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Revised Zinc, Zinc Salts and Zeolites Summary Document: Registration Review Preliminary Work Plan

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Revised Zinc, Zinc Salts and Zeolites Summary Document Registration Review Preliminary Work Plan: Initial Docket March 2009

Approved By:

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Date: 3/31/09

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I. PRELIMINARY WORK PLAN – ZINC, ZINC SALTS AND ZEOLITES

Revisions to Summary Document

This document was revised after publication to include a link to a list of zinc-related water body impairments as defined under section 303(d) of the Clean Water Act. This revision can be found in the Water Quality section on pages 15-16 of this document.

Introduction

The Food Quality Protection Act of 1996 mandated a registration review program. All pesticides distributed or sold in the United States must generally be registered by EPA, based on scientific data showing that they will not cause unreasonable risks to human health, (including occupational and non-occupational exposures) or the environment when used as directed on product labeling. The registration review program is intended to make sure that, as the ability to assess risk evolves and as policies and practices change, all registered pesticides continue to meet the statutory standard of no unreasonable adverse effects to human health and the environment. Changes in science, public policy, and pesticide use practices will occur over time. Through the registration review program, the Agency periodically reevaluates pesticides to make sure that as change occurs, products in the marketplace can be used safely. Information on this program is provided at: http://www.epa.gov/oppsrrd1/registration_review/.

The Agency has begun to implement the new Registration Review program pursuant to FIFRA Section 3(g) and will review each registered pesticide every 15 years to determine whether it continues to meet the FIFRA standard for registration. The public phase of registration review begins when the initial public docket is opened for each case. The docket is the Agency's opportunity to state what it knows about the pesticide and what additional risk analyses and data or information it believes are needed to make a registration review decision. After reviewing and responding to comments and data received in the docket during this initial comment period, the Agency will develop and commit to a final work plan and schedule for the registration review process of Zinc, Zinc Salts and Zeolites.

Zinc salts were first registered as a pesticide in 1973. The Zinc, Zinc Salts and Zeolites case contains four active ingredients: zinc chloride (PC Code 087801), zinc oxide (PC Code 088502) zinc sulfide monohydrate (PC Code 52700), and zinc (PC Code 129015). Zinc chloride is formulated as a soluble concentrate and ready to use liquid used for application to walkways and patios for control of moss on and around buildings. Zinc oxide is formulated as a wettable powder fungicide and bacteriostat used for textiles, fibers, tree roots, and wood treatments. Zinc sulfate monohydrate is formulated as a soluble concentrate also for control of moss on and around buildings. Zinc (PC Code 129015) is sold as a formulating wettable powder product only and is incorporated in polymer, plastic, and textile products to suppress the growth of algae, mold, and mildew. A Reregistration Eligibility Decision (RED) was issued for the three zinc salts in 1992, excluding metallic zinc.

Several registrations exist for zinc and silver-zinc zeolites containing metallic zinc (129015), which have been identified as toxicologically distinct from other zinc-containing compounds in this case. Due to their distinct nature, the Agency is evaluating whether zinc and silver-zinc zeolites should be split from this case to form their own case in the future. Currently zinc-containing zeolites are considered in the zinc sections of this document.

Risk Assessment Status & Anticipated Risk Assessment Status and Data Needs

Human Health Risk Assessment Status and Anticipated Data Needs

Toxicity

The Agency has reviewed all toxicity studies submitted for the zinc salts and has determined that the toxicological database is sufficient. The Agency has not selected toxicological endpoints for zinc salts since zinc is ubiquitous in the environment, an essential nutrient, exists naturally in food and is considered by the Food and Drug Administration (FDA) as generally recognized as safe (GRAS) for use in foods and nutrients. The toxicological database for the zinc salts case is currently comprised of published and unpublished studies either submitted to the Agency or obtained directly from published open literature.

The Food and Drug Administration (FDA) considers zinc chloride as GRAS for use in foods and nutrients under 21 CFR 182.8985 and 21 CFR 182.5991. The FDA also considers zinc oxide and zinc sulfate as GRAS for use in foods under 21 CFR 182.8991 and 182.8997, respectively. The FDA also considers zinc oxide and zinc sulfate as GRAS for use in nutrients under 21 CFR 182.5985 and 182.5997, respectively.

Silver-zinc and zinc zeolites are included with metallic zinc for the purposes of this registration review. It should be noted that the silver-zinc and zinc zeolites were all registered after the Zinc Salts RED was published.

Acute Toxicity

Zinc Chloride

Data from the existing RED indicates that zinc chloride has an acute toxicity category II for acute oral (rat). It is a corrosive for the skin and eyes (acute toxicity category I). The acute inhalation study for zinc chloride is assigned as acute toxicity category III.

Zinc Oxide

Data evaluated for the existing RED indicates that zinc oxide has an acute toxicity category IV for acute oral (rat). It is a not a skin irritant (acute toxicity category

IV) and only a mild eye irritant (acute toxicity category III). The acute inhalation studies were waived for the technical active ingredient.

Zinc Sulfate Monohydrate

Data evaluated for the existing RED indicates that zinc sulfate monohydrate has an acute toxicity category III for acute oral (rat). It is a mild eye irritant (acute toxicity category III). The acute inhalation, dermal and sin studies were waived for the technical active ingredient.

Zinc (Metallic)

Data for metallic zinc were not available at the time the RED was completed. However, data from a product toxicity review (D281773) containing 1.36% zinc indicates that metallic zinc has an acute toxicity category IV for acute oral, acute dermal and acute inhalation. It is a mild skin irritant (acute toxicity category IV) and mild eye irritant (acute toxicity category III) and a nonsensitizer.

Silver-zinc and zinc zeolites are included with metallic zinc for the purposes of this registration review. It should be noted that the silver-zinc and zinc zeolites were all registered after the Zinc Salts RED was published.

Sub-chronic and Chronic Toxicity

The Food and Drug Administration (FDA) considers zinc chloride GRAS for use in foods and nutrients under 21 CFR 182.8985 and 21 CFR 182.5991. The FDA also considers zinc oxide and zinc sulfate GRAS for use in foods under 21 CFR 182.8991 and 182.8997, respectively. The FDA also considers zinc oxide and zinc sulfate GRAS for use in nutrients under 21 CFR 182.5985 and 182.5997, respectively.

Zinc is ubiquitous in the environment and occurs in the earth's crust at an average concentration of approximately 70 mg/kg. This ion exists in the form of zinc salts such as zinc sulfide, zinc carbonate, and zinc oxide. Zinc is also an essential nutrient in the body. For toxicological concerns, there are adequate toxicology studies in the zinc database to evaluate incidental oral exposures. At high levels, oral exposure to zinc in animal studies may result in toxic effects such as pancreatic and renal lesions as well as histological alterations in the pituitary and adrenal glands. However, based on the currently registered use patterns, exposure to zinc is not anticipated to be high. Zinc is widely distributed in plants and animals, and is normally present in food. Zinc is also a normal part of metabolism in all living organisms. Based on this information, no toxicological endpoints were selected.

