ANT AND ROACH KILLER	Solution	Disodium octaborate tetrahydrate 1%
30375			GREEN WAY ANT & ROACH BAIT GEL	Paste	Disodium octaborate tetrahydrate 6.0%
28468	Domestic		GOURMET LIQUID ANT BAIT	Liquid	Borax (sodium tetraborate decahydrate) 5.4%

Registration number	Marketing Class	Registrant	Product Name	Formulation type	Guarantee
29344			GREENWAY LIQUID ANT KILLING BAIT	Solution	Disodium octaborate tetrahydrate 1%
30173	Domestic	INNOVATIVE PEST CONTROL PRODUCTS	GREEN WAY ANT BAIT GEL	Paste	Borax (sodium tetraborate decahydrate) 0.61%
30628			GREEN WAY AND & ROACH BAIT GEL-D		Disodium octaborate tetrahydrate 6.0%
29057	Manufacturing Concentrate		GOURMET LIQUID ANT BAIT MUP	Liquid	Borax (sodium tetraborate decahydrate) 5.4%
21324	Commercial	KAI R. SPANGENBERG EFTF I/S	IMPEL (BORON) RODS WOOD PRESERVATIVE	Solid	Disodium octaborate tetrahydrate 98%
23398			IMPEL (BORON) RODS II WOOD PRESERVATIVE FOR REMEDIAL TREATMENT OF UTIL		
24493			BORACOL 20-2 REMEDIAL WOOD PRESERVATIVE	Solution	Disodium octaborate tetrahydrate 19.6%
25664			BORACOL 20-2 BD PREVENTIVE AND REMEDIAL WOOD PRESERVATIVE FOR STRUCTURES		Didecyl dimethyl ammonium chloride 1%; Disodium octaborate tetrahydrate 19.6%
25665			BORACOL 10-2 BD PREVENTIVE & REMEDIAL WOOD PRESERVATIVE		Didecyl dimethyl ammonium chloride 2.0%; Disodium octaborate tetrahydrate 9.8%
31203	Domestic	KUUS INC.	KNOCK DOWN ECO ANT KILLER BAIT	Paste	Borax (sodium tetraborate decahydrate) 5.0%
30270	Domestic	LES MARQUES METRO S.E.N.C.	SELECTION ANT CONTROL SYSTEM		Borax (sodium tetraborate decahydrate) 5.0%
24074	Domestic	LES PRODUITS DE CONTROLE SUPERIEUR INC/ SUPERIOR CONTROL	SUPER ANTS KILLER	Solution	Borax (sodium tetraborate decahydrate) 5.4%
24314			THE INSECT DESTROYER	Dust or powder	Boric acid 100%

Registration number	Marketing Class	Registrant	Product Name	Formulation type	Guarantee
29620		PRODUCTS INC	SUPERIOR ANT TRAPS KILLS ANTS	Paste	Borax (sodium tetraborate decahydrate) 5.0%
30625	Commercial	LORD'S ADDITIVES LLC	LORD'S ZB-SHIELD	Soluble powder	Zinc borate 99.6%
30429	Technical Grade Active Ingredient		LORD'S ZINC BORATE	Solid	
21003	Commercial	NISUS CORPORATION	BLUE DIAMOND MAGNETIC ROACH FOOD 2000 PASTE FORMULA	Paste	Boric acid 33.33%
26565			NIBAN GRANULAR BAIT C	Granular	Boric acid 5.0%
29169			PROFESSIONAL ROACH BAIT	Paste	Boric acid 33.33%
30157			BORA-CARE TERMITICIDE AND INSECTICIDE CONCENTRATE	Solution	Disodium octaborate tetrahydrate 8.4%
26564	Domestic		NIBAN GRANULAR BAIT D	Granular	Boric acid 5.0%
30293			HOMEOWNERS DIY ROACH BAIT	Paste	Boric acid 33.33%
25662	Domestic	PERMA-CHINK SYSTEMS, INC.	SHELL-GUARD	Solution	Disodium octaborate tetrahydrate 5.29%
16487	Domestic	PIC CORP.	PIC ANT TRAPS KILLS ANTS	Paste	Borax (sodium tetraborate decahydrate) 5.0%
23422			PIC ANT CONTROL SYSTEM II		
19424	Commercial	ROACH REMOVER INC.	ROACH DIE-IT		Boric acid 50%
18449	Domestic	S.C. JOHNSON AND SON LTD.	RAID ANT KILLER LIQUID	Solution	Borax (sodium tetraborate decahydrate) 7.7%
25735			RAID ANT ROACH & EARWIG GEL BAITS	Solid	Boric acid 2.0%
26430	Commercial	SASHCO INCORPORATED	PENETREAT	Soluble powder	Disodium octaborate tetrahydrate 98%
9167	Domestic	SCOTTS CANADA LTD.	ORTHO ANT B GON MAX ANT ELIMINATOR LIQUID	Solution	Borax (sodium tetraborate decahydrate) 5.4%
23372			ORTHO ANT B GON MAX	Paste	Borax (sodium