Several existing registrations exist for silver-zinc zeolites which are composed of zinc (metallic) (PC Code 129015). Zeolites are clay-like materials that can be combined

with various metal ions. According to a submitted study (MRID 458033-01), "the silver-zinc zeolites are silver-zinc ion-exchange products which are stabilized by inert ion exchange carrier." The silver-zinc zeolites labels are unique from the rest of the zinc salt active ingredients because they are used for indirect food contact uses (countertops, appliances, kitchen hardware, tiles, food trays, food processing equipment, food storage containers, food packaging, food processing utensils); drinking water contact uses (tubing, plumbing supplies and fixtures); dermal contact (apparel items and interior furnishings) and HVAC uses (D287537; D287389). The other zinc salts are not used for food contact products. There are currently no tolerances or exemptions for the requirement of a tolerance for any zinc salts in this registration review case. A tolerance or exemption from the requirement of tolerance may be needed for zinc portion of silver-zinc zeolites for these indirect food uses. It should be noted that the silver-zinc zeolites have been identified as toxicologically distinct from other zinc-containing compounds in this case. Because the toxicity of the silver-zinc zeolites is unknown, the Agency intends to evaluate these compounds and will determine if they need to be evaluated separately. However, in the interim, these compounds are included in the case with zinc and zinc salts.

The primary source of information for this assessment is the 1992 Zinc Salts RED. It should be noted that the silver-zinc and zinc zeolites were all registered after the Zinc Salts RED was published. Toxicity endpoints for zinc and zinc salts were not originally selected in the RED because zinc is ubiquitous in the environment and occurs in the earth's crust at an average concentration of approximately 70 mg/kg. Zinc is also an essential nutrient in the body and is GRAS in food as dietary supplements. At registered application rates, exposure to zinc salt pesticides is not likely to be higher than that which is found in ambient levels and at levels of zinc nutrient which are required by the human body.

Dietary and Drinking Water Assessment

As mentioned previously, the FDA considers zinc and zinc chloride generally recognized as safe (GRAS) for use in foods and nutrients under 21 CFR 182.8985 and 21 CFR 182.5991. The FDA also considers zinc oxide and zinc sulfate as GRAS for use in foods under 21 CFR 182.8991 and 182.8997, respectively. The FDA also considers zinc oxide and zinc sulfate as GRAS for use in nutrients under 21 CFR 182.5985 and 182.5997, respectively. Therefore, no dietary or drinking water assessment is needed for zinc and zinc salts.

The silver-zinc zeolites labels are unique from the rest of the zinc salt active ingredients because they are used for indirect food contact uses (countertops, appliances, kitchen hardware, tiles, food trays, food processing equipment, food storage containers, food packaging, food processing utensils); drinking water contact uses (tubing, plumbing supplies and fixtures); dermal contact (apparel items and interior furnishings) and HVAC uses (D287537; D287389). For dietary exposure for silver-zinc compounds, the Agency needs toxicology studies conducted with the highest percentage of silver and zinc end-use formula silver-zinc product for subchronic toxicity in the rodent, subchronic toxicity in

the non-rodent, developmental toxicity in the rodent, and reproductive toxicity in the rodent. This information will be used to conduct a dietary assessment on the silver-zinc zeolites in end use products.

In addition for silver-zinc zeolite, there are registered drinking water contact uses (tubing, plumbing supplies and fixtures). It should be noted that zinc is ubiquitous in the environment and the use as a pesticide would likely be negligible to the background concentrations of zinc already present naturally in the environment. Because of the minimal zinc resulting from these uses and dilution a drinking water assessment on zinc and zinc salt is not needed. However, a drinking water assessment is needed for silver-zinc zeolites.

Occupational and Residential Assessment

An occupational and/or residential exposure assessment is needed for an active ingredient if (1) certain toxicological criteria are triggered and (2) there is potential exposure to handlers (mixers, loaders, applicators, etc.) during use or to persons entering treated sites after application is complete. For zinc and zinc salts, the toxicological criteria are not triggered. Given the lack of concern for toxicity, and low potential for occupational and residential exposure, mixer/loader/applicator and post application occupational and residential risks from the existing uses of zinc salts are considered inconsequential and are not of concern. Additional occupational and residential risk assessments are not needed. However, for silver-zinc and zinc zeolites, the Agency anticipates needing occupational and/or residential exposure assessments particularly from dermal and inhalation exposure for workers preserving materials. In addition, dermal contact to treated apparel and incidental exposure via mouthing to treated fabrics would need to be assessed.

For zinc and zinc salts there are currently 17 registered products. Most of the uses include handler exposure to mixing/loading soluble concentrates and wettable powders during manufacturing of material preservatives and wood pressure treatment exposures to zinc from ammonical copper zinc arsenate (ACZA). There would also likely be dermal and inhalation exposure applying zinc preservative sprays to moss on walkways and roofs. Occupational exposure scenarios would include inhalation and dermal exposure for workers preserving materials such as fabric or plastics. Occupational postapplication exposure scenarios would include dermal and incidental ingestion from contact with wood products (utility poles, building poles, foundation piling, marine piling, etc.) and residential postapplication exposures would include dermal and incidental ingestion to treated countertops and treated apparel and pressure treated decks.

As mentioned in the toxicology section, zinc is ubiquitous in the environment and occurs in the earth's crust at an average concentration of approximately 70 mg/kg. Zinc is also an essential nutrient in the body and is GRAS in food as dietary supplements. At registered application rates, exposure to zinc salt pesticides is not likely to be higher

than that which is found in ambient levels and at levels of zinc nutrient which are required by the human body.

Human Health Toxicity Data Needs:

The Agency does not anticipate needing any further studies for the zinc salts which include zinc chloride (PC Code 087801), zinc oxide (PC Code 088502) and zinc sulfide monohydrate (PC Code 527200). According to a previous review (D287537 and D287380, U.S. EPA 2004a and U.S. EPA 2004b) of the food use of silver-zinc zeolites, toxicological data are needed to support the food uses of the silver-zinc zeolites. Data needs for zinc active ingredient in silver-zinc zeolites currently fall under zinc (metallic) [PC Code 129015].

The Agency will be reviewing the silver-zinc zeolite compounds to determine if the toxicity is similar to salts of silver and zinc. This evaluation will determine if the hazards would need to be considered separately for each silver-zinc zeolite compound. Therefore, for the purposes of registration review, toxicity data needs for the silver-zinc and zinc zeolites are as follows:

Human Health Toxicity Data Requirements:

- (GLN 870.3100) 90-Day Oral Toxicity-rodent
- (GLN 870.3150) 90-Day Oral Toxicity-non-rodent
- (GLN 870.3250) 90-Day Dermal Toxicity-rodent
- (GLN 870.3700) Developmental Toxicity- rodent
- (GLN 870.3800) Reproductive Toxicity- rodent

Once the Agency receives and reviews these toxicological studies, additional occupational, dietary and aggregate assessments may be needed.

Further information and detailed justifications for required studies are available in "Summary of Human Health Effects Data for the Zinc Salts Registration Review Decision Document," dated March 4, 2009.

Anticipated Physical/ Chemical Property Data Needs

All product chemistry data requirements have been fulfilled for the active ingredients zinc chloride, zinc sulfate monohydrate, zinc oxide, and zinc metal, including zeolites. Therefore, the Agency does not anticipate needing additional product chemistry data for zinc chloride at this time.

Further information is available in "Summary of Product Chemistry, Environmental Fate, and Ecotoxicity Data for the Zinc salts Registration Review Summary Document," dated February 23, 2009.

Anticipated Environmental Fate and Ecological Risk Assessment and Data Needs

Environmental Fate Summary

Since most of the applied zinc and zinc salts will transform to zinc oxide/hydroxide, the needed ecotoxicity studies for zinc oxide are sufficient for the other active ingredients (see Zinc Oxide below).

Zinc Chloride

No studies have been submitted or reviewed regarding the environmental fate of zinc chloride. An environmental risk assessment was not conducted on the zinc chloride use patterns described in this document. However, the Agency anticipates conducting an environmental fate assessment for zinc chloride pesticides used in residential outdoors for control of moss on roofs, decks, steps, patios, walks, bricks, cement, sidewalks, fences, fence posts, foundations and other outdoor structures made of composition shingles, wood, gravel, brick and unpainted cement.

Zinc Sulfate Monohydrate

No studies have been submitted or reviewed regarding the environmental fate of zinc sulfate monohydrate. An environmental risk assessment was not conducted on the zinc sulfate monohydrate use patterns described in this document. However, the Agency anticipates conducting an environmental fate assessment for zinc sulfate monohydrate pesticides used in residential outdoors to kill moss on roofs, pitched roof that can be walked upon such as composition shingles, wood shingles, or shakes; rock, gravel, flat roofs and roofs that cannot be walked upon; decks, steps, patios, walks, bricks, cement, sidewalks, walkways, driveways, fences, fence posts, foundations and other outdoor structures made of composition shingles, wood, gravel, brick and unpainted cement.

Zinc, Metallic

No studies have been submitted or reviewed regarding the environmental fate of zinc. An environmental risk assessment was not conducted on the zinc use patterns described in this document. However, the Agency anticipates conducting an environmental fate assessment for material preservatives that potentially pass through wastewater treatment plants (WWTPs) and may be discharged into terrestrial and aquatic environments. Also, the Agency anticipates conducting an environmental fate assessment for zinc pesticides used in residential outdoors for control of moss, mildew, slime mold and algae growth on roofs, decks, patios, sidewalks, driveways, residential lawns and other residential outdoor structures.

Zinc Oxide

No studies have been submitted or reviewed regarding the environmental fate of zinc oxide. An environmental risk assessment was not conducted on the zinc oxide use

patterns described in this document. However, the Agency anticipates conducting an environmental fate assessment for material preservatives that potentially pass through wastewater treatment plants (WWTPs) and may be discharged into terrestrial and aquatic environments.

Silver-Zinc Zeolites

No studies have been submitted or reviewed regarding the environmental fate of silver-zinc zeolies. An environmental risk assessment was not conducted on silver-zinc zeolites based on the use patterns described in this document. However, the Agency does not anticipate conducting and environmental fate assessment on the silver-zinc zeolites.

Ecological Effects Summary

Zinc Chloride

The Agency has no submitted ecotoxicity data for zinc chloride. No risk assessment was performed for zinc chloride. Ecological effects data have been submitted for zinc oxide only. Since most of the applied zinc and zinc salts will transform to zinc oxide/hydroxide, the ecotoxicity studies for zinc oxide are sufficient for the other active ingredients (see Zinc Oxide below).

An ecological risk assessment was not conducted on the zinc chloride use patterns described in this document. The Agency anticipates conducting an ecological risk assessment for outdoor residential uses of zinc chloride for control of moss on roofs, decks, steps, patios, walks, bricks, cement, sidewalks, fences, fence posts, foundations and other outdoor structures made of composition shingles, wood, gravel, brick and unpainted cement.

Zinc Sulfate Monohydrate

The Agency has no submitted ecotoxicity data for zinc sulfate monohydrate. No risk assessment was performed for zinc sulfate monohydrate. Ecological effects data have been submitted for zinc oxide only. Since most of the applied zinc and zinc salts will transform to zinc oxide/hydroxide, the ecotoxicity studies for zinc oxide are sufficient for the other active ingredients (see Zinc Oxide below).

An ecological risk assessment was not conducted on the zinc sulfate monohydrate use patterns described in this document. The Agency anticipates conducting an ecological risk assessment for outdoor residential uses of zinc sulfate monohydrate to kill moss on roofs, pitched roof that can be walked upon such as composition shingles, wood shingles, or shakes; rock, gravel, flat roofs and roofs that cannot be walked upon; decks, steps, patios, walks, bricks, cement, sidewalks, walkways, driveways, fences, fence posts, foundations and other outdoor structures made of composition shingles, wood, gravel, brick and unpainted cement.

Zinc, Metallic

The Agency has no submitted ecotoxicity data for zinc. No risk assessment was performed for zinc. Ecological effects data have been submitted for zinc oxide only. Since most of the applied zinc and zinc salts will transform to zinc oxide/hydroxide, the ecotoxicity studies for zinc oxide are sufficient for the other active ingredients (see Zinc Oxide below).

An ecological risk assessment was not conducted on the zinc use patterns described in this document. The Agency anticipates conducting an ecological risk assessment for the materials preservative uses of zinc that potentially pass through wastewater treatment plants (WWTPs) and may be discharged into terrestrial and aquatic environments and outdoor residential uses for control of moss, mildew, slime mold and algae growth on roofs, decks, patios, sidewalks, driveways, residential lawns and other residential outdoor structures.

Silver-Zinc Zeolites

The Agency has no submitted ecotoxicity data for silver-zinc zeolites and no risk assessment was performed. An ecological risk assessment was not conducted on the silver-zinc zeolites use patterns described in this document. Based on the indoor use patterns, and the fact that it is unlikely to result in significant ecological exposure, the Agency does not anticipate conducting an ecological risk assessment for the silver-zinc zeolites.

Zinc Oxide

An ecological risk assessment was not conducted on the zinc oxide use patterns described in this document. Zinc oxide uses that have potential for environmental exposure are materials preservative and wood preservative uses. The Agency anticipates conducting an ecological risk assessment for wood preservatives and material preservatives that potentially pass through wastewater treatment plants (WWTPs) and may be discharged into terrestrial and aquatic environments.