Registration number	Marketing Class	Registrant	Product Name	Formulation type	Guarantee
			ANT TRAPS		tetraborate decahydrate) 5.0%
30014			SCOTTS® ECOSENSE ANT-B-GON® ANT ELIMINATOR LIQUID	Solution	Borax (sodium tetraborate decahydrate) 5.4%
27814	Technical Grade Active Ingredient	SEARLES VALLEY MINERALS INC.	THREE ELEPHANT BORIC ACID GRANULAR TECHNICAL	Granular	Boric acid 99.755%
28108			THREE ELEPHANT DISODIUM OCTABORATE TETRAHYDRATE TECHNICAL	Soluble powder	Disodium octaborate tetrahydrate 20.9%
30622	Domestic	SHOPPERS DRUG MART/PHARMAPRIX	LIFE BRAND ANT CONTROL SYSTEM	Paste	Borax (sodium tetraborate decahydrate) 5.0%
28805	Commercial	SOCIETA' CHIMICA LARDERELLO S.P.A.	BOROWOOD	Soluble powder	Disodium octaborate tetrahydrate 20.9%
28829	Technical Grade Active Ingredient		BOROWOOD DISODIUM OCTABORATE TETRAHYDRATE TECHNICAL		
14116	Domestic	SURE-GRO IP INC.	WILSON LIQUID ANTOUT	Solution	Borax (sodium tetraborate decahydrate) 5.4%
23446			C-I-L ANT TRAP	Paste	Borax (sodium tetraborate decahydrate) 5.0%
27017			WILSON ANTOUT ANT TRAPS		
27124			GREEN EARTH HOMECARE ANT, ROACH & CRAWLING INSECT KILLER DUST	Dust or powder	Boric acid 99%
28793			WILSON ANTOUT ANT BAIT	Paste	Borax (sodium tetraborate decahydrate) 5.0%
29090			GREEN EARTH HOMECARE Liquid ANT BAIT	Liquid	Borax (sodium tetraborate decahydrate) 5.4%
30040			WILSON ANTOUT OUTDOOR ANT STAKES	Paste	Borax (sodium tetraborate decahydrate) 5.0%