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

Environmental Fate and Ecotoxicity Data Gaps and Anticipated Work

Environmental fate and ecological risk assessments have not been conducted for zinc oxide. The Agency anticipates conducting environmental fate and ecological risk assessments for material preservatives that potentially pass through waste water treatment plants (WWTPs) and may be discharged into terrestrial and aquatic environments. Therefore, the Agency anticipates the need for proposed environmental fate and ecotoxicity data for zinc oxide and/or any of its major degradation products that are of potential concern for all registered uses of zinc oxide. The data submitted for zinc oxide will also be used in risk assessments for zinc chloride, zinc sulfate monohydrate, and zinc. The following environmental fate and ecotoxicity data are required in order to conduct environmental fate and ecological risk assessments:

- The Agency anticipates needing the following data in order to conduct a complete environmental fate assessment for indoor uses:
    - (GLN 850.6800) modified activated sludge respiration inhibition; and
    - (GLN 835.1110) activated sludge sorption isotherm.
- The Agency anticipates needing the following data in order to conduct a complete ecological risk assessment, including an endangered species assessment for indoor uses:
    - (GLNs 850.4400 & 850.5400) algal toxicity (Tier II) using freshwater green alga, *Selenastrum capricornutum.*

Potential Zinc Oxide Ecological Effects and Environmental Fate Data for Outdoor Wood Preservative Uses

If zinc oxide is intended for treatment of wood products used in outdoor scenarios (e.g., decks, decking materials, aquatic uses), the Agency anticipates needing some, or all of, the following data in order to conduct the environmental fate and ecological risk assessments, including an endangered species assessment. However, note that the data needed will depend on: the quantities of zinc oxide (and/or major degradates or metabolites) leaching from wood; the types of chemical(s) leaching from wood (e.g., parent compound, major degradates or metabolites); the outdoor use scenarios in which zinc oxide-treated wood may be used; and the Agency's evaluation of the leaching data along with the available use, effects, and exposure information for zinc oxide.

Ecological Effects Studies:[1]

To support registration of wood preservatives, the following ecological effects and environmental fate data are needed:

a. **Needed Ecological Effects Data**:

Guideline Number	Description of Data Requirement
850.1010:	Aquatic invertebrate acute EC_{50} using *Daphnia magna* (using TGAI and TEP) (satisfied);
850.1075:	Fish acute LC_{50}s with a coldwater (rainbow trout, preferred) and a warmwater (bluegill sunfish, preferred) species (using TGAI and Typical End-Use Product (TEP) (satisfied);
850.2100:	Avian acute oral LD_{50} with bobwhite quail (preferred) or mallard duck (using Technical Grade Active Ingredient (TGAI) (satisfied);
850.4225:	Seedling emergence - dose response using rice (*Oryza sativa*);
850.4250:	Vegetative vigor - dose response using rice (*Oryza sativa*);
850.4400:	Aquatic plant growth using floating macrophyte *Lemna gibba;* and
850.5400:	Aquatic plant growth (algal and aquatic plant toxicity) - Tier II (dose response) (using TGAI or TEP) – Four species: freshwater green alga, *Selenastrum capricornutum*, blue-green cyanobacterium, *Anabaena flos-aquae,* the freshwater diatom, *Navicula pelliculosa, and* marine diatom, *Skeletonema costatum*.

b. Conditionally-Required (CR) Ecological Effects Data:

850.1025: Oyster acute (shell deposition) or
850.1055: Acute oyster embryo larval

850.1035: Acute Mysid
850.1045: Acute Penaeid

850.1075: Acute Fish Toxicity (estuarine/marine species) Acute LC_{50}s/EC_{50}s using estuarine/marine organisms (fish) species (using TGAI and TEP);
850.1300: Aquatic Invertebrate life cycle study (using most sensitive species - freshwater or estuarine/marine) Daphnid chronic toxicity test;
850.1350: Aquatic Invertebrate life cycle study (using most sensitive species - freshwater or estuarine/marine) Mysid chronic toxicity test;
850.1400: Fish early-life stage toxicity studies (using TGAI and most sensitive species - freshwater or estuarine/marine);
850.1500: Fish (freshwater and/or estuarine/marine species) life cycle study (using TGAI);

1 Test material depends in part on what chemicals are leaching from Zinc oxide-treated wood.

850.1710: Oyster BCF
850.1730: Fish BCF
850.1850: Aquatic organism bioavailability/biomagnifications, toxicity tests (using TGAI or PAIRA);

850.1735: Whole sediment, acute invertebrates (freshwater) (using TGAI);
850.1740: Whole sediment; acute invertebrates (estuarine/marine) (using TGAI);
850.1950: Field testing for aquatic organisms (estuarine/marine) (using TEP);
850.2200: Avian dietary LC_{50} with bobwhite quail and/or mallard duck (using TGAI) (satisfied);
850.2300: Avian reproductive studies with bobwhite quail and/or mallard duck (using TGAI); and
None: Whole sediment - chronic invertebrates (freshwater and/or estuarine/marine) (using TGAI or TEP).
850.3020: Honeybee acute contact LD_{50} (using TGAI);
850.3030: Toxicity of residues to honeybees, "Honey Bee Toxicity of Residues on Foliage" (using TGAI);
850.4300: Terrestrial Plants Field Study (using TGAI);
850.4450: Aquatic Plants Field Study (using TGAI)

c. Needed Environmental Fate Data:

Guideline Number	Description of Data Requirement
835.2240:	Photodegradation in water (using TGAI or PAIRA);
835.2240:	Photodegradation in soil (using TGAI or PAIRA);
835.1230/	Leaching and/
835.1240:	Adsorption/Desorption studies (using TGAI or PAIRA);
835.4100:	Aerobic soil metabolism (using TGAI or PAIRA);
None:	Aquatic leaching from wood study. (For guidance refer to: Standard Method of Determining The Leachability of Wood Preservatives, American Wood-Preservers' Association Standard E11-06);
None:	Soil leaching from wood study (AWPA E20-04)
835.4400:	Anaerobic aquatic metabolism (using TGAI or PAIRA); and
850.6800:	Modified activated sludge, respiration inhibition (using TGAI).

d. Conditionally-Required (CR) Environmental Fate Data:

835.4200: Anaerobic soil metabolism (using TGAI or PAIRA);
835.4300: Aerobic aquatic metabolism (using TGAI or PAIRA);
835.4400: Anaerobic aquatic metabolism (using TGAI or PAIRA);
835.6200: Aquatic (sediment) [using Typical End-use Product (TEP)]; and
None: Monitoring of representative U. S. waters (residue of concern).

The above listed wood preservative data requirements for zinc oxide will also satisfy data needs for residential outdoor moss control uses of zinc chloride, zinc sulfate monohydrate, and zinc metal.

Further information and detailed justifications for required studies are available in "Summary of Product Chemistry, Environmental Fate, and Ecotoxicity Data for the Zinc Salts Registration Review Summary Document," dated March 23, 2009.

Incidents:

A search of the OPP Incident Data System (IDS) found one reported incident for zinc chloride, and no reported incidents for the rest of the zinc salts case. In the single zinc chloride incident, the subject reported a stinging cheek, pain near a kidney and blood in urine. The report did not clarify further and the route of exposure to zinc chloride is unknown.

Timeline:

EPA has created the following estimated timeline for the completion of the Zinc, Zinc Salts and Zeolites registration review:

Anticipated Schedule

Activities	**Estimated Month/Year**
Phase 1: Opening the docket	
Open Public Comment Period for Zinc, Zinc Salts and Zeolites Docket	March 2009
Close Public Comment Period	June 2009
Phase 2: Case Development	
Develop Final Work Plan (FWP)	September 2009
Issue DCI	June 2010
Data Submission	July 2012
Open Public Comment Period for Preliminary Risk Assessments	February 2013
Close Public Comment Period	March 2013
Phase 3: Registration Review Decision	
Open Public Comment Period for Proposed Reg. Review Decision	June 2014
Close Public Comment Period	September 2015
Final Decision and Begin Post-Decision Follow-up	November 2015
Total (years)	6

Guidance for Commenters:

The public is invited to comment on EPA's preliminary registration review work-plan and rationale. The Agency will consider all comments as well as any additional

information or data provided in a timely manner prior to issuing a final work plan for the Zinc, Zinc Salts and Zeolites case.

Stakeholders are also specifically asked to provide available information and data in the following areas:

1. Confirmation on the following label information:
    a. Sites of application
    b. Formulations
    c. Application methods and equipment
    d. Maximum application rates
    e. Frequency of application, application intervals and maximum number of applications
    f. Geographic limitations on use
2. Use or potential use distribution
3. Use history
4. Usage/use information for non-agricultural uses (e.g., materials preservation)
5. Typical application interval
6. State or local use restrictions
7. Ecological incidents (non-target plant damage and avian, fish, reptilian, amphibian and mammalian mortalities) not already reported to the Agency
8. Monitoring data
9. Structure Activity Relationships

Environmental Justice

EPA seeks to achieve environmental justice, the fair treatment and meaningful involvement of all people, regardless of race, color, national origin, or income, in the development, implementation, and enforcement of environmental laws, regulations, and policies. To help address potential environmental justice issues, the Agency seeks information on any groups or segments of the population who, as a result of their location, cultural practices, or other factors, may have atypical, unusually high exposure to Zinc, Zinc Salts and Zeolites, compared to the general population. Please comment if you are aware of any sub-populations that may have atypical, unusually high exposure compared to the general population.

Water Quality

Zinc salts and zinc zeolites are not identified as a cause of impairment for any water-bodies listed as impaired under section 303(d) of the Clean Water Act, based on information provided at: http://oaspub.epa.gov/tmdl/waters_list.impairments?p_impid=3. However, zinc (metallic) has been identified as a cause of impairment for water bodies listed as impaired under section 303(d) of the Clean Water Act, based on information provided at:
http://iaspub.epa.gov/tmdl_waters10/attains_nation_cy.cause_detail_303d?p_cause_grou

p_id=706. This list indicates 437 impairments listed for zinc in water and 10 for zinc in sediment. The Agency will determine whether pesticide use was a contributor and/or determine if use might occur in these watersheds.

The Agency invites submission of water quality data for these chemicals. To the extent possible, data should conform to the quality standards in Appendix A of the "OPP Standard Operating Procedure: Inclusion of Impaired Water Body and Other Water Quality Data in OPP's Registration Review Risk Assessment and Management Process," (http://www.epa.gov/oppsrrd1/registration_review/water_quality_sop.htm), in order to ensure they can be used quantitatively or qualitatively in pesticide risk assessments.

Trade Irritants

Through the registration review process, the Agency intends to solicit information on trade irritants and, to the extent feasible, take steps toward facilitating irritant resolution. Growers and other stakeholders are asked to comment on any trade irritant issues resulting from lack of Maximum Residue Limits (MRLs) or disparities between U.S. tolerances and MRLs in key export markets, providing as much specificity as possible regarding the nature of the concern. In the case of Zinc, Zinc Salts and Zeolites, there are currently no residue tolerances established for Zinc, Zinc Salts and Zeolites. However, there are indirect food uses as Zinc, Zinc Salts and Zeolites is registered for use as a materials preservative in dishwashing liquids and general cleaning solutions, resulting in indirect contact with surfaces that may come in contact with food. Additionally, there are no MRLs established for Zinc, Zinc Salts and Zeolites. Therefore, the Agency does not anticipate current uses of Zinc, Zinc Salts and Zeolites posing concerns as a trade irritant.

Structure Activity Relationships

EPA must rely upon information of appropriate quality and reliability for each decision made by the Agency. In the Office of Pesticide Programs (OPP), the evaluation process for a pesticide chemical traditionally begins with the applicant's submission of a set of studies conducted with the specific pesticide chemical of interest. The use of the results of such testing (measured data) is a logical, scientifically rigorous process that identifies the physical, chemical, and environmental fate properties of the pesticide, as well as the dose and endpoints at which an adverse effect can occur in various animal species.

Today, there is significant interest in alternative techniques, i.e., techniques other than data generation that could significantly inform the Agency's decision-making process. Recently, OPP has made increasing use of structure activity relationship (SAR) as part of its regulatory decision-making process. In the SAR process, a chemical's molecular structure is compared to that of other chemicals for which data are available. These structural similarities are then used to make predictive judgments about a chemical's physical, chemical, and biological properties. Thus, the chemical's physical, chemical, and biological properties are a function of (or directly related to) the chemical's

molecular structure. Quantitative SAR is referred to as QSAR. To develop a QSAR, a selected set of measured data on a single physical, chemical, or biological property is used to derive a model (an equation) to predict the value of that property.

Since SAR assessments and QSAR modeling are another set of tools that are available to Agency scientists, OPP has begun a process shift that envisions shifting from the current study-by-study approach to an approach in which the use of predicted data, generated using validated models, is considered along with information from open literature and studies specifically generated under Part 161 requirements. All relevant information would be considered as part of a weight-of-the-evidence evaluation.

At this time, EPA believes that for certain endpoints, especially physical/chemical and fate properties, that SAR and QSAR might be effectively utilized to fulfill these data requirements for many antimicrobial pesticide chemicals. When considering biological properties, at this time, EPA believes that SAR and QSAR can be most effectively utilized in the evaluation of chemicals that exhibit lower toxicity for human health and/or ecotoxicity parameters. This is appropriate because the risk assessment for lower toxicity chemicals can be stream-lined, i.e., a screening-level assessment procedure rather than multiple tiers of assessments with progressively more data requirements.