Registration number	Marketing Class	Registrant	Product Name	Formulation type	Guarantee
30596			WILSON ANTOUT ANT BAIT GEL		Borax (sodium tetraborate decahydrate) 0.61%
31901	Domestic	SURE-GRO IP INC.	WILSON ANTOUT FOR CARPENTER ANTS BATTERY POWERED	Solution	Disodium octaborate tetrahydrate 23.6%
31902			WILSON ANTOUT FOR CARPENTER ANTS BATTERY POWER REFILL		
31910			WILSON ANTOUT FOR CARPENTER ANTS		
21054	Domestic	SUREKILLER PRODUCTS LTD.	SUREKILLER BUG BUSTER INSECT POWDER	Dust or powder	Boric acid 100%
26872			SUREKILLER INSECT POWDER		Boric acid 80%
18879	Commercial	U.S. BORAX INC.	20 MULE TEAM TIM-BOR INDUSTRIAL WOOD PRESERVATIVE	Soluble powder	Disodium octaborate tetrahydrate 98%
20477			POLYBOR 3 DARKLING BEETLE CONTROL		
23283			BOROGARD ZB CORROSION INHIBITOR, BIOCIDE & FIRE RETARDANT		Zinc borate 100.0%
24091			TIM-BOR PROFESSIONAL		Disodium octaborate tetrahydrate 98%
30274			COMPOSIBOR®		Zinc borate 100.0%
18292	Technical Grade Active Ingredient		20 MULE TEAM BORIC ACID TECHNICAL		Boric acid 100%
18607			20 MULE TEAM BORAX TECHNICAL		Borax (sodium tetraborate decahydrate) 100%
19025			20 MULE TEAM NEOBOR TECHNICAL		
19027			ZINC BORATE TECHNICAL		Zinc borate 100.0%
24739			OCTABOR TECHNICAL	Soluble powder	Disodium octaborate tetrahydrate 98%
29553	Domestic	WAL-MART CANADA INC.	GREAT VALUE ANT CONTROL SYSTEM	Paste	Borax (sodium tetraborate decahydrate) 5.0%

Registration number	Marketing Class	Registrant	Product Name	Formulation type	Guarantee
31345	Domestic	WATERSTEM INC.	WATERSTEM ANTRX ANT BAIT		Borax (sodium tetraborate decahydrate) 5.0%
29828	Commercial	WOOD CARE SYSTEMS	BOR8®-RODS WOOD PRESERVATIVE	Solid	Disodium octaborate tetrahydrate 98%
20203	Domestic	WOODSTREAM CANADA CORPORATION	SAFER'S ATTACK ANT KILLER	Solution	Borax (sodium tetraborate decahydrate) 5.4%
24355			SAFER'S ATTACK ANT TRAP	Paste	
30891			TERRO® ANT KILLER	Solution	
30897			TERRO® ANT KILLER LIQUID ANT BAITS		
30902			TERRO® OUTDOOR LIQUID ANT BAITS		
31253			TERRO® OUTDOOR LIQUID ANT BAIT STAKES		

Appendix III Mixer/Loader/Applicator and Post-application Risk Assessment

Table 1 M/L/A Exposure of Commercial Products Containing Boron

Application Description/Site	PHED Assessment Used	Amount Applied (kg ai/day)[a]	PPE and Engineering Controls	Exposure (mg/kg bw/day)		MOE		
				Dermal[b]	Inhalation[c]	Dermal[d]	Inhalation[e]	Combined [f]
PASTE								
Bait Station (open bait)	liquid, open pour, low pressure handwand (M/L/A)	0.014 [g]	Single layer, gloves [h]	1.63×10^{-5}	7.83×10^{-6}	178000	371000	120000
Crack and crevice, putty knife	paintbrush application	0.014 [g]	Single layer, no gloves	6.98×10^{-3}	1.28×10^{-4}	415	22600	408
Brush, trowel	paintbrush application	1.08 [i]	Chemical resistant coveralls, gloves	6.05×10^{-2}	1.00×10^{-2}	**48**	**290**	**41**
SOLUTION								
Bait station (refilling), drop treatment	liquid, open pour, low pressure handwand (M/L/A)	0.007 [j]	Single layer, gloves	8.43×10^{-6}	4.04×10^{-6}	344000	718000	232000
roller or spray, pressurized injector	liquid, open pour, low pressure handwand (M/L/A)	0.94 [k]	Single layer, gloves	1.11×10^{-3}	5.31×10^{-4}	2620	5460	1770
Brush	paintbrush application	0.94 [k]	Chemical resistant coveralls, gloves	5.27×10^{-2}	8.71×10^{-3}	**55**	333	**47**
enclosed bait	n/a [l]	-	-	-	-	-	-	-
SOLID								
Implant rod	n/a [l]	-	-	-	-	-	-	-
DUST/POWDER								
crack and crevice, bellows duster, power duster, or other	granular bait dispersed by hand [m]	0.23 [n]	Chemical resistant coveralls, gloves, dust mask	9.92×10^{-3}	3.51×10^{-4}	292 [u]	8260	282 [u]
crack and crevice, pressure duster, power duster in **poultry houses**	granular bait dispersed by hand [m]	1.89	Chemical resistant coveralls, gloves, respirator	8.06×10^{-2}	1.43×10^{-3}	**36**	2030	**35**
SOLUBLE POWDER								
Brush	paintbrush application	0.69 [o]	Chemical resistant coveralls, gloves	3.89×10^{-2}	6.43×10^{-3}	**75**	451	**64**