If stakeholders believe that submission of predicted data can fulfill one of the data needs for Zinc, Zinc Salts and Zeolites, then the Agency invites submission of this information. The submitter would be expected to supply a rationale describing the utility of the information and provide documentation on the scientific validity of the information. The determination that the predicted data fulfills the data requirement would be at the sole discretion of the Agency. Pre-submission consultation with the Agency is encouraged.

Next Steps:

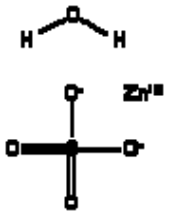
After the 90-day public comment period closes, the Agency will prepare a Final Work Plan for this pesticide.

II. FACT SHEET

Background Information

- Registration review case number: 4099
- PC Codes: 087801 (zinc chloride), 088502 (zinc oxide), 527200 (zinc sulfate monohydrate), 129015 (zinc)
- CAS#: 7646-85-7 (zinc chloride), 1314-13-2 (zinc oxide), 7446-19-7 (zinc sulfate monohydrate), 7646-85-7 (zinc)
- Registrants: Central Garden & Pet D/B/A Lilly Miller Brands/ Excel Garden (zinc chloride), Solutia, Inc., AS America, Inc. Arch Wood Protection, Inc.(zinc oxide), Central Garden & Pet D/B/A Lilly Miller Brands/ Excel Garden, Retta Mfg, Inc, Waupaca Northwoods LLC. D/B/A Waupaca Materials (zinc sulfate monohydrate), Ciba Corporation, All American Metal Products, Fuji Chemicals Industries, LTD. (zinc)
- First approved for use in a registered product: April 1973
- Antimicrobials Division Chemical Review Manager (CRM): Eliza Blair, blair.eliza@epa.gov

Chemical Structure:

Zinc Chloride	Cl^{-} Zn^{2+} Cl^{-}
Zinc Oxide	Zn^{2+} O^{2-}
Zinc Sulfate Monohydrate	
Zinc	Zn

Use & Usage Information

- All Zinc salts are registered as non-food-use chemicals, except for zinc zeolites products, which have indirect food uses when incorporated into materials such as countertops.
- Number of products and concentrations:
  - 2 active Zinc chloride products in concentrations ranging from 13 to 62%
  - 3 active Zinc oxide products in concentrations ranging from 97 to 100%
  - 3 active Zinc sulfate monohydrate products in 97% concentration

    - 9 active antimicrobial sulfuric acid products in concentrations ranging from 1.36 to 99.15%
- Pests controlled are moss, fungus, and bacteria.
- Use sites:
    - Zinc chloride: outdoor ground and structure moss killer
    - Zinc oxide: materials preservative in ceramics, plastics, glazes, fibers, adhesives and sealants; one wood preservative use
    - Zinc sulfate monohydrate: outdoor ground and structure moss killer
    - Zinc: outdoor ground and structure moss killer, materials preservative in adhesives, sealants, caulks, coatings, films, laminates, plastics (including films, sheets, slabs, and molded plastic parts), fibers (for apparel, interior furnishings, industrial and other household items, packaging, transportation items), specialty products (cat litter, drainage and sewage pipe, flooring, plaster, sinks, stucco, tile, toilets) and other finished products. May also be incorporated into **plastic film**: (non-food use only and no water pipes) polypropylene, polyvinyl chloride, polyacetate, and polyester; **paints**: (Water base and solvent base); **paper coating**: (non-food packaging paper, no food contact) (not for paper production use); **adhesive**: (non food contact) plywood adhesives; **synthetic fibers**: polyester, nylon, polypropylene, acrylic and rayon; **pigments**: dyestuffs and inks; and textile finishing and manufacturing.

Recent Regulatory Actions

There have been no recent significant regulatory activities regarding zinc, zinc salt and zeolite products (i.e., tolerance related actions, changes of use patterns, or submission of toxicology studies).

Human Health Risk Assessment Status

The Agency will not require any further data for the zinc salts which include zinc chloride, zinc oxide and zinc sulfide monohydrate. However, as per the Agency's last review (D287537 and D287380, U.S. EPA 2004a and U.S. EPA 2004b) of the food use of silver-zinc zeolites, it appears toxicological data are needed to support the food uses of the silver-zinc zeolites. Data needs for zinc active ingredient in silver-zinc zeolites currently fall under zinc (elemental) [PC Code 129015].

Further information and detailed justifications for required studies are available in "Summary of Human Health Effects Data for the Zinc salts Registration Review Decision Document", dated March 4, 2009.

Environmental Fate & Ecological Risk Assessment Status

The Agency will conduct ecological risk assessments for all zinc salts. Since most of the applied zinc salts will transform to zinc oxide/hydroxide, the ecological effects and

environmental fate data requirements for zinc oxide listed on pages 13-16 are sufficient for the other active ingredients.

Further information and detailed justifications for required studies are available in "Summary of Product Chemistry, Environmental Fate, and Ecotoxicity Data for the Zinc salts Registration Review Summary Document", dated February 26, 2009.

Tolerances

Zinc is considered Generally Recognized as Safe (GRAS) by the Food and Drug Administration (FDA) as a food additive and dietary supplement under 21 CFR 182.8985 and 21 CFR 182.5991. The FDA also considers zinc oxide and zinc sulfate GRAS for use in foods under 21 CFR 182.8991 and 182.8997, respectively. The FDA also considers zinc oxide and zinc sulfate GRAS for use in nutrients under 21 CFR 182.5985 and 182.5997, respectively.

Data Call-In Status

A RED for Zinc Salts was completed in 1992, and a Data Call-In (DCI) was issued for Zinc Salts in 1993. However, no zinc zeolite-containing products were registered at this time.

Labels

There are 17 products registered for Zinc salts. The EPA Registration Numbers are provided in Table 1 below. Product registration labels may be obtained from the Pesticide Product Label System (PPLS) website at: http://oaspub.epa.gov/pestlabl/ppls.home.