Application Description/Site	PHED Assessment Used	Amount Applied (kg ai/day)[a]	PPE and Engineering Controls	Exposure (mg/kg bw/day)		MOE		
				Dermal[b]	Inhalation[c]	Dermal[d]	Inhalation[e]	Combined [f]
Spraying, injecting wood	liquid, open pour, low pressure handwand (M/L/A)	0.69 [o]	Chemical resistant coveralls, gloves	8.61×10^{-3}	1.23×10^{-3}	337	2350	295 [u]
Crack and crevice, dusting (applied as a powder)	granular bait dispersed by hand [m]	0.21 [p]	Chemical resistant coveralls, gloves	8.78×10^{-3}	1.55×10^{-3}	330	1870	281 [u]
Granular spreader, dust applicator in **poultry houses** (applied as a powder) [t]	Granule, open pour, belly grinder	22.6 [q]	Chemical resistant coveralls (no glove data) [r]	8.93×10^{-2}	2.26×10^{-2}	**32**	**128**	**26**
Pressure sprayer in **poultry houses**	Wettable Powder, Open Pour, Low Pressure Handwand	4.9 [s]	Chemical resistant coveralls, gloves	6.12×10^{-2}	8.77×10^{-2}	**47**	**33**	**19**
Additive; material preservation process	wettable powder, open M/L	3.39	Single layer, gloves	2.25×10^{-3}	2.38×10^{-3}	1290	1220	626
	wettable powder, closed M/L	169	Closed system	4.57×10^{-3}	3.81×10^{-4}	634	7610	585
PRESSURIZED PRODUCT								
small openings, cracks, crevices, and closed voids, injection tube required	aerosol application	0.05 [g]	Single layer, gloves	8.70×10^{-3}	9.77×10^{-4}	333	2970	300
GRANULAR								
voids, bait trays, or bellows-type duster/snuffer	Granular bait dispersed by hand	0.004 [g]	Single layer	8.60×10^{-4}	3.31×10^{-5}	3370	87700	3250

Shaded cells (bold numbers) indicate the MOEs did not reach the target MOE of 300.

a Amount applied (kg ai/day) presented as percent boron equivalence using the following conversion factors:
for BNS ($Na_2B_4O_7$ - 10 H_2O) , boron equivalent (%/100) = 0.11338
for BOA (H_3BO_3) , boron equivalent (%/100) = 0.17491
for BOC ($Na_2B_8O_{13}$ - $4H_20$) , boron equivalent (%/100) = 0.20965
for ZBT (2Zn0 - $3B_2O_3$ - $3.5H_2O$) , boron equivalent (%/100) = 0.14927
In addition to boron equivalence factors (above), values presented for amount applied (in kg active ingredient/day), also take into account specific gravities (where applicable) and guarantees.

b Dermal Exposure (mg/kg bw/day) = unit exposure × kg handled per day × dermal absorption/80 kg bw

c Inhalation exposure (mg/kg bw/day) = unit exposure × kg handled per day/80 kg bw

d Dermal MOE $= \frac{BMDL_{dermal}}{Exposure_{dermal}}$ The short/intermediate/long-term dermal BMDL based on two 90-day dog toxicity studies is 2.9 mg/kg bw/day; the target MOE is 300. Dermal absorption = 10%.

e Inhalation MOE $= \frac{BMDL_{inhalation}}{Exposure_{inhalation}}$ The short/intermediate/long-term inhalation BMDL based on two 90-day dog toxicity studies is 2.9 mg/kg bw/day; the target MOE is 300.

f Dermal and inhalation risks were based on the same endpoints, therefore the risk from these routes were combined in the following equation:

Combined MOE = $1/[1/ MOE_{dermal} + 1/MOE_{inhalation}]$

g Rate obtained from CPMA 2014 survey

h For the PHED 'liquid, open pour, low pressure handwand' scenario, only gloved data is available.

i Estimate 18.75 L (or 23.81 kg product) applied based on USEPA assumption that commercial applicators of antifouling paint apply 18.75 L of paint (using a paintbrush) per day (based on professional judgment). Assumed paintbrush scenario for application directly to poles and application to wraps attached to poles. PHED 'paintbrush' data is not considered overly conservative and was deemed the most adequate data to use in this scenario. Note: "Pole Bandaging" application not reviewed in this assessment.

j Area treated per day not specified, assumed 1 package used per day. Maximum package size 10 L.

k Assuming the maximum label application rate of 1 L / 1 m^2 (in two applications, therefore 2 × 0.5 L / m^2): As the average area treated/day unknown, 18.75 L/day was used based on USEPA assumption that commercial applicators of antifouling paint are capable of applying 18.75 L of paint per day (using a paintbrush, based on professional judgment).

l Exposure assumed negligible for:
- Enclosed bait stations (applicator required to perforate holes on sides of enclosed container with nail).
- Rods. Exposure would likely be limited to incidental exposure. Due to the physical nature of the rods (i.e., fused anhydrous boron), the amount of boron available from the rod for dermal or oral absorption is expected to be negligible. Potential exposure may be minimized by wearing non-absorbent gloves while working with the product. PPE required on label indicates "chemical resistant gloves required in cases of prolonged contact". A risk assessment was not performed for rods.

m Based on PHED 'granular bait dispersed by hand'. This estimate is assumed to be conservative, however use specific data is not available for this application scenario.

n Rate obtained from CPMA 2014 survey. Assumed 1.34 kg product applied per day. For equivalent dust/powder product used in poultry house or barn, 11 kg of product is used (based on label rate).

o Typical area treated per day not determined. Assumed 18.75 L based on USEPA assumption that commercial applicators of antifouling paint apply 18.75 L of paint per day (using a paintbrush, based on professional judgment).

p Net contents = 11.5 kg. Assumed 1 kg applied per day based on professional judgment.

q Assume 110 kg product used to treat 1 poultry house (rate = 1kg/10m^2; average size of poultry house = 1100m^2)

r CR coveralls over a single layer and no gloves were assumed for the PHED 'granular/open pour/belly grinder M/L/A'; no adequate hand data available. Additional

gloved data from other scenarios were not considered as a surrogate for hand exposure values since the MOE values were well below the target without hand exposure.

s Label states that 600L of product is required to treat 1100m^2 poultry house at a rate of 1kg/25L.

t Applied as powder, NOT formulated into solution from soluble powder.

u Although the calculated MOEs do not reach the target MOE of 300, due to conservatisms in the risk assessment they are not expected to be of concern.