Table 1. Registered Active Products of Zinc chloride

EPA Reg. No.	Product Name	Formulation Type	Percent Active Ingredient Zinc chloride	Registrant
802-508	Lilly Miller® Moss-Kil	Soluble concentrate	62	Central Garden & PET D/B/A Lilly Miller Brands/ Excel Garden
802-553	Lilly Miller Ready-to-Use Moss-Kil	Ready-to-use solution	13	Central Garden & PET D/B/A Lilly Miller Brands/ Excel Garden

Table 2. Registered Active Products of Zinc Sulfate Monohydrate

EPA Reg. No.	Product Name	Formulation Type	Percent Active Ingredient Zinc sulfate monohydrate	Registrant
802-591	Lilly Miller Moss-Kil Granules	Granular EP	99	Central Garden & PET D/B/A Lilly Miller Brands/ Excel Garden
10699-1	Moss-B-Ware	Wettable powder/dust EP	99	Retta Manufacturing, Inc.
72106-6	Nulife Structural Rid Moss	Wettable powder/dust EP	99	Waupaca Northwoods LLC

Table 3. Registered Active Products of Zinc oxide

EPA Reg. No.	Product Name	Formulation Type	Percent Zinc oxide	Registrant
62190-29	Chemonite™ Part C	Technical Chemical Formulating Use Only	97	Arch Wood Protection, Inc.
71645-3	Zinc Oxide	Formulation intermediate Formulating Use Only	99.4	Solutia, Inc.
82691-1	Stay Clean Additive A	Technical Chemical Formulating/Manufacturing Use Only	100	American Standard Companies, Inc.

Table 4. Registered Active Products of Zinc

EPA Reg. No.	Product Name	Formulation Type	Percent Active Ingredient Zinc	Registrant
2724-690	Ion Moss	Wettable powder/dust	22.28	Wellmark International
40810-18	Irgaguard B5000	Formulation intermediate	1.36	Ciba Corporation
40810-19	Irgaguard ® B502 I	Formulation intermediate	6.8	Ciba Corporation
40810-23	Irgaguard B102 N	Formulation intermediate	19.87	Ciba Corporation
40810-24	Irgaguard B7000	Dust	17.9	Ciba Corporation
40810-25	Irgaguard B102 Z	Formulation intermediate	14.3	Ciba Corporation
40810-27	Irgaguard B6000	Dust	3.58	Ciba Corporation
67771-1	Moss-Kil Roof Strip Goodbuy	Impregnated materials	99.15	All American Metal Products, Inc.
82415-2	Bactekiller® AZ	Wettable powder	6.5	Fuji Chemical Industries, Ltd.

Incidents

A search of the OPP Incident Data System (IDS) found one reported incident for zinc chloride, and no reported incidents for the rest of the zinc salts case. In the single zinc chloride incident, the subject reported a stinging cheek, pain near a kidney and blood in urine. The report did not clarify further and the route of exposure to zinc chloride is unknown.

III. GLOSSARY of TERMS & ABBREVIATIONS

ai	Active Ingredient
AR	Anticipated Residue
ASTM	American Society for Testing and Materials
AWPA	American Wood Preserver's Association
CFR	Code of Federal Regulations
cPAD	Chronic Population Adjusted Dose
CSF	Confidential Statement of Formula
CSFII	USDA Continuing Surveys for Food Intake by Individuals
DCI	Data Call-In
DEEM	Dietary Exposure Evaluation Model
DFR	Dislodgeable Foliar Residue
DNT	Developmental Neurotoxicity
DWLOC	Drinking Water Level of Comparison
EC	Emulsifiable Concentrate Formulation
EDWC	Estimated Drinking Water Concentration
EEC	Estimated Environmental Concentration
EPA	Environmental Protection Agency
EUP	End-Use Product
FDA	Food and Drug Administration
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FFDCA	Federal Food, Drug, and Cosmetic Act
FQPA	Food Quality Protection Act
FOB	Functional Observation Battery
GENEEC	Tier I Surface Water Computer Model
IR	Index Reservoir
LC_{50}	Median Lethal Concentration. A statistically derived concentration of a substance that can be expected to cause death in 50% of test animals. It is usually expressed as the weight of substance per weight or volume of water, air or feed, e.g., mg/l, mg/kg or ppm.
LD_{50}	Median Lethal Dose. A statistically derived single dose that can be expected to cause death in 50% of the test animals when administered by the route indicated (oral, dermal, inhalation). It is expressed as a weight of substance per unit weight of animal, e.g., mg/kg.
LOC	Level of Concern
LOAEL	Lowest Observed Adverse Effect Level
µg/g	Micrograms Per Gram
µg/L	Micrograms Per Liter
mg/kg/day	Milligram Per Kilogram Per Day
mg/L	Milligrams Per Liter
MOE	Margin of Exposure
MRID	Master Record Identification (number). EPA's system of recording and tracking submitted studies.
MUP	Manufacturing-Use Product
NA	Not Applicable
NAWQA	USGS National Ambient Water Quality Assessment
NPDES	National Pollutant Discharge Elimination System
NR	Not Required
NOAEL	No Observed Adverse Effect Level
OPP	EPA Office of Pesticide Programs
OPPTS	EPA Office of Prevention, Pesticides and Toxic Substances
PAD	Population Adjusted Dose
PAIRA	Pure Active Ingredient Radiolabelled
PCA	Percent Crop Area
PDP	USDA Pesticide Data Program

PHED	Pesticide Handler's Exposure Data
PHI	Preharvest Interval
ppb	Parts Per Billion
PPE	Personal Protective Equipment
ppm	Parts Per Million
PRZM/EXAMS	Tier II Surface Water Computer Model
Q_1*	The Carcinogenic Potential of a Compound, Quantified by the EPA's Cancer Risk Model
RAC	Raw Agriculture Commodity
RED	Reregistration Eligibility Decision
REI	Restricted Entry Interval
RfD	Reference Dose
RQ	Risk Quotient
SCI-GROW	Tier I Ground Water Computer Model
SAP	Science Advisory Panel
SF	Safety Factor
SLN	Special Local Need (Registrations Under Section 24©) of FIFRA)
TGAI	Technical Grade Active Ingredient
TEP	Typical End-Use Product
USDA	United States Department of Agriculture
UF	Uncertainty Factor
WPS	Worker Protection Standard

IV. Appendix A

Use Patterns Eligible for Reregistration
Case 4099 Zinc, Zinc Salts and Zeolites

Use Site	Formulation	Method of Application	Application Rate/ No. of applications	Use Limitations
Residential and public access premises				
Use on all outdoor structures made of wood, gravel, brick, unpainted cement, or composition, shingles, fence posts, sidewalks, patios, steps, decks, or roofs	Ready to use Reg: 802-553	Spray	Hold nozzle six to ten inches from surface and spray to thoroughly wet area apply when the air is still and when no rain is expected for 24hrs	
	Granular Reg: 802-591 Reg: 802-508 Reg: 72106-6 Reg: 10699-1	Apply directly from container as a powder or spray	Apply at the rate of 4lbs. 4000 square feet of area To apply as spray, use a sprinkling can or tank sprayer. Slowly add granules to 13 1/3 gals. Of water spray to thoroughly wet surface, using I gallon to 300 sq. ft of area	
	Ready to use Reg:67771-1	Metal strip	Apply to surface area by glue or nail last for 25yrs	
Food handling/storage establishments premises and equipment				
Plastics including films, sheets, slabs, and molded plastic parts	Formulation inter mediate Reg: 40810-18	Incorporation		