Table 2 Adult Short-term Applicator Exposure of Domestic Products Containing Boron

Formulation[a]	Application Description/Site	Assessment Used	Amount Applied (kg ai/day)[b]	Exposure (mg/kg bw/day)		MOE		
				Dermal [c]	Inhalation [d]	Dermal [e]	Inhalation [f]	Combined [g]
Solution	Open baiting, refill bait station, spot treatment (drop)	USEPA RES SOPs (2012)	0.03	4.80×10^{-3}	8.00×10^{-4}	607	3800	520
	Spray or inject							
	Brush, roll		0.96	1.19	5.30×10^{-3}	**2**	549	**2**
	Enclosed Bait [a]		-	-	-	-	-	-
Dust/Powder	Plunger duster, bulb duster	USEPA RES SOPs (2012)	0.02	0.014	0.001	**210**	3030	**190**
	Shaker can		0.05	0.533	0.022	**5**	**130**	**5**
Granular	Crack and crevice by hand	USEPA RES SOPs (2012) – modified to assume 1 bottle	0.004[h]	1.90×10^{-3}	4.60×10^{-5}	1500	62800	1460
	Push-rotary spreader			9.80 × 10-6	3.10 × 10-7	295000	9250000	285000

Shaded cells (bold numbers) indicate the MOEs did not reach the target MOE of 300.

a Exposure assumed negligible for:
- Enclosed bait stations (applicator required to perforate holes on sides of enclosed container with nail)
- Paste and solid formulations

b Amount applied = Amount product handled (kg product/day) × guarantee × boron equivalence factor. Amount applied (kg ai/day) presented as percent boron equivalence using the following conversion factors:
for BNS ($Na_2B_4O_7$ - 10 H_2O) , boron equivalent (%/100) = 0.11338
for BOA (H_3BO_3) , boron equivalent (%/100) = 0.17491
for BOC ($Na_2B_8O_{13}$ - $4H_20$) , boron equivalent (%/100) = 0.20965
for BNP $Na_2B_4O_7$ - 5 H_2O , boron equivalent (%/100) = 0.14842
In addition to boron equivalence factors (above), values presented for amount applied (in kg active ingredient/day), also take into account specific gravities (where applicable) and guarantees. Maximum rates used.

c Dermal Exposure (mg/kg bw/day) = Unit Exposure (mg/kg ai) × Application Rate × Amount Handled per Day(Area treated per day) × Dermal Absorption (10%)/Body Weight (kg)

d Inhalation Exposure (mg/kg bw/day) = Unit Exposure (mg/kg ai) × Application Rate × Amount Handled per Day(Area treated per day)/Body Weight (kg)

e Dermal MOE = $\frac{BMDL\ dermal}{Exposure\ dermal}$ The dermal BMDL is 2.9 mg/kg bw/day; the target MOE is 300. Dermal absorption = 10%.

f Inhalation MOE = $\frac{BMDL\ inhalation}{Exposure\ inhalation}$ The inhalation BMDL is 2.9 mg/kg bw/day; the target MOE is 300.

g Dermal and inhalation risks were based on the same endpoints, therefore the risk from these routes were combined in the following equation:

Combined MOE = $1/[1/\ MOE_{\ dermal} + 1/MOE_{\ inhalation}]$

h Assume 1 package used/day, net contents = 0.5 kg.

Table 3 Post-application MOEs Resulting from Commercial and Domestic Application of Boron-Containing Compounds

Formulation	Application Description/Site	Margins of Exposure		
		Adult Dermal	**Child Dermal**	**Child Incidental Oral**
Paste	Enclosed bait	n/a		
	Open bait, crack and crevice with putty knife or injection, continuous bead application[a, b]	1200	630	8200
	Brush, trowel	n/a	n/a	n/a
Solution	Brush, roller, spray, or inject	n/a (if sealed)		
	Open bait, refillable bait station	12000	12000	8200
	drops	12000	12000	8200
	Enclosed bait	n/a		
Solid	Rod	n/a		
	Enclosed bait	n/a		
Dust/Powder	Crack and crevice, bellows duster, power duster, or other	410	420	**280**
Soluble Powder	Brushing, spraying, or dipping wood	n/a		
	Drill and injection or dusting, crack and crevice	410	420	**280**
	Additive; material preservation process	n/a		
Pressurized Product	Small openings, cracks, crevices, and closed voids, with injection tube	410	420	**280**

Granular	Crack and crevice, voids, bait trays, bellows-type duster/snuffer	410	420	**280**
	Fertilizer or seed spreader	n/a		
	Pressure sprayer	n/a		

Shaded cells (bold numbers) indicate the MOEs did not reach the target MOE of 300 however, due to conservatisms in the risk assessment, exposure is not expected to be of concern.

a Assessed using “crack and crevice application to hard surface” scenario.

b Post-application exposure assumed negligible if application is restricted to sites truly inaccessible to children and pets (i.e. within crack and crevice or void). However, open bait scenarios could occur in sites accessible to children and potential exposure could occur.

Appendix IV Label Amendments for Products Containing Boron

The label amendments presented below do not include all label requirements for individual end-use products, such as first-aid statements, disposal statements, precautionary statements and supplementary protective equipment. Information on labels of currently registered products should not be removed unless it contradicts the following label statements.

Cancelled Uses

The following uses must be removed from commercial class product labels:

- Application by brush of solution or soluble powder formulations
- Application to poultry houses/barns of dust/powder formulations

The following formulations must be removed from domestic class products:

- All dust formulation products
- All granular formulation products
- Products formulated as solutions (except for enclosed bait stations and spot treatment with gel formulations)

End-use products with Multiple Formulations and/or Application Methods

Certain boron end-use product labels include more than one formulation and application method. Registrants are required to clarify the supported uses and formulations, and where necessary, seek separate product registrations. These include but are not limited to products that include multiple formulations on the same label (for example, dust, granular and soluble product). Similarly, registrations with bait stations and bait station refill must be registered as separated products with specific use instructions for each use.

Add to USE PRECAUTIONS

The following statements must be added to all current commercial class product labels:

For all formulations:

"Apply/use only in areas inaccessible to children and pets."

"Do not apply as a broadcast application."

The following statements must be added to all current domestic class product labels:

For all bait stations and gel formulations:

"Apply/use only in areas inaccessible to children and pets."

Engineering Controls and Personal Protective Equipment for Commercial Products

Statements must be amended (or added) to include the following directions to the appropriate labels in order to mitigate the risk of exposure to boron:

Mixing/Loading

For dust/powder formulations:

"Wear long pants, long-sleeved shirt, chemical resistant coveralls, chemical resistant gloves and a NIOSH approved N95 (minimum) filtering face piece respirator (dust mask) that is properly fit tested when mixing and loading boron as a dust/powder."

For soluble powder formulations used as an additive (material preservation process):

I. For bulk containers (PCP30625, 30429, 30275)

"Industrial users of the product must be equipped to handle the powdered product using closed system application/loading equipment (i.e. screw feeder apparatus). Bulk containers (1134 kg) must be used"

II. For smaller size containers (PCP23283)

For smaller size containers that are manually loaded, the following statement must be added:

"Do not handle more than 113 kg (5 × 22.7 kg bags) in one day."

For all other formulations:

"Wear long pants, long-sleeved shirt, chemical-resistant coveralls, and chemical-resistant gloves when mixing and loading boron."

Applying

For dust/powder formulations:

"Wear long pants, long-sleeved shirt, chemical resistant coveralls, chemical resistant gloves and a NIOSH approved N95 (minimum) filtering face piece respirator (dust mask) that is properly fit tested when applying boron as a dust/powder."

"Visible dust/powder must be removed or wiped away after application to voids."

For all other formulations:

"Wear long pants, long-sleeved shirt, chemical-resistant coveralls, and chemical-resistant gloves when applying boron."