Use Site	Formulation	Method of Application	Application Rate/ No. of applications	Use Limitations
Appliances and equipment, beverage dispensing equipment, beverage processing equipment, bottles, brush bristles, brush handles, containers, conveyor belts, countertops, food handling equipment, food processing, equipment, food storage containers, food trays and covers, food packaging, food processing utensils, gaskets, general purpose containers, kitchen and bathroom hardware, liners, mats, non-woven fabrics, plastic film, plumbing supplies and fixtures, protective covers, sinks, sponges, tape, tiles, tubing				
Adhesives and sealants Appliances, ceramic tile, construction material, glazing for windows, grout and joint compound, paper, pipe sealant, and insulating materials, plastic, plumbing adhesives, rubber, sealants for pipes, showers, wood, wood and plastic composites	Formulation intermediate Reg: 40810-18	Incorporation		

Use Site	Formulation	Method of Application	Application Rate/ No. of applications	Use Limitations
Coatings, films, and laminates Appliances, barrier fabrics, building materials and components such as walls wallboard, floors, concrete, siding, roofing,, shingles, hardware, floors, ceilings, commercial and industrial application Cookware Food warp including coated deli paper, coated meat interleaves and plastic warp Collection and storage equipment such as conveyor belts, piping systems, silos, tanks, and process vessels Countertops Furniture, general purpose containers, glazing for cement tile, glazing for vitreous china used in plumbing fixtures such as toilets, sinks, countertops Industrial equipment Natural and synthetic fibers and fabrics	Formulation intermediate Reg: 40810-18	Incorporation		
Fibers Apparel such as outerwear, uniforms, gloves, aprons, coats, bags, containers, conveyor	Formulation intermediate Reg: 40810-18	Incorporation		

Use Site	Formulation	Method of Application	Application Rate/ No. of applications	Use Limitations
belts, table cloths, napkins, wiping cloths, mops, sponges, brush bristles, filters, packaging, including bags, sacks, wraps, cushion, absorbent materials, and containers Kitchen: commercial and industrial wipes and fabrics Food packaging				
Human drinking water systems				
Plastics: Fibers: Coatings: Films and laminates: Adhesives and sealants Including ice making equipment, water pans, piping, tubing, guards, ice storage bins, trays, ice scoops, buckets, valves and gaskets Drinking water contact materials water bottles, cups, gaskets, plumbing fixtures, storage tanks and vessels, water piping, tubing, valves, spigots, coolers, water dispensing components, housing units and water filter components	Formulation intermediate Reg: 40810-18	Incorporation		

Use Site	Formulation	Method of Application	Application Rate/ No. of applications	Use Limitations
Materials preservative				
Plastics including films, sheets, slabs, and molded plastic parts, Appliances and equipment, auto mobile parts, brush bristles, brush handles, building material,conveyor belts, countertops, flooring, footwear, gaskets, general purpose containers, indoor and outdoor furniture, insulation for wire and cable, kitchen and bathroom hardware, liners, mats, mops, non-woven fabrics, plastic film, plumbing supplies and fixtures, protective covers, shower curtains, siding for housing, sinks, sponges, tape, tiles, tubing, vacuum cleaner bags, waste containers	Formulation intermediate Reg: 40810-18 Reg: 40810-23 Reg: 40810-24 Reg: 40810-27 Reg: 82451-2 Reg: 40810-19 Reg: 40810-25 Technical Reg: 71645-3 Reg: 82691-1	Incorporation	1.50% by weight	
Fibers Apparel such as umbrellas, outerwear, sportswear, sleepwear, socks, and hosiery, caps, undergarments, inner liners for jackets, trim for outerwear, and garments, uniforms, outerwear, gloves,	Formulation intermediate Reg: 40810-18 Reg: 40810-23 Reg: 40810-24 Reg: 40810-27 Reg: 82451-2	Incorporation	0.75% to 1.50% by weight	

Use Site	Formulation	Method of Application	Application Rate/ No. of applications	Use Limitations
aprons, coats, and shoes, Conveyor belts Industrial and other household items such as artificial leather, filters, book covers, mops, cloth for sails, ropes, tents and other outdoor equipment, tarps, awnings, bags, brush bristles, commercial and industrial wipes and fabrics, sponges, wiping cloths Interior furnishings such as mattress covers, pads and filling, pillow covers, sheets, blankets, fiberfill for quilts, and pillows, curtains, draperies, carpet and carpet underlay, rugs, upholstery, towels, wall covering fabrics, cushion pads, sleeping bags Packaging Transportation items such as automotive and truck upholstery carpeting, rear decks, trunk liners, convertible tops, interior liners	Reg: 40810-19 Reg: 40810-25 Technical Reg: 71645-3 Reg: 82691-1			
Coatings, films, and laminates Appliances, automotive and vehicle parts, barrier fabrics,	Formulation intermediate	Incorporation	1.50% by weight	

Use Site	Formulation	Method of Application	Application Rate/ No. of applications	Use Limitations
building materials and components such as walls wallboard, floors, concrete, siding, roofing,, shingles, hardware, floors, ceilings, commercial and industrial application Collection and storage equipment such as conveyor belts, piping systems, silos, tanks, and process vessels Countertops Furniture, general purpose containers, glazing for cement tile, glazing for vitreous china used in plumbing fixtures such as toilets, sinks, countertops Industrial equipment Natural and synthetic fibers and fabrics	Reg: 40810-18 Reg: 40810-23 Reg: 40810-24 Reg: 40810-27 Reg: 82451-2 Reg: 40810-19 Reg: 40810-25 Technical Reg: 71645-3 Reg: 82691-1			
Adhesives and sealants Appliances, automotive and vehicle parts, bathrooms, cardboard, ceramic tile, construction material, glazing for windows, grout and joint compound, paper, pipe sealant, and insulating materials, plastic, plumbing adhesives, rubber,	Formulation intermediate Reg: 40810-18 Reg: 40810-23 Reg: 40810-24 Reg: 40810-27 Reg: 82451-2 Reg: 40810-19	Incorporation	2.00% by weight	

Use Site	Formulation	Method of Application	Application Rate/ No. of applications	Use Limitations
sealants for pipes, showers, wood, wood and plastic composites	Reg: 40810-25 Technical Reg: 71645-3 Reg: 82691-1			
Miscellaneous applications Cat litter, drainage and sewage pipe, flooring, plaster, sinks, stucco, tile, toilets, Heating, ventilation and air conditioning (HVAC)	Formulation intermediate Reg: 40810-18 Reg: 40810-23 Reg: 40810-24 Reg: 40810-27 Reg: 82451-2 Reg: 40810-19 Reg: 40810-25 Technical Reg: 71645-3 Reg: 82691-1	Incorporation		