Add to DIRECTION FOR USE

For all solution and soluble powder wood treatment products:

"Treated wood must be sealed or used in locations where post-application exposure will not occur."

References

Studies considered in Health Assessment

Toxicology:

A. List of Studies/Information Submitted by Registrant

PMRA Document Number	Reference
2531679	2010. Single-dose Oral (gavage) Toxicokinetic Study of Zinc Borate 2335 in Sprague Dawley Rats. DACO4.4.1
2531678	1996. Firebrake 415: Twenty-eight day Sub-acute oral (gavage) toxicity study in the rat. DACO4.3.3

B. Additional Information Considered

Published Information

PMRA Document Number	Reference
2077077	Ku, Warren W., et al, 1993, Testicular toxicity of Boric Acid (BA): Relationship of Dose to Lesion Development and Recovery in the F344 Rat – Reproductive Toxicology, Volume 7, Pages 305 to 319, DACO: 4.5.1
2077099	Weir RJ; Fisher, RS, 1972. Toxicologic studies on borax and boric acid. Toxicol. Appl. Pharm. 23: 351-364, DACO4.8
2578857	Anderson et al. (1993). Protective Action of Zinc against Cobalt-Induced Testicular Damage in the Mouse. Reprod Toxicol 7:49-54. DACO12.5.4
2578856	Fernandez et al. (2003). Cadmium-Induced Changes in Apoptotic Gene Expression Levels and DNA Damage in Mouse Embryos Are Blocked by Zinc, Tox Sciences 76:162-170. DACO12.5.4
pending	2016 Environment Canada, Health Canada Draft Screening Assessment: Boric Acid, its Salts and its Precursors Healthy Environments and Consumer Safety. March XX 2016. DACO12.5

PMRA Document Number	Reference
2604919	2015, Boric Acid/Sodium Salts of Boric Acid. Human Health Draft Risk Assessment for Registration Review. Case number 0024. December 2015. US EPA. Docket Number EPA-HQ-OPP-2009-0306, DACO 12.5
2604858	2014, Opinion proposing harmonised classification and labelling at EU level of boric acid, CAS RN 10043-35-3. , [ECHA] European Chemicals Agency Committee for Risk Assessment. CLH-O-0000003738-64-03/D. Adopted 14 March 2014. DACO 12.5
2604855	2010, Proposal for identification of a substance as substance of very high concern (SVHC). Substance name: Boric acid. [ECHA] European Chemicals Agency Annex XV dossier. EC Number: 233-139-2/234-343-4. CAS RN: 10043-35-3/11113- 50-1. DACO 12.5

Occupational /Residential:

A. List of Studies/Information Submitted by Registrant

PMRA Document Number	Reference
2283972	1995. *In vivo* percutaneous absorption of boric acid, borax and disodium octaborate tetrahydrate (DOT) in man. DACO4.5
2283971	1996. *In vitro* percutaneous absorption of boric acid, borax, and disodium octaborate tetrahydrate (DOT) in human skin. DACO4.5

B. Additional Information Considered

Published Information

PMRA Document Number	Reference
2409268	U.S. EPA (2012a). Standard Operating Procedures for Residential Pesticide Exposure Assessment. EPA: Washington, DC. Revised October 2012. DACO12.5.5
2604886	2010a. [SCCS] Scientific Committee on Consumer Safety. European Commission. Opinion on boron compounds. DACO 12.5

PMRA Document Number	Reference
2604892	2010b. [SCCS] Scientific Committee on Consumer Safety. European Commission. Opinion on sodium perborate and perboric acid. DACO 12.5
2604904	2008. Alberta Health and Wellness. The Alberta Biomonitoring Program: Chemical Biomonitoring in Serum of Pregnant Women in Alberta. Edmonton (AB): Alberta Health and Wellness. ISBN 978-0-7785-6695-3. DACO 12.